

# Diffuse peritonitis

## The importance of source control

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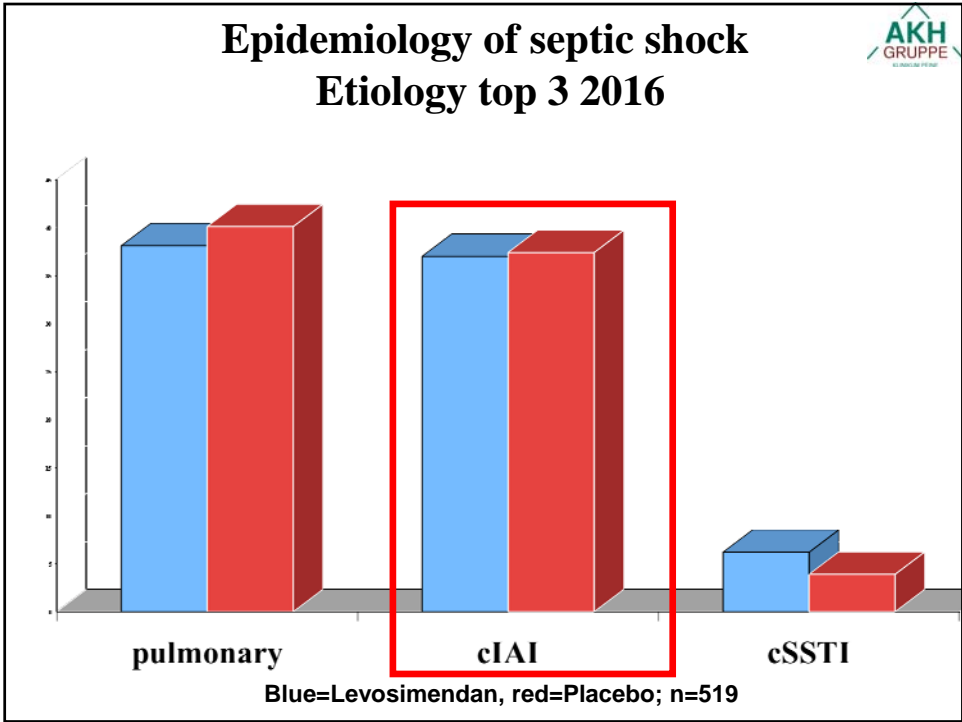


## Intra-abdominal infections: Clinical classification

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

ESBL, extended-spectrum beta-lactamase; HAP, healthcare-associated peritonitis; MRSA, methicillin resistant *Staphylococcus aureus*; VRE, vancomycin-resistant *Enterococci*.

Adapted from: 1. Weigelt J. *Clev Clin J Med* 2007;74(Suppl 4):S29-37; 2. DiPiro JT, Rogers DA. Intra-abdominal infections. In: DiPiro JT, Talbert RL, Yee GC, Matzke GR, Wells BG, Posey LM, eds. *Pharmacotherapy: A Pathophysiologic Approach*. 3rd ed. Stamford, Conn: Appleton & Lange;1997:2148.



### Management of cIAI

**Intensive care**

Treatment of sepsis

**Surgery**

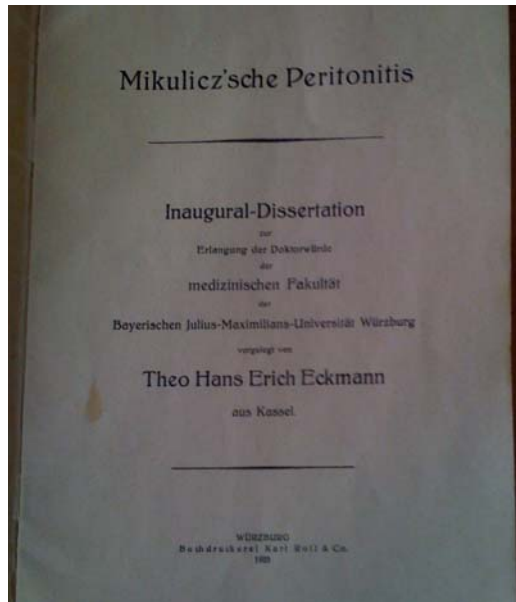
Source control  
Damage control

**Antibiotics**

Coverage of causative organisms

Modified from Marshall and Innes. Crit Care Med 2003;31:2228-37

# Treatment of cIAI 1925



„surgeons should respect God and the peritoneum“

collective: n=25

mortality: 80% (!)

