

**Results from the International Conference of  
Experts on Intra-Abdominal Hypertension (IAH) and  
Abdominal Compartment Syndrome (ACS)**

**DEFINITIONS**

*Intensive Care Medicine 2006; 32:1722-1732*



**World Society of the Abdominal Compartment Syndrome**

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

# INTRODUCTION TO THE DEFINITIONS

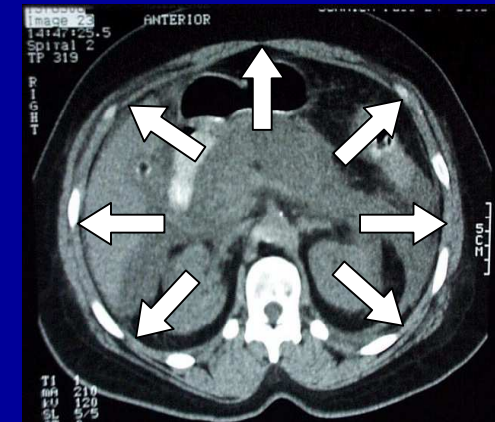
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- Intra-abdominal hypertension (IAH) and abdominal compartment syndrome (ACS) have been increasingly recognized in the critically ill as causes of significant morbidity and mortality.
- The variety of previous definitions has led to confusion and difficulty in comparing one study to another.
- An international group of critical care specialists convened to standardize definitions for both IAH and ACS as well as establish standards for the measurement of intra-abdominal pressure (IAP).



# DEFINITION 1: WHAT IS INTRA-ABDOMINAL PRESSURE?

- *“Intra-abdominal pressure (IAP) is the steady-state pressure concealed within the abdominal cavity.”*
- Elevated IAP is a common finding in the ICU
- IAP increases and decreases with respiration
- IAP is directly affected by:
  1. Solid organ or hollow viscera volume
  2. Space occupying lesions
    - Ascites, blood, fluid, tumors
  3. Conditions that limit expansion of the abdominal wall
    - Burn eschars, third-space edema



## DEFINITION 2: WHAT IS ABDOMINAL PERFUSION PRESSURE?

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- *“Abdominal perfusion pressure (APP) = mean arterial pressure (MAP) minus intra-abdominal pressure (IAP) = MAP - IAP.”*
- The critical IAP that leads to organ failure varies by patient
- A single threshold IAP cannot be globally applied to all patients
- Analogous to cerebral perfusion pressure, APP assesses not only the severity of IAP, but also the relative adequacy of abdominal blood flow
- APP is superior to IAP, arterial pH, base deficit, and arterial lactate in predicting organ failure and patient outcome
- Failure to maintain APP > 60 mmHg by day 3 predicts survival



## DEFINITION 3: WHAT IS THE FILTRATION GRADIENT?

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- *“Filtration gradient (FG) = glomerular filtration pressure (GTP) minus proximal tubular pressure (PTP) = MAP – 2\*IAP.”*
- Inadequate renal perfusion pressure and renal FG have been proposed as key causes of IAP-induced renal failure
- The FG is the mechanical force across the renal glomerulus
- GTP may be estimated by APP or MAP – IAP
- PTP may be assumed to be IAP in patients with elevated IAP
- Changes in IAP will have a greater impact upon renal function and urine production than will changes in MAP
- Oliguria is one of the first visible signs of elevated IAP



# DEFINITION 4: HOW SHOULD IAP BE MEASURED?

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- *“IAP should be expressed in mmHg and 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.”*
- Physical exam is inaccurate in predicting IAP
  - Sensitivity 40-61%
  - Positive predictive value 45-76%
- IAP measurements are essential to the diagnosis of elevated IAP and the management of IAH
- A variety of techniques may be used to measure IAP



## **DEFINITION 5: WHAT IS THE REFERENCE STANDARD FOR IAP?**

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- **“The reference standard for intermittent IAP measurement is via the bladder with a maximal instillation volume of 25ml sterile saline.”**
- **Intra-vesicular or “bladder” pressure measurement represents a safe, rapid, and cost-effective method for monitoring IAP.**
- **Bladder pressure measurements can be performed in any ICU using commonly available equipment.**
- **The recommended instillation volume has been decreased.**
  - **Larger volumes of saline can lead to falsely elevated IAP measurements**



# DEFINITION 6: WHAT IS NORMAL IAP?

- *“Normal IAP is approximately 5-7 mmHg in critically ill adults.”*
- IAP varies by disease severity:

Normal adult	0-5 mmHg
Typical ICU patient	5-7 mmHg
Post-laparotomy patient	10-15 mmHg
Patient with septic shock	15-25 mmHg
Patient with acute abdomen	25-40 mmHg

- An IAP in excess of 15 mmHg can cause significant end-organ dysfunction, failure, and patient death.





