The MET Afferent limb

Calling criteria and delayed activation

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Overview

• Why is the MET needed?
• Sensitivity/specificity of calling criteria
• Do MET criteria predict increased risk
• A dose of reality
• Delayed MET activation
  – incidence and consequence
Why is the MET needed?

• Serious adverse events common in hospitalized patients
  – 3.7% to 16.6% admissions

• Preceded by instability in up to 80%
  – Manifest as deranged vital signs
MET criteria are based on vital signs

Criteria for initiation of a MET call*

- Staff member is worried about the patient
- Acute change in heart rate to < 40 or > 130 beats/min
- Acute change in systolic blood pressure to < 90 mmHg
- Acute change in respiratory rate to < 8 or > 30 breaths/min
- Acute change in pulse oximetry saturation to < 90%, despite oxygen administration
- Acute change in conscious state
- Acute change in urine output to < 50 mL in 4 hours.
• **Early intervention** in the course of deterioration improves outcome

  – AMI  
  GISSI  Am Heart J 1999

  – Sepsis  
  Rivers NEJM 2001

  – Trauma  
  Nardi  Min. Anest 2002

  – Embolic stroke  
  NINDS NEJM 1995
Unwell patient → Fulfil MET criteria → Vitals measured → MET called

Measure observations

Act in timely manner (call the MET)
• SOCCER studies $^{1,2}$
  – Retrospective study 3046 patients in 5 non-MET hospitals over 14 days
  – Warning signs of variable threshold
    • Early signs (26) both biochemical
    • Late signs (21) & clinical
  – Many predicted increased risk of death, cardiac arrest, transfer to ICU

1. Harrison et al. Resucitation 2005
2. Jacques et al. Resucitation 2005
Base deficit = -5 to -8 mmol/L
Partial airway obstruction (excluding snoring)
Poor peripheral circulation
Greater than expected drain fluid loss
pH 7.2–7.3
PaCO₂ 51–60 mmHg
Urine output <200 mL over 8 h
Noted decreased urine output
GCS <9–11 or fall in GCS by >2
Any seizure
Respiratory rate 5–9 or 31–40
New pain
SpO₂ 90–95%
Other
Systolic BP 80–100 mmHg
Alteration in mentation
PaO₂ 50–60 mmHg
Uncontrolled pain
Pulse rate 40–49 or 121–140/min
BSL 1–2.9 mmol/L
Systolic BP 181–240 mmHg
Complaining of chest pain

Cardiac arrest
Urine output <200 mL/24 h
pH < 7.2
Unresponsive to verbal commands
Other
Anuric
Base deficit < -8.0 mmol/L
GCS ≤ 8
PaO₂ < 50 mmHg
Pulse rate > 140 or < 40
Respiratory rate > 40 or < 5 b/min
PaCO₂ > 60 mmHg
Failure to reverse variable < 1 h
SpO₂ < 90%
Systolic BP < 80 mmHg
Airway obstructed/stridor
• The size of the problem
  – 3046 patients, 5 hospitals in 2 weeks
  – 12,384 ES
  – 1410 LS

∴ Per hospital per week
  – 1,238 early signs
  – 141 late signs
• Approximate frequency of calls
  – 8 per hour for ES
  – One per hour for LS

• Who will perform these reviews??
• Max Bell et al (Karolinska, Sweeden)
  – Prospective study over 2 separate days
  – Nurses measured observations on all in-patients (some missed)
  – Compared with
    • MET criteria (Bellomo et al)
    • Other criteria with increased / decreased sensitivity
### Table 3  Altered criteria

<table>
<thead>
<tr>
<th>Criteria</th>
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<tbody>
<tr>
<td><strong>The extended criteria</strong></td>
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<tr>
<td>Respiratory rate of $\leq 10$ or $&gt;28$ breaths/min</td>
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<tr>
<td>Heart rate of $&lt;50$ or $&gt;120$ /min (beats/min)</td>
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<tr>
<td>Systolic blood pressure of $&lt;100$ mmHg</td>
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<td></td>
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<tr>
<td><strong>The restricted criteria</strong></td>
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<tr>
<td>Respiratory rate of $\leq 6$ or $&gt;32$ breaths/min</td>
</tr>
<tr>
<td>Heart rate of $&lt;35$ or $&gt;140$ /min (beats/min)</td>
</tr>
<tr>
<td>Systolic blood pressure of $&lt;80$ mmHg</td>
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More sensitive

Less sensitive
• MET criteria
  – 4.5% fulfilled MET criteria (40 patients)
    • 30 days mortality = 25%
    • Compared with 3.5% if no MET criteria
  – Extended criteria (more sensitive)
    • Increased deaths (18 vs 10)
    • 13.8% hospital patients (3 x number)
  – Restricted criteria (less sensitive)
    • Less deaths (4 vs 10)
    • Only picked up 20 patients (half number)
• Conclusion
  – The proportion of patients that fulfill MET criteria will depend on thresholds
  – If too sensitive will see very large number of patients
  – If too restrictive then will miss important adverse events (including subsequent deaths)
MET criteria and patient risk

