



World Society  
of the Abdominal  
Compartment  
Syndrome

# Intra-abdominal Hypertension and Abdominal Compartment Syndrome: Updated Consensus Definitions and Clinical Practice Guidelines

Dr Nguyen Son Thanh  
Infectious disease Department  
Children's Hospital 2



World Society  
of the Abdominal  
Compartment  
Syndrome

**WSACS**

- **WSACS** founded in 2004
- 2006 : Society's publication of IAH and ACS expert consensus definitions
- 2007: Clinical practice guidelines
- 2009: Recommendations for research
- 2013 : Updated Consensus definitions and Clinical practice guidelines



Intensive Care Med (2013) 39:1190–1206  
DOI 10.1007/s00134-013-2906-z

CONFERENCE REPORTS AND EXPERT PANEL

Andrew W. Kirkpatrick  
Derek J. Roberts  
Jan De Waele  
Roman Jaeschke  
Manu L. N. G. Malbrain  
Bart De Keulenaer  
Juan Duchesne  
Martin Bjorck  
Ari Leppaniemi  
Janeth C. Ejike  
Michael Sugrue  
Michael Cheatham

Rao Ivatury  
Chad G. Ball  
Annika Reintam Blaser  
Adrian Regli  
Zsolt J. Balogh  
Scott D'Amours  
Dieter Debergh  
Mark Kaplan  
Edward Kimball  
Claudia Olvera  
The Pediatric Guidelines  
Sub-Committee for the  
World Society of the Abdominal  
Compartment Syndrome

## **Intra-abdominal hypertension and the abdominal compartment syndrome: updated consensus definitions and clinical practice guidelines from the World Society of the Abdominal Compartment Syndrome**

- Updated Consensus definitions

- Updated Clinical practice guidelines

---

Received: 10 February 2013  
Accepted: 18 March 2013  
Published online: 15 May 2013  
© The Author(s) 2013. This article is  
published with open access at  
Springerlink.com

---

D. J. Roberts  
Departments of Surgery and Community  
Health Sciences, University of Calgary,  
Calgary, AB T2N 5A1, Canada  
e-mail: Derek.Roberts01@gmail.com

B. De Keulenaer · A. Regli  
Intensive Care Unit, Fremantle Hospital,  
Alma Street, PO Box 480, Fremantle, WA  
6959, Australia  
e-mail: bdekeul@hotmail.com

J. De Waele

J. Duchesne



World Society  
of the Abdominal  
Compartment  
Syndrome

# Updated Consensus definitions

- Evaluated existing 2006 consensus definitions and risk factors
- Updated new definitions
- Created Pediatric guidelines sub-committee



# Consensus definitions

**Table 1** Final 2013 consensus definitions of the World Society of the Abdominal Compartment Syndrome

No. Definition

*Retained definitions from the original 2006 consensus statements [13]*

1. IAP is the steady-state pressure concealed within the abdominal cavity
2. The reference standard for intermittent IAP measurements is via the bladder with a maximal instillation volume of 25 mL of sterile saline
3. IAP should be expressed in mmHg and measured at end-expiration in the supine position after ensuring that abdominal muscle contractions are absent and with the transducer zeroed at the level of the midaxillary line
4. IAP is approximately 5–7 mmHg in critically ill adults
5. IAH is defined by a sustained or repeated pathological elevation in IAP  $\geq 12$  mmHg
6. ACS is defined as a sustained IAP  $> 20$  mmHg (with or without an APP  $< 60$  mmHg) that is associated with new organ dysfunction/failure
7. IAH is graded as follows  
Grade I, IAP 12–15 mmHg  
Grade II, IAP 16–20 mmHg  
Grade III, IAP 21–25 mmHg  
Grade IV, IAP  $> 25$  mmHg
8. Primary IAH or ACS is a condition associated with injury or disease in the abdominopelvic region that frequently requires early surgical or interventional radiological intervention
9. Secondary IAH or ACS refers to conditions that do not originate from the abdominopelvic region
10. Recurrent IAH or ACS refers to the condition in which IAH or ACS redevelops following previous surgical or medical treatment of primary or secondary IAH or ACS
11. APP = MAP – IAP

