AUSTRALIAN COMMISSION
ON SAFETY AND QUALITY IN HEALTH CARE

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# Safety and Quality Issues in Cosmetic Surgery

## A rapid review

KP Health have prepared this report on behalf of the Australian Commission on Safety and Quality in Health Care.

KPH
knowledge into practice

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# Preface

This preface was written by the Australian Commission on Safety and Quality in Health Care (the Commission) to provide context and background to the report – *Safety and Quality Issues in Cosmetic Surgery: A rapid review.*

## Background

The Commission leads and coordinates national improvements in safety and quality of health care in partnership with the Australian Department of Health and Aged Care (the Department), state and territory governments, and the private sector. Collaboration also occurs with patients, clinicians, and health services.

The Australian cosmetic surgery sector has grown exponentially to become a distinctive service operating alongside the existing health framework. Cosmetic surgery is unique in that surgical interventions are employed, not for medical purposes, but to achieve a change in physical appearance which is more aesthetically pleasing from the perspective of the person undergoing cosmetic surgery.

In September 2022, in response to concerning reports of patient harm, Australian Health Ministers agreed to a suite of urgent reforms to the cosmetic surgery sector. As part of this announcement, the Commission was tasked with developing the National Safety and Quality Cosmetic Surgery Standards (Cosmetic Surgery Standards).

The Commission released the *National Safety and Quality Cosmetic Surgery Standards* on the 14 December 2023, following broad consultation with consumers, clinicians, services, professional and peak bodies, regulators and other representatives of the sector. A Cosmetic Surgery Module was released to apply in health service organisations already implementing the National Safety and Quality Health Service Standards.

To inform the development of the Cosmetic Surgery Standards and associated implementation resources, the Commission sought a rapid review of current literature on patient safety and quality risks for cosmetic surgery, tools, strategies and techniques to address these risks, and the effectiveness of these methods. Current literature was deemed as systematic reviews and clinical guidelines published since 2013, with secondary searches performed based on relevant references identified in the primary search. A search of websites from national and international medical regulatory authorities and cosmetic and aesthetic professional medical associations was also undertaken. The review was conducted by KP Health.

## Scope

There are specific safety and quality risks that are unique to the cosmetic surgery sector, and if not mitigated, can contribute to severe consequences for patient health outcomes. Given this, the Commission asked the authors to focus on person-centred evidence that describes the processes and structures that are needed to deliver safe and high-quality clinical care within the cosmetic surgery sector.

Specific questions were outlined by the Commission for this review and included:

- What are the patient safety and quality care risks relevant to cosmetic surgery?
- What interventions, tools or resources were identified in the literature that minimise patient safety and quality risks relevant to cosmetic surgery?
- What is the evidence for the effectiveness of these interventions, tools or resources?

- What safety and quality standards and guidelines for clinical practice operate nationally and internationally for cosmetic surgery, and what do they address?

## Findings

The findings of this rapid review were structured according to the four key questions posed by the Commission and based on the 158 systematic reviews and 11 guidelines sourced. The systematic reviews and guidelines largely focussed on specific cosmetic surgery procedures, current surgical techniques used, likely complications, and overall outcomes. There was minimal evidence discussing organisational and procedural aspects relevant to a safe environment for cosmetic surgery.

Safety and quality risks were identified as part of the evidence review, with concerns related to:

- Patient assessment, screening and selection
- Patient consent and feedback
- The location cosmetic surgery is performed
- Allogenic implants
- Complications of cosmetic surgery
- Post-surgery follow-up and continuity of care
- Cosmetic tourism.

The literature extensively covered information about cosmetic surgery complications, as well as measures to minimise and control these adverse outcomes. Considerable detail on risks associated with cosmetic tourism was also identified, inclusive of associated mitigation strategies. While cosmetic tourism is not in direct scope of this review, it has been included in the paper as it is a growing industry and the adverse consequences are likely to be managed in Australian health services by Australian medical practitioners, with risks for both the patient and community.

While at-risk, prospective cosmetic surgery candidates were identified in a few reviews, patient selection and suitability criteria inclusive of specific psychological assessments was limited. Where psychological assessment of patients was recorded, there was no independent verification of the validity of the tools used in those studies. Although the requirement for valid consent was universally accepted, there was minimal information on how to quantify patient comprehension of the surgery, inclusive of both short and long-term complications.

Promotion of cosmetic surgery to patients through traditional advertising modes and social media was briefly referenced, however, this excluded a comprehensive assessment of suitable and allowable content, risks and safety measures.

The findings indicated instances within Australia where national cosmetic surgery guidelines promulgated by jurisdictional regulatory authorities describe in detail minimum expectations of registered medical practitioners performing cosmetic surgery. However, it was noted at that time, the Medical Board of Australia guidelines make no specific reference to audit, quality assurance and peer review, which are identified requirements in New Zealand and Singapore.

The authors interpretation of these findings led them to surmise that to support safe and quality care in services where cosmetic surgery is performed, the development of cosmetic surgery accreditation standards should complement existing regulatory guidelines and take into consideration the safety and quality issues identified within the review. It is also important that guidelines are regularly and routinely updated to reflect the rapidly changing demand for and provision of cosmetic surgery, and to address any emerging issues.

## Limitations

This review provides important and relevant information about safe and quality care in cosmetic surgery, however, there were identified gaps in the published literature.

There was a significant lack of evidence surrounding validated methods for psychological screening of cosmetic surgery candidates, inclusive but not limited to body dysmorphic disorder. There was also limited evidence to demonstrate that patients had fully comprehended consent procedures, even though valid consent is a universally accepted requirement of surgery.

Little detail was obtained from the literature about the appropriate facility in which cosmetic surgery should be performed, and only passing reference was made to the appropriateness of advertising for cosmetic procedures, with no detail or analysis identified.

The findings and recommendations from rapid literature reviews are necessarily limited by the choice of search terms and strategy, and it is always possible that significant research or practice-based evidence was not discovered.

## Current status

The Commission is:

- Developing a suite of resources to support the initial implementation of the Cosmetic Surgery Standards
- Developing a process for the accreditation of these standards in facilities preforming cosmetic surgery
- Approving accrediting agencies to undertake the assessments and developing training for assessors.

# Contents

# Executive Summary

This report summarises current literature on patient safety and quality risks for cosmetic surgery, tools, strategies and techniques to address these risks, and the effectiveness of these methods drawn from systematic reviews published since 2013. Secondary searches were performed based on relevant references identified in the primary search to provide additional context and to better inform this work.

A search of websites of national and international medical regulatory authorities and cosmetic and aesthetic professional medical associations was also undertaken.

## Review questions

The review aimed to address the following questions:

1. What are the patient safety and quality care risks relevant to cosmetic surgery?
2. What interventions, tools or resources were identified in the literature that minimise patient safety and quality risks relevant to cosmetic surgery?
3. What is the evidence for the effectiveness of these interventions, tools or resources?
4. What safety and quality standards and guidelines for clinical practice operate nationally and internationally for cosmetic surgery, and what do they address?

## Summary of methods used

MEDLINE, Embase, and Cochrane databases were searched for systematic reviews and clinical guidelines published in the last 10 years (2013-current), with a full text version available in English. Included articles focused on cosmetic surgery and included relevant information regarding safety and quality.

Search results had to meet eligibility criteria summarised in the PICOS statement below.

**Participants** – adults and adolescents (persons aged 10-19 years).

**Intervention** – interventions, tools, resources to reduce risk to patients specifically associated with cosmetic surgery.

**Comparator** – no intervention/usual care, alternative intervention.

**Outcomes** – any patient safety outcome, including improvements in recovery, reductions in specific or multiple adverse effects (e.g. infection, seroma, hematoma etc), reductions in service use such as length of stay.

**Study design** – Systematic reviews, clinical guidelines.

The database search identified 1,690 potentially relevant articles. Duplicates were removed, leaving 1,103 articles for screening. The full text articles for 220 results were sourced and an additional 51 articles excluded, leaving 169 eligible articles for inclusion in the review.

A web-based search of medical regulatory authorities in Australia, Canada, Malaysia, New Zealand, Singapore, United Kingdom and the United States of America for cosmetic surgery guidelines was conducted.

A secondary search for professional codes of conduct was performed of cosmetic and aesthetic surgery professional colleges and associations. The sites searched are listed as **Attachment A.**

# Key findings

The results of the rapid review of the literature, 158 systemic reviews and 11 guidelines was largely focused on specific cosmetic surgery procedures, the surgical strategies used and outcome measures, including complications. Patient selection and suitability were addressed in a number of reviews, with only limited reference to specific psychological assessments.

Promotion of cosmetic surgery to patients through traditional advertising modes and social media were briefly referenced, but without providing a comprehensive assessment of suitable and allowable content, risks and safety measures.

The literature review identified cosmetic tourism, when patients elect to undergo cosmetic surgery procedures abroad, as a growing industry. While cosmetic tourism is not in direct scope of this review, it has been included in the paper as the adverse consequences are likely to be managed in Australian health services by Australian medical practitioners, with risks for both the patient and community.

The website review of regulatory authorities and professional associations identified general policies on cosmetic surgery for five national regulators including Australia, New Zealand, United Kingdom, Malaysia and Singapore, mainly dating from 2016 and 2017. Professional associations including specialist colleges, notably the Royal College of Surgeons England also had detailed policies, which broadly aligned with regulatory authority guidance.

## Question 1 - What are the patient safety and quality care risks relevant to cosmetic surgery?

The evidence review identified patient safety and quality care risks related to:

- The patient themselves, and assessment and selection of at-risk patient cohorts
- Informed patient consent and quality feedback
- Allogenic implants
- Complications of cosmetic surgery
- Post-surgery follow-up and continuity of care
- Cosmetic surgery tourism.

### Patient factors

Pre-operative recognition of patients suitable and unsuitable for cosmetic surgery is important to prevent an unsatisfactory outcome for both the patient and medical practitioner.

A proportion of cosmetic surgery candidates experience appearance-related psychosocial distress, have inappropriate and unrealistic expectations about the likely positive impact cosmetic surgery will have on their life, and who wish to achieve instantly recognisable results.[1]

The literature identified the following high-risk areas of focus for pre-operative patient screening:

- People with body dysmorphic disorder
- Young people and teenagers
- Cosmetic surgery candidates after massive weight loss
- Medically at-risk candidates.

### Patient consent and feedback

The literature reviewed identified issues with patient consent, including difficulty in assessing a patient's understanding of the consent form.[2] Some studies have also found patient recollection and understanding of consent for cosmetic surgery is low and declines over time.[3, 4]

A range of patient feedback mechanisms were identified in the literature. However, ad hoc patient outcome tools were shown to likely be inadequate as they lack proven reliability and validity. Generic outcome measures may also be inadequate as they may not be responsive to the patient's changes in surgical outcomes over time.[5] Other tools have disadvantages related to the inability to measure all important outcomes, as they were developed for a specific patient population and could not estimate whether a clinically meaningful difference had in fact been achieved.

## Allogenic cosmetic surgery implants

Allogenic implants used in cosmetic surgery are available in a variety of materials. Each of these materials pose certain complication risks based on their surface contour (smooth vs. porous), pliability, reactivity with surrounding tissue, shape and placement.[6-8]

The literature provides little guidance about implant choice. In the end, the choice of the implant is an agreed decision between the patient and medical practitioner based on clinical experience, patient preference, medical circumstances and aesthetic goal of the procedure.[9]

Infections, seromas, haematomas, implant rupture, deflation, extrusion and necrosis can arise from implant surgery as immediate or short-term complications, or tissue atrophy and capsular contracture as longer-term complications.[10, 11]

Breast implant illness, breast implant–associated anaplastic large cell lymphoma (BIA-ALCL), squamous cell carcinoma (SCC) and non BIA-ALCL lymphomas are known complications associated with breast implants.[12]

## Post-surgery complications

Surgical complications not related to a specific operation or surgical site are broadly the same for cosmetic surgery as other surgery types. All patients who undergo surgical operations are at risk of developing temporary or permanent complications depending on the type of operation, use of implanted materials, anaesthetic and patient risk factors. The complications listed below may occur after cosmetic surgery, with incidence varying between procedures.

### Short term complications

Short term complications that may be specifically relevant for people who undergo cosmetic surgery are haematoma, bleeding and swelling. These factors impair healing, slow post-operative recovery and can alter the final intended aesthetic outcome resulting in reduced patient satisfaction.[13, 14]

### Surgical risks to nerves

The risk of post-operative nerve injury is of particular concern with facial surgery. There is a risk of temporary or permanent injury to the facial nerve in face lift surgery.[15] Submandibular gland resection involves deep neck surgery with the marginal mandibular nerve at risk.[16] Other nerve injuries are reported with cosmetic breast surgery and abdominoplasty.[17-19] Abnormal sensation is a common post-operative occurrence of liposuction which may take up to six months to resolve.[20]

### Surgical site infection risks

Post-operative surgical site infections (SSIs) may adversely impact the aesthetics of the surgical outcome.[21, 22] SSIs are associated with an increased risk of psychological complications, including depression and anxiety.[23] Infections that cause localised deformity, scar and asymmetry are the most common reasons for legal action against the medical practitioner.[24]

### Risk of seroma formation

Seroma formation is a common cosmetic surgery complication which causes patient discomfort, and usually requires multiple percutaneous aspirations or additional surgical procedures.[25-27] The

prolonged recovery time of seromas can delay the patient's return to normal activities and carries the risk of infection and abscess.[28, 29]

Risk of venous thromboembolism

Venous thromboembolism (VTE) can be an immediately life-threatening complication of any surgical procedure. The role of VTE prophylaxis in aesthetic surgery is still not well understood or standardised. The safety of VTE prophylaxis is not yet fully established where patients are assessed as low risk.[30, 31]

Risks associated with implant surgery

Complications and adverse outcomes specific to implant surgery include implant rupture, deflation, extrusion, surrounding tissue necrosis, atrophy and capsular contracture.[10, 11] Capsular contracture is characterised as progressive and disfiguring changes which lead to poor outcomes, patient discomfort, poor aesthetics, premature explantation and re-operation.[10, 32, 33]

Autologous implants often formed from patient cartilage in general have easy availability, good patient-compatibility, low incidence of complications, and good grafting quality. However, autologous costal cartilage can warp, be re-absorbed and have donor-site morbidity including bruising and scarring.[34]

Risks associated with autologous fat grafts

Autologous fat grafts are considered to be very safe, however increasing use in novel sites such as gluteal grafts has led to cases of intravascular injection and fat migration.[35] The presence of fat tissue in the bloodstream is pathological and can lead to severe neurological complications.[36] Fat can enter the blood stream either microscopically, which produces fat embolus syndrome, or macroscopically, with direct occlusion of blood vessels and clinical manifestations the same as a standard blood clot thromboembolism with very poor recovery rates.[35]

## Post-surgery follow-up and continuity of care

References to follow-up after surgery and continuity of care in the evidence review focused almost exclusively on prevention, identification and management of surgical complications rather than organisational and procedural arrangements to ensure patient safety.

Reviews of cosmetic tourism highlighted a common problem of the lack of formal arrangements in the patient's home country to manage follow-up and complications, which predictably are difficult to organise.[37]

## Cosmetic tourism

The increasing number of Australian residents seeking cosmetic procedures overseas (cosmetic tourists) has led to reports of poor outcomes and complications on return to Australia, although the actual rates of adverse events are hard to determine.[38] The risks are both patient- and society-related.

Patient risks are exposed when complications arise, with a lack of post-surgical follow up especially for infections in the country where the surgery was performed or on return to Australia. There are also thromboembolism risks associated with long flights, multiple and prolonged surgeries and lack of prophylaxis.[39]

Society risks relate to the cost of managing often complex post-surgical complications on return to Australia.[38] Travellers may be colonised by drug-resistant bacteria and be carriers for months after returning home. Tourists who visit medical facilities on return present a greater risk of spreading these difficult to treat organisms.[40-42]

## Questions 2 - What interventions, tools or resources were identified in the literature that minimise patient safety and quality risks relevant to cosmetic surgery?

## Question 3 - What is the evidence for the effectiveness of these interventions, tools or resources?

The body of the report discusses the evidence in relation to the effectiveness of interventions, tools and strategies applied to particular identified risks associated with cosmetic surgery procedures. There were significant gaps in the evidence. Where interventions were proposed and likely implemented there was often no information provided as to whether outcomes were changed, or interventions were effective.

The identified interventions are grouped as follows:

- Patient factors
- Patient consent and feedback
- Facilities where cosmetic surgery is performed
- Post-surgery complications
- Cosmetic tourism.

### Patient factors

The review identified pre-operative patient screening tools which aim to minimise the patient safety and quality risks relevant to cosmetic surgery.

Tools include:

- Psychological assessment for body dysmorphic disorder, although evidence of the effectiveness of these tools is limited
- Comprehensive and sensitive pre-operative assessment to determine the physical and emotional maturity of young people seeking cosmetic surgery[43, 44]
- Formal psychological assessment of young people to evaluate their desired goals, expectations and factors motivating them to seek cosmetic surgery[45, 46]
- The Pittsburgh Rating Scale as a validated measure of contour deformities after bariatric weight loss[47] which has applications in preoperative planning and evaluating surgical outcomes for all types of cosmetic surgery after massive weight loss[48]
- Q Portfolio which can assist in making risk assessments of patients, however is yet to be validated for clinical use.[49]

### Patient consent and feedback

Pre-operative assessments, management of patient expectations and understanding of patient perspectives are necessary to achieve successful cosmetic outcomes. The consent process can be supported by the use of standard instruments which allow the medical practitioner to provide information about different surgical approaches, expected outcomes, likely patient benefit, and help understand any patient psychological conditions.[50, 51] No evidence was identified that demonstrated the effectiveness of interventions in relation to patient consent procedures.

The use of reliable, valid, and responsive patient questionnaires is essential to provide information about the impact and effectiveness of cosmetic surgery. Patient satisfaction is a key measure of operation success in conjunction with or indeed in place of more objective measures such as post-operative complication rates.[50]

Carefully developed and refined patient reported outcome measures (PROMs) are becoming increasingly relevant in modern clinical outcomes research. The Royal College of Surgeons England (RCSE) recommends the use of PROMs from the Q Portfolio for abdominoplasty, augmentation mammoplasty, blepharoplasty, liposuction, rhinoplasty and rhytidectomy to inform assessment, consent and outcome review.[49]

### Facilities where cosmetic surgery is performed

In the peer-reviewed articles only passing reference was made to where cosmetic surgery can be safely performed.

A French guideline requires cosmetic surgeons to practice in facilities authorised and certified by the French National Authority for Health.[52] Singapore and Malaysia also specify the type of facility in which cosmetic surgeries can be performed.[53, 54]

No evidence was identified that demonstrated the effectiveness of interventions in relation to facilities where cosmetic surgery is performed.

### Post-surgery complications

Various methods and concepts with variable outcomes have been developed to avoid swelling, bruising and infections associated with cosmetic surgery, with a focus on the following:[55]

- Preventing bleeding
- Corticosteroid use
- Infection, prevention and control measures
- Seroma prevention
- VTE prevention.

### Cosmetic tourism strategies to improve safety

A number of strategies are recommended to improve the safety of cosmetic tourism, including:

- Internationally consistent antimicrobial stewardship, infection control and surveillance strategies[56-58]
- Making available the Australian Breast Device Registry (ABDR) to all patients in Australia undergoing breast device surgery and Australian patients having breast augmentation performed overseas. This would allow all Australians who undergo breast augmentation to access their operative and implant details[38]
- Guidelines and practice standards for cosmetic tourism with the support and agreement of the operating overseas medical practitioners and medical practitioners in Australia.[59]

## Question 4 - What safety and quality standards and guidelines for clinical practice operate nationally and internationally for cosmetic surgery, and what do they address?

The Medical Board of Australia (MBA), New Zealand Medical Council, United Kingdom's General Medical Council and Singapore Medical Council have issued comprehensive cosmetic surgery guidelines.[53, 60-62] The Malaysian Ministry of Health also provides detailed guidance for the profession.[54]

The general requirements are consistent with good medical practice, consent procedures and advertising rules, and include requirements in relation to psychological assessment for people with evidence of psychological disorders.

The Australian, New Zealand and United Kingdom guidelines all have comprehensive requirements regarding prospective patients aged under 18 years.

The MBA guidelines state that cosmetic surgery procedures should only be provided by a medical practitioner who has the appropriate training, expertise and experience, which is consistent with the United Kingdom's requirements. In other countries, more prescriptive measures are in place limiting cosmetic surgery to recognised surgeons, often in prescribed sub- specialties.

The MBA guidelines make no specific reference to audit, quality assurance and peer review, which are requirements in New Zealand and Singapore.

National and international professional associations have developed guidelines which largely align with national regulatory bodies, usually with an emphasis on the professional interests of their members, but also which provide additional options for sanctions for member breaches of the guidelines, including suspension and expulsion from the association.

## Gaps in the evidence

Gaps in the published literature were sometimes referenced, and in some instances addressed in national professional guidance. The gaps in the evidence review included:

- A paucity of evidence regarding validated methods to routinely screen cosmetic surgery candidates for psychological issues, including but not limited to body dysmorphic disorder
- Little evidence of methods to validly and consistently assess, categorise and compare patient characteristics for different types of cosmetic surgery
- Limited evidence demonstrating patient understanding in relation to consent procedures
- Little detail about the type of facility appropriate for where cosmetic surgery is performed
- Only passing reference to advertising of cosmetic surgery procedures, but with no detail or analysis.

## Conclusion

Although the evidence review included 169 articles the content was quite narrow, with a very heavy emphasis on specific surgical procedures, current techniques, likely complications and overall outcomes. There was little evidence about more organisational and procedural aspects relevant to a safe environment to undertake cosmetic surgery. Consequently, the guidance of MBA and other national boards was important in identifying these relevant issues.

The evidence review identified safety and quality risks related to patient assessment, screening and selection, patient consent and feedback, where cosmetic surgery is performed, allogenic implant surgery, complications of cosmetic surgery, post-surgery follow-up and continuity of care, and cosmetic tourism.

Information about complications of cosmetic surgery and measures to minimise and control the complications were extensively covered in the literature. There was also considerable detail in a number of systematic reviews about risks associated with cosmetic tourism, including recommendations as to how to potentially mitigate them.

While at-risk prospective cosmetic surgery candidates were identified in a number of papers, details about assessment and management strategies were usually cursory. Where psychological assessment of patients was recorded, there was no independent verification of the validity of the tools used in those studies. Valid consent for cosmetic surgery was universally accepted, however there was little information as to how to ensure the fundamental premise of patient understanding of the surgery and its short- and long-term consequences.

One international guideline provided information regarding minimum expectations about the

licensing arrangements for facilities where cosmetic surgery is performed, which was consistent with national regulatory authority requirements.

In a number of cases including in Australia and the United Kingdom, national cosmetic surgery guidelines promulgated by jurisdictional regulatory authorities describe in detail minimum expectations of registered medical practitioners performing cosmetic surgery. It is important that these guidelines are regularly and routinely updated to reflect the rapidly changing demand for and provision of cosmetic surgery, and to address any emerging issues.

To support safe and quality care in services where cosmetic surgery is performed, the development of cosmetic surgery accreditation standards should complement existing regulatory guidelines and take into consideration the safety and quality issues identified in this review.

# Background

On 2 September 2022, Australian Health Ministers agreed on reforms to ensure medical practitioners providing cosmetic surgery are appropriately qualified and work to the highest health and safety standards expected in Australia.[63]

As part of this work, the Australian Commission on Safety and Quality in Health Care (the Commission) was tasked with developing specific safety and quality standards for where and how cosmetic surgery can be performed in Australia.

This rapid literature review of the peer-reviewed and 'grey' literature has been prepared to inform the Commission's work in developing the National Safety and Quality Cosmetic Surgery Standards.

## Cosmetic surgery in Australia

The size of the cosmetic surgery sector in Australia is difficult to quantify. Anecdotally, it has experienced growth in recent years. Given there is no coordinated data collection of procedures performed, and patients self-fund the procedures, there is little high-quality data to analyse. It is understood that cosmetic surgery in Australia is performed by medical practitioners from several specialties and registration categories using a variety of titles and having membership of an array of professional bodies.[64]

A 2022 review commissioned by the Australian Health Practitioner Regulation Agency (Ahpra) and the Medical Board of Australia (MBA) found that the cosmetic surgery sector is a unique market disrupter, largely sitting outside existing health system frameworks because when a patient self-refers, they bypass the usual referral pathways from general practitioner to specialist. Cosmetic surgery is not formally recognised as a medical specialty and does not fit comfortably with the specialist registration model.[64]

Cosmetic surgery involves surgical interventions to achieve a change in physical appearance which is more aesthetically pleasing from the perspective of the person undergoing the cosmetic surgery. Demand for cosmetic surgery is generally consumer driven. As a result, there are specific safety and quality risks that are unique to the cosmetic surgery sector. Cosmetic surgery that is not delivered to acceptable safety and quality standards can have severe consequences on patient health outcomes.[64]

## Review methodology

The objective of the rapid literature review was to identify:

- Cosmetic surgery patient safety and quality care issues
- Evidence and strategies to reduce or prevent adverse events in cosmetic surgery
- Components of cosmetic surgery accreditation standards used to support improvement and quality of care in cosmetic surgery.

### *In-scope*

Cosmetic surgical procedures are defined as operations and other procedures which involve cutting beneath the skin to revise or change the appearance, colour texture, structure or position of normal bodily features with the dominant purpose of achieving what the patient perceives to be a more desirable appearance. Examples include breast augmentation, abdominoplasty, rhinoplasty, blepharoplasty, surgical face lifts, cosmetic genital surgery, liposuction and fat transfer.[60]

***Out of scope***

- Non-surgical cosmetic procedures
- Procedures that serve a clinical or functional purpose or restore normal body features.

***Research questions:***

1. What are the patient safety and quality care risks relevant to cosmetic surgery?
2. What interventions, tools or resources were identified in the literature that minimise patient safety and quality risks relevant to cosmetic surgery?
3. What is the evidence for the effectiveness of these interventions, tools or resources?
4. What safety and quality standards and guidelines for clinical practice operate nationally and internationally for cosmetic surgery, and what do they address?

## Peer-reviewed literature search

MEDLINE, Embase, and Cochrane databases were searched for systematic reviews and clinical guidelines published in the last 10 years (2013-2023t), with a full text version available in English. Included articles focused on cosmetic surgery and relevant information regarding safety and quality.

