Diffuse peritonitis
The importance of source control

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Intra-abdominal infections:
Clinical classification

<table>
<thead>
<tr>
<th>Peritonitis Type</th>
<th>Definition</th>
<th>Surgical Treatment Necessary</th>
<th>Spectrum of Bacteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary</td>
<td>Infection of ascites via translocation without organ perforation</td>
<td>Primarily No</td>
<td>Monoinfection (Mainly E. coli)</td>
</tr>
<tr>
<td>Secondary –</td>
<td>Community-acquired organ perforation without previous operation</td>
<td>Yes</td>
<td>Mixed infection (Gram-positive, Gram-negative, Anaerobes)</td>
</tr>
<tr>
<td>Community-</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Acquired</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Secondary –</td>
<td>Organ perforation following operation</td>
<td>Yes</td>
<td>Mixed infection (resistant bacteria, Candida spp.)</td>
</tr>
<tr>
<td>Postoperative</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tertiary</td>
<td>Recurrent infection without organ perforation following operation</td>
<td>Primarily No</td>
<td>Mixed infection (MRSA, VRE, ESBL, Candida spp)</td>
</tr>
</tbody>
</table>
**Epidemiology of septic shock**

**Etiology top 3 2016**

Blue=Levosimendan, red=Placebo; n=519

**Management of cIAI**

Treatment of cIAI 1925

"surgeons should respect God and the peritoneum"

collective: n=25
mortality: 80% (!)
"improvement is necessary"

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Therapeutic management of peritonitis:
A comprehensive guide for intensivists
P. Montravers1*, S. Blot2,10, G. Dimopoulos3, C. Eckmann4, P. Eggimann5, X. Guirao6, J.A. Paiva7,11, G. Sganga8 and J. De Waele9

Table 1: Step by step approach for the treatment of patients with peritonitis

<table>
<thead>
<tr>
<th>Phase</th>
<th>Goal</th>
<th>Manoeuvre</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial</td>
<td>Severity assessment</td>
<td>Applying score of sepsis</td>
</tr>
<tr>
<td></td>
<td>Sepsis containment</td>
<td>Adequate and early empirical antibiotic therapy</td>
</tr>
<tr>
<td></td>
<td>Preparing for surgery</td>
<td>Adequate haemodynamic monitoring and fluid management</td>
</tr>
<tr>
<td></td>
<td>Source control</td>
<td></td>
</tr>
<tr>
<td>1st</td>
<td>Source control</td>
<td>Simple closure</td>
</tr>
<tr>
<td></td>
<td>SSI prevention (Incisional)</td>
<td>Wound protection</td>
</tr>
<tr>
<td></td>
<td>Microbiological diagnosis</td>
<td>Peritoneal cultures</td>
</tr>
<tr>
<td></td>
<td>Decrease peritoneal inoculum</td>
<td>Initial abdominal cleansing</td>
</tr>
<tr>
<td></td>
<td>Peritonitis assessment</td>
<td>Looking for the source of the infection</td>
</tr>
<tr>
<td>2nd</td>
<td>Source control</td>
<td>Resection ± intestinal anastomosis</td>
</tr>
<tr>
<td></td>
<td>Abdominal closure</td>
<td>Stoma</td>
</tr>
<tr>
<td></td>
<td>Decrease peritoneal inoculum</td>
<td>Final abdominal cleansing</td>
</tr>
<tr>
<td>3rd</td>
<td>Abdominal closure</td>
<td>Primary or deferred abdominal wall closure</td>
</tr>
<tr>
<td>Final</td>
<td>Treatment of residual inoculum</td>
<td>Adequate empirical antibiotic therapy</td>
</tr>
<tr>
<td></td>
<td>and perioperative resuscitation</td>
<td>Endorsement to Survival sepsis campaign principles</td>
</tr>
</tbody>
</table>

Source control issues in diffuse secondary peritonitis

- Timing of source control?
- Value of laparoscopic approach?
- Relaparotomy on demand or open abdomen?
- When to perform relaparotomy?

Timing of surgery in GI perforation with peritonitis and septic shock

![Graph showing 60-day survival rate over time from admission initiation of surgery](graph.png)

(OR 0.29, 95% CI 0.16-0.47; <0.00001!)

CI, confidence interval; GI, gastrointestinal; OR, odds ratio.
Timing of surgery in persistant peritonitis - sometimes an idea for preventing MDR

Montravers P et al Crit Care 2015 70
(slide with permission from J. de Waele)

Laparoscopy in diffuse peritonitis - current evidence

<table>
<thead>
<tr>
<th>Source of Infection</th>
<th>Level of Evidence</th>
<th>Random. Studies diffuse Peritonitis</th>
<th>Level of recommendation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Appendicitis</td>
<td>I</td>
<td>no</td>
<td>A</td>
</tr>
<tr>
<td>Cholecystitis</td>
<td>I</td>
<td>no</td>
<td>A</td>
</tr>
<tr>
<td>Gastric perforation</td>
<td>I</td>
<td>no</td>
<td>A</td>
</tr>
<tr>
<td>Small bowel perforation</td>
<td>IV</td>
<td>no</td>
<td>B</td>
</tr>
<tr>
<td>Iatrogenic colonic perforation</td>
<td>IV</td>
<td>no</td>
<td>B</td>
</tr>
<tr>
<td>Postoperative Peritonitis</td>
<td>IV</td>
<td>no</td>
<td>C</td>
</tr>
</tbody>
</table>

