DOI: https://doi.org/10.5114/ait.2019.87648

Awareness and knowledge of intra-abdominal hypertension and abdominal compartment syndrome: results of a repeat, international, cross-sectional survey

Robert Wise[1,2], Reitze Rodseth[2,3], Annika Reintam Blaser[4,5], Derek J. Roberts[6], Jan J. De Waele[7], Andrew W. Kirkpatrick[8], Bart L. De Keulenaer[9,10], Manu L.N.G. Malbrain[11,12]; for the WSACS – the Abdominal Compartment Society

[1]*Department of Critical Care, Edendale Hospital, Pietermaritzburg, South Africa*
[2]*Department of Anaesthetics and Critical Care, Nelson R. Mandela School of Medicine, University of KwaZulu-Natal, Pietermaritzburg, South Africa*
[3]*JB & Partners and Department of Anaesthetics, Nelson R. Mandela School of Medicine, University of KwaZulu-Natal, Pietermaritzburg, South Africa*
[4]*Department of Anaesthesiology and Intensive Care, University of Tartu, Estonia*
[5]*Department of Intensive Care Medicine, Lucerne Cantonal Hospital, Lucerne, Switzerland*
[6]*Division of Vascular and Endovascular Surgery, Department of Surgery, University of Ottawa, Ottawa, Canada*
[7]*Department of Critical Care Medicine, Ghent University Hospital, Ghent, Belgium*
[8]*Regional Trauma Services, Departments of Surgery and Critical Care Medicine, Foothills Medical Centre, Calgary, Canada*
[9]*Department of Intensive Care Medicine, Fiona Stanley Hospital, Murdoch, Australia*
[10]*School of Surgery, University of Western Australia, Sterling Highway, Crawley, Australia*
[11]*Intensive Care Unit, University Hospital Brussels (UZB), Jette, Belgium*
[12]*Faculty of Medicine and Pharmacy, Vrije Universiteit Brussel (VUB), Brussels, Belgium*

Abstract

Background: Intra-abdominal hypertension (IAH) and abdominal compartment syndrome (ACS) are increasingly recognized as aetiologies of organ failure and mortality among a wide variety of patient populations. Since the first global survey in 2007, several surveys have been conducted. However, it remains unclear to what extent healthcare professionals in clinical practice are aware of the widely accepted definitions and recommendations proposed in the World Society of the Abdominal Compartment Syndrome (WSACS) guidelines and whether these recommendations are being applied clinically.

Methods: We conducted an international cross-sectional survey to determine the impact of the 2013 WSACS IAH/ACS Consensus Definitions and Clinical Management Guidelines on IAH/ACS clinical awareness and management. We also aimed to compare the results to the findings of the global survey conducted in 2007.

Results: The survey had 559 respondents with most respondents being physicians from Europe, and who worked in mixed intensive care units (87.3%; $n = 448$). The majority of respondents (73.2%) were aware of WSACS (the Abdominal Compartment Society), with a greater percentage being aware of the WSACS guidelines compared to the 2007 survey (60.2% vs. 28.4%). A considerable proportion of respondents (18%) never measure intra-abdominal pressure (IAP), with the most common reason for not measuring IAP being reliance on physical examination (39%; $n = 38$). Analysis of the 11 questions related to knowledge and clinical practice of IAH, ACS and WSACS consensus definitions showed an improvement from the first survey (42.7% of questions answered correctly in comparison to 48.0% in this survey, $P = 0.0001$). The responses to how physicians managed IAH and ACS were different to the previous survey, with diuretics being used "usually" or "frequently" (49.2%), more than inotropes (38.6%), decompressive laparotomy (37.0%), paracentesis (36.5%), and fluids/blood products (24.2%). Most respondents would perform/request a decompressive laparotomy in cases of ACS. Polycompartment syndrome was something considered by 39% ($n = 218$) in their daily practice. Almost two thirds of respondents (63.5%; $n = 355$) thought that gastrointestinal injury should be added to the Sequential Organ Failure Assessment (SOFA) score.

Conclusions: This survey shows an improvement in general awareness and knowledge regarding IAP, IAH and ACS, although the level of understanding and awareness

Anaesthesiol Intensive Ther 2019; 51, 3: 186–199

Received: 01.05.2019, **accepted:** 26.05.2019

of WSACS guidelines remains low. There appear to be some practice changes and greater awareness of the need to monitor abdominal pressures. Future initiatives should focus on education, identifying which patients should receive routine monitoring, and incorporation of IAH and ACS care into ICU bundles and protocols already in existence.

Key words: abdominal pressure, abdominal hypertension, abdominal compartment syndrome, survey, knowledge, definitions, awareness, international.

CORRESPONDING AUTHOR:

Robert Wise, Head Clinical Unit, Critical Care, Edendale Hospital, Plessislaer, Pietermaritzburg, South Africa, e-mail: robwiseICU@gmail.com

INTRODUCTION

Intra-abdominal hypertension (IAH) and abdominal compartment syndrome (ACS) are increasingly recognized as risk factors for organ failure and mortality among a wide variety of patient populations. These conditions result in increased resource utilization and potentially an economic burden on healthcare resources [1–11]. Despite this, intra-abdominal pressure (IAP) measurements are not universally performed, even in those situations where evidence or expert opinion suggests that it may influence patient management and associated outcomes [6, 12].

The Abdominal Compartment Society (the World Society of the Abdominal Compartment Syndrome – WSACS, www.wsacs.org) was founded in 2004 by an international group of clinicians in order to coordinate and promote research, education and awareness of IAH and ACS. An international survey conducted after the publication of the WSACS consensus definitions and recommendations in 2006–2007 revealed a lack of clinical awareness about IAH and ACS [12]. In particular there was an important knowledge deficit about IAH/ACS diagnosis and IAP monitoring. These guidelines were subsequently updated in 2013 and published as the 2013 WSACS IAH/ACS Consensus Definitions and Clinical Management Guidelines on IAH/ACS [6].

Since the first global survey, several other surveys have been conducted, the majority of which focused on the awareness or knowledge of clinicians regarding these conditions within one geographical area, country, or specialty [13–16]. It remains unclear, however, to what extent healthcare professionals in clinical practice are aware of the now widely accepted definitions and recommendations proposed in the WSACS guidelines. It is also unclear whether these definitions and recommendations are considered important, how and when they are applied, and whether clinicians perceive IAH and ACS to be significant in the management of their patients.

