Update Management of Sepsis

Surviving Sepsis Campaign

Dhani Redhono

Society of Critical Care Medicine
The Intensive Care Professionals

ESICM
European Society of Intensive Care Medicine
The Intensive Connection
Sepsis Screening Form

HEALTHCARE PROFESSIONAL WHO CONTACTED THE DOCTOR TO COMPLETE THIS SECTION

Date: ___________ Time Started: ___________
Healthcare Professional’s Name: ___________________________
Healthcare Professional’s Signature: ___________________________
MCRN/NMBI PIN: ___________________________

Doctor to review within 30 mins (use ISBAR). DOCTOR TO COMPLETE REMAINDER OF THIS DOCUMENT AS APPROPRIATE.

Clinical Suspection of INFECTION

AND 2 or more Systemic Inflammatory Response Syndrome (SIRS) criteria

- Respiratory rate > 20 (bpm)
- Heart rate > 90 (bpm)
- WCC < 4 or > 12 x 10⁹/L
- Temperature <36 or >38.3 (°C)
- Acutely altered mental status
- Bedside glucose >7.7 mmol/L (in the absence of diabetes mellitus)

OR Unwell and at risk of Neutropenia*

*Note: Some groups of patients, such as older people or immunocompromised may not meet these SIRS criteria, even though infection is suspected and they are very unwell. When this occurs check lactate, blood pressure, organ dysfunction criteria and C-reactive protein (CRP) before excluding sepsis.

NO Following a history and examination, and in the absence of clinical signs, sepsis is not diagnosed.

YES. THIS IS SEPSIS

Time Zero: ___________

Sepsis Six Regimen to be completed within 1 hour

TAKE 3

BLOOD CULTURES: Take blood cultures before giving antimicrobials (if no significant delay i.e. >45 minutes) and other cultures as per examination.

BLOODS: Check point of care lactate & full blood count. Other tests and investigations as per history and examination. Consider source control.

URINE OUTPUT: Assess urine output and consider urinary catheterisation for accurate measurement in severe sepsis/septic shock.

Laboratory tests should be requested as EMERGENCY aiming to have results available and reviewed within 1 hour.

Look for signs of new organ dysfunction:

- Systolic BP <90 or Mean Arterial Pressure (MAP) < 65
- or Systolic BP more than 40 below patient’s normal
- New need for oxygen to achieve saturation > 90%
- Lactate > 2 mmol/L (following administration of fluid bolus)
- Urine output < 0.5ml/kg for 2 hours – despite adequate fluid resuscitation
- Acutely altered mental status
- Glucose > 7.7 mmol/L (in the absence of diabetes)
- Creatinine > 177 micromol/L
- Bilirubin > 70 micromol/L
- INR > 1.5 or aPTT > 60s
- Platelets < 100 x 10⁹/L

Any new organ dysfunction due to infection: THIS IS SEVERE SEPSIS

Inform Registrar or Consultant immediately. Reassess frequently in 1st hour.
Consider other investigations and management +/- source control if patient does not respond to initial therapy as evidenced by haemodynamic stabilisation then improvement.

GIVE 3

OXYGEN: Titrate O₂ to saturations of 94-98% or 88-92% in chronic lung disease.

FLUIDS: Start IV fluid resuscitation if evidence of hypovolaemia. 500ml bolus of isotonic crystalloid over 15mins & give up to 30ml/kg, reassessing for signs of hypovolaemia, normovolaemia, or fluid overload.

ANTIMICROBIALS: Give IV antimicrobials according to the site of infection and following local antimicrobial guidelines.

Type: ___________________________
Dose: ___________________________
Time given: ___________________________

Look for signs of septic shock

(following administration of fluid bolus of up to 2L)

- Lactate > 4 mmol/L
- Hypotensive (Systolic BP < 90 or MAP < 65)

If either present: THIS IS SEPTIC SHOCK

Critical care consult required

Consultant referral
Consider transfer to a higher level of care
Critical care consult requested

Pathway Modification

All Pathway modifications need to be agreed by the Hospital Sepsis Steering Committee and be in line with the National Clinical Guideline.

File this document in patient notes - Document management plan.

