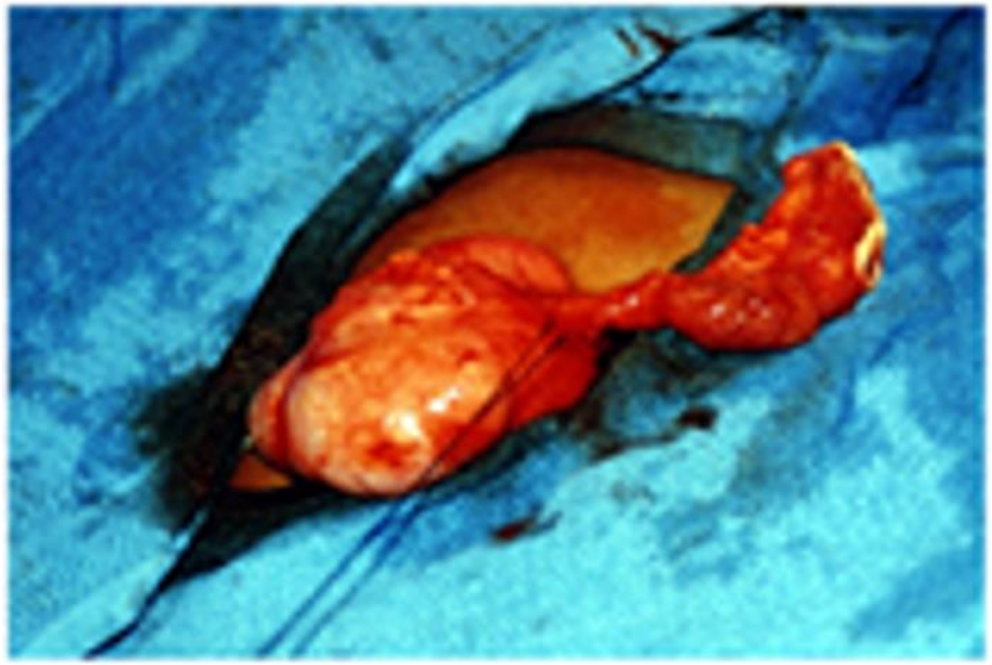
Viêm phúc mạc thứ phát: Cấp cứu nội - ngoại khoa

Ths. Nguyễn Vinh Anh

Bộ môn Hồi sức Cấp cứu Chống độc

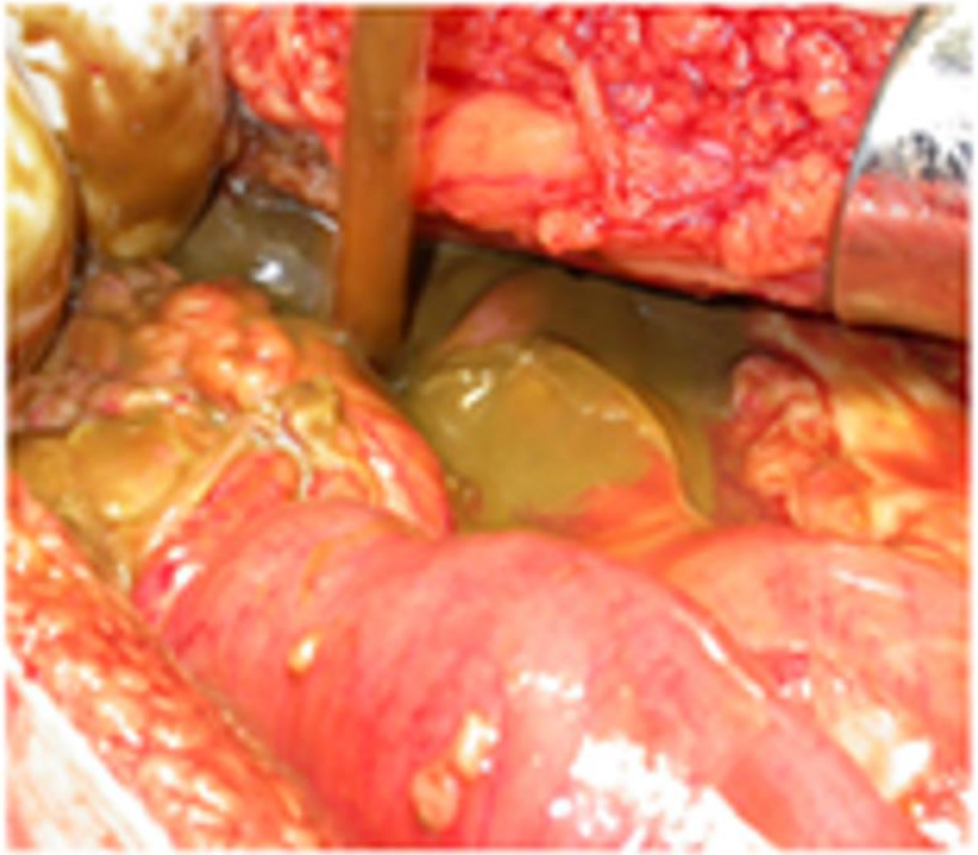
Đại học Y Dược Tp.HCM

Bệnh nhân 1: Nam, 20 tuổi, đau hố chậu (P), không sốt



Bệnh nhân 2:

Nữ, 66 tuổi, đau + đề kháng khắp bụng, sốc



Bệnh nhân 3: Nam, 55 tuổi, hậu phẫu N6 thủng đại tràng (T), sốt cao liên tục + bụng chướng đề kháng

Viêm phúc mạc (VPM) thứ phát

- Nguyên nhân NK hàng đầu nhập ICU, sau viêm phổi, 5.8–10 % mọi lượt nhập ICU và gần 20 % các trường hợp NK.
- Tăng tỷ lệ VPM liên quan đến chăm sóc y tế, 50%, chủ yếu VPM hậu phẫu.
- 40% VPM thứ phát diễn tiến đến sepsis → NKH từ NK ổ bụng (Abdominal Sepsis)

Sartelli *et al. World Journal of Emergency Surgery* (2015) 10:61
DOI 10.1186/s13017-015-0055-0

World Journal of Emergency Surgery

RESEARCH ARTICLE Open Access

Global validation of the WSES Sepsis Severity Score for patients with complicated intra-abdominal infections: a prospective multicentre study (WISS Study)

- Multi-center observational study: in 132 medical institutions worldwide, 54 nations, during a 4-month period (October 2014–February 2015) enrolled 4553 patients with cIAIs.
- 87.5 % were affected by community-acquired IAIs while the remaining 12.5 % suffered from healthcare-associated infections.
- 17.4 % were admitted in critical condition (severe sepsis/septic shock).
- The overall mortality: 9.2%, in which 32.2% were HA-IAIs

Table 1 Source of infection in 4553 patients from 132 hospitals worldwide (15 October 2014–15 February 2015)

Source of infection	Number (%)
Appendicitis	1553 (34.2 %)
Cholecystitis	837 (18.5 %)
Post-operative	387 (8.5 %)
Colonic non diverticular perforation	269 (5.9 %)
Gastro-duodenal perforations	498 (11 %)
Diverticulitis	234 (5.2 %)
Small bowel perforation	243 (5.4 %)
Others	348 (7.7 %)
PID	50 (1.1 %)
Post traumatic perforation	114 (2.5 %)
Missing	
Total	4553 (100 %)

PID pelvic inflammatory disease

The WISS study (WSES cIAIs Score Study) 2015

Mortality by sepsis status: no sepsis 1.2%, sepsis only 4.4%, severe sepsis 27.8%, and septic shock 67.8%.

Table 2 Univariate analysis of patients with complicated intra-abdominal infection comparing patients who survived ($n = 4117$) and patient who died ($n = 416$)

Variable	Survided (%) $n = 4117$	Died (%) $n = 416$	p value
Sepsis status			<0.0001
No sepsis	1914 (46.5 %)	23 (5.5 %)	
Sepsis	1725 (41.9 %)	80 (19.2 %)	
Severe sepsis	404 (9.8 %)	157 (37.7 %)	
Septic shock	74 (1.8 %)	156 (37.5 %)	
Healthcare associated infection	433 (10.5 %)	134 (32.2 %)	<0.0001

The WISS study (WSES cIAIs Score Study) 2015

Định nghĩa

The International Sepsis Forum Consensus Conference on Definitions of Infection in the Intensive Care Unit

Thierry Calandra, MD, PhD; Jonathan Cohen, MB, FRCP; for the International Sepsis Forum Definition of Infection in the ICU Consensus Conference

Crit Care Med 2005

- Nhiễm khuẩn trong ổ bụng (IAIs): nguyên phát, thứ phát và thứ cấp (primary, secondary, or tertiary)
- VPM thứ phát: thường gặp nhất, TLTV 15-35%.

Viêm phúc mạc thứ phát - Secondary peritonitis

- Microbial infection of the peritoneal space following perforation, abscess formation, ischemic necrosis, or penetrating injury of the intra-abdominal contents.
- *Microbiologically confirmed*: Isolation of one or more microbial pathogens found in the peritoneum or the blood 24 hrs after a gastrointestinal perforation
- *Probable*: Compatible clinical illness associated with documented evidence of perforation (free air in the abdomen on radiographic studies or surgical confirmation of peritoneal inflammation following luminal perforation in the absence of microbiologically confirmed peritonitis). A Gram stain in the absence of a positive culture from the peritoneum would be considered probable secondary bacterial peritonitis.
- *Possible*: Upper gastrointestinal perforation or penetrating abdominal trauma that is surgically repaired without further evidence of microbiologic confirmation or clinical signs or symptoms supportive of a diagnosis of bacterial or fungal peritonitis. A finding of an inflammatory peritoneal fluid in the presence of a documented but localized intra-abdominal abscess in the absence of culture confirmation would also be considered possible secondary bacterial peritonitis.

The International Sepsis Forum Consensus Conference on Definitions of Infection in the Intensive Care Unit
Thierry Calandra et al. Crit Care Med 2005

Abcess trong ổ bụng

- *Microbiologically confirmed*: Clinical, radiographic, and direct surgical confirmation of an inflammatory collection within the peritoneal space or surrounding structures with isolation of one or multiple microbial pathogens from the fluid collection.
- *Probable*: The presence of an abnormal collection of fluid in the intra-abdominal contents or surrounding structures with evidence of inflammatory cells and/or positive Gram stain but with negative cultures from that fluid accumulation or blood.
- *Possible*: Clinical or radiographic evidence of an abnormal fluid accumulation within the abdominal contents or surrounding structures but without microbiologic or surgical confirmation.

The International Sepsis Forum Consensus Conference on Definitions of Infection in the Intensive Care Unit
Thierry Calandra et al. Crit Care Med 2005

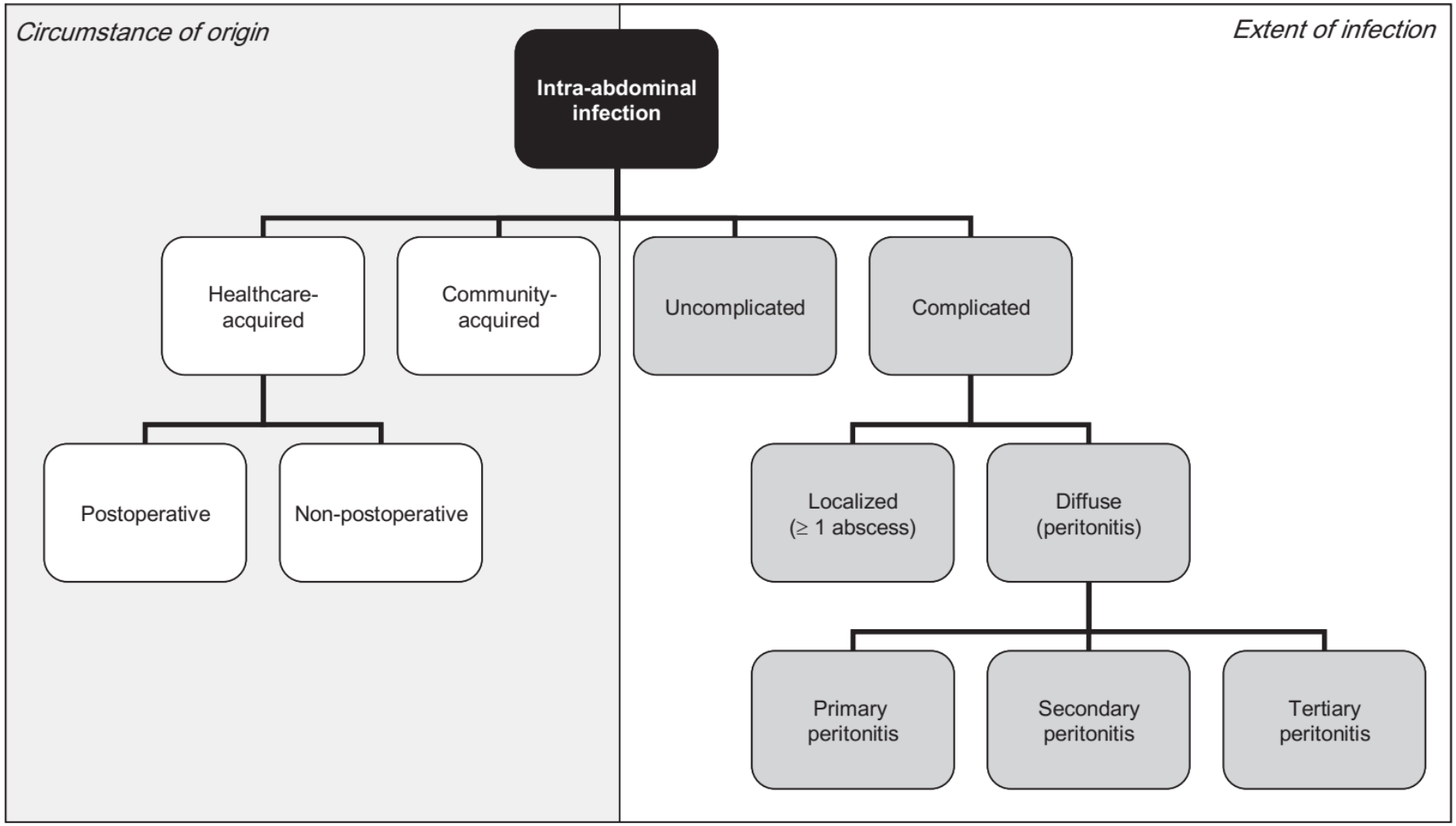


Fig. 1. Classification scheme for intra-abdominal infections.

The International Sepsis Forum Consensus Conference on Definitions of Infection in the Intensive Care Unit
Thierry Calandra et al. Crit Care Med 2005

Phân loại

- **Uncomplicated IAIs** the infectious process only involves a single organ and does not proceed to peritoneum.
- **Complicated IAIs,** the infectious process proceeds beyond the organ, and causes either localized peritonitis or diffuse peritonitis.
- **Community-acquired intra-abdominal infections (CA-IAIs)**
- **Healthcare-acquired intra-abdominal infections (HA-IAIs):** develop in hospitalized patients or residents of long-term care facilities. They are characterized by increased mortality because of both underlying patient health status and increased likelihood of infection caused by multi drugs resistant organisms.