We conducted an international cross-sectional survey to determine the impact of the 2013 WSACS IAH/ACS Consensus Definitions and Clinical Management Guidelines on IAH/ACS clinical awareness and management among a multidisciplinary group of stakeholder clinicians. We also aimed to compare the results to the findings of the global survey conducted in 2007 to assess whether awareness had improved over time.

METHODS

Design

We conducted a self-administered, electronic, cross-sectional survey of healthcare professionals working in critical care units across all continents. The study was approved by the University of KwaZulu-Natal Research Ethics Board and was conducted and reported according to recommendations for performing survey research. The survey was endorsed by the Abdominal Compartment Society (WSACS, www.wsacs.org), the European Society of Intensive Care Medicine (ESICM, www.esicm.org), and the Critical Care Society of South Africa (CCSSA, https://www.criticalcare.org.za).

Study population

The population of interest included intensivists and those performing a large majority of their work in critical care units but who were not necessarily qualified intensivists. This was necessary to include those countries in which patients are frequently cared for by non-intensive care unit (ICU) specialists. The population was largely contacted through their respective critical care societies.

Questionnaire development and testing

The questionnaire was developed by modifying a previously used questionnaire administered to critical care healthcare professionals in 2006–2007 [12]. The survey questionnaire was refined to incorporate current questions pertinent to the field using the existing literature and input provided by a team of experts. A team of experts consisting of published authors in the field, leaders in WSACS and critical care societies, and experienced intensivists, assessed the questionnaire's clarity, ambiguity, length, and completeness. The instrument was pilot tested on 10 intensive care specialists. The questionnaire focused on three main areas: demographics, knowledge and awareness of IAH and ACS, and clinical practice related to the subject (the final survey instrument is reported in the Appendix).

Questionnaire administration

We first administered questionnaires by e-mail to all members of the supporting societies (ESICM, WSACS, and CCSSA), as well as to all members of the Belgian Intensive Care Society (SIZ, www.siz.be). Participants of the 8th WCACS (World Congress on Abdominal Compartment Syndrome) meeting (June 2017, Banff, Canada) were also encouraged to complete the questionnaire. No reminders were sent after the initial emails. Links to the survey were also sent to the countries of WSACS representatives and further distributed to local critical care societies. E-mails explained the study purpose and invited potential respondents to participate by accessing a link to a secure, web-based survey. Consent was required in the electronic survey, in order to proceed to the questions. We were unable to personalize emails because we were not given access to email databases from the supporting societies. Respondent confidentiality was assured, and a random draw could be entered for a free registration to the 8th WCACS.

Data analyses

We summarized categorical and continuous survey responses using counts (percentages) and medians (with interquartile ranges [IQRs]). The survey consisted of 53 questions (detailed in Appendix 1) – of these a total of 11 questions were classified as knowledge questions with one or more correct answers. Based on the results of these questions an average score for the correct answers could be calculated (expressed as a percentage). Subgroup analyses were performed based on country of origin, primary specialty, and whether the participant was aware of the WSACS or the previously published consensus definitions. All data analyses were performed using STATA software version 15 (Stata Statistical Software: Release 15 (2017). StataCorp LLC, 4905 Lakeway Drive, College Station, TX, USA). All tests were 2-sided, and we considered those resulting in values of $P < 0.05$ significant.

RESULTS

Respondent demographics

The survey had 559 respondents. Most respondents were physicians and resided in Europe (Table 1).

As with the 2007 survey, the majority of respondents worked in mixed ICUs (87.3%; $n = 448$), with surgical ICUs being the next largest contributor (7.8%; $n = 40$). There were small contributions from medical (1.2%; $n = 6$), paediatric (1.8%; $n = 9$), trauma (1.4%; $n = 7$), and other ICUs (0.6%; $n = 3$) (Table 2).

Number of ACS cases

The clear majority of respondents (93%; $n = 486$) had treated at least 1 case of ACS in the previous year. In keeping with the previous survey, most physicians (56%, $n = 294$) treated between 1 and 5 and 20% between 6 to 10 cases of ACS per year.

IAH and ACS definitions

The majority of respondents (73.2%) were aware of WSACS, but fewer of them knew about the WSACS guidelines (60.2% were aware of any guidelines and 55.5% were aware of the revision of the guidelines in 2013). However, this number was markedly increased from 28.4% in the 2007 survey ($P \leq 0.0001$). There was an improved familiarity with IAH and its effects compared to the previous survey (Table 3). Most respondents were also familiar with

TABLE 1. Respondent demographics

Variable	2007 survey	Current survey		*P*-value (Fisher exact)
	n = 2244	*n* = 559 (100%)	95% CI (%)	
Professional				
Physicians	63.9%	84.0% (471)	81.0–87.1	< 0.0001
Nurses	10.6%	5.4% (30)	3.8–7.6	0.0001
Fellow physicians	7.3%	8.8% (49)	6.7–11.4	NS
Student nurses	0.2%	0.9% (5)	0.3–2.1	0.02
Other or not reported	17.5%	0.7% (4)	0.2–1.9	< 0.0001
Geographical				
Europe	31.6%	42.0% (235)	38.0–46.2	< 0.0001
Asia	7.2%	9.3% (52)	7.2–12.0	NS
North America	53.0%	15.0% (84)	12.3–18.2	< 0.0001
South America	4.8%	10.4% (58)	8.1–13.2	< 0.0001
Africa	1.4%	17.0% (95)	14.1–20.3	< 0.0001
Australia	2.0%	6.3% (35)	4.5–8.6	< 0.0001

TABLE 2. Type of intensive care unit (ICU) of respondent

ICU respondents type of ICU	2007 survey	Current survey		*P*-value (Fisher exact)
	n = 2244 (100%)	*n* = 513 (91.8%)	95% CI (%)	
Mixed	55.3%	87.3% (448)	84.2–89.9	< 0.0001
Trauma	30.4%	1.4% (7)	0.6–2.9	< 0.0001
Surgical	29.7%	7.8% (40)	5.8–10.5	< 0.0001
Cardiac	15.3%	0%	–	< 0.0001
Medical	14.8%	1.2% (6)	0.5–2.6	< 0.0001
Paediatric	10.2%	1.8% (9)	0.9–3.4	< 0.0001
Burns	8.5%	0%	–	< 0.0001
Other	4.8%	0.6% (3)	0.1–0.2	< 0.0001

TABLE 3. Perceptions regarding definitions of normal intra-abdominal pressure (IAP), intra-abdominal hypertension and abdominal compartment syndrome and effects of IAP on organ dysfunction