Doctor’s Name: ___________________________
Doctor’s Signature: ___________________________
MCRN: ___________________________
Date: ___________
Time: ___________
Treatment of Septic Shock

Hemodynamic Stabilization
- Fluids
- Vasoactive agents

Infection Control
- Antibiotics
- Source control

Modulation of the septic response

Steroid ....
Initiate bundle upon recognition of sepsis/septic shock. May not complete all bundle elements within one hour of recognition.

1. Measure lactate level. Remeasure lactate if initial lactate elevated (> 2 mmol/L).

2. Obtain blood cultures before administering antibiotics.

3. Administer broad-spectrum antibiotics.

4. Begin rapid administration of 30 mL/kg crystalloid for hypotension or lactate ≥ 4 mmol/L.

5. Apply vasopressors if hypotensive during or after fluid resuscitation to maintain a mean arterial pressure ≥ 65 mm Hg.
HOUR-1 BUNDLE: INITIAL RESUSCITATION FOR SEPSIS AND SEPTIC SHOCK:

1) Measure lactate level.*
2) Obtain blood cultures before administering antibiotics.
3) Administer broad-spectrum antibiotics.
4) Begin rapid administration of 30mL/kg crystalloid for hypotension or lactate ≥4 mmol/L.
5) Apply vasopressors if hypotensive during or after fluid resuscitation to maintain a mean arterial pressure ≥ 65 mm Hg.

*Remeasure lactate if initial lactate elevated (> 2 mmol/L).
Lactate levels and mortality rates

<table>
<thead>
<tr>
<th>Study</th>
<th>Lactate</th>
<th>0-2.4 mmol/L</th>
<th>2.5-3.9 mmol/L</th>
<th>&gt;4 mmol/L</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shapiro et al</td>
<td>Lactate</td>
<td>Mortality</td>
<td>4.9%</td>
<td>9.0%</td>
</tr>
<tr>
<td>Mikkelsen et al</td>
<td>Lactate</td>
<td>Mortality</td>
<td>8.7%</td>
<td>16.4%</td>
</tr>
<tr>
<td>Bhat et al</td>
<td>Lactate</td>
<td>Mortality</td>
<td>12.7%</td>
<td>19.5%</td>
</tr>
</tbody>
</table>

1. Most studies used lactate >4 mmol/L increased mortality
2. The exact lactate level that should trigger aggressive resuscitative effort remains unknown
3. An intermediate lactate level that associated with a sudden increase in mortality not clear

West J Emerg Med. 2019;20(2)185-190
Severe Sepsis Bundle

Activate Within **ONE hour of presentation**

- Blood cultures x 2 sets
  - Drawn before antibiotic and within 1 hr after TOP (time of presentation)
  - 4 bottles total with minimum 8-10 mL/bottle
- IV Broad Spectrum Antibiotic
  - Start within 1 hr after TOP unless given within past 24 hours
- Lactate
  - Drawn within 1 hr after TOP
  - Require 2-5 mL blood in GREY top tube: Immediately put sample on ICE & transport to lab for analysis.
  - If initial Lactate >18, then repeat within 3 hrs after 1st lactate draw
- IV fluid bolus (0.9% NS or LR)
  - Min 30 mL/kg only if Septic Shock present
  - Start within 1 hr after TOP and complete within 3 hrs
Treating sepsis: the latest evidence

- Antibiotics: Early administration
- Fluids: Several liters initially
  - Colloids
  - Crystalloid
  - Starches
  - High chloride
- Vasopressors: 1–6 hours after onset
  - Norepinephrine
  - Epinephrine
  - Vasopressin
  - Phenylephrine
- Enteral feeding
- Insulin therapy
- Deep sedation
- Molecular targeted therapies
- Lung protective ventilation
- Goal oriented therapy
- EGDT: Early goal directed therapy
- Urinary catheter

Designed by: Will Stahl-Timmins
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Patients given Antibiotics within 3 hours of TOP are ~80-85% more likely to survive. In both the Pediatric & Adult patient population, after the first hours of severe sepsis or septic shock, every additional hour Antibiotics are delayed significantly increases the patient’s risk of mortality by 8-12% per hour!
Initial Resuscitation

• Resuscitation from sepsis-induced hypoperfusion, at least 30ml/kg of intravenous crystalloid fluid be given within the first 3 hours.

