Sepsis

A continuing fight against the rising tide

Patricia Stassen
Acute internist and nephrologist
May 2014, SAMsterDAM
Close connection
Giant pumps from Netherlands start work in Somerset

13 February 2014 Last updated at 18:46 GMT
The Low Lands
Success in sepsis care – building DAMs
Mrs X

Call from GP to internist
Hypotensive woman 64 years old
Ill for 1 day, no specific complaints – malaise/chills
Odd behavior, confused

At the ED
Leukocytes 52, 16% bands, CRP 600 mg/l, lactate 5.0 mmol/l, cultures
Antibiotics (within 3 hours), fluid challenges, oxygen

Transfer to ICU

Diagnosis: septic shock – focus unknown
Mrs X – flashback

Call to ED desk with information 3 hours before
2 hours later, after transport by ambulance,
ED doctor finds the patient with BP 105/65, pulse 130/min, T 37.3
No fluid bolus, no antibiotics, doctor not warned by nurse
What went wrong? What were the “holes”?

- Loss of information (3x)
- No recognition (2x)
- Underestimation of the situation (2x)
- ED not stand-by

- Loss of time

- Compliance to guidelines: 100%
Acute care chain

GP - EMS staff - ED nurse - doctor
Highly qualified personnel
4 chances for correct diagnosis and treatment

Challenge: $1+1+1+1 \geq 5$
General practitioner and sepsis

No protocols for sepsis in NL
No studies

However, before referral to ED: consultation with internist..

Challenges for GP: Protocols — sepsis is a GP problem
Recognition
Communication - handover
HELP THEM!

JOIN THE
HOLLAND EVENING

ORGANISED AT THE KARACHI GYMKHANA
AT 9-30 P.M. ON 19TH MARCH '53 BY THE
NETHERLANDS FLOOD RELIEF
ORGANIZATION

Pakistani appeal poster for 1953 flood victims
Advantages of EMS

Time, 1:1 situation, highly qualified personnel, most seriously ill patients

<table>
<thead>
<tr>
<th>Table 1</th>
<th>Patient characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n (%)</td>
</tr>
<tr>
<td><strong>Demographics</strong></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>149 (47.5)</td>
</tr>
<tr>
<td>Mean age (SD)</td>
<td>71±15</td>
</tr>
<tr>
<td><strong>Outcome</strong></td>
<td></td>
</tr>
<tr>
<td>Admittance to the hospital</td>
<td>307 (97.8)</td>
</tr>
<tr>
<td>Length of hospital stay (median, IQR) (days)</td>
<td>7 (4–12)</td>
</tr>
<tr>
<td>MCU-admittance</td>
<td>6 (1.9)</td>
</tr>
<tr>
<td>ICU-admittance</td>
<td>22 (7.0)</td>
</tr>
<tr>
<td>Mortality within 28 days</td>
<td>61 (19.4)</td>
</tr>
<tr>
<td><strong>Severity of sepsis</strong></td>
<td></td>
</tr>
<tr>
<td>Sepsis</td>
<td>136 (43.3)</td>
</tr>
<tr>
<td>Severe sepsis</td>
<td>150 (47.8)</td>
</tr>
<tr>
<td>Septic shock</td>
<td>28 (8.9)</td>
</tr>
</tbody>
</table>

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*Septic patients arriving with emergency medical services: a seriously ill population*

EMS and sepsis

Identification of sepsis and start treatment in the ambulance speeds up care at the ED

More iv fluids in the first hour at the ED
Band, Acad Emerg Med 2011;934, Seymour, Prehosp Emerg Care 2010;145

Antibiotics earlier at the ED
Studnek, Am J Emerg Med 2012;51
Role of EMS

Sepsis is often missed by EMS personnel (52-69%)
Suffoletto, Prehosp Emerg Care 2011;325, Guerra, J Emerg Med 2013;1116

Table 3: Presence and assessment of SIRS criteria during the ambulance ride in non-documented patients

<table>
<thead>
<tr>
<th></th>
<th>Number (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prehospital vital signs did not meet sepsis criteria</td>
<td>8 (5.7)</td>
</tr>
<tr>
<td>Vital signs needed to identify sepsis not assessed in ambulance</td>
<td>45 (32.1)</td>
</tr>
<tr>
<td>Patients identified at the ED by leukocyte count or low pCO2</td>
<td>65 (46.4)</td>
</tr>
<tr>
<td>Sepsis not documented despite presence of 2 SIRS criteria</td>
<td>22 (15.7)</td>
</tr>
</tbody>
</table>

Challenges for EMS:
Systematic assessment of every patient
Knowledge on sepsis definition
Change of treatment protocols
Not all patients can be recognized by EMS

Roest, submitted
The ED – really important

Only 8.2% admitted to MCU/ICU

Acute physicians and nurses play pivotal role
• identification
• provision of care

Medicine most frequent admitting specialty

Lower mortality in sepsis patients admitted through the ED vs direct admission

![Table 1](image)

Recognition of sepsis

Brazil: 43% severe sepsis missed
UK: 17% diagnosis sepsis noted in chart
Assuncao, J Crit Care 2010;545, Cronshaw, Emerg Med J 2011; 670

Identifying sepsis is not a goal of triage systems (eg MTS)
Atypical presentation
• Elderly patients (2/3 of all patients)
• Immunocompromised
### TABLE 2
Self-reported familiarity with SIRS criteria

