

Management of Abdominal Compartment Syndrome and the Open Abdomen

M. Björck^{*}, A. Wanhainen

Department of Surgical Sciences, Section of Vascular Surgery, Uppsala University, Uppsala, Sweden

WHAT THIS PAPER ADDS

The understanding of the epidemiology and pathophysiology of intra-abdominal hypertension and abdominal compartment syndrome (ACS) has improved over the last two decades, and the creation of the World Society of the ACS (www.wsacs.org) in 2004 was an important step forward. Several papers were published, reporting on this clinical problem in association with vascular surgery, in particular open and endovascular aortic aneurysm repair. This review summarizes contemporary knowledge in this field.

Objectives: The management of the abdominal compartment syndrome (ACS) and the open abdomen (OA) are important to improve survival after major vascular surgery, in particular ruptured abdominal aortic aneurysm (RAAA). The aim is to summarize contemporary knowledge in this field.

Methods: The consensus definitions of the World Society of the Abdominal Compartment Syndrome (WSACS) that were published in 2006 and the clinical practice guidelines published in 2007 were updated in 2013. Structured clinical questions were formulated (modified Delphi method), and the evidence base to answer those questions was evaluated using the Grading of Recommendations, Assessment, Development, and Evaluation (GRADE) guidelines.

Results: Most of the previous definitions were kept untouched, or were slightly modified. Four new definitions were added, including a definition of OA and of lateralization of the abdominal wall, an important clinical problem to approach during prolonged OA treatment. A classification system of the OA was added. Seven recommendations were formulated, in summary: Trans-bladder intra-abdominal pressure (IAP) should be monitored in patients at risk. Protocolized monitoring and management are recommended, and decompression laparotomy if ACS. When OA, protocolized efforts to obtain an early abdominal fascial closure, and strategies utilizing negative pressure wound therapy should be used, versus not. In most cases the evidence was graded as weak or very weak. In six of the structured clinical questions, no recommendation could be made.

Conclusion: This review summarizes changes in definitions and management guidelines of relevance to vascular surgery, and data on the incidence of ACS after open and endovascular aortic surgery.

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INTRODUCTION

The understanding of the importance of intra-abdominal hypertension (IAH) and abdominal compartment syndrome (ACS) in the pathophysiology of postoperative complications after vascular surgery has increased over time.^{1,2} ACS is often a consequence of aggressive resuscitation after major bleeding, and in the first paper naming the condition the vascular surgeon Irving Kron described it

following ruptured abdominal aortic aneurysm (RAAA) repair.³ The association between IAH/ACS and colonic ischemia after RAAA repair has been demonstrated in several investigations,^{4–9} and it seems that survival can be improved if the hypoperfusion of the abdominal organs created by IAH/ACS can be reversed in time.^{4,8,9}

The application of damage control principles¹⁰ not only in trauma, but also in emergency surgery, as well as the understanding of the advantage of whole blood resuscitation,¹¹ and the development of massive transfusion protocols, are important recent advances in the management of the bleeding vascular patient.

The creation of the multidisciplinary World Society of the Abdominal Compartment Syndrome (WSACS; www.wsacs.org) in 2004 was an important event, and was followed

^{*} Corresponding author. M. Björck, Department of Surgical Sciences, Vascular Surgery, Uppsala University, SE-751 85 Uppsala, Sweden.

E-mail address: martin@bjorck.pp.se (M. Björck).

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by the publication of consensus definitions in 2006¹² and of clinical practice guidelines in 2007.¹³ When those guidelines were updated in 2012–2013, an evidence-based methodology was used,¹⁴ offering an opportunity to repeat this process with a vascular surgical perspective.

The aim of this review is to update the information on IAH/ACS, taking advantage of this evidence-based methodology, with focus on aspects of interest to vascular surgical patients.