*New definitions accepted by the 2013 consensus panel*

12. A polycompartment syndrome is a condition where two or more anatomical compartments have elevated compartmental pressures
13. Abdominal compliance is a measure of the ease of abdominal expansion, which is determined by the elasticity of the abdominal wall and diaphragm. It should be expressed as the change in intra-abdominal volume per change in IAP
14. The open abdomen is one that requires a temporary abdominal closure due to the skin and fascia not being closed after laparotomy
15. Lateralization of the abdominal wall is the phenomenon where the musculature and fascia of the abdominal wall, most exemplified by the rectus abdominus muscles and their enveloping fascia, move laterally away from the midline with time

ACS abdominal compartment syndrome, APP abdominal perfusion pressure, IAH intra-abdominal hypertension, IAP intra-abdominal pressure, MAP mean arterial pressure



# Pediatric specific definitions

- IAP: the steady-state pressure concealed within the abdominal cavity.
- IAP in critically ill children: approximately 4-10 mm Hg (**adults: 5-7 mmHg**)
- IAP (mmHg): measured at end-expiration in the complete supine position after ensuring that abdominal muscle contractions are absent and with the transducer zeroed at the level of the midaxillary line.



## Pediatric specific definitions (cont')

- Reference standard for intermittent IAP measurement in children: via the bladder using 1 mL/kg instillation volume of sterile saline, min volume: 3 mL - max volume: 25 mL
- IAH in children: a sustained or repeated pathological elevation in IAP  $> 10$  mmHg (adults IAP  $\geq 12$ mmHg )



## Pediatric specific definitions (cont')

- ACS in children: a sustained elevation IAP  $> 10$  mmHg associated with new or worsening organ dysfunction that can be attributed to elevated IAP (adults IAP  $> 20$ mmHg  $\pm$  APP $<60$  mmHg + new organ dysfunction/failure)
- A polycompartment syndrome: a condition where two or more anatomical compartments have elevated compartmental pressures



## Pediatric specific definitions (cont')

- Primary IAH/ACS: a condition associated with injury or disease in the abdominopelvic region that frequently requires early surgical or interventional radiological intervention
- Secondary IAH/ACS refers to conditions that do not originate from the abdominopelvic region
- Recurrent IAH/ACS refers to the condition in which IAH or ACS redevelops following previous surgical or medical treatment of primary or secondary IAH or ACS



## Pediatric specific definitions (cont')

- Abdominal compliance: a measure of the ease of abdominal expansion, which is determined by the elasticity of the abdominal wall and diaphragm. It should be expressed as the change in intra-abdominal volume per change in intra abdominal pressure
- $APP = MAP - IAP$
- The open abdomen is one that requires a temporary abdominal closure due to the skin and fascia not being closed after laparotomy

# Pediatric specific definitions (cont')

**Table 3** Classification scheme for the complexity of the open abdomen

---

*1 No fixation*

- |     |                           |
|-----|---------------------------|
| 1A: | Clean, no fixation        |
| 1B: | Contaminated, no fixation |
| 1C: | Enteric leak, no fixation |

*2 Developing fixation*

- |     |                                   |
|-----|-----------------------------------|
| 2A: | Clean, developing fixation        |
| 2B: | Contaminated, developing fixation |
| 2C: | Enteric leak, developing fixation |

*3 Frozen abdomen*

- |     |                              |
|-----|------------------------------|
| 3A: | Clean, frozen abdomen        |
| 3B: | Contaminated, frozen abdomen |

*4 Established enteroatmospheric fistula, frozen abdomen*

---



# Updated Clinical practice guidelines

- Updated consensus management statements
- **GRADE** recommendations for guideline developers
- **Recommendations:**
  - The direction (for/against/no recommendation)
  - The strength (recommend/suggest):
    - strong **recommendations (Grade 1)** or
    - weak **suggestions (Grade 2)**
- **Quality of evidence:** very low (D), low (C), moderate (B), and high (A)



# Consensus management statements

Table 5 Final 2013 WSACS consensus management statements

---

## *Recommendations*

1. We recommend measuring IAP when any known risk factor for IAH/ACS is present in a critically ill or injured patient [GRADE 1C]
2. Studies should adopt the trans-bladder technique as the standard IAP measurement technique [not GRADED]
3. We recommend use of protocolized monitoring and management of IAP versus not [GRADE 1C]
4. We recommend efforts and/or protocols to avoid sustained IAH as compared to inattention to IAP among critically ill or injured patients [GRADE 1C]
5. We recommend decompressive laparotomy in cases of overt ACS compared to strategies that do not use decompressive laparotomy in critically ill adults with ACS [GRADE 1D]
6. We recommend that among ICU patients with open abdominal wounds, conscious and/or protocolized efforts be made to obtain an early or at least same-hospital-stay abdominal fascial closure [GRADE 1D]
7. We recommend that among critically ill/injured patients with open abdominal wounds, strategies utilizing negative pressure wound therapy should be used versus not [GRADE 1C]



