Commentary

'Progression towards the minimum': the importance of standardizing the priming volume during the indirect measurement of intra-abdominal pressures

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See related research by Malbrain and Deeren, http://ccforum.com/content/10/3/R98

Abstract

The abdominal compartment syndrome is a state of serious organ dysfunction. The syndrome results from sustained intra-abdominal hypertension, which is indirectly identified by measuring intra-bladder pressures (IBPs) using various priming volumes. This technique is poorly standardized across published data. Malbrain and Deeren have identified the risk of falsely elevated IBPs with instillation priming volumes greater than 50 ml. This overestimation appears to increase with larger priming aliquots. As a result, erroneous IBP measurements may incorrectly label a patient with the abdominal compartment syndrome, and therefore subject them to the potential complications of surgical and/or medical decompression techniques. The utility and benefit of using continuous IBP monitoring is discussed. These data require confirmation in other patient subgroups with younger ages, altered body mass indices and varied diagnoses.

The abdominal compartment syndrome is a state of serious organ dysfunction resulting from sustained intra-abdominal hypertension (IAH). The syndrome affects all organ systems. While the abdominal compartment syndrome is the most obvious manifestation of IAH, lesser degrees of hypertension are now being implicated as injurious to the critically ill patient [1,2]. Physical examination has little role in the detection of IAH [3]. Considering the importance of this disease, indirect measurement of IAH is now advised for essentially all critically ill patients undergoing resuscitation [4].

IAH is most simply identified by measuring intra-bladder pressures (IBPs) using various priming volumes. An international, multidisciplinary society, the World Society on the Abdominal Compartment Syndrome, has recently recommended IBP measurement as the standard reference technique for the indirect, intermittent determination of intra-abdominal pressure (IAP) [5]. Despite the simplicity of this method, it remains poorly standardized across the published literature. Basic research into the validity and standardization of the method, as well as the true meaning of IAP measurements, is immediately needed to guide the critical care community.

In their manuscript entitled 'Effect of bladder volume on measured intravesical pressure: a prospective cohort study', Malbrain and Deeren have begun to address the issue of optimal instillation volumes in the indirect determination of IBP, and hence of IAP [1]. This information is vital for all critically ill patients, and the authors should be commended for addressing such a simple but important question. Although published vesicular instillation volumes range from 50 to 300 ml, the most accurate priming volume remains unclear [6,7].

The study by Malbrain and Deeren [1] was a prospective evaluation of the IAP effects of incrementally instilling 25 ml fluid aliquots into the bladder. It comprised a small, but critically ill, cohort of patients, with a mean Acute Physiology and Chronic Health Evaluation II score of 28. The authors calculated absolute IBP biases using median values, and showed that the IAP may be overestimated with instillation volumes greater than 50 ml. Statistical increases in IBP were evident with instillation volumes of only 25 ml, and became clinically relevant at volumes of 75 ml, when diagnosing IAH at a threshold of 12 mmHg [8]. This potential misdiagnosis was actually common, with 23% of patients having IAH with 50 ml or 100 ml infusate, versus only 7% at baseline [1].

Simply put, overestimation of IAP appears to increase with larger priming aliquots than 50 ml. As a result, overinfusing

IAH = intra-abdominal hypertension; IAP = intra-abdominal pressure; IBP = intra-bladder pressure.

saline into the bladder during this routine measurement may incorrectly label a patient with IAH or abdominal compartment syndrome, and therefore subject them to the potential complications of surgical and/or medical treatments. This could be clinically disastrous because the recognized treatment of abdominal compartment syndrome is often surgical decompression of the abdomen [9,10]. While effective, this treatment modality is itself morbid, with numerous potential complications. As the importance of IAP in the critical care setting is appreciated in a broader sense, the risk of misinterpreting basic physiologic measurements will assume a greater role. In addition to unnecessarily decompressing the abdomen in a patient with a potentially normal IAP, resuscitation might be altered if abdominal perfusion pressures are erroneous [11] or if ventilatory parameters are inappropriately adjusted [12]. Furthermore, other important diagnoses may be ignored if IAH is incorrectly ascribed as the primary pathology.

Other recent research corroborates Malbrain and Deeren's findings. De Waele and colleagues recently found that the minimum volume required to ensure a positive oscillation test was only 10 ml saline, and that progressive increases in mean blood pressure were obtained with each successive 10 ml aliquot [13]. We agree with Malbrain and Deeren that the appropriate amount of priming may be only be that required to create a fluid column without interposed air. This can also be achieved with standard arterial pressure transducers providing continuous bladder pressures measured through the third limb of a standard three-way foley catheter. These catheters are primed through a constant infusion of 4 ml/hour saline [14].

Recognizing the simplicity of this method, we have postulated that this immense wealth of physiological data may guide the care of critically ill patients. This technique provides interpreting clinicians with IAP changes on a real-time basis, and forgoes the need for the priming volumes. It also limits detrusor spasm, false IAP values, and reduces nursing workloads. At our institution, we have begun to think of IAP measurement as routine in the critically ill and it is something we refer to as 'the fifth vital sign'.

In summary, Malbrain and Deeren's manuscript is both timely and important. It begins to address the standardization of indirect IAP measurements and techniques. This work requires confirmation in larger sample sizes and among other patient subgroups, including those with younger mean ages, alternate body mass indices and varied diagnoses. Despite these needs, these data clearly show that large instillation volumes may artificially elevate IAP values. These data also imply that, if the clinician is not thoughtful, inappropriate therapy might result.

Competing interests

The authors declare that they have no competing interests.

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