Variable	2007 survey	Current survey		*P*-value (Fisher exact)
	n = 2244 (100%)	*n* = 559 (100%)	95% CI (%)	
Confirmed familiarity with				
IAH or its effects	85.6%	96.4% (539)	94.5–97.7	< 0.0001
ACS or its effects	98.8%	96% (537)	94.1–97.4	< 0.0001
Abdominal perfusion pressure	80.9%	92.8% (519)	90.4–94.7	< 0.0001
Definition of APP = MAP – IAP	n/a	86.7% (489/564)	83.6–89.3	
Perceptions regarding IAP, IAH and APP				
IAP normal 0–5 mm Hg	38%	35.2% (191)	31.3–39.3	0.0965
IAP normal 6–10 mm Hg	46%	52.7% (286)	48.5–56.8	0.0294
IAP normal 11–15 mm Hg	14%	11.4% (62)	9–14.4	0.0718
IAP normal > 16 mm Hg	2.3%	0.7% (4)	0.2–1.9	0.0159
IAH cut-off of above 12 mm Hg	n/a	56.6% (313)	52.44–60.7	
IAH cut off of above 15 mm Hg	74.9%	82.1% (454)	78.7–85	0.0016
What IAP causes organ dysfunction?				< 0.0001
≥ 20 mm Hg	62.2%	40% (219)	35.8–44.0	
≥ 15 mm Hg		27.5% (151)	23.9–31.3	
With IAH and organ dysfunction – what IAP defines ACS?				< 0.0001
> 15 mm Hg	n/a	18.8% (103)	15.7–22.3	
> 20 mm Hg	n/a	53.0% (293	49.2–57.5	
> 25 mm Hg	60.2%	19.3% (106)	16.2–22.8	
Best APP threshold?		541 respondents		
APP > 75 mm Hg		5.2% (28)	3.6–7.4	
APP > 65 mm Hg		35.7% (193)	3.2–4.0	
APP > 55 mm Hg		31.6% (171)	27.8–36.7	
APP > 45 mm Hg		14.0% (76)	10.6–18.4	
None of the above		7.8% (42)		

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

ACS and its effects as well as with abdominal perfusion pressure, despite only 60.3% being familiar with previous consensus definitions and guidelines (Table 3). Perceptions regarding normal IAP, cut-off levels for IAH and ACS for adult patients and related organ dysfunctions are presented in Table 3. For the paediatric population, the answers regarding at which IAP level ACS occurs varied greatly (Table 4).

TABLE 4. Intra-abdominal pressure measurement

Variable	2007 survey	Current survey		*P*-value (Fisher exact)
	n = 2244	*n* = 558	95% CI (%)	
Do you measure IAP?				
No	4%	18% (101/558)	15.1–21.5	< 0.0001
Yes				
IAP measure bladder	91.9%	93.7% (428/457)	91.0–95.6	0.2148
Direct peritoneal	1.2%	0.9% (4/457)	0.3–2.3	0.8088
Transgastric	0.3%	–		
Combination	6.3	5.5% (25/457)	3.7–7.9	0.5931
10–25 mL	17.2%	54.2% (247/456)	49.6–58.7	< 0.0001
50–100 mL	50.9%	25.7% (117/456)	24.8–26.6	< 0.0001
100 mL	27.9%	6.6% (30/456)	4.4–9.0	< 0.0001
200 mL	4%	2.2% (10/456)	1.1–4.0	0.0755
Unsure how much fluid to use		11.4% (52/456)	10.0–12.8	
Immediate	7%	12.3% (56/457)	9.54–15.6	0.0004
Wait 30 seconds	35.2%	37.4% (171/457)	33.1–41.9	0.3911
Wait 31 to 60 seconds	36.6%	31.5% (144/457)	27.4–35.9	0.0418
Wait 61 to 120 seconds	19%	9.6% (44/457)	7.2–12.7	< 0.0001
Aware of continuous? Yes		58% (265/457)	53.4–62.4	
IF yes – which technique are you aware of?		73.8% bladder 21.4% direct peritoneal 12.5% gastric 11.8% – non above		
What IAP is ACS in paediatric patients?				
5 mm Hg		4.7% (26/559)	3.4–6.4	
10 mm Hg		20.4% (114/559)	17.3–23.9	
12 mm Hg		16.8% (94/559)	13.9–20.2	
15 mm Hg		22.7% (127/559)	19.4–26.4	
20 mm Hg		20% (112/559)	16.9–23.6	
25 mm Hg		3% (17/559)	1.9–4.9	
> 25 mm Hg		3.2% (18/559)	2.0–5.1	
How often do you routinely measure IAP?				
Continuously	3.5%	2.4% (11/457)	1.3–4.3	0.2550
4 hourly	19.1%	30.9% (141/457)	26.8–35.2	< 0.0001
6 hourly	13.1%	22.5% (103/457)	18.9–26.6	< 0.0001
8 hourly	13.2%	17.9% (82/457)	14.7–21.7	0.0095
12 hourly	5.6%	5% (23/457)	3.3–7.5	0.7358
Daily	2.2%	2% (9/457)	1.0–3.7	1.0000
When clinically indicated	41.8%	12.5% (57/457)	9.7–15.8	< 0.0001
Other	1.8%	2% (9/457)	1.0–3.7	0.7044
I don't measure IAP routinely		4.8% (22/457)	3.2–7.2	

IAP – intra-abdominal pressure, ACS – abdominal compartment syndrome

IAP measurement

A considerable proportion of respondents (18%) never measure IAP. The most common reasons for not measuring IAP were reliance on physical examination (39%; *n* = 38), a lack of knowledge (15.3%; *n* = 15), a perceived lack of patients with IAH (13.3%; *n* = 13), or due to expense (5.1%; *n* = 5).

Practices to measure IAP in respondents who use it in practice (457/559) are presented in Table 4.