**Table 2** Risk factors for intra-abdominal hypertension and abdominal compartment syndrome

Risk factor
<i>Diminished abdominal wall compliance</i>
Abdominal surgery [27–29]
Major trauma [27, 30, 31]
Major burns
Prone positioning [32–34]
<i>Increased intra-luminal contents</i>
Gastroparesis/gastric distention/ileus [35]
Ileus
Colonic pseudo-obstruction
Volvulus
<i>Increased intra-abdominal contents</i>
Acute pancreatitis [28]
Distended abdomen
Hemoperitoneum/pneumoperitoneum or intra-peritoneal fluid collections [36]
Intra-abdominal infection/abscess [37]
Intra-abdominal or retroperitoneal tumors
Laparoscopy with excessive insufflation pressures
Liver dysfunction/cirrhosis with ascites [28]
Peritoneal dialysis
<i>Capillary leak/fluid resuscitation</i>
Acidosis [3, 4, 19, 38, 47]
Damage control laparotomy
Hypothermia [30]
Increased APACHE-II or SOFA score [36, 38]
Massive fluid resuscitation or positive fluid balance [2, 27, 29–31, 36, 48]
Polytransfusion [30]
<i>Others/miscellaneous</i>
Age [29]
Bacteremia
Coagulopathy
Increased head of bed angle [40–42]
Massive incisional hernia repair
Mechanical ventilation [35]
Obesity or increased body mass index [2, 28, 48]
PEEP > 10 [28]
Peritonitis
Pneumonia
Sepsis [29, 37]
Shock or hypotension [3, 4, 28, 30, 45]



# Consensus management statements (cont')

## *Suggestions*

1. We suggest that clinicians ensure that critically ill or injured patients receive optimal pain and anxiety relief [GRADE 2D]
2. We suggest brief trials of neuromuscular blockade as a temporizing measure in the treatment of IAH/ACS [GRADE 2D]
3. We suggest that the potential contribution of body position to elevated IAP be considered among patients with, or at risk of, IAH or ACS [GRADE 2D]
4. We suggest liberal use of enteral decompression with nasogastric or rectal tubes when the stomach or colon are dilated in the presence of IAH/ACS [GRADE 1D]
5. We suggest that neostigmine be used for the treatment of established colonic ileus not responding to other simple measures and associated with IAH [GRADE 2D]
6. We suggest using a protocol to try and avoid a positive cumulative fluid balance in the critically ill or injured patient with, or at risk of, IAH/ACS after the acute resuscitation has been completed and the inciting issues have been addressed [GRADE 2C]
7. We suggest use of an enhanced ratio of plasma/packed red blood cells for resuscitation of massive hemorrhage versus low or no attention to plasma/packed red blood cell ratios [GRADE 2D]
8. We suggest use of PCD to remove fluid (in the setting of obvious intraperitoneal fluid) in those with IAH/ACS when this is technically possible compared to doing nothing [GRADE 2C]. We also suggest using PCD to remove fluid (in the setting of obvious intraperitoneal fluid) in those with IAH/ACS when this is technically possible compared to immediate decompressive laparotomy as this may alleviate the need for decompressive laparotomy [GRADE 2D]
9. We suggest that patients undergoing laparotomy for trauma suffering from physiologic exhaustion be treated with the prophylactic use of the open abdomen versus intraoperative abdominal fascial closure and expectant IAP management [GRADE 2D]
10. We suggest not to routinely utilize the open abdomen for patients with severe intraperitoneal contamination undergoing emergency laparotomy for intra-abdominal sepsis unless IAH is a specific concern [GRADE 2B]
11. We suggest that bioprosthetic meshes should not be routinely used in the early closure of the open abdomen compared to alternative strategies [GRADE 2D]



