

Recognition and Management of Intra-abdominal Hypertension and Abdominal Compartment Syndrome

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ABSTRACT

Objective: To determine ICU registrars' level of awareness regarding measurement of intra-abdominal pressure (IAP), features of intra-abdominal hypertension (IAH), and management of abdominal compartment syndrome (ACS).

Methods: We surveyed 40 Australasian ICU registrars attending a post-graduate teaching course in 2004. The survey questions explored clinical experience and understanding of IAP, methods of measurement of IAP, diagnosis and causes of IAH and management of ACS in critically ill patients.

Results: The survey recorded a 90% response rate. Ninety two percent of the ICU registrars had used IAP in their clinical practice; 52% of those with experience in IAP measurement had only employed it infrequently. While 90% affirmed their knowledge that IAP can rise due to intraperitoneal pathology, causation of IAH by retroperitoneal conditions was poorly understood. Ninety two per cent correctly said that ACS should be treated by abdominal decompression. Only 70% of our respondents felt confident not to perform a computed tomography (CT) scan of the abdomen before treating a patient with ACS. The majority understood the need for, and the modes of, therapy for ACS; but 33 % erroneously said that they would treat IAP > 30 mmHg regardless of organ dysfunction and another 22 % were unsure of the threshold of therapy for ACS.

Conclusions: ICU registrars in Australasia appreciate the techniques for, and significance of, IAP measurements and recognise and treat ACS appropriately. Retroperitoneal causes of IAH and the threshold for treatment for ACS were not well understood by the respondents. (**Critical Care and Resuscitation 2005; 7: 298-302**)

Key words: Intra-abdominal hypertension, abdominal compartment syndrome, intra-abdominal pressure measurement, trainee awareness

Measurement of intra-abdominal pressure (IAP) is one of the many clinical tools available to the clinician that aids in management of patients with intra- and retro-peritoneal conditions. Intra-abdominal hypertension (IAH) and abdominal compartment syndrome (ACS) are well-recognised clinical entities in medical and surgical diseases of the abdomen.¹ The occurrence of IAH during the ICU stay is an independent predictor of outcome from critical illness.²

Despite the prolificacy of peer-reviewed publications, there is variability in the extent of use of IAP in

intensive care units in Australasia, and indeed globally.³ The practice is also quite variable amongst surgeons. The lack of uniformity in its employment as an objective tool, the differing threshold for therapeutic decision making in IAH and ACS, and the uncertainty in some as to whether IAH is a phenomenon or epiphenomenon¹ have all contributed to the inconsistency in clinical practice. This variable practice is also reflected in training and education issues and the consequent awareness of IAH and ACS amongst critical care clinicians.

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To determine the level of awareness of measurement of IAP, features of IAH and management of ACS, we surveyed a group of Intensive Care Unit (ICU) registrars from Australia and New Zealand attending a post-graduate teaching course.

MATERIALS and METHODS

The Australian and New Zealand Intensive Care Society (ANZICS) coordinates an annual intensive care course that is attended by ICU registrars from Australasia. We undertook an anonymous 28-questions survey that sought to evaluate the trainees' familiarity with the measurement of IAP and the management of IAH and ACS.

The survey was given to all ICU registrars attending the post-graduate teaching course in 2004; however it was completed on a voluntary basis. Each question could be answered as 'yes', 'no' or 'unsure'. The questions were specifically designed to explore clinical experience and understanding of IAP (17 questions) and the diagnosis and management of IAH and ACS (11 questions). Further, the number of years of ICU experience was collected for each ICU registrar that completed the survey. The survey was conducted during the course but the course curriculum did not include any discussion on IAP and ACS.

RESULTS

The survey was undertaken during the 2004 course that attracted 40 ICU registrars, who were at the time of the survey, working in 24 intensive care units in Australia and New Zealand

There were 36 completed surveys, recording a 90% response rate. Twenty-nine of the registrars (72%) were working in C-24 training units as accredited by the Joint Faculty of Intensive Care Medicine (JFICM).⁴ Four registrars (10%) were from C-12 training ICU's and one registrar (3%) worked in a C-6 training unit. There were six registrars (15%) from large ICUs not accredited for JFICM training at the time of the survey.

The survey and the responses to questions on IAP are depicted in Table 1.

Ninety two percent of the ICU registrars had used IAP in their clinical practice but 52% of those with experience in IAP measurement had employed it infrequently, on less than 10 occasions. Only a quarter of the ICU registrars had used IAP on more than 25 occasions.