### Search terms

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| **#1** | *Surgery, Plastic/ or *Reconstructive Surgical Procedures/ or "plastic surgery".ti,ab. or "reconstructive surgery".ti,ab. or (cosmetic ADJ3 surgery).ti,ab. or "aesthetic surgery".ti,ab. OR *Abdominoplasty/ OR Abdominoplasty.ti,ab. OR "tummy tuck".ti,ab. OR *Lipectomy/ OR "belt lipectomy".ti,ab. OR "biceps implants".ti,ab. OR brachioplasty.ti,ab. OR *Mammaplasty/ OR *Breast Implants/ OR "breast augmentation".ti,ab. OR "breast reduction".ti,ab. OR "breast lift".ti,ab. OR "buttock augmentation".ti,ab. OR "buttock reduction".ti,ab. OR "buttock lift".ti,ab. OR "calf implants".ti,ab. OR "deltoid implants".ti,ab. OR *Rhytidoplasty/ OR facelift.ti,ab. OR "face lift".ti,ab. OR "facial implants".ti,ab. OR "fat transfer".ti,ab. OR labiaplasty.ti,ab. OR liposuction.ti,ab. OR mastopexy.ti,ab. OR monsplasty.ti,ab. OR "neck lift".ti,ab. OR "pectoral implants".ti,ab. OR "penis augmentation" OR<br>*Rhinoplasty/ OR rhinoplasty.ti,ab. OR "triceps implants".ti,ab. OR vaginoplasty.ti,ab. OR (*Rejuvenation/ AND surgery.ti,ab.) OR blepharoplasty.ti,ab. OR "arm lift".ti,ab. OR "abdominal etching".ti,ab. OR "areola reduction".ti,ab. OR "mummy makeover".ti,ab. OR "belly button surgery".ti,ab. OR "body lift".ti,ab. OR "butt lift".ti,ab. OR "breast implant removal".ti,ab. OR "brow lift".ti,ab. OR "forehead lift".ti,ab. OR "forehead rejuvenation".ti,ab. OR "forehead reduction".ti,ab. OR "butt augmentation".ti,ab. OR "butt implant".ti,ab. OR "calf reduction".ti,ab. OR "cheek implant".ti,ab. OR "cheek augmentation".ti,ab. OR "cheek lift".ti,ab. OR "mid-face lift".ti,ab. OR "chin implant".ti,ab. OR "chin augmentation".ti,ab. OR "clitoral hood reduction".ti,ab. OR hoodectomy.ti,ab. OR "toe shortening".ti,ab. OR "toe lengthening".ti,ab. OR "foot narrowing".ti,ab. OR "dimpleplasty".ti,ab. OR "ear lobe surgery".ti,ab. OR "otoplasty".ti,ab. OR "ear pinning".ti,ab. OR "hair transplant".ti,ab. OR "eyebrow transplant".ti,ab. OR "eyelid retraction repair".ti,ab. OR "eyelid surgery".ti,ab. OR "facial feminization surgery".ti,ab. OR "nose job".ti,ab. OR "lip augmentation".ti,ab. OR "scalp advancement".ti,ab. OR "hairline lowering".ti,ab. OR "chest masculinization".ti,ab. OR "top surgery".ti,ab. OR "chest feminization".ti,ab. OR "subcutaneous mastectomy".ti,ab. OR "jaw reduction".ti,ab. OR "lip implants".ti,ab. OR "lip lift".ti,ab. OR "lip reduction".ti,ab. OR "mole removal".ti,ab. OR "thigh lift".ti,ab. OR "genioplasty".ti,ab. OR "mentoplasty".ti,ab. OR "buccal fat removal".ti,ab. OR "body contouring".ti,ab. |
| **#2** | *patient safety/ OR *Patient Satisfaction/ OR *quality improvement/ OR *"Quality of Health Care"/ OR (safety.ti,ab. AND patient.ti,ab.) OR quality improvement.ti,ab. OR quality care.ti,ab. OR healthcare safety.ti,ab. OR patient protecting.ti,ab. OR *Iatrogenic Disease/ OR iatrogenic.ti,ab. OR *Infections/ OR infection*.ti,ab. OR *Sepsis/ OR sepsis.ti,ab. OR ((prevention OR prevent OR avoid OR avoidance OR reduce OR reduction)ti,ab. AND (error*.ti,ab. OR adverse.ti,ab. OR complication*.ti,ab. OR harm.ti,ab. OR inappropriate.ti,ab. OR incorrect.ti,ab. OR risk.ti,ab.)) |

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| **#3** | (systematic review or meta-analysis).pt. OR meta-analysis/ or systematic review/ or systematic reviews as topic/ or meta-analysis as topic/ or "meta analysis (topic)"/ or "systematic review (topic)"/ or exp technology assessment, biomedical/ or network meta-analysis/ OR ((systematic* adj3 (review* or overview*)) or (methodologic* adj3 (review* or overview*))).ti,ab,kf. OR ((quantitative adj3 (review* or overview* or synthes*)) or (research adj3 (integrati* or overview*))).ti,ab,kf. OR ((integrative adj3 (review* or overview*)) or (collaborative adj3 (review* or overview*)) or (pool* adj3 analy*)).ti,ab,kf. OR (data synthes* or data extraction* or data abstraction*).ti,ab,kf. OR (handsearch* or hand search*).ti,ab,kf. OR (mantel haenszel or peto or der simonian or dersimonian or fixed effect* or latin square*).ti,ab,kf. OR (met analy* or metanaly* or technology assessment* or HTA or HTAs or technology overview* or technology appraisal*).ti,ab,kf. OR (meta regression* or metaregression*).ti,ab,kf. OR (meta-analy* or metaanaly* or systematic review* or biomedical technology assessment* or bio-medical technology assessment*).mp,hw. OR (medline or cochrane or pubmed or medlars or embase or cinahl).ti,ab,hw. OR (cochrane or (health adj2 technology assessment) or evidence report).jw. OR (comparative adj3 (efficacy or effectiveness)).ti,ab,kf. OR (outcomes research or relative effectiveness).ti,ab,kf. OR ((indirect or indirect treatment or mixed-treatment or bayesian) adj3 comparison*).ti,ab,kf. OR (meta-analysis or systematic review).mp. OR (multi* adj3 treatment adj3 comparison*).ti,ab,kf. OR (mixed adj3 treatment adj3 (meta-analy* or metaanaly*)).ti,ab,kf. OR umbrella review*.ti,ab,kf. OR (multi* adj2 paramet* adj2 evidence adj2 synthesis).ti,ab,kf. OR (multiparamet* adj2 evidence adj2 synthesis).ti,ab,kf. OR (multi-paramet* adj2 evidence adj2 synthesis).ti,ab,kf. |
| **#4** | (guideline or practice guideline or consensus development conference or consensus development conference, NIH).pt. OR (guideline* or standards or consensus* or recommendat*).ti. OR (practice parameter* or position statement* or policy statement* or CPG or CPGs or best practice*).ti. OR (care adj2 (path or paths or pathway or pathways or map or maps or plan or plans or standard)).ti. OR ((critical or clinical or practice) adj2 (path or paths or pathway or pathways or protocol*)).ti. OR (algorithm* and (pharmacotherap* or chemotherap* or chemotreatment* or therap* or treatment* or intervention*)).ti. OR (algorithm* and (screening or examination or test or tested or testing or assessment* or diagnosis or diagnoses or diagnosed or diagnosing)).ti. OR (guideline* or standards or consensus* or recommendat*).au. OR (guideline* or standards or consensus* or recommendat*).ca. OR systematic review.ti,pt,kf,sh. and (practice guideline* or treatment guideline* or clinical guideline* or guideline recommendation*).ti,ab,kf. |
| **#5** | #1 AND #4 *(i.e. any guidelines relating to cosmetic surgery)* |
| **#6** | #1 AND #2 AND #3 *(i.e. any systematic reviews relating to safety and cosmetic surgery)* |
| **#7** | #5 AND #6 |
| **#8** | Limit #7 to published 2013-current |

## PICOS statement

Search results had to meet the eligibility criteria summarised in the PICOS statement below.

**Participants** – adults and adolescents (persons aged 10-19 years).

**Intervention** – interventions, tools, resources to reduce risk to patients specifically associated with cosmetic surgery.

**Comparator** – no intervention/usual care, alternative intervention.

**Outcomes** – any patient safety outcome, including improvements in recovery, reductions in specific or multiple adverse effects (e.g. infection, seroma, haematoma etc), reductions in service use such as length of stay.

**Study design** – Systematic reviews, clinical guidelines.

**Other limitations** – last 10 years (2013-current), full text version available in English, sources must focus on cosmetic surgery and include relevant information regarding safety and quality.

### Screening for eligibility

Search results were screened automatically and manually to remove duplicates. Results were then screened by article type to exclude conference abstracts, editorials and study protocols. Titles (and abstracts where necessary and available) were then screened to exclude articles that were not relevant to cosmetic surgery, or that clearly did not meet the eligibility criteria. Full text articles were sourced for the remaining results. These were screened against the eligibility criteria.

### Results

The database search identified 1,690 potentially relevant articles. Duplicates were removed, leaving 1,103 articles for screening. The full text articles for 220 results were sourced and an additional 51 articles excluded, leaving 169 eligible articles for inclusion in the review.

## Search of professional clinical practice guidelines

A search of websites of national and international medical regulatory authorities and cosmetic, aesthetic and plastic surgery professional associations was also performed. This included a web-based search of medical regulatory authorities in Australia, Canada, Malaysia, New Zealand, Singapore, United Kingdom and the United States of America (USA) for cosmetic surgery guidelines.

A secondary search for professional codes of conduct was performed of cosmetic and aesthetic surgery professional colleges and associations. The sites searched are listed as **Attachment A**.

# Findings

The findings relating to Question 4 are presented first given they provide context for the other research questions.

## Question 4: What safety and quality standards and guidelines for clinical practice operate nationally and internationally for cosmetic surgery, and what do they address?

### National and international regulatory guidelines

In 2016 and 2017 the Medical Board of Australia (MBA), New Zealand Medical Council (NZMC), United Kingdom General Medical Council (GMC-UK) and Singapore Medical Council (SMC) issued comprehensive cosmetic surgery guidelines.[53, 60-62] The Malaysian Ministry of Health (MMOH) also provided detailed guidance for the profession.[54]

The literature search did not identify Canadian provincial medical boards or USA medical boards issued cosmetic surgery guidelines. Relevant professional requirements in these countries were listed in advertising guidelines and general ethical codes. These are described below.

#### General requirements

The MBA's *Good medical practice code of conduct* outlines a standard ethical approach to professional clinical practice involving cosmetic medical and surgical procedures.[65] This approach is largely reflected in the international guidelines.

The Australian guidelines include:[60]

- An overarching principle recognising that as cosmetic surgery does not have a medical imperative there are different considerations for the doctor-patient relationship including disclosure of risk
- Advice on undertaking a comprehensive patient assessment
- Information to include a detailed plain language written consent process covering all relevant issues including financial arrangements
- Instructions articulating the clinical responsibility of the primary medical practitioner for the management of the patient and the supervision and competence of other staff
- Requirements regarding the choice of a suitable facility where the surgery is performed
- Expectations around the medical practitioner's training, experience and competence
- Legislative requirements regarding advertising of services.

#### Psychological screening and assessment

For adult patients, the Australian guidelines include obligations requiring independent third-party evaluation if significant psychological problems are evident.[60] This is also described in the New Zealand guidelines.[61]

The Singapore guidelines require the application of appropriate assessment tools to ensure safe counselling of vulnerable patients.[53]

The Australian Psychological Society has developed detailed guidelines about the assessment of candidates for cosmetic surgery which align with the MBA's expectations.[66]

## Cooling-off periods

Cooling-off periods allow patients to consider the information provided to them and reflect on their decision.

The Australian guidelines require a period of seven days from signing the consent form until the procedure.[60] The New Zealand guidelines specify seven days from the initial consultation until the procedure.[61] The United Kingdom recommends a period of reflection of 14 days.[62]

## Teenage patients

The Australian, New Zealand and United Kingdom guidelines all have requirements regarding prospective patients aged under 18 years. The MBA obligations require:[60]

- A formal assessment of the young person's ability to consent
- Seeking a parent's opinion where appropriate and practicable
- A second assessment by a psychologist, psychiatrist or general practitioner independent of the medical practitioner
- Encouragement of the young person to discuss the proposed surgery with their general practitioner
- A three-month cooling-off period.

The GMC-UK also requires that:[62]

- Any procedure must be in the best interest of the young person
- Any choice will least restrict future options
- The parent can consent to the procedure if the child does not have the maturity or capacity to do so, but the child must be involved in the decision as much as possible and the procedure should not proceed if the child does not want it.

## Medical practitioner qualifications

The MBA guidelines state that cosmetic surgery procedures should only be provided by a medical practitioner who has the appropriate training, expertise, and experience, which is consistent with the United Kingdom's requirements.[60]

In New Zealand, cosmetic surgeons must be registered with a surgical scope of practice (e.g. plastic and reconstructive surgery, general surgery, ear, nose and throat (ENT) surgery, ophthalmology) and have relevant training and expertise, with independently accredited competence. A special category is available for dermatologists.[61]

In Singapore, doctors permitted to undertake cosmetic surgery are plastic surgeons, dermatologists, ophthalmologists with oculoplastic training, ENT surgeons with facial plastic training and general surgeons with vascular training.[53] Similar restrictions apply in Malaysia.[54]

## Cosmetic surgery advertising requirements

Internationally most Medical Boards have separate advertising guidelines for cosmetic surgery, comparable in content to the MBA's *Guidelines for advertising of regulated health service* which are referenced in the cosmetic surgery guidelines.[67]

In Australia, medical practitioners must not make claims about qualifications, experience or expertise that mislead patients by implying they are more skilled or experienced than they are.[60]

In Singapore, where cosmetic surgery and aesthetic practice is not considered a specialty, terms such as aesthetic plastic surgeon are not allowed.[53]

In Canada, where standards for the medical profession are determined by each province, British Columbia and Ontario prohibit registrants from using the term "surgery" or the title "surgeon" or a variation or abbreviation unless the medical practitioner is certified by the Royal College of Physicians and Surgeons of Canada in a surgical specialty or subspecialty.[68]

## General advertising requirements

Medical registration authorities in Australia and overseas regularly update the general requirements in relation to advertising of medical services which apply to cosmetic surgery.

The 2020 Australian guidelines state that for a regulated health service, the advertising must not:[67]

- Be false, misleading or deceptive, or likely to be misleading or deceptive
- Offer a gift, discount or other inducement, unless the terms and conditions of the offer are also stated
- Use testimonials or purported testimonials about the service or business
- Create an unreasonable expectation of beneficial treatment
- Directly or indirectly encourage the indiscriminate or unnecessary use of regulated health services.

## Facilities where cosmetic surgery is performed

General requirements for facilities where cosmetic surgery is performed include:

Australia

The MBA expects that the medical practitioner is familiar with relevant legislation, regulations and standards which apply to the facility and that the facility is appropriate for the level of risk, with staffing and equipment to manage complications and emergencies.[60]

New Zealand

The NZMC requires surgical procedures are performed in a day procedure centre or a hospital with an anaesthetist present and with adequate and appropriate back-up to address any foreseeable operative complications.[61]

United Kingdom

The GMC-UK requires that the facility is safe, suitably equipped and staffed and complies with regulatory requirements.[62]

Malaysia

The MMOH requires that aesthetic surgery is performed by a surgical specialist under local anaesthetic in a minor surgery room or under general or spinal anaesthesia in an operating theatre located in an ambulatory care centre or hospital, as defined.[54]

Singapore

For each procedure, the SMC sets requirements regarding who can perform the procedure and in what type of facility. For example, ‘brow lifts’ can be performed by ENT surgeons with facial plastic training, ophthalmologists trained in oculoplastic surgery, and plastic surgeons. Brow lifts must be performed in an operating theatre or clinic, as defined. A cosmetic abdominoplasty can only be performed by a plastic surgeon in an operating theatre.[53]

The SMC surgeon and facility requirements for invasive procedures is provided as **Attachment B.**

### Audit, quality assurance and peer review

The MBA guidelines make no specific reference to audit, quality assurance and peer review, which are requirements of the medical councils of New Zealand and Singapore.

## Professional Associations with cosmetic surgery in scope

### Australia and New Zealand

In Australia and New Zealand, professional associations represent their member interests and may provide fellowship opportunities and continuing education.

The Australian Medical Council affiliated organisations whose scope includes cosmetic surgery are:

- Australasian College of Dermatologists
- Australian and New Zealand College of Anaesthetists (ANZCA)
- Royal Australian College of General Practitioners (RACGP)
- Royal Australasian College of Physicians
- Royal Australian and New Zealand College of Obstetrics and Gynaecology (RANZCOG)
- Royal Australian and New Zealand College of Ophthalmologists
- Royal Australasian College of Surgeons
- Australian Society of Plastic Surgeons
- Australian and New Zealand Association of Oral & Maxillofacial Surgeons
- Australian Society of Otolaryngology and Head and Neck Surgery
- Urological Society of Australia and New Zealand.

Public messaging and formal positions on cosmetic surgery

None of the colleges or associations listed above have formal, publicly available policies or guidelines on the broad scope of cosmetic surgery. However, a number have public positions, statements or media releases on aspects of cosmetic surgery or have made public submissions to the Ahpra review on cosmetic surgery.

College websites have links to articles published in their journals in relation to female genital cosmetic surgery (RACGP, RANZCOG), body dysmorphic disorder (RANZCOG) and cosmetic surgery in children (RACGP), but these do not represent formal positions.[69, 70]

Royal Australian and New Zealand College of Obstetrics and Gynaecology (RANZCOG)

There is a current position statement (2019) from RANZCOG that advises surgical or laser techniques which claim to improve the appearance of the female genital tract are relatively new, poorly understood and backed by limited clinical evidence.[69] The position statement refers to procedures such as vaginal rejuvenation, designer vaginoplasty, and techniques for vaginal atrophy and says there is no evidence that these procedures are effective, enhance sexual function or improve self-image.[69, 71]

RANZCOG advises that surgical techniques which claim to improve the appearance of the female genital tract are relatively new, poorly understood and lack clinical evidence. It recommends that:[69]

- Obstetricians and gynaecologists educate women that there is a large variation in the appearance of normal female external genitalia and normal physiological changes occur over time

- The reasons patients request surgery other than for gynaecological conditions should be carefully assessed
- The risks of potential complications such as scarring, adhesions, permanent disfigurement, infection, dyspareunia and altered sexual sensations should be discussed in detail with prospective patients
- Sexual counselling is provided to patients requesting surgery that is purported to enhance gratification
- Medical practitioners who perform these procedures should not promote or advertise that these surgeries enhance sexual function.

Australian and New Zealand College of Anaesthetists (ANZCA)

ANZCA has addressed concerns it has about standards and safety of cosmetic surgery undertaken in day procedure hospitals and when anaesthesia is provided by non-ANZCA fellows by issuing a consumer information bulletin. It advises that:[72]

- General anaesthetics must always be administered by a specialist anaesthetist, or another registered medical practitioner specifically trained to deliver general anaesthesia and working within their scope of practice
- Cosmetic surgery operations should be done in a hospital operating theatre or a clinic that meets standards set by health authorities, including having access to suitable medical equipment and enough staff to be able to resuscitate patients or deal with other complications.

Australasian College of Cosmetic Surgery and Medicine (ACCSM)

ACCSM has a code of practice which places heavy emphasis on individual ethical behaviour, and compliance with the MBA advertising and consent guidance. It proposes a one-to-five-day cooling-off period depending on individual circumstances. It also requires members to disclose to patients if they have performed less than 100 operations of the proposed surgery.[73] ACCSM audits members and the code is underpinned by an internal complaints process.

## International

United Kingdom

The Royal College of Surgeons England (RCSE) has based its Professional Standards for Cosmetic Surgery on the GMC-UK guidance with additional expectations of members. The additional requirements include:[49]

- Meet RCSE continuing education and revalidation requirements including patient experience from cosmetic practice and present the results for discussion at routine appraisal
- Maintain an accurate portfolio of data and undertake regular audit of clinical activity, including contributing to national audits and registries where available, participate in case reviews in morbidity and mortality meetings, take part in professional networks to discuss complex cases and ensure that any implants, medicines and medical devices are compliant with national requirements
- Use patient reported outcome measures (PROMs) from the Q Portfolio for abdominoplasty, augmentation mammoplasty, blepharoplasty, liposuction, rhinoplasty and rhytidectomy operations
- Surgery is carried out at a registered premises

- Surgeons must take responsibility for ensuring that staff, skill mix and equipment are available and fit for purpose before proceeding, including anesthetics, recovery and on-call cover for overnight stays
- Attempt to identify the psychologically vulnerable patient and be prepared to avoid or defer operations pending a psychological assessment
- Refer a patient to a mental health expert if the psychological state may affect the patient's satisfaction with the outcome of surgery.
- Allocate the appropriate time and number of consultations to allow an in-depth discussion of the procedure with the patient, including:
    - History of previous cosmetic procedures, outcomes and patient satisfaction
    - Full explanation of the procedure and its implications, complexity, duration of pain, length of recovery and associated complications
    - Explanation of the quality of evidence for the procedure
    - Likely outcomes of the procedure, including the anticipated impact on day-to-day life
    - Follow-up treatment, aftercare and relevant financial implications
    - Explanation of fee structures including for the management of complications
    - Alternative (operative, non-operative, do nothing) options
    - Information about the surgeon's personal complication rate or their most common complications.
- Ensure consent is obtained in writing by the operating surgeon.
- Ensure consent is obtained in a two-stage process with a cooling-off period of at least two weeks between the stages to allow the patient to reflect on the decision, if this is not possible good reasons should be recorded in the patient record.
- Information on the procedure should be received at a different time to signing the consent form.
- Post-operatively have a detailed discussion explaining the course of the operation where relevant, explain any complications that have occurred and possible solutions.
- Ensure there are clear arrangements for patient care in the event of an emergency.
- Ensure the patient is aware of a clear process for complaints.
- Maintain accurate, clear, legible, comprehensive and contemporaneous records of all important communications with the patient.
- Use standardised recording forms on consent and complications.
- Ensure details of specific implants or injectables are provided in a timely manner to the regulatory authorities.
- Communicate clearly relevant professional qualifications to patients, including specialist registration on the GMC-UK register and certification in the areas of cosmetic surgery in which they practice.
- Disclose any personal affiliation or other financial or commercial interest including other private healthcare companies, pharmaceutical companies or instrument manufacturers.

- Ensure that any advertising is realistic and ethical, be for the sole purpose of conveying factual information and refrain from the use of financial inducements.

The British Association of Plastic, Reconstructive and Aesthetic Surgeons (BAPRAS) and British Association of Aesthetic Plastic Surgeons (BAAPS) have Codes of Practice and Conduct respectively.

BAPRAS requires that members comply with relevant GMC-UK guidelines.[74] Both BAPRAS and BAAPS extend cautions about disclosable potential conflicts of interest to cover relationship and financial interests in device manufacturers and distributors and the pharmaceutical industry.[74, 75]

BAPRAS and BAAPS provide specific and detailed guidance in relation to patients aged under 18 years. While parents/guardians written consent is not legally required above the age of 16 it is recommended to obtain the parent's verbal consent.[74, 75]

Europe

The European Society of Plastic Reconstructive and Aesthetic Surgery (ESPRAS) has endorsed a position statement on protecting patients from unsafe cosmetic surgical practices by specifying minimum standards of training and education.[76]

ESPRAS supports a cooling-off period of one week for cosmetic surgery procedures which require a general anaesthetic, regional block or sedation.[76]

USA

The American Society of Plastic Surgery has policies on breast augmentation surgery for teenagers.[77]

The American College of Obstetricians and Gynecologists also advocates against labiaplasty where it is not medically indicated, arguing it carries substantial risk and lacks effectiveness.[78]

# Question 1: What are the patient safety and quality care risks relevant to cosmetic surgery?

The literature review identified a range of patient safety and quality care risks associated with cosmetic surgery. The safety and quality risks are grouped into five categories, and where relevant, these risks are separated into before, during and after surgery.

- Patient factors to inform patient selection
- Informed patient consent and quality feedback
- General complications with cosmetic surgery
- Complications associated with specific forms of cosmetic surgery
- Complications linked to specific cosmetic surgery procedures.

The literature review identified cosmetic tourism, when patients elect to undergo cosmetic surgery procedures abroad, as a growing industry. While cosmetic tourism is not in direct scope of this review, the adverse consequences of cosmetic tourism are likely to be managed in Australian health services by Australian medical practitioners, with risks for both the patient and community. Cosmetic tourism and its associated risks are discussed in a dedicated section below.

## Patient factors

The patient factor risks are all considered 'before' surgery risks. Preoperative recognition of patients suitable and unsuitable for cosmetic surgery is important to prevent an unsatisfactory outcome for both the patient and medical practitioner.

An increasing number of people are seeking cosmetic surgery procedures to change aspects of their appearance and improve psychosocial wellbeing.[79] The majority of people seeking cosmetic surgery do not have evidence of a psychological or psychiatric disorder, have relatively realistic expectations, are satisfied with the outcome and report improvements in self-esteem, quality of life and relationships.[80-82]

However, there are safety and quality risks that the literature recommends medical practitioners prioritise as part of the patient selection process:

- General at-risk characteristics of cosmetic surgery candidates
- Psychological screening
- Young people and teenagers
- Surgery candidates after massive weight loss
- Physically at-risk candidates.

### General at-risk characteristics of cosmetic surgery candidates

The literature identified a range of predictors related to the patient perceiving negative outcomes associated with the cosmetic surgery, including:[1, 83]

- Male gender
- Aged less than 40
- Expectations about secondary gain in unrelated domains of their life such as their job or interpersonal relationships
- People who are vague about the changes they want
- Candidates who have had previously successful surgeries, with minimal deformities or abnormalities who want further changes

- Patients who have had multiple surgeries in the past
- Narcissistic personality and obsessive personality disorders
- Pressure from partners or family for unwanted surgery
- Changes linked to a patient's personal, cultural, or familial identity may experience unexpected disruptions within relationships following the loss of a shared physical familial or cultural characteristic.

Medical practitioners who perform cosmetic surgery on unsuitable patients are at risk of harassment and threats of violence, repeated demands for unnecessary procedures, complaints, and legal action.[80, 84]

## Psychological screening of cosmetic surgery candidates

A proportion of cosmetic surgery candidates experience appearance-related psychosocial distress and have inappropriate and unrealistic expectations about the potentially positive impact surgery will have on their lives, particularly job prospects and personal relationships, and generally wish to achieve instantly recognisable results.[1]

People with body dysmorphic disorder (BDD) and its variants often seek cosmetic surgery to remedy their perception of physical flaws.

The specific diagnostic criteria for BDD are:[85]

- Preoccupation with one or more non-existent or slight physical flaw
- Repetitive behaviours such as mirror checking or comparing one's appearance with others
- Preoccupation with appearance that causes impairment in social, occupation, or other areas of function
- There is no other attributable diagnosis.

The rate of BDD in the general population is estimated at about 2%.[86] Research published in 2008 suggests rates of BDD are at 5-15% amongst people seeking cosmetic surgery, and a 2022 meta-analysis with a sample size of 14,913 people (48 articles) found a rate of 19.2%.[86-89]

In 2016, an internationally recognised expert team calculated the weighted prevalence of BDD in different settings, with women outnumbering men in most settings, although not cosmetic surgery settings:[90]

- Adults in the community at 1.9%
- Adolescents at 2.2%
- Student populations at 3.3%
- Adult psychiatric inpatients at 7.4%
- Adolescent psychiatric inpatients at 7.4%
- Adult psychiatric outpatients at 5.8%
- General cosmetic surgery at 13.2%
- Rhinoplasty surgery at 20.1%
- Cosmetic dermatology outpatients at 9.2%.

There is a low level of awareness and understanding about BDD amongst the public and health professionals, leading to low detection rates. When people with BDD do seek help they are more likely to present in a cosmetic or dermatology setting than a psychiatric one.[89]

The diagnosis is often missed in psychiatric settings when the patient presents with other related problems of depression, substance misuse or social anxiety. Health professionals are often not confident in the diagnosis and treatment of BDD, and due mainly to patient shame it is under-reported and under-diagnosed.[90]

Approximately 81% of patients with BDD who undergo surgery are dissatisfied with their post-operative result, which are likely to cause further distress, worsen BDD symptoms and increase risk of self-harm.[1, 91] These patients are also likely to find a new perceived defect and want additional surgery.[84]

## Young people and teenagers

Social media, the internet and the use of smartphones have had a profound effect on teenagers, with this generation of adolescents more exposed to peer appearance feedback than any previous generation. Consequently, they are more vulnerable to being bullied and teased, which has been found to be a key factor in them seeking cosmetic surgery.[92] As active participants on social media, adolescents can receive instant external feedback regarding their body image from friends, peers, and unknown social media users. There is evidence that adolescent girls are at risk of overvaluation of shape and weight, dietary restraint, body dissatisfaction, and internalisation of the thin 'ideal' body type.[93, 94] This paradigm change in adolescent behaviours is evident in the rise of cosmetic surgery procedures performed in this group.[92]

If cosmetic surgery for a younger person or teenager is contemplated, ideally it should be delayed until the anatomical region to be operated on has completed its normal growth which for the:[44, 92, 95, 96]

- Ear, is older than 5 years
- Nose, is 15-17 years in girls, and 16-18 years in boys
- Breast, where all surgery should be delayed until after the age of 18 years.

## Surgery candidates after massive weight loss

Bariatric surgery for extreme obesity is increasingly popular, however the resultant massive weight loss frequently results in an excess of overstretched skin causing physical discomfort and negatively affecting quality of life, self-esteem, body image, and physical functioning.[97]

There is a significantly increased risk of post-operative complications after cosmetic surgery for patients who have had previous bariatric surgery compared with other patients, with malnutrition and malabsorption being possible explanations.[98, 99] Wound dehiscence and seroma are common complications, with minor complications occurring in a high percent of patients, regardless of the surgical procedure that is performed.[48]

Severe complications increase the average cost per patient by almost three times.[100]

## Medically at-risk candidates

Medically at-risk patients include those who:[101-103]

- Have a high body mass index (BMI)
- Have long-term, complex or high-risk medical conditions that increase surgical or anaesthetic risk, such as cardiorespiratory disease or immunosuppression
- Are older patients, as wound healing is impaired in aged skin which may lead to a higher risk of infection, delayed wound healing, necrosis and more prominent scarring
- Tobacco smokers, as smoking causes delayed healing and complications. Smokers have a much higher incidence of seroma compared to non-smokers.

Medically at-risk patients are at greater risk of adverse post-operative complications and of rapid

deterioration in their condition, even after low-risk procedures.[104] Identifying potential risk factors in the patient population can better help to identify the risk of postoperative complications and potentially allow for targeted intervention and medical optimisation prior to surgery.[105]

## Patient consent and feedback

Patient consent or informed consent is a person's voluntary decision about their health care that is made with knowledge and an understanding of the benefits and risks involved. The evidence review identified several deficiencies in general patient consent procedures. There is, for instance, difficulty in assessing the patient's understanding of the consent form.[2] Some studies also found patient recollection and understanding of consent for cosmetic surgery is low and declines over time.[3, 4]

One study found, if a medical practitioner does not conduct pre-operative assessments, manage patient expectations or take the time to understand the patient's perspective regarding the cosmetic surgery, the medical practitioner risks undesirable outcomes such as reputational damage, harassment, repeated demands for unnecessary procedures, complaints and in extreme cases, litigation.[84]

## General complications with cosmetic surgery

All invasive procedures expose patients to well-recognised surgical and anaesthetic risks. The safety and quality risks discussed in this section are 'during' or 'after' surgery risks. These risks are broadly the same for cosmetic surgery as with other surgery types. Complications during and after surgery can range in severity from minor time-limited complications which do not require specific treatment, to severe complications which require an emergency department visit, hospital admission or reoperation. The severe complications are more likely after major abdominal cosmetic surgery.[106]

The complications listed below may occur after cosmetic surgery, with incidence varying between procedures. Depending on severity, these complications may be managed conservatively, in the ambulatory setting or may require hospitalisation.[106, 107]

### Swelling, bleeding and haematoma

Despite sophisticated advances in cosmetic surgery techniques and knowledge, there can still be significant complications including haematoma, bleeding, swelling and infection. These common complications impair healing time, slow post-operative recovery, require reoperation, increase costs, alter the final intended cosmetic outcomes and reduce patient satisfaction.[13, 14]

### Surgical site infections

Post-operative surgical site infections (SSIs) occur at or near the surgical incision within 30 days of the procedure. Reducing the incidence of SSIs is particularly relevant in cosmetic surgery as any infection is likely to adversely impact the aesthetics of the surgical outcome.[21, 22]

The development of SSIs in patients who have undergone elective cosmetic surgery is associated with an increased risk of psychological complications, including depression and anxiety.[23]

### Seroma formation

Seroma formation is a common complication of cosmetic surgical procedures where anatomical dead space is created.[25] Seromas cause patient discomfort, and usually require multiple percutaneous aspirations and possibly additional surgical procedures.[26, 27] Seromas can prolong recovery time and delay the patient's return to normal activities.[28] Seromas also carry the risk of becoming infected, resulting in an abscess.[29]

### Nerve injury

The risk of post-operative nerve lesions is of particular concern with facial surgery. There is a risk of temporary or permanent injury to the facial nerve in face lift surgery.[15] Submandibular gland resection involves deep neck surgery with the marginal mandibular nerve at risk.[16]

Other nerve injuries are reported with cosmetic breast surgery and abdominoplasty.[17-19]

Additionally, abnormal sensation is a common post-operative occurrence of liposuction which may take up to six months to resolve.[20]

### Venous thromboembolism (VTE)

VTE can be an immediately life-threatening complication of any surgical procedure. Excluding abdominoplasty, it is estimated that 70–80% of the plastic surgery patient population falls into a low-risk category for VTE.[31]

## Complications associated with specific forms of cosmetic surgery

This section provides some background to different forms of cosmetic surgery and discusses the risks associated with each:

- Allogenic cosmetic surgery implants
- Liposuction and body-contouring
- Autologous fat transfer and grafts.