• Following initial fluid resuscitation, additional fluids be guided by frequent reassessment of hemodynamic status.
• Routine microbiologic cultures (including blood) be obtained before starting antimicrobial therapy in patients with suspected sepsis and septic shock.

• Microbiologic cultures always include at least two sets of blood cultures (aerobic and anaerobic).
1. **Blood Cultures (X 2 Sets)**

- **Blood Cultures** are used to detect microorganisms such as bacteria and fungi present in blood.

**COLLECTION:** Aerobic bottle FIRST then anaerobic bottle
- Adults require 8-10 mL per bottle X 4 bottles
- Pediatrics require 5 mL per bottle X 4 bottles *

- One BC from each vascular access in place >48 hrs
- Culture other sites as clinically indicated
  - Blood cultures should always be drawn prior to start of antimicrobial therapy

*NOTE:* Because microorganisms may only be intermittently present in blood, a series of blood cultures is usually done before the result can be considered negative.
• Administration of IV antimicrobials be initiated as soon as possible after recognition and within 1 h for both sepsis and septic shock.

• Empiric broad-spectrum therapy with one or more antimicrobials to cover all likely pathogens.
• Empiric combination therapy aimed at the most likely bacterial pathogen(s) for the initial management of septic shock.

• Combination therapy not be routinely used for on-going treatment of most other serious infections, including bacteremia and sepsis without shock.
Empiric antimicrobial therapy be narrowed once pathogen identification and sensitivities are established and/or adequate clinical improvement is noted.

Antimicrobial treatment duration of 7-10 days is adequate for most serious infections associated with sepsis and septic shock.
Bacteria cause sepsis

<table>
<thead>
<tr>
<th>Mouth</th>
<th>Skin/Soft Tissue</th>
<th>Bone and Joint</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peptococcus Peptostreptococcus</td>
<td>S. aureus S. pyogenes</td>
<td>S. aureus Streptococci N. gonorrhoeae</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Abdomen</th>
<th>Urinary Tract</th>
<th>Upper Respiratory</th>
</tr>
</thead>
<tbody>
<tr>
<td>E. coli Klebsiella Enterococcus Bacteroides sp.</td>
<td>E. coli, Proteus Klebsiella Enterococcus Staph saprophyticus</td>
<td>Viruses</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Lower Respiratory Community</th>
<th>Lower Respiratory Hospital</th>
<th>Meningitis</th>
</tr>
</thead>
</table>
Antimicrobial Therapy

- Daily assessment for de-escalation of antimicrobial therapy in patients with sepsis and septic shock.
- Measurement of procalcitonin levels can be used to support shortening the duration of antimicrobial therapy in sepsis patients.
Procalcitonin Guided Antibiotic Therapy

Procalcitonin (PCT) algorithm for stewardship of antibiotic therapy in patients with LRTI

- **< 0.1 µg/l**
  - Bacterial etiology **very unlikely**
  - **NO antibiotics**!

- **0.1 - 0.25 µg/l**
  - Bacterial etiology **unlikely**
  - no antibiotics

- **>0.25 - 0.5 µg/l**
  - Bacterial etiology **likely**
  - Antibiotics yes

- **>0.5 µg/l**
  - Bacterial etiology **very likely**
  - Antibiotics YES!

**Remeasure PCT after 6-24 hours**

**Initial antibiotics can be considered in case of:**
- Respiratory or hemodynamic instability
- Life-threatening comorbidity
- Need for ICU admission
- **PCT < 0.1 µg/l**: CAP with PSI IV or CURB = ≥ 4, COPD with GOLD IV
- **PCT < 0.25 µg/l**: CAP with PSI ≥IV or CURB ≥3, COPD with GOLD ≥III
- Localised infection (abscess, empyema)
- Compromised host defense (e.g. immuno-suppression other than corticosteroids)
- Concomitant infection in need of antibiotics