<table>
<thead>
<tr>
<th>Group</th>
<th>Familiar (%)</th>
<th>Somewhat familiar (%)</th>
<th>Not at all familiar (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MD (n = 44)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Attending</td>
<td>64.3</td>
<td>28.6</td>
<td>7.1</td>
</tr>
<tr>
<td>Resident</td>
<td>87.5</td>
<td>12.5</td>
<td>0.0</td>
</tr>
<tr>
<td>Total</td>
<td>72.7</td>
<td>22.7</td>
<td>4.5</td>
</tr>
<tr>
<td>RN (n = 56)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0-2 y(^a)</td>
<td>30.8</td>
<td>38.5</td>
<td>30.8</td>
</tr>
<tr>
<td>2-5 y</td>
<td>7.7</td>
<td>46.8</td>
<td>46.8</td>
</tr>
<tr>
<td>5-10 y</td>
<td>20.0</td>
<td>60.0</td>
<td>20.0</td>
</tr>
<tr>
<td>10+ y</td>
<td>5.0</td>
<td>35.0</td>
<td>60.0</td>
</tr>
<tr>
<td>Total</td>
<td>14.3</td>
<td>41.1</td>
<td>44.6</td>
</tr>
</tbody>
</table>

\(MD\), Doctor of medicine; \(RN\), registered nurse; \(SIRS\), systemic inflammatory response syndrome.

\(^a\)y = years of experience.
Definition of sepsis

Diagnostic criteria never validated

<table>
<thead>
<tr>
<th>SIRS</th>
<th>Clinical diagnosis severe sepsis/shock</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td>Yes</td>
<td>76%</td>
</tr>
<tr>
<td>No</td>
<td>39%</td>
</tr>
<tr>
<td>Yes</td>
<td>24%</td>
</tr>
<tr>
<td>No</td>
<td>61%</td>
</tr>
</tbody>
</table>

Gille-Johnson, Scand J Infect Dis 2013;186
Adapted from v Onna, 2014
**Sepsis screening tool**

**Step 1:** Screen every patient

<table>
<thead>
<tr>
<th>SICU Bedside Nurse SIRS score</th>
</tr>
</thead>
<tbody>
<tr>
<td>current heart rate</td>
</tr>
<tr>
<td>T min</td>
</tr>
<tr>
<td>T max</td>
</tr>
<tr>
<td>current resp rate</td>
</tr>
<tr>
<td>latest WBC count</td>
</tr>
</tbody>
</table>

If SIRS score ≥ 4, then notify SICU Nurse Practitioner to complete sepsis screening form.

- SICU
- overflow
- MICU
- NICU
- CCU

Completed by: ______________, RN  
Date / time: ______________

**Step 2:** Infection and focus?

**Step 3:** Treatment protocol

Sepsis related mortality ↓ 35 to 23%

Moore, J Trauma 2009, 1539
Protocols not followed adequately

Despite suboptimal compliance (7-27%), impressive decrease in mortality (52-35%)

The effects of implementation of the Surviving Sepsis Campaign in the Netherlands  
Tromp, Neth J Med, 2011
Treatment at ED

Delay between sepsis recognition – doctor assessment: > 1 hr
Time to senior review: > 3 hrs
Time to critical care review: 4 hrs

Inadequately experienced clinical staff
Poor flagging
Poor prioritisation

Disconnection between assessment-type and intervention-type items of SSC
Underperforming in
• active doctor led decision-making
• escalation-type interventions

Meyer, Acute Medicine, 2013, 5-12
Future in sepsis care

Computer versus paper system for recognition and management of sepsis in surgical intensive care

<table>
<thead>
<tr>
<th>Severity</th>
<th>Time From Protocol Order to Antibiotic Administration (Mean ± SEM, h)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Paper System</td>
</tr>
<tr>
<td>Sepsis</td>
<td>2.1 ± 2.0</td>
</tr>
<tr>
<td>Severe sepsis</td>
<td>1.0 ± 0.2</td>
</tr>
<tr>
<td>Septic shock</td>
<td>1.1 ± 0.1</td>
</tr>
<tr>
<td>All</td>
<td>1.2 ± 0.2</td>
</tr>
</tbody>
</table>

Croft, J Trauma Acute Care Sug, 2014
Why is timing important?
Duration of hypotension before initiation of effective antimicrobial therapy is the critical determinant of survival in human septic shock*

Multicentre retrospective cohort study
Increase in mortality per hour delay: 7.6%

Kumar, Crit Care Med 2006
Earlier treatment

RCT multicenter start iv antibiotics (ceftriaxone) in ambulance
Proof of principle: is timing important?
Side effects:
• strengthening the chain of acute care
• improved recognition
• aggressive early treatment

Start in Dordrecht & Amsterdam as we speak, then the rest of the Netherlands
Challenges for acute internists

- Strengthening the chain
  - Organization ED/AMU
    - teamwork
    - seniority of staff
    - logistics
  - Early recognition/screening
    - electronic aids
    - triage
    - training/education
    - handover
  - Treatment
    - implementation of protocols
    - decision making – the difficult ones
- Research!! Recognition, markers, early treatment
We can build the DAMs together

TIME TO ACT
Severe sepsis: rapid diagnosis and treatment saves lives

Voorkomen van lijnsepsis en behandeling van ernstige sepsis