### Allogenic cosmetic surgery implants

Allogenic implants used in cosmetic surgery are available in a variety of materials, such as silicone, polyethylene Goretex, mesh and polyester fibre. Each of these materials poses certain complication risks based on their surface contour (smooth vs. porous), pliability, and reactivity with surrounding tissue. In addition, certain implant locations within the head and neck are at risk of specific post-operative complications.[6]

Risks

Infections, seromas, haematomas, implant rupture, deflation, extrusion and necrosis can arise from implant surgery as immediate or short-term complications, or tissue atrophy and capsular contracture as longer-term complications.[10, 11]

Capsular contracture is a risk related to allogenic implants and develops when the body detects a foreign object inside the body and begins to create fibrous scare tissue in self-defence. The scar tissue surrounds the foreign object like a capsule in order to protect the body. Capsular contracture is characterised as progressive and can create disfiguring changes which lead to poor outcomes, patient discomfort, can reduce the cosmetic outcome of the procedure, premature explantation and re-operation.[10, 32, 33]

Factors influencing rates of capsular contracture include the presence of post-operative seroma and haematoma, smooth implants, sub-glandular placement of the prosthesis and subsequent trauma.[108]

### Liposuction and body-contouring

Liposuction is a body contouring procedure that relies on controlled localised removal of fatty deposits.[109] Liposuction methods have evolved and advanced substantially over recent years, generally improving patient outcomes.[20]

Risks

Risk factors for complications from liposuction are excessive infiltration and toxicity from local anaesthetic or adrenaline (usually with some hour-delayed onset), excessive removal of adipose tissue with volume depletion in the third space, post-operative respiratory depression and early discharge. The risk of VTE is associated with blood flow stasis, trauma and possible hypercoagulation status. As a result of better understanding of surgical techniques and the introduction of new infiltration techniques these complications are now very rare.[106]

Bruising is inevitable in liposuction and varies according to the individual patient, the volume of the treated area, and the extent of the treatment. Oedema usually subsides within several weeks, but in distal areas, such as the calf or ankle, may persist from six months to a year. Induration will subside in a similar fashion. Hyperaesthesia or dysaesthesia are common consequences of the procedure, which will gradually improve in three to six months after surgery. A minor degree of irregularity in the overlying skin also improves within a period of a few months. Localised infections are not frequent but are easily treated, whereas the very rare complication of toxic shock syndrome, a systemic disease caused by the toxin of S aureus, is a life-threatening event.[20]

### Autologous fat transfer and grafts

Autologous fat grafting (AFG) consists of transferring fat or adipose tissue harvested from one site to another in the same patient. Autologous fat is considered an ideal soft tissue filler as it is easily accessible, biocompatible and cheap, while providing both volume augmentation and skin quality improvement.[110] These features make it a useful tool for cosmetic purposes. AFG is associated with increased skin trophism and vascularisation, reduced post-operative pain, and improved cosmetic results compared to cases where it is not used.[111-113] The safety and efficacy of fat grafting has been largely studied in different body areas, especially the breast, where fat grafting has been extensively used for both augmentation and reconstructive procedures.[114]

Risks

Recent research demonstrates that the majority of risks from AFG are no different from other forms of surgery.[115-120]

Severe complications of intravascular injection and fat migration have been found in relation to gluteal grafts and some risks with face grafts have also been identified.[121] The exact rate of intravascular injection or migration is overall likely to be low, however the presence of fat tissue in the bloodstream is pathological and can lead to significant complications such as fat embolus syndrome and macroscopic fat embolus (MAFE).[35] The recovery rate of major complication (MAFE) is very poor.[36]

## Complications linked to specific cosmetic surgery procedures

This section discusses the following cosmetic surgery procedures and outlines the risks linked to each:

- Breast surgery
- Facial and oral surgery
- Body contouring surgery
- Female genital cosmetic surgery
- Penile augmentation surgery.

## Breast surgery

There are broadly four major forms of cosmetic breast surgery:

- Breast augmentation (augmentation mammaplasty) with the insertion of implants to increase breast size
- Autologous fat transfer breast augmentation
- Mastopexy where the breast is lifted by removing excess skin and tightening the surrounding tissue to reshape and support the new breast contour
- Secondary reduction mammoplasty, which may be performed to correct poor cosmetic outcomes from a primary reduction procedure.

There are a range of risks associated with cosmetic breast surgery.

### Breast augmentation and implant surgery

Before surgery risks

There are a number of decisions patients and medical practitioners have in relation to breast augmentation and implant surgery, all of which have a substantial influence on aesthetics, patient satisfaction and overall success of the procedure. These include the:[9, 122, 123]

- Implant size and shape
- Implant type and texture
- Surgical incisional site
- Implant plane.

Two systems are used to choose breast implants:[122]

- A tissue-based planning implant sizing system, that selects implants that best fits the breast based on patient breast measurements and tissue type
- Patient or medical practitioner selection systems that allow the medical practitioner or patient preference to dominate the decision process for implant dimensions.

The patient selection system offers short-term patient satisfaction but can lead to higher rates of complications, including breast tissue atrophy, ptosis, and visible implant distortions. The tissue-based system offers greater longevity while limiting patient preference.[7, 122]

Round implants have been found to have a higher cumulative risk in developing capsular contracture, implant rupture in primary augmentation, a higher infection risk in primary reconstruction and a greater risk of bottoming-out compared to other shaped implants.[8] However, the literature argues there is little consensus in the cosmetic surgery community on choosing the shape of an implant.[7, 8]

The current literature does not provide a guideline about the choice of implant. In the end, the choice of the implant is an agreed decision between the patient and medical practitioner based on clinical experience, patient preference, medical circumstances and cosmetic goals of the procedure.[9]

During and after surgery risks

Infections, seromas, haematomas, implant rupture, deflation, extrusion and necrosis can arise from breast implant surgery as immediate or short-term complications.[10] Recognised longer-term complications include breast tissue atrophy, calcium deposits, and capsular contracture.[10, 11]

Capsular contracture is a major and frequent complication of breast implant surgery occurring in 2.5-14% of patients.[124-126] The relative risk factors for capsular contraction in cosmetic breast

augmentation in descending order are: subglandular placement, smooth implant surface, hematoma/seroma before capsular contracture, surgical bra use, periareolar incision site, antibiotic pocket irrigation and a device size of less than 355 ml.[126] Almost half of contractures occur within the first two years of implantation and 80% within the first five years.[126] There is a complication-related re-operation rate of up to 15% within the first year.[127]

Patients undergoing revision mammaplasty, breast reconstruction or those who have previously developed a contracture are at higher risk of developing this complication. Patients who have had radiotherapy have the highest risk of developing severe capsular contractions, with studies reporting prevalence of up to 43%.[128, 129]

### Breast implant illness

Breast implant illness is a systemic complication associated with breast implants. It is poorly understood with an unknown aetiology. Patients with breast implant illness may experience autoimmune symptoms including fatigue, difficulty concentrating, hair loss, weight change, and depression. A review of epidemiological studies demonstrates an association between breast implants and autoimmune diseases. The most commonly recognised are Sjogren's syndrome, rheumatoid arthritis, systemic sclerosis, chronic fatigue syndrome, and Raynaud's syndrome.[32]

### Breast implant–associated anaplastic large cell lymphoma (BIA-ALCL)

BIA-ALCL is a rare form of non-Hodgkin lymphoma. The aetiology of BIA-ALCL appears complex and multi-factorial.

Breast implants are the sole cause of BIA-ALCL.[130] Proposed inter-related factors include:[131]

- Textured implants
- Bacterial contamination at the time of surgery which causes inflammation
- Patient genetic predisposition
- Time for the lymphoma to develop.

The estimated risk rate of developing BIA-ALCL increases with greater texturing of the implant. Micro-textured implants have an estimated risk of one in 18,000. There are no confirmed cases of BIA-ALCL related to smooth breast implants. As of 1 April 2022, the USA Food and Drug Administration (FDA) reported 1130 unique cases of BIA-ALCL and 59 total deaths worldwide through medical device reports and post-market surveillance efforts.[132]

As of 26 September 2019, four deaths in Australia have been reported to the Therapeutics Goods Administration (TGA).[133] The relatively high incidence in Australia likely reflects the much higher proportional use of textured implants compared with the USA.[133]

The FDA issued a notice on 8 September 2022 which advised of reports about squamous cell carcinoma (SCC) and non BIA-ALCL lymphomas in the capsule that forms around breast implants. After post-market monitoring and research the FDA was aware of less than 20 cases of SCC and less than 30 cases of various lymphomas in the capsule around the breast implant.[12]

### Secondary breast reduction

There are several indications for secondary breast reduction after a primary reduction, which include poor outcomes from the original surgery related to asymmetry, undesirable shape, excessive scarring or a recurrent increase in breast volume.[134]

Breast re-reduction surgery is complex and poses significant challenges for medical practitioners. Complication rates significantly exceed those of primary reduction with necrosis or loss of the nipple-areola complex a particular risk due to changes in blood supply from the earlier surgery.[135]

## Facial and oral surgery

Facial cosmetic surgeries are one of the most commonly performed operative procedures worldwide, which include facelifts, rhinoplasty, and maxillofacial cosmetic surgery.

Before surgery risks

The importance of patient selection for facial and oral is demonstrated by increased rates of complications and in particular skin necrosis in patients who smoke, have autoimmune disorders and hypercoagulable states and have had a number of previous revision surgeries.[136]

A number of psychosocial aspects linked to poor outcomes have been identified in relation to facial surgery, including younger male patients who have unrealistically high expectations about likely impact on job prospects, personal relationships and who wish to achieve instantly recognisable results.[1]

### Rhinoplasty

Rhinoplasty is one of the most common cosmetic procedures performed. A rhinoplasty can involve external or internal incisions, alteration of the nasal turbinates and valves, tip reduction, reshaping of the dorsal hump, and symmetrical reshaping of the nasal vault. Augmentation rhinoplasty procedures use grafts or implants to modify the shape of the nose.[137]

The nose is highly vascularised, which increases the risk of complications of swelling and bruising which can result in decreased visual acuity, impaired healing and reduced patient satisfaction.[138]

### Rhinoplasty implants

Both solid silicone material and autologous cartilage tissue are used for nasal grafting in rhinoplasty. Autologous grafts have easy availability, good patient-compatibility, low incidence of complications, and good grafting quality. Autologous rib cartilage is used in both primary and revision surgery when septal or conchal cartilage has been depleted due to earlier rhinoplasty procedures and because of the advantages of its strength and volume. However autologous costal cartilage can warp, be re-absorbed and have donor-site morbidity.[34]

A recent meta-analysis shows the use of autologous cartilage gains more satisfaction, has less total complication rate, and results in less secondary surgery compared with silicone material, though the overall quality of the evidence was not high.[139]

2022 systematic reviews and meta-analyses undertaken by Keyhan and colleagues on the complications after dorsum nasal augmentation found that use of alloplastic materials such as polyethylene and silicone compared to the use of diced cartilage had respectively:[140, 141]

- A revision rate with of 6.40% compared with 3.03%
- An infection rate of 2.75% compared with 2.30%
- Deviation rates of 1.91% compared with 1.77%
- Irregularity of 0.72% compared with 1.36%
- Haematoma of 0.70% compared with 1.36%
- Extrusion of 0.78% compared to 0.78%
- Overcorrection of 0.49% compared with 3.06%.

Other autologous graft complications included resorption (2.52%), insufficient augmentation (3.93%), supra-tip depression (1.13%), and visible bulging of the graft (2.64%). The total rates for donor site hypertrophic scar and donor site hematoma were 2.64% and 3.58%, respectively. The authors concluded that both forms of augmentation had overall complication and revision rates that were acceptable and relatively low and therefore were a reliable treatment choice.[34, 140-142]

### Septoplasty

Septoplasty is a common surgical procedure with uncommon complications such as septal haematoma, synechial bands and septal perforation which can cause considerable short- and long-term morbidity.[143]

### Rhytidectomy (face lifts)

Facelifts are predominantly achieved by operating upon the superficial musculoaponeurotic system (SMAS), which is the layer of tissue or membrane that connects the face and neck muscles to the skin. The area of largest concern is the possibility of temporary or permanent facial nerve injury. Other complications include haematoma, seroma, skin necrosis, and infection.[15]

### Facial implants

There is increasing demand from patients to change their facial profile.[144] Implantable alloplastic biomaterials such as silicone and polyethylene, are efficient and easy to use and have become an integral part of facial cosmetic surgery. A 2022 review comparing risks and outcomes associated with alloplastic implants for facial skeleton implantation of the mid and lower face over a twenty-year period, found in relation to implant type, either silicone or polyethylene:[145]

- The silicone group had a higher incidence of infections of 2.2% compared with the polyethylene group of 0.7%
- The rate of displacements was 0.8% in the silicone groups compared with 0% in the polyethylene group
- The polyethylene group showed a higher incidence of prominence problem of 3.9% compared with 1.4 % for silicone
- Exposure/extrusion rates were 0.3% for polyethylene compared with 0% for silicone
- Silicone had overall complication rates of 8.8% for malar areas and 1% for the chin
- Reoperation rates were 4.1% for silicone and 4.8% for the polyethylene implants
- More broadly complications with polyethylene implants were temporal fossa (2.6%), chin (3.3%), mandibular angle/ramus (3.5%), fronto-cranial (9.7%), malar (10.4%), nasal (24.6%) and ears (50%)
- Chin and mandibular implants were the safest, whereas malar implants had a high incidence of prominence problems.

The review also found that there is a particular risk of complications where the facial implants are placed under tension or where there is thin soft-tissue coverage.[145]

### Brow ptosis

A surgical browlift is performed to raise the position of the brows. A USA survey of complications from 3,417 endoscopic browlifts reported alopecia (2.9%), reoperation (1.8%), asymmetry (1.2%), and sensory loss (0.6%) to be the most likely complications.[146]

### Submandibular gland resection

Submandibular gland resection is a procedure undertaken to enhance neck aesthetics. It is associated with usually minor, self-limiting complications including haematoma and transient marginal mandibular nerve weakness. If deep neck surgery is involved there are risks of major haemorrhage, sialoma and persistent dry mouth.[146]

## Body contouring surgery

Body contouring surgery includes a range of cosmetic procedures designed to improve

appearance by modifying aspects of size or shape. It is most commonly performed to contour the waist, abdomen, thighs, buttocks, upper torso and upper arms. Surgical methods include removal of fat and excess skin, fat grafting and insertion of surgical implants to improve skin tone and definition.[16]

### Brachioplasty

Brachioplasty procedures have increased in popularity in recent years, mirroring the rise in bariatric procedures but are also indicated for senile elastosis and 'natural' massive weight loss. Brachioplasty reshapes the upper arms by reducing excess skin, and in some cases fat.[147]

Before surgery risks

Patient selection and choice of the appropriate approach remains critical to achieve an aesthetically desirable outcome without cosmetic or functional detriment.[148, 149]

During and after surgery risks

Pooled rates of complications after brachioplasty are reported to be significant, with one review finding an overall rate of almost 28.9%, with another qualitative study reporting complication rates of 25% to 40%, and revision rates ranging between 3% and 25%.[48, 150]

A 2022 systematic review and meta-analysis of 29 studies from across the world involving 1,578 patients found the following incidence of adverse outcomes:[147]

- Aberrant scarring, 9.9%
- Ptosis or recurrence, 7.79%
- Wound dehiscence, 6.81%
- Seroma, 5.91%
- Infection, 3.64%
- Nerve-related complications, 2.47%
- Lymphoedema or lymphocele formation, 2.46%
- Skin necrosis or delayed healing, 2.27%
- Haematoma, 2.06%

The operative reintervention rate for cosmetic purposes was 7.46% and for non-cosmetic purposes was 1.62%.

### Medial thighplasty

Medial thighplasty, or a thigh lift, is an invasive procedure that removes excess skin and fat from the thigh area. A high BMI before massive weight loss and before medial thighplasty are associated with a higher risk of developing postoperative complications.[151] A 2015 literature review of 447 patients found complication rates of wound dehiscence of up to 18% and seroma of 8% after thigh lift. Minor complications occurred in a high percent of patients, regardless of the type of thighplasty procedure performed.[48]

### Gluteoplasty and gluteal augmentation

Augmentation gluteoplasty is the cosmetic surgery procedure focused on the buttocks and the anatomy of the gluteal region, and has been performed more frequently in the past decade. The most popular methods for buttock augmentation involve silicone prostheses and autologous fat grafting.[152]

During and after surgery risks

A 2016 systematic review of 44 articles found that the commonly reported complications:[152]

- In 2,375 patients receiving silicone implants were wound dehiscence (9.6%), seroma (4.6%), infection (1.9%) and transient sciatic paresthesias (1.0%), with an overall complication rate of 21.6%
- In 3,567 patients receiving autologous fat grafts were seroma (3.5%), under correction (2.2%), infection (2.0%), and pain or sciatalgia (1.7%), with an overall complication rate of 9.9%.

A further 2019 review found the overall complication rate for gluteal augmentation surgery was 12.4%. Implants had the highest complication rate (31.4%), flaps were intermediate (23.1%) and fat grafting had the lowest (6.8%).[153]

## Female genital cosmetic surgery

Female genital cosmetic surgery is defined as any elective intervention to enhance the aesthetic appearance of the external genitalia, modify genital organs, or functional vaginal procedures, in the absence of anatomic pathology, to help improve quality of life.[154]

During and after surgery risks

Risks of complications associated with female genital cosmetic surgery include scarring, adhesions, permanent disfigurement, infection, dyspareunia and altered sexual sensations.[155] Smoking and sexual dysfunction may increase the risk of complications.[156]

For labiaplasty, common post-operative complications include dehiscence, haematoma formation, flap necrosis (for wedge resection), discomfort, visible scarring, superficial infections, under-resection, and over-resection.[157]

A 2022 systematic review and meta-analysis of 46 studies (3,804 patients) found for labiaplasty the overall pooled incidence of infection, haematoma, postoperative bleeding, pain and discomfort and labial asymmetry were all less than 1% of patients. Dyspareunia was reported in about 1.2% of patients. The most common cause for revision surgery was dehiscence (2.33%), followed by aesthetic concerns (0.92%), bleeding (0.289%) and hematoma (0.05%).[158]

## Penile augmentation surgery

There are two general categories of penile augmentation surgery, to increase the length of the penis and to increase the girth of the penis.

Before surgery risks

There are no accepted clinical guidelines to determine physical, psychological, clinical or urological benefits of penis augmentation surgery. It should be considered experimental and necessitates a comprehensive patient assessment.[159]

Most men who seek penile augmentation have normal sized penis by clinical standards, however there are inconsistent methods used to assess penile dimensions.[160, 161] A man with a clinically normal-sized penis may have a preoccupation with a minor or non-existent flaw causing intense shame and embarrassment. This may constitute penile dysmorphic disorder, a subtype of BDD.[162, 163]

During and after surgery risks

Girth procedures are often performed after length procedures because complication rates increase if both length and girth procedures are performed simultaneously.[164, 165]

Procedures for enhancing penile length include suspensory ligament release with skin advancement, penile disassembly, suprapubic lipectomy and implant placement.[166-169] Suspensory

ligament release may rarely cause dorsal nerve injury, vessel injury, or penile instability if there is an aggressive release of the ligament or dissection of the corporal bodies from the ischiopubic rami.[167]

Autologous fat injections can increase girth but complications include asymmetry, nodules, contour irregularity loss of penile rigidity, graft resorption, penile curvature, penile shortening or deformity, erectile dysfunction, penile skin loss, and donor-site complications.[167, 170]

## Questions 2: What interventions, tools or resources were identified in the literature that minimise patient safety and quality risks relevant to cosmetic surgery?

## Question 3: What is the evidence for the effectiveness of these interventions, tools or resources?

The literature review identified a range of interventions, tools and resources which minimise patient safety and quality risks. However, there were gaps in the evidence in relation to the effectiveness of interventions, tools and strategies applied to particular identified risks associated with cosmetic surgery procedures. Where interventions were proposed and likely implemented there was often no information provided as to whether outcomes were changed or interventions were effective. These gaps are identified in the following section.

The identified interventions are grouped as follows:

- Patient factors
- Patient consent and feedback
- Facilities where cosmetic surgery is performed
- Post-surgery complications
- Allogenic cosmetic surgery implants
- Liposuction and body contouring
- Autologous fat grafts and transfers
- Facial and oral surgery
- Cosmetic tourism.

### Patient factors

Candidates for cosmetic surgery are likely to benefit from the use of short, clinically useful assessment scales which can identify people who would benefit from additional information and education. Patient-centred self-reporting instruments are increasingly being used in clinical care, patient education, benchmarking, and quality improvement in clinical practice generally.

Studies suggest BDD should be screened for before surgery to avoid operating on people who have an altered perception of their body.[171-173] In particular, studies have found pre-operative screening and assessment for BDD is relevant for people considering rhinoplasty, genital cosmetic surgery and, teenagers and young people.[43, 44, 90, 167, 174]

#### Assessment tools

Assessment tools are available for a number of aspects of cosmetic surgery practice. Standardisation of measurement allows more accurate analysis of outcomes and can help to inform patients and educate medical practitioners.[175]

Body Dysmorphic Disorder assessment tools

Tools are available to aid in the diagnosis of BDD, some of which have been simplified for general use, while others require specialised psychology training to ensure accurate assessment and diagnosis.

Self-assessment and clinician assessment tools which may be of use in initial patient assessment,

ongoing management and benchmarking include:

- Body Dysmorphic Disorder Questionnaire (BDDQ)
- Dysmorphic Concern Questionnaire (DCQ)
- Body Dysmorphic Symptom Scale (BDSS)
- Q-series of patient-reported outcome measures
- Cosmetic Procedure Screening Scale (COPS).

Versions of BDDQ, COPS and BDSS were found to be adequate in screening for BDD but have limitations as a general cosmetic screening tool.[176] Evidence suggests further research is needed to establish more effective methods to identify BDD in candidates for cosmetic surgery.[177]

A 2015 study determined that while BDDQ was an accurate (91.7%), sensitive (100%), and specific (90.3%) screening instrument for BDD a systematic approach required a further structured clinical interview for patients with a positive screen.[178]

An Australian study using DCQ as a screening measure for BDD found a cut-off score of 9 resulted in the correct classification of 96.4% of patients with BDD and 90.6% of controls. It concluded that the results supported the use of the DCQ as a brief, sensitive, and specific screening instrument for BDD.[179]

Surgery candidates after massive weight loss

The Pittsburgh Rating Scale is a validated measure of contour deformities after bariatric weight loss.[47] It can be used to describe the level of deformity and the broad type of intervention that is appropriate. The scale has applications in preoperative planning and evaluating surgical outcomes for all types of cosmetic surgery after massive weight loss.[48]

Rhinoplasty assessment tools

The Rhinoplasty Outcomes Evaluation, the FROI-17, the RHINO Scale, the EARS survey and the FACE-Q rhinoplasty module have been developed for both functional and cosmetic aspects of rhinoplasty, though not all satisfy all international guideline requirements.[180] Studies identified the need for a new self-assessment tool that encompasses functional, psycho-relational, and cosmetic properties to measure satisfaction and quality of life of patients undergoing rhinoplasty. Research indicates the ultimate goal in the development of this new questionnaire should be to better understand the impact of cosmetic and functional procedures from the patient's point of view and, with this knowledge, to improve patient outcomes.[181]

Female genital cosmetic surgery

Diagnostic criteria have been developed for use in female genital cosmetic surgery however the anatomical gradings are still arbitrary or use indirect measures with no consensus on what constitutes abnormal anatomy.[182-184]

A 2020 systematic review suggested the distinction between medically indicated procedures for pelvic organ prolapse and elective surgical interventions should be clear and well documented during pre-operative counselling. Adoption of a consistent numeric scale to assess overall, cosmetic, and functional satisfaction should be employed to facilitate efficacy comparison. There should also be uniform reporting of agreed quantifiable outcome measures.[174]

Studies suggest, ideally, any system should be feasible, easy to use, applicable across clinical specialties, cover patient cosmetic, functional, and sexual concerns and address the desired outcomes of surgery.[157, 174, 185]

### Young people and teenagers

The methods available to safeguard teenage cosmetic surgery candidates centre on comprehensive pre-operative assessment, participation of parents and guardians, and informed consent.

Research indicates medical practitioners should perform a comprehensive and sensitive pre-operative assessment to determine the physical and emotional maturity of the prospective patient. The mental health status of teenagers is of particular relevance as symptoms of BDD commonly emerges at this age.[43, 44]

Formal psychological assessment of teenagers should be conducted that includes an evaluation of the patient's desired goals, whether their expectations are realistic and factors motivating them to seek cosmetic surgery.[46, 186]

Studies also recommend the assessment include discussions of patient specific risks of surgery, what should be expected immediately after surgery, self-care during recovery (including pain and discomfort), and limitations and complications of the procedure. Studies suggest parents and guardians should participate in these discussions. If there are concerns about consent or maturity, a wait and see approach is recommended.[92]

## Patient consent and feedback

### Patient consent

The patient consent process can be supported by the use of standard instruments which allow the medical practitioner to provide information about different surgical approaches, expected outcomes, likely patient benefit, and screen for psychological conditions.[50, 51]

Information about risk decreases the likelihood of proceeding with surgery especially patients with good mental health. Acknowledgement and emphasis on disclosure of related risks and financial burden when complications arise is important.[187]

Studies have found patient satisfaction and improvement in quality of life are the results that determine the success of cosmetic surgery and are therefore central to ensuring informed consent. The appropriate surgery should be chosen based on the type of surgery and according to patient expectations about desired appearance. Patients require careful attention in presurgical consultations, and clear communication should be prioritised to ensure that the medical practitioner understands the patient's expectations.[180]

No evidence was identified that demonstrated the effectiveness of interventions in relation to patient consent procedures.

### Patient questionnaires

The use of reliable, valid, and responsive patient questionnaires is essential to provide information about the impact and effectiveness of cosmetic surgery. Ad hoc outcome tools are likely to be inadequate, as they lack proven reliability and validity. Generic measures may be insufficient because they may not be responsive to surgical change.[5]

Carefully developed and refined patient reported outcome measures (PROMs) are becoming increasingly relevant in modern clinical outcomes research. A validated PROM should allow the comparison of techniques, the quantification of positive effects, the patients most likely to benefit from the procedure, and should also provide a follow-up standard and a benchmark for clinical studies, regulatory and efficacy studies. Patient self-assessment can provide timely information about satisfaction, and can benefit the patients themselves as they search for relevant data to help them better understand the expected results.[188]

The RCSE recommends the use of PROMs from the Q Portfolio for abdominoplasty, augmentation mammoplasty, blepharoplasty, liposuction, rhinoplasty and rhytidectomy to inform assessment, consent and outcome review.[49]

In 2022 the USA FDA recognised FACE-Q as a patient-reported outcome instrument that can be used to assess outcomes of cosmetic facial procedures from the patient's perspective. The scales should be used as a co-primary endpoint or composite endpoint with other clinical outcomes. The FDA assessment concluded that supporting evidence demonstrated evidence of content validity, construct validity and reliability through the development and testing of this tool. Disadvantages included the tool's inability to measure all important outcomes, that it was developed for a specific patient population and it could not estimate whether a clinically meaningful difference had in fact been achieved.[189]

## Facilities where cosmetic surgery is performed

In the peer-reviewed articles only passing reference was made to where cosmetic surgery can be safely performed.

On reviewing available evidence, a French guideline determined that medical practitioners entitled to perform cosmetic facial surgeries within their specialties must practice in structures affiliated with specialised health facilities authorised by the French Regional Health Agencies and certified or awaiting certification by the French National Authority for Health.[52]

Singapore (see **Attachment B**) and Malaysia also specify the type of facility in which cosmetic surgeries can be performed.[53, 54]

No evidence was identified that demonstrated the effectiveness of interventions in relation to facilities where cosmetic surgery is performed.

## Post-surgical complications

Various methods and concepts with variable outcomes have been developed to avoid common post-surgical complications such as swelling, bruising and infections.[55]

### Swelling and bruising

Most cosmetic surgical procedures are conducted in soft tissue, which carries the risk of low-volume bleeding. Core aspects of haematoma prevention are recognised to be:[15, 190]

- Strict perioperative blood pressure control
- Expectant pain, nausea, and anxiety management
- Use of intraoperative tumescent solution which includes adrenaline
- Meticulous haemostasis with the "second-look" technique
- Intraoperative use of antifibrinolytic drugs, tissue sealants and platelet-rich plasma.

Tranexamic acid (TXA) is a synthetic low-cost antifibrinolytic drug manufactured and approved for intravenous and oral use. Its systemic prophylactic use reduces intraoperative and post-operative bleeding volume by 30-40%.[191]

Tissue sealants are classified as platelet rich plasma (platelet gels) and fibrin sealants. Platelet gel has been found to reduce post-operative drainage volume by 24% in patients who underwent facelift surgery.[192, 193] Research has found fibrin sealants significantly reduced the incidence of hematoma and TXA reduced interoperative bleeding and postoperative swelling and bruising in breast and facial surgery.[194]

An alternative to systemic use, TXA can be administered subcutaneously or applied on the surgical

site to achieve sufficient drug concentrations with negligible risk of systemic adverse effects, while still preventing haematoma.[192, 195] TXA mixed with tumescent may reduce post-operative drain output, thereby expediting drain removal but it has no effect on seroma formation or infection in breast surgery.[196-198]

## Corticosteroid use

Corticosteroid administration provides anti-inflammatory properties by inhibiting the initial process of inflammation.[199]

Studies have identified that corticosteroids have a significant effect in reducing pain and swelling following facial plastic, dentoalveolar, and maxillofacial surgeries.[200] It has been found a pre-operative and post-operative steroid dose was associated with less swelling and bruising than only a pre-operative dose.[29]

## Surgical site infections (SSI)

A meticulous aseptic working environment and technique has a significant effect on the reduction in post-operative infections.[9] Use of prophylactic antibiotics is recommended in some circumstances, usually as a single pre-operative dose and, depending on the nature of the operation, a short course postoperatively.[201, 202]

A 2021 systematic review and meta-analysis of randomised control trials found that:[201]

- Neither pre-operative or post-operative antibiotic prophylaxis was supported for elective hand and upper extremity surgery
- Pre-operative antibiotic prophylaxis decreases rates of SSI in elective oral and maxillofacial surgery, but there is a lack of evidence for the use of postoperative antibiotics
- Pre-operative mouthwash use of either povidone or chlorohexidine in oral surgeries is recommended
- There is some evidence that pre-operative showering with povidone and chlorohexidine solutions decreases skin colonisation but there is no evidence that this decreases SSI rates
- There are no differences in SSI rates between different types of dressings.