METHODS

The updated consensus guidelines are named “Intra-abdominal hypertension and the abdominal compartment syndrome: updated consensus definitions and clinical practice guidelines from the World Society of the Abdominal Compartment Syndrome” and were published in *Intensive Care Medicine* in 2013.¹⁴ The consensus panel consisted of a multidisciplinary group, most of whom were surgeons and/or intensivists. They first identified 24 clinically relevant issues, and then conducted a series of systematic and structured literature reviews to identify relevant studies related to IAH or ACS. The updated consensus definitions and management statements were then derived, using a modified Delphi method, as well as the Grading of Recommendations, Assessment, Development, and Evaluation (GRADE) guidelines, respectively.^{15,16} Questions were based on polling of the WSACS Executive Committee, and were formulated according to the Patient, Intervention, Comparison, Outcome, and study design (PICO) format. Quality of evidence was graded from high (A) to very low (D), and management statements from strong “recommendations” (desirable effects clearly outweigh potential undesirable ones) to weaker “suggestions” (potential risks and benefits of the intervention are less clear), or “no recommendation”. Details of this complex methodology are reported in the original publication, including multiple supplementary web-published documents.¹⁴ A dedicated Pediatric Guidelines Sub-Committee was also created,¹⁴ so that, for the first time, the definitions and guidelines could also be adapted to children. Although the principles are the same, all values and thresholds are different in children; for details, please consult the original publication.¹⁴

This review summarises the changes in definitions and management guidelines of relevance to vascular surgery, as well as data on the incidence of IAH/ACS after open and endovascular aortic surgery.

RESULTS AND DISCUSSION

Revised definitions

In the 2006 consensus definitions document¹² from WSACS, IAH and ACS were defined. For a non-intensivist it may seem strange to define a “normal” intra-abdominal pressure (IAP) in a critically ill patient, but this is natural for intensivists who have the perspective of the intensive care unit (ICU) population, rather than of the general (healthy) population. The updated document¹⁴ has therefore kept the wording “IAP is approximately 5–7 mmHg in critically ill adults”. What is

more important than this “pseudo-normality” is the definition of IAH: “IAH is defined by a sustained or repeated pathological elevation in IAP >12 mmHg”. The words “sustained or repeated” are important as a single value maybe recorded when the patient is in pain and is therefore not sufficient to define the pathology. This upper threshold for “normality” is important to consider in patients operated on for RAAA, as it has been shown in multiple prospective clinical studies that it is uncommon for the IAP to be <12 mmHg in the early postoperative period after open surgery.^{7,8,17,18} Recommendation on the technique of how to measure IAP has not changed since the 2004 publication.¹²

The definition of ACS has undergone a minor change in the updated version, the difference being that the subdefinition of an abdominal perfusion pressure (APP) <60 mmHg was removed, as the GRADE process found that the evidence base for this subdefinition was too weak. The revised definition reads as follows: “ACS is defined as a sustained IAP >20 mmHg (with or without an APP <60 mmHg) that is associated with new organ dysfunction/failure”. The APP is defined as the mean arterial pressure (MAP) minus the IAP.

Note again the exact wording of the definition: “a sustained IAP >20 mmHg” means that the measurement has to be repeated at least once, and it needs to be associated with “new organ dysfunction/failure”; in other words, with a timely deterioration of vital organ function.

It should also be noted that the fact that there is insufficient evidence to define the ACS as an APP <60 mmHg does not necessarily rule out that a patient with hypotension and an intermediate IAH (15–19 mmHg) and new organ dysfunction or failure, may, in some cases, benefit from abdominal decompression. When there is no evidence, the clinician may need to rely on clinical experience (Fig. 1).

Four new definitions were added to the updated consensus document; two are of more basic scientific interest, but two have clinical relevance. First, the open abdomen (OA) was not defined previously, which created some uncertainty in clinical research: “The open abdomen is one that requires a temporary abdominal closure due to the skin and fascia not being closed after laparotomy”. Second, the importance of lateralization of the abdominal wall has been highlighted by recent research (see below): “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”.

The incidence and predictors of IAH/ACS after aortic surgery

The incidence will depend on several factors. The routines for resuscitation are of paramount importance. Balogh et al.¹⁹ showed that the administration of crystalloids was an independent risk factor for ACS in abdominal trauma patients. Although this has not been shown specifically in AAA patients, there are strong reasons to believe that it is true in any bleeding patient, and that a preoperative policy

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