# Consensus management statements (cont')

## *No recommendations*

1. We could make no recommendation regarding use of abdominal perfusion pressure in the resuscitation or management of the critically ill or injured
2. We could make no recommendation regarding use of diuretics to mobilize fluids in hemodynamically stable patients with IAH after the acute resuscitation has been completed and the inciting issues have been addressed
3. We could make no recommendation regarding the use of renal replacement therapies to mobilize fluid in hemodynamically stable patients with IAH after the acute resuscitation has been completed and the inciting issues have been addressed
4. We could make no recommendation regarding the administration of albumin versus not, to mobilize fluid in hemodynamically stable patients with IAH after acute resuscitation has been completed and the inciting issues have been addressed
5. We could make no recommendation regarding the prophylactic use of the open abdomen in non-trauma acute care surgery patients with physiologic exhaustion versus intraoperative abdominal fascial closure and expectant IAP management
6. We could make no recommendation regarding use of an acute component separation technique versus not to facilitate earlier abdominal fascial closure

---

ACS abdominal compartment syndrome, IAP intra-abdominal pressure, IAH intra-abdominal hypertension, PCD percutaneous catheter drainage



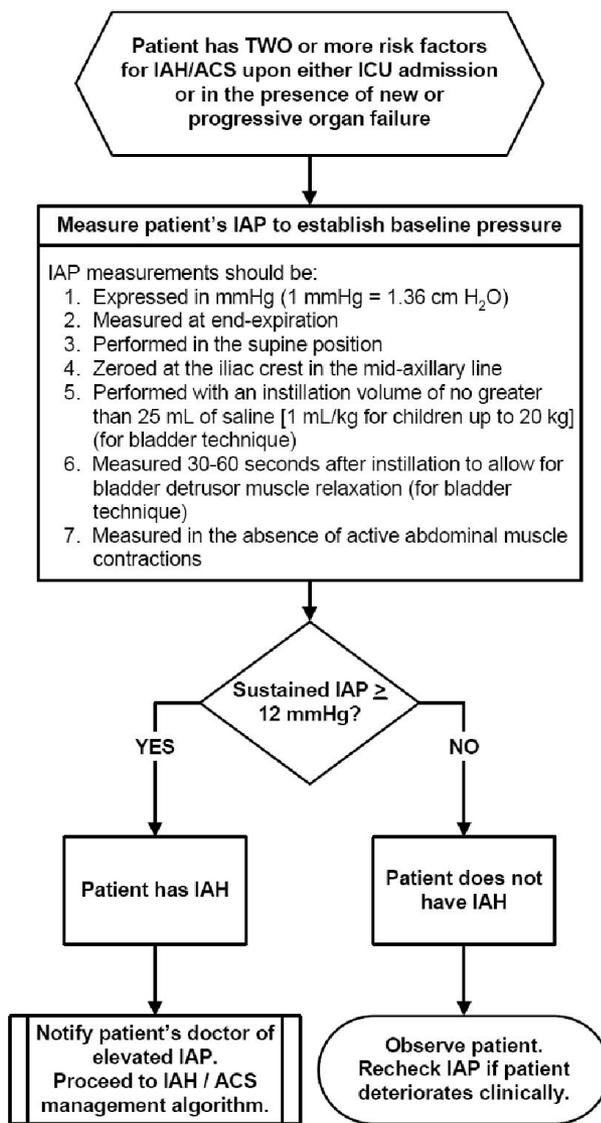
World Society  
of the Abdominal  
Compartment  
Syndrome

# IAH ASSESSMENT ALGORITHM 2006

[www.wsacs.org](http://www.wsacs.org)

## INTRA-ABDOMINAL HYPERTENSION (IAH) ASSESSMENT ALGORITHM

- Patients should be screened for IAH/ACS risk factors upon ICU admission and with new or progressive organ failure.
- If two or more risk factors are present, a baseline IAP measurement should be obtained.
- If IAH is present, serial IAP measurements should be performed throughout the patient's critical illness.