For breast surgery the evidence is mixed. Because of the serious consequences of infections, the use of pre-operative antibiotics is recommended, but there is no evidence concerning post-operative antibiotics in breast surgeries except in implant-based breast reconstruction, which should be discontinued after 24 hours. A significant reduction in risk of SSI with antibiotic prophylaxis versus control was found for patients undergoing cosmetic breast surgery. The duration of antibiotic use should generally be limited to a single pre-operative dose because studies have generally showed no benefit for longer term antibiotic prophylaxis.[144]

There is no evidence to support the use of preventive, peri-operative and post-operative antibiotics in non-complex rhinoplasty and septo-rhinoplasty.[143, 203]

## Seroma prevention

Effective strategies for seroma prevention include:[29]

- Use of closed-suction drains
- Keeping the drains in place until there was minimal output volume
- Maintaining a high-pressure gradient in the drains
- Using sharp or ultrasonic dissection rather than cautery
- Ligating blood vessels with sutures or clips

- Using quilting or progressive tension sutures
- Using fibrin, thrombin, or talc
- Immobilising the surgical site postoperatively.

Seroma formation is a particularly noted complication in abdominoplasty. Abdominoplasty surgery which preserves Scarpa's fascia allows decreased tension at wound closure, preserves the abdominal blood supply and lymphatic vessels reduces the risk of seroma. A combined lipo-abdominoplasty procedure which combines abdominoplasty with Scarpa's fascia preservation and liposuction has a beneficial impact on complication rates. There are fewer complications in patients with lipo-abdominoplasty compared with the traditional abdominoplasty overall and for haematoma and seroma.[29]

### VTE prevention

High quality protocols for VTE prophylaxis are in place for orthopaedic surgery and general surgery. Protocols for VTE prophylaxis in cosmetic surgery, are not well understood or standardised.[30]

Before surgery

Consensus recommendations have been developed for cosmetic surgery patients which recommend that pre-operatively all patients should be risk stratified. VTE risk factors should be scored with an appropriate scale such as the Caprini/Davison risk assessment module, with particular attention to patients with a family or previous history of VTE, BMI greater than 30, age older than 40, patients on hormone replacement therapy or the oral contraceptive pill, and patients who have undergone bariatric procedures.[204]

During surgery

Research has found intra-operatively, graded compression stockings and intermittent pneumatic compression devices should be placed on all patients. Attempts should be made to reduce the operative time and concurrent procedures, as an increased length of surgery is a risk factor. Choice of anaesthetic should reflect relative risk.[205]

After surgery

Studies have found:[8, 206]

- Benefits in ambulation as soon as possible after surgery
- Every patient should receive mechanical prophylaxis
- Patients should be managed according to their pre-operative risk rating. The risk of VTE should be balanced against the increased risk of bleeding with the use of low molecular weight heparin, keeping in mind that bleeding is an expected, manageable complication, whereas pulmonary embolism can be a fatal and unacceptable sequela in the setting of elective surgery.

## Allogenic cosmetic surgery implants

### Breast implant surgery

Significant research has identified mechanisms to optimise patient outcomes from breast implant surgery. These relate to implant shape, incisional site and the surgical plane where the implant is positioned. Studies show strong evidence that the inframammary incision has the lowest rates of complications in terms of infection, mal-positioning and development of capsular contracture.[207]

Studies confirm that subpectoral breast augmentation placements have a decreased rate of capsular contracture compared with prepectoral breast augmentation.[208-211] There was no significant difference with regard to reoperation, seroma, rippling, infection or implant rupture between subpectoral and prepectoral techniques.[210] Sub-glandular placement significantly increased the incidence of capsular contractures, haematomas and seromas compared to other placement techniques. The subpectoral and subfascial planes were determined to be safe and effective for controlling total complications and achieving high satisfaction rates.[212]

The use of nipple shields has been shown to reduce a potential risk of implant contamination and development of capsular contraction.[213] Additionally, use of an implant insertion funnel can overcome biofilm formation and subsequent pocket contamination by reducing bacterial contamination through decreasing the contact between the implant and the patient's skin and the surgeon's gloves.[214] Insertion funnels also allow for easier insertion, the reduction in the scar length and a reduced time of implant insertion which, in turn, can also reduce device contamination.[215, 216]

In relation to irrigation of the breast pocket, studies have shown a lower rate of capsular contracture and re-operation rates with the use of povidone-iodine at concentrations of 4% to 10% compared with saline. The optimal concentration of antiseptic required to be effective without causing cytotoxicity to fibroblasts and further tissue damage is uncertain.[217]

Antibiotics and pirfenidone reduce the incidence of capsular contracture, although their mechanisms of action are not fully understood.[218] The most studied substances with potential for treating or preventing capsular contraction are the leukotriene receptor antagonists (LRA).[219]

### Breast implant illness

Explantation of the breast implant results in alleviation of adverse symptoms in over 50% of patients. Recent studies demonstrate a possible role of bacterial biofilm and subsequent host-pathogen interactions as a confounding factor to breast implant illness.[130]

## Liposuction and body contouring

Pump liposuction has largely been replaced by disposable syringes of various sizes and gauges to ensure accuracy of fat removal.[20] The mechanism by which the suction is performed includes where the cannula is attached to: a vacuum device (suction-assisted liposuction), vibrating power-assisted liposuction (PAL), laser-assisted liposuction (LAL), ultrasound-assisted liposuction (UAL), which now includes a cold ultrasonic method (Vaser) to reduce the risk of thermal complications, waterjet-assisted liposuction (WAL), and radiofrequency-assisted liposuction. All systems have relative advantages and disadvantages. It has been postulated that LAL in particular improves cosmetic outcomes, achieves better skin retraction and reduces blood loss, postoperative recovery time and operating time.[220] All reviewed liposuction methods used postoperative garments and well-established wound treatment protocols.[221]

## Autologous fat grafts and transfers

### Gluteal grafts

An uncommon but emerging risk of gluteal AFGs is the risk of fat embolisation. The following measures have been identified to lower this risk:[155]

- Use a blunt cannula with as large a diameter as possible (at least 18 G)
- Use small amounts of adrenaline at the recipient site before harvesting the fat
- Inject in the retrograde direction
- Know the depth of large blood vessels, especially the external and internal carotidal circulation

- Avoid excessive single point injection dose (<0.1 mL)
- Use 1 ml syringes.

## Facial and oral surgery

### Rhinoplasty

Professional guidance has been developed in the USA to assist medical practitioners and patients in pre-operative assessment for rhinoplasty:[222]

- Medical practitioners should ask all rhinoplasty candidates about their motivations, expectation of outcomes and provide feedback as to whether these are realistic
- Candidates should be assessed pre-operatively for nasal airway obstruction and comorbid conditions that could modify or contraindicate surgery, including obstructive sleep apnoea, BDD, bleeding disorders, or chronic use of topical vasoconstrictive intranasal drugs
- Candidates with obstructive sleep apnoea should be educated about the effect surgery will have on nasal airway obstruction and its likely perioperative management
- Candidates should be told what to expect after surgery, how surgery might affect the ability to breathe through the nose, strategies to manage discomfort, potential complications of surgery and the possible need for future nasal surgery
- Details of pre-operative assessment should be recorded in the patient record
- Patient satisfaction with their nasal appearance and nasal function should be reviewed at a minimum of 12 months after rhinoplasty.

### Septoplasty

Medical practitioners have developed a variety of techniques to help reduce the incidence of complications resulting from septoplasty. However, there is a lack of consensus about the best method to manage post-operative pain and discomfort. A 2021 systematic review, which included only low-quality studies found that nasal packing after septoplasty was more likely to cause adverse events, including respiratory distress, pain, sleep disturbance, crusting, epiphora, dysphagia, and adhesion. Nasal packing did not show benefits in preventing bleeding, haematoma, and residual nasal septum deviation when compared with other techniques. Subgroup analyses favoured trans-septal suture which decreased respiratory distress, pain, sleep disturbance, crusting, epiphora, dysphagia, and adhesion. No significant differences in oxygen desaturation, infection, septal perforation, bleeding, haematoma, and residual nasal septum deviation were found. Combinations of packing and trans-septal suture did not improve patient outcomes.[223]

### Rhytidectomy (face lifts)

A meta-analysis of all rhytidectomy methods found there was no statistically significant difference in the risk of permanent injury when comparisons were made across all techniques.[224]

### Brow ptosis

There are endoscopic and open approaches to brow ptosis which vary with respect to incision site, dissection plane, and fixation method. Research suggests, in selecting an appropriate surgical approach, medical practitioner/patient preferences and expectations should be considered in relation to risk/benefit profiles, including potential complications.[146]

# Cosmetic tourism

A review of cosmetic tourism identified aspects which are not consistent with expected standards and guidance current in Australia.

Cosmetic tourism in the Australian context is used to describe people travelling overseas for cosmetic surgery. It is increasing in popularity for many reasons including: lower cost, anonymity, shorter waiting times, patient dictated operations, less stringent regulation, multiple procedures for a discounted price, new procedures not used in the home country, personal recommendations, availability for teenage patients and influence of social media advertisements.[39, 225, 226]

## Patient consent

As described by many of the national and international guidelines, for a patient to make an informed decision, there needs to be a consultation with the medical practitioner prior to any financial commitment, followed by a cooling-off period. With cosmetic tourism, any prior patient counselling is often only provided by a non-medically trained representative.[227]

Patients commonly pay for procedures in advance before travelling, and in many cases before they have a consultation with the operating medical practitioner. While it may be possible to convey some information prior to consultation with the medical practitioner, it is not possible to accurately assess key anatomical features.[38] A language barrier may further compromise the patient's care, with patients feeling obligated to proceed with surgery on arrival, without providing valid informed consent.[39]

## Overseas facilities

Research has found some overseas facilities may lack appropriate maintenance of facilities, equipment and devices. Drugs and medical products may not be subject to the same regulatory scrutiny as in the country of residence and some drugs may be counterfeit, out of date, or otherwise ineffective.[228]

## Post-return care and complications

### Management of post-return complications

Ongoing care and follow-up upon returning home is an area of particular concern for patients who choose to pursue cosmetic surgery overseas. There is often a lack of planned medical care and a legal protection framework in place, should complications occur. A lack of access to the provider in the post-operative period is also significant concern, often arising due to geographic distance between the patient and the medical practitioner.[229] Any complications that develop often requirement treatment in the home country's health system.[38]

### Infections

Travelling to foreign countries exposes patients to a wide variety of pathogenic microorganisms, particularly rarer pathogens which can be harder to diagnose and treat.[228] Some infections tend to be diagnosed late because of a low clinical suspicion, leading to a prolonged clinical course often involving multiple operations and medications.[230, 231] There is a general concern of multidrug-resistant spread by cosmetic tourists as travellers are frequently colonised by drug-resistant bacteria and may be carriers for months after returning home.[228, 232, 233]

Healthcare-associated multidrug-resistant-bacterial infections are very heterogeneous and have very different antimicrobial resistance patterns depending on the country of acquisition. This can:[228]

- Have an impact at the patient level with inadequate empirical antimicrobial treatment
- Lead to the development of nosocomial outbreaks in home country hospitals with cosmetic tourists serving as index cases
- Bring global transmission of antimicrobial resistance into the community as a result of inadvertent human carriage.

Medical tourists are also at risk of healthcare-related infections such as wound, blood-borne and nosocomial infections and travel-related infections as a result of exposure to diseases that are endemic to the host country.[40] Tourists who visit medical facilities may be at high risk of spreading bacteria.[39, 41, 42, 234, 235]

## Venous thromboembolism (VTE)

There are specific risks related to VTE because surgery is often extensive with prolonged procedures under general anaesthesia. In addition, travelling and long-haul flights are independent risk factors. These risk factors become cumulative for cosmetic tourists.[39]

# Discussion

As described, this review was structured in two parts, an evidence review of systematic reviews from 2013 for the last 10 years which identified 169 articles for inclusion, and a review of websites and publications of Australian and international registration authorities and professional associations.

A number of reviews related to cosmetic tourism. While cosmetic tourism is not in direct scope of this review, it has been included in the paper as the adverse consequences of cosmetic tourism are likely to be dealt with in Australian facilities by Australian medical practitioners, with risks for both the patient and society.

## Advertising of cosmetic surgery procedures

Medical registration authorities in Australia and overseas set out general requirements in relation to advertising of medical services which apply to cosmetic surgery. There were no references or analysis in the systematic reviews as to what constitutes reasonable and appropriate advertising of cosmetic surgery procedures. There were general references to the influence of social media on young people and also in relation to the increase in popularity of specific surgical procedures including gluteal augmentation, AFG and female genital cosmetic surgery.

## Facilities where cosmetic surgery is performed

Requirements about operating in licensed premises were described in a French guideline, which were consistent with the expectations of Australian national boards. It is noted that health service regulations in some Australian states and territories specify which surgeries must be performed in licensed premises, however review of these requirements was outside the scope of this review.

## Patient factors and assessment tools

Preoperative recognition of patients suitable and unsuitable for cosmetic surgery is important to prevent an unsatisfactory outcome for both the patient and medical practitioner. The literature identified the following high-risk areas for focus for pre-operative patient screening:

- People with BDD
- Young people and teenagers
- Cosmetic surgery candidates after massive weight loss
- Medically at-risk candidates.

In particular, the review identified that amongst cosmetic surgery candidates, there is a high prevalence of BDD. Studies have found pre-operative screening and assessment for BDD is particularly relevant for people considering rhinoplasty, genital cosmetic surgery and teenagers and young people. In recognition of this, for adult patients, the Australian guidelines include obligations requiring independent third-party evaluation if significant psychological problems are evident. This is also described in the New Zealand guidelines. The Australian, New Zealand and United Kingdom guidelines all have requirements regarding prospective patients aged under 18 years.

The review also found cosmetic surgery candidates are likely to benefit from the use of short, clinically useful assessment scales which can identify people who would benefit from additional information and education. The review identified pre-operative patient screening tools which aim to minimise the patient safety and quality risks relevant to cosmetic surgery. Tools include:

- Psychological assessment for BDD, although evidence of the effectiveness of these tools is limited

- Comprehensive and sensitive pre-operative assessment to determine the physical and emotional maturity of young people seeking cosmetic surgery
- Formal psychological assessment of young people to evaluate their desired goals, expectations and factors motivating them to seek cosmetic surgery
- The Pittsburgh Rating Scale as a validated measure of contour deformities after bariatric weight loss which has applications in preoperative planning and evaluating surgical outcomes for all types of cosmetic surgery after massive weight loss
- Q Portfolio which can assist in making risk assessments of patients, however is yet to be validated for clinical use.

The review found it is in the best interest of the person and the medical practitioner that these assessments take place to avoid potentially significant future problems. Training in the effective and efficient use of these tools is required to ensure a valid assessment. Strategies need to be developed (such as policies and processes) to allow assessments to occur routinely and readily in the clinical setting.

## Patient consent and feedback

As described by many of the national and international guidelines, for a patient to make an informed decision, there needs to be a consultation with the medical practitioner prior to any financial commitment, followed by a cooling-off period.

The review identified issues with patient consent, including difficulty in assessing a patient's understanding of the consent form. Studies also found patient recollection and understanding of consent for cosmetic surgery is often low and declines over time. The requirement for valid, informed consent for cosmetic surgery was universally accepted, however there was little information as to how to ensure the patient understands the surgery and, its short- and long-term consequences sufficiently for consent to be truly informed.

While the review found no evidence that demonstrated the effectiveness of interventions in relation to patient consent procedures, guidelines published by national and international regulatory bodies consistently highlighted the importance of informed consent, cooling-off periods and appropriate screening and assessment (both physical and psychological) of prospective patients.

Outcome measures were described in the literature. However, ad hoc patient outcome tools were shown to lack reliability and validity. Generic outcome measures may be considered insufficient because they may not be responsive to surgical change. Other tools have disadvantages relating to the inability to measure all important outcomes, being relevant for a specific patient population and being unable to estimate whether a clinically meaningful outcome had been achieved as a result of cosmetic surgery.

Carefully developed and refined PROMs are becoming increasingly relevant in modern clinical outcomes research. Specifically, the RCSE recommends the use of PROMs from the Q Portfolio for abdominoplasty, augmentation mammoplasty, blepharoplasty, liposuction, rhinoplasty and rhytidectomy to inform assessment, consent and outcome review.

## Complications with cosmetic surgery

All surgical procedures expose patients to well-recognised surgical and anaesthetic risks. These risks are broadly the same for cosmetic surgery as for other surgery types. Complications during and after surgery can range in severity from minor time-limited complications which do not require specific treatment, to severe complications which require an emergency department visit, hospital admission or reoperation. The more severe complications are more likely after major abdominal cosmetic surgery.

Information about complications of cosmetic surgery and measures to minimise and control them

were extensively described in the literature. The literature review identified key complications associated with cosmetic surgery include:

- Swelling, bleeding and haematoma
- SSIs
- Seroma formation
- Nerve injury
- VTE.

The literature also identified there are significant risks associated with allogenic implants. This includes infections, seromas, haematomas, implant rupture, deflation, extrusion and necrosis as immediate or short-term complications, or tissue atrophy and capsular contracture as longer-term complications.

Additionally, there have been a number of identified adverse events with breast implants, including breast implant illness, BIA-ALCL, SCC and non BIA-ALCL lymphomas. Ensuring compliance with international device production standards and TGA conditions for breast implant devices is an important step in minimising poor outcomes.

## Management of post-surgical care and complications

There was no information in the systematic reviews about continuity of care and post-surgical follow-up except in relation to cosmetic tourism and management of postoperative complications.

The MBA, consistent with other boards internationally, requires surgeons to operate in facilities with qualified staff who are delegated by the medical practitioner to provide immediate and ongoing care, consistent with agreed professional and surgical standards.

Post-operative complications are relatively common in cosmetic surgery, but with the additional imperative that excessive swelling, bruising, bleeding or surgical site infections will not only cause a delay in healing but may impair final aesthetic outcomes and cause patient dissatisfaction.

## Cosmetic tourism - strategies to improve safety

Public education campaigns can ensure adequate information is available to medical tourists. Some cosmetic surgery professional associations provide this information on their websites, but additional government mandated resources are likely to be more influential. Systematic education on medical tourism related problems is also important for medical practitioners in order for them to recognise and address these issues.

Over prescription of antibiotics

Studies suggest the need for a coordinated effort among nations to reduce over prescription of antibiotics, manage infections that do occur and monitor areas of high risk.[56-58] Internationally consistent antimicrobial stewardship, infection control and surveillance strategies are advocated for.

Australian Breast Device Registry (ABDR)

The ABDR is available to all patients in Australia undergoing breast device surgery and can also be used for recording information for breast augmentation performed overseas. The standardised Data Collection Form records a minimum data set at the time of surgery in Australia. From a cosmetic tourism perspective, this form could be taken overseas by patients or distributed to Australian patients by overseas hospitals and submitted to the ABDR upon return to Australia. This would allow Australians who undergo breast augmentation to access their operative and implant information.[38]

Guidelines and practice standards for cosmetic tourism

A structured approach has been proposed which covers key stages of overseas surgery, but would necessarily require the support and agreement of the operating overseas medical practitioners and medical practitioners in Australia. It proposes:[59]

- Advanced planning and accountability where the patient and primary overseas medical practitioner establish a documented plan regarding the management of immediate and acute complications as well as delayed cosmetic complications or revisions. A specific medical practitioner in the home jurisdiction must be chosen and a care plan agreed beforehand
- Both the patient and the primary overseas medical practitioner ensure that appropriate and complete medical records, operative notes and pre-operative and post-operative photographs are transferred to the home jurisdiction medical practitioner
- If the home jurisdiction medical practitioner treats a complication, this must be communicated to the primary medical practitioner including the specific complication treated, method of treatment, and outcome, including relevant documentation and photographs. The complication should be reported to the index treating hospital and international state governing body in order to accurately report outcome data
- Adequate standards for investigation and reporting, terminology and data sharing of potentially transmitted infections will improve the safety of medical tourism related services.

## Gaps in the evidence

Gaps in the published literature were sometimes referenced, and in some instances addressed in national professional guidance. The gaps in the evidence review included:

- A paucity of evidence regarding validated methods to routinely screen cosmetic surgery candidates for psychological issues, including but not limited to body dysmorphic disorder
- Little evidence of methods to validly and consistently assess, categorise and compare patient characteristics for different types of cosmetic surgery
- Limited evidence demonstrating patient understanding in relation to consent procedures
- Little detail about the type of facility appropriate for where cosmetic surgery is performed
- Only passing reference to advertising of cosmetic surgery procedures, but with no detail or analysis.

# Conclusion

Although the evidence review included 169 articles the content was quite narrow, with a very heavy emphasis on specific surgical procedures, current techniques, likely complications and overall outcomes. There was little evidence about more organisational and procedural aspects relevant to a safe environment to undertake cosmetic surgery. Consequently, the guidance of MBA and other national boards was important in identifying these relevant issues.

The evidence review identified safety and quality risks related to patient assessment, screening and selection, patient consent and feedback, where cosmetic surgery is performed, allogenic implant surgery, complications of cosmetic surgery, post-surgery follow-up and continuity of care, and cosmetic tourism.

Information about complications of cosmetic surgery and measures to minimise and control them were extensively covered in the literature. There was also considerable detail in several systematic reviews about risks associated with cosmetic tourism, including recommendations as to how to potentially mitigate these.

While at-risk prospective cosmetic surgery candidates were identified in a number of papers, details about assessment and management strategies were usually cursory. Where psychological assessment of patients was recorded, there was no independent verification of the validity of the tools used in those studies. Valid consent for cosmetic surgery was universally accepted, however there was little information as to how to ensure the fundamental premise of patient understanding of the surgery and, its short- and long-term consequences.

One international guideline provided information regarding minimum expectations about the licensing arrangements for facilities where cosmetic surgery is performed, which was consistent with national regulatory authority requirements.

In a number of cases including in particular Australia and the United Kingdom, national cosmetic surgery guidelines promulgated by jurisdictional regulatory authorities describe in detail minimum expectations of registered medical practitioners performing cosmetic surgery. It is important that these guidelines are regularly and routinely updated to reflect the rapidly changing demand for and provision of cosmetic surgery, and to address any emerging issues.

To support safe and quality care in services where cosmetic surgery is performed, the development of cosmetic surgery accreditation standards should complement existing regulatory guidelines and take into consideration the safety and quality issues identified in this review.

# List of abbreviations

| Abbreviation | Full term |
|---|---|
| ABDR | Australian Breast Device Registry |
| ACCSM | Australasian College of Cosmetic Surgery and Medicine |
| AFG | Autologous fat grafting |
| Ahpra | Australian Health Practitioner Regulation Agency |
| ANZCA | Australian and New Zealand College of Anaesthetists |
| BAPRAS | British Association of Plastic, Reconstructive & Aesthetic Surgeons |
| BAAPS | British Association of Aesthetic Plastic Surgeons |
| BDSS | Body Dysmorphic Symptom Scale |
| BDDQ | Body Dysmorphic Disorder Questionnaire |
| BMI | Body Mass Index |
| BIA-ALCL | Breast implant–associated anaplastic large cell lymphoma |
| BDD | Body dysmorphic disorder |
| COPS | Cosmetic Procedure Screening Scale |
| DCQ | Dysmorphic Concern Questionnaire |
| ENT | Ear Nose and Throat |
| ESPRAS | European Society of Plastic Reconstructive and Aesthetic Surgery |
| FDA | American Food and Drug Administration |
| GMC-UK | General Medical Council – United Kingdom |
| LAL | Laser-assisted liposuction |
| LRA | Leukotriene receptor antagonists |
| MAFE | Macroscopic fat embolus |
| MBA | Medical Board of Australia |
| MMOH | Malaysian Ministry of Health |
| NZMC | New Zealand Medical Council |
| PAL | Power-assisted liposuction |
| PROMS | Patient Reported Outcome Measures |
| RACGP | Royal Australian College of General Practitioners |
| RANZCOG | Royal Australian and New Zealand College of Obstetricians and Gynaecologists |

| | |
|---|---|
| RCSE | Royal College of Surgeons of England |
| SCC | Squamous cell carcinoma |
| SMAS | Superficial musculoaponeurotic system |
| SMC | Singapore Medical Council |
| SSI | Surgical site infections |
| TGA | Therapeutic Goods Administration |
| TXA | Tranexamic acid |
| UAL | Ultrasound-assisted liposuction |
| VTE | Venous thromboembolism |
| WAL | Waterjet-assisted liposuction |

# Overview of included literature

| Review | Topic/type of surgery | Search dates | Included trials | Participants | Reported study quality | Patient safety and quality care risks (occurrence, or frequency if recorded) | Interventions, tools, resources | Evidence of effectiveness |
|---|---|---|---|---|---|---|---|---|
| Al-Halabi 2018 | Breast implants | - Dec 2017 | N=41 | N=171 | NR | Case reports of periprosthetic mycobacterial infections following bilateral breast augmentation. | - | - |
| Alcantara, 2021 | Bichectomy | 2015 - 2019 | N = 12 | NR | NR | No rates reported.<br>Immediate post-operative complications: edema (247/298), trismus (20/298), ache (22/298).<br>Hematoma, paresthesia, infections, xerostomia, sialocele, facial paralysis. | - | - |
| Aldhabaan, 2022 | Any type of facial plastic surgery (NB includes reconstructive) | - Oct 2019 | N = 19 studies (10 eligible for meta-analysis) | N= 439 | Overall low RoB (Cochrane tool). Areas of potential bias: random sequence generation and patients' allocation. All | Periorbital edema, bruising ecchymosis, intraoperative bleeding | Pre- and postoperative corticosteroids. | Periorbital edema and ecchymosis scores significantly reduced compared to placebo −0.82, 95% CI (−1.37, −0.26), and -0.95, 95% CI (−1.32, −0.57). Differences were not maintained at day 3 and 7. Smaller doses |

| Review | Topic/type of surgery | Search dates | Included trials | Participants | Reported study quality | Patient safety and quality care risks (occurrence, or frequency if recorded) | Interventions, tools, resources | Evidence of effectiveness |
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| | | | | | were double- or triple-blinded. | | | of (8 mg and 10 mg) associated with smaller differences in mean score of upper and lower eyelid edema and ecchymosis; higher doses associated with greater differences. Preoperative corticosteroid usage significantly reduced the intraoperative bleeding compared to placebo for higher doses > 50 mg per day ($p < 0.0001$), but not for 8 mg corticosteroid ($p = 0.06$). Adding postoperative steroid dose was associated with less edema and ecchymosis than preoperative administration alone. |
| Aljerian 2022 | Brachioplasty | NR (included articles published 1989-2018) | 29 observational studies | N=1,578 | NR | Aberrant scarring, 9.9% (95 % CI: 6.1-15.6%); ptosis or recurrence, 7.79% (4.8- 12.35%); wound dehiscence, 6.81% (4.63-9.90%); seroma, | Procedure-related factors investigated included incision placement (medial versus other) and adjunctive | Multivariate meta-regression demonstrated that medial incision placement was associated with a higher risk of |

| Review | Topic/type of surgery | Search dates | Included trials | Participants | Reported study quality | Patient safety and quality care risks (occurrence, or frequency if recorded) | Interventions, tools, resources | Evidence of effectiveness |
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| | | | | | | 5.91% (3.75-9.25%); infection, 3.64% (2.3-5.53%); nerve-related complications, 2.47% (1.45-4.18%); lymphedema or lymphocele formation, 2.46% (1.55-3.88%); skin necrosis or delayed healing, 2.27% (1.37-3.74%); hematoma, 2.06% (1.38-3.06%). Operative reintervention rate for aesthetic purposes 7.46% (5.05-10.88%), operative reintervention rate for nonaesthetic purposes 1.62% (1.00-2.61%). | liposuction of the arm (yes versus no). | complications, whereas the incidence of certain complications was lowered with adjunctive liposuction ($p < 0.05$). |
| Alqabbani 2022 | Rhinoplasty (short nose correction) | - Mar 2021 | 24 studies (9 case reports, 14 retrospective care reviews, 1 prospective observational study) | N=1,450 | Scores of 6-12/13 on CARE checklist for case reports, scores of 6-7/8 on Newcastle-Ottawa Scale for observational | N= 30 patients had implant deviation or migration, n= 22 patients experienced postoperative infection, and n= 12 patients required corrective surgery | - | - |

| Review | Topic/type of surgery | Search dates | Included trials | Participants | Reported study quality | Patient safety and quality care risks (occurrence, or frequency if recorded) | Interventions, tools, resources | Evidence of effectiveness |
|---|---|---|---|---|---|---|---|---|
| Ardehali 2017 | Abdominoplasty 2017 | 1962-Jan 21 2015 | 15 studies (4 RCTs and 11 nRCTs) | N=1,824 | High or unclear RoB for all studies, particularly nRCTs. These received an average of 6/9 stars on NOS. | Postoperative seroma. | Preservation of Scarpa's fascia, placement of progressive tension sutures, fibrin glue. | Preservation of Scarpa's fascia or placement of progressive tension sutures associated with significantly reduced incidence of seroma compared with standard abdominoplasty (P < 0.0001 and P < 0.0002). Application of fibrin glue similar to standard in terms of seroma development. |
| Ariyan 2015 | Breast (9), head and neck (17), orthognathic (10), rhinoplasty/ septoplasty (7), hand (19), skin (5), abdominoplasty (2). | - Jan 2014 | 67 | NR | Breast: low; head and neck: very low; orthognathic surgery: low; rhinoplasty/ septoplasty: low; hand: low; skin: very low; abdominoplasty : NR. | Surgical-site infection | Antibiotic prophylaxis | Clean cosmetic breast: significant reduction (2.5% vs 11.4%; OR, 0.16; 95%CI, 0.04-0.61; p = 0.01).<br>Clean head and neck: no significant reduction in risk (1.0% vs 1.%; OR, 0.77; 95% CI, 0.13-4.65; I2 = 16%; p = 0.77).<br>Contaminated head and neck: significant reduction (16.4% vs 41.9%; OR, 0.23; |