TABLE 5. Risk factors for intra-abdominal hypertension and abdominal compartment syndrome

Variable	Current survey	
	n = 559	95% CI (%)
ACS is important in trauma	98.2% (549/559)	
In medical patients	86.4% (483/559)	
Risk in medical – *n* = 464		
Acute pancreatitis	76.1% (353/464)	72–80
Sepsis	45.9% (213/464)	41.4–50.5
Massive fluid resuscitation	63.6% (295/464)	59.1–67.8
Mechanical ventilation	16.2% (75/464)	13.1–19.8
Obesity	21.3% (99/464)	17.8–25.3
Organ failure	42% (195/464)	37.6–46.6
Patient at risk	75% (348/464)	70.9–79.0
Risk in surgical – *n* = 464		
Trauma surgery	77.4% (359/464)	73.3–81.0
Abdominal surgery	76.3% (354/464)	72.2–80.0
Massive fluid resuscitation	70.5% (327/464)	66.2–74.5
Abdominal vascular surgery	46.6% (216/464)	42.1–51.1
O/G surgery	14.4% (67/464)	11.5–18.0

ACS – abdominal compartment syndrome

Regarding measurement of IAP in the open abdomen, 11.9% (*n* = 67) did not think it necessary to monitor IAP because they believed that the IAP would not increase. A further 25.2% (*n* = 141) did not measure IAP if the abdomen was open, while 23.8% would measure IAP routinely and 28.6% would sometimes take readings.

Perceptions regarding risk factors for IAH/ACS

Most of the respondents considered ACS to be important both in trauma (98.2%) and in medical patients (86.4%). Perceptions regarding risk factors for IAH/ACS are presented in Table 5.

Knowledge and clinical practice of IAH, ACS and WSACS consensus definitions

To evaluate evolution of knowledge we analysed 11 questions where correct answers were defined based on WSACS guidelines and compared the results from 2007 to the current survey (Table 6).

The previous survey had 13 knowledge questions with 43.0% of these answers being correct. Eleven of these were repeated in this survey. Analysis of these 11 questions showed that the first survey had 42.7% of questions answered correctly in comparison to 48.0% in this survey ($P = 0.0001$).

There were improvements in seven of the questions with declines in three others. One question did not show a significant change in either direction.

There were significant improvements in answers related to definitions, measurement of IAP, and basic IAH/ ACS knowledge. Declines occurred in the areas of intravesical measurement, criteria for abdominal decompression, and knowledge linked to the IAP at which organ dysfunction may occur.

TABLE 6. Knowledge and clinical practice of intra-abdominal hypertension, abdominal compartment syndrome and World Society of the Abdominal Compartment Syndrome (WSACS) consensus definitions

Knowledge question		Correct answer	2007	Current	Two-tailed *P*-value
1	What is "normal" IAP?	< 10 mm Hg	81.0%	86.6%	0.002
2	Are you familiar with the concept of abdominal perfusion pressure?	Yes	80.9%	86.7%	0.001
3	On what criteria do you base your decision to decompress a patient with ACS?	Combination of IAP and organ dysfunction	72.9%	59.3%	0.0001
4	Would you perform surgical decompression in a patient with ACS?	Yes, but only in selected cases	64.7%	64.4%	0.921
5	Are you aware of continuous IAP measurement techniques?	Yes	52.2%	58.4%	0.017
6	How often do you measure IAP?	Every 4 to 6 hours	29.6%	53.2%	0.0001
7	What IAP level defines ACS?	20 mm Hg	27.8%	52.5%	0.0001
8	What IAP level defines IAH?	12 mm Hg	17.5%	44.2%	0.0001
9	For the transvesical (bladder) technique, how long do you wait before reading the IAP (i.e. to achieve a stable tracing)?	61—120 seconds	17.3%	9.5%	0.0001
10	For the transvesical (bladder) technique, the volume instilled in the bladder before IAP measurement should be...	20—25 mL	15.7%	53.7%	0.0001
11	At what level of IAP do you think organ dysfunction may occur in patients with IAH?	10—12 mm Hg	9.7%	4.9%	0.0002
Overall score			42.7%	48%	0.0001

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

TABLE 7. Awareness of the Abdominal Compartment Syndrome (WSACS), 2006/2007 and 2013 guidelines (best results highlighted in dark grey, worst in light grey)

	Anaesthesia	Intensive Care	Surgery/trauma	Internal Medicine	Paediatrics	Emergency Medicine
Aware of WSACS	66.9%	78.2%	80.6%	78.8%	76.9%	62.2%
Aware of 2006/7 WSACS guidelines	52.9%	68.8%	66.9%	57.6%	61.5%	43.2%
Aware of 2013 revised guidelines	43.3%	62.9%	64.0%	57.6%	61.5%	37.8%

TABLE 8. On what criteria do you commonly base your decision to perform (or request) surgical decompression on a patient with abdominal compartment syndrome?

Question: What is the decision to perform decompressive laparotomy based on?	Current survey
The IAP	24.1% (*n* = 137)
The degree of organ dysfunction	59.3% (*n* = 337)
The cause of ACS	44.2% (*n* = 251)
The evolution of IAP	36.6% (*n* = 208)
The evolution of organ dysfunction	51.9% (*n* = 295)
I do not surgically decompress patients with ACS	4.6% (*n* = 26)
Other	2.6% (*n* = 15)

IAP – intra-abdominal pressure, ACS – abdominal compartment syndrome

TABLE 9. What factors influence the decision to perform/request a decompressive laparotomy in a patient with known or suspected intra-abdominal hypertension?

Question: What other factors influence the decision to perform decompressive laparotomy?	2007 survey	Current survey
Abdominal distension	61.1%	51.2% (291)
Decreasing cardiac output	66.6%	62.1% (353)
Increasing oxygen requirement	60.9%	45.1% (256)
Increasing vasopressor or inotrope doses	62.1%	59.0% (355)
Increasing ventilator pressures	73.4%	69.2% (393)
Worsening acidosis	71.4%	69.9% (397)
Worsening oliguria	74.5%	81.0% (460)
Other	–	3.5% (20)

Treatment interventions

The responses on how physicians managed IAH and ACS were different to the previous survey. Diuretics appeared to be "usually" or "frequently" (49.2%) used more than inotropes (38.6%), decompressive laparotomy (37.0%), paracentesis (36.5%), and fluids/ blood products (24.2%).

Most respondents would perform/request a decompressive laparotomy in cases of ACS, with 64.4% specifying that it would be in selected patients. This is very similar to the findings in 2007 when 65% of respondents indicated that decompression would be preferred in selected cases only. This decision for a decompressive laparotomy was based on 5 predominant factors, the greatest of which were the degree of organ dysfunction (59.3%; *n* = 337) and the evolution of this dysfunction (51.9%; *n* = 295). Other factors included the cause of ACS (44.2%; *n* = 251), the evolution of IAP (36.6%; *n* = 208), and the IAP measurement (24.1%; *n* = 137).

Other factors were also identified as influencing the decision to perform or request a decompressive laparotomy in a patient with known or suspected high IAP (Tables 8 and 9).