The International Sepsis Forum Consensus Conference on Definitions of Infection in the Intensive Care Unit
Thierry Calandra et al. Crit Care Med 2005

VPM thứ cấp - Tertiary peritonitis

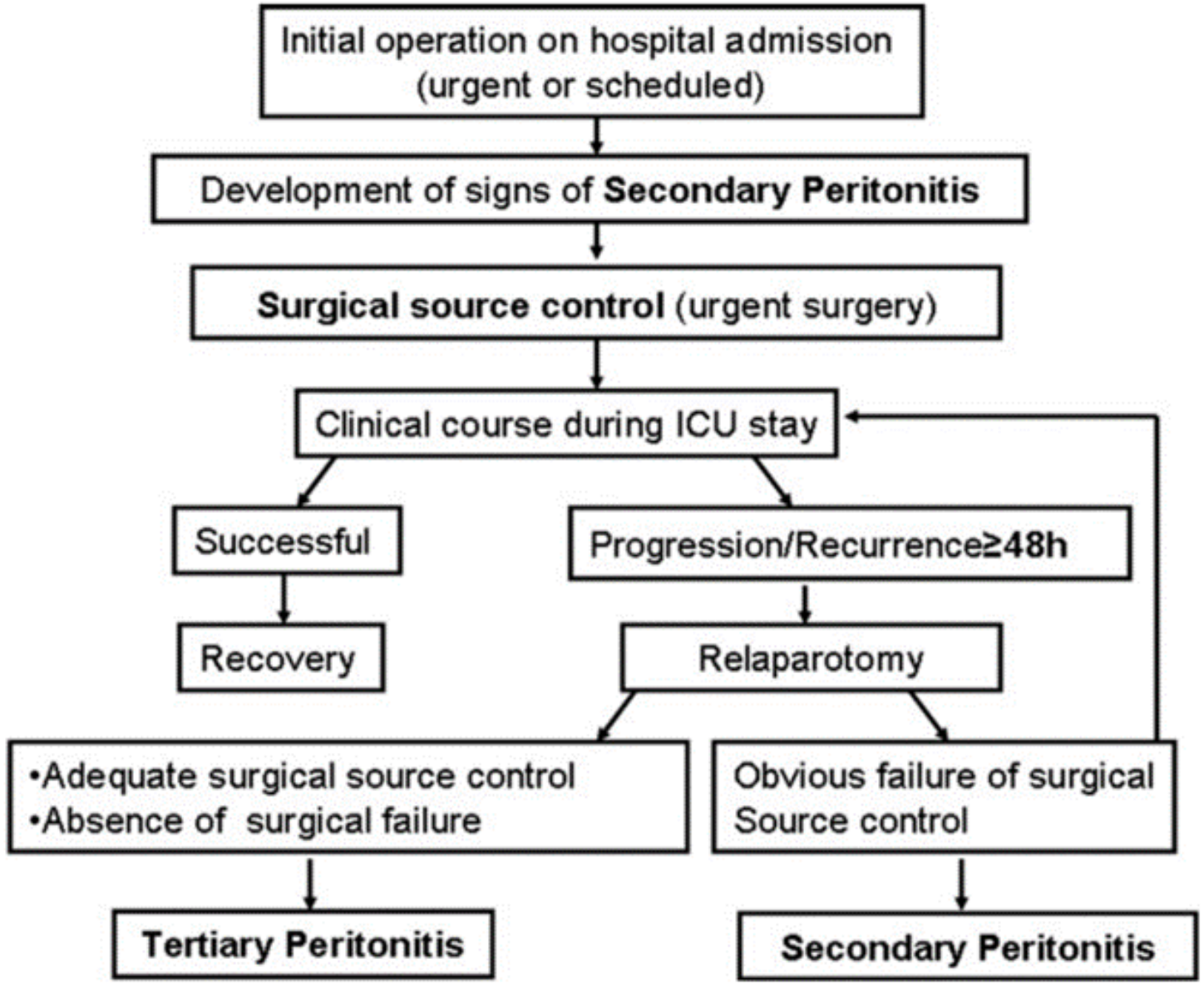
Persistent intra-abdominal inflammation and clinical signs of peritoneal irritation following secondary peritonitis from nosocomial pathogens.

The International Sepsis Forum Consensus Conference on Definitions of Infection in the Intensive Care Unit
Thierry Calandra et al. Crit Care Med 2005

VPM thứ cấp - Tertiary peritonitis

- Defined as intra-abdominal infection persisting >48 hours after adequate surgical source control and is characterized by prolonged systemic inflammation
- Death rate ranges from 30% to 60%
- Associated mostly with opportunistic and nosocomial pathogens, including multi-drug resistant (MDR) germs such as Enterococcus, Enterobacter, and Candida

The International Sepsis Forum Consensus Conference on Definitions of Infection in the Intensive Care Unit
Thierry Calandra et al. Crit Care Med 2005



Source: Josep Ballus et al. Factors Associated with the Development of Tertiary Peritonitis in Critically Ill Patients. SURGICAL INFECTIONS. 2017

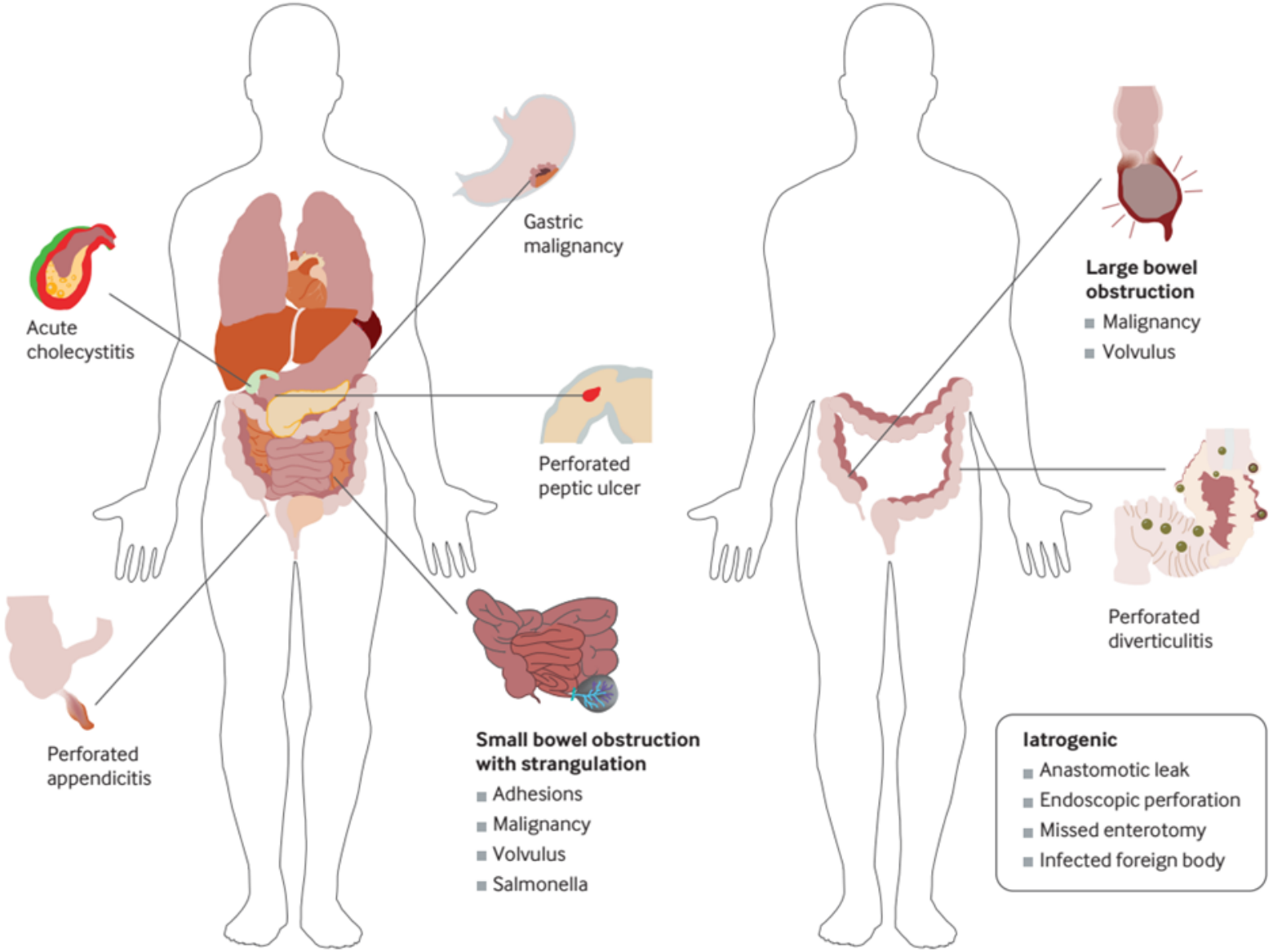


Fig 1 | Common etiologies of secondary peritonitis in adults

James T Ross et al. Secondary peritonitis: principles of diagnosis and intervention. BMJ 2018

Phúc mạc

JOHN C. HALL et al. The Pathobiology of Peritonitis . GASTROENTEROLOGY 1998

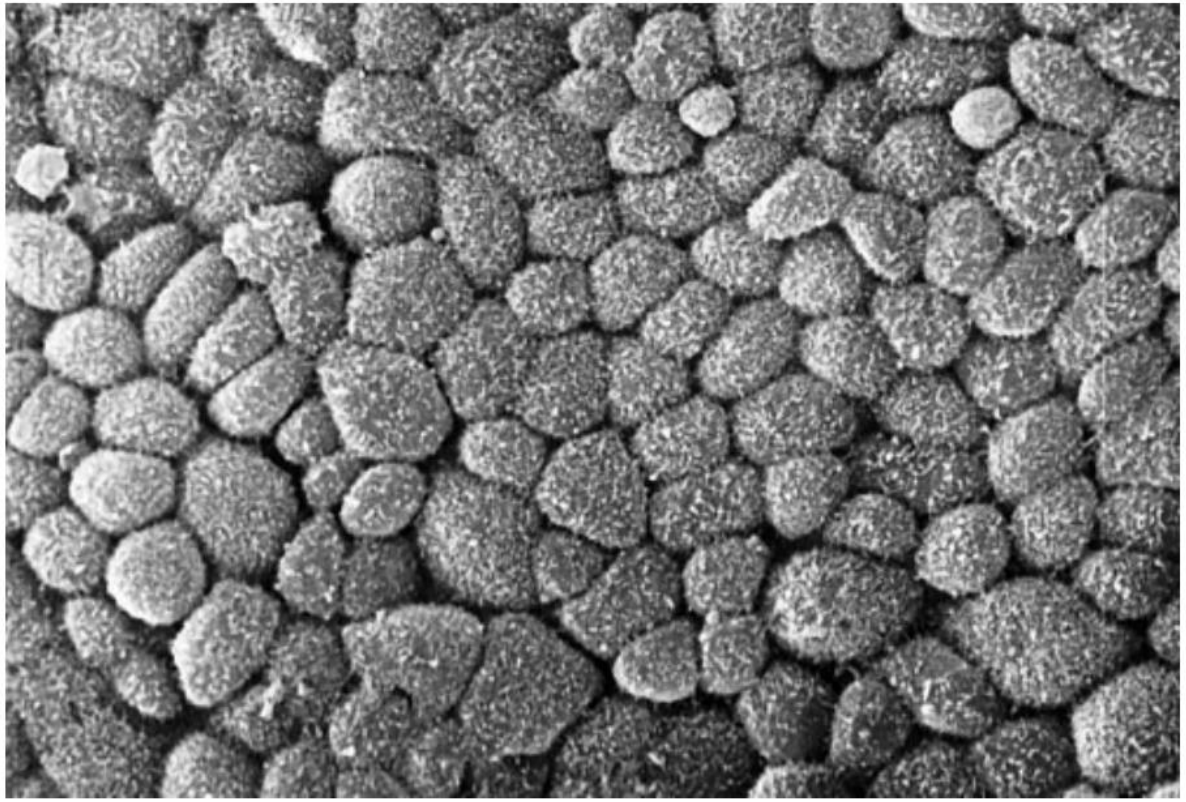


Figure 1. Scanning electron micrograph of murine visceral mesothelium. Note the polygonal periphery of the closely apposed mesothelial cells and the presence of many microvilli on their coelomic surface (original magnification 1500×). Courtesy of Dr. S. Mutsaers.

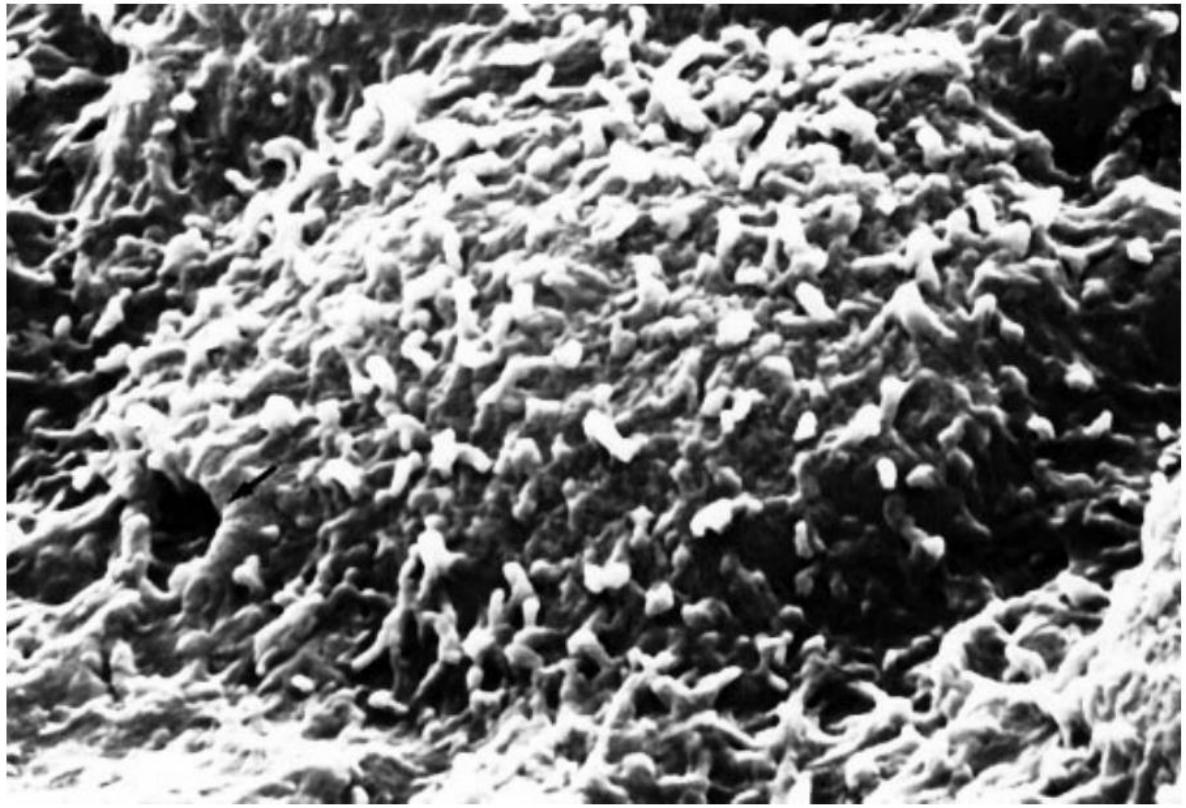


Figure 3. Scanning electron micrograph of a murine mesothelial cell and an adjacent stoma (*arrow*). Many microvilli can be seen on the surface of the mesothelial cells (original magnification 27,000×).

Local and systemic innate immune response to secondary human peritonitis

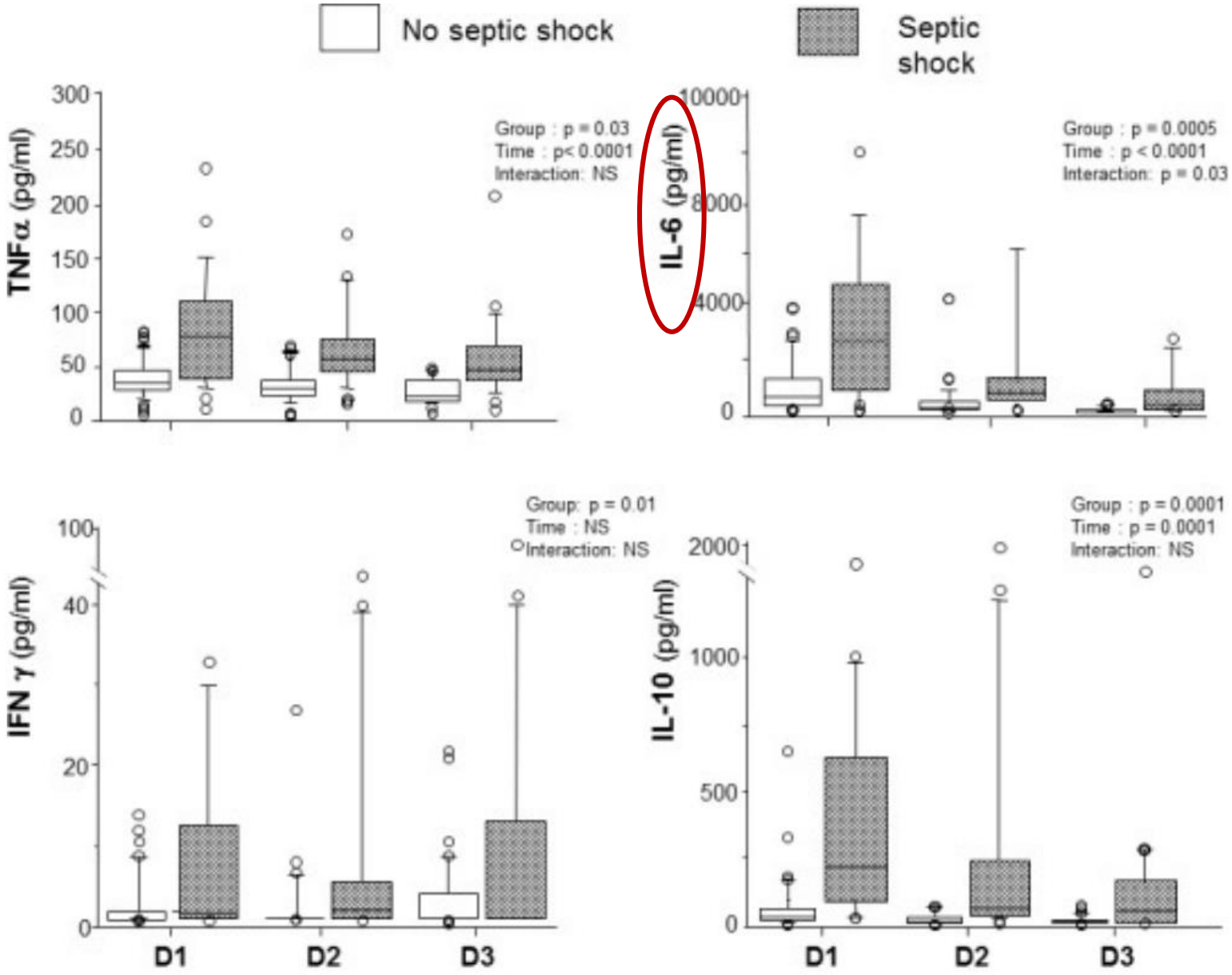
Florence Riché[1*], Etienne Gayat[1,2,5], Corinne Collet[3,5], Joaquim Matéo[1], Marie-Josèphe Laisné[1],