### Risk Factors for IAH / ACS

1. Diminished abdominal wall compliance
  - Acute respiratory failure, especially with elevated intrathoracic pressure
  - Abdominal surgery with primary fascial or tight closure
  - Major trauma / burns
  - Prone positioning, head of bed > 30 degrees
  - High body mass index (BMI), central obesity
2. Increased intra-luminal contents
  - Gastroparesis
  - Ileus
  - Colonic pseudo-obstruction
3. Increased abdominal contents
  - Hemoperitoneum / pneumoperitoneum
  - Ascites / liver dysfunction
4. Capillary leak / fluid resuscitation
  - Acidosis (pH < 7.2)
  - Hypotension
  - Hypothermia (core temperature < 33°C)
  - Polytransfusion (>10 units of blood / 24 hrs)
  - Coagulopathy (platelets < 55000 / mm<sup>3</sup> OR partial thromboplastin time (PTT) > 2 times normal OR prothrombin time (PTT) < 50% OR international standardised ratio (INR) > 1.5)
  - Massive fluid resuscitation (> 5 L / 24 hours)
  - Pancreatitis
  - Oliguria
  - Sepsis
  - Major trauma / burns
  - Damage control laparotomy

### IAH Grading

Grade I	IAP 12-15 mmHg
Grade II	IAP 16-20 mmHg
Grade III	IAP 21-25 mmHg
Grade IV	IAP $\geq$ 25 mmHg

### Abbreviations

IAH - intra-abdominal hypertension  
ACS - abdominal compartment syndrome  
IAP - intra-abdominal pressure

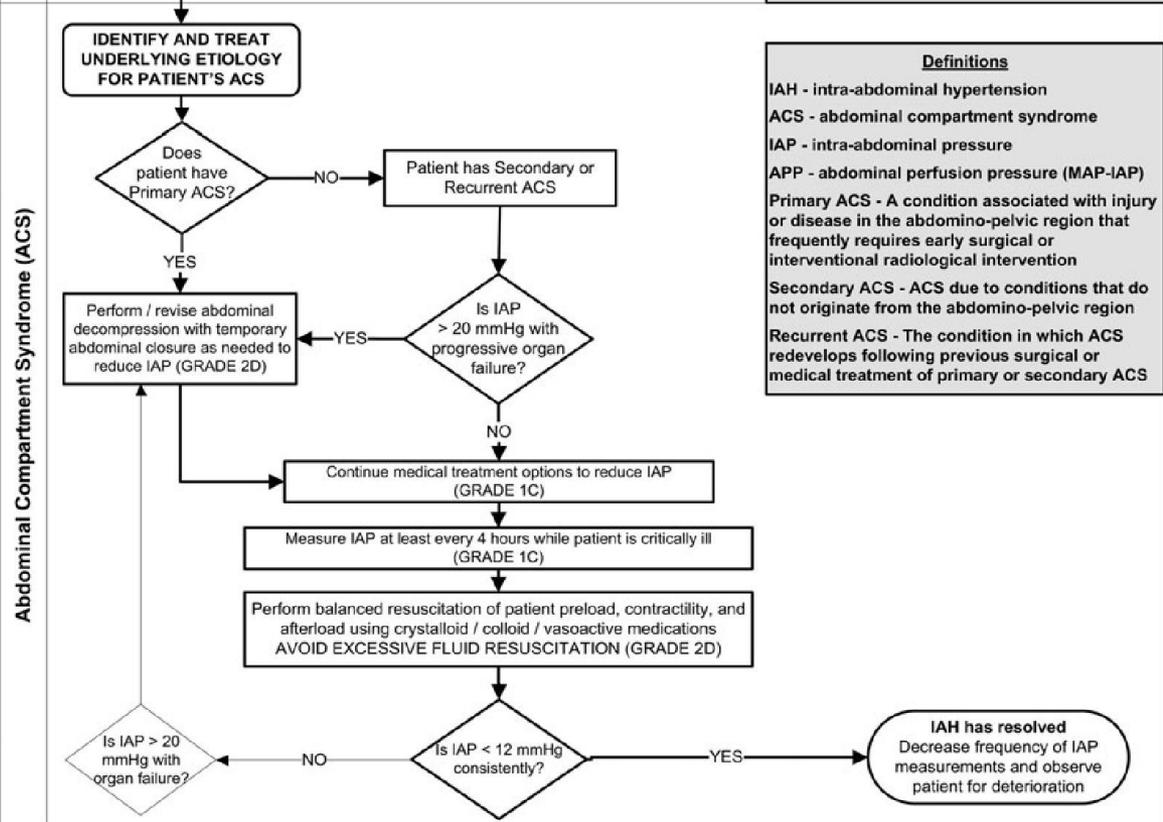
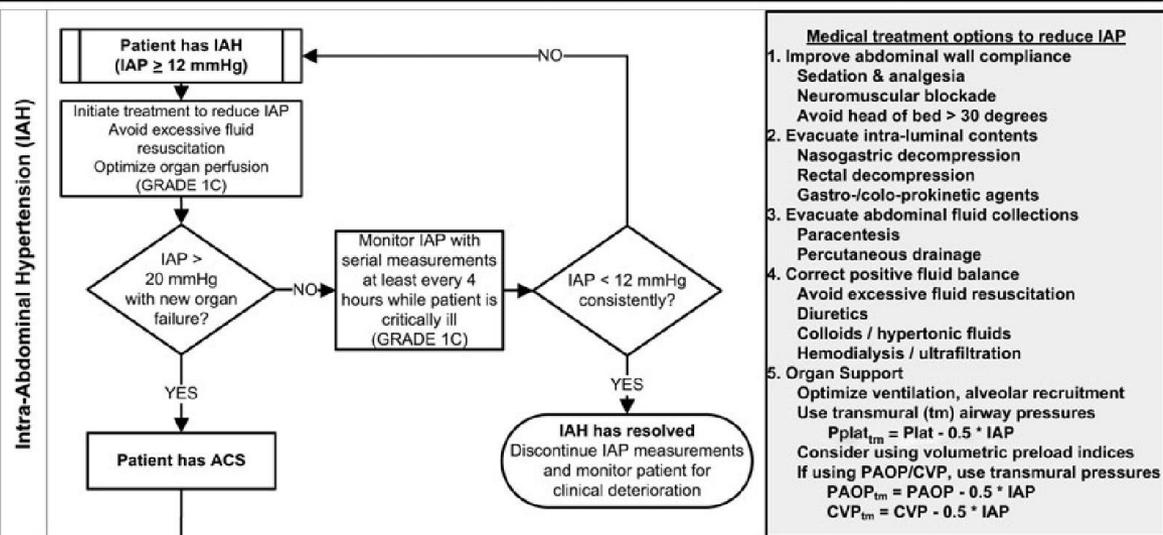