The immediate surgical closure after initial laparotomy was predominantly by Bogota bag (31.1%; *n* = 173) or a commercial negative pressure wound device (25.0%; *n* = 139). Other closure techniques included skin only (5.2%; n=29) and a temporary mesh closure (4.5%; *n* = 25). Closure on subsequent laparotomies showed similar results with the Bogota bag (21.1%; *n* = 118), commercial negative pressure wound device (24.9%; *n* = 139), skin only (6.8%; *n* = 38) and a temporary mesh closure (7.3%; *n* = 41). The most common mesh used was prolene/ Marlex (12.3%; *n* = 69) followed by vicryl/Dexon (11.4%; *n* = 64), Gore-tex (5.2%; *n* = 29), and Vypro (1.4%; *n* = 8). Just less than half of respondents (43.6%; *n* = 224) had heard of the surgical technique of lateralisation of the musculature of the abdominal wall.

Other findings

Polycompartment syndrome was something considered by 39% (*n* = 218) in their daily practice, compared to 23.6% (*n* = 132) who did not incorporate it. A large proportion (36.3%; *n* = 203) had not heard of the concept, while 1.1% (*n* = 6) did not believe it existed. The concept of abdominal compliance was found to be useful by 56.5% (*n* = 312) of respondents, while a further 32% (*n* = 177) were aware of this concept, with a small number unsure about its clinical applicability. Only 11.4% (*n* = 63) were unfamiliar with this concept. Almost two thirds of respondents (63.5%; *n* = 355) thought that gastrointestinal injury should be added to the sequential organ failure assessment (SOFA) score, while a quarter (24.5%; *n* = 137) had not heard of gastrointestinal failure.

DISCUSSION

Our survey aimed to determine the impact of the 2013 WSACS IAH/ACS Consensus Definitions and Clinical Management Guidelines on IAH/ACS clinical awareness and management [6]. Several areas of improvement were identified, while others remained as they were following the 2007 survey. The current survey was predominantly completed by doctors, with fewer nurses responding. The majority of responses came from Europe, with much less participation from North America, but a greater percentage of total responses from Africa, South America, Asia and Australia. As with the previous global survey, the majority of respondents worked in mixed ICUs, followed by trauma, surgical, cardiac, and medical units.

Several areas of improvement were noted in comparison to the survey in 2007. More participants were familiar with IAH and abdominal perfusion pressure (APP). There was also an improvement in the awareness of the WSACS Consensus guidelines and definitions of 2006/2007. Likewise, knowledge of the WSACS initial consensus guidelines published in 2006 and 2007 had improved from 31% to 60% ($P \leq 0.0001$). However, just over half were aware that these guidelines were updated in 2013 while 74% believed they should be translated into the respondent's native language. Intensivists showed the greatest awareness of the 2006/2007 guidelines, followed by surgery, paediatrics, and medicine. Awareness of the 2013 update followed a similar pattern. However, after more than a decade of these guidelines being available, it is remarkable that despite an improvement in the overall awareness of IAH and ACS, only about two thirds of intensivists, surgeons and traumatologists responding to the survey were aware of these guidelines (Table 7).

There was also improvement in the set of 11 knowledge questions related to IAH, ACS and WSACS definitions. The improvement was significant, but it remains surprising that basic definitions and guidelines concerning IAP measurement are still not well known throughout the world, more than a decade after the guidelines were first published. This may be a reflection of both undergraduate and post-graduate teaching, and highlights the need to update curricula as new medical research is published.

Only 11% of respondents were not aware of abdominal compliance, with over 88% being aware of and/or using this in clinical practice. The concept of a polycompartment syndrome is relatively new to medical literature and was considered by a large proportion (39%; $n = 218$). A greater awareness of WSACS was shown (73% vs. 41%; $P \leq 0.0001$), and although there are no data to demonstrate increased presence of the subject at scientific meetings, there has been an increase in research and publications.

Of interest, surgical practices varied considerably, with the most common techniques of surgical closure following initial laparotomy being the Bogota bag or commercial negative pressure wound devices. These were also the two most common techniques for closure at subsequent laparotomies. The Bogota bag technique still featured frequently and may be an indication of the differences in practices between countries, possibly related to economics. Of concern was the lack of knowledge of the simple surgical technique of lateralisation of the musculature of the abdominal wall. This highlights yet another area for improved education.

Although a crude and subjective measure of exposure and diagnosis of ACS, respondents reported diagnosing ACS more frequently than the previous survey. This may be due to a greater awareness of the condition (as opposed to a change in the patient profile presentations) and even improved access to measurement techniques.

Concerns raised by this survey include the apparent decrease in knowledge related to measurement, criteria for abdominal decompression, and the IAP at which organ dysfunction may occur.

Also, there was an increase in the percentage who did not measure IAP (4% to 18%; $P \leq 0.0001$). We explored reasons for not performing these measurements and found that the majority relied on physical examination, despite evidence showing clinical examination as an inaccurate predictor of abdominal pressures [17]. Just over 5% of respondents did not measure IAP because of the cost involved. This is an area that should be explored to determine the cost-effectiveness of identifying patients with IAH or ACS. The response for those that did measure IAP showed that over 90% performed measurements before 60 seconds, something that may lead to inaccurate readings. Furthermore, 37.1% of respondents did not measure IAP in the setting of an open abdomen. While abdominal wall diameter may be increased with an open abdomen, it does not necessarily translate to improved compliance, and hence IAP still remains a potential problem.

Although IAH and ACS are associated with poor outcomes, there is still no convincing evidence that early management of IAH improves patient outcomes. This is a possible reason why clinicians are not following the current IAP/ACS guidelines and should be explored with future research. It was difficult to comment with any certainty on whether participants aware of WSACS identified more cases of ACS than others, as only 26.8% of participants were not aware of WSACS.

Limitations

This survey attempted to incorporate as many countries as possible, but the response rate could not be monitored and surveys are open to selection bias. Representation from those working in paediatric ICUs was small. The survey was relatively long, and we could not capture the rationale behind every practice or experience expressed in the answers. There may have been a bias towards those involved in IAP and ACS research to respond to the survey. However, if this is true, the results may be even more surprising, as we would have expected better results from the knowledge and practice questions.