**Consider the course of PCT**

**If antibiotics are initiated:**
- Repeated measurement of PCT on days 3, 5, 7
- Stop antibiotics using the same cut offs above
- If initial PCT levels are >10 µg/l, then stop when 80-90% decrease of peak PCT
- If initial PCT remains high, consider treatment failure (e.g. resistant strain, empyema, ARDS)
- **Outpatients**: duration of antibiotics according to the last PCT result:
  - >0.25-0.5 µg/l: 3 days
  - >0.5 - 1.0 µg/l: 5 days
  - >1.0 µg/l: 7 days
Guideline recommendations

- Combination empirical therapy for the following patients (grade 2B):
  - Neutropenic with severe sepsis and for patients with difficult-to-treat, multidrug-resistant bacterial pathogens (Acinetobacter or Pseudomonas bacteremia)
  - Severe infections associated with respiratory failure and septic shock (Pseudomonas bacteremia)
  - Septic shock from bacteremic Streptococcus pneumoniae
Combination therapy vs. monotherapy for septic shock

<table>
<thead>
<tr>
<th></th>
<th>Mortality rate *</th>
<th># deaths</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Monotherapy (n=1223)</td>
<td>Combination Rx (n=1223)</td>
</tr>
<tr>
<td>28-Day, %</td>
<td>36.3</td>
<td>29</td>
</tr>
<tr>
<td>ICU, %</td>
<td>35.7</td>
<td>28.8</td>
</tr>
<tr>
<td>Hospital, %</td>
<td>47.8</td>
<td>37.4</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All Gram +, %</td>
<td>39.9</td>
<td>30.7</td>
</tr>
<tr>
<td>All Gram -, %</td>
<td>34.5</td>
<td>28.2</td>
</tr>
</tbody>
</table>

* Propensity score adjusted
## Sepsis from pulmonary source

<table>
<thead>
<tr>
<th>Infection</th>
<th>Example antibiotic regimens</th>
</tr>
</thead>
</table>
| CAP       | β-lactam<sup>1</sup> + azithromycin  
           | β-lactam<sup>1</sup> + respiratory FQ<sup>2</sup> |
| HCAP      | antipseudomonal β-lactam<sup>3</sup>  
           | + aminoglycoside<sup>4</sup> or antipseudomonal FQ<sup>5</sup>  
           | + vancomycin or linezolid |

<sup>1</sup> ceftriaxone, cefotaxime, ampicillin/sulbactam  
<sup>2</sup> levofloxacin, moxifloxacin  
<sup>3</sup> piperacillin/tazobactam, cefepime, meropenem, imipenem, doripenem  
<sup>4</sup> gentamicin, tobramycin, amikacin  
<sup>5</sup> levofloxacin, ciprofloxacin  

Clin Infect Dis 2007;44:S27-72  
Am J Respir Crit Care Med 2005;171:388-416
## Sepsis from Biliary Tract Infection

<table>
<thead>
<tr>
<th>Infection</th>
<th>Example antibiotic regimens</th>
</tr>
</thead>
<tbody>
<tr>
<td>E coli, Klebsiella, Enterococ</td>
<td>Ampicillin/sulbactam, meropenem, imipenem, piperacillin/tazobactam</td>
</tr>
<tr>
<td>With Diabetes</td>
<td>Anaerobes antibiotic</td>
</tr>
</tbody>
</table>

Burke 2017
# Sepsis from Intra abdominal & Pelvic Infection

<table>
<thead>
<tr>
<th>Infection</th>
<th>Example antibiotic regimens</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aerobes gram negative, B fragilis,</td>
<td><strong>Monotherapy</strong>: Ampicillin/sulbactam, meropenem, imipenem, tigecycline, piperacillin/tazobactam</td>
</tr>
<tr>
<td></td>
<td><strong>Combination therapy</strong>: Clindamycin or metronidazole + Aztreonam, levofloxacin or aminoglycoside</td>
</tr>
</tbody>
</table>

Burke 2017
Sepsis from catheter-related bloodstream infection (CRBSI)

<table>
<thead>
<tr>
<th>Infection</th>
<th>Example antibiotic regimens</th>
</tr>
</thead>
<tbody>
<tr>
<td>CRBSI</td>
<td>vancomycin <em>or</em> daptomycin$^1$ + antipseudomonal β-lactam$^{2,3}$ +/- aminoglycoside$^4$</td>
</tr>
<tr>
<td>Fungemia risk factors</td>
<td>+ fluconazole <em>or</em> echinocandin$^5$</td>
</tr>
</tbody>
</table>