| Review | Topic/type of surgery | Search dates | Included trials | Participants | Reported study quality | Patient safety and quality care risks (occurrence, or frequency if recorded) | Interventions, tools, resources | Evidence of effectiveness |
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| | | | | | | | | 95%CI, 0.11-0.46; p < 0.0001).<br>Clean orthognathic/ mandibular: no significant difference (0 vs 2.2%; OR, 0.56; 95%CI, 0.02-14.3; p = 0.73).<br>Contaminated orthognathic/ mandibular: significant reduction (6.5% vs 31.8%; OR, 0.17; 95%CI, 0.10-0.31; p < 0.0001).<br>Contaminated septoplasty/ rhinoplasty: significant (4.9% vs 11.3%; OR, 0.45; 95%CI, 0.24-0.86; p = 0.02).<br>Clean hand and limb: no significant reduction (8.8% vs 14.5%; OR, 0.57; 95%CI, 0.21-1.57; p = 0.28).<br>Contaminated hand and limb: significant reduction (5.1% vs 7.7%; OR, 0.54; 95%CI, 0.30- 0.96; p = 0.04). |

| Review | Topic/type of surgery | Search dates | Included trials | Participants | Reported study quality | Patient safety and quality care risks (occurrence, or frequency if recorded) | Interventions, tools, resources | Evidence of effectiveness |
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| | | | | | | | | Clean skin surgery: not significant (1.3% vs 4.5%; OR, 0.55; 95%CI, 0.13-2.38; p = 0.42). |
| Arshad, 2016 | Cell-Assisted Lipotransfer (CAL) for Breast Augmentation | 2007-Dec 2015 | N= 11 (8 non-randomized prospective observational; 1 non-randomized retrospective observational; 1 case study; 1 case series). | N= 336 | High risk of selection and performance bias. Few studies used comparison groups. Attrition bias observed in some studies, and financial conflicts of interest were not declared in some cases. Low risk of measurement bias. | Overall complication rate: 37%. Most common side effect: calcification (83% of all complications). Acute complications were poorly reported. | - | Conclusions: The literature indicates that CAL may be a promising surgical technique. Presently, studies demonstrate high levels of bias, lack control groups and display considerable heterogeneity, making the generalizability of study results and effect size unclear. |
| Asserson, 2019. | Gluteoplasty (comparison of different techniques). | 1992-2017 | N= 46 | N= 4,362 | Not assessed. | Overall complication rate: 12.4% 10 most common complications: asymmetry, capsular contracture, fat embolism, hematoma, infection, necrosis, pain, seroma, wide scar formation, and wound dehiscence. | Different techniques: fat grafting / flaps / implants. | Complication rates per technique: Fat grafting: 6.8%; flaps 23.1%; and implants 31.4%. Implants was at the top in asymmetry, capsular contracture, hematoma, infection, seroma, wide scar formation, and wound dehiscence. Fat grafting was first in both fat embolism and pain. |

| Review | Topic/type of surgery | Search dates | Included trials | Participants | Reported study quality | Patient safety and quality care risks (occurrence, or frequency if recorded) | Interventions, tools, resources | Evidence of effectiveness |
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| | | | | | | | | Flaps were only first in necrosis. |
| Ausen, 2022. | Soft tissues procedures (not specific Plastic Surgery) | Mar 2020 | N= 14 RCTs | N= 1,923 | Not assessed. | Bleeding / Postoperative Haemorrhagic Incidence / Intervention / Transfusion | Use of local tranexamic acid. | Local use of tranexamic acid may reduce blood loss comparably to intravenous prophylactic use with negligible risk of systemic adverse effects. It may also prevent reoperation because of hematoma. No single superior means of administration or dosage is supported in the literature, and lowest effective dose is unknown. Tranexamic acid in local anesthetics/ tumescence with added adrenaline may be beneficial for both topical and infiltrative use. More high-quality studies are needed. |
| Awad, 2022 | Breast Implant | Mar 2020 | N= 14 (8 retrospec-tive cohorts; 3 RCT; 2 prospective cohort studies; and 1 retrospective chart review) | N= 6,494 | RCTs: Jadad Scale – n= 2 Good quality (score 4) / n= 1 poor quality (score 2 – inappropriate randomization). Other studies: MINORS scale - N= 4 high quality (scores ≥ | Overall rates: Capsular contracture: 1% to 23%. Infection: 0% to 10%. Reoperation: 1% to 18% | Antibiotic, Antiseptic (Povidone-Iodine), and Saline Irrigation. | Level IV Capsule contracture rates: no significant difference between antibiotic and povidone-iodine irrigation (data comparing these 2 groups were limited and confounded by the concurrent use of steroids). Both were |

| Review | Topic/type of surgery | Search dates | Included trials | Participants | Reported study quality | Patient safety and quality care risks (occurrence, or frequency if recorded) | Interventions, tools, resources | Evidence of effectiveness |
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| | | | | | 16) ; n= 7 low quality (scores < 16) | | | superior compared with saline irrigation.<br>Infection: conflicting results or absent data.<br>Reoperation: antibiotic irrigation and povidone-iodine: lower reoperation rates compared with saline irrigation. |
| Baker, 2021 | Breast Implant | Not reported | N= 9 (1 prospective, 8 retrospective) | Not reported | Not assessed | Infection rates: 1.82% to 19.7%<br>Capsule contracture rates: 0.61% to 40.5% (obs: mixed results, studies highly heterogeneous). | Breast irrigation with either: chlorhexidine gluconate / triple antibiotic solution (TAS) / single antibiotic irrigation / povidone-iodine | Chlorhexidine gluconate, Povidone-iodine, and TAS irrigation of the breast pocket can provide protection against infection and implant loss in both reconstruction and augmentation surgeries. The best method for infection prevention may be a combination of antiseptics and antimicrobials. |
| Basta, 2022 | Plastic Surgery | Not reported | N= 10 | N= 2,416 | All studies: level 4 retrospective cohorts, subject to selection and recall bias. | Pulmonary complications: predicted 3.8%, observed 17.5%<br>VTE: predicted 1.4%, observed 5.2%<br>Estimates of SRC predictive accuracy: pulmonary complication AUC = 0.67 (0.48–0.87), cardiac complication AUC = | Use of National Surgical Quality Improvement Project Surgical Risk Calculator (NSQIP-SRC) in Plastic Surgery | Apart from mortality, surgical and medical complications were significantly underpredicted by the SCR.<br>Limitations of the SRC are perhaps most pronounced where complex, multidisciplinary |

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| | | | | | | 0.66 (0.20–0.99), and VTE AUC = 0.55 (0.47–0.63).<br>The SRC substantially underpredicted rates of SSI (predicted 4.9%, observed 13.2%) and unplanned reoperation (predicted 7.6%, observed 18.1%).<br>Surgical complication AUCs were all at or less than 0.60: SSI AUC = 0.55 (0.46–0.63), unplanned reoperation AUC = 0.54 (0.49–0.58), serious complication AUC = 0.58 (0.43–0.73), and any complication AUC = 0.60 (0.57–0.64).<br>Mortality, although evaluated in only 2 studies, was relatively accurate as predicted by the SRC with an AUC = 0.87 (0.54–0.99) | | reconstructions are needed. |
| Bauermeister, 2019. | Reduction mammaplasty | 1987-2018 | N= retrospective cohort of service cases from 2006-2017<br>+<br>N= 33 articles from literature review | N= 469 patients (938 breast reductions).<br>Not reported for literature review. | Not reported | N= 154 complications with use of the superomedial pedicle technique (overall complication rate of 16%, of which 10% were from minor complications related to delayed wound healing). | Superomedial pedicle technique | Overall complication rate was 16%, of which 10% were minor complications related to delayed wound healing. No cases of skin flap necrosis occurred. Increased complications were highly correlated with a BMI > 30, breast reduction weights > 831 |

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| | | | | | | Total complications included: major (hematoma 20 (2%), 17 of which required re-operation; infection 9 (1%); partial nipple necrosis 24 (3%)) and minor (delayed wound healing 84 (10%)). No cases of full nipple-areolar complex or skin flap necrosis occurred. | | g, and sternal notch to nipple distances > 35.5 cm. |
| Benslimane, 2020 | Partial Removal of the Submaxillary Gland (SMG) | 1950 – Mar 2019 | N= 6 | N= 602 patients (n= 1,200 partial SMG resection) | All studies level of evidence IV | Hematoma related to partial SMG resection: one case (0.08%), hematoma related to cervicofacial skin flap: 1.4%, sialoceles 1.3%, transient marginal mandibular nerve weakness: 4.7%. No mortalities, permanent motor nerve damage or dry mouth were reported. The clinical impact score was positive for five out of the six reports | - | Level of evidence III |
| Brightman, 2018 | Breast Augmentation (Cosmetic Tourism) | Apr 2017 | N= 17 observational studies (mix of surveys, case reports, case series, and retrospective reviews with cost analysis). | NR | Not assessed | Complications from cosmetic tourism for breast augmentation. Infectious complications were common. Wound dehiscence and aesthetic dissatisfaction also featured. Catastrophic outcomes | - | There were expectations that home country health systems would treat complications and provide non-medically indicated revision procedures. The burden on home country health |

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| | | | | | | such as sepsis, intubation and ventilation, radical bilateral mastectomy, irreversible hypoxic brain injury and death were also reported. | | systems was evident from a public health perspective. |
| Broer, 2021 | Secondary Breast Reduction | Jan 2021 (1990-2020) | N= 18 studies + online survey with surgeons | N= 1,431 questionaries. N= 244 patients for literature review | Most studies level IV | Major complications, defined as nipple-areolar complex (NAC) necrosis/ loss (n=3), NAC congestion (n=1), as well as major seroma and abscess (each n=1): 2.5 %. Minor complications, as defined as delay in wound healing, delay in the return of nipple sensitivity, mild fat necrosis, minor necrosis of the areolar edge, dog-ear, or small hematoma: 9.4% Recommendations as to which pedicle should be utilized in secondary breast reduction procedures differed largely. | - | - |
| Brown, 2018 | Plastic Surgery (craniofacial, orthognathic, aesthetic surgery, burn care, and reconstructive microsurgery) | Sep 2017 (Studies from 2003 to 2017) | N= 33 (15 RCT; 1 nRCT; 14 retrospective cohort; 1 case series; 2 case reports) | N= 1,823 (n= 1328 with TXA and n= 495 with EAPA). | Not assessed | Use of TXA in aesthetic surgery: significant reduction in total blood loss (27.6%, $p < 0.05$) and intraoperative bleeding (48.8%, $p < 0.05$). Notably, | Antifibrinolytic Agents: Tranexamic acid (TXA) and ε-aminocaproic acid (EAPA) | It is likely that tranexamic acid may have definitive benefit when used in rhinoplasty, with positive effects such as intraoperative bleeding |

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| | | | Only Aesthetic surgeries: N= 6 RCT and n= 1 case series using TXA; no studies using EAPA | Only Aesthetic surgeries: N= 263 using TXA. | | tranexamic acid was superior to steroid treatment in the prevention of bleeding. Reports of significant decreasing the intraoperative bleeding rate, eyelid edema, and periorbital ecchymosis in rhinoplasty and rhytidectomia. Other surgeries with benefits in reducing in bleeding: liposuction, reduction mammaplasty. No thromboembolic events or other systemic complications related to the use of tranexamic acid were reported.<br><br>No studies found on EAPA in cosmetic surgery. | | reduction, improved visibility of the surgical field, and reduced postoperative eyelid edema and periorbital ecchymosis. Tranexamic acid may be considered as a useful substitute for steroids in rhinoplasty and thus eliminate the deleterious and well-described side effects of systemic steroid use. |
| Byun, 2013 | Browlift | Jan 2012 | N= 82 (80 retrospective chart reviews, 2 cohorts) | Sample size ranged from n= 11 to n= 1,000 patients | MINORS Scale: Mean MINORS score: 14.10 (range, 4-20) for the non-comparative studies. For the n= 2 comparison studies: mean MINORS score: | Most common complications among all surgical browlifts: Unacceptable scarring and paresthesia. For anterior hairline incision with subcutaneous dissection: alopecia 8.5%, paresthesia 5.4%, unacceptable | - | - |

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| | | | | | 19.0 (range 18-20) | scarring 2.1%, skin necrosis 1.8%.<br>For coronal incision with subgaleal dissection: unacceptable scarring 3.6%, hematoma 0.5%, infection 0.2%.<br>Endoscopic techniques with subperiosteal dissection: highest complication rates: 6.2% for paresthesia, 3.6% for asymmetry, 3.0% for alopecia, and 2.7% for lagophthalmos | | |
| Calpin, 2022 | Breast Surgery | Apr 2021 | N= 7 (3 RCT; 2 retrospective cohort; 2 prospective cohort) | N= 1,446 patients (1,830 procedures) | New Castle Ottawa Scale (NOS) and Cochrane RBA Tool<br>Low risk of attrition bias and reporting bias; 50% high risk of selection bias. | Seroma and hematoma (post operative bleeding) rates<br><br>Significant reduction in haematoma rates in the TXA group (TXA: 3.184% (22/691) vs Control: 6.787% (64/943), OR: 0.41, 95% CI: 0.20-0.86, P = 0.020).<br>Haematoma rates reduced following TXA use in cosmetic procedures (TXA: 3.807% (15/394) vs. Control: 9.091% (34/374), OR: 0.41, 95% CI: 0.22-0.75, P = 0.004).<br>TXA administration did not impact seroma | Tranexamic acid (TXA) | Perioperative administration of TXA may impact the incidence of haematoma in breast surgery, particularly in cosmetic procedures and procedures without axillary lymph node dissection (ALND).<br>TXA has no effect on seroma formation or infection in breast surgery. |

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| | | | | | | formation or infection rates. | | |
| Cason, 2021 | Rhytidectomy | 1975 - Mar 2020 | N= 48 | NR | N= 9 studies: evidence Level II; n= 24 studies evidence Level III; n= 15 studies Level IV evidence. | Overall incidence of hematoma varied among different studies with different techniques and comparison groups (from 0% to 23%) | Different methods (such as preoperative medications, intraoperative medications or interventions, use of fibrin tissue sealants) for reducing hematoma incidence rates. | No single intervention has been consistently proven to mitigate the development of postoperative hematoma after rhytidectomy.<br>Ideal: multimodal approach with evidence-based interventions (see below)<br>Level II: strict blood pressure control; and haemostatic agents (TXA, platelet-rich plasma). |

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| | | | | | | | | Level III: expectant management of pain, nausea, and vomiting; pre-infiltration /tumescence; and meticulous homeostasis with “second look” technique. |
| Chen, 2022 | Rhinoplasty | July 1990 – Apr 2020 | N= 20 retrospective cohort | N= 1,648 | Not assessed | Pooled rates of complications: 3.05% warping (95% CI 1.36–5.19%); 1.2% resorption (95% CI 0.26–2.56%); 1.45% infection (95% CI 0.34–3.06%); 1.53% contour irregularity (95% CI 0.53–2.88%). Revision rate: 2.25% (95% CI 0.96–3.9%). Donor-site morbidities: hypertrophic chest scar 2.08% (95% CI 0.31–4.83%); pneumothorax 0% (95% CI 0–0.46%). Pooled rates of complications: 9.06% (95% CI 6.13–12.43%) at the recipient site when complications at the recipient site did not include revision surgery; 1.47% (95% CI 0.17–3.56%) at the donor site; 15.13% (95%CI 11.03–19.69%) overall. | Use of autologous costal cartilage as grafts | Level III |

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| | | | | | | Recipient-site adverse event rate: 12.44% (95% CI 8.98–16.33%). | | |
| Chien, 2022 | Facial Rhytidectomy | - Dec 2021 | N= 7 RCT | N= 259 | Assessed (Cochrane RBA Tool 2.0) but not reported. | Drainage volume: significantly lower in the tissue sealant group than in the control group (mean difference [MD]: -11.01, confidence interval [95% CI]: -18.39 to -3.63, p < 0.00001). Hematomas: incidence lower in the tissue sealant group (RR: 0.29, 95% CI: 0.08–0.99, p = 0.05). Autologous and homologous tissue sealants can be compared in future RCTs. | Use of tissue sealants (2 categories: autologous and homologous) vs control group. | - |
| Chin, 2020 | Oculoplasty (epicanthoplasty, lateral canthoplasty, and upper and lower blepharoplasty) | Jan 2012 – Jan 2018 | N= 79 | NR | Studies subjected to publication and selection bias. | Main complications: Epicanthoplasty: scaring (2.82% - 16.7%); transient epiphoria 9.2% Lateral canthoplasty: no complications reported. Upper Lid Blepharoplasty: ecchymosis, scar, cosmesis (incidence not reported) Lower Lid Blepharoplasty: lower lid malposition, scleral show, lower lid | - | - |

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| | | | | | | retraction, rounded palpebral fissures, and hollow lower lid area (incidence not reported). | | |
| Chun, 2022 | Rhinoplasty | Jan 2000 – Dec 2020 | N= 35 | N= 2,290 | Not assessed | Overall incidence of postoperative complications: 13.8% | Use of Structural Grafts: columellar strut grafts (CSGs) and septal extension grafts (SEGs) | More patients had postoperative complications after receiving SEGs (23.7%) than CSGs (9.7%).<br>The most common complications included nasal dorsum irregularities/ dissatisfaction (5.7%); tip shape deformation/ dissatisfaction (3.8%); asymmetry (1.5%); and others (<1%).<br>Nasal dorsum irregularities and tip shape deformation/ dissatisfaction were most common in patients receiving CSGs and SEGs, respectively |
| Coroneos, 2016 | Rhinoplasty | Apr 2013 | N= 8 RCT | N= 336 | Cochrane ROB:<br>All studies: Low risk of performance bias, detection bias and other bias.<br>All studies: Unclear risk of selection bias, | - | Systemic Perioperative Corticosteroids | Perioperative corticosteroids reduced the worst edema (SMD: −1.03, 95%CI −1.30 to −0.76, P < .001) and ecchymosis (SMD: −0.78, 95%CI −1.09 to 0.47, P < .001) after rhinoplasty.<br>At one day postoperative, a single |

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| | | | | | and reporting bias.<br>N= 6/8 studies: low risk of attrition bias (unclear risk for the other 2) | | | dose of perioperative corticosteroid reduced edema (SMD −1.15, 95%CI −1.42 to −0.87, P < .001) and ecchymosis (SMD −0.79, 95%CI −1.05 to −0.52, P < .001).<br>No clinical benefit in edema or ecchymosis was found seven days postoperatively, nor did intraoperative bleeding increase.<br>There is high quality evidence to support perioperative systemic corticosteroid treatment in rhinoplasty to reduce short-term edema and ecchymosis without increased intraoperative bleeding. |
| Da Silva, 2014 | Facial Plastic Surgery | Jan 2014 | N= 10 RCT | N= 422 | Cochrane RBA Tool<br>All studies: Unclear risk of selection bias. Low Risk of performance bias and detection bias; attrition bias; reporting bias; and other bias. | Oedema:<br>Day 1 (Scale 1 to 4) Standardised mean difference (95% CI) = -1.16 [-1.71, -0.61] n = 60 2 studies.<br>Ecchymosis:<br>Day 1 (Scale 1 to 4) Standardised mean difference (95% CI) = -1.03 [-1.58, -0.49] n = 60 2 studies | Perioperative corticosteroids for preventing complications | Quality of the evidence: LOW<br>There is limited evidence for rhinoplasty that a single perioperative dose of corticosteroids decreases oedema and ecchymosis formation over the first two postoperative days, but the difference is not maintained after this period. There is also limited evidence that |

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| | | | | | | | | high doses of corticosteroids decrease both ecchymosis and oedema between the first and seventh postoperative days. The clinical significance of this decrease is unknown and there is little evidence available regarding the safety of this intervention. |
| De Vasconcellos, 2018 | Rhinoplasty | Dec 2017 | N= 5 RCT | N= 276 | Most RCTs had a low risk for random sequence generation, blinding, and incomplete outcome data. However, most of the trials had unclear allocation concealment and reporting bias. | | Preoperative Tranexamic Acid (TXA) for Treatment of Bleeding, Edema, and Ecchymosis | TXA: was associated with reduced bleeding during rhinoplasty was found (WMD, −42.28 mL; 95% CI, −70.36 to −14.21 mL), with differences (P = .01) between oral (WMD, −61.70 mL; 95% CI, −83.02 to −40.39 mL; I 2 = 0%) and intravenous (WMD, −23.88 mL; 95% CI, −45.19 to −2.58 mL; I 2 = 56%) administration. TXA: Eyelid edema and ecchymosis scores: significantly lower compared with the control group within the first postoperative week: lower eyelid edema, WMD, −0.76; 95% CI, −1.04 to −0.49 and lower eyelid ecchymosis, WMD, |

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| | | | | | | | | −0.94; 95% CI, −1.80 to −0.08.<br>No cases of thromboembolic events were reported. |
| Di Summa, 2019 | Nonimplant-based mastopexy | Mar 2017 | N= 34 | N= 1,888 | Not assessed | Overall complication rate: 10.4%.<br>Most represented complications: scar-related (3%, including hypertrophic or unesthetic appearance); and nipple–areola-related problems (2.9%; including distortion, asymmetry, and reduction in sensation). | - | - |
| Drinane, 2017 | Implant-based Breast Augmentation | Jan 2000 – Oct 2015 | N= 8 (2 case series; 6 retrospective studies) | N= 10,923 | MINORS Scale:<br>N= 5/8 studies good quality (score 16)<br>N= 3/8 studies low-quality (scores 12-14) | - | Antimicrobial Irrigation (AMI) of the implant to prevent Capsule Contracture (CC) | Risk of CC:<br>Combined AMI+Iodine: OR, 2.60; 95% CI, 2.3–2.94, I 2 = 97%, P < 0.00001<br>AMI subgroup: OR, 1.42; 95% CI, 1.14–1.78, I 2 = 89%, P < 0.00001<br>Iodine subgroup: OR, 0.54; 95% CI, 0.24–1.22, P = 0.05; I 2 = 73% |
| Ehrl, 2018 | Breast Surgery (reconstructive and aesthetic) | Mar 2017 | N= 68 | N= 87 cases of Post-surgical pyoderma gangrenosum (PSPG) | Not assessed | The majority of PSPG (44%) occurred after breast reduction surgery and microsurgical breast reconstruction (16%). The most common associated | - | - |

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| | | | | | | conditions were malignancies in 37% and autoimmune deficiencies in 17%. | | |
| Elena-Scarafoni, 2021 | Plastic Surgery (Rhinoplasty, Blepharoplasty, Face Lift, Breast Surgery, Body Contouring, Burn, Microsurgery) | NR | N= 23<br>Rhinoplasty: 5 RCT and 2 meta-analysis<br>Blepharoplasty: 1 RCT<br>Face Lift: 1 case series; 2 retrospective cohort; 1 prospective cohort; 1 RCT<br>Breast Surgery: 3 oncological surgery, 1 cosmetic breast reduction<br>Body Contouring: 1 prospective study<br>Burn: 1 RCT, 1 case report, 1 retrospective cohort<br>Microsurgery: 2 retrospective cohort | NR | Not assessed | | Use of Tranexamic Acid (TXA) | The literature shows a clear benefit of using TXA to decrease blood loss regardless of the administration route, with no risk of thrombosis events. Also, TXA elicits a potent anti-inflammatory response with a decrease in postoperative edema and ecchymosis, which improves recovery time. |
| Elhawary, 2021 | Plastic Surgery (Hand; Craniofacial; Breast; Head and Neck; Other sites) | 1975 – Feb 2020 | N= 50 Level 1 evidence randomized and prospective controlled trials | NR | All studies level 1 of evidence. | Antibiotics:<br>Average SSI rate in individuals not treated with antibiotics across all studies: 9.5% (head | Antibiotics; Showering, Prepping and Draping; Dressings | Antibiotic Prophylaxis on SSI:<br>Not recommended: nontraumatic hand / |

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| | | | assessing methods of Surgical Site Infections (SSI) reduction | | | and neck oncologic surgeries being associated with the highest SSI rates compared with all other types (P < 0.01)). | | craniofacial (septal and ear).<br>Recommended: traumatic hand / breast (mixed benefits demonstrated) / head and neck oncology / maxillofacial.<br><br>Dressings, showering, close-suction drains for breast surgery, povidone scrubbing: no benefits demonstrated in SSI reduction = not recommended.<br><br>Preoperative mouthwash (povidone or chlorhexidine): recommended for oral surgery. |
| Escandon, 2022 | High-Definition Lipoplasty in Males | Feb 2021 | N= 13 (4 case series; 6 single-arm retrospective cohort; 2 single-arm prospective cohort; 1 two-arm prospective cohort). | N= 1,284 | All studies level of evidence 4.<br><br>NOS: Most studies scored 4-5. | Fluid collection or seroma formation was the most common complication, reported in 60 patients, followed by hyperpigmentation (n= 53), contour irregularities (n= 11), revision surgery (n= 11), anaemia (n= 7), port dehiscence (n= 6), and hematoma or bruising (n= 5). | - | - |

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| Escandon, 2022 | Labiaplasty | Oct 2020 | N= 46 | N= 3,804 | 89% studies level 4 / 11% level 3b. Overall, the included studies have a significant risk of bias as most studies had a Newcastle-Ottawa Scale score of 4 or 5, and n=16 studies (34.8 percent) were case series or case reports. | Overall pooled incidence of dehiscence: 1% Overall pooled incidence of infection less than 1% Subgroup analysis did not reveal any pooled incidence of infection greater than 1 percent. Overall pooled incidence of hematoma less than 1%. Overall pooled incidence of pain or discomfort less than 1%. Rarely reported: flap necrosis, dyspareunia, urinary retention, labial fistula. | - | - |
| Fallahi, 2022 | Rhinoplasty | Mar 2021 | N= 40 (28 spreader grafts; 8 spreader flaps; 4 both) | N= 1,596 patients for spreader grafts. N= 570 for spreader flaps. | Cohort studies: n= 14 good quality; n= 9 fair quality; n= 2 poor quality.<br><br>Clinical Trials: n= 7 low risk of bias; n= 6 some concern; n= 1 high risk of bias. | Spreader graft: from 21 studies reporting complications, 6 of them reported no complication. Most common complications were nasal obstruction, inverted V deformity and open roof deformity, deviation, and infection. Spreader flap group: from 6 studies reporting any existing complications, 1 reported no | Complications associated with Spreader Grafts and Spreader Flaps | Level of evidence IV. These two methods seem to have no significant difference in terms of complication rates, and both are recommended as a choice in middle vault reconstruction when each of their clinical use is indicated. |

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| | | | | | | complications. Five other studies reported some degree of complications.<br>Revision rate: Spreader graft: 10 patients (0.62%) underwent revision surgery; Spreader flap: only 2 patients (0.35%) revised surgically. | | |
| Ferzli, 2020 | Otoplasty (Cartilage-Sparing) | Aug 2019 | N= 20 (14 case series; 5 retrospective cohort; 1 prospective) | Sample sizes ranged from n= 17 to 565 | All studies low quality (70% level of evidence IV, 30% level III). | The posterior suturing technique of cartilage sparing otoplasty seems to be the safest and achieves the best outcomes. This is likely attributed to not scoring the cartilage.<br>There has been data to show suture extrusion with this technique; however, the highest level of evidence from this review shows that the addition of a postauricular fascial flap prevents complications and recurrence. The fascial flap is believed to add an additional layer over the sutures to prevent extrusion and given auricular support. | | Studies on otoplasty have low quality. Cartilage-sparing otoplasty outcomes seem to be superior to cartilage-scoring otoplasty. |
| Ferzli, 2021 | Rhinoplasty | Sep 2020 | N= 8 | N= 18 patients | Low level of evidence | Factors contributing to cutaneous ischemia leading to necrosis | Risk factors for skin necrosis | |

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| | | | | | | included revision setting, tight postoperative taping and splinting, diced cartilage glue graft onlay techniques, excessive thinning of subcutaneous tissue, extended alar-based reduction combined with open approach, and patient's smoking status. | | |
| Garcia, 2020 | "Cosmetic Gynecology" | Apr 2019 | N= 42 (3 RCT; 12 prospective; 25 retrospective; 2 undetermined cohort) | Sample sizes ranged from n= 6 to 812 | N= 7/42 (16.7%) were very low quality, n= 18/42 (42.9%) were low quality, and n= 17/42 (40.5%) were moderate quality. There were no high-grade studies. | Complication rates: Labia minora reduction and clitoral hood: 0 - 25% Labia majora augmentation: 5.6% - 30% Surgical vaginal caliber reduction: 3.8% - 15.8% Mons pubis reduction: 0 - 25.8% Energy-based therapies: 0 - 5.6% | - | - |
| Giordano, 2017 | Face Lift | Jun 2016 | N= 13 (5 RCT; 8 comparative) | N= 2,434 | RCT: risk of bias mostly either low or unclear (Cochrane Collaboration's tool) Non-RCTs: assessed with New Castle Ottawa scale | A statistically significantly decrease in post-operative haematoma [risk ratio (RR), 0.37; 95% CI, 0.18-0.74; p= 0.005] and wound drainage (MD, -16.90, 95% CI Z -25.71, -8.08, p < 0.001) was observed with tissue sealant use. | Use of any type of tissue sealants (including platelet-rich plasma) to reduce hematoma and complications | Level of evidence III: The use of tissue sealants prevents post-operative haematomas and reduces wound drainage. |