Table 2 Plasma and peritoneal fluid cytokines and peritoneal fluid/plasma ratio at Day 1 of peritonitis

	Plasma (pg/ml)	Peritoneal fluid (pg/ml)	Peritoneal/plasma ratio
IL-1	5 (5 to 8)	7,190 (1,180 to 22,670)	1,310 (145 to 3,888)
TNFα	40 (29 to 69)	262 (90 to 882)	158 (8 to 454)
IL-6	907 (289 to 2,389)	164,352 (22,859 to 328,410)	25 (3 to 75)
IFN γ	1 (1 to 3)	3 (1 to 9)	5 (2 to 21)
IL-10	43 (21 to 136)	1,135 (260 to 2,945)	25 (4 to 75)

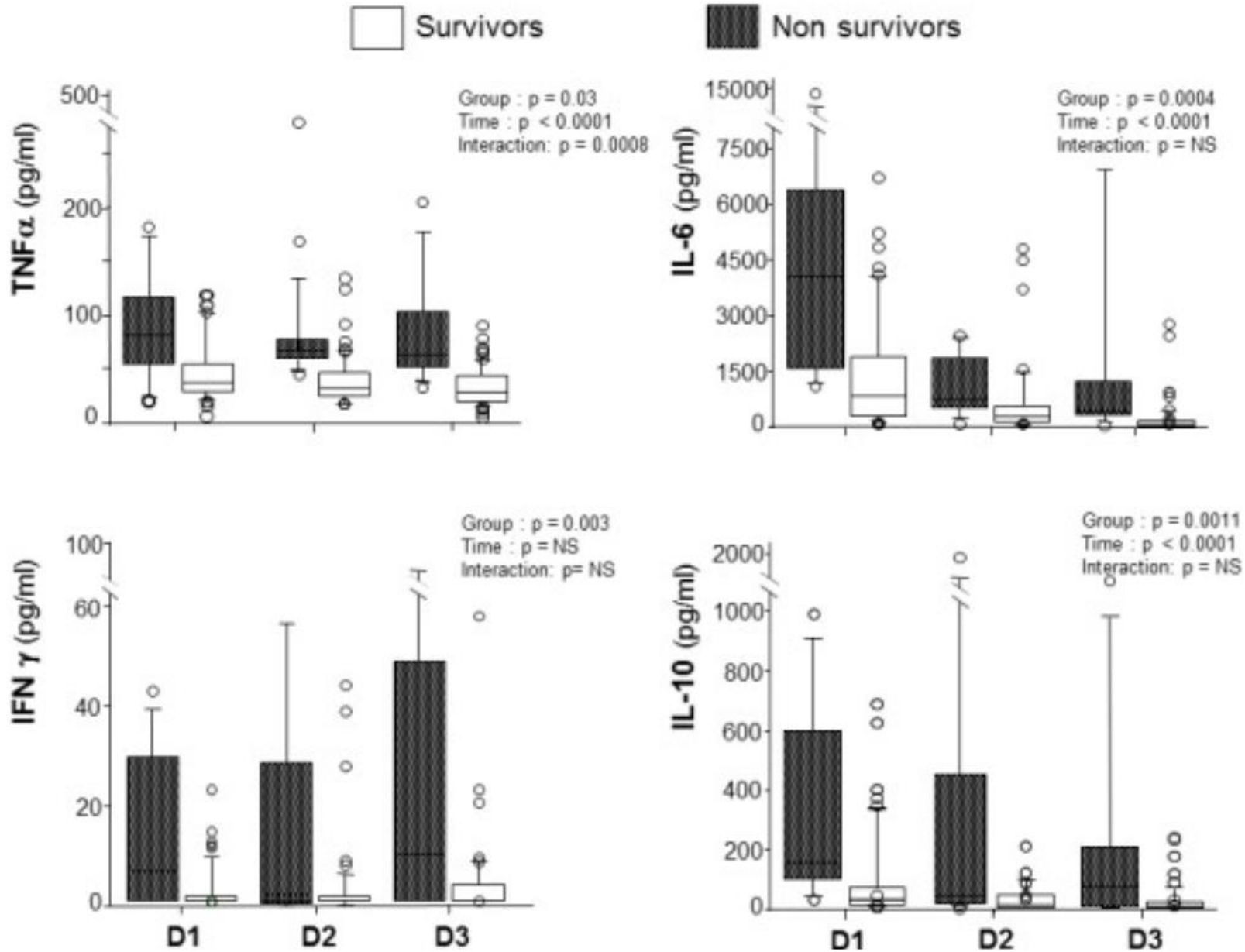
Values are expressed as median (25^{th} to 75^{th} percentiles).

Time course of plasma cytokines in patients with septic shock and no septic shock.



Riché *et al. Critical Care* 2013, **17**:R201

Time course of plasma cytokines in non-survivors and survivors.



Riché *et al. Critical Care* 2013, **17**:R201

Table 3 Plasma cytokines (pg/ml) at Day 1 according to peritoneal fluid culture

	Monomicrobial (number = 34)	Polymicrobial (number = 32)	*P* value
IL-1	5 (5 to 8)	5 (5 to 7)	0.19
TNFα	36 (26 to 52)	45 (31 to 100)	0.02
IL-6	630 (243 to 1,360)	1,500 (510 to 2,828)	0.51
IL-10	27 (5 to 67)	50 (30 to 210)	0.03
IFNγ	1 (1 to 2)	1 (1 to 3)	0.49

Table 4 Peritoneal fluid cytokines (pg/ml) at Day 1, according to peritoneal fluid culture

	Monomicrobial (number = 34)	Polymicrobial (number = 32)	*P* value
IL-1	8,194 (3,115 to 31,440)	4,400 (509 to 16,730)	0.09
TNFα	290 (89 to 1,185)	260 (93 to 695)	0.42
IL-6	72,390 (13,760 to 201,600)	236,800 (86,670 to 383,700)	0.02
IL-10	550 (243 to 4,246)	1,505 (320 to 2,610)	0.78
IFNγ	3 (1 to 23)	2 (1 to 7)	0.23

Table 3 Plasma cytokines (pg/ml) at Day 1 according to peritoneal fluid culture

	No anaerobes (number = 44)	Anaerobes (number = 12)	
IL-1	5 (5 to 8)	5 (5 to 8)	0.93
TNFα	38 (29 to 66)	50 (37 to 106)	0.017
IL-6	876 (300 to 1,846)	2,755 (456 to 4,550)	0.21
IL-10	40 (17 to 90)	197 (27 to 715)	0.0005
IFNγ	1 (1 to 2)	1 (1 to 13)	0.12

Table 4 Peritoneal fluid cytokines (pg/ml) at Day 1, according to peritoneal fluid culture

	No anaerobes (number = 44)	Anaerobes (n = 12)	
IL-1	4,682 (1,000 to 19,220)	26,000 (7,282 to 54,890)	0.04
TNFα	252 (95 to 851)	805 (88 to 1,009)	0.54
IL-6	164,400 (25,380 to 328,400)	156,800 (1,536 to 270,300)	0.44
IL-10	1,252 (386 to 2,785)	370 (167 to 4,380)	0.96
IFNγ	2 (1 to 6)	10 (5 to 28)	0.01

Tác nhân – The infecting flora

- Yếu tố ảnh hưởng: vị trí thủng, áp lực chọn lọc kháng sinh, chủng địa phương.
- Tác nhân thường gặp nhất: *Escherichia coli*.
- *Klebsiella* : 10%, *Pseudomonas* : 5% to 8% HAIs
- Đa vi khuẩn (polymicrobial)
- Candida

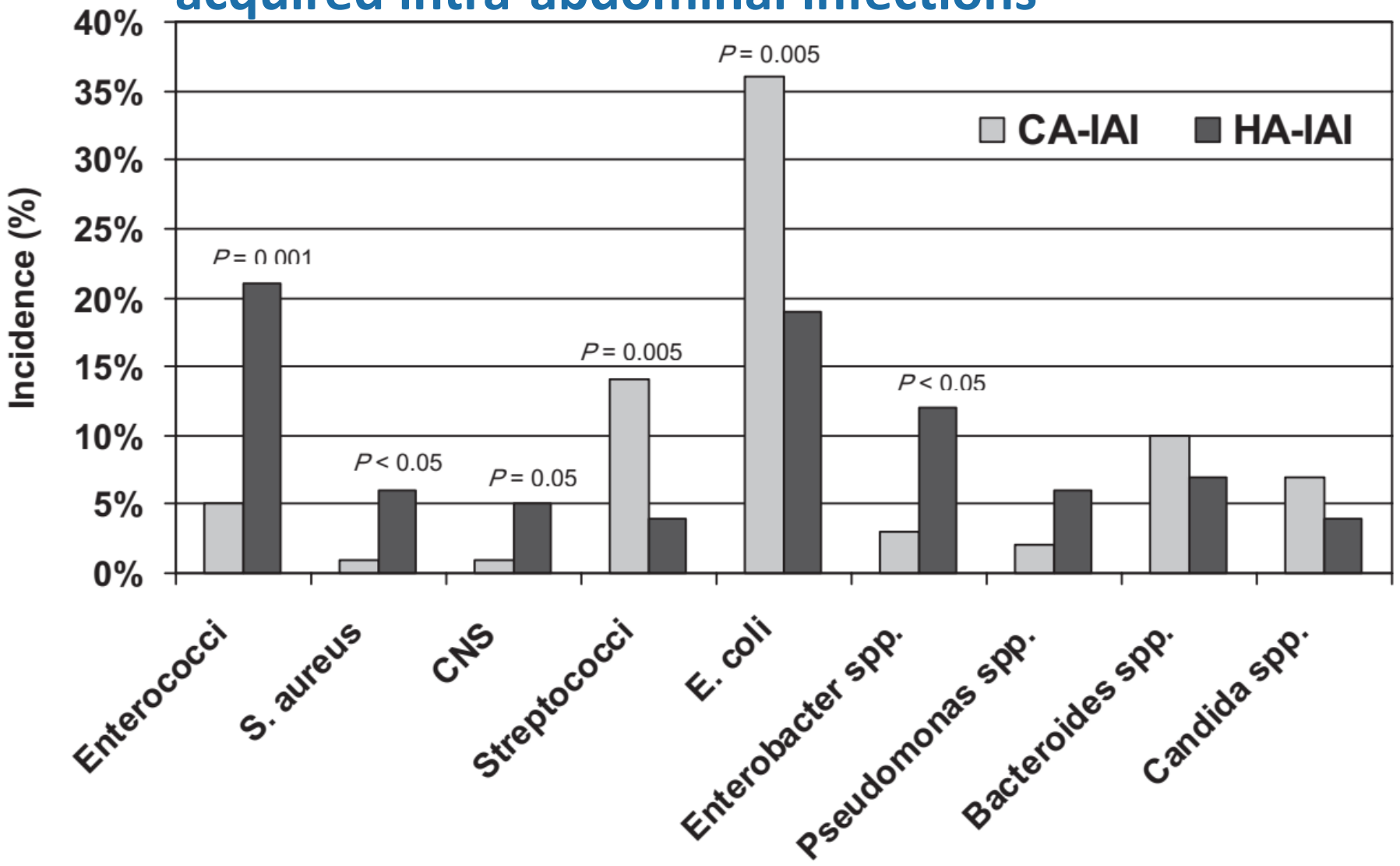
Table 8. Organisms Identified in 3 Randomized Prospective Trials of Investigational Antibiotics for Complicated Intra-abdominal Infection, including 1237 Microbiologically Confirmed Infections

Organism	Patients, % (n = 1237)
Facultative and aerobic gram-negative	
Escherichia coli	71
Klebsiella species	14
Pseudomonas aeruginosa	14
Proteus mirabilis	5
Enterobacter species	5
Anaerobic	
Bacteroides fragilis	35
Other *Bacteroides* species	71
Clostridium species	29
Prevotella species	12
Peptostreptococcus species	17
Fusobacterium species	9
Eubacterium species	17
Gram-positive aerobic cocci	
Streptococcus species	38
Enterococcus faecalis	12
Enterococcus faecium	3
Enterococcus species	8
Staphylococcus aureus	4

- \

Solomkin JS, et al. Ann Surg 2003
Solomkin JS et al, Ann Surg 2001
Solomkin JS et al, Ann Surg 1996

Microbiology of community-acquired versus healthcare-acquired intra-abdominal infections



Roehrborn A, et al: The microbiology of postoperative peritonitis. Clin Infect Dis 2001;33:1513–1519

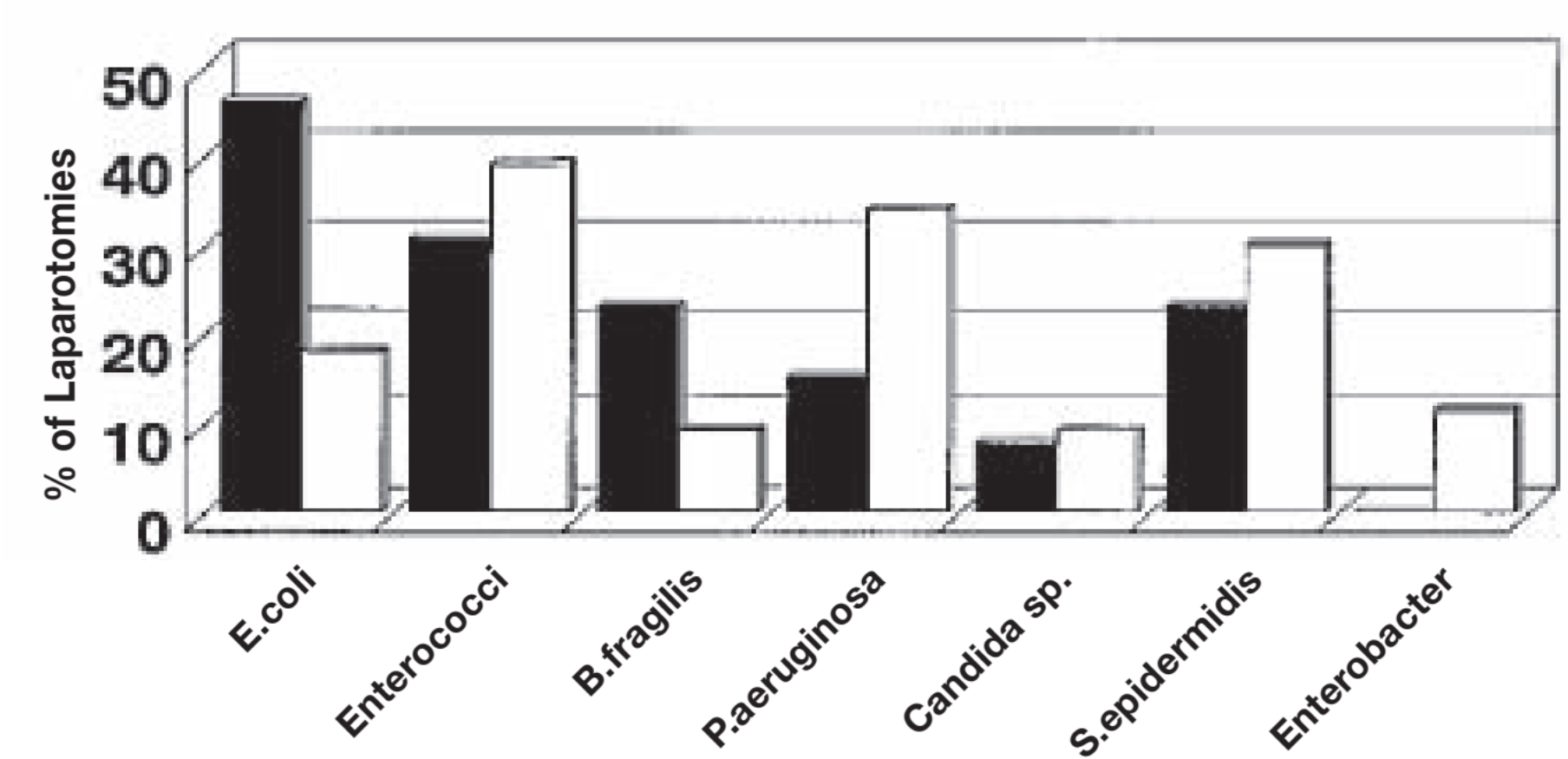


Fig. 2. Differences in the microbiology of secondary vs. tertiary peritonitis.

