

Surgery in Geriatrics and Frailty

APEROLD study: acute peritonitis in the oldest nonagenarian patients with acute abdomen. Which is the fate?

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SUPPLEMENTARY MATERIAL

Appendix A. Risk prediction score

Table 1. ASA Physical Status Classification System.

ASA PS Classification

ASA I	Definition
ASA II	A normal healthy patient
ASA III	A patient with mild systemic disease
ASA IV	A patient with severe systemic disease
ASA V	A patient with severe systemic disease that is a constant threat to life
ASA VI	A moribund patient who is not expected to survive without the operation
	A declared brain-dead patient whose organs are being removed for donor purposes

Statement on ASA Physical Status Classification System¹⁵

Developed by: Committee on Economics. Last Amended: December 13, 2020 (original approval: October 15, 2014)

<https://www.asahq.org/standards-and-practice-parameters/statement-on-asa-physical-status-classification-system>

Table 2. fTRST Screening Tool.

fTRST screening tool		
Item	Score	
	Yes	No
1. Presence of cognitive impairment (disorientation, diagnosis of dementia, or delirium)	2	0
2. Lives alone or no caregiver available, willing, or able	1	0
3. Difficulty with walking or transfers or fall(s) in the past 6 months	1	0
4. Hospitalized in the last 3 months	1	0
5. Polypharmacy: 5 medications	1	0

fTRST, Flemish version of the Triage Risk Screening Tool.

fTRST Screening Tool¹⁶

Performance of Two Geriatric Screening Tools in Older Patients With Cancer Cindy Kenis, Lore Decoster, Katrien Van Puyvelde, Jacques De Gre`ve, Godelieve Conings, Koen Milisen, Johan Flamaing, Jean-Pierre Lobelle, and Hans Wildiers

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Table 3. APACHE II Score.

Physiological variable A	High abnormal range					Low abnormal range			
	+4	+3	+2	+1	0	+1	+2	+3	+4
TEMPERATURE - rectal	≥41	39-40.9		38.5-38.9	36-38.4	34-35.9	32-33.9	31-31.9	≤30
MEAN ARTERIAL PRESSURE mmHg	≥160	130-159	110-129		70-109		50-69		≤49
HEART RATE	≥100	140-179	110-193		70-109		50-69	40-54	≤39
RESPIRATORY RATE	≥50	35-49		25-34	12-24	10-11	6-9		≤5
OXYGENATION a) FIO ₂ ≥0.5 record A-aDO ₂ b) FIO ₂ <0.5 record PaO ₂	≥500	350-499	200-349		<200 PO ₂ ≥70	PO ₂ 61-70		PO ₂ 55-60	PO ₂ <55
ARTERIAL PH	≥7.7	7.6-7.69		7.5-7.59	7.33-7.49		7.25-7.32	7.15-7.24	<7.15
HCO ₃ (mEq/l)	≥52	41-51.9		32-40.9	22-31.9		18-21.9	15-17.9	<15
K (mEq/l)	≥7	6-6.9		5.5-5.9	3.5-5.4	3-3.4	2.5-2.9		<2.5
Na (mEq/l)	≥100	160-179	155-159	150-154	130-149		120-129	111-119	<110
S. Creat (mqm/dl)	≥3.5	2-3.4	1.5-1.9		0.6-1.4		<0.6		
Hematocrit (%)	≥60		50-59.9	46-49.9	30-45.9		20-29.9		<20
TCL (10 ³ /cc)	≥40		20-39.9	15-19.9	3-14.9		1-2.9		<1
GCS									
15 -> 0	12 -> 3	9 -> 6	6 -> 9						
14 -> 1	11 -> 4	8 -> 7	5 -> 10						
13 -> 2	10 -> 5	7 -> 8	4 -> 11						
			3 -> 12						
Age score									
<div style="display: flex; justify-content: space-between;"> <44 0 </div>									
CHRONIC HEALTH POINT APACHE II									

			SCORE
45-54	2	If the patient has a history of severe organ system insufficiency or is immunocompromised assign points as follows	
55-64	3	If elective postoperative patient with immunocompromise or history of severe organ insufficiency	2 Points
65-74	5		
≥75	6	If nonoperative patient or emergency postoperative patient with immunocompromised or severe organ insufficiency	5 Points

APACHE II Score¹⁷

https://www.researchgate.net/figure/Definition-of-each-scoring-system-A-The-APACHE-II-scoring-system-was-defined-in-this_fig1_262054481

Table 4. Charlson Comorbidity Index (CCI).