1 if high rates of vancomycin MIC ≥ 2 μg/mL  
2 piperacillin/tazobactam, cefepime  
3 meropenem, imipenem, doripenem  
4 gentamicin, tobramycin, amikacin  
5 caspofungin, micafungin, anidulafungin  

## Sepsis from urosepsis

<table>
<thead>
<tr>
<th>Infection</th>
<th>Example antibiotic regimens</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aerobic Gram negative, Pseudomonas aeruginosa, Enterobacter sp</td>
<td>Monotherapy: Levofloxacin, Aminoglycoside 3\textsuperscript{rd} or 4\textsuperscript{th} Cephalosporin,</td>
</tr>
<tr>
<td>Enterococci</td>
<td>Ampicillin or vancomycin, Linezolid or daptomycin</td>
</tr>
<tr>
<td>VRE</td>
<td></td>
</tr>
<tr>
<td>Community acquired</td>
<td>Levofloxacin, azteronam or aminoglycoside</td>
</tr>
<tr>
<td>Nosocomial urosepsis</td>
<td>Piperacillin/tazobactam, Imipenem or meropenem</td>
</tr>
</tbody>
</table>

# Sepsis from unknown source

<table>
<thead>
<tr>
<th>Infection</th>
<th>Example antibiotic regimens</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unknown (GI, GU Tract, Pelvis)</td>
<td>Monotherapy: Meropenem, imipenem, tigecycline piperacillin/tazobactam</td>
</tr>
<tr>
<td></td>
<td>Combination therapy: Metronidazole + Aztreonam or cefepime</td>
</tr>
</tbody>
</table>

Clin Infect Dis 2009;48:503-35; Burke 2017
### Antimicrobial Treatment of Sepsis

<table>
<thead>
<tr>
<th>Source or device</th>
<th>Usual pathogens</th>
<th>Usual nonpathogens&lt;sup&gt;a&lt;/sup&gt;</th>
<th>Emperic monotherapy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lower gastrointestinal tract, pelvis&lt;sup&gt;b&lt;/sup&gt;</td>
<td><em>B. fragilis</em></td>
<td><em>S. aureus</em></td>
<td>Meropenem</td>
</tr>
<tr>
<td></td>
<td>Aerobic GNBs</td>
<td><em>E. faecalis</em> (VSE)</td>
<td>Tigecycline</td>
</tr>
<tr>
<td>Genitourinary tract, kidney, prostate&lt;sup&gt;b&lt;/sup&gt;</td>
<td>Aerobic GNBs</td>
<td><em>B. fragilis</em></td>
<td>Ertapenem</td>
</tr>
<tr>
<td></td>
<td><em>E. faecalis</em> (VSE)</td>
<td><em>S. aureus</em></td>
<td>Piperacillin-tazobactam</td>
</tr>
<tr>
<td>Central venous catheter intravenous lines</td>
<td><em>S. aureus</em></td>
<td><em>B. fragilis</em></td>
<td>Meropenem</td>
</tr>
<tr>
<td></td>
<td>Aerobic GNBs</td>
<td></td>
<td>Tigecycline</td>
</tr>
<tr>
<td></td>
<td><em>E. faecalis</em></td>
<td></td>
<td>Piperacillin/tazobactam</td>
</tr>
<tr>
<td>Pulmonary: NP, VAP</td>
<td><em>P. aeruginosa</em></td>
<td><em>S. aureus</em></td>
<td>Meropenem&lt;sup&gt;c&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>Aerobic GNBs</td>
<td><em>Enterobacter</em> sp</td>
<td>Cefepime</td>
</tr>
<tr>
<td></td>
<td></td>
<td><em>B. cepacia</em></td>
<td>Cefoperazone</td>
</tr>
<tr>
<td></td>
<td></td>
<td><em>S. maltophilia</em></td>
<td>Levofloxacin</td>
</tr>
<tr>
<td></td>
<td></td>
<td><em>E. faecalis</em> (VSE)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td><em>B. fragilis</em></td>
<td></td>
</tr>
</tbody>
</table>

<sup>a</sup> No need to include in empiric coverage.