Modified after: Coccolini F et al World J Gastrointest Surgery 2015
Surgical treatment of perforated diverticulitis randomized controlled trial

Laparoscopy

Purulent: LOLA
Online randomisatie

Faecal: DIVA
Online randomisatie

Hartmann procedure
Anastomose ± ileostoma

“Study interrupted due to increased event rate in the lavage group”

Lavage drainage
Hartmann procedure
Anastomose ± ileostoma

Lap. Lavage in diffuse purulent perf. diverticulitis
Definitive treatment? Bridge to definitive surgery?
Schultz JK et al. JAMA 2015;314:1364-75

- SCANDIV trial (randomized, open-label)
- Exclusion criteria: fecal peritonitis
- Lap lavage (n=101) vs. primary resection (n=98)
- No difference in LOS
- Re-intervention rate in LL-Gruppe significantly higher (15/74 vs 4/70 P., p=0.01)
- 4 carcinoma in laparoscopic group not detected
- ➔ „findings do not support laparoscopic lavage for treatment of perforated diverticulitis“
Laparoscopic therapy in diffuse sec. peritonitis – limitations

- Not in ischemia
- Not in advanced progressive peritonitis
- Not in ileus situation
- Very little evidence
- High expertise necessary
  If in doubt: open procedure (laparotomy!)
  
Level of evidence: IV („expert“ opinion)

Source control in sec. peritonitis – abdominal closure

- **Primary closure + relaparotomy on demand**
  
- Programmed lavage
  
- Laparostomy
Laparostomy - ongoing indications

- Loss of abdominal wall (necrosis)
- Weakness of the fascia
- Abdominal compartment syndrome
- Tertiary peritonitis

Lamme B et al. Chirurg 2005

Planned Relaparotomy vs. Relaparotomy on demand: Dutch Peritonitis Study Group

- n = 232 (116 PR, 116 ROD)
- Primary Endpoints: death and/or morbidity
- Results: ROD PR p-value
- mortality: 29% 36% 0.22 (ns)
- Morbidity: 40% 44% 0.58 (ns)
- Relaparotom.: 42% 94%
- ICU: 7 d 11 d 0.001 (s)
- LOS: 27 d 35 d 0.008 (s)

Van Ruler et al. JAMA (2007) 298: 865-72
Postoperative sepsis following diffuse peritonitis: what is the reason?

Surgeons believe... Intensivists believe...

Abdominal infections in the ICU: Characteristics, treatment and outcome

<table>
<thead>
<tr>
<th>Collective</th>
<th>1,265 ICUs, 75 countries (EPIC II)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Results I</td>
<td>19.6% cIAI of 7,083 infected patients</td>
</tr>
<tr>
<td>Results II</td>
<td>Mean SAPS score 39, SOFA score 7.6</td>
</tr>
<tr>
<td>Results III</td>
<td>Significantly more <em>E.coli</em>, anaerobes + less enterococci in patients &lt;2 days on ICU</td>
</tr>
<tr>
<td>Results IV</td>
<td>29% of cIAI patients had pneumonia</td>
</tr>
<tr>
<td>Results V</td>
<td>ICU mortality, 29%; hospital mortality, 36%</td>
</tr>
<tr>
<td>Results VI</td>
<td>Mortality for cIAI significantly higher than for other infections (29.4 vs. 24.4%, p&lt;0.001)</td>
</tr>
</tbody>
</table>

cIAI, complicated intra-abdominal infection; ICU, Intensive Care Unit; SAPS, Simplified Acute Physiology Score; SOFA, Sequential Organ Failure Assessment.

Diffuse post-operative peritonitis: value of diagnostic parameters and impact of early indication for relaparotomy

Clinical predictors of ongoing infection in secondary peritonitis: Systematic review

- 37/197 Studies included
- 10/76 factors statistically relevant:
  - Age
  - Comorbidity
  - Diffuse P.
  - Peritonitis source upper GI-tract
  - Source control
  - Bilirubin
  - Kreatinine
  - Lactate
  - Pa02/Fi02
  - Albumin
- To date no scoring-system sufficiently evaluated or validated

Source control in abdominals sepsis

suspected intra-abdominal infection

risk profile

focus

yes

laparotomy

source control

abdominal CT scan

no

positive

focal collection

percutaneous Drainage (CT)

negative

diffuse P.

ischemia

laparotomy

source control

persist. Sepsis: relaparotomy!


Picture is property of the speaker

Diffuse peritonitis

plea for an interdisciplinary approach

Intensive Care

AMS /ID

Surgery

AMS, antimicrobial stewardship; ID, infectious disease.

Eckmann C, Personal opinion