Items	
Prior myocardial infarction	1
Congestive heart failure	1
Peripheral vascular disease	1
Cerebrovascular disease	1
Dementia	1
Chronic pulmonary disease	1
Rheumatologic disease	1
Peptic ulcer disease	1
Mild liver disease	1
Diabetes	1
Cerebrovascular (Hemiplegia) event	2
Moderate to severe renal disease	2
Diabetes with chronic complication	2
Cancer without metastases	2
Leukemia	2
Lymphoma	2
Moderate or severe liver disease	2
Metastatic solid tumor	6
Acquired immunodeficiency syndrome (AIDS)	6

Charlson Comorbidity Index (CCI)¹⁸

https://www.researchgate.net/figure/CCI-Charlson-comorbidity-index-score_fig3_301936501

Table 5. POSSUM - Physiological Score Operative Severity Score.

Physiological score				
	1	2	4	8
Age (years)	≤60	61-70	≥71	
Cardiac signs	No failure	Diuretic, digoxin, antianginal or hypertensive therapy	Peripheral edema; warfarin therapy	Raised jugular venous pressure
Chest radiograph			Borderline cardiomegaly	Cardiomegaly
Respiratory history	No dyspnoea	Dyspnoea on exertion	Limiting dyspnoea (one flight)	Dyspnoea at rest (rate>30/min)
Chest radiograph		Mild COAD	Moderate COAD	Fibrosis or consolidation
Blood pressure (systolic) mmHg	110-130	131-170 100-109	≥171	≤89
Pulse (beats/min)	50-80	81-100 40-49	101-120	≥121
Glasgow coma score	15	12-14	9-11	≤8
Hemoglobin (g/100mL)	13-16	11.5-12.9	10-11.4	≤9.9
White cell count (x10 ¹² /L)	4-10	10.1-20 3.1-4	≥20.1 ≤3	
Serum urea (mmol/L)	≤7.5	7.6-10	10.1-15	≥15
Serum sodium (mmol/L)	≥136	131-135	126-130	≤125
Serum potassium (mmol/L)	3.5-5	3.2-3.4 5.1-5.3	2.9-3.4 5.4-5.5	≤2.8 ≥6

Electrocardiogram	Normal	Atrial fibrillation	Any other abnormal rhythm Or 25 ectopics/min Q waves or ST/T wave changes
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POSSUM - Physiological Score Operative Severity Score¹⁹

https://www.researchgate.net/figure/POSSUM-physiological-score-according-to-Copeland-and-al_fig1_262680555

Appendix B. Case report form (CRF)