„improvement is necessary“

## Therapeutic management of peritonitis: A comprehensive guide for intensivists

P. Montravers<sup>1\*</sup>, S. Blot<sup>2,10</sup>, G. Dimopoulos<sup>3</sup>, C. Eckmann<sup>4</sup>, P. Eggimann<sup>5</sup>, X. Guirao<sup>6</sup>, J.A. Paiva<sup>7,11</sup>, G. Sganga<sup>8</sup> and J. De Waele<sup>9</sup>

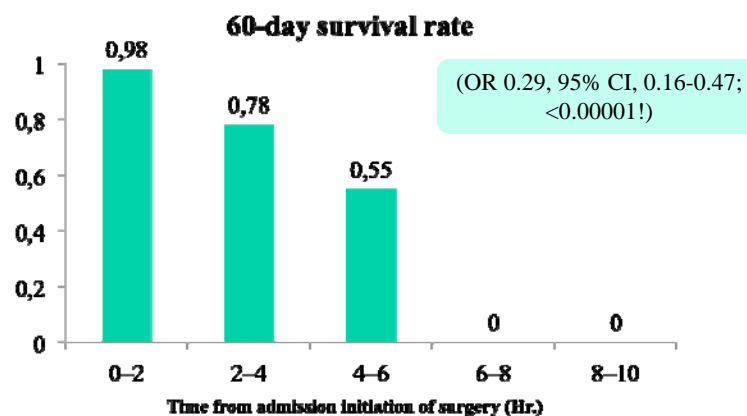
**Table 1: Step by step approach for the treatment of patients with peritonitis**

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

## 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



## Timing of surgery in persistent peritonitis sometimes an idea for preventing MDR

**Table 8 Univariate and multivariate analyses of risk factors for emergence of MDR microorganisms among the 173 reoperations in 98 patients with persistent peritonitis**

Variable	Univariate analysis			Multivariate analysis					
	Missing data	Emerging MDR strains (n = 63)	No emergence of MDR strains (n = 110)	Odds ratio	95% CI	P-value	Odds ratio	95% CI	P-value
Type 1 diabetes mellitus	0	10 (16)	7 (6)	2.77	0.99, 7.08	0.061	-	-	-
SOFA score, per one point	0	8 ± 4	7 ± 3	1.07	0.97, 1.17	0.17	-	-	-
Time to reoperation, days	0	7 ± 6	4 ± 3	1.19	1.08, 1.32	<0.0001	1.19	1.08-1.33	0.0006
Polymicrobial initial infection	0	39 (62)	86 (78)	0.453	0.23, 0.89	0.034	-	-	-
Duration of anti-infective therapy, days	0	8 ± 5	6 ± 4	1.12	1.04, 1.21	0.0003	-	-	-
Use of third-generation cephalosporins	0	3 (5)	13 (12)	0.37	0.10, 1.36	0.17	-	-	-
Use of fluoroquinolones	0	9 (14)	5 (5)	3.5	1.12, 10.95	0.039	-	-	-

Results are expressed as mean ± SD or total number (%). An interaction between time to reoperation and duration of antibiotic therapy was identified (Pearson correlation coefficient between the two variables = 0.46 (95% CI 0.33, 0.57) (P < 0.0001)). An interaction term was added in the multivariate analyses of risk factors for emergence of MDR microorganisms, which did not modify the results. C-index: 0.69 (95% CI: 0.61, 0.77); Hosmer-Lemeshow test P-value: 0.08. MDR, multidrug-resistant.

