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Protocols for diagnosis and management of intra-abdominal hypertension in intensive care units.

Protocolos para diagnóstico e manejo da hipertensão intra-abdominal em centros de tratamento intensivo.

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A B S T R A C T

Objectives: Intra-abdominal hypertension (IAH) is a common morbid condition in critically ill patients. Abdominal compartment syndrome (ACS) is a severe condition that requires surgical treatment, and it is an evolution of undiagnosed and untreated IAH. This study aims to highlight the importance of clinical evidence, and proposes screening as well as medical protocols for IAH and ACS, in intensive care units. **Methods:** Database searches were performed and the recommended World Society of the Abdominal Compartment Syndrome standards and protocols were used. **Results:** Protocols for IAH and ACS investigation, measurements, management and control, tailored for the Brazilian ICU reality, were indicated. **Conclusion:** We extensively detailed IAH medical evidence, using the most up-to-date literature about IAH care and how to measure intra-abdominal pressure (IAP), which can be easily reproduced in any intensive care unit.

HEADINGS: Intra-Abdominal Hypertension. Fasciotomy. Clinical Trial Protocol. Intensive Care Units.

INTRODUCTION

Abdominal compartment syndrome (ACS) is a morbid condition that affects critically ill patients. Its etiology is of multiple and complex causes and it is characterized by intra-abdominal hypertension (IAH), the crucial pathophysiological phenomena leading to the organic dysfunctions seen in patients[1]. Its definition encompasses the elevation of the abdominal pressure above 20 millimeters of mercury (mmHg), associated with another organic dysfunction.

Despite its high lethality, as demonstrated by several authors, this condition is underdiagnosed by many professionals, as it has been demonstrated by qualitative observational studies of medical professionals in large hospitals[2,3].

The doctors neglect abdominal compartment syndrome. Cross-sectional studies in general Intensive Care Units (ICU) have shown abdominal hypertension in 50% of inpatients[2,4,5]. In addition, patients with a higher risk of developing compartment syndrome are precisely those with the most challenging diagnoses. The physical examination is only 50% accurate in pointing out a patient with increased intraabdominal pressure[6].

The latest evidence shows that high intraabdominal pressure and ACS are associated with high morbidity and mortality, and the only way to prevent it is by measuring intra-abdominal pressure and implementing treatment protocols[5].

METHODOLOGY

The present study is a brief review of the subject and proposes screening, diagnosis and management protocols for HIA and ACS, suitable for the Brazilian reality.

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A search was performed in the Pubmed and Google Scholar databases, using the terms "*Intra-abdominal hypertension*", "*Open abdomen*" and "*Abdominal compartment syndrome*".The articles were selected according to their relevance and number of citations, prioritizing the ones endorsed by the WSACS (*World Society of the Abdominal Compartmental Syndrome*), which is a society composed by the world's greatest specialists of this syndrome. Based on the most current consensus, practical protocols for diagnosing and management of ACS have been proposed, in accordance with the reality of the intensive units, in Brazil.

RESULTS

Abdominal compartment syndrome (ACS) is defined as an increase of the intra-abdominal pressure, together with the dysfunction or failure of an organ[7].

In critically ill patients, the pressure is usually between 5-7 mmHg. Elevations above 12 mmHg are considered as intra-abdominal hypertension (IAH), which is classified as follows (Table 1):

Table 1. *Classification of intra-abdominal hypertension.*

Intra-abdominal pressure	IAH classification*
12-15 mmHg	IAH grade I
16-20 mmHg	IAH grade II
21-25 mmHg	IAH grade III
>25 mmHg	IAH grade IV

** IAH: Intra-Abdominal Hypertension.*

ACS is defined as an increased intraabdominal pressure (above 20 mmHg) associated with another organ dysfunction. For example, the patient has no renal failure, but after an increased IAP pressure, oliguria and increased nitrogen levels are seen; or he/she develops intestinal ischemia, with worsening of gasometry parameters or digestive bleeding or even liver failure characterized by high liver enzymes and dyscrasia[8].

The central role of measuring intra-abdominal pressure in critically ill patients, as well as the careful surveillance and proactive procedures to prevent the development of ACS in patients diagnosed with IAH, is crucial.

When should intra-abdominal pressure be checked?

In the last WSACS consensus in 2013, it was recommended to measure intra-abdominal pressure in all critical patients or those with a severe acute injury who have risk criteria for developing ACS, as well as adopting institutional protocols to measure IAP[8].

Recommendations of the intra-abdominal pressure measurement protocol

As the risk criteria for developing ACS are extensive, ranging from major operations, sepsis and multiple trauma, we propose the measurement of IAP at the time of admission in the intensive care unit and 6 hours later for every patient (Figure 1). Both measurements are performed to see if there is any tendency leading to an increase in abdominal pressure. If a high value is identified, the patient's abdominal pressure should be monitored[9,10].

Measuring intra-abdominal pressure

Several methods have been developed to measure IAP as accurately as possible. Direct intermittent measurements