Patient selection	Patients aged 90 years or older at time of hospital admission?		YES <input type="checkbox"/> NO <input type="checkbox"/>	
	Diagnosis of acute secondary peritonitis undergoing surgical treatment or non-operative management		YES <input type="checkbox"/> NO <input type="checkbox"/>	
Patient data	Age			
	Sex		M <input type="checkbox"/> F <input type="checkbox"/>	
	Weight		___ kg	
	Height		___ cm	
	BMI		_____	
	Current smoker (within 1 year)		YES <input type="checkbox"/> NO <input type="checkbox"/>	
	Comorbidities	Hypertension requiring treatment		YES <input type="checkbox"/> NO <input type="checkbox"/>
		Atrial fibrillation		YES <input type="checkbox"/> NO <input type="checkbox"/>
		Congestive heart failure		YES <input type="checkbox"/> NO <input type="checkbox"/>
		Myocardial infarction		YES <input type="checkbox"/> NO <input type="checkbox"/>
		Peripheral vascular disease		YES <input type="checkbox"/> NO <input type="checkbox"/>
		CVA with mild or no residual TIA		YES <input type="checkbox"/> NO <input type="checkbox"/>
		Dementia		YES <input type="checkbox"/> NO <input type="checkbox"/>
		Hemiplegia		YES <input type="checkbox"/> NO <input type="checkbox"/>
		Chronic obstructive pulmonary disease (COPD)		YES <input type="checkbox"/> NO <input type="checkbox"/>
		Diabetes without end-organ damage		YES <input type="checkbox"/> NO <input type="checkbox"/>
		Diabetes with end-organ damage		YES <input type="checkbox"/> NO <input type="checkbox"/>
		Prostatic hyperplasia		YES <input type="checkbox"/> NO <input type="checkbox"/>
		Moderate or severe liver disease		YES <input type="checkbox"/> NO <input type="checkbox"/>
		Moderate or severe renal disease		YES <input type="checkbox"/> NO <input type="checkbox"/>
Peptic ulcer disease		YES <input type="checkbox"/> NO <input type="checkbox"/>		
Connective tissue disease		YES <input type="checkbox"/> NO <input type="checkbox"/>		
Cancer without metastasis		YES <input type="checkbox"/> NO <input type="checkbox"/>		
Metastatic solid cancer		YES <input type="checkbox"/> NO <input type="checkbox"/>		
Leukemia (acute or chronic)/ Lymphoma		YES <input type="checkbox"/> NO <input type="checkbox"/>		

		AIDS or other immunodeficiency disorders	YES [] NO []
		None	YES [] NO []
		Unknown	YES [] NO []
	Previous abdominal surgery		YES [] NO []
	Pharmacotherapy	None	YES [] NO []
		Warfarin or Direct oral anticoagulants (DOACs) therapy	YES [] NO []
		Mono or dual antiplatelet therapy	YES [] NO []
		Diuretic, antianginal, digoxin or hypertensive therapy	YES [] NO []
		Oral glucose-lowering medications or other anti- diabetic drugs	YES [] NO []
		Steroid use for chronic condition	YES [] NO []
		Other therapies	YES [] NO []
	Functional status	Independent	YES [] NO []
		Partially dependent	YES [] NO []
		Totally dependent	YES [] NO []
	Living situation	Home independent	YES [] NO []
		Home with family/ caregiver	YES [] NO []
		Residential care	YES [] NO []
		Other	_____
	Activities of daily living (ADL)		_____
	Instrumental activities of daily living (IADL)		_____
	Clinical frailty scale (CFS)		_____
Clinical status at hospital admission	Date of symptoms onset		__ / __ / __
	Date of hospital admission		__ / __ / __
	Temperature		_____ °C
	Systolic blood pressure		_____ mmHg
	Mean arterial pressure		_____ mmHg
	Heart rate		_____ bpm

	Respiratory rate	_____ b/m
	Dyspnoea at rest	YES [] NO []
	Glasgow coma scale (GCS)	_____
	Peripheral oedema	YES [] NO []
	Raised jugular venous pressure	YES [] NO []
	Hypotension with need for pressor amine	YES [] NO []
Quick SOFA (qSOFA) score for sepsis	Systolic Blood Pressure <100mmHg	YES [] NO []
	Respiratory rate >22 b/m	YES [] NO []
	GCS <15	YES [] NO []
	Total points	_____
Abdominal rebound tenderness	None	YES [] NO []
	Light	YES [] NO []
	Medium	YES [] NO []
	Strong	YES [] NO []
Arterial blood gas at hospital admission	Arterial PH	_____
	PaCO ₂	_____ mmHg
	PaO ₂	_____ mmHg
	O ₂ saturation	_____ %
	FiO ₂	_____ %
	PaO ₂ /FiO ₂ ratio	_____
	HCO ₃	_____ mmol/L
	Base excess (BE)	_____
	Lactate (Lac)	_____ mmol/L
Blood tests at hospital admission	White blood cell count	_____ x 10 ⁹ /L
	Polymorphonuclear leukocytes	_____ %
	Haemoglobin	_____ g/dL
	Haematocrit	_____ %
	Platelet	_____ x 10 ⁹ /L
	Urea	_____ mmol/L
	Sodium	_____ mmol/L