Nathens AB et al. Tertiary peritonitis: clinical features of a complex nosocomial infection. World J Surg 1998;22:158–163

International Journal of Antimicrobial Agents 49 (2017) 734–739

Epidemiology and trends in the antibiotic susceptibilities of Gram-negative bacilli isolated from patients with intra-abdominal infections in the Asia-Pacific region, 2010–2013

Ya-Ting Chang [a,b], Geoffrey Coombs [c], Thomas Ling [d], V. Balaji [e], Camilla Rodrigues [f], Hiroshige Mikamo [g], Min-Ja Kim [h], Datin Ganeswrie Rajasekaram [i], Myrna Mendoza [j], Thean Yen Tan [k], Pattarachai Kiratisin [l], Yuxing Ni [m], Weinman Barry [n], Yingchun Xu [o], Yen-Hsu Chen [a,b,p,*], Po-Ren Hsueh [q,**]

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[e] *Christian Medical College, Vellore, India*
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[h] *Korea University Anam Hospital, Seoul, South Korea*
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[j] *Philippine General Hospital, Manila, Philippines*
[k] *Changi General Hospital, Singapore*
[l] *Siriraj Hospital, Bangkok-Noi, Thailand*
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[n] *Merck Sharp & Dohme, Kenilworth, NJ, USA*
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The Study for Monitoring Antimicrobial Resistance Trends (SMART) with Intra-Abdominal Sepsis in Asian Pacific Region 2010-2013

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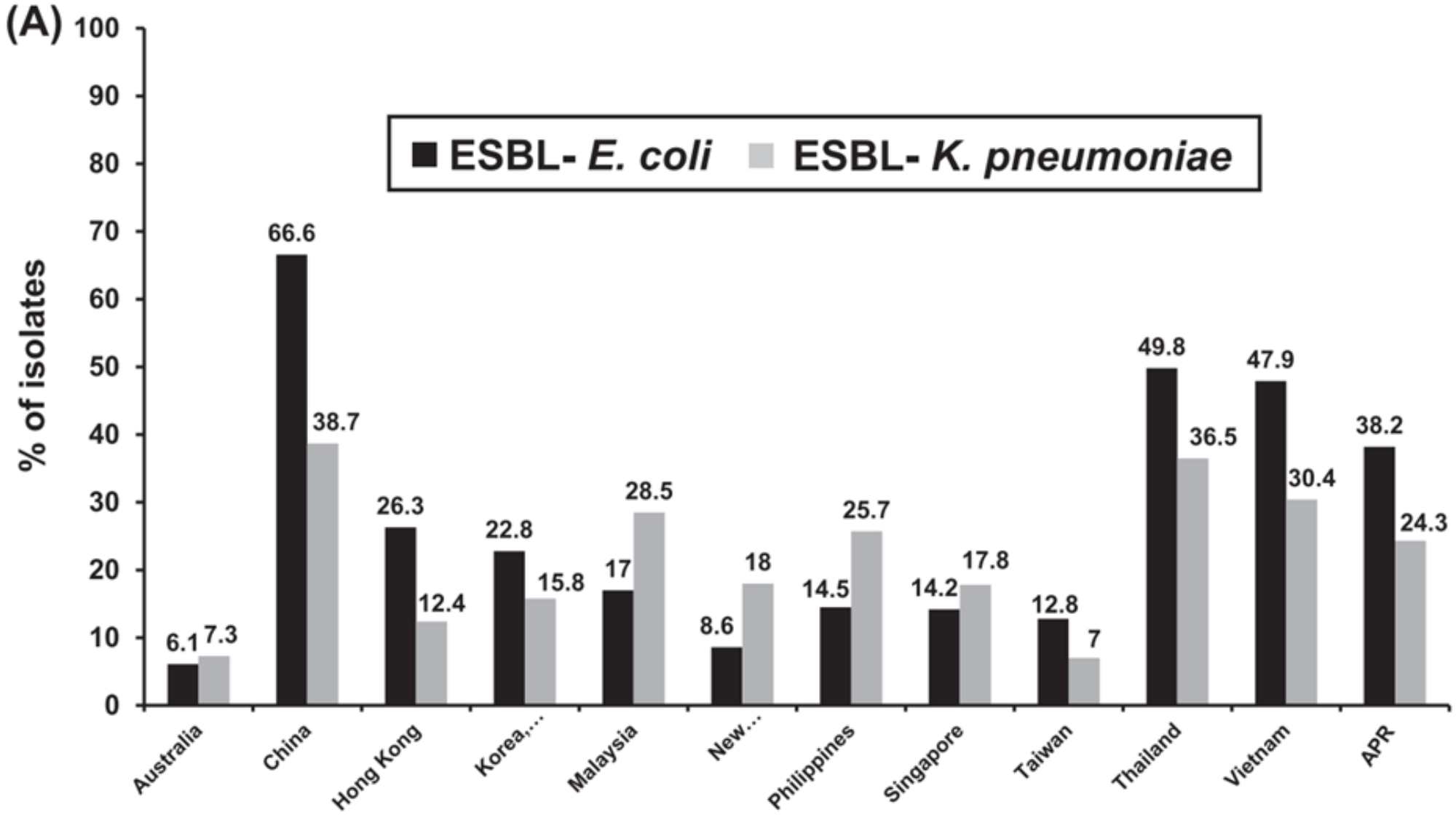

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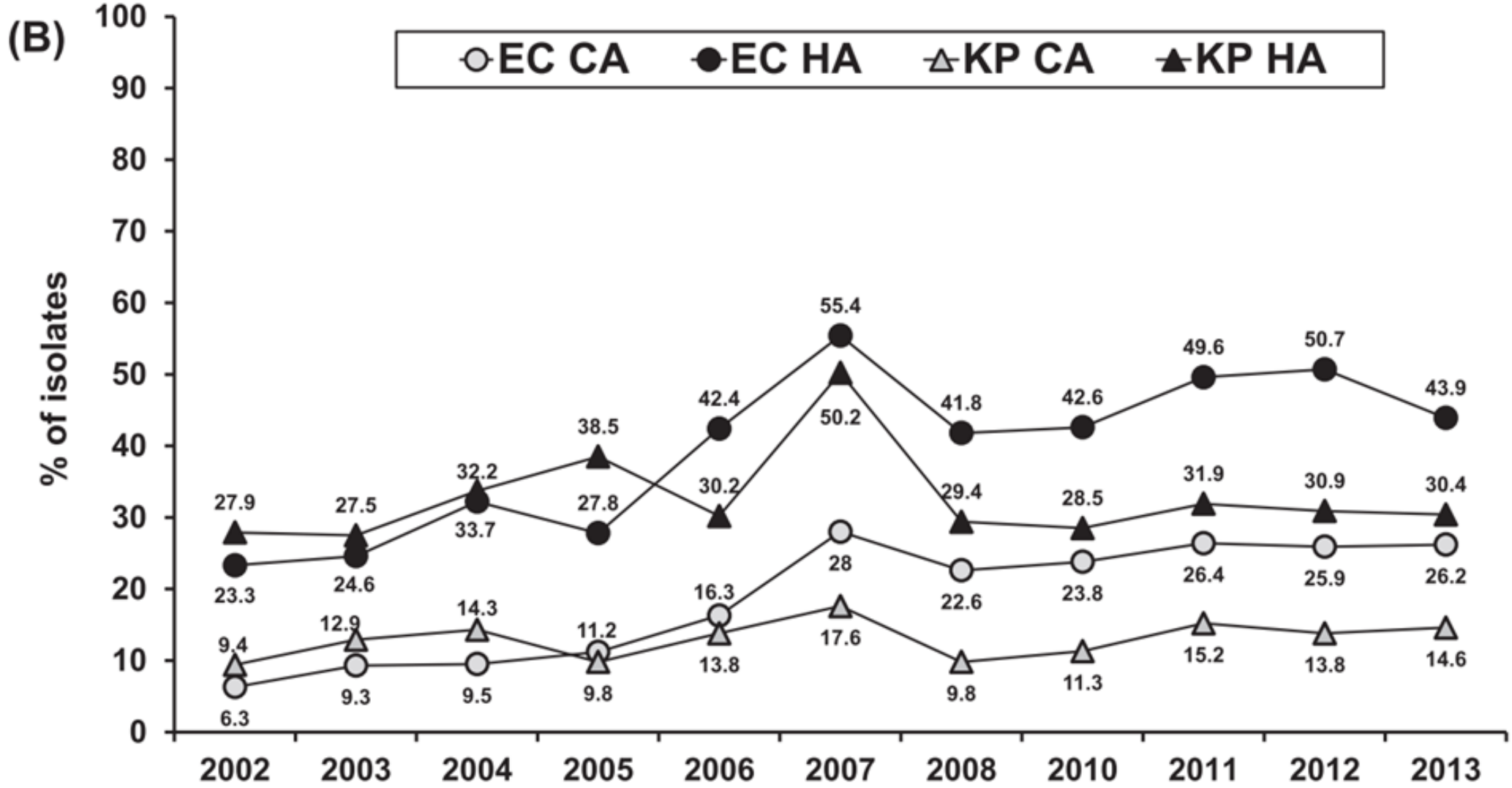


The Study for Monitoring Antimicrobial Resistance Trends (SMART) with Intra-Abdominal Sepsis in Asian Pacific Region 2010-2013

Table 1
In vitro susceptibility rates (% susceptible[a]) of common organisms isolated from community-associated (CA) and hospital-associated (HA) intra-abdominal infections (IAIs) in the Asia-Pacific region[b]

Micro-organism	Type of IAI (no. of isolates)	SAM	AMK	CRO	CAZ	CTX	FOX	FEP	ETP	IPM	LVX	CIP	TZP
Escherichia coli, ESBL-negative	CA (2363)	47.9	99.3	91.5	91.7	90.7	89.3	99.0	99.7	99.7	79.7	77.2	96.2
	HA (2514)	42.2*	98.6*	86.7*	87.7*	86.9*	82.9*	97.8*	99.0*	99.2*	69.5*	66.1*	92.7*
E. coli, ESBL-positive	CA (815)	12.9	92.9	1.5	29.6	0.9	74.5	8.3	96.7	99.1	27.6	23.6	90.9
	HA (2223)	8.3*	91.8	0.9	28.4	0.5*	67.8*	7.6	95.6	98.7	21.5*	18.9*	87.0
Klebsiella pneumoniae, ESBL-negative	CA (1028)	82.8	99.1	95.5	95.5	95.2	91.3	98.7	98.1	98.7	94.3	92.1	95.8
	HA (1479)	78.5*	99.3	93.4*	94.9	94.5	89	98.0	98.0	98.4	93.8	89.2*	95.5
K. pneumoniae, ESBL-positive	CA (165)	3.6	86.1	3.0	22.4	5.5	70.4	13.9	87.3	92.7	58.8	35.8	64.2
	HA (651)	2.9	85.1	3.1	25.7	2.3*	70.4	15.2	85.3	90.8	53.5	33.2	62.2
Klebsiella oxytoca, ESBL-negative	CA (116)	78.4	100.0	96.6	94.8	96.6	92.9	99.1	100.0	100.0	94.0	94.0	98.3
	HA (147)	63.3*	100.0	84.4*	95.9	93.2	93.4	99.3	100.0	98.6	95.2	93.9	86.4*
K. oxytoca, ESBL-positive	CA (11)	0.0	100.0	18.2	54.5	9.1	66.7	63.6	100.0	100.0	81.8	63.6	72.7
	HA (45)	2.2	88.9	6.7	35.6	2.2	75	26.7*	97.8	97.8	57.8	51.1	75.6
Proteus mirabilis, ESBL-negative	CA (145)	82.8	97.2	93.8	96.6	95.2	94.4	97.9	100.0	31.7	91.0	84.8	97.9
	HA (179)	78.2	98.9	93.3	97.8	95.5	98.4	97.8	93.3*	37.4	87.7	77.1	98.9
P. mirabilis, ESBL-positive	CA (11)	45.5	81.8	36.4	63.6	45.5	85.7	63.6	100.0	45.5	72.7	45.5	90.9
	HA (57)	14.0*	89.5	7.0*	86.0	7.0*	85.4	26.3*	96.5	14.0*	33.3*	22.8	89.5
Citrobacter freundii	CA (98)	50.0	96.9	61.2	70.4	65.3	17.1	93.9	96.9	89.8	91.8	89.8	85.7
	HA (201)	30.3*	100.0*	39.3*	43.8*	39.3*	8.2	83.1*	96.0	93.0	81.1*	76.6*	70.6*
Enterobacter cloacae	CA (255)	24.7	99.2	54.9	64.7	59.6	5.7	85.1	86.3	89.8	94.1	88.2	74.5
	HA (605)	13.4*	95.0**	38.7*	46.9*	39.3*	4.8	72.7*	76.5*	91.4	83.6*	77.9*	63.5*
Enterobacter aerogenes	CA (87)	33.3	98.9	58.6	65.5	59.8	15.6	94.3	95.4	87.4	90.8	90.8	78.2
	HA (193)	18.7*	99.0	42.0*	47.7*	44.0*	6.2*	85.0*	89.1	78.2	88.1	82.4	65.8*
Morganella morganii	CA (69)	4.3	94.2	82.6	76.8	60.9	81.8	97.1	100.0	18.8	84.1	72.5	95.7
	HA (146)	2.7	95.9	77.4	69.9	55.5	84.8	91.1	97.3	21.9	84.2	73.3	95.2
Serratia marcescens	CA (65)	7.7	96.9	81.5	92.3	78.5	26	90.8	95.4	81.5	95.4	92.3	90.8
	HA (110)	4.5	97.3	67.3*	84.5	57.3*	18.9	88.2	90.9	79.1	90.0	78.2*	78.2*
Pseudomonas aeruginosa	CA (488)		91.0		84.0		N/A	81.8		82.0	81.1	81.1	83.8
	HA (1178)		89.4		73.9*		N/A	72.3*		72.9*	74.8*	75.6*	74.1*
ACB complex	CA (130)	31.7	44.6	20.2	31.7	23.1	N/A	26		41.5	37.7	34.6	33.7
	HA (560)	25	30.9*	19.8	22.3*	16.7	N/A	18.9*		27.9*	23.8*	21.3*	22.1*

SAM, ampicillin/sulbactam; AMK, amikacin; CRO, ceftriaxone; CAZ, ceftazidime; CTX, cefotaxime; FOX, cefoxitin; FEP, cefepime; ETP, ertapenem; IPM, imipenem; LVX, levofloxacin; CIP, ciprofloxacin; TZP, piperacillin/tazobactam; ESBL, extended-spectrum β-lactamase; N/A, data are not available; ACB, *Acinetobacter calcoaceticus–baumannii* complex.

Viêm phúc mạc thứ phát hậu phẫu

The Microbiology of Postoperative Peritonitis

A. Roehrborn,[1] L. Thomas,[2] O. Potreck,[4] C. Ebener,[5] C. Ohmann,[1,3] P. E. Goretzki,[1] and H. D. Röher[1]

[1]Department of General and Trauma Surgery, [2]Institute of Medical Microbiology and Virology, and [3]Coordination Center for Clinical Trials, Heinrich Heine University, Düsseldorf; [4]Lukas Krankenhaus, Department of General Surgery, Neuss; and [5]Department of Surgery, University of Regensburg, Regensburg, Germany

Table 1. Bacteriology of postoperative versus community-acquired peritonitis.

Strain	No. (%) of isolates of Postoperative peritonitis (n = 111)	No. (%) of isolates of Community-acquired peritonitis (n = 118)	P
Enterococci	23 (21)	6 (5)	.001
Escherichia coli	21 (19)	42 (36)	.005
Enterobacter species	13 (12)	4 (3)	<.05
Bacteroides species	8 (7)	12 (10)	
Klebsiella species	8 (7)	8 (7)	
Staphylococcus aureus	7 (6)	1 (1)	<.05
Coagulase-negative staphylococci	6 (5)	1 (1)	.05
Candida species	4 (4)	8 (7)	
Pseudomonas species	7 (6)	2 (2)	
Streptococci	4 (4)	17 (14)	.005
Hemolyzing streptococci		4 (3)	
Other	10 (9)	13 (11)	
Total	111	118	

Clinical Infectious Diseases 2001;33:1513–9

Table 2. Bacteriologic findings at relaparotomy in survivors and nonsurvivors of postoperative peritonitis.

Strain	No. (%) of isolates recovered from		
	Survivors (n = 58 isolates)	Nonsurvivors (n = 53 isolates)	P
Enterococci	10 (17)	13 (25)	
Escherichia coli	16 (28)	5 (9)	<.05
Enterobacter species	3 (5)	10 (19)	<.05
Bacteroides species	4 (7)	4 (8)	
Klebsiella species	4 (7)	4 (8)	
Staphylococcus aureus	3 (5)	4 (8)	
Coagulase-negative staphylococci	4 (7)	2 (4)	
Candida species	1 (2)	3 (6)	
Pseudomonas species	6 (10)	1 (2)	
Streptococci	1 (2)	3 (6)	
Other	6 (10)	4 (8)	
Total	58	53	

Table 3. Bacteria obtained by culture after interval antibiotics and without pretreatment among patients with postoperative peritonitis.