<sup>b</sup> Source unknown.

<sup>c</sup> Vancomycin, daptomycin, or linezolid in most intravenous-line infections in institutions where CVC infection due to MRSA more prevalent than CVC infection due to MSSA.

Fluid Therapy

• Crystalloids as the fluid of choice for initial resuscitation and subsequent intravascular volume replacement in patients with sepsis and septic shock.

• Albumin in addition to crystalloids when patients require substantial amounts of crystalloids
We recommend an initial target mean arterial pressure of 65 mmHg in patients with septic shock requiring vasopressors. (Strong recommendation; moderate quality of evidence)
Vasoactive agents

- Norepinephrine as the first choice vasopressor

- Vasopressin (up to 0.03 U/min) or epinephrine to norepinephrine with the intent of raising MAP to target, or adding vasopressin (up to 0.03 U/min) to decrease norepinephrine dosage.
Curah Jantung

- Volume Sekuncup
  - Preload
    - Cairan
  - Kontraktilitas
    - Intoropik
  - Afterload
    - Vasodilator Vasopresor

- Denyut Jantung

Kandungan O₂ arterial

- Hb
- 1,34
- SaO₂

Transfusi darah
Maksimalkan Oksigenasi
Normalkan pH, pCO₂ & suhu
Manajemen hemodinamik

1. Resusitasi cairan
2. Inotropik $\rightarrow$ ↑ Cardiac Output (CO)
3. Vasopresor $\rightarrow$ ↑ Tekanan darah (TD)

Nutrition

• Early initiation of enteral feeding rather than a complete fast or only IV glucose in critically ill patients with sepsis or septic shock who can be fed enterally.

• Early trophic/hypocaloric or early full enteral feeding in critically ill patients with sepsis or septic shock; if trophic/hypocaloric feeding is the initial strategy, then feeds should be advanced according to patient tolerance.
Nutrition

• Parenteral nutrition alone or in combination with enteral feeds (but rather to initiate IV glucose and advance enteral feeds as tolerated) over the first 7 days in critically ill patients with sepsis or septic shock in whom early enteral feeding is not feasible.
Nutrition

• Routinely monitoring gastric residual volumes in critically ill patients with sepsis or septic shock.

• Use of prokinetic agents in critically ill patients with sepsis or septic shock and feeding intolerance
Sepsis Berat

Fuel Source

- Glycerol 30g
- Amino acid
- Fatty acid

Fuel Consumption

- Glucose 360g
- Lactate 136g
- Adipose tissue 160g
- Muscle 250g
- Protein
- Inflammatory Mass 76g
- Brain
- Kidney

36
Kebutuhan energi pada kondisi stres metabolik
Metabolisme saat sepsis:

- Metabolic rate $\uparrow$

  $\rightarrow$ hipermetabolik

- Keseimbangan nitrogen $\rightarrow$ negatif

- Resistensi insulin

- Hiperglikemia
Metabolisme protein Sepsis

Critical ill (trauma, sepsis, luka bakar, postop) → protein otot dipecah kemudian diubah menjadi AA dan AA ini dipakai untuk sintesis protein dan glukoneogenesis.
Basal Energy Expanditure

Perhitungan Basal Energy Expenditure (BEE)

Persamaan Harris-Benedict:

Laki-laki: $66,47 + (13,75 \times BB) + (5 \times TB) - (6,76 \times Umur)$

Wanita : $655,1 + (9,56 \times BB) + 1,85 \times TB) - (4,67 \times Umur)$

Rata-rata BEE adalah mendekati 25 kcal/kgbb/hari

Faktor Stres

Koreksi terhadap perhitungan kebutuhan energi derajat hipermetabolisme :

* Postoperasi (tanpa komplikasi) $1,00 - 1,30$
* Kanker $1,10 - 1,30$
* Peritonitis / sepsis $1,20 - 1,40$
* Sindroma kegagalan organ multiple $1,20 - 1,40$
* Luka bakar $1,20 - 2,00$

(perkiraan BEE + % luas permukaan tubuh yang terbakar)

Koreksi kebutuhan energy (kкал/hari) = BEE x faktor stres
Thank You!