	Potassium	_____mmol/L
	Creatinine	_____mg/dL
	PT-INR	_____
	APTT	_____
	Total Bilirubin	_____mg/dL
	Direct Bilirubin	_____mg/dL
	Lipase	_____U/l
	GGT	_____U/l
	GOT	_____U/l
	GPT	_____U/l
	C-reactive protein (CRP)	_____mg/L
	Procalcitonin (PCT)	_____µg/L
ECG at hospital admission	Sinus rhythm	YES [] NO []
	Atrial fibrillation	YES [] NO []
	5 ectopic beats/min or Q waves or St/T waves changes	YES [] NO []
	Any other abnormal rhythm	YES [] NO []
Etiology of secondary acute peritonitis	Small bowel obstruction	YES [] NO []
	Small bowel perforation	YES [] NO []
	Large bowel obstruction (not malignant)	YES [] NO []
	Perforated diverticulitis	YES [] NO []
	Perforated peptic ulcer or gastric cancer	YES [] NO []
	Acute cholecystitis	YES [] NO []
	Acute appendicitis	YES [] NO []
	Obstructed abdominal wall hernia	YES [] NO []
	Colorectal cancer obstruction/perforation	YES [] NO []
	Bowel infarction	YES [] NO []
	Splenic abscess	YES [] NO []
If other, what?	_____	
	ASA score	_____

Scores for prediction of risk	Flemish version of the Triage Risk Screening Tool (fTRST)		_____
	Charlson's Comorbidity Index		_____
	APACHE II		_____
	P-POSSUM score	Physiological score	_____
		Operative Severity Score	_____
		Morbidity	_____%
		Mortality	_____%
	ACS NSQIP Surgical Risk Calculator	Serious complication	_____%
		Any complication	_____%
		Readmission	_____%
		Return to OR	_____%
Death		_____%	
Discharge to Nursing or to Rehab Facility		_____%	
Sepsis		_____%	
Treatment	Patient undergone surgery?		YES [] NO []
	Patient undergoing non-operative management?		YES [] NO []
Surgery	Date of intervention		_ / _ / _
	Timing of surgery	<6 hours	[]
		From 6 hours to 24 hours	[]
		>24 hours	[]
	Operative time		_____min
	Abdominal approach	Laparotomy	[]
		Laparoscopy	[]
		Robotic	[]
	If initially laparoscopic or robotic, conversion to open surgery?		YES [] NO []
	Traumatic emergency surgery?		YES [] NO []
	Damage control procedure?		YES [] NO []
Type of intervention performed	Small bowel resection with or without anastomosis	YES [] NO []	
	Colonic resection with primary anastomosis with or without	YES [] NO []	

		diverting stoma	
		Hartmann's procedure	YES [] NO []
		Stoma without colic resection	YES [] NO []
		Total or subtotal Gastrectomy/ Gastric or duodenal resection	YES [] NO []
		Gastroenteroanastomosis/ Bowel bypass	YES [] NO []
		Gastric perforation repair	YES [] NO []
		Cholecystectomy	YES [] NO []
		Appendectomy	YES [] NO []
		Splenectomy	YES [] NO []
		Abdominal wall repair with or without bowel resection	YES [] NO []
		Open abdomen	YES [] NO []
		If other, what?	_____
		Intraoperative complications	YES [] NO []
		If yes, what?	_____
	Operative blood loss	<100 mL	YES [] NO []
		101-500 mL	YES [] NO []
		500-999 mL	YES [] NO []
		>1000 mL	YES [] NO []
	Peritoneal Contamination	No soiling	YES [] NO []
		Minor soiling	YES [] NO []
		Local pus	YES [] NO []
		Free bowel content, pus or blood	YES [] NO []
	Malignancy status	Not malignant	YES [] NO []
		Primary malignancy only	YES [] NO []
		Malignancy + nodal mets	YES [] NO []
		Malignancy + distal mets	YES [] NO []
		Intraoperative death	YES [] NO []
		Antimicrobial therapy	YES [] NO []