World Society  
of the Abdominal  
Compartment  
Syndrome

# IAH/ACS MANAGEMENT ALGORITHM

[www.wsacs.org](http://www.wsacs.org)

## COMPARTMENT SYNDROME (ACS) MANAGEMENT ALGORITHM





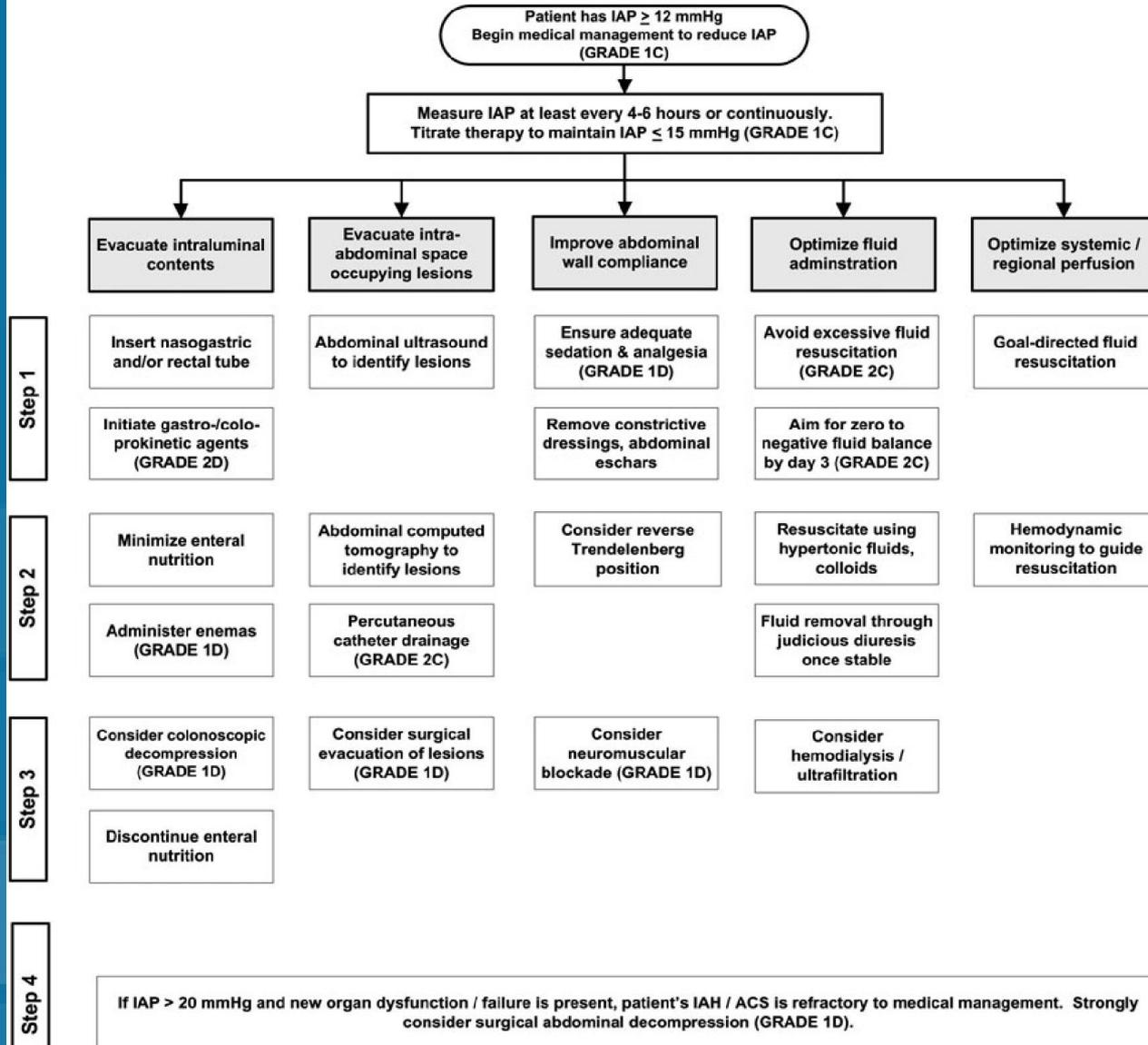
World Society  
of the Abdominal  
Compartment  
Syndrome

# IAH/ACS MEDICAL MANAGEMENT ALGORITHM

[www.wsacs.org](http://www.wsacs.org)

## IAH / ACS MEDICAL MANAGEMENT ALGORITHM

- The choice (and success) of the medical management strategies listed below is strongly related to both the etiology of the patient's IAH / ACS and the patient's clinical situation. The appropriateness of each intervention should always be considered prior to implementing these interventions in any individual patient.
- The interventions should be applied in a stepwise fashion until the patient's intra-abdominal pressure (IAP) decreases.
- If there is no response to a particular intervention, therapy should be escalated to the next step in the algorithm.





# Pediatric IAH/ACS management

**Table 6** Opinions of the Pediatric Guidelines Sub-Committee regarding the suitability of the WSACS management recommendations for the care of children

---

*Statements accepted as appropriate*

1. Measure IAP when any known risk factor is present in a critically ill or injured patient
2. Protocolized monitoring and management of IAP should be utilized when caring for the critically ill or injured
3. Use percutaneous catheter drainage to remove fluid in those with IAH/ACS when this is technically possible, whether an alternative is doing nothing or decompressive laparotomy
4. Use decompressive laparotomy in cases of overt ACS
5. Negative pressure wound therapy should be utilized to facilitate earlier abdominal fascial closure among those with open abdominal wounds
6. Use a protocol to try to avoid a positive cumulative fluid balance in the critically ill with, or at risk of, IAH



# Pediatric IAH/ACS management (cont')

*Statements not accepted as appropriate for pediatric care that were not supported for adult care*

1. No recommendation was made regarding the use of the abdominal perfusion pressure as a resuscitation endpoint
2. No recommendation was made regarding the use of decompressive laparotomy for patients with severe IAH without formal ACS
3. Biological meshes should not be routinely utilized to facilitate early acute fascial closure
4. No recommendation could be made to utilize the component separation technique to facilitate earlier acute fascial closure among patients with open abdominal wounds
5. Use of enhanced ratios of plasma to packed red blood cells during resuscitation from massive hemorrhage
6. Efforts and/or protocols to obtain early or at least same-hospital-stay fascial closure

---

*ACS* abdominal compartment syndrome, *IAP* intra-abdominal pressure, *IAH* intra-abdominal hypertension

**Thanks for your attention!**