All but four of the registrars (88%) were aware that intravesical pressure measurement is the most commonly used method to monitor IAP. Notably only 20% of our respondents recognised that IAP measured through urinary catheter is as good as laparoscopic

Table 1. ICU registrars survey on awareness of intra-abdominal pressure

<i>Intra-abdominal Pressure (IAP)</i>		<i>Yes</i>	<i>No</i>	<i>Unsure</i>
1	I have never used IAP in my practice	3	33	-
2	I have only rarely (< 10 times) used IAP	19	17	-
3	I have occasionally (10 – 25 time) used IAP	7	29	-
4	I have used IAP often (> 25 times) in my practice	9	27	-
5	I know about IAP but have never used it so far	3	33	-
6	IAP is measured by instilling 50-ml Saline in to the Foley's catheter and then transducing the pressure	18	6	12
7	IAP is not measurable in patients with anuric renal failure	1	26	9
<i>My understanding of IAP is that</i>		<i>Yes</i>	<i>No</i>	<i>Unsure</i>
8	Intravesical (Urinary bladder) pressure is the most commonly used method	32	1	3
9	Bladder pressure method is as good as the pressure measured at laparoscopy	7	14	15
10	IAP is useful only in surgical patients (postoperatively)	-	33	3
11	IAP rises due to intra-peritoneal pathology	34	-	2
12	IAP rises due to retro-peritoneal pathology	20	8	8
13	IAP rises in both intra- and retro-peritoneal disorders	21	7	8
14	IAP above 12 mm Hg defines Intra-abdominal hypertension	4	24	8
15	IAP above 20 mm Hg defines Intra-abdominal hypertension	23	6	7
16	Intra-gastric and Intrarectal pressures are as good as Bladder Pressure as a measure of IAP	2	17	17
17	IAH is an epiphenomenon and not a phenomenon	6	6	24

pressure measurement. Forty percent were unsure of the latter fact and another 40% did not appreciate that urinary bladder pressure equalled laparoscopic measurement of IAP.

The survey and the responses to questions on IAH and ACS are depicted in Table 2.

In our survey while almost all the respondents (34/36) affirmed their knowledge that IAP can rise due to intraperitoneal pathology, only a little more than half were aware that IAP could also rise due to retroperitoneal pathology. Nearly a quarter of the respondents were unsure whether retroperitoneal pathology could lead to IAH while another quarter erroneously believed that IAH could not occur in retroperitoneal disease states.

Only half the respondents correctly recognised that the incidence of IAH does depend on the cut-off level for IAP. Sixty-seven percent of the respondents were unsure of the fact that IAH is a phenomenon and not an epiphenomenon (the raised IAP is a coincidentally witnessed clinical feature).

Regarding the diagnosis of ACS, 30% of the ICU registrars were unsure of the fact that IAH plus organ dysfunction defined ACS. Of these, eight respondents (22%) were unsure and three respondents (8%) called the above definition wrong.

The vast majority of the respondents in this study (86%) correctly recognised ACS as a clinical emergency

while only 8% of those surveyed did not deem it an emergency. A slightly larger number (92%) correctly said that ACS should be treated by abdominal decompression. Quizzed on therapy of ACS, 64% of the respondents correctly said that they would treat ACS irrespective of IAP. An encouragingly large number of ICU registrars surveyed for our study emphasised correctly that ACS would merit treatment regardless of the presence of renal insufficiency (80%), lactic acidosis (83%) or high-dose catecholamine requirement (80%). Only 70% of our respondents felt confident not to perform a Computed Tomography (CT) scan of the abdomen before treating a patient with ACS; (out of the 7 respondents who were unsure whether to do a CT, four of them had worked in ICU for > 2 years).

DISCUSSION

IAH and ACS are clinical entities with growing significance in the critically ill population.^{1,2} Our survey of ICU registrars revealed widespread awareness about the entity of IAH and its method of measurement.

Intravesical pressure, as measured through an indwelling urinary catheter, is the indirect gold standard method whilst the direct gold standard is the pressure measured via direct needle puncture in to the abdominal cavity, as during peritoneal dialysis or at laparoscopy.⁵ Disappointingly, only 20% of respondents recognised that IAP measured in the urinary bladder is

Table 2. ICU registrars Survey on awareness of intra-abdominal hypertension and abdominal compartment syndrome

<i>Intra-abdominal Hypertension</i>		<i>Yes</i>	<i>No</i>	<i>Unsure</i>
18	The incidence of IAH varies depending on the ICU (Cut off level for IAP)	19	3	14
19	IAH > 30 mm Hg demands surgical treatment regardless of other factors	12	16	8
20	IAH + Organ Dysfunction defines Abdominal Compartment Syndrome (ACS)	25	3	8
21	Abdominal Compartment Syndrome is a clinical emergency	31	3	2
22	ACS should be treated regardless of the IAP	23	5	8
23	ACS should usually be treated by abdominal decompression (Surgery, Paracentesis etc.)	33	1	2
<i>Regarding established abdominal compartment syndrome (ACS)</i>		<i>Yes</i>	<i>No</i>	<i>Unsure</i>
24	ACS is an epiphenomenon and not a phenomenon	5	14	17
25	ACS merits treatment only when there is renal insufficiency	2	29	5
26	ACS should be treated only if there is lactic acidosis	1	30	5
27	ACS should be treated only in case of massive inotrope requirement	-	29	7
28	Before treating ACS, a contrast-enhanced CT abdomen should always be done	3	26	7

equivalent to the direct gold standard, measured by laparoscopic technique.