- Austin – “Repeat MET call study”
- 1664 patients & 2237 METs over 2 yrs
  - $\frac{3}{4}$ single MET review
  - $\frac{1}{4}$ multiple METs

(Dr Paolo Calzavacca)
• One MET call and not NFR →
  – mortality = 16.6%

• More than one MET and not NFR →
  – mortality = 34.1%

• Mortality of other patients
  – All ICU patients = 14%
  – All hospital patients < 4%
? “Austin syndrome”

• Goldhill & McNarry (BJA 2004) 🇬🇧
  – ↑ vital sign abnormalities = ↑ risk of death

• Bell et al (Resus. 2006) 🇸🇪
  – 1097 patients on 2 days
    • 4.5% had MET criteria
    • 30 day mortality = 25% vs 3.5%

• Buist et al (Resuscitation 2004) 🇦🇺
  – 6300 patients over 7 mo.
  – 8.9% had MET criteria = 6.8 fold ↑ mortality
Missing observations

- **MERIT study**
  - In adverse events
    - 60% no BP, HR, RR within 15 minutes of event

- **Post op major surgery** (McGain et al (MJA 2008))
  - 211 patient files, 5 large hospitals
  - first 3 post-op days,
    - Only 17% complete documentation of vitals and medical and nursing review.
  - first 7 postoperative ward days,
    - nursing review not documented 5.6% shifts
    - medical review not documented 14.9% days.
• Cretikos et.al. (MJA 2008)
  – *Respiratory rate; the neglected vital sign*

• Leuvan CH, Mitchell I. (CCR 2008)
  – *Missed opportunities*

  – RR most poorly recorded vital sign
“If you don’t take a temperature, you can’t find a fever.”

Failure of crisis detection
Act in timely manner
(call the MET)
Delayed MET activation - Incidence

- Observations measured → fulfill MET
  - But MET activation delayed

- Austin hospital
  - 28% of 162 cardiac arrests followed an initial MET call \(^1\)
  - 84% of these < 5min after MET activation
  - Delayed MET activation → cardiac arrest

1. Jones et al. ICM 2006
• Delayed MET activation common (>30 min delay) \(^1,^2\)
  • GCS 35% (16hr)
  • Arrhythmia 24% (13hr)
  • Resp distress 50% (12hr)
  • Hypotension 39% (5hr)

1. Downey et al. CCM 2008  2. Quach et al. JCC 2008
Delayed MET activation – Consequence

Delayed MET activation increases death

Log Rank $P = .049$
What happens in reality?

• Ward nurses busy
• Survey of nurses at Austin hospital ¹  
  – Discretion of nurses to call MET even when patient has criteria
• Alfred hospital ²  
  MET criteria changed  
  (nurses reluctant to call)

1. Jones etal Qual Saf Health Care 2006  
2. Jones D etal AIC. 2006
RESCUE study

- ACQSHC sponsored
- CI = Prof. Tracey Bucknall
- Point prevalence study
- Ten hospitals – student nurses
  1. Did set vitals
  2. Assessed obs. chart for prior 24 hr period
- Two major questions
  - What % had MET criteria
  - What % of these got MET call
Total patients
N = 2199

Seen
N = 1688 (77%)

Not seen
N = 511 (23%)

Chart review 24hr MET criteria
N = 90 (5.3%)

Single set vitals MET criteria
N = 56 (3.3%)

Got MET call next 24 hours
N = 10 (17.9%)
• What does this mean

• If you are a nurse on ward:
  – When you do a set of vitals 1/30 chance they will fulfill MET criteria
  – 1/20 chance that your patient will fulfill MET criteria in a given 24 hour period

• When you find MET criteria
  – 4/5 chance you wont call a MET
• This is **NOT** “nurse bashing”
  – The MET has “objectified” what constitutes a “sick patient”
  – Presence of MET criteria = “the patient is unwell”
  – MET criteria based on vital signs
  – These are mostly measured by nurses
Conclusions

- SAEs are common
- Calling criteria complex issue
  - Sensitivity and specificity
  - High case burden if too sensitive
  - Whether nurses want to call
  - Ease of use
- Delayed MET activation
  - Common
  - Counter to “early intervention improving outcome”
  - Increases risk of death
• Large number of patients at-risk
• Better hospital based strategies to:
  – Identify deteriorating patient reliably
  – Review in timely manner
  – Provide effective treatment
• Once MET criteria identified
  – Timely calling of MET
  – Effective management and patient
• This is not a “nurse bashing” session
• Better
  – Nurse : patient ratios
  – Electronic monitoring systems
  – Medical education
  – Access to critical care beds