Strain	No. (%) of isolates recovered from patients who received: No interval antibiotics ($n = 36$)	Interval antibiotics ($n = 75$)	P
Escherichia coli	13 (36)	8 (11)	.005
Enterococci	5 (14)	18 (24)	
Enterobacter species	4 (11)	9 (12)	
Coagulase-negative staphylococci	0 (0)	6 (8)	
Other	14 (39)	34 (45)	
Total	36	75	

Thang điểm tiên lượng

- Disease-independent scores: APACHE II, SOFA or Simplified Acute Physiology Score (SAPS II)
- Peritonitis-specific scores: MPI.

Mannhem Severity Index

Risk Factor	Weighting if present
Age >50 years	5
Female sex	5
Organ failure	7
Malignancy	4
Preoperative duration of peritonitis >24 h	4
Origin of sepsis not colonic	4
Diffuse generalized peritonitis	6
Exudate	
Clear	0
Cloudy, Purulent	6
Fecal	12

Definitions of Organ Failure

Kidney	Creatinine level >177 umol/L
	Urea level >167 mmol/L
	Oliguria <20 ml/h
Lung	PO_2 <50 mmHg
	PCO_2 >50 mmHg
Shock	Hypodynamic or Hyperdynamic
Intestinal obstruction	Paralysis >24h or complete mechanical obstruction

British Journal of Surgery 1994, 81, 209–213

Prediction of outcome using the Mannheim peritonitis index in 2003 patients

A. BILLING, D. FRÖHLICH, F.W. SCHILDBERG and the Peritonitis Study Group

Chirurgische Klinik, Klinikum Großhadern, Ludwig-Maximilians-Universität München, Germany
Correspondence to: Dr A. Billing, Chirurgische Klinik und Poliklinik, Ludwig-Maximilians-Universität München, Klinikum Großhadern, D-8000 München 70, Germany

- Reliability of MPI in 2003 patients from 7 centres in Europe.
- Threshold index score of 26, the sensitivity was 86%, specificity 74% and accuracy 83% in predicting death.
- Score less than 21: the mean mortality rate was 2-3%,
- Score 21-29: 22.5%
- Score greater than 29: 59%

The WISS study (WSES cIAIs Score Study) 2015

Table 5 WSES sepsis severity score for patients with complicated Intra-abdominal infections (Range: 0–18)

Clinical condition at the admission	
• Severe sepsis (acute organ dysfunction) at the admission	3 score
• Septic shock (acute circulatory failure characterized by persistent arterial hypotension. It always requires vasopressor agents) at the admission	5 score
Setting of acquisition	
• Healthcare associated infection	2 score
Origin of the IAIs	
• Colonic non-diverticular perforation peritonitis	2 score
• Small bowel perforation peritonitis	3 score
• Diverticular diffuse peritonitis	2 score
• Post-operative diffuse peritonitis	2 score
Delay in source control	
• Delayed initial intervention [Preoperative duration of peritonitis (localized or diffuse) > 24 h)]	3 score
Risk factors	
• Age>70	2 score
• Immunosuppression (chronic glucocorticoids, immunosuppresant agents, chemotherapy, lymphatic diseases, virus)	3 score

- **WSES Sepsis Severity Score.**
- Score 0-3, TLTV 0.63 %
- 6.3 % for those who had a score of 4–6
- 41.7 % for those who had a score of ≥ 7
- score of ≥ 9 the mortality rate was 55.5 %
- Score of ≥ 11 the mortality rate was 68.2 %
- Score ≥ 13 the mortality rate was 80.9 %.
- ROC/AUC: cutoff point for predicting mortality was a Sepsis Severity Score of 5.5, sensitivity of 89.2 %, a specificity of 83.5 %

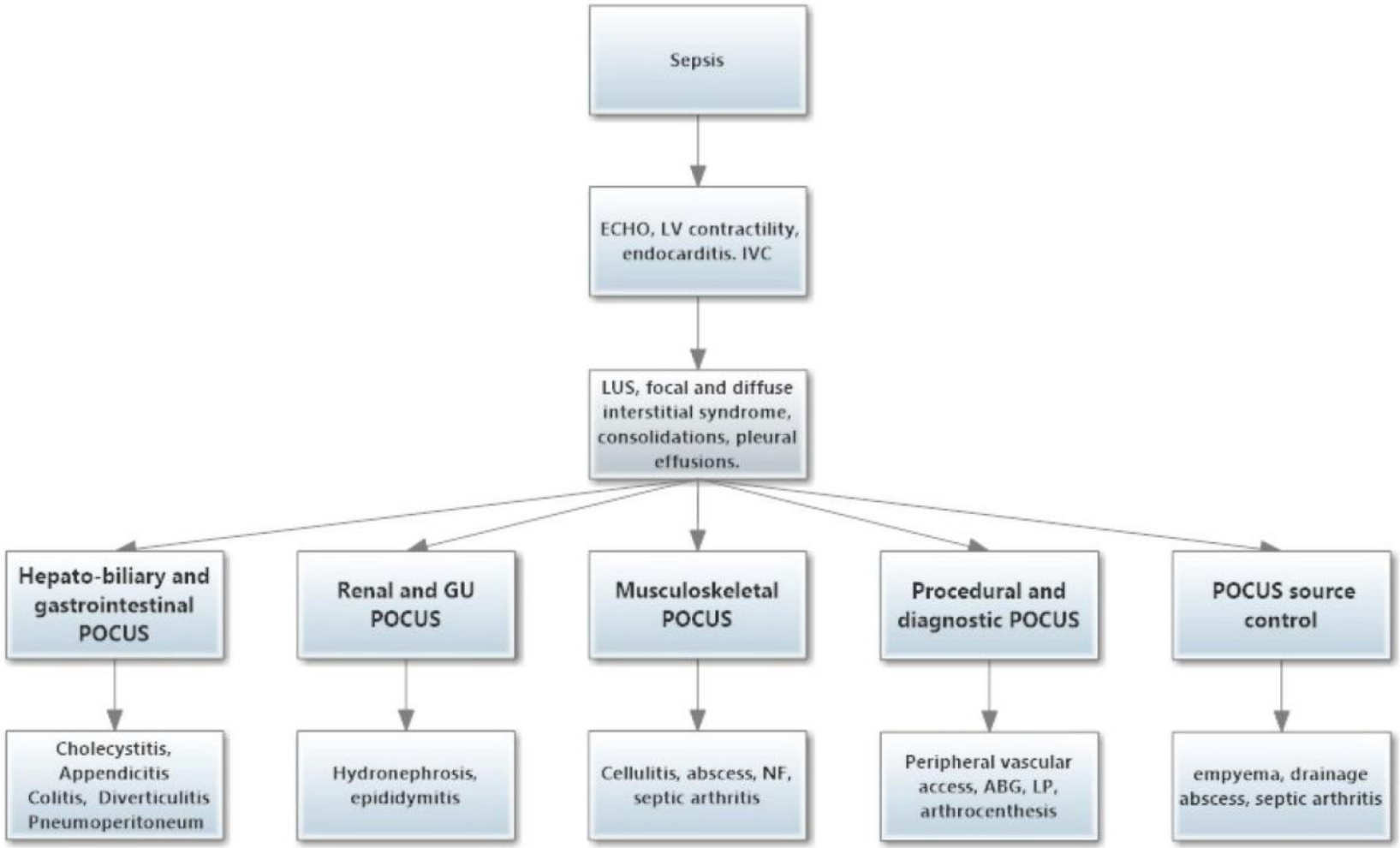
VPM thứ phát - Xử trí

The cornerstones of effective treatment of IAIs are:

- Early recognition
- Adequate source control
- Appropriate antimicrobial therapy
- Prompt resuscitation

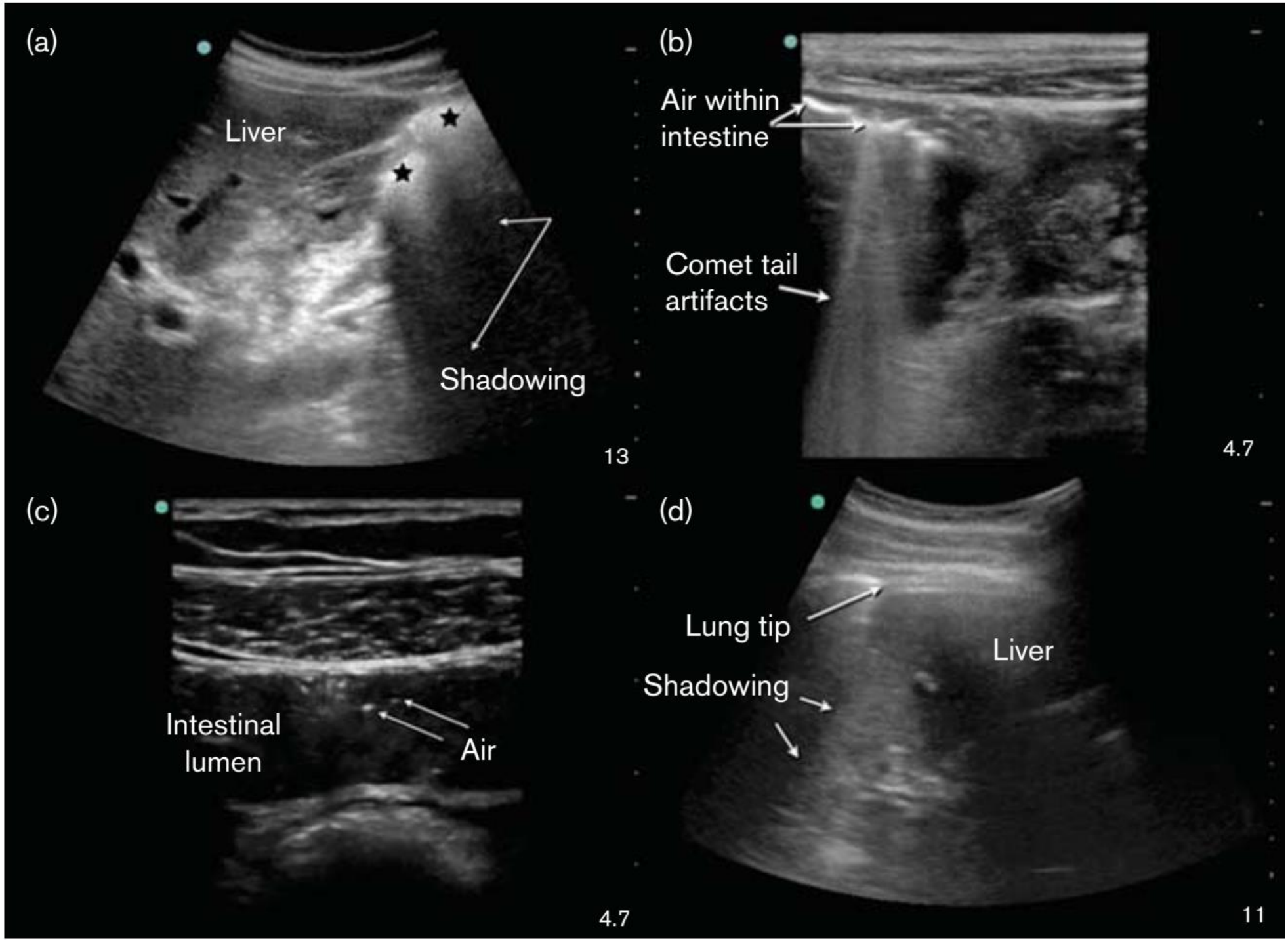
Viêm phúc mạc thứ phát - Chẩn đoán

Bedside ultrasound



Suggested approach using point-of-care-ultrasound (POCUS) in the emergency department to patients presenting with sepsis.

Alonso JV et al. Protocols for Point-of-Care-Ultrasound (POCUS) in a Patient with Sepsis; An Algorithmic Approach. Bull Emerg Trauma. 2019;7(1):67-71.