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| | | | | | (NOS) for risk of bias, which resulted in 0-4 stars per category, indicating a high to low bias. | A significant decrease in oedema was detected (RR, 0.30; 95% CI, 0.11-0.85, p = 0.02) but not in ecchymosis, seroma, skin necrosis, and hypertrophic scarring with tissue sealant use. | | |
| Gornitsky, 2019 | Fat grafting in the facial region | - Dec 2015 | N= 43 (Most case series) | N= 4,577 | Formally not assessed. Reported high risk of publication bias. | Overall complication rate: 2.27% (n = 104). Most common complications: asymmetry, skin irregularities, hypertrophy, prolonged edema (lasting greater than 3 weeks), fat necrosis, infection, telangiectasia, erythema and activation of acne. | - | - |
| Gould, 2020 | Subfascial Breast Augmentation | Apr 2017 | N= 22 | N= 3,743 | Risk of bias: not assessed for the observational studies.<br>The quality of this systematic review and meta-analysis was assessed using the PRISMA checklist (but not reported). | Capsular Contracture (CC): n= 38 cases (1.01%). The weighted rate of CC was determined to be 0.69%<br>Infections: 0.1%<br>Occasionally reported: rippling, malrotation, axillary banding, sensory deficit, and asymmetry.<br>Not reported: animation deformity. | Subfascial technique for reducing complications. | Level of evidence IV: Subfascial breast augmentation appears to have a low complication rate and an extremely low rate of capsular contracture at approximately 1%. |

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| Groen, 2016 | Breast Augmentation | Feb 2016 | N= 22 (10 retrospective cohort; 12 prospective cohort) | N= 3,565 | ROB (ACROBAT-NRSI): moderate in the preintervention (68.2% of studies), postintervention (72.7% of studies), and overall (72.7% of studies) ratings.<br><br>N= 3/22: Level III<br>N= 19/22: Level IV | Complication Rate: 17.2% (95% CI 15.9-18.5)<br>Most frequent:<br>Indurations: 33.3%, 95% CI 20.4-46.3<br>Persistent Pain: 25%, 95% CI 0.5-49.5<br>Hematoma: 16.4%, 95% CI 14.5-18.4<br>Micro-calcifications on mammograms: 9.0%, 95% CI 6.4-11.5<br>Macrocalcifications on mammogram: 7.0%, 95% CI 3.8-10.2. | Autologous Fat Grafting (AFG) | Level of evidence III: AFG is a promising method in achieving autologous cosmetic breast augmentation with satisfactory volume retention and satisfaction rates. Complications and radiological findings are comparable to those after implant augmentation. |
| Halk, 2019 | Liposuction | Apr 2017 | N= 26<br>(6 RCT, 20 observational) | NR | All RCT considered low quality (level of evidence 2b)<br>Observational studies: level 2b. | Serious Adverse Events (SAE) ratios (liposuction as an uncombined procedure): ranging between 0 and 7.9/1,000 procedures.<br>Mortality rates: between 0 and 0.55 per 1,000 uncombined procedures.<br>Most frequently occurring SAEs: excessive blood loss requiring transfusion or resulting in anemia (0.08%-2.3%), (surgical) infections requiring IV therapy (0.11%-3.8%, and VTE (0.02%-8%). | | Liposuction using tumescent local anesthesia: safest method of fat removal, especially if no or only minimal systemic anesthesia is used. Performance of this technique in an office-based setting: safe beyond doubt.<br>With systemic anesthesia: an outpatient or ambulatory surgery facility seems also safe.<br>Regardless of the physician specialty, knowledge, and training on the execution of the |

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| | | | | | | | | tumescent procedure are vital to ensure optimal safety. |
| Hardwicke, 2013 | Aesthetic Breast Surgery | 1990-2012 | Reduction Mammoplasty: N= 7 (2 RCT, 2 prospective controlled trials, 3 retrospective controlled trials)<br><br>Augmentation Mammoplasty: N= 4 (2 RCT, 2 retrospective controlled trials). | N= 758 patients (1,502 breasts) | Reduction Mammoplasty: Jadad Scale (0-5): mean methodologic quality score of the randomized controlled trials was 4.5.<br><br>Jadad Scale (0-5): mean methodologic quality score of the randomized controlled trials was 2.5. | Reduction mammaplasty, when antibiotics are administered as a single preoperative dose, the risk of developing surgical-site infection is halved. Overall infection rate: 18.9% with no prophylaxis and 9.8% with any antibiotic regimen.<br>Augmentation mammaplasty: no effect on infection rates with any antibiotic regimen.<br>Overall infection rate with no prophylaxis: 0.3%, and with any antibiotic regimen: 1.5%.<br>Capsular contracture: data insufficient for meta-analysis.<br>Overall findings: Meta-analysis of surgical-site infection incidence after aesthetic breast surgery: significant reduction in infections overall with antibiotic prophylaxis compared with controls (p = 0.02) This was most significant with a single | Systemic Antibiotics | Level of evidence II: For cases of reduction mammaplasty, the authors recommend a single intravenous perioperative dose of antibiotic with action against Staphylococcus species. For augmentation mammaplasty, there is no evidence to refute current guidelines, based on recommendations obtained from other forms of implant surgery. |

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| | | | | | | preoperative antibiotic dose (p = 0.02) rather than a preoperative dose followed by an extended postoperative course (p = 0.79). | | |
| Hehemann, 2019 | Penile Girth Enlargement | NR | N= 13 (9 retrospective, 4 prospective) | N= 1,565 | NR | Most studies: no serious complications reported. Graft sclerosis, preputial edema, paraphimosis, pain with erection, edema and ulceration, hematoma, diminished sensation. | - | - |
| Ho, 2020 | Abdominoplasty | Jan 2009 – Oct 2017 | N= 16 | N= 4,295 | NR | Overall complication rates ranged from 9.3–33.8%.<br>Revision rates were 3–21.9%.<br>Summary measures favouring the sub-scarpal fat preservation and drains, and drains only groups for overall complications.<br>There were no significant differences between groups for seroma, haematoma, infection/abscess, skin/fat necrosis, dehiscence, surgical revision rate and VTE (VTE) rate. | Comparative efficacy of drains, progressive tension sutures (PTS) and subscarpal fat preservation in reducing complications of abdominoplasty | The rates of individual complications are no different with or without the use of PTS, drain or subscarpal fat preservation in different combinations.<br>Lower rates of overall complications observed from this study appear to favour the use of “fat preservation only”, “PTS only” or “PTS and drain” techniques. However, due to the inconsistent manner in which different authors define complications, we cannot draw solid conclusions to support this finding.<br>Furthermore, although the use of drains has |

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| | | | | | | | | not been found to have a significant effect on complications, there is insufficient evidence to conclusively recommend against its routine use. |
| Horsnell, 2017 | Aesthetic Breast Augmentation | 2000-2016 | N= 10 (1 case control study, 6 retrospective cohort studies, 3 case series) | N= 11,772 | Not formally assessed but reported to be low quality of evidence (no prospective studies) | Pooled capsular contracture (CC) rate: 2.54% (0% to 7%)<br><br>Antibiotic irrigation was shown to reduce capsular contracture 10-fold in two papers, have no effect in one and increase it in a further paper. However, these changes did not persist after multivariate analysis. | Intra-operative techniques to reduce the risk of CC (antibiotic irrigation, drains, insertion funnel, povidone-iodine, nipple shields) | There was limited evidence to support intra-operative techniques to reduce capsular contracture rate.<br>Where available, the literature tends to support the use of antibiotic and povidone-iodine irrigation, the use of insertion funnels and nipple shields and the avoidance of drains.<br>However due to the poor quality of the evidence these findings should be treated cautiously. |
| Huang, 2015 | Prosthesis-based mammoplasty | Jun 2014 | N= 13 (3 prospective RCT, 10 retrospective with control group)<br><br>(9 studies on cosmetic, 4 studies on reconstructive) | N= 3,941 cosmetic | RCTs: Jadad Score(0-5): average score 3 (range 2-4)<br>Non-RCT: NOS: average score7.5 (range 4-9) | Infection Risk:<br>Extended systemic antibiotic prophylaxis: pooled RR = 0.638, 95%CI 0.453-0.898) compared with antibiotic prophylaxis within 24 h.<br>Subgroup analysis:<br>Reconstruction Surgery: pooled RR = 0.508, 95%CI 0.349-0.739 | Antibiotic Prophylaxis (Systemic and Topical) | Extended systemic antibiotic prophylaxis (24 h postoperatively) will significantly reduce Surgical Site Infection (SSI) risk, especially in implant breast reconstruction.<br>Topical antibiotic irrigation would decrease capsule |

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| | | | | | | Aesthetic breast surgery: pooled RR = 1.458, 95%CI 0.602-3.528).<br>Topical antibiotic irrigation:<br>CC risk: pooled RR = 0.472, 95%CI 0.316-0.707<br>Not able to reduce infection risk. | | contracture (CC) risk, while might not be able to reduce infection rate. Cephalosporin is generally recommended as antibiotic prophylactic regimen. Risk factors such as chest irradiation and diabetes should be take into consideration when prescribing antibiotic prophylaxis. |
| Hudise, 2022 | Augmentation Rhinoplasty | Oct 2019 | N= 30 | N= 1,013 | Overall low risk of bias according to the ROBINS-1 tool | Overall complication rate: 7.1% (95% CI 4.9%−9.3%)<br>Most common complications: secondary surgery for re-correction (4.1%), infection (2.1%), warping (1.6%), hypertrophic scars (1.6%). | Use of autologous vs alloplastic grafts on complications of the nasal dorsum reconstruction | Overall complications:<br>Alloplastic group 7.8% (95% CI 4.1%−11.5%)<br>Autogenic group 6.9% (95% CI 4.3%− 9.6%)<br><br>Infection rate:<br>Alloplastic group 3.7% (95% CI 0.4%−7.0%)<br>Autogenic group 2.1% (95% CI 0.8%− 3.4%)<br><br>Re-correction surgery:<br>Alloplastic group 3.7% (95% CI 1.0%-6.4%)<br>Autogenic group 4.2% (95% CI 2.4%-6.1%) |

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| Jabour, 2017 | Abdominoplasty | Dec 2015 | N= 7 (3 RCT, 4 retrospective studies). | N= 808 | Assessed but not reported | Seroma Incidence:<br>PTS + drains vs drains only: superior (RR, 0.28; 95% CI, 0.09-0.82; P = 0.02)<br>PTS + drains vs PTS only: no difference (RR, 1.23; 95% CI, 0.44-3.44; P = 0.69)<br>Surgical Time:<br>Substantial heterogeneity - mean surgical time difference between the PTS + Drains group and the drains only group was 23.19 mn (95% CI, −2.34-48.72; P = 0.07) | Addition of Progressive Tension Sutures (PTS) to Drains Reduce Seroma Incidence | Addition of PTS to drains reduces the risk of postoperative seroma in standard abdominoplasty. More RCTs with larger sample sizes and better comparability are warranted to confirm with more confidence the impact of PTS in abdominoplasty |
| Jacono, 2019 | Rhytidectomy | Dec 2018 | N= 183 | NR | Not assessed | Complications:<br>Temporary Facial Nerve Injury: higher rates in High lateral SMAS (1.85%) and composite rhytidectomy (1.52%), statistically significant difference compared with SMAS plication (odds ratio [OR] = 2.71 and 2.22, respectively, P < 0.05)<br>Permanent Facial Nerve Injury: Risk of permanent injury did not differ among techniques.<br>Hematoma: Increase in major hematoma for the deep plane (1.22%, OR | Complication rates for Different Sub-superficial musculo-aponeurotic system (SMAS) facelift Techniques | |

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| | | | | | | = 1.67, P < 0.05) and SMAS imbrication (1.92%, OR = 2.65, P < 0.01)<br>Skin Necrosis: higher with the SMAS flap (1.57%, OR = 2.29, P < 0.01)<br>Seroma: deep plane vs SMAS plication technique (OR= 2.8, 95% CI= 1.14 to 6.98, P< 0.05) and SMASectomy/imbrication vs SMAS plication (OR= 5.89, 95% CI = 3.15 to 11.0, P < 0.01).<br>Infection: SMAS flap vs SMAS plication (OR = 0.50, 95% CI = 0.27 to 0.90, P < 0.05).<br>Infection incidence: SMAS plication (0.53%), SMASectomy/imbrication (0.77%), SMAS flap (0.26%), high lateral SMAS (0.87%), deep plane (0.73%), and composite (1.12%) | | |
| Janis, 2016 | Plastic Surgery (did not specify cosmetic surgery) | NR | N= 75 | N= 7,173 patients | Level of evidence: Very low to moderate.<br>Risk of Bias: n=5/14 interventions with high risk of | Effective strategies for seroma prevention included the use of closed-suction drains; keeping the drains until their output volume was minimal; maintaining a high pressure gradient | Strategies for Postoperative Seroma Prevention | Level of evidence II |

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| | | | | | bias; n= 9/14 interventions with low risk of bias | in the drains; using sharp or ultrasonic dissection rather than cautery; dissecting the abdomen in a place superficial to the Scarpa fascia; ligating blood vessels with sutures or clips; using quilting or progressive tension sutures; using fibrin, thrombin, or talc; and immobilizing the surgical site postoperatively.<br>Surgical-site compression did not prevent seroma accumulation.<br>The use of sclerosants at the initial operation actually increased the risk of seroma | | |
| Kadakia, 2022 | Rhinoplasty | NR (studies included 1977-2019) | N= 13 (11 retrospective, 1 case series, 1 prospective)<br>N= 11 included in meta-analysis | N= 1,017 patients (1956 IHCC grafts) | Assessed but not reported | Overall pooled complication rates:<br>Resorption: 1.14% (95% CI: 0.3%-2.0%)<br>Warping: 0.5% (95% CI: 0.1%-0.9%)<br>Infection: 1.2% (95% CI: 0.3%-2.1%)<br>Mobility: 1.0% (95% CI: 0.1%-2.0%)<br>Graft removal or replacement: 0.8% (95% CI: 0.1%-1.6%)<br>No allergic reactions or systemic disease | Use of Irradiated homologous costal cartilage (IHCC) grafts | The overall complications associated with IHCC use in rhinoplasty were very low. Costal cartilage allografts are an area of renewed interest that may represent an alternative to autologous costal cartilage grafting in rhinoplasty due to their low complication rates, convenience, cost-effectiveness, and |

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| | | | | | | associated with IHCC use were reported in any of the studies | | elimination of donor-site complications. |
| Kenny, 2022 | Reduction mammaplasty | NR | N= 64 | NR | Not assessed | - | Risk Factors for wound breakdown or infection | Smoking status, BMI and steroid use appear to be the patient risk factors with the greatest evidence to suggest they pose an increased risk of wound complication following RM.<br>In terms of strategies to reduce wound complications, a single dose of preoperative antibiotics appears to have a beneficial effect on wound complications and infections notably |
| Keyhan, 2021 | Augmentation Rhinoplasty | Aug 2020 | N= 16<br>(6 observational retrospective, 8 observational prospective; 2 RCT) | N= 481 | Not assessed | Complication rates:<br>Graft resorption 2.52%<br>Insufficient augmentation 3.93%<br>Graft displacement 1.77%<br>Infection 2.3%<br>Irregularity 1.36%<br>Supra-tip depression 1.13%<br>Overcorrection 3.06%<br>Hematoma at recipient site 1.36%<br>Visible bulging of the graft 2.64%<br>Donor site hypertrophic scar 2.64% | Use of Autogenous Diced Cartilage Wrapped in Fascia for dorsum augmentation | Level of evidence IV: Current findings suggest the overall complications and revision rates with the use of diced cartilage wrapped in fascia for dorsum augmentation were relatively low and this technique is a reliable treatment choice for patients with primary/secondary dorsum deficiencies. |

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| | | | | | | Donor site hematoma 3.58%<br>Revision surgery 3.03% | | |
| Keyhan, 2022 | Augmentation Rhinoplasty | Sep 2020 | N= 27 (21 retrospective and 6 prospective case series) | N= 3,803 | Mourad risk of bias in case series assessment tool: All studies score 5/8, except one that scored 4/8. | Complication rates:<br>Infection 2.75%<br>Deviation 1.91%<br>Irregularity 0.72%<br>Hematoma 0.70%<br>Extrusion 0.78%<br>Overcorrection 0.49%<br>Revision rate: 6.4% (95%CI 3.84-9.57) | Use of polymer-based alloplastic (synthetic) materials for dorsum augmentation | Level of evidence V: This meta-analysis suggested an acceptable rate of complications and revision surgery with synthetic materials. Synthetic materials might be a proper option when the use of autogenous grafts is not applicable. Judicious case selection and prompt management of complications are crucial whit alloplastic materials. |
| Khan, 2015 | Breast Reduction Surgery | Mar 2015 | N= 3 RCT | N= 306 patients (505 breasts) | N= 1 intermediate to high quality; n= 2 low to intermediate quality | Apart from a significantly shorter duration of hospital stay for those participants who did not have drains (MD 0.77; 95% CI 0.40 to 1.14), there was no statistically significant impact of the use of drains on outcomes. | Use of wound draining | The limited evidence available shows no benefit in using postoperative closed suction drains in breast reduction surgery, however, this is based on only three trials, two of which had methodological limitations that put them at a high risk of bias. There is no evidence available evaluating the impact of using drains in breast augmentation |

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| | | | | | | | | and breast reconstruction surgery. |
| Khavanin, 2014 | Single-Stage Augmentation-Mastopexy | May 2013 | N= 23 | N= 4,856 | Many of the included studies are of a low level of evidence ranging from case series to lesser quality prospective cohort studies | Pooled total complication rate: 13.1% (95% CI, 6.7 to 21.3%).<br>Most common individual complications:<br>Recurrent ptosis 5.2% (95%CI 3.1 to 7.8%)<br>Poor scaring 3.7% (95%CI 1.9 to 6.1%)<br>Capsular contracture 3.0% (95% CI 1.4 to 5.0%)<br>Tissue-related assimetry 2.9% (95%CI 1.2 to 5.4%)<br>Infection, hematoma, and seroma were rare, with pooled incidences of less than 2 percent each.<br>Reoperation rate: 10.7%(95%CI, 6.7 to 15.4%). | | Pooled complication and reoperation rates for single-stage augmentation-mastopexy were acceptably low and comparable to published rates for primary augmentation or mastopexy alone. It must be noted that all studies included in this systematic review emphasized the importance of careful patient selection. In a carefully selected patient under the care of a skilled surgeon, combined augmentation-mastopexy can be safe and effective. |
| Killion, 2015 | Rhytidectomy | Jul 2013 | N= 7 randomized trials | N= 654 sides of faces | Not assessed | Hematoma formation: RR 0.25, P = 0.002 (four times less likely with the use of fibrin glue)<br>Seroma formation: no significant reduction (RR 0.56, P = 0.19).<br>Not enough data to properly measure 24- | Use of tissue glues compared to control | |

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| | | | | | | hour drainage and ecchymoses. | | |
| Kim, 2021 | Rhinoplasty | May 2019 | N= 6 RCT | N= 224 | N= 4 unclear risk of bias, n= 1 high risk of bias, n= 1 low risk of bias. | External approach compared to internal approach:<br>Mucosal injury OR 0.41; 95% CI 0.11-0.99 I2 29%)<br>Significant differences in eyelid ecchymosis and edema, except for eyelid ecchymosis at 7 days postoperatively. However, all significant results showed a small effect size with a standardized mean difference near 0.2. | Different Methods of Lateral Osteotomy to Reduce Eyelid Edema and Ecchymosis | |
| Kisel, 2022 | Rhinoplasty | Jan 2022 | N= 8 RCT | N= 440 | N= 6 low risk of bias, n= 1 intermediate risk of bias, n= 1 high risk of bias | Piezosurgery: statistically significant ($p < 0.05$) reduction in: Short-term Edema; Ecchymosis; Pain; Mucosal injury<br><br>Length of surgery: varied. | Comparison Between Piezosurgery and Conventional Osteotomy | Level of evidence III: Piezoelectric osteotomies reduce oedema and ecchymosis compared to conventional osteotomies, in addition to improving pain and mucosal injury. However, disadvantages such as length of surgery time and cost have been reported. |
| Kullar, 2018 | Rhinoplasty and Septorhinoplasty | NR | N= 10 (4 observational prospective, 4 randomized | N= 5,427 | Not assessed | Antibiotics perioperatively: similar infection and/or bacteremia rates (0–13.3%) in those | Use of systemic antibiotics | Peri- and postoperative antibiotics in noncomplex rhinoplasty and septorhinoplasty are not beneficial in |

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| | | | prospective, 2 retrospective) | | | receiving or not receiving antibiotics.<br><br>Antibiotics postoperatively: antibiotics decreased the infection rate from 27% to 8% in complex revision cases. No difference in noncomplex cases. | | decreasing infection risk.<br>Antibiotics, with a first-generation cephalosporin such as cefazolin (non–β-lactam, such as clindamycin, if β-lactam allergy), should be considered in patients with comorbidities/undergoing complex surgery.<br>If perioperative antibiotics are used, antibiotics should be administered within 1 hour of incision and discontinued within 24 hours of the operation. |
| Laikhter, 2022 | Aesthetic Plastic Surgery | Nov 2020 | N= 14 (10 RCT, 2 prospective cohort, 2 retrospective cohort)<br>(n= 12 included for meta-analysis) | N= 820 | N= 9 low risk of bias, n= 1 some concerns on risk of bias. | TXA:<br>Associated with 26.3 mL average blood loss reduction (95% CI, –40.0 to –12.7 mL; P < 0.001)<br>Trend toward decreased postoperative hematoma (OR 0.280; 95% CI, 0.076-1.029; P = 0.055)<br>Decreased ecchymosis (5/7 studies)<br>Decreased drain output (3/7 studies)<br>Improved surgical site quality (1 study) | Use of Tranexamic Acid (TXA) in rhinoplasty (6), rhytidectomy (3), liposuction (3), reduction mammaplasty (1), and blepharoplasty (1) | Level of evidence IV:<br>TXA is associated with decreased blood loss and a trend toward decreased hematoma formation in aesthetic plastic surgery. Its use has the potential to increase patient satisfaction with postoperative recovery and decrease costs associated with complications, including hematoma evacuation. |

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| Largo, 2014 | Breast Augmentation | Dec 2012 | N= 36 (6 prospective cohort, 15 case reports, 10 case series, 3 retrospective cohort, 1 non-randomized retrospective controlled cohort, 1 diagnostic validation cohort) | N= 1,453 | N= 2 level of evidence III, n= 17 level of evidence IV, n= 17 level of evidence V) | Minor complications 9.7%<br>Major clinical complications requiring surgical intervention or hospitalisation 6.1%<br>Radiological changes 18.3%<br>Breast Cancer 0.14% (2 cases) | Autologous fat graft for breast augmentation | |
| Ledo, 2021 | Rhinoplasty | Oct 2019 | N= 6 (3 prospective, 3 retrospective) | N= 4,044 | MINORS Score<br>N= 1 score 9<br>N= 2 score 10<br>N= 3 score 12 | Reoperation rate 1.51% (0% to 5.2%)<br>Infection rate 0.06% (0% to 4%)<br>Partial resorption 0.67% (0% to 5.2%) | Use of free diced cartilage grafts | |
| Leopardi, 2014 | Breast Augmentation | 2001-2009 | N= 18 (most case series) | N= 1,606 | Overall quality of the evidence base was poor (level IV) | Most common complications:<br>Fat necrosis 1-17%<br>Cysts 5-20%<br>Lumps 0-8%<br>Calcification 4-20%<br>Reabsorption of fat: varying degrees (first 12 months)<br>No data on macrocalcifications, mammography alterations or breast cancer. | Autologous fat transfer (AFT) for breast augmentation | |
| Li, 2018 | Mammaplasty | Mar 2018 | N= 10 (2 RCT, 4 prospective controlled trials, | N= 682 patients (27% cosmetic surgery) | NOS Scale:<br>N= 3 score 7, n=2 score 4, | No complications associated with BTX-A were mentioned. | Use of Botulinum Toxin A (BTX A) | Level of evidence III:<br>It seems all the studies demonstrate the valid |

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| | | | 3 retrospective cohort, 1 case series) | | n=4 score 3, n=1 score 1 | Almost all the studies reported efficacy for pain control.<br>Other assessments included increased speed of expander enlargement and volume were mentioned in four papers, two articles analyzed the visual analogue scores, three suggested relief of capsular contracture, two reported lower narcotic use, three mentioned shorter hospital stays and one proved lowering the rate of unplanned expander. | for implant placement | usage of BTXA, but the quality of this evidence still under the line. |
| Li, 2019 | Breast Augmentation | Dec 2018 | N= 11 (5 prospective, 6 retrospective) | N= 18,109 | "Methodological Index":<br>N= 7 low-quality<br>N= 4 high-quality | Subpectoral vs Prepectoral:<br><br>Superior in:<br>Capsular contracture (OR 0.26; 95% CI 0.13–0.55, p<0.00001)<br>Hematoma (OR 0.35; 95% CI 0.13–0.89, p = 0.03)<br><br>Inferior in:<br>Implant displacement (OR 4.90; 95% CI 1.43–16.77, p = 0.01)<br>Animation deformity (OR 14.47; 95% CI 1.70–123.07, p = 0.01) | Subpectoral Versus Prepectoral Breast Augmentation | Level of evidence III: Subpectoral and subglandular (prepectoral) breast augmentations both have their merits and demerits regarding complications. The pros and cons of each procedure should be fully explained to patients and selection of implant plane should be considered more comprehensively |

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| | | | | | | No difference: Reoperation rates (OR 0.98; 95% CI 0.72–1.35, p = 0.920); Seroma (OR 1.06; 95% CI 0.22–5.06, p = 0.94); Rippling (OR 1.39; 95% CI 0.76–2.52, p = 0.28); Infection (OR 1.21; 95% CI 0.46–3.16, p = 0.70); Implant rupture (OR 1.67; 95% CI 0.61–4.55, p = 0.32) | | |
| Li, 2021 | Reduction Mammaplasty | Jun 2019 | N= 11 (2 RCT, 9 observational comparative) | N= 1,610 | All studies high risk of selection bias and performance bias; low risk of detection, reporting and other bias. Mixed risks for attrition bias. | Vertical vs Inverted-T Scar:<br><br>Overall incidence of complications: OR: 2.06; 95%CI, 1.15 to 3.70; P: 0.002<br>Wound dehiscence: OR: 4.62; 95%CI, 2.33 to 9.16; P<0.00001<br>No significant differences in seroma, hematoma, nipple necrosis, fat necrosis and reoperation were noted. | Vertical Scar Versus Inverted-T Scar | Level of evidence III: Both two breast reduction techniques are equally safe, while the vertical scar approach resulted in a statistically lower rate of overall complications and wound dehiscence. |
| Li, 2022 | Rhinoplasty | Studies published from May 2000 to Feb 2021 | N= 14 (11 case series, 1 RCT, 1 prospective cohort, 1 retrospective cohort) | N= 2,380 | N= 12 high-risk of bias (lack of blinding), n= 2 unclear risk Most studies level of evidence IV. | Overall complication rate: 11.5%<br>Revision surgery 5.3%<br><br>Main complications: Infection 4.5%; Visible irregularity 5.3%; Overcorrection 0.7%; Absorption 0.5% | Use of diced cartilage for dorsal augmentation | |

| Review | Topic/type of surgery | Search dates | Included trials | Participants | Reported study quality | Patient safety and quality care risks (occurrence, or frequency if recorded) | Interventions, tools, resources | Evidence of effectiveness |
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| | | | | | | No significant difference in the rates of visible irregularity among the wrapped diced cartilage, glued diced cartilage, and free diced cartilage groups. | | |
| Locketz, 2020 | Aesthetic Facial Plastic Surgery | Apr 2020 | N= 11 (8 RCT, 2 retrospective case series or cohort, 1 clinical opinion) | N= 612 | Not assessed | Intraoperative blood loss: significant reductions found in 5 rhinoplasty studies.<br><br>Postoperative edema and ecchymosis: significantly reduction found in 3 rhinoplasty and 2 rhytidectomy studies<br><br>Some findings in reduction of operative time and time to achieve hemostasis, reduced postoperative drain output and faster time to drain removal. No studies reported an adverse outcome directly related to TXA. | Use of Tranexamic Acid (TXA) in rhinoplasty (6 studies), rhytidectomy (4 studies) and blepharoplasty (1 study) | Level of evidence II: Existing literature investigating TXA in aesthetic facial plastic surgery is sparse with varying levels of evidence and heterogeneous data. Literature suggests systemic TXA reduces intraoperative blood loss during rhinoplasty, although the clinical significance of this blood loss reduction is unclear. TXA may also reduce postoperative edema and/or ecchymosis in rhytidectomy and rhinoplasty, although the lack of validated grading scales yields insufficient evidence to support this claim. |
| Luan, 2022 | Rhinoplasty | Apr 2020 | N= 10 retrospective case series | N= 959 | All the included trials had moderate-to high | Main complications: Warping 2.07% (95% confidence interval [CI], 0.80%–5.23%) | Use of irradiated homologous costal cartilage | |

| Review | Topic/type of surgery | Search dates | Included trials | Participants | Reported study quality | Patient safety and quality care risks (occurrence, or frequency if recorded) | Interventions, tools, resources | Evidence of effectiveness |
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| | | | | | methodological quality except for small sample sizes and subjectively reporting of some complications. | Infection 1.77% (95% CI, 1.10%–2.83%)<br>Resorption 1.34% (95% CI, 0.34%–5.16%)<br>Displacement 2.13% (95% CI, 0.86%–5.19%)<br>Revision 2.99% (95% CI, 1.24%–7.03%)<br>Extrusion 0.16% (95% CI, 0.01%–3.25%)<br>Avulsion 2.04% (95% CI, 1.02%–4.02%) | | |
| McCrossan, 2021 | Aesthetic Breast Surgery | Nov 2020 | N= 24 (8 retrospective reviews, 7 case series, 9 case reports) | N= 171 | Not assessed | N= 222 complications reported.<br>Common complications: Wound infection n=67 (39%); Breast abscess/ collection n= 21 (12%); Wound dehiscence n=20 (12%); Ruptured implant n=13 (8%); Exlpantation n= 32 (39% of implant-based procedures)<br><br>N= 103 returns to theatre, n= 2 ICU stay, and n=1 death. | Medical Tourism in Aesthetic Breast Surgery | Level of evidence III: Aesthetic breast surgery tourism is popular within the cosmetic tourism industry. However, with infective complications (39%) and return to theatre rates (51%) significantly higher than expected, it is clear that having these procedures abroad significantly increases the risks involved. The high complication rate not only impacts individual patients, but also the home country healthcare systems. |
| McGuire, 2019 | Rhinoplasty | Jun 2018 | N= 5 RCT (4 included in meta-analysis) | N= 332 | N= 4 high-quality, low risk of bias. | TXA: mean reduction in intraoperative blood loss of −41.6 mL (95% CI, −69.8 to −13.4 mL) compared with controls (P = .004). | Use of Tranexamic Acid (TXA) to reduce intraoperative blood loss and postoperative | Level of evidence IV: Tranexamic acid has the ability to significantly reduce intraoperative blood loss and postoperative edema |