Future

The survey demonstrates improvements in the field of IAH and ACS, but also areas of concern. Knowledge has improved, yet there are obviously significant variations in practice related to IAP measurement. Awareness of WSACS guidelines is not as good as one would expect, and there are still many clinicians who do not measure IAP. At the same time, the necessity to integrate gastrointestinal injury into the SOFA score was supported by nearly two thirds of respondents. There is an obvious need to improve our understanding of aspects related to choosing which patients require IAP monitoring, frequency of monitoring, and how to incorporate IAP into current standard of care protocols and bundles. It is clear that there are several areas that require further research, while others necessitate education, most likely at both pre-graduate and post-graduate levels.

CONCLUSION

This survey shows an improvement in general awareness and knowledge regarding IAP and ACS, although the level of understanding and awareness of WSACS guidelines remains low. There appear to be some practice changes and greater awareness of the need to monitor abdominal pressures. Concepts such as abdominal compliance and polycompartment syndrome seem to be improving, although it is still concerning that some clinicians never monitor IAP and still believe that clinical examination is reliable. Future initiatives should focus on education, identifying which patients should receive routine monitoring, and incorporation of IAH and ACS care into ICU bundles and protocols already in existence.

ACKNOWLEDGEMENTS

1. Financial support and sponsorship: We would like to acknowledge the support of the Abdominal Compartment Society (WSACS, www.wsacs.org), the European Society of Intensive Care Medicine (ESICM, www.esicm.org), and the Critical Care Society of South Africa (CCSSA, https://www.criticalcare.org.za).

2. Conflict of interest: Dr Kirkpatrick is immediate Past-President of the WSACS and served as the Principle Investigator or a randomized trial of open abdomen management funded by the KCI Corporation. Prof. Dr. Manu Malbrain is a professor at the faculty of Medicine and Pharmacy at the Vrije Universiteit Brussels (VUB) and a member of the Executive Committee of the Abdominal Compartment Society, formerly known as the World Society of Abdominal Compartment Syndrome (https://www.wsacs.org/). He is inaugural President, co-founder of the WSACS and current Treasurer. He is a co-founder of the International Fluid Academy (IFA). The IFA is integrated within the not-for-profit charitable organization iMERiT, International Medical Education and Research Initiative, under Belgian law. The content of the IFA website (http://www.fluidacademy.org) is based on the philosophy of FOAM (Free Open Access Medical education – #FOAMed). He is a member of the medical advisory Board of Pulsion Medical Systems (now fully integrated in Getinge, Solna, Sweden) and Serenno Medical (Tel Aviv, Israel), and consults for Baxter, Maltron, ConvaTec, Acelity, Spiegelberg and Holtech Medical. Dr. Reintam Blaser received speaker fees and honoraria for advisory board participation from Fresenius and Nestlé, and the University of Tartu received a study grant from Fresenius. All other authors have no completing interests to declare.

REFERENCES

1. Balogh Z, McKinley BA, Cox Jr CS, et al. Abdominal compartment syndrome: the cause or effect of postinjury multiple organ failure. Shock 2003; 20: 483-492. doi: 10.1097/01.shk.0000093346.68755.43.
2. Balogh ZJ, Leppaniemi A. The neglected (abdominal) compartment: what is new at the beginning of the 21st century? World J Surg 2009; 33: 1109. doi: 10.1007/s00268-009-0001-y.
3. Hong JJ, Cohn SM, Perez JM, Dolich MO, Brown M, McKenney MG. Prospective study of the incidence and outcome of intra-abdominal hypertension and the abdominal compartment syndrome. Br J Surg 2002; 89: 591-596. doi: 10.1046/j.1365-2168.2002.02072.x.
4. Horoz O, Yildizdas D, Asilioglu N, et al. The prevalence of and factors associated with intra-abdominal hypertension on admission day in critically ill pediatric patients: a multicenter study. J Crit Care 2015; 30: 584-588. doi: 10.1016/j.jcrc.2015.01.021.
5. Kim I, Prowle J, Baldwin I, Bellomo R. Incidence, risk factors and outcome associations of intra-abdominal hypertension in critically ill patients. Anaesth Intensive Care 2012; 40: 79-89. doi: 10.1177/0310057X1204000107.
6. Kirkpatrick AW, Roberts DJ, De Waele J, et al. Intra-abdominal hypertension and the abdominal compartment syndrome: updated consensus definitions and clinical practice guidelines from the World Society of the Abdominal Compartment Syndrome. Intensive Care Med 2013; 39: 1190-1206. doi: 10.1007/s00134-013-2906-z.
7. Malbrain ML, Peeters Y, Wise R. The neglected role of abdominal compliance in organ-organ interactions. Crit Care 2016; 20: 67. doi: 10.1186/s13054-016-1220-x.
8. Malbrain ML, Roberts D, Sugrue M, et al. The polycompartment syndrome: a concise state-of-the-art review. Anaesth Intensive Ther 2014; 46: 433-450. doi: 10.5603/AIT.2014.0064.

9. Malbrain ML, Chiumello D, Pelosi P, et al. Prevalence of intra-abdominal hypertension in critically ill patients: a multicentre epidemiological study. Intensive Care Med 2004; 30: 822-829. doi: 10.1007/s00134-004-2169-9.
10. Murtaza G, Pal K, Jajja M, Nawaz Z, Koondhar R, Nasim S. Intra abdominal hypertension; incidence, prevalence and outcomes in a mixed intensive care unit: Prospective cohort study. Int J Surg 2015; 19: 67-71. doi: 10.1016/j.ijsu.2015.05.014.
11. Zhang H, Liu D, Tang H, et al. Prevalence and diagnosis rate of intra-abdominal hypertension in critically ill adult patients: a single-center cross-sectional study. Chin J Traumatol 2015; 18: 352-356. doi: https://doi.org/10.1016/j.cjtee.2015.11.015.
12. Wise R, Roberts D, Vandervelden S, et al. Awareness and knowledge of intra-abdominal hypertension and abdominal compartment syndrome: results of an international survey. Anaesthesiol Intensive Ther 2015; 47: 14-29. doi: 10.5603/AIT.2014.0051.
13. Ejike JC, Newcombe J, Baerg J, Bahjri K, Mathur M. Understanding of abdominal compartment syndrome among pediatric healthcare providers. Critical Care Res Pract 2010; 2010: 876013. doi: http://dx.doi.org/10.1155/2010/876013.
14. Zhou JC, Zhao HC, Pan KH, Xu QP. Current recognition and management of intra-abdominal hypertension and abdominal compartment syndrome among tertiary Chinese intensive care physicians. J Zhejiang Univ Sci B 2011; 12: 156-162. doi: 10.1631/jzus.B1000185.
15. Kaussen T, Steinau G, Srinivasan PK, et al. Recognition and management of abdominal compartment syndrome among German pediatric intensivists: results of a national survey. Ann Intensive Care 2012; 2 (Suppl 1): S8. doi: 10.1186/2110-5820-2-S1-S8.
16. Zhang HY, Liu D, Tang H, et al. Study of intra-abdominal hypertension prevalence and awareness level among experienced ICU medical staff. Mil Med Res 2016; 3: 27. doi: 10.1186/s40779-016-0097-y.
17. Sugrue M, Bauman A, Jones F, et al. Clinical examination is an inaccurate predictor of intraabdominal pressure. World J Surg 2002; 26: 1428-1431. Doi: 10.1007/s00268-002-6411-8.