Hoffman et al. European Journal of Emergency Medicine 2012

Hơi “không bình thường” trong ổ bụng

- Extraluminal

  Free air intra-abdominal or retroperitoneal

  - Intraluminal

    Air in preformed cavities or vessels

  - Intraparenchymal

    Air in tissue or parenchyma

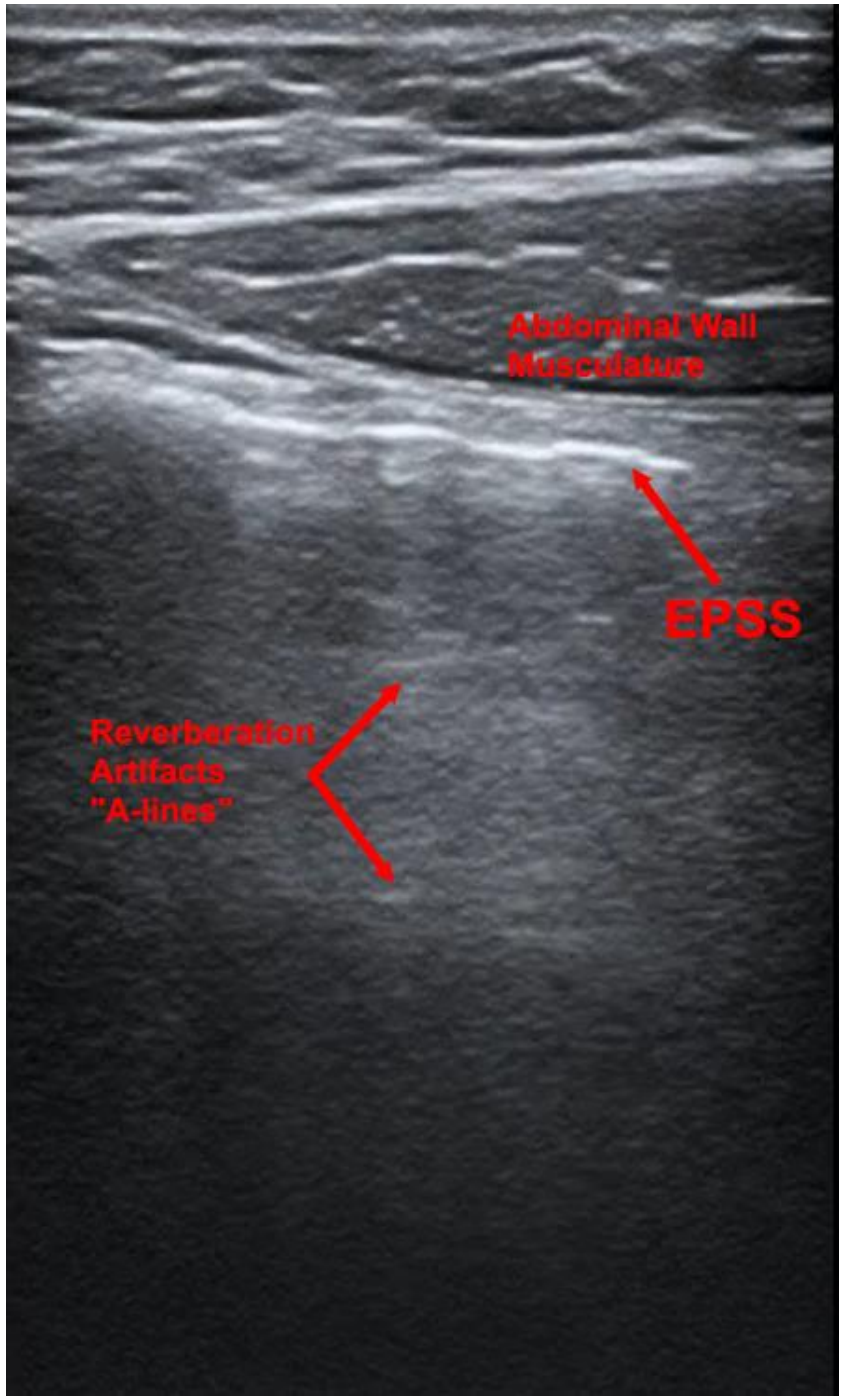
  - Intramural air

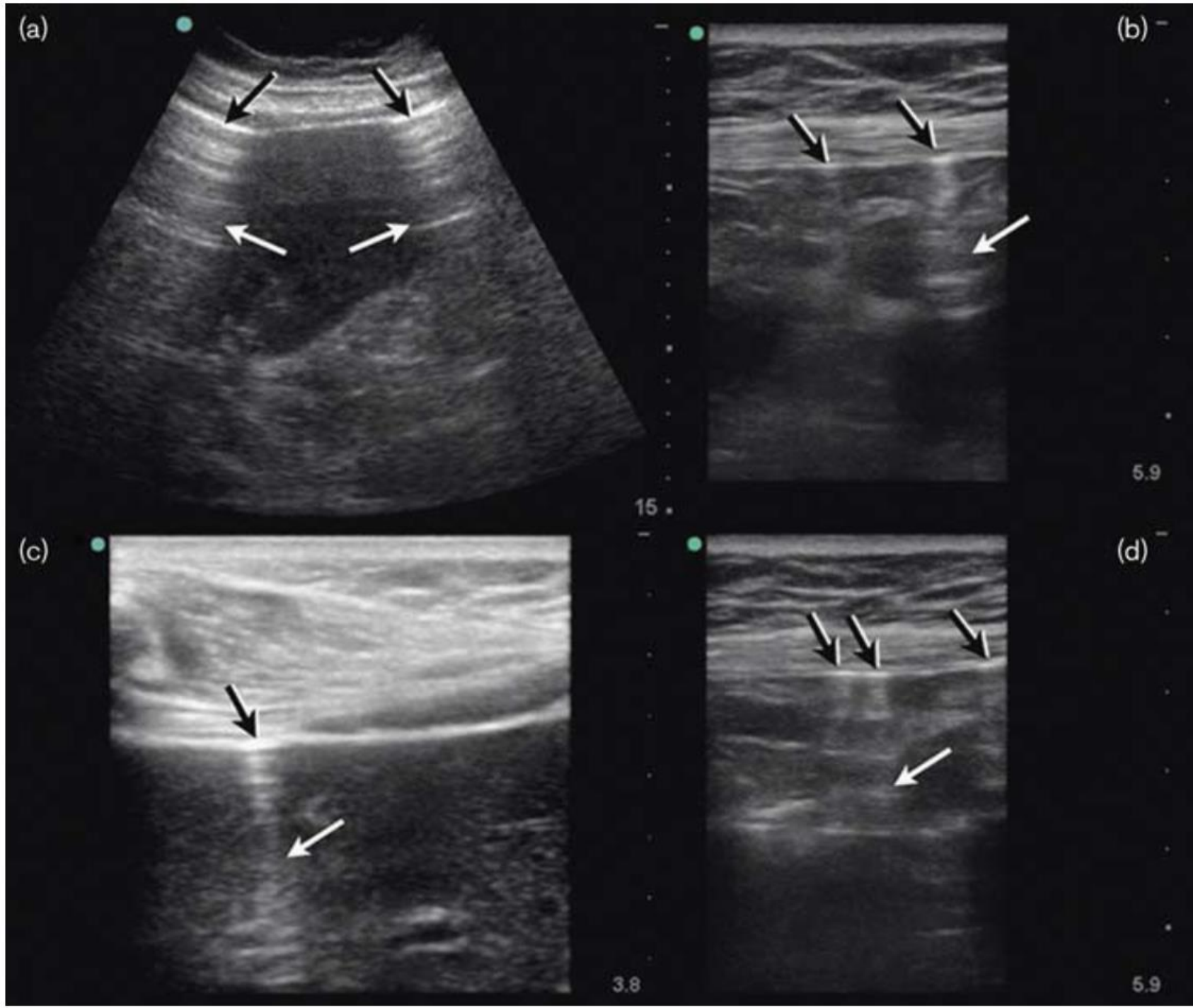
Hơi tự do trong ổ bụng

POCUS: độ nhạy 92%, độ đặc hiệu 53% cho chẩn đoán hơi tự do trong ổ bụng,

The air within the peritoneal space rises and causes an **enhanced peritoneal stripe sign (EPSS):** Muradali et al, 1999.

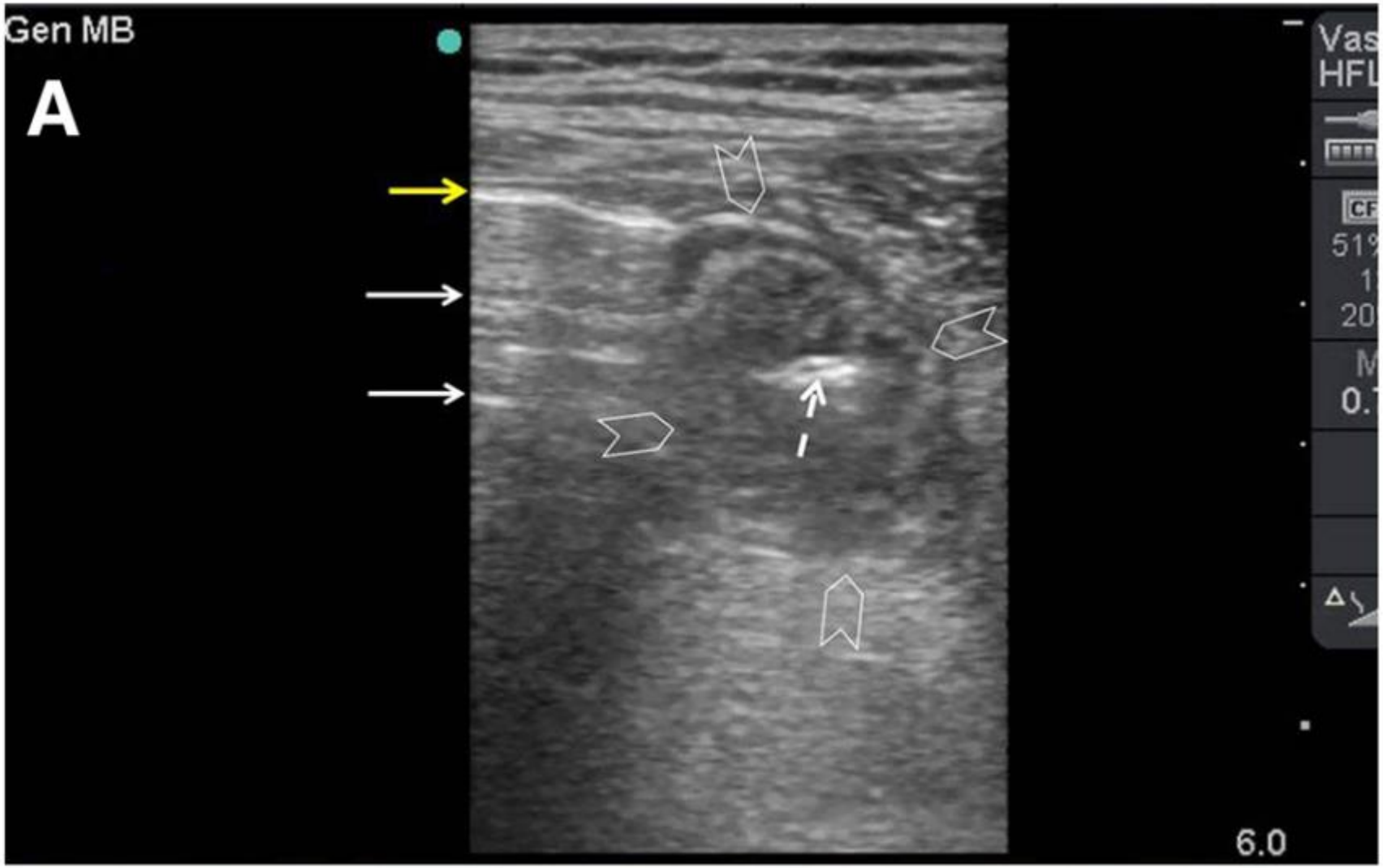
Indiran V et al. (2018). Enhanced peritoneal stripe sign. Abdominal Radiology, 43, 3518-3519.



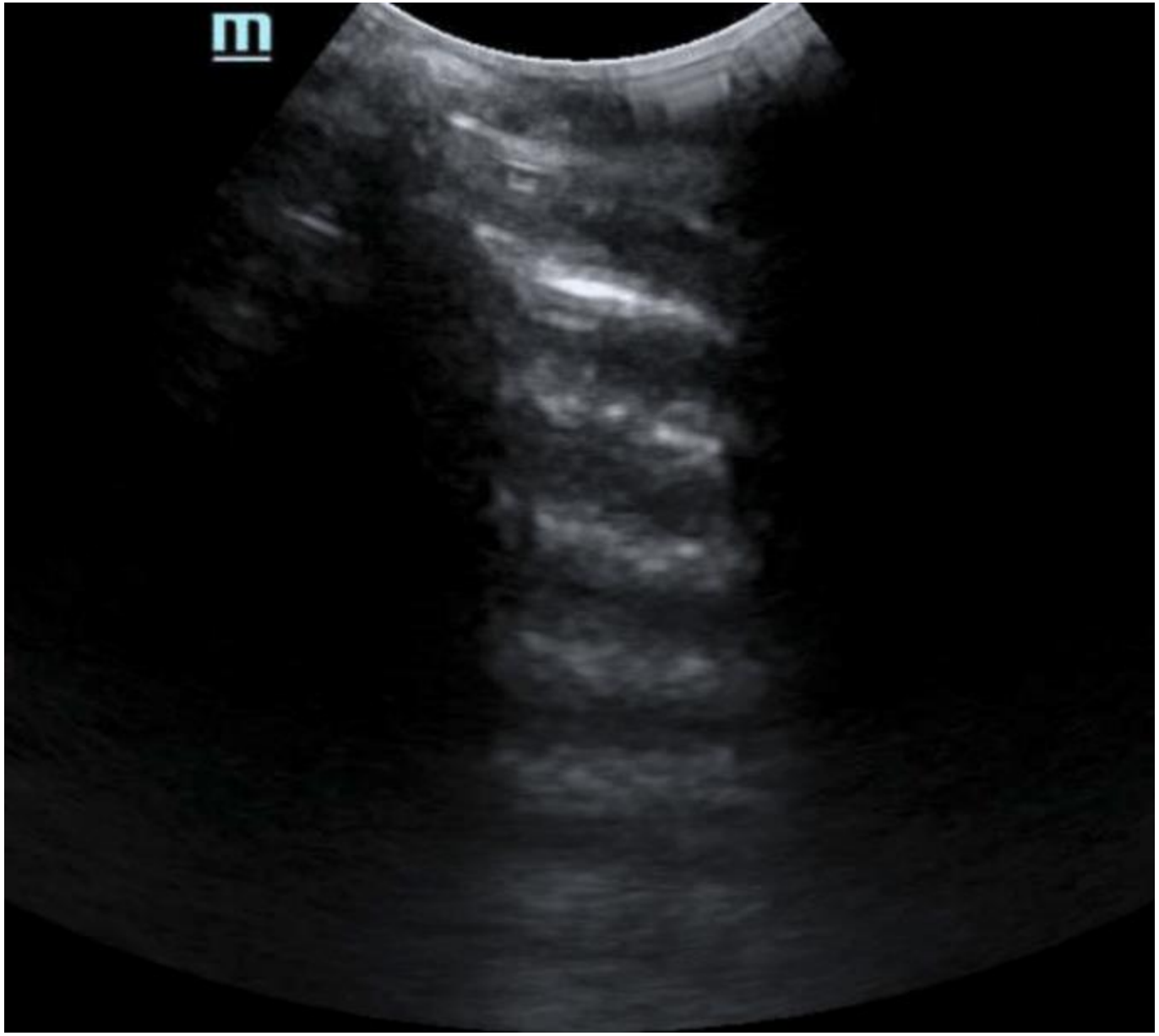


Enhanced Peritoneal Stripe Sign (EPSS)

Hoffman et al. European Journal of Emergency Medicine 2012

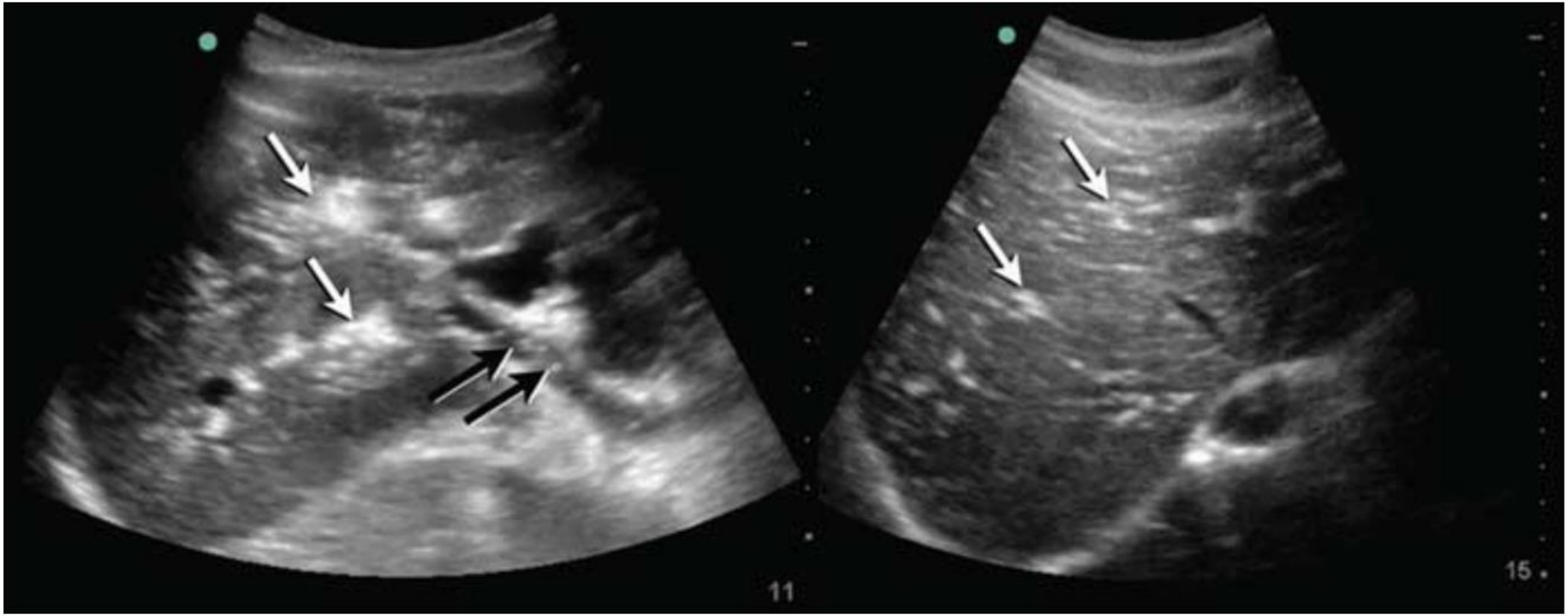

Gen MB
A
6.0

- **“Đường A trong ổ bụng”**



http://www.emdocs.net/us-probe-ultrasound-for-diagnosis-of-pneumoperitoneum/

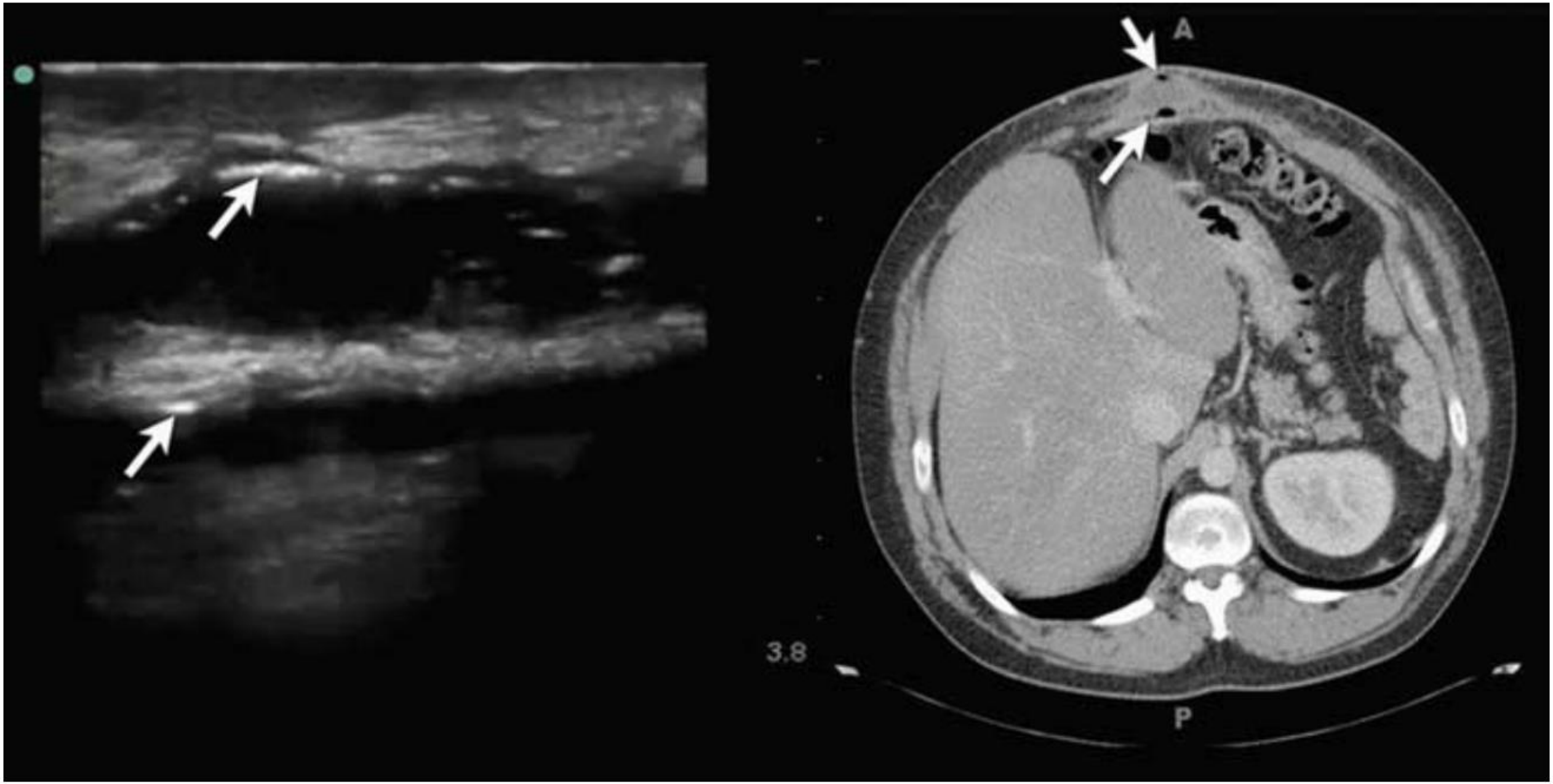
Hoffman et al. European Journal of Emergency Medicine 2012