# DEFINITION 7: WHAT IS INTRA-ABDOMINAL HYPERTENSION?

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- *“IAH is defined by a sustained or repeated pathological elevation in IAP  $\geq$  12mmHg.”*
- The definition of IAH has varied over the years with thresholds as high as 40 mmHg being previously advocated.
  - Most clinicians are therefore concerned only when IAP exceeds 20-25 mmHg
    - This is well above the IAP that can cause organ dysfunction and failure
  - Failure to intervene when IAP rises above 25 mmHg is associated with poorer outcome



# DEFINITION 8: HOW IS IAH GRADED?

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- *“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 > 25mmHg.”*
- The IAH grades have been revised downward as the detrimental impact of elevated IAP on end-organ function has been recognized



# DEFINITION 9: WHAT IS ABDOMINAL COMPARTMENT SYNDROME?

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- *“ACS is defined as a sustained IAP > 20mmHg (with or without an APP < 60mmHg) that is associated with new organ dysfunction/ failure.”*
- ACS = IAH + organ dysfunction
- The most common organ dysfunction / failure(s) are:
  - Metabolic acidosis despite resuscitation
  - Oliguria despite volume repletion
  - Elevated peak airway pressures
  - Hypercarbia refractory to increased ventilation
  - Hypoxemia refractory to oxygen and PEEP
  - Intracranial hypertension

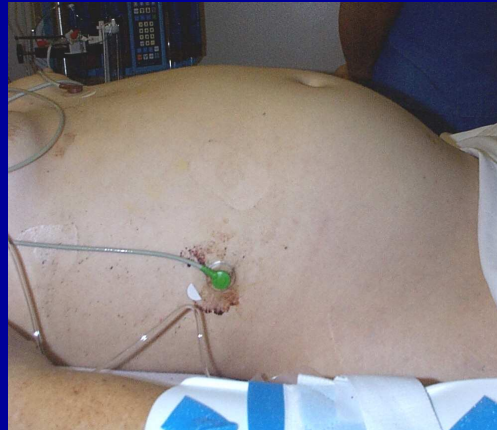


# DEFINITION 10: WHAT IS PRIMARY ACS?

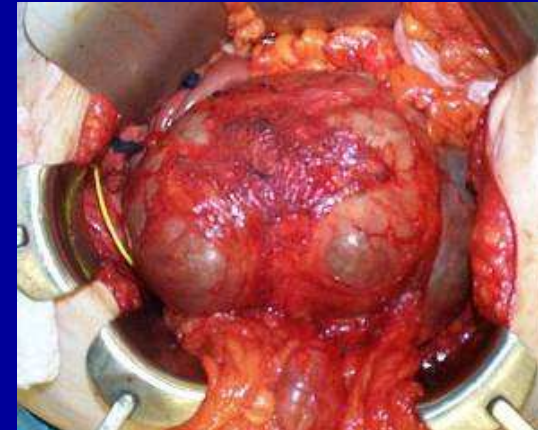
- *“Primary ACS is a condition associated with injury or disease in the abdominopelvic region that frequently requires early surgical or interventional radiological intervention.”*



Traumatic Injury



Ascites / Fluid



Abdominal Tumor



# DEFINITION 11: WHAT IS SECONDARY ACS?

- *“Secondary ACS refers to conditions that do not originate from the abdominopelvic region.”*



**Sepsis /  
Capillary Leak**



**Burns**



**Massive  
Resuscitation**



## DEFINITION 12: WHAT IS RECURRENT ACS?

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- *“Recurrent ACS refers to the condition in which ACS redevelops following previous surgical or medical treatment of primary or secondary ACS.”*
- Following damage control laparotomy and a temporary abdominal closure (TAC), a patient’s IAH recurred (IAP 24 mmHg, APP 46 mmHg) accompanied by decreased urinary output.
- Revision of the TAC allowed the edematous viscera to decompress resulting in resolution of the IAH (IAP 13 mmHg, APP 67 mmHg) and restoration of adequate renal function.



# CONCLUSIONS

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- **Significant progress has been made over the past decade towards understanding the causes and pathophysiology surrounding IAH and ACS.**
- **The WSACS hopes that these definitions, based upon the best current medical evidence as well as expert opinion, will serve as a practical yet comprehensive framework for both interpreting past research and planning future clinical and basic science research.**
- **Specific guidelines and recommendations for the management of patients with IAH/ACS have been published separately.**



# WORLD SOCIETY OF THE ABDOMINAL COMPARTMENT SYNDROME (WSACS)

- The WSACS was founded to promote education and research on IAH and ACS.
- Its membership includes physicians, surgeons, anesthetists, intensivists, nurses, respiratory therapists, and others.
- For further details, go to: [www.wsacs.org](http://www.wsacs.org)



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## Results from the International Conference of Experts on Intra-abdominal Hypertension and Abdominal Compartment Syndrome. I. Definitions

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**Abstract Objective:** Intra-abdominal hypertension (IAH) and abdominal compartment syndrome (ACS) have been increasingly recognized in the critically ill over the past decade. The variety of definitions proposed has led to confusion and difficulty in comparing one study to another. **Design:** An international consensus group of critical care specialists convened at the second World Congress on Abdominal Compartment Syndrome to standardize definitions for IAH and ACS based upon the current understanding of the pathophysiology surrounding these two syndromes. **Methods:** Prior to the conference the authors developed a blueprint for the various definitions, which was further refined both during and after the conference. The present article serves as the final report of the 2004 International ACS Consensus Defi-