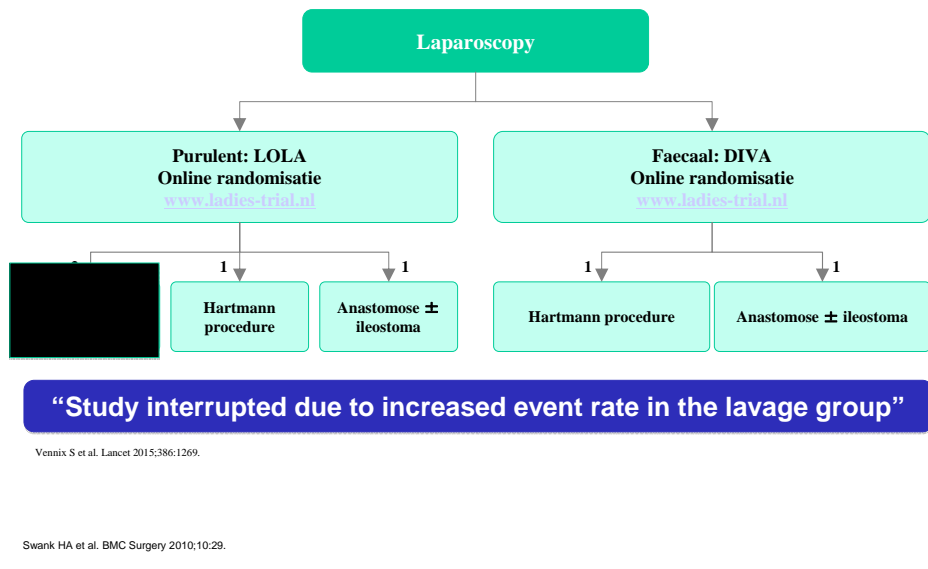
Montravers P et al Crit Care 2015 70  
(slide with permission from J. de Waele)

## Laparoscopy in diffuse peritonitis- current evidence

Source of infection	Level of Evidence	Random. Studies diffuse Peritonitis	Level of recommendation
Appendicitis	I	no	A
Cholecystitis	I	no	A
Gastric perforation	I	no	A
Small bowel perforation	IV	no	B
Iatrogenic colonic perforation	IV	no	B
Postoperative Peritonitis	IV	no	C

Modified after: Coccolini F et al World J Gastrointest Surgery 2015

## Surgical treatment of perforated diverticulitis randomized controlled trial



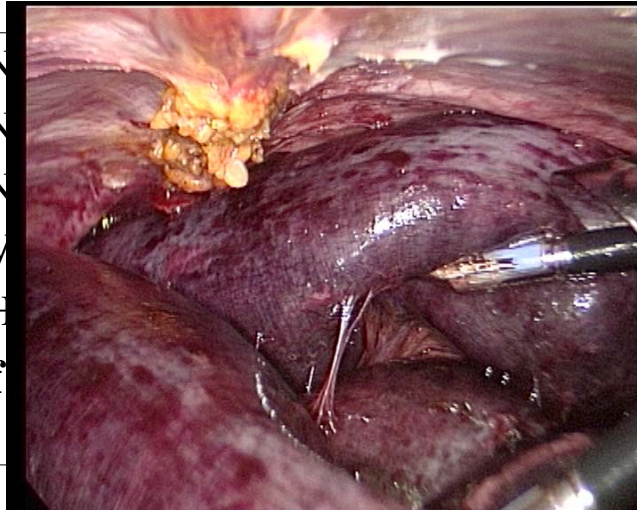
## Lap. Lavage in diffuse purulent perf. diverticulitis Definitive treatment? Bridge to definitive surgery?

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

- N
  - N
  - N
  - V
  - H
- If**



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



Picture is property of the speaker

Lamme B et al Chirurg 2005

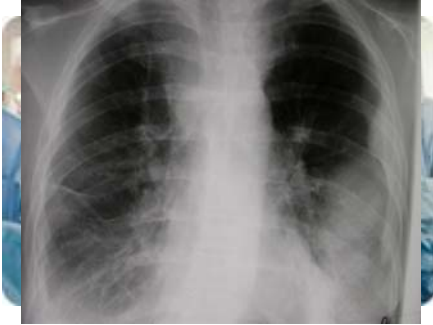
## Planned Relaparotomy vs. Relaparotomy on demand: Dutch Peritonitis Study Group

• 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...