Appendix: WSACS Questionnaire

Survey Questions

Demographics

1. What is your occupation? (*Mark only one oval.*)
- Doctor
- Doctor in training
- Nurse
- Nurse in training
- Respiratory therapist
- Other: .....

2. What is your primary area of training? (*Check all that apply.*)
- Anaesthesiology
- Cardiology
- Emergency Medicine
- Intensive Care Medicine
- Internal Medicine
- Paediatrics
- Surgery / Trauma
- Other: .....

3. Do you manage patients in an intensive care unit (as a ICU doctor or together with ICU doctors)? (*Mark only one oval.*)
- Yes. Skip to question 5.
- No. Skip to question 6.

4. What type of intensive care unit (ICU) do you work in primarily (choose as many as applicable)? (*Check all that apply*).
- Medical
- Medical + Surgical
- Surgical
- Trauma
- Burns
- Paediatric
- Cardiac
- Neurosurgical
- Other
- None

5. If you are a surgeon, what type of surgery are you predominantly involved in? (*Check all that apply.*)
- Not applicable
- Cardiothoracic surgery
- General surgery
- Neurosurgery
- Obstetrics and gynaecology surgery
- Orthopaedic surgery
- Trauma surgery
- Vascular surgery
- Other:

6. How long have you worked in your profession (since first graduating as a doctor, nurse, allied health professional, etc)? (*Mark only one oval.*)
- I am still a student
- Less than 5 years
- 5 to 10 years
- 10 to 15 years
- More than 15 years

7. I predominantly work in a … (*Mark only one oval.*)
- University hospital
- Private hospital
- Public/government hospital
- Military hospital

8. In your hospital, there are … (*Mark only one oval.*)
- Less than 10 ICU beds
- 10 to 20 ICU beds
- 20–50 ICU beds
- More than 50 ICU beds

9. Please specify on which continent you work. (*Mark only one oval.*)
- Africa
- Asia
- Australia
- Europe
- North America
- South America

10. In which country do you practise your profession? .....

11. Are you familiar with intra-abdominal hypertension (IAH) or the effect of elevated intra-abdominal pressure (IAP) on organ function? (*Mark only one oval.*)
- Yes
- No

12. Are you familiar with abdominal compartment syndrome (ACS)? (*Mark only one oval.*)
- Yes
- No

13. Are you familiar with the concept of abdominal perfusion pressure? (*Mark only one oval.*)
- Yes
- No

14. Do you believe that IAH and ACS are important problems in SURGICAL/TRAUMA patients? (*Mark only one oval.*)
- Yes
- No

15. Do you believe that IAH and ACS are important problems in MEDICAL patients? (*Mark only one oval.*)
- Yes
- No

16. Approximately how many cases of ACS have you seen in the last year? (*Mark only one oval.*)
- I don't monitor for ACS
- 0
- 1–5
- 6–10
- 11–20
- More than 20

17. What do you regard as a "normal" IAP in healthy ADULTS? (*Mark only one oval.*)
- 0–5 mm Hg
- 6–10 mm Hg
- 11–15 mm Hg
- > 16 mm Hg
- Other: .....

18. What IAP do you regard as intra-abdominal hypertension (IAH) in ADULTS? (*Mark only one oval.*)
- > 5 mm Hg
- > 10 mm Hg
- > 12 mm Hg
- > 15 mm Hg
- > 20 mm Hg
- > 25 mm Hg
- Other: .....

19. In ADULT patients with IAH and organ dysfunction, at what IAP do you think abdominal compartment syndrome(ACS) can occur? (*Mark only one oval.*)
- 5 mm Hg
- 10 mm Hg
- 12 mm Hg
- 15 mm Hg
- 20 mm Hg
- 25 mm Hg
- More than 25 mm Hg
- Other: .....

20. What IAP do you regard as signifying abdominal compartment syndrome (ACS) in CHILDREN? (*Mark only one oval.*)
- 5 mm Hg
- 10 mm Hg
- 12 mm Hg
- 15 mm Hg
- 20 mm Hg
- 25 mm Hg
- More than 25 mm Hg
- Other: .....

21. Do you measure IAP in your patients? (*Mark only one oval.*)
- Yes. Skip to question 24.
- No. Skip to question 23.

22. Please indicate reasons why you do not measure IAP. (*Check all that apply.*)
- I do not know how to measure IAP
- I think it has no clinical relevance
- Costs
- I rely on clinical/physical examination and assessment
- I do not know how to interpret IAP
- I do not treat any patients with IAH
- There is insufficient evidence to suggest that treatment of IAH improves patient
- Outcomes
- Other: .....

Skip to question 32.

23. What method(s) do you use to measure IAP? (*Check all that apply.*)
- Transvesical (bladder) measurement
- Transgastric (stomach) measurement
- Direct (peritoneal) measurement
- Other: .....

24. For the transvesical (bladder) technique of measuring IAP, what volume do you instil into the bladder before IAP measurement? (*Mark only one oval.*)
- 0 mL
- 10–25 mL
- 50 mL
- 100 mL
- 200 mL
- I don't know
- Other: .....

25. After instillation of the fluid into the bladder for the transvesical (bladder) technique, do you wait before reading the IAP? (*Mark only one oval.*)
- I do not wait, I measure IAP immediately
- I wait up to 30 seconds
- I wait 31–60 seconds
- I wait 61–120 seconds
- I wait more than 120 seconds
- Other: .....

26. Are you aware of continuous IAP measurement techniques? (*Mark only one oval.*)
- Yes. Skip to question 28
- No. Skip to question 29

27. With which continuous IAP technique(s) are you familiar? (*Check all that apply.*)
- Intravesicular (bladder)
- Stomach
- Direct peritoneal
- Solid state transducer
- None of the above
- Other: .....