Non-operative management	If yes, which antibiotic/antifungal?		_____
	Endoscopic procedure		YES [] NO []
	Percutaneous drainage		YES [] NO []
	Embolization procedure		YES [] NO []
	ICU stay		YES [] NO []
	If yes, length of ICU stay		_____ days
	Palliative care		YES [] NO []
Post-operative in-hospital course	Need for a postoperative Intensive Care Unit (ICU)?		YES [] NO []
	If yes, length of ICU stay		_____ days
	Post-operative in-hospital complications		YES [] NO []
	If yes, what?		_____
	The Clavien-Dindo classification of surgical complications	<i>Grade I</i>	<i>Any deviation from the normal postoperative course without the need for pharmacological treatment or surgical, endoscopic and radiological interventions Allowed therapeutic regimens are: drugs as antiemetics, antipyretics, analgesics, diuretics and electrolytes and physiotherapy. This grade also includes wound infections opened at the bedside.</i>
<i>Grade II</i>		<i>Requiring pharmacological treatment with drugs other than such allowed for grade I complications. Blood transfusions and total parenteral nutrition are also included.</i>	YES [] NO []
<i>Grade III</i>		<i>Requiring surgical, endoscopic or radiological intervention</i> <i>- IIIa Intervention under regional/local anesthesia</i>	YES [] NO []
<i>Grade III</i>		<i>Requiring surgical, endoscopic or radiological intervention</i> <i>- IIIb Intervention under general anesthesia</i>	YES [] NO []

	Grade IV <i>Life-threatening complication (including CNS complications)* requiring ICU- management</i> <i>Iva single organ dysfunction (including dialysis)</i>	YES [] NO []	
	Grade IV <i>Life-threatening complication (including CNS complications)* requiring ICU- management</i> <i>IVb multiorgan dysfunction</i>	YES [] NO []	
	Grade V <i>Death of a patient</i>	YES [] NO []	
Complications needed for an Intensive Care Unit (ICU)?		YES [] NO []	
If yes, length of ICU stay		_____ days	
Complications needed for endoscopic or radiological procedures?		YES [] NO []	
If yes, which procedure?		_____	
Length of hospital stay		_____ days	
Discharge	At home totally independent	YES [] NO []	
	At home with caregiver	YES [] NO []	
	Rehabilitation facility	YES [] NO []	
	Residential care	YES [] NO []	
	Other	_____	
Non-operative management in-hospital course	In-hospital death		YES [] NO []
	Length of hospital stay		_____ days
	Discharge	At home totally independent	YES [] NO []
		At home with caregiver	YES [] NO []
		Rehabilitation facility	YES [] NO []
		Residential care	YES [] NO []
Other		_____	
Post-operative post-discharge complications?		YES [] NO []	

Follow-up (Day 30)	If yes, what?		_____
	The Clavien-Dindo classification of surgical complications		Grade_____
	Readmission within 30 days from discharge?		YES [] [NO []
	If yes, why?		_____
Follow-up (1 year)	Death within 1 year from hospital admission?		YES [] NO []
	Readmission between 30 days and 1 year from discharge?		YES [] NO []
	If yes, why?		_____
	Functional status	Independent	[]
		Partially dependent	[]
		Totally dependent	[]
	Activities of daily living (ADL)		_____
	Instrumental activities of daily living (IADL)		_____
	Living situation	Home independent	[]
		Home with family/ caregiver	[]
		Rehabilitation facility	[]
		Residential care	[]
Other		_____	

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