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| | | | | | | Reduction of postoperative edema and ecchymosis found in three studies compared to control (no difference compared to corticosteroid) | edema and ecchymosis | and ecchymosis among patients undergoing primary elective rhinoplasty. |
| McGuire, 2020 | Secondary Rhinoplasty | Dec 2018 | N= 18 (no RCT) | Sample sizes ranged from n= 9 to 357 (mean n= 64) | MINORS for non-comparative studies: n= 9 /15 high methodological quality (60%)<br><br>MINORS for comparative studies: All 3 comparative studies high methodological quality<br><br>Most studies level of evidence III and IV | Rates of warping remained low with no major complications with the use of a variety of approaches Secondary rhinoplasties which did not describe a method to address warping showed increased rates of warping compared to counter balancing techniques, chimeric grafts, titanium microplating, Kirschner wire and suture usage,irradiation, and various carving techniques. | Prevention of Autologous Costal Cartilage Graft Warping | |
| Michot, 2016 | Associated abdominoplasty and breast surgery | Apr 2015 | N= 32 observational studies (n= 4 comparing combined surgery with abdominoplasty alone) | N= 945 patients (from 4 comparative studies) | The level of evidence of included studies is low or moderate. | Major complications: Combined surgery (CS): OR 14.71 [CI 95% 1.82—118.79] Abdominoplasty alone: OR 5.35 [CI 95% 2.06—13.91]<br><br>Minor complications: | Comparison between combined surgery (CS) (breast + abdomen) with abdominoplasty alone | The results of this systematic review appears in favor of an increase in major complications related to abdominoplasty combined with breast surgery compared to abdominoplasty alone |

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| | | | | | | CS: overall OR 1.85 [CI 95% 1.14-3.01] / wound dehiscence OR 2.29 [CI 95% 1.07-4.9] | | but the level of evidence of included studies is low or moderate. Prospective cohort comparative studies are necessary to provide strong evidence. However, we recommend avoiding this procedure in massive weight loss patients or patients with thromboembolism history. |
| Mittal, 2020 | Abdominoplasty and Liposuction | 2004-2019 | N= 25 (14 retrospective, 4 prospective, 3 literature reviews, 4 CME articles) | NR | Not assessed | Abdominoplasty: highest occurrence of VTE among aesthetic procedures.<br>Higher incidence of VTE: abdominoplasty combined with liposuction.<br>Independent risk factors for VTE: circumferential procedures, obesity and HRT (hormone replacement therapy).<br>2005 Caprini/Davison risk assessment model: most appropriate model for risk stratification in plastic surgery patients.<br>Newer oral anticoagulants hold promise. | VTE (VTE) Prophylaxis | Level of evidence III:<br>Preoperative risk stratification: for all patients.<br>Chemoprophylaxis: considered in cases with a Caprini RAM score> 7 or in those with independent risk factors.<br>Administering regional blocks for anaesthesia and avoiding full muscle paralysis help reduce the risk of VTE. |

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| Molina-Burbano, 2021 | Face Lift | Sep 2019 | N= 15 (7 prospective, 7 retrospective, 1 comparative) | N= 1,116 | Risk of Bias assessed but not reported. Levels of evidence: III (n= 3 studies), IV (n= 11 studies), and V (n= 1 study) | Data on the incidence of complications were limited. Reported complications included: transient postoperative swelling, hematoma, wound healing disorders. | Use of different techniques of Fat Grafting (lipofilling) for various types of Face Lift | Level of evidence III: Combined facelift and fat grafting is a safe and efficacious means to simultaneously address age-related ptosis and volume loss. Further research is required to validate and improve existing treatment modalities. |
| Montemurro, 2021 | Primary Breast Augmentation | May 2019 | N= 74 | NR | Not assessed. | Increased risk of complications: smoking, high BMI<br>Bacterial contamination: related to increased risk of capsular contracture, infection, and anaplastic large cell lymphoma (BIA-ALCL). | Review of controllable factors to reduce the rate of complications | Level of evidence III: Most of the strategies to reduce the risk of any complication are based on meticulous hygienic precautions and adequate training of the surgeon.<br>Smoking cessation and normalizing the BMI should be advised before primary breast augmentation. |
| Morkuzu, 2022 | "No Touch" Breast Augmentation and Reconstruction | Jan 2005 – Jan 2021 | N= 6 (5 retrospective cohort, 1 prospective trial). No RCT | NR | Not formally assessed | Capsular Contracture: Meta-analysis of these studies resulted in a risk ratio reduction of 0.42 (95% CI, 0.25–0.69 P = 0.0006).<br><br>Other findings: shorter incision lengths (35.5±2.1mm), less insertion time (mean = 6 seconds), and | Use of the Keller funnel ("no touch" technique) to reduce the risk of implant contamination. | The Keller funnel reduces subsequent capsular contracture rate, surgical time, and incision length and allows for easier insertion. |

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| | | | | | | decreased complications. | | |
| Motakef, 2015 | Vaginal Labiaplasty | Sep 1984 – Nov 2013 | N= 19 (16 retrospective, 3 case reports) | NR | Not assessed | Common postoperative complications: dehiscence (0-36%), hematoma (0-8.3%), flap necrosis (for wedge resection) (4.8%), discomfort, visible scarring, superficial infections (0-36%), under-resection, and over-resection. Re-operation rate: ranged from 0 – 25%. | Different techniques of vaginal labiaplasty | - |
| Myung, 2017 | Reduction Malarplasty | NR | N= 14 retrospective reviews | N= 3,149 | Not assessed | Most frequent complications: Transient sensory weakness, with 5.8% (Z = −18.012; 95% confidence interval, 4.3–7.6%), Drooping (2.8%), Nonunion (2.2%), Asymmetry (1.8%), Mouth opening restriction (1.8%), Uncontrolled bleeding (1.3%), Facial nerve injury (0.9%). | Postoperative complications associated with reduction malarplasty via intraoral approach. | |
| Nasr, 2016 | Abdominoplasty | Apr 2015 | N= 7 (5 RCT = included for meta-analysis) | N= 452 | All RCTs considered high risk of bias. | Total incidence of seroma: TA 11.4% vs controle 27.8% Meta analysis: | Effect of Tissue Adhesives (TA) on Seroma Incidence | Level of evidence II: Patients who received TAs following abdominoplasty had a similar incidence of seroma compared with |

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| | | | | | | Seroma RR 0.42 (CI95% 0.12-1.141 p=0.16) - no difference<br>Total drainage volume mean difference –20.42 ml (CI95% -36.8 to –4.67 p=0.01) | | patients who did not receive TAs.<br>However, the total drainage volume was significantly lower for patients who received TAs.<br>There is a paucity of high-quality evidence to support the delivery of TAs to prevent seroma formation after abdominoplasty. Well-designed RCTs are needed to assess with confidence the overall effects of TAs in abdominoplasty |
| Nicksik, 2021 | Cosmetic and Reconstrutive Plastic Surgery | 1975-2021 | N= 155 (most case reports and case series) | N= 473 | Not assessed. Most studies level of evidence V. | Most described dermatologic complication for cosmetic surgeries: Post-surgical pyoderma gangrenosum (PSPG): 0-13.79%<br>Others: Contact dermatitis (0-8.84%); HSV-1 reactivation (0-5.56%); VZV infection (0-0-9.09%); Suture hypersensitivity (0-6.25%); Koebner phenomenon (0-14.29%). | Dermatologic Complications Following Cosmetic and Reconstructive Plastic Surgery | |
| Nuyen, 2019 | Rhinoplasty | Feb 2018 | N= 5 RCTs | N= 589 | N= 4 studies low risk of bias, n= 1 | No significant differences in outcome of preventive antibiotic | Antibiotic Prophylaxis | Level of evidence I: This study's results suggest that pooled |

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| | | | | | study unclear risk of bias. | therapy given either preoperatively or postoperatively were found, with a pooled RR of 0.92 (95% CI, 0.35-2.43; P = .86). | | evidence from the 5 RCTs does not support the use of preventive antibiotic therapy in rhinoplasty. |
| Oranges, 2015 | Labia Minora Reduction | Oct 2014 | N= 38 | N= 1,981 | Assessed but not reported. | Complications reportedly occurred in 134 (6.76%) of the 1981 patients.<br>Most common complications: wound dehiscence, hematoma, postoperative bleeding, and urinary retention.<br>No complications were serious, and all resolved easily.<br>Revision surgery: 4.1% | Different techniques of labia minora reduction | |
| Oranges, 2022 | Chin Augmentation | 1997-2020 | N= 54 (36 retrospective, 9 prospective, 7 case series, 2 case reports) | N= 4,897 | Good quality for representative study sample, comparison performed on comparable groups at baseline, randomization, credible tools for data collection, limited attrition rate. | The overall complication rate of the most represented groups was 15.7% for implants and 19.7% for osteotomy, including 2.4% and 16.4% cases of transient mental nerve related injuries respectively. | Different techniques of chin augmentation | |
| Orholt, 2020 | Breast Augmentation | NR | N= 22 (3 prospective, 19 retrospective) | N= 2,073 | Included studies with moderate quality: mean Methodological Index for | Low rates of major complications: hematoma, 0.5 %; infection, 0.6 %; and seroma, 0.1 % | Use of Fat Grafting for Breast Augmentation | |

| Review | Topic/type of surgery | Search dates | Included trials | Participants | Reported study quality | Patient safety and quality care risks (occurrence, or frequency if recorded) | Interventions, tools, resources | Evidence of effectiveness |
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| | | | | | Nonrandomized Studies score (max 16) of 9.80 (range 8 to 13). | None of these patients needed revision surgery.<br>Most frequent minor complication: palpable cysts in 2.0 percent of the patients.<br>Radiologic changes: oil cysts 6.5 %; calcifications 4.5 %; and fat necrosis 1.2 %.<br>Risk of needing additional radiologic imaging (to exclude malignant changes): 16.4 %<br>Risk of being referred for biopsy 3.2% | | |
| Ovadia, 2018 | Reduction Mammaplasty | Jul 2017 | N= 36 | NR | Not assessed | Ischemic nipple-areolar complex (NAC) complication rates<br>Deskinning: 0 to 1.4%.<br>De-epithelialization: 0 to 11.1% | Pedicle De-epithelialization vs deskinning | Level of evidence III: Pedicle de-epithelialization is commonly performed despite limited definitive evidence evaluating its surgical necessity or benefits. Available evidence suggests deskinning may yield acceptable results; however, further investigation is necessary. |
| Padilla, 2018 | Plastic Surgery | Oct 2017 | N= 20 (case reports and case series) | N= 42 cases of postoperative infections (elective surgery abroad) | Not assessed | Most frequent elective procedures: abdominoplasty (33 %), mammaplasty (27 %), and liposuction (24 %), | Medical Tourism and Postoperative Infections | |

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| | | | | | | with many medical tourists undergoing a combination of these procedures.<br>Most common causes of infection among medical tourists: rapidly growing mycobacteria including *M. abscessus, M. fortuitum, and M. chelonae* (91% of the cases) | | |
| Pasca, 2022 | Breast Surgery with Prosthesis | Aug 2021 | N= 6 (2 observational prospective, 1 observational retrospective, 2 RCTs, 1 non-randomized clinical trial) | N= 2,276 breasts | Observational studies: NOS Scores 7 to 8 (good quality)<br>RCTs: overall risk of bias: some concerns | LRAs for Management of CC (treating and preventing combined): risk difference (RD) –0.38 (95% CI of –0.69 to –0.08, Z value 2.48, P = 0.01).<br>Subgroup analysis based on the type of drug: only montelukast yielded statistical significance (RD = –0.27, 95% CI = –0.51 to –0.03, Z = 2.20, P = 0.03). Zafirlukast did not seem to influence CC.<br>Subgroup analysis based on treatment timing: prophylaxis was ineffective; only treatment for ongoing CC yielded statistically significant improvements. | Use of Leukotriene Receptor Antagonists (LRAs) for Treatment and Prevention of Periprosthetic Capsular Contracture (CC). | Level of evidence IV: The current meta-analysis proved that LRAs could be used in the management of CC. Only treatment for ongoing CC showed statistically significant improvements. Montelukast seemed to be more efficient with a safer profile for adverse effects, whereas zafirlukast yielded no statistically significant results. |

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| Pavli, 2021 | Medical tourism (cosmetic surgery and organ transplantation) | Jan 2010 - Dec 2019 | N= 49 (n= 27 for cosmetic surgeries) | NR | Not assessed. | Breast cosmetic surgery: most common cosmetic procedure (70.4% of cosmetic surgery studies). 89% studies documented wound infection, most of them by non-tuberculosis mycobacterium (NTM). Multidrug-resistant microorganisms were reported in 21 (58.3%) of all studies reviewed (including transplant), including NTM such as *M. abscessus, M. chelonae, M. senegalense and M. fortuitum.* | Infectious complications related to medical tourism | |
| Pereira-Netto, 2018 | Liposuction | NR | N= 7 (4 prospective, 1 prospective observational, 1 randomized clinical trial, 1 double-blinded randomized) | N= 626 | Most studies with high or intermediate risk of bias (mainly selection bias and issues with blinding) | 3 studies did not describe complications. 2 studies: no complications observed Others: hematomas more frequent in LC; ecchymosis was milder and with short duration in LAL when compared to LC | Laser-Assisted Liposuction (LAL) Versus Traditional Liposuction (LC) | Level of evidence III: Although studies have concluded that LAL promotes greater fat reduction, better skin retraction, and greater patient satisfaction compared to traditional liposuction, the high bias impedes a more reliable conclusion. |
| Perzia, 2021 | Abdominoplasty | Sep 2018 | N= 10 | N= 1,596 (691 chemoprophylaxis and 905 control) | N= 9 studies level of evidence II, N= 1 study level I. | Most abdominoplasties were associated with liposuction. Overall incidences: VTE 0.56% (9/1596) | VTE (VTE) and bleeding events with chemoprophylaxis | The prevalence of bleeding in abdominoplasty was low. Chemoprophylaxis was not associated with increased risk of |

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| | | | | | | Bleeding 1.6% (25/1596)<br>Compared with no chemoprophylaxis, chemoprophylaxis was not associated with increased incidence of bleeding (1.3% [9/671] vs 0.91% [8/881], P = 0.417) or decreased incidence of VTE (0.87% [6/691] vs 0.33% [3/901], P = 0.187). | | bleeding or decreased risk of VTE, though the lack of risk stratification and heterogeneity of the cohort precludes firm conclusions. |
| Prabhu, 2022 | Cosmetic Breast Surgery | Nov 2021 | N= 60 (36 retrospective review, 8 prospective cohort, 16 RCTs) | Mean sample size: 781 (range 3 – 16,812) | Level of evidence: n= 17 studies level II, n= 26 studies level III, n= 17 studies level IV<br><br>N= 11 non-comparative studies high quality<br>N= 9 comparative studies high quality<br><br>MINORS Score for comparative studies ranged 10-19 (mean 14.9) / non-comparative studies ranged 6-12 (mean 9.5) | Studies investigating approaches to antisepsis in cosmetic breast surgery indicated conflicting opinions on prophylactic antibiotics.<br>Studies focusing on risk factor assessment tools held possible utility in identifying high-risk patients for cosmetic surgery.<br>Studies assessing anesthesia in cosmetic breast surgery demonstrated a significant benefit to tumescent local anesthesia.<br>Drains for decreasing hematoma and seroma largely showed no benefit. | Patient Safety Initiatives in Cosmetic Breast Surgery | |

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| Qiao, 2021 | General Surgeries | Dec 2020 | N= 17 RCTs | N= 633 | N= 8 trials: low risk of bias across all domains,<br>N= 3 studies: high risk of performance bias (patients not blinded) | Compared to control group, botulinum toxin had:<br>VSS Score: significantly lower (MD = -0.97, 95%CI = -1.56 to -0.39, p = 0.001)<br>VAS Score: significantly higher (MD = 1.26, 95%CI = 1.04 to 1.47, p <0.00001)<br>Scar width: significantly thinner (MD = -0.25, 95%CI = -0.37 to -0.12, p <0.0001)<br>Higher patient satisfaction: (RR = 3.38 95%CI = 1.45 to 7.89, p = 0.005)<br>No significant differences number of adverse events. | Use of Botulinum Toxin Injections for preventing postoperative scars and improving scar quality | Level of evidence III: This meta-analysis demonstrated that botulinum toxin injections can significantly improve cosmetic appearance and postoperative scar quality. At the therapeutic dose, no significant complications were observed, indicating that botulinum toxin injections are safe. |
| Rodgers, 2022 | Breast Reduction | 2001-2021 | N= 8 (2 prospective, 6 retrospective). No RCTs | N= 963 patients (525 Wise pattern; 438 vertical pattern) | Not assessed | Vertical pattern reduction as reference group:<br>Pooled OR 1.56 (99% CI, 0.66–3.71) based on the random-effects meta-analysis. | A comparison of complication rates in Wise Pattern versus Vertical breast reduction. | Comparison of the overall rate of complications with Wise pattern and vertical reduction demonstrated no significant difference in overall complication rate. |
| Rojas, 2018 | Reconstructive and aesthetic operations of the mid and lower face | Apr 2015 | N= 14 (n= 9 “Medpor”; n= 5 silicone) | N= 991 (n= 626 for “Medpor” and n= 365 for silicone) | Not assessed | Complication Rates:<br>Total: Medpor4.8% vs Silicone 4.7%<br>Silicone: higher incidence of infections (2.2%) and displacements (0.8%). | Use of facial implants (“Medpor” and silicone) | Medpor implantation is more common than silicone. Complication rates are low with the use of both materials. Patient follow-up is deficient and has not |

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| | | | | | | Medpor: higher incidence of prominence problems (3.9%).<br>Exposure/extrusion rates: low for both implant types.<br>Chin and mandibular implants were the safest.<br>Malar implants: high incidence of prominence problems. | | improved in the past 20 years, raising questions on the reliability of complication rates. |
| Ruffolo, 2021 | Superficial Cutaneous Surgery | 1995-2019 | N= 37 (including RCTs, systematic reviews and meta-analysis, Cochrane reviews). | NR | Level of evidence of included studies:<br>Level 1A – N= 15<br>Level 1B – N= 6<br>Level 2B – N= 10<br>Level 4 – N= 1<br>Level 5 – N=1 | | Prevention of Surgical Site Infection (SSI) in superficial cutaneous surgeries | Chlorhexidine is the antiseptic of choice in clean or outpatient superficial cutaneous procedures.<br>Decolonization of carriers of Staphylococcus aureus with mupirocin is warranted for all superficial cutaneous procedures. Minor procedure rooms may be considered for superficial cutaneous procedures that possess an inherently low risk of SSI.<br>Surgeons may consider nonsterile gloves instead of sterile gloves for clean or outpatient superficial cutaneous procedures. |

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| | | | | | | | | Postoperative use of topical antibiotics may be discontinued, as there are risks of adverse effects and increasing bacterial resistance without a significant reduction in SSI. |
| Sadhra, 2017 | Otoplasty (Prominent ear correction) | Jan 2000 – Dec 2015 | N= 28 (2 RCts, 22 non-randomized non-comparative, 2 non-randomized comparative) | N= 3,493 | Mean Detsky score for RCTs: 14.5 (one study meeting the threshold of high-quality). Non-comparative studies - mean MINORS score: 11.7 (n= 10 high-quality) Comparative studies –mean MINORS score: 17 (n= 3 high-quality) | Pooled proportions: Haematoma and/or bleeding incidence: 2.5% (95% CI: 1.4-3.8%) Infection 0.8% (95% CI: 0.4-1.3%) Skin/wound healing problems 3% (95% CI: 1.4-5.1%) Suture-related problems 1.8% (95% CI: 0.8-3.2%) Scarring 1.6% (95% CI: 0.8-2.6%) Pain and itching 13% (95% CI: 5.4-23.1%) Revision surgeries/ recurrence 5% (95% CI: 2.9-7.7%) | | |
| Safran, 2020 | Gluteal Augmentation | Aug 2018 | N= 13 (12 randomized prospective, 1 non-randomized prospective) * included studies were on micro-FES | N= 762 (n= 362 corticosteroid-treated; n= 400 controls) | Not assessed | Average incidence of clinical or subclinical micro-FES: Corticosteroid-treated group: 13.4% vs. control group 39.4%. | The potential role of Corticosteroid Prophylaxis for the prevention of Microscopic Fat Embolism Syndrome (micro-FES) | All studies were identified from the orthopedic literature given that none were available directly from within plastic surgery. The prophylactic efficacy of multiple IV |

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| | | | following long-bone fractures posttrauma | | | Overall, of the 12 articles reporting on the incidence of micro-FES as an outcome, 9 studies (75%) demonstrated a statistically significant decrease in micro-FES incidence following corticosteroid prophylaxis ($P < 0.05$). Finally, inhaled corticosteroids may be less efficacious. | | doses of methylprednisolone, or a single larger dose, was established, whereas the efficacy of inhaled corticosteroids remains elusive. A single perioperative IV dose of methylprednisolone may be most appropriate for utilization by plastic surgeons. |
| Samargandi, 2018 | Implant-Based Breast Augmentation | Jan 2016 | N= 7 (1 RCT, 1 prospective cohort, 3 retrospective controlled cohort, 2 retrospective non-controlled) | Sample sizes ranged from N= 55 to N= 856. | RCT: high risk of selection bias and other bias, unclear risk of selection, attrition, and reporting bias). Non-randomized studies - MINORS score ranged 9-20.<br><br>Level of evidence:<br>Level II – n= 1<br>Level III– n= 5<br>Level IV– n= 7 | The rate of CC was less than 2% in 8 studies, between 3% and 6% in 4 studies, and 13.9% in 1 study. Included studies demonstrated significant clinical and methodological heterogeneity. The solitary low-quality RCT concluded that antibiotic irrigation was superior to saline irrigation. Three non-randomized studies demonstrated no significant difference in the rate of CC with the use of antibiotics. One non-randomized controlled study showed that the use of mixture of antibiotic and | Antibiotic irrigation of pocket to prevent Capsular Contracture (CC) | The available evidence on the use of antibiotic irrigation to prevent CC is weak and it is based on studies with high risk of bias. |

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| | | | | | | povidone-iodine significantly lowered the rate of CC. | | |
| Schiraldi, 2022 | Facial Fat Grafting (FFG) | Jul 2021 | N= 103 (n= 66 aesthetic or mixed purposes) | N= 5,479 | Not assessed | Average complication rate ranged from 1.5% to 81.4%.<br>A total of 298 adverse events were identified: 40 (13.4%) intravascular injections, 13 (4.3%) asymmetry, 57 (19.1%) irregularities, 22 (7.4%) graft hypertrophy, 21 (7%) fat necrosis, 73 (24.5%) prolonged oedema, 1 (0.3%) infection, 6 (2%) prolonged erythema, 15 (5%) telangiectasia and 50 (16.8%) cases of acne activation.<br><br>Severity of complications:<br>Minor 48.3% / Moderate 38.3% / Severe 13.4% | | |
| Seretis, 2017 | Abdominoplasty | Jun 2016 | N= 9 (6 RCTs, 3 prospective controlled) | N= 664 patients | RCTs; low risk of bias<br>Prospective controlled studies: intermediate risk of bias | Seroma rate:<br>Prevention group (PG) 7.5% vs Control Group (CG) 19.5% - OR 0.29 CI95% 0.10-0.67<br>Subgroup analysis: Significant differences, favoring SFP and TA groups were revealed. Borderline differences | Techniques for Prevention of Seroma formation (progressive tension sutures (PTS group), Scarpa's fascia preservation (SFP group), use of tissue adhesives | Level of evidence 2: The meta-analysis demonstrates that certain preventive measures significantly reduce the seroma and infection rates, time to drain removal and the length of hospital stay relative to conventional |

| Review | Topic/type of surgery | Search dates | Included trials | Participants | Reported study quality | Patient safety and quality care risks (occurrence, or frequency if recorded) | Interventions, tools, resources | Evidence of effectiveness |
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| | | | | | | [0.36, (0.13, 1.02), P = .05] for the use of PTS were detected. No difference between methods of abdominal flap dissection was revealed.<br>Infection Rate: OR 0.25 CI95% 0.10-0.64 p= 0.004)<br>Time to drain removal: OR -1.8 CI95% -2.74--0.86 p =0.0002<br>Length of hospital stay: -2.08 CI95% -3.21 - -0.96 p <0.0003<br>No difference in Hematoma and Wound Dehiscence Rates, reoperation and readmission rates, total drain output. | (TA group), or abdominal flap dissection method (DM group) | abdominoplasty with the use of drains. Seroma rates can be significantly reduced by performing abdominoplasty with preservation of Scarpa's fascia, use of tissue adhesives and, possibly, use of progressive tension sutures |
| Seretis, 2022 | Abdominoplasty | Jul 2022 | N= 12 (6 RCTs, 2 prospective controlled, 4 retrospective controlled) | N= 543 (n= 299 block group BG/ n= 244 control group CG) | RCTs: low risk of bias<br>Controlled studies: intermediate risk of bias | Transversus abdominis plane blocks have been found to reduce 24-hour and 48-hour opioid consumption (−3.70 and −5.01 weighted mean difference, respectively).<br>In addition, the nerve blocks reviewed effectively prolonged the time to first rescue analgesia request, were safe in terms of complications, and were | Efficacy of different nerve blocks on postoperative pain and sequelae | Level of evidence 3: Nerve blocks emerge as an effective and safe adjunct for adequate pain management following abdominoplasty. |

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| | | | | | | associated with high satisfaction rates. | | |
| Sharif-Askary, 2020 | Rhinoplasty (mixed cosmetic and functional) | Apr 2018 | N= 36 (6 RCTs, 13 retrospective reviews, 16 prospective cohorts, 1 not specified) | N= 32,418 | The publications in this review are inherently at high risk for bias | A total of 13 types of adverse events were reported:<br>Need for revision (0 to 10.9 %),<br>Infection (0 to 4 %),<br>Dehiscence (0 to 5 %)<br>Bleeding (0 to 4.1 %)<br>Septal perforation (0 to 2.6 %)<br>Nasal airway obstruction requiring revision (0 to 3 %)<br>Hypertrophic scarring (0 to 1.5 %) | | |
| Shen, 2019 | Implant-based Breast Augmentation | Mar 2019 | N= 19 (2 RCTs, 4 prospective cohorts, 13 retrospective cohorts) | N= 25,744 | RCTs: n=1 score 4 / n=1 socre 2<br>Non-randomized studies: n= 16 low risk of bias (NOS score > 6) / n= 1 higher risk of bias (NOS Score 5) | SG placement significantly increased the incidence of capsular contractures (SP vs. SG: OR 0.42; 95%CI 0.28–0.63; SF vs. SG: OR 0.41; 95% CI 0.17–0.97), hematomas (SF vs. SG: OR 0.22; 95% CI 0.06–0.63), and seromas (SF vs. SG: OR 0.04; 95% CI 0.00–0.81) compared to other placement techniques. Muscle movement only occurred in the SP group, but it did not increase the risk of subsequent | Comparative assessment of three planes of implant placement: subglandular (SG), subpectoral (SP), and subfascial (SF) planes | Our evidence suggests that SG placement increases the risk of capsular contractures, hematomas, and seroma |

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| | | | | | | malplacements, asymmetries, or ruptures.<br>Comparisons did not show significant differences in the remaining results | | |
| Shortt, 2014 | Breast Reduction | Jul 2007 | N= 3 RCTs | N= 114 | N= 2 Jadad Score 5 (high quality); n= 1 Jadad Score 2 (low quality) | The meta-analysis revealed a 75% reduction in wound infections with preoperative antibiotics (OR 0.25 [95% CI 0.09 to 0.72]).<br>Subgroup with only high-quality RCTS: OR 0.16 (CI95% 0.04-0.61) | Antibiotic Prophylaxis | |
| Simno, 2016 | Gluteal Augmentation | Apr 2015 | N= 44 | N= 2,375 patients in implant studies; N= 3,567 patients in AFG studies | Not assessed | Silicone Implants:<br>Overall complication rate 21.6%<br>Most common: wound dehiscence (9.6 %), seroma (4.6 %), infection (1.9 %), and transient sciatic paraesthesia (1.0 %)<br><br>Autologous Fat Grafting:<br>Overall complication rate 9.9%<br>Most common: seroma (3.5 %), under-correction (2.2 %), infection (2.0 %), and pain or sciatalgia (1.7%) | Safety and Efficacy of different techniques (silicone implants; autologous fat grafting AFG) | |

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| Sisti, 2015 | Medial Thigh Lift | Included studies 1988-2015 | N= 16 (15 retrospective, 1 case report) | N= 447 | Not formally assessed. High heterogeneity of the study populations. Selection bias and lack of common outcome measures. | Pooled data: Overall complication rate 42.7%<br>Most frequent complications<br>Wound dehiscence (82/447 patients, 18.34%)<br>Seroma (36/447 patients, 8.05%)<br>Wound infection (21/447, 4.96%)<br>Hypertrophic scarring (11/447 patients, 2.4%)<br>Scar migration (16/447 patients, 3.57%)<br>No major complications, such as thromboembolism and sepsis, were observed.<br>In all the studies, the surgical revision rate was 0-18% | | |
| Song, 2022 | Rhinoplasty | Mar 2022 | N= 11 (1 RCT, 10 prospective) | N= 469 | MINORS scores ranged from 8 to 12, with a mean score of 9.55. | Total complication rates:<br>Irregularity 1.2%<br>Visibility 0.2%<br>Deviation 0.7%<br>Erythema 1%<br>Graft resorption 0%<br>Depression 0%<br>Infection 0%<br>Revision rate was 1.2%. | Complications of diced cartilage wrapped in blood products | Diced cartilage wrapped in blood products such as autologous platelet-rich fibrin (PRF) and fibrin glue was safe and effective in rhinoplasty |
| Sood, 2017 | Implant-based Breast Augmentation | Mar 2017 | N= 4 | N= 587 | Not assessed | The average capsular contracture rate was similar, 31% (range, 0-35) in the massage group versus 40% | Breast massage, implant displacement, and prevention of | The available data do not support breast massage to prevent capsular contracture; more studies with |