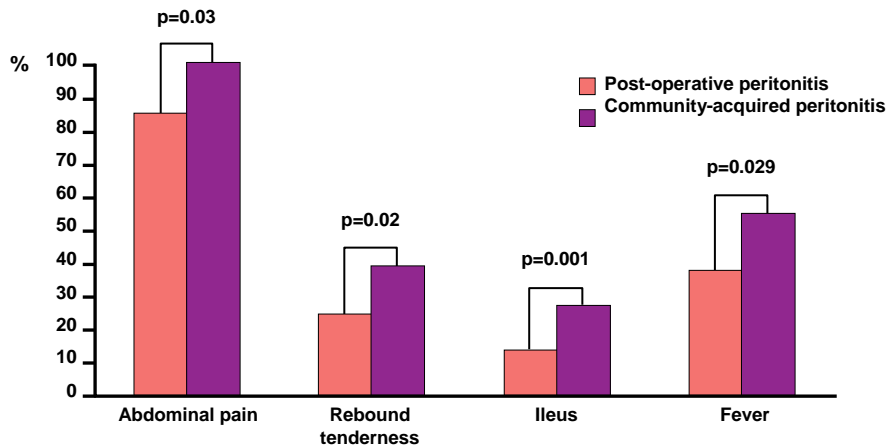
Intensivists believe...

## Abdominal infections in the ICU: Characteristics, treatment and outcome

<b>Collective</b>	1,265 ICUs, 75 countries (EPIC II)
<b>Results I</b>	19.6% cIAI of 7,083 infected patients
<b>Results II</b>	Mean SAPS score 39, SOFA score 7.6
<b>Results III</b>	Significantly more <i>E.coli</i> , anaerobes + less enterococci in patients <2 days on ICU
<b>Results IV</b>	29% of cIAI patients had pneumonia
<b>Results V</b>	ICU mortality, 29%; hospital mortality, 36%
<b>Results VI</b>	Mortality for cIAI significantly higher than for other infections (29.4 vs. 24.4%, p<0,001)

cIAI, complicated intra-abdominal Infection; ICU, Intensive Care Unit; SAPS, Simplified Acute Physiology Score; SOFA, Sequential Organ Failure Assessment.  
De Waele J, et al. *BMC Infect Dis* 2014;14:420.

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



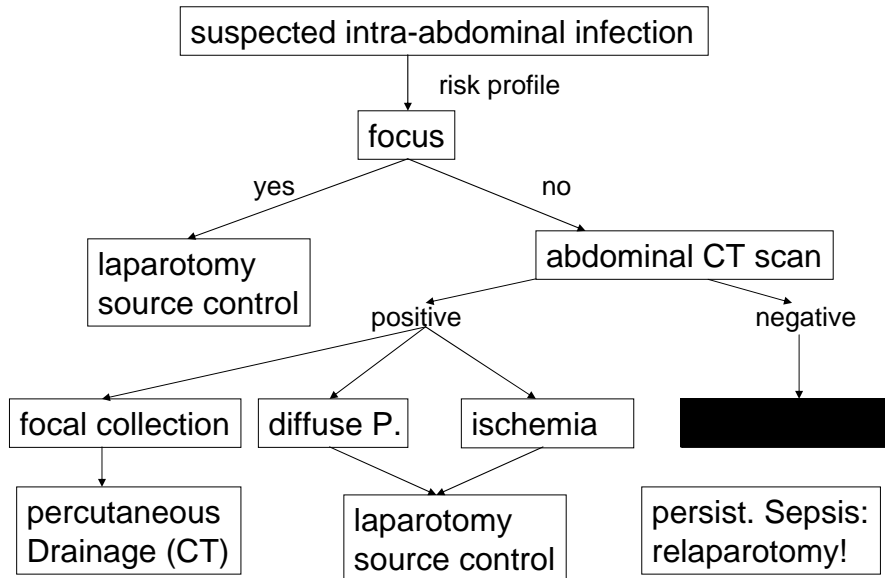
Bader FG, Eckmann C. Eur J Med Res 2009;14:491-6

## 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
  - PaO<sub>2</sub>/FiO<sub>2</sub>
  - Albumin
- To date no scoring-system sufficiently evaluated or validated

Lamme B et al. World J Surg (2006) 30: 2170-2181

# Source control in abdominal sepsis

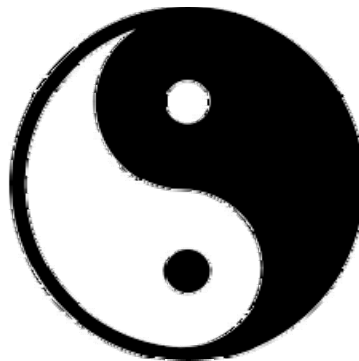


Modified after: Marshall JC: Crit Care Med 31 (2003) 2228

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