Studies have shown that IAP measured via the urinary bladder is equivalent to the IAP determined via intragastric pressure,⁶ intra-jejunal pressure,⁷ and, indeed, from Jackson-Pratt abdominal drain tube pressure measurements.⁸ Intra-abdominal pressure can also be measured continuously either via a continuous irrigation method using a 3-way urinary catheter,⁹ or via balloon-tipped catheter in the stomach (Spiegelberg technique).¹⁰ Whilst the mean IAP on admission is not an independent risk factor for mortality, the occurrence of IAH during the ICU stay is indeed an independent outcome predictor.¹

One half of the surveyed ICU registrars did not appreciate that, for defining IAH, the incidence of IAH varies with the cut-off level of IAP value. The incidence of IAH has been shown to vary with the threshold of IAP cut-off and the higher the IAP, the greater the frequency of renal dysfunction.¹¹ Encouragingly a high proportion of those surveyed correctly defined IAH as IAP > 20 mmHg which was the level employed in widespread clinical practice.^{1,2,12} The level at which IAP becomes IAH has recently been revised.

The international consensus⁵ has evolved its definition of IAH and has given the option of abdominal perfusion pressure (APP) that is defined as mean arterial pressure minus the IAP ($MAP - IAP = APP$). IAH is defined as either (a) an IAP > 12 mmHg recorded by a minimum of three standardised measurements 4 - 6 hours apart or (b) $APP < 60$ mmHg, recorded by a minimum of two standardised measurements 1 - 6 hours apart.⁵ We did not include APP in our questionnaire as our survey preceded the International Consensus Conference's definition of IAH and ACS. Abdominal compartment syndrome is defined as IAP > 20 mmHg with or without $APP < 50$ mmHg during three standardised measurements 1 - 6 hours apart and that is associated with a new onset single or multiple organ system failure.⁵ We also did not differentiate ACS in to primary and secondary syndromes; primary ACS is that associated with abdomino-pelvic diseases or following abdominal surgery whereas secondary ACS refers to conditions that do not originate from the abdomen (such as sepsis and capillary leak, major burns, and other conditions requiring massive fluid resuscitation), yet result in the signs and symptoms commonly associated with primary ACS.⁵

We found the ICU registrars' knowledge of ACS and its therapy encouraging. This contrasts with a recent American survey that showed significant variation in the management of ACS and that a large percentage of Intensive Care clinicians were unaware of the current standards in the management of ACS.¹³

Our survey was conducted on a voluntary basis during an Intensive Care post-graduate teaching course with 90% response rate. Our survey's response rate compares favourably to a survey on ACS undertaken in the United States (36% response rate)¹³ and a postal survey undertaken in the United Kingdom (66% response rate).³ Postal surveys traditionally do not attract a high percentage of responders,^{3,14,15} in contradistinction to face-to-face¹⁶ or examination¹⁷ based questionnaires. Possible reasons for the healthy response rate of our questionnaire-based survey include the anonymous nature of the survey and the fact that the survey, though entirely voluntary, was conducted during a training course. However, as the course curriculum did not include any discussion on IAH and ACS, the course had no impact on the responses.

As such surveys do reflect practice and knowledge, we believe our survey is indicative of the prevailing Australasian practice pertaining to IAH and ACS. While a larger study of all the Intensive Care Units in Australia and New Zealand may be a stronger reflection of the Australasian practice, the respondents in this survey hailed from 24 different ICU's from all over Australia and New Zealand. Significantly, the vast majority of the respondents (72 %) were from large C-24 training units.

Any purported benefit from use of the IAP measurements is dependent on proper measurement technique and correct interpretation of the measured variables. It is notable that for bedside haemodynamic measurements taken using a pulmonary artery catheter, significant inter-observer variability was apparent,¹⁸ and that the interpretation of the derived haemodynamic data was generally poorly performed by both critically care trained doctors and nurses alike.^{17,19} Measurements of IAP may potentially be subject to similar limitations in its clinical utility.

Intra-abdominal hypertension and abdominal compartment syndrome are long-established entities and are independent predictors of morbidity and mortality.^{1,18} The threshold for intervention also varies,²⁰⁻²² reflecting the variable response amongst clinicians, to a measured value of IAP. Further it is also probable that there is individual variability in patients' responses to a given value of IAP.

IAH and ACS are relevant to both surgical and non-surgical diseases of the abdomen. Acidosis, hypothermia, polytransfusion, coagulopathy, sepsis, liver diseases and positive-pressure ventilation are some of the conditions that predispose to IAH.⁵

We conclude that there is a reasonably high degree of awareness, among ICU registrars in Australasia, of the techniques for, and significance of, IAP measurements and there is a good understanding of the

requirement for recognising and treating ACS. However many ICU registrars were unsure whether IAH and ACS are of themselves a pathological cause of organ dysfunction rather than an epiphenomenon. The majority understood the modes of treatment and the clinical syndrome of ACS. Retroperitoneal causes of ACS and the importance of organ dysfunction mandating therapy, rather than the mere presence of IAH, were poorly understood.

IAP is an useful adjunct to the clinical tools in managing abdominal diseases. IAH is an entity that is seen in Medical and Surgical diseases of the abdomen and can easily be diagnosed and tracked. ACS is a potentially fatal condition if untreated. We recommend clinical vigilance for IAH and ACS.

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