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| | | | | | | (range, 30-90) in the non-massage group | capsular contracture | standardized techniques are needed to better assess the efficacy of breast massage in preventing capsular contracture |
| Stojkovic, 2013 | Breast Reduction Surgery | Aug 2012 | N= 3 RCTs | N= 306 patients (n= 505 breasts – 254 drained vs. 251 not drained) | All studies high risk of performance and detection bias. | Significantly shorter duration of hospital stay for those participants who did not have drains (MD 0.77; 95% CI 0.40 to 1.14).<br>No statistically significant impact of the use of drains on outcomes: hematoma, edema, seroma, fat necrosis, wound infection, nipple loss, wound problems, major complications, pain/discomfort, costs. | Wound drainage | The limited evidence available shows no significant benefit of using post-operative wound drains in reduction mammoplasty, though hospital stay may be shorter when drains are not used. No data are available for breast augmentation or breast reconstruction, and this requires investigation. |
| Tham 2022 | Dorsal Preservation Rhinoplasty | -1 Aug 2021 | 22 (17 in quantitative analysis) Most retrospective cohort studies. | N=5,660 | Overall, the quality rating for most studies was rated as ‘‘fair’’. | Postoperative hump recurrence rates pooled from 15 studies, found to be low (4.18%, 95% CI: 2.41–6.40%). Revision rhinoplasty pooled from 14 studies, found to be low (3.48%, 95% CI: 1.77– 5.74%). Rates of postoperative nasal deviation pooled from 4 studies, found to be low (1.13%, 95% CI 0.37–2.28%). Only 3 studies reported rates of | - | - |

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| | | | | | | infection, pooled rate was low (1.89%, 95% CI: 0.35–4.62%). | | |
| Tiourin 2021 | Facelift surgery | -21 Dec 2020 | 36 | NR | NR | Bleeding and ecchymosis | Perioperative blood pressure management, tissue sealants, tranexamic acid, drains, wetting solution infiltrate, compression dressings. | Effective strategies to reduce the time to hemostasis, postoperative drainage volume, and hematoma rate included perioperative blood pressure management, tissue sealants, and tranexamic acid. While the use of drains or wetting solution infiltrate did not demonstrate to significantly influence bleeding outcome measures, these methods may provide other advantages to facelift surgery. Compression dressings have not demonstrated a significant effect on facelift outcome measures. |
| Torresetti 2022 | Breast augmentation | -29 Apr 2021 | 38 (inc. 5 (2 RCT, 3 case series) that specifically investigated the role and effectiveness of surgical drains and early postoperative | Seroma formation: n=4,417. Hematoma formation: n=5,882. | NR | Seroma formation rate ranged from 0% to 2.8%. Hematoma formation rate ranging from 0% to 6.7%. Infection rate ranged from 0% to 14.2%, with the majority of the studies reporting no infections (n=22). | Surgical drains. | Among studies using drains, the seroma rate ranged from 0% to 2.63%, while in the other studies not using drains ranged from 0% to 2.8%. Among studies using drains, the hematoma rate ranged from 0 to 5.3%, while in |

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| | | | complication rates.) | | | | | the other studies not using drains ranged from 0% to 6.7%. Among studies using drains, the infection rate ranged from 0% to 8.3%, while in the other studies not using drains ranged from 0% to 14.2%. |
| Traboulsi-Garet 2021 | Buccal fat pad excision for cheek refinement | -28 May 2019 | 4 (3 case series and 1 RCT) | N=121 | Mean NOS score for 3 observational studies was 5 (Range: 3 to 8). The RCT was high risk of bias, mainly owing to selection and detection bias. | 7 complications reported in 134 cheek refinement procedures. (weighted mean postoperative complication rate: 3.3%; 95%CI: 0% to 10.5%). Most common complications were trismus (2.24%; 3 cases), transient paralysis of the buccal branch of the facial nerve (1.49%; 2 cases), fever (0.75%; 1 case), facial asymmetry (0.75%; one case) and postoperative infections (13.9%). | All included reports followed an intraoral approach, the incision was made in two regions: at bite level or at maxillary gingivo-buccal sulcus. | No differences were found between the location of the incision (P = 0.522). |
| Trøstrup 2019 | Nipple reduction | NR (studies published 1974-2017) | 30 (3 case reports, 24 original research papers, 3 correspondence) | N=639 (n=582 female, n=57 male) | NR | Adverse effects were only briefly mentioned. Scarring/ contracture were not described in any of the studies. Post-operative complications such as hematoma, delayed healing and | - | - |

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| | | | | | | infections reported in only 12 studies. Ability to breastfeed only briefly mentioned in a few studies. | | |
| Vairinho 2018 | Breast reduction | - Apr 2016 | N= 54 | N= 3,126 | NR | Mean frequency of necrosis of the nipple-areola complex (NAC) was 5.1%. Data from cohorts that differentiated showed mean rate 2.7% for partial necrosis, 0.9% for total necrosis.<br>Superior pedicle: partial 7.3%, total 2.1%.<br>Inferior pedicle: 7.5% and 0.17%.<br>The risk factors for necrosis were the weight of the tissue resected, smoking, obesity, the surgical technique used, and stretch marks. | 1. The first preventive treatment is patient selection. Surgery can be delayed to eliminate some of the specific patient-risk factors identified, that is, by smoking cessation, weight loss for overweight women, and diabetes control. Surgeons should decline to operate on women when the benefit-risk balance does not favor surgery. A NAC graft can also be proposed from the outset, especially for gigantomastia, hard (inelastic) breasts, patients with cardiovascular risk factors, etc.<br>2. The type of breast influences the risk of complications, with in particular the volume and still more the weight of the resection and the plasticity of the breast, important for shaping the flap (also associated with technical performance).<br>3. An appropriate method must be used to avoid pedicles that are too long and thus at risk of twisting, to preserve NAC vascularization.<br>4. Several intraoperative procedures can reduce the risk of venous necrosis: impeccable hemostasis to avoid hematomas, reduction of pedicle volume to diminish NAC tension (appropriate flap shaping), avoidance of excessively compressive bandages, appropriate pedicle thickness (neither too thin, to maintain good vascularization, nor too thick, to avoid venous compression). In some cases, a NAC graft can be proposed | |

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| | | | | | | | from the outset (e.g., gigantomastia, nonmalleable breast). | |
| Van der Sluis 2023 | Abdominoplasty | - Nov 2022 | N= 8 | N=846 | N= 5 studies Level of Evidence II, n= 3 studies were Level of Evidence III | Seroma, total drain output, hematoma, time to drain removal, length of hospital stay, wound dehiscence, infection rate. | Scarpa's fascia preservation | (No meta-analysis) Associated with decreased seroma incidence, reduced drain output, faster drain removal, and less infections. Did not affect the incidence of hematoma, hospital stay duration, or would dehiscence. |
| Varadharajan 2015 | Rhinoplasty (with autologous costal cartilage) | Jan 1980-Jul 2014 | N= 21 (case series) | N=1,545 | Quality assessed but not reported. | Pooled donor site complication incidence: pneumothorax (0.1%), pleural tear (0.6%), infection (0.6%), seroma (0.6%), scar-related problems (2.9%), severe donor site pain (0.2%). Pooled recipient site complications: warping (5.2%), infection (2.5%), displacement/ extrusion (0.6%), graft fracture (0.2%), graft resorption (0.9%). | One study found that by modifying their technique to maintain the integrity of the perichondrium at the donor site, seroma rates could be reduced (9 cases of seroma were initially reported and none occurred after modifying the technique).<br>The classic harvest technique can be modified to obtain a conservative central segment harvest, which has been shown to result in low donor site morbidity in a large case series.<br>The most frequently applied techniques to minimize warping were to delay grafting or to immerse the graft in solution prior to shaping or insertion. Warping rates with these techniques varied substantially, ranging from 0% to 26.1%.<br>Utilizing the central segment of costal cartilage is thought to minimize warping, therefore this method was employed in many studies.<br>The majority of studies utilizing this technique reported warping rates less than 10%,with 2 reporting rates greater than 10%, | |

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| | | | | | | | suggesting this technique may be efficacious in reducing warping rates.<br>One study compared a standard grafting technique with the accordion technique (scouring the cartilage prior to insertion), with no reported cases of warping in the latter technique (in 23 patients). In a small series, researchers performed no carving on harvested grafts, instead place them with the convex edge of the graft oriented superiorly to utilize the natural curvature of the graft for shaping the nose (no cases of warping were reported). One study combined the use of central segment cartilage with Kirschner wires, but still reported an 8.1% warping rate in addition to Kirschner wire extrusion in 3 patients.<br>A large case series combined autologous costal cartilage with an allogenic material (expanded polytetrafluoroethylene) to form a heterologous graft that the authors theorized would reduce warping rates. The overall warping rating in this study was very high (25.8%); however, the study did not report individualized complication rates for this intervention compared with the use of autologous costal cartilage alone. | |
| Vermeersch 2022 | Hand rejuvenation through autologous fat transfer | -Nov 2020 | N= 10 (2 RCTs, 2 observational studies with a comparison group, 6 case series) | N=320 | RCTs scored 3 and 5 of 11 for PEDro; low quality according to Cochrane. Observational studies scored 8-9/9 on NOS, indicating low risk of bias. All | Some degree of postoperative oedema was present in nearly all patients. Other complications were infection (0.67%), cysts/irregularities (1.3%), temporary dysesthesia (5.3%), and ecchymosis (7%). There | NR | NR |

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| | | | | | other studies low quality. | were no major complications. | | |
| Vila 2020 | Dorsal augmentation rhinoplasty | -Feb 2019 | N= 28 | N=1,041 | The risk of bias was rated as high for n= 23 studies and unclear for n= 5 studies. | Warping, resorption, contour irregularity, infection, revision surgery | Autologous vs Homologous Costal Cartilage Grafts | When autologous cartilage (n = 748) vs IHCC (n = 153) vs Tutoplast cartilage (n = 140) grafts were compared, no difference in warping (5%; 95% CI, 3%-9%), resorption (2%; 95% CI, 0%-2%), contour irregularity (1%; 95% CI, 0%-3%), infection (2%; 95% CI, 0%-4%), or revision surgery (5%; 95% CI, 2%-9%) was found. |
| Vila 2022 | Forehead reduction | -May 2020 | N= 8 retrospective cohort studies | N=882 | Studies were rated 8/9 on the Newcastle-Ottawa score: high study quality. All lost a point in comparability due to no controls. | Reported complications included temporary alopecia, permanent alopecia, unacceptable scarring, persistent paresthesia beyond 12 months, and hematoma. Overall, the pooled rate for all complications was 1% or less. | Fixation method | No difference in complication rates stratified by fixation method. |
| Vyas 2020 | Augmentation phalloplasty | -Apr 2019 | N= 16 | N=1,192 | N= 9 studies Newcastle-Ottawa Scale score 6; n= 7 scored 5, n= 1 scored 4. Quality was poor regarding methodology for patient selection | Pooled complication rate 14.6%, combined augmentation had the highest rate. Mechanical complication such as penile retraction, fibrosis, asymmetry, and curvature were among the most | NR | NR |

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| | | | | | and outcomes reporting. | common reported complications. 19 implant infections were reported in one study, and 1 donor-site infection in another. Neurologic injury in the form of decreased sensation reported in 4 patients. Graft and implant removal reported by 2 studies in 4 and 19 patients, respectively. | | |
| Wee 2015 | Rhinoplasty (with Autologous Rib Cartilage Use) | 1946-Jun 2013 | N= 10 | N=491 | NR | In meta-analysis, the combined rates were 3.08% (95% confidence interval [CI], 0%-10.15%) for warping, 0.22% (95% CI, 0%-1.25%) for resorption, 0.56% (95% CI, 0%-2.61%) for infection, 0.39% (95% CI, 0%-1.97%) for displacement, 5.45% (95% CI, 0.68%-13.24%) for hypertrophic chest scarring, 0% (95% CI, 0%-0.32%) for pneumothorax, and 14.07% (95% CI, 6.19%-24.20%) for revision surgery. | NR | NR |
| Wijaya 2022 | Abdominoplasty | - Jun 2021 | N= 7 (3 prospective | N=682 | Jadad score 3-4/5 | 6 studies reported seroma and wound | Scarpa fascia preservation; | Abdominoplasty with scarpa fascia |

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| | | | nRCTs and 4 RCTs) | | | dehiscence, 5 reported hematoma, infection rate, and skin necrosis, 4 reported time to drain removal and total drain output. | scalpel for dissection (instead of electro-cautery) | preservation significantly reduced incidence of seroma (OR = -1.34, 95% CI = -2.09 - -0.59, P<0.05), length of hospital stay (SMD = - 1.65; 95% CI = - 3.50–0.20; P = 0.08), time to drain removal (SMD = - 3.64; 95% CI = - 5.76 - - 1.52; P<0.05), and total drain output (SMD = - 401.60; 95% CI = - 593.75 - - 209.44; P<0.05). Failed to achieve a statistically significant reduction in hematoma (OR=- 1.30, 95% CI = - 2.79–0.18, P = 0.08), infection (OR = - 1.03; 95% CI = - 2.17–0.12; P = 0.08), skin necrosis (OR = 0.63; 95% CI = - 1.20–2.45; P = 0.50), and wound dehiscence (OR = 0.28; 95% CI = - 0.28–0.83; P = 0.33). Seroma incidence rate was lower when a scalpel was utilized for dissection rather than electro-cautery (3% (95% CI = 1–7%) versus 11% (95% CI = 5–18%)). |
| Willet 2023 | High-definition liposuction | 1980-2020 | N= 21 (all case series) | N= 6,964 | NR | Overall complication rate of 14.4% (n=994), | NR | NR |

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| | | | | | | with only 0.2% (n=13) of complications classified as major. Transient hyperpigmentation was the most frequently reported complication (3.8% (n=260) patients), followed by seroma (3.3% (n=2310)) and transient soft tissue fibrosis (2.7% (n=185)). Abscesses/localised infections occurred in 0.1% (n=7) and haematomas 0.1% (n=5). | | |
| Wu 2021 | Autologous Fat Transplantation for Aesthetic Breast Augmentation | - 1 Apr 2020 | N=84, (n=64 in meta-analysis) (17 prospective cohort studies, 4 retrospective cohort studies, 6 case-control studies, 38 case series) | N=6,468, n=5,162 in meta-analysis | Most studies had a low level of evidence (levels 2b-5) | 8% of procedures resulted in clinical complications. Main complication: oil cysts. Other common complications: calcification, fat necrosis, small nodule, infection in receiving area, asymmetry, insufficient transplantation, depression in donor area, hematoma. Pneumothorax occurred in 1 case. 30 patients required further surgical treatment. | NR | NR |
| Wu 2022 | Augmentation rhinoplasty | NR (studies published | N= 7 RCTs | N=1,233 | Jadad score 3-4/5 | Total complication rate, secondary surgery rate | Solid silicone material vs autologous | Rhinoplasty with AC would reduce the complication rate [RR |

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| | | 2016-2021) | | | | | cartilage (AC) tissue | =0.34; 95% CI: (0.22, 0.52); Z=−5.010; P<0.0001], and result in less secondary surgery rate [RR =0.34; 95% CI: (0.18, 0.64); Z=−3.363; P=0.001] comparing to silicone prosthesis (SP) material. |
| Xia 2019 | Lipoabdominoplasty | -Jul 2018 | N= 17 (7 cohort studies, 10 retrospective case series) | N=14,061 | 4-8/9 on Newcastle-Ottawa Scale | Of 14,061 patients, 577 (4.1%) developed seroma; 113 (0.8%) hematoma; 783 (5.6%) wound infection, dehiscence, or fat necrosis; 35 (0.2%) deep venous thrombosis; 110 (0.7%) scar deformity. | Lipoabdominoplasty vs abdominoplasty | Fewer complications in the lipoabdominoplasty group than in the traditional abdominoplasty group (RR = 0.85; 95% CI 0.74–0.97; p = 0.017). Lower incidence of hematoma (RR = 0.56; 95% CI 0.36–0.86; p = 0.009) and seroma (RR = 0.69; 95% CI 0.57–0.85; p = 0.000). No statistically significant differences in perfusion-related complications (RR = 1.07; 95% CI 0.87–1.32; p = 0.523), deep venous thrombosis (RR = 1.56; 95% CI 0.42–5.79; p = 0.505), or scar deformity (RR = 1.08; 95% CI 0.55–2.10; p = 0.827). |
| Xiao 2017 | Abdominoplasty | -Oct 2016 | N= 4 | N=630 | Jadad scores varied from 3 to 4; all 4 studies high quality. | 3 studies reported seroma, 2 reported hematoma/bleeding, 2 reported time until drain | Scarpa fascia preservation | Scarpa fascia preservation associated with significant reduced seroma (OR 0.16; 95% |

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| | | | | | | removal, drain output, and hospital stay, 2 reported infection, 3 reported suture rupture. | | CI 0.06–0.43; P = 0.0004), time until drain removal (std. MD = -0.92; 95% CI -1.31 to -0.54; P<0.00001;), drain output (std. MD = -0.92; 95% CI -1.38 to -0.45; P = 0.0001), and hospital stay (std. MD = -0.93; 95% CI -1.48 to -0.39; P = 0.0008).<br>It failed to alter hematoma/bleeding (OR 0.46; 95% CI 0.09–2.38; P=0.36), infection (OR 0.38; 95% CI 0.11–1.25; P = 0.11), and suture rupture (OR 0.67; 95% CI 0.12–3.73; P = 0.65) |
| Yue 2022 | Facial | -May 2021 | N= 10 RCTs | N=344 | Cochrane used, all low risk. | Postoperative facial scars | Botulinum toxin A (BTA) | Facial scar with BTA injection had a higher VAS score (MD = 1.10, 95% CI = 0.89 to 1.30, p<0.00001), lower overall VSS scores (Std. MD = -0.64, 95% CI = -1.03 to -0.25, p = 0.001), lower Observer Scar Assessment Scale (OSAS) score (MD = -0.83, 95%CI=-1.33to-0.34, p=0.001, smaller scar width (MD =- 1.05, 95% CI =- 1.27 to- 0.83, p<0.00001). No significant statistical difference in Patient |

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| | | | | | | | | Scar Assessment Scale (PSAS) or in complications (pooled relative risk, 0.99, 95% CI, 0.22 to 4.53, p = 0.99). |
| Zapata-Copete 2017 | Breast reduction | Jan 1970-Dec 2016 | N= 5 | N=584 | Low risk of bias for most study items. High risk of selection and detection bias in one study. | Surgical site infection (SSI). 14.5% overall incidence. | Antibiotic prophylaxis | 10.5% incidence of SSI in the intervention group, 18.7% in the control group. Overall RD for SSI was -0.08 (95% CI -0.14--0.03), favoring antibiotic prophylaxis compared with placebo. |
| Zhang 2016 | Reduction mammoplasty (for macromastia or gigantomastia) | - Dec 2015 | N= 16 | N=10,593 | NR | Infection, wound healing problems, scars, fat necrosis, seroma, lost nipples and reoperations. Overall incidence of complications of 11 studies was 11.0% (range 5% to 56%). | Risk factors with sufficient data were BMI, age, tissue resection weight (TRW), smoking and radiation therapy. | BMI³30 kg/m2 highly associated with significant increase in overall incidence of complications after RM (OR 0.73; 95% CI: 0.61–0.89, p = 0.001). Also highly associated with a significant increase in the incidence of infection (OR 0.68; 95% CI: 0.52–0.89, p = 0.004). Age³50 years not associated with significant increase in overall incidence of complications after RM (OR 0.96; 95% CI: 0.71–1.29, p = 0.78). TRW³1000 g not associated with |

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|---|---|---|---|---|---|---|---|---|
| | | | | | | | | significant increase in the overall incidence of complications after RM (OR 1.04; 95% CI: 0.43–2.50, p = 0.93). Smoking highly associated with significant increase in overall incidence of complications (OR 1.56; 95% CI: 0.98–2.49, p = 0.06). Also associated with significant increase in incidence of wound dehiscence after RM (OR 2.73; 95% CI: 1.60–4.67, p = 0.0002). |
| Zhao 2023 | Cell-assisted fat transfer (in reconstruction of human soft tissues) | - 31 Apr 2021 | N= 14 | N=722 | N= 6 studies: level II;<br>N= 4 studies: level III;<br>N= 4 studies level IV | Complications like necrotic cysts, oil cysts, solid indurations, etc. | Cell-assisted fat transfer compared with conventional lipotransfer | Complication rate analysis: no significant difference between the two groups (5 studies, OR=1.98, 95%CI [0.81, 4.86], P=0.14).<br>Fat survival: significantly higher in the CAL group, compared to the conventional fat graft group (SMD=2.81, 95%CI [1.54, 4.08], P < 0.001). By site: No significant difference for breast lipofilling (SMD=1.80, 95%CI [-0.31, 3.91], P=0.09). Survival rate in facial filling higher in the CAL group (SMD=3.01, 95%CI [1.68, 4.33], P < |

| Review | Topic/type of surgery | Search dates | Included trials | Participants | Reported study quality | Patient safety and quality care risks (occurrence, or frequency if recorded) | Interventions, tools, resources | Evidence of effectiveness |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | 0.001). Upper arm (1 study), survival rate 80.9% CAL, 16.3% non-CAL (P < 0.001). |

# Attachment A – Website search of regulatory authorities and professional associations

| Jurisdiction | Organisation | Website |
|---|---|---|
| Australia | Australian Commission on Safety and Quality in Health Care | https://www.safetyandquality.gov.au/ |
| Australia | Australian Health Practitioner Regulation Agency | https://www.ahpra.gov.au/ |
| Australia | Australian Medical Association | https://www.ama.com.au/ |
| Australia | Australian Medical Council | https://www.amc.org.au/ |
| Australia | Australian Society of Plastic Surgeons | https://plasticsurgery.org.au/ |
| Australia | Australian Society of Otolaryngology and Head and Neck Surgery | https://asohns.org.au/ |
| Australia | Medical Board of Australia | https://www.medicalboard.gov.au/ |
| Australia | Royal Australian College of General Practitioners | https://www.racgp.org.au/ |
| Australia | Safer Care Victoria | https://www.safercare.vic.gov.au/ |
| Australia | Australian Society of Anaesthetists | https://asa.org.au/ |
| Australia | Cosmetic Nurses Association | https://www.cosmeticnursesassociation.org.au/ |
| Australasian | Australasian College of Aesthetic Medicine | https://www.acam.org.au/ |
| Australasian | Australasian Society of Aesthetic Plastic Surgeons | https://aestheticplasticsurgeons.org.au/ |
| Australasian | Australasian College of Cosmetic Surgery and Medicine | https://www.accsm.org.au/ |
| Australasian | Australasian Foundation for Plastic Surgery | https://plasticsurgeryfoundation.org.au/ |
| Australasian | Australasian College of Dermatologists | https://www.dermcoll.edu.au/ |
| Australasian | Royal Australasian College of Physicians | https://www.racp.edu.au/ |

| Jurisdiction | Organisation | Website |
|---|---|---|
| Australasian | Royal Australasian College of Surgeons | https://www.surgeons.org/en |
| Australasian | Australasian Academy of Facial Plastic Surgery | https://www.aafps.com.au/ |
| Australasian | Skin Cancer College Australasia | https://www.skincancercollege.org/ |
| ANZ | Australian and New Zealand Association of Oral & Maxillofacial Surgeons | https://www.anzaoms.org/ |
| ANZ | Royal Australian and New Zealand College of Obstetrics and Gynaecology | https://ranzcog.edu.au/ |
| ANZ | Urological Society of Australia and New Zealand | https://www.usanz.org.au/ |
| ANZ | Australian and New Zealand College of Anaesthetists | https://www.anzca.edu.au/ |
| ANZ | Royal Australian and New Zealand College of Ophthalmologists | https://www.ranzco.edu/ |
| NZ | Medical Council of New Zealand | https://www.mcnz.org.nz/ |
| NZ | Health Quality and Safety Commission | https://www.hqsc.govt.nz/ |
| NZ | Health Practitioners Disciplinary Tribunal | https://www.hpdt.org.nz/ |
| NZ | New Zealand Association of Plastic Surgeons | https://plasticsurgery.org.nz/ |
| NZ | Royal New Zealand College of General Practitioners | https://www.rnzcgp.org.nz/ |
| NZ | Clinical Aesthetic Network New Zealand | https://cannz.co.nz/ |
| UK | General Medical Council | https://www.gmc-uk.org/ |
| UK | Joint Council on Cosmetic Practice | https://jccp.org.uk/ |
| UK | Royal College of Surgeons of England | https://www.rcseng.ac.uk/ |
| UK | British Association of Plastic, Reconstructive and Aesthetic Surgeons | https://www.bapras.org.uk/ |

| Jurisdiction | Organisation | Website |
|---|---|---|
| UK | British Association of Aesthetic Plastic Surgeons | https://baaps.org.uk/ |
| UK | Care Quality Commission | https://www.cqc.org.uk/ |
| UK | Regulation and Quality Improvement Agency (Northern Ireland) | https://www.rqia.org.uk/ |
| UK | Health and Care Professions Council | https://www.hcpc-uk.org/ |
| UK | British Medical Association | https://www.bma.org.uk/ |
| UK | British Association of Cosmetic Nurses | https://www.bacn.org.uk/ |
| Singapore | Singapore Medical Council | https://www.healthprofessionals.gov.sg/smc |
| Singapore | Ministry of Health | ttps://www.moh.gov.sg/ |
| Canada | Royal College of Physicians & Surgeons | https://www.royalcollege.ca/ |
| Canada | Federation of Medical Regulatory Authorities of Canada | https://www.fmrac.ca/ |
| Canada | Canadian Patient Safety Institute | https://www.patientsafetyinstitute.ca/ |
| Canada | Accreditation Canada | https://www.accreditation.ca/ |
| Canada | Medical Council of Canada | https://mcc.ca/ |
| Canada | Canadian Medical Association | https://www.cma.ca/ |
| Canada | Canadian Society of Plastic Surgeons | https://plasticsurgery.ca/ |
| Canada | Canadian Society of Aesthetic Plastic Surgeons | https://csaps.ca/ |
| Canada | Canadian Board of Aesthetic Medicine | https://www.cbamedicine.com/ |
| Canada | Canadian Association of Aesthetic Medicine | https://www.caam.ca/ |
| Canada | Canadian Society of Aesthetics Specialty Nurses | https://csasn.org/ |
| USA | Federation of State Medical Boards | https://www.fsmb.org/ |

| Jurisdiction | Organisation | Website |
|---|---|---|
| USA | American College of Surgeons | https://www.facs.org/ |
| USA | American Society of Plastic Surgeons | Https://www.plasticsurgery.org/ |
| USA | Agency for Healthcare Research and Quality | https://www.ahrq.gov/ |
| USA | American Medical Association | https://www.ama-assn.org/ |
| USA | American Academy of Cosmetic Surgery | https://www.cosmeticsurgery.org/ |
| USA | American Board of Cosmetic Surgery | https://www.americanboardcosmeticsurgery.org/ |
| Europe | European Society for Plastic, Reconstructive and Aesthetic Surgery | https://www.espras.org/ |
| Europe | European Association of Plastic Surgeons | https://www.euraps.org/ |
| Europe | European Network for Safer Healthcare | https://www.eusaferhealthcare.eu/ |
| Malaysia | Malaysia Ministry of Health | https://www.healthprofessionals.gov.sg/ |

# Attachment B – Singapore Medical Council requirements for invasive cosmetic surgery

| Singapore Medical Council Table 2 Invasive procedures for certain specialists | | |
|---|---|---|
| **Type of procedure** | **Appropriate premises at which procedure can be done** | **Specialists who can perform the procedure (COC not required)** |
| Abdominoplasty | Operating Theatre | • Plastic Surgeons |
| Blepharoplasty (including Double Eyelid) | Operating Theatre/Clinic | • ENT Surgeons with facial plastic training;<br>• Ophthalmologists trained in oculoplastic surgery; and<br>• Plastic Surgeons |
| Breast Enhancement / Reduction (Implants or any other invasive methods, including fat but excluding fillers) | Operating Theatre | • Plastic Surgeons |
| Brow Lifts | Operating Theatre/Clinic | • ENT Surgeons with facial plastic training;<br>• Ophthalmologists trained in oculoplastic surgery; and<br>• Plastic Surgeons |
| Endovenous Laser Sclerotherapy | Operating Theatre/Clinic | • Dermatologists;<br>• Plastic Surgeons; and<br>• General Surgeons trained in vascular surgery or General Surgeons who have completed 20 cases (as primary surgeon) under the supervision of a General Surgeon trained in vascular surgery |
| Free Fat Grafting (Body) | Operating Theatre/Clinic | • Dermatologists;<br>• Plastic Surgeons; and<br>• Ophthalmologists trained in oculoplastic surgery (extracted with syringes) |
| Hair Transplantation | Operating Theatre/Clinic | • Dermatologists; and<br>• Plastic Surgeons |
| Facial Implants (excluding Breast Implants) | Operating Theatre/Clinic | • ENT Surgeons with facial plastic training;<br>• Plastic Surgeons; and<br>• Ophthalmologists trained in oculoplastic surgery |
| Rhinoplasty | Operating Theatre/Clinic | • ENT Surgeons; and<br>• Plastic Surgeons |
| Rhytidectomy (Facelift) | Operating Theatre/Clinic | • ENT Surgeons with facial plastic training;<br>• Plastic Surgeons; and<br>• Ophthalmologists trained in oculoplastic surgery |

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