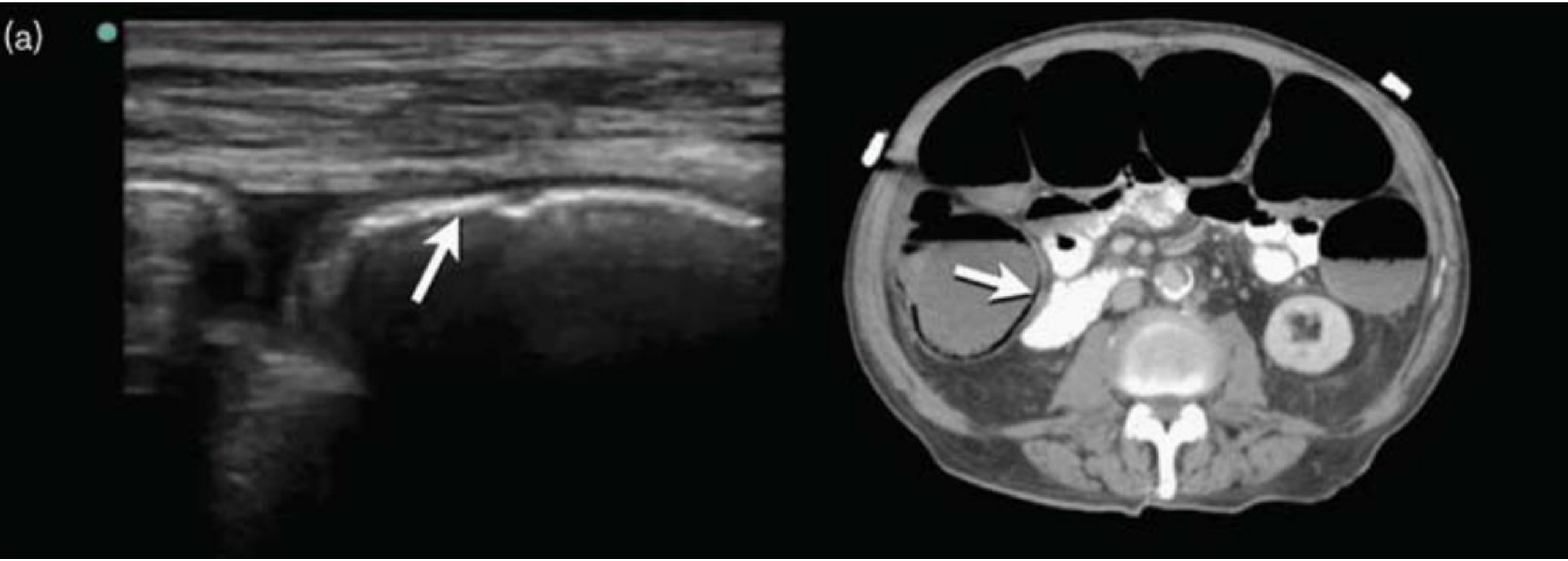
Air bubbles detected within the portal vein (black arrows) and accumulating in smaller portal vessels (white arrows). The patient was found to have bowel necrosis

Large amount of air in the inferior vena cava and the hepatic venous system of the liver (white arrows). Gunshot wound, injury to the femoral vein and prolonged cardiopulmonary resuscitation.

Hoffman et al. European Journal of Emergency Medicine 2012



Hơi trong thành ruột



Hoffman et al. European Journal of Emergency Medicine 2012

Adequate resuscitation

- Improve microvascular blood flow and increase cardiac output
- The SSC advocated a mean arterial pressure (MAP) goal of 65 mm Hg during the first 6 h of treatment.
- RCT: “Sepsis and Mean Arterial Pressure” (SEPSISPAM)
- Overly aggressive fluid resuscitation may increase intra-abdominal pressure and worsen the inflammatory response
- Mortality was lowest when vasopressors were delayed by 1 h and infused from hours 1 to 6 following onset of shock.

Table 3 Time to antimicrobial therapy and source control according to survival

	Survivors	Nonsurvivors	*P* value
Time to antimicrobial therapy (hours)			
28-day survival	2.0 (0.6 to 5.6) ($n = 659$)	2.5 (1.0 to 6.6) ($n = 352$)	0.112
ICU survival	2.0 (0.7 to 5.4) ($n = 667$)	2.8 (0.9 to 7.0) ($n = 329$)	0.023
Hospital survival	2.0 (0.6 to 5.1) ($n = 581$)	2.8 (0.9 to 7.0) ($n = 329$)	0.020
Time to source control (hours)			
28-day survival	2.0 (–0.5 to 10.1) ($n = 286$)	5.7 (0.4 to 18.0) ($n = 139$)	0.004
ICU survival	2.0 (–0.6 to 9.1) ($n = 286$)	6.0 (0.5 to 19.9) ($n = 132$)	<0.001
Hospital survival	2.0 (–0.5 to 9.3) ($n = 249$)	5.5 (0.4 to 18.9) ($n = 166$)	0.001

Data are shown as median and interquartile range.

Early initiation of appropriate antibiotic therapy

Lựa chọn KS:

- Ổ/vị trí nhiễm khuẩn
- Độ nặng nhiễm khuẩn
- Nguy cơ kháng thuốc

Table 2. Agents and Regimens that May Be Used for the Initial Empiric Treatment of Extra-biliary Complicated Intra-abdominal Infection

Regimen	Community-acquired infection in pediatric patients	Community-acquired infection in adults	
		Mild-to-moderate severity: perforated or abscessed appendicitis and other infections of mild-to-moderate severity	High risk or severity: severe physiologic disturbance, advanced age, or immunocompromised state
Single agent	Ertapenem, meropenem, imipenem-cilastatin, ticarcillin-clavulanate, and piperacillin-tazobactam	Cefoxitin, ertapenem, moxifloxacin, tigecycline, and ticarcillin-clavulanic acid	Imipenem-cilastatin, meropenem, doripenem, and piperacillin-tazobactam
Combination	Ceftriaxone, cefotaxime, cefepime, or ceftazidime, each in combination with metronidazole; gentamicin or tobramycin, each in combination with metronidazole or clindamycin, and with or without ampicillin	Cefazolin, cefuroxime, ceftriaxone, cefotaxime, ciprofloxacin, or levofloxacin, each in combination with metronidazole[a]	Cefepime, ceftazidime, ciprofloxacin, or levofloxacin, each in combination with metronidazole[a]

[a] Because of increasing resistance of *Escherichia coli* to fluoroquinolones, local population susceptibility profiles and, if available, isolate susceptibility should be reviewed.

Solomkin J. S et al, IDSA guidelines on IAIs. **Clinical Infectious Diseases 2010**

Table 3. Recommendations for Empiric Antimicrobial Therapy for Health Care–Associated Complicated Intra-abdominal Infection

Organisms seen in health care–associated infection at the local institution	Regimen				
	Carbapenem[a]	Piperacillin-tazobactam	Ceftazidime or cefepime, each with metronidazole	Aminoglycoside	Vancomycin
<20% Resistant *Pseudomonas aeruginosa,* ESBL-producing Enterobacteriaceae, *Acinetobacter,* or other MDR GNB	Recommended	Recommended	Recommended	Not recommended	Not recommended
ESBL-producing Enterobacteriaceae	Recommended	Recommended	Not recommended	Recommended	Not recommended
P. aeruginosa >20% resistant to ceftazidime	Recommended	Recommended	Not recommended	Recommended	Not recommended
MRSA	Not recommended	Not recommended	Not recommended	Not recommended	Recommended

NOTE. ESBL, extended-spectrum β-lactamase; GNB, gram-negative bacilli; MDR, multidrug resistant; MRSA, methicillin-resistant *Staphylococcus aureus*. "Recommended" indicates that the listed agent or class is recommended for empiric use, before culture and susceptibility data are available, at institutions that encounter these isolates from other health care–associated infections. These may be unit- or hospital-specific.

[a] Imipenem-cilastatin, meropenem, or doripenem

Solomkin J. S et al, IDSA guidelines on IAIs. **Clinical Infectious Diseases 2010**

STOP-IT ClinicalTrials

N Engl J Med 2015;372:1996-2005.
DOI: 10.1056/NEJMoa1411162

Trial of Short-Course Antimicrobial Therapy for Intraabdominal Infection

R.G. Sawyer, J.A. Claridge, A.B. Nathens, O.D. Rotstein, T.M. Duane, H.L. Evans, C.H. Cook, P.J. O'Neill, J.E. Mazuski, R. Askari, M.A. Wilson, L.M. Napolitano, N. Namias, P.R. Miller, E.P. Dellinger, C.M. Watson, R. Coimbra, D.L. Dent, S.F. Lowry,* C.S. Cocanour, M.A. West, K.L. Banton, W.G. Cheadle, P.A. Lipsett, C.A. Guidry, and K. Popovsky

Table 2. Primary and Major Secondary Outcomes.*

Variable	Control Group (N = 260)	Experimental Group (N = 257)	P Value
Primary outcome: surgical-site infection, recurrent intraabdominal infection, or death — no. (%)	58 (22.3)	56 (21.8)	0.92
Surgical-site infection	23 (8.8)	17 (6.6)	0.43
Recurrent intraabdominal infection	36 (13.8)	40 (15.6)	0.67
Death	2 (0.8)	3 (1.2)	0.99
Time to event — no. of days after index source-control procedure			
Diagnosis of surgical-site infection	15.1±0.6	8.8±0.4	<0.001
Diagnosis of recurrent intraabdominal infection	15.1±0.5	10.8±0.4	<0.001
Death	19.0±1.0	18.5±0.5	0.66
Secondary outcome			
Surgical-site infection or recurrent intraabdominal infection with resistant pathogen — no. (%)	9 (3.5)	6 (2.3)	0.62
Site of extraabdominal infection — no. (%)			
Any site†	13 (5.0)	23 (8.9)	0.11
Urine	10 (3.8)	13 (5.1)	0.65
Blood	3 (1.2)	5 (1.9)	0.71
Lung	3 (1.2)	3 (1.2)	0.99
Area of skin other than surgical site	1 (0.4)	4 (1.6)	0.36
Vascular catheter	0 (0)	2 (0.8)	0.47
Clostridium difficile infection — no. (%)	3 (1.2)	5 (1.9)	0.71
Extraabdominal infection with resistant pathogen — no. (%)	6 (2.3)	2 (0.8)	0.29

Table 2. Primary and Major Secondary Outcomes.*

Variable	Control Group (N = 260)	Experimental Group (N = 257)	P Value
Duration of outcome — days			
Antimicrobial therapy for index infection			<0.001
Median	8	4	
Interquartile range	5–10	4–5	
Antimicrobial-free days at 30 days			<0.001
Median	21	25	
Interquartile range	18–25	21–26	
Hospitalization after index procedure			0.48
Median	7	7	
Interquartile range	4–11	4–11	
Hospital-free days at 30 days			0.22
Median	23	22	
Interquartile range	18–26	16–26	

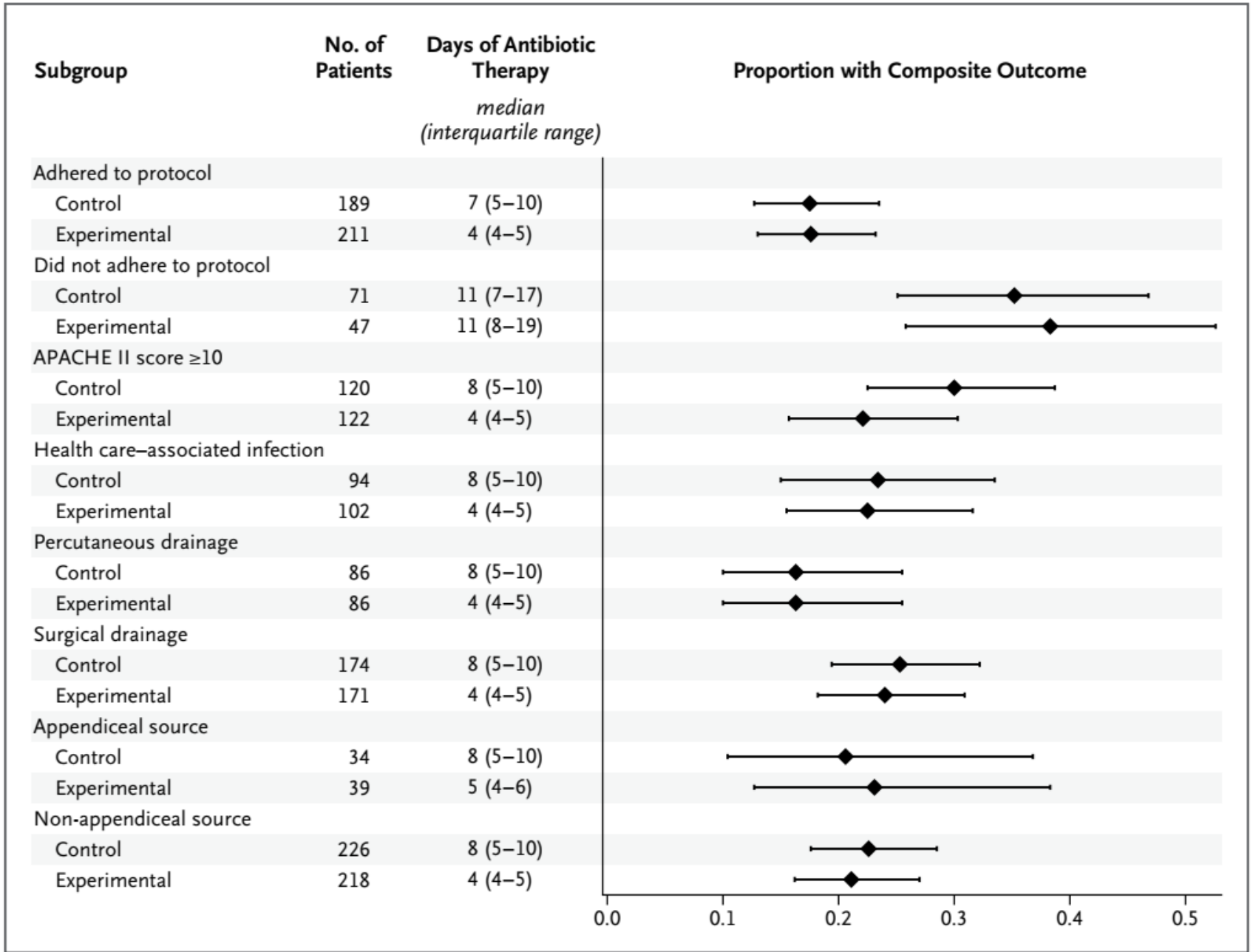


Figure 3. Primary Composite Outcome in Key Subgroups.

The median proportions of patients with the composite outcome are shown. I bars indicate the interquartile range.

Patients with Complicated Intra-Abdominal Infection Presenting with Sepsis Do Not Require Longer Duration of Antimicrobial Therapy

Rishi Rattan, MD, Casey J Allen, MD, Robert G Sawyer, MD, Reza Askari, MD, Kaysie L Banton, MD,

- STOP-IT (StudytoOptimizePeritonealInfection Therapy)trial databasemeeting criteria for sepsis were analyzed.
- Patients had been randomized to receive antibiotics until 2 days after the resolution of fever, leukocytosis, and ileus, with a maximum of 10 calendar days of therapy (n = 45), or to receive a fixed short-course of antibiotics for 4 +/- 1 calendar days (n = 67)

J Am Coll Surg 2016;222:440–446.