28. In which MEDICAL patient population(s) do you measure IAP? (*Check all that apply.*)
- I do not measure IAP in medical patients
- Acute pancreatitis
- Sepsis
- Massive fluid resuscitation
- Mechanical ventilation
- None of the above
- Obesity
- Organ failure
- Patient at risk for IAH
- Other: .....

29. In which SURGICAL patient population(s) do you commonly measure IAP? (*Check all that apply.*)
- I do not measure IAP in surgical patients
- Abdominal surgery
- Abdominal vascular surgery
- Cardiothoracic surgery
- Massive fluid resuscitation during or prior to surgery
- Neurosurgery
- Obstetrics/Gynaecology surgery
- Trauma surgery
- None of the above
- Other: .....

30. When initially setting out to monitor IAP, how often do you ROUTINELY measure it? (*Mark only one oval.*)
- I do not routinely measure IAP
- Once every 4 hours
- Once every 6 hours
- Once every 8 hours
- Once every 12 hours

- Once every 24 hours
- When clinically indicated
- Continuously
- Other: .....

31. At what level of IAP do you think organ dysfunction may occur in patients with intra-abdominal hypertension (IAH)? (*Mark only one oval.*)

- I do not think elevated IAP causes organ dysfunction
- 5 mm Hg
- 10 mm Hg
- 12 mm Hg
- 15 mm Hg
- 20 mm Hg
- 25 mm Hg
- Other: .....

32. Do you think any of these statements regarding APP (abdominal perfusion pressure) are correct? (*Check all that apply.*)

- APP has no clinical use
- APP = CPP (cerebral perfusion pressure)
- APP = MAP – IAP (mean arterial pressure – intra-abdominal pressure)
- APP = MAP – CVP (mean arterial pressure – central venous pressure)
- I do not know

33. What do you believe is the best APP threshold in relation to outcome? (*Mark only one oval.*)

- APP > 45 mm Hg
- APP > 55 mm Hg
- APP > 65 mm Hg
- APP > 75 mm Hg
- None of the above (I believe it does not make a difference)
- Other: .....

Management

Please indicate the frequency with which you use the following interventions in managing IAH and ACS.

34. Inotropes/vasopressors (*Mark only one oval.*)

- Never
- Rarely
- Sometimes
- Usually
- Frequently
- Not applicable

35. Diuretics (*Mark only one oval.*)

- Never
- Rarely
- Sometimes
- Usually
- Frequently
- Not applicable

36. Fluid/Blood products (*Mark only one oval.*)

- Never
- Rarely
- Sometimes
- Usually
- Frequently
- Not applicable

37. Abdominal paracentesis (*Mark only one oval.*)

- Never
- Rarely
- Sometimes
- Usually
- Frequently
- Not applicable

38. Decompressive laparotomy (*Mark only one oval.*)

- Never
- Rarely
- Sometimes
- Usually
- Frequently
- Not applicable

39. Would you perform (or request) surgical decompression in a patient with ACS? (*Mark only one oval.*)

- Yes, always
- Yes, but in selected patients
- Never
- Other: .....

40. On what criteria do you commonly base your decision to perform (or request) surgical decompression on a patient with ACS? (*Check all that apply.*)

- The IAP
- The degree of organ dysfunction
- The cause of ACS
- The evolution of IAP
- The evolution of organ dysfunction
- I do not surgically decompress patients with ACS
- Other: .....

41. Which of the following factors would affect your decision to consult a surgeon to discuss the option of a decompressive laparotomy or perform a decompressive laparotomy on a patient with a known or suspected elevation in IAP (select more than one if applicable)?* (*Check all that apply.*)

- Abdominal distension
- Decreasing cardiac output
- Increasing oxygen requirement
- Increasing pressor or inotrope doses
- Increasing ventilator pressures
- Worsening acidosis
- Worsening oliguria
- None of the above
- Other: .....

42. How do you most commonly deal with the open abdomen after the INITIAL decompression? (*Mark only one oval.*)

- Not applicable
- Skin-only closure
- Bogota bag or silo
- Barker's vacuum pack technique
- Commercial negative pressure wound therapy
- Immediate primary fascial closure
- Temporary mesh closure (e.g. Dacron)
- None of the above
- Other: .....

43. How do you most commonly deal with the open abdomen after SUBSEQUENT abdominal explorations? (*Mark only one oval.*)
- Not applicable
- Skin-only closure
- Bogota bag or silo
- Barker's vacuum pack technique
- Commercial negative pressure wound therapy
- Temporary mesh closure (e.g. Dacron)
- None of the above
- Other: .....

44. What type of temporary mesh closure do you prefer? (*Mark only one oval.*)
- Not applicable
- Dermal template (Alloderm, Xenmatrix)
- Gore-Tex
- Prolene/Marlex mesh
- Vicryl/Dexon mesh
- Vypro mesh
- Other: .....

45. Is the concept of a polycompartment syndrome something you consider in your daily practice? (*Mark only one oval.*)
- Yes
- No
- Polycompartment syndrome does not exist
- I have not yet heard of a polycompartment syndrome

46. Do you think acute gastrointestinal injury (AGI) should be included as a SOFA subscore? (*Mark only one oval.*)
- Yes
- No
- I have not heard of AGI

47. Do you usually measure IAP in open abdomen patients? (*Mark only one oval.*)
- Not applicable, I do not measure IAP
- When the abdomen is open there is no need since IAP cannot increase
- Yes
- Sometimes
- No

48. Are you aware of the concept of lateralization of the abdominal musculature? (*Mark only one oval.*)
- Yes
- No

49. Classification of the open abdomen is ..... (*Mark only one oval.*)
- Important to facilitate comparison of patient groups
- Important to highlight challenges these patients face and for comparative reasons
- Only important to those doing research
- Not important

50. Please complete the sentence: Regarding the concept of abdominal compliance, I am ..... (*Mark only one oval.*)
- Aware of this and use it in clinical practice
- Aware of but do not understand the clinical relevance
- Only aware of the concept
- Not aware of the concept

51. Were you aware of the existence of the Abdominal Compartment Society (WSACS) before taking this survey? (*Mark only one oval.*)
- Yes
- No

52. Were you aware of the publications of the WSACS consensus guidelines in 2006 and 2007? (*Mark only one oval.*)
- Yes
- No

53. Were you aware that the WSACS definitions and guidelines were revised in 2013 and are available at www.wsacs.org? (*Mark only one oval.*)
- Yes
- No

54. Do you think the 2013 guidelines for IAH/ACS should also be launched in your own native language? (*Mark only one oval.*)
- Yes
- No