Table 4. Primary and Major Secondary Outcomes: Intention-to-Treat Analysis

Outcome	Control group (n = 75)	Experimental group (n = 85)	p Value
Primary outcome			
Surgical site infection, n (%)	8 (10.6)	9 (10.6)	1.000
Recurrent intra-abdominal infection, n (%)	14 (18.6)	14 (16.5)	0.835
Death, n (%)	0 (0)	2 (2.4)	0.499
Time to event, days after index source-control procedure, mean ± SD			
Diagnosis of surgical site infection	13.6 ± 9.4	6.7 ± 3.4	0.055
Diagnosis of recurrent intra-abdominal infection	14.7 ± 7.9	10.4 ± 5.8	0.114
Death	—	14.0 ± 9.9	—
Secondary outcome			
Surgical site infection with resistant pathogen, n (%)	0 (0)	2 (2.4)	0.499
Recurrent intra-abdominal infection with resistant pathogen, n (%)	2 (2.7)	1 (1.2)	0.600
Any extra-abdominal infection, n (%)	8 (10.6)	10 (11.8)	0.835
Clostridium difficile infection, n (%)	0 (0)	0 (0)	1.000
Duration of outcome, d			
Antimicrobial therapy for index infection, median (range)	8.0 (5.0–10.0)	5.0 (4.0–5.0)	<0.001
Antimicrobial-free days at 30 d, mean ± SD	19.4 ± 6.5	21.7 ± 6.8	0.034
Hospitalization after index procedure, median (range)	7.0 (4.0–13.0)	7.0 (4.0–11.0)	0.640
Hospital-free days at 30 d, mean ± SD	19.8 ± 7.8	19.7 ± 8.4	0.920

Kháng sinh tại Cấp cứu

- Nhiễm khuẩn ổ bụng: KS trong vòng 4 giờ
- Có nhiễm khuẩn huyết/sốc: KS và hồi sức theo SSC 2018
- Lập lại liều KS đúng theo phác đồ trong lúc chờ mổ, hoặc nhắc lại liều KS trong vòng 60 phút trước rạch da.
- Trong lúc mổ: nếu KS có half-life ngắn, lập lại, đảm bảo nồng độ KS trong máu cao xuyên suốt phẫu thuật.

* Source: Based on: Mazuski JE, Tessier JM, May AK, Sawyer RG, Nadler EP, Rosengart MR, et al. The Surgical Infection Society Revised Guidelines on the Management of Intra-Abdominal Infection. Surg Infect (Larchmt). 2017;18(1):1-76.[14]

ATB for how long ?

Table 1 - Conditions for which therapeutic antimicrobials (> 24 hours) are not recommended, assuming that the source has been adequately controlled*

Traumatic or iatrogenic enteric perforations operated on within 12 hours
Gastroduodenal perforations operated on within 24 hours
Acute or gangrenous appendicitis without perforation
Acute or gangrenous cholecystitis without perforation
Transmural bowel necrosis without perforation, established peritonitis, or abscess

* Source: Based on: Mazuski JE, Tessier JM, May AK, Sawyer RG, Nadler EP, Rosengart MR, et al. The Surgical Infection Society Revised Guidelines on the Management of Intra-Abdominal Infection. Surg Infect (Larchmt). 2017;18(1):1-76.[14]

Lower-risk patients with CA-IAI

- narrower-spectrum antimicrobial : against the usual gram-negative Enterobacteriaceae, aerobic streptococci, and obligate anaerobic micro-organisms associated with these infections (Grade 1-A).
- **Do not routinely use broader-spectrum or additional agents to provide** antipseudomonal, anti-enterococcal coverage (Grade 1-A), or antifungal therapy (Grade 2-B).

* Source: Based on: Mazuski JE, Tessier JM, May AK, Sawyer RG, Nadler EP, Rosengart MR, et al. The Surgical Infection Society Revised Guidelines on the Management of Intra-Abdominal Infection. Surg Infect (Larchmt). 2017;18(1):1-76.[14]

Lower-risk patients with CA-IAI

- Use cefotaxime or ceftriaxone plus metronidazole or ertapenem as the preferred agents for initial empiric therapy of lower-risk patients (Grade 1-A).
- Use ciprofloxacin plus metronidazole or moxifloxacin monotherapy for patients who have serious blactam allergies (Grade 1-A).

* Source: Based on: Mazuski JE, Tessier JM, May AK, Sawyer RG, Nadler EP, Rosengart MR, et al. The Surgical Infection Society Revised Guidelines on the Management of Intra-Abdominal Infection. Surg Infect (Larchmt). 2017;18(1):1-76.[14]

Higher-risk patients with CA-IAI

- Use meropenem , piperacillin-tazobactam, doripenem, imipenem-cilastatin, or cefepime plus metronidazole as the preferred agents for initial empiric therapy of higher-risk patients (Grade 2-A).
- Consider use of aztreonam plus metronidazole plus vancomycin as an option for higher-risk patients with a severe reaction to b-lactam agents (Grade 2-B).
- **Do not add an adjunctive aminoglycoside** or fluoroquinolone to a b-lactam agent for empiric treatment of higher-risk patients (Grade 1-B).
- Consider use of antifungal agents for empiric therapy of critically ill patients with an upper gastrointestinal source (Grade 2-B).
- Do not use cephalosporin-, aztreonam-, or fluoroquinolonebased regimens for empiric therapy of patients who reside in geographic areas where there is a high prevalence of extended-spectrum b-lactamase (ESBL)-producing Enterobacteriaceae in the community (Grade 1-B).

* Source: Based on: Mazuski JE, Tessier JM, May AK, Sawyer RG, Nadler EP, Rosengart MR, et al. The Surgical Infection Society Revised Guidelines on the Management of Intra-Abdominal Infection. Surg Infect (Larchmt). 2017;18(1):1-76.[14]

“Source control”

- Defined as any procedure, or series of procedures that eliminates infectious foci, controls factors that promote on-going infection and corrects or controls anatomic derangements to restore normal physiologic function.
- The primary objectives of intervention include (a) determining the cause of peritonitis, (b) draining fluid collections, and (c) controlling the origin of the abdominal sepsis.

Early and effective source control

- Can be achieved either by nonoperative or operative means.
- Nonoperative interventional procedures include percutaneous drainages of abscesses: Ultrasound and CT guided percutaneous drainage
- The principal cause for failure of percutaneous drainage is misdiagnosis of the magnitude, extent, complexity, location of the abscess

Source control failure

Table 1. Clinical Factors Predicting Failure of Source Control for Intra-abdominal Infection

Delay in the initial intervention (>24 h)
High severity of illness (APACHE II score ⩾15)
Advanced age
Comorbidity and degree of organ dysfunction
Low albumin level
Poor nutritional status
Degree of peritoneal involvement or diffuse peritonitis
Inability to achieve adequate debridement or control of drainage
Presence of malignancy

NOTE. APACHE, Acute Physiology and Chronic Health Evaluation.

Solomkin J. S et al, IDSA guidelines on IAIs. Clinical Infectious Diseases 2010

Table 3. Mortality differences after relaparotomy for persisting abdominal sepsis according to the preoperative APACHE II score.

APACHE II score	Relaparotomy ≤48 hr (%)	Relaparotomy >48 hr (%)	Significance (p)
≤10	0	25	0.09
11–15	0	33	0.02
16–20	0	78	0.002
21–25	57	100	0.02
≥26	79	94	0.2
Overall	28	77	0.0001

Source: Koperna T et al, World J Surg 2000, 24(1):32-37.

Damage control open-abdomen

Sartelli *et al. World Journal of Emergency Surgery* (2015) 10:35
DOI 10.1186/s13017-015-0032-7

WORLD JOURNAL OF EMERGENCY SURGERY

REVIEW Open Access

The role of the open abdomen procedure in managing severe abdominal sepsis: WSES position paper

Massimo Sartelli[1*], Fikri M. Abu-Zidan[2], Luca Ansaloni[3], Miklosh Bala[4], Marcelo A. Beltrán[5], Walter L. Biffl[6],

- primary anastomosis should be delayed until improvement of the peritoneal compartment and the patient's general condition.

Coccolini *et al. World Journal of Emergency Surgery* (2017) 12:39
DOI 10.1186/s13017-017-0146-1

World Journal of Emergency Surgery

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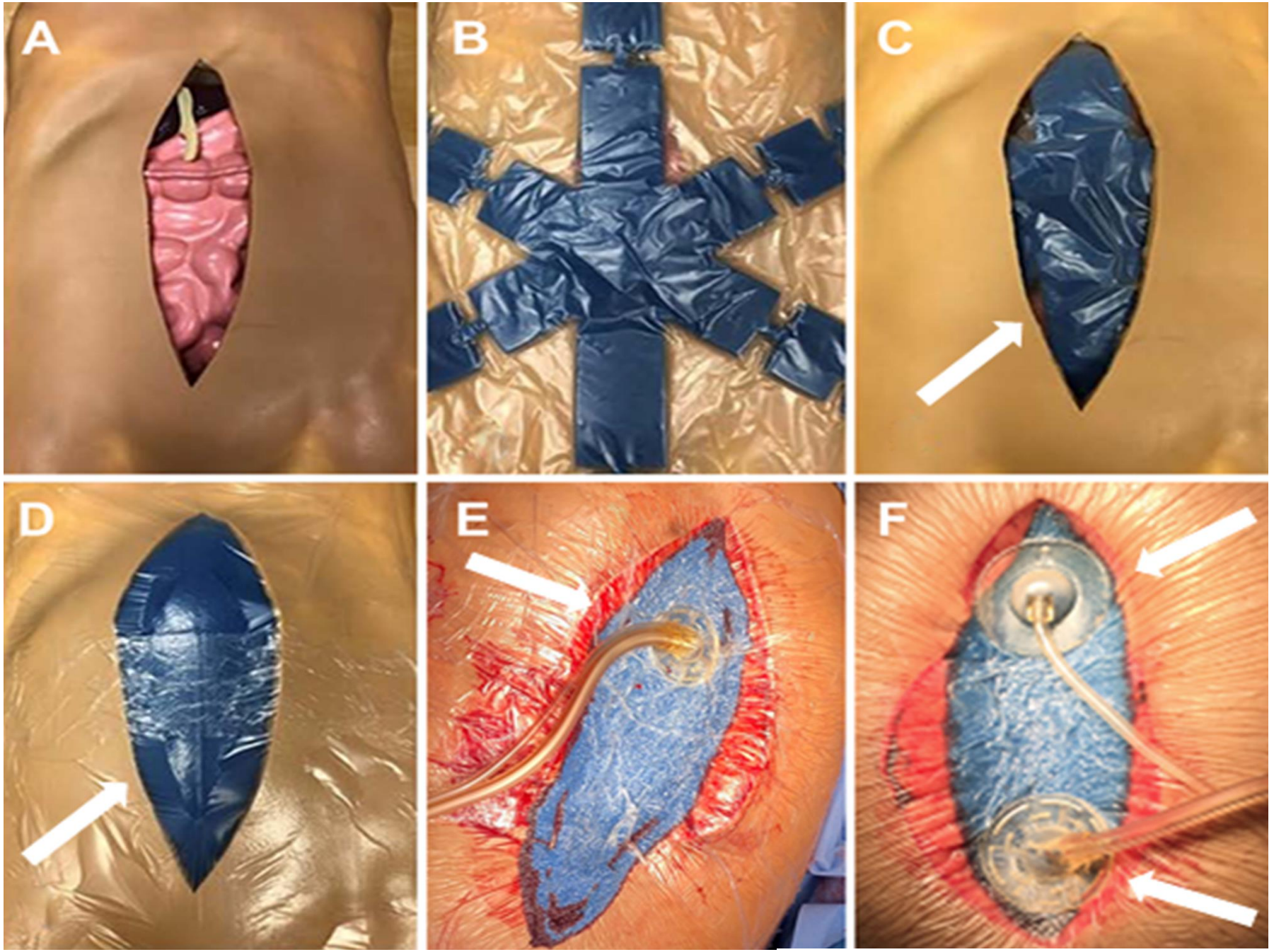
The role of open abdomen in non-trauma patient: WSES Consensus Paper

Table 2 Statement Grid

	Statements
Open Abdomen indication:	
➢ Peritonitis	The open abdomen is an option for emergency surgery patients with severe peritonitis and septic shock under the following circumstances: abbreviated laparotomy due to the severe physiological derangement, or the need for a deferred intestinal anastomosis or a planned second look for intestinal ischemia, or persistent source of peritonitis (failure of source control), or extensive visceral edema with the concern for development of abdominal compartment syndrome (Grade 2C).
Optimal technique for temporary abdominal closure	Negative pressure wound therapy with continuous fascial traction is suggested as the preferred technique for temporary abdominal closure (Grade 1B). Temporary Abdominal Closure without Negative pressure wound therapy (e.g., mesh alone, Bogota bag) whenever possible should NOT be applied for the purpose of temporary abdominal closure, because of low delayed fascial closure rate and being accompanied by a significant intestinal fistula rate (Grade 1B).



2019 Fernandez et al. Cureus 11(9): e5667. DOI 10.7759/cureus.5667

Temporary coverage

- usually comprises negative pressure devices (maximum negative pressure of minus 75 mmHg) to prevent abdominal compartment syndrome (ACS)
- allows a re-look every 24–48 h.

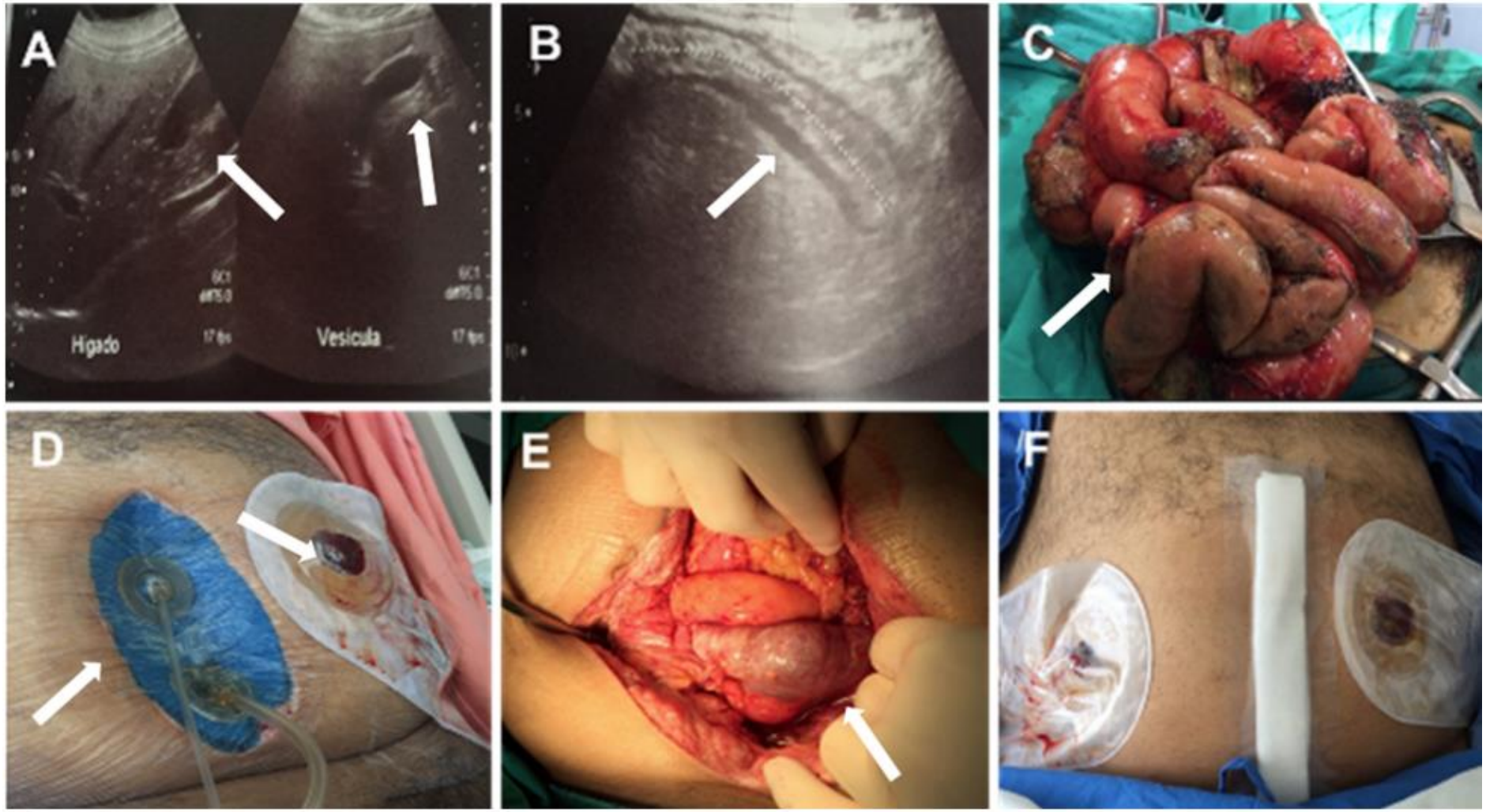


FIGURE 7: Perforated diverticulitis and diffuse peritonitis

A. Abdominal ultrasound showing cholecystolithiasis (arrows); B. Abdominal ultrasound showing acute appendicitis (arrow); C. Active diffuse suppurative peritonitis; D. Abdominal installation and temporary colostomy; E. Open abdomen 72 hours after abdominal instillation (arrow); F. Closed abdomen

2019 Fernandez et al. Cureus 11(9): e5667. DOI 10.7759/cureus.5667

Microbiologic evaluation

- Cấy máu: tùy thuộc vào bệnh cảnh của bệnh nhân
- Cấy dịch ổ bụng: 10ml hoặc mẩu mô
- **Intraoperative cultures:**

- Not routine in mild-to-moderate community-acquired peritonitis; low suspicion of multidrug resistance.

- Culture: useful as a baseline measure to monitor subsequent emergence of epidemiologically important microorganisms

- Recommend to obtain peritoneal fluid in the most severe patients, even with community-acquired peritonitis, in the case of previous antibiotic therapy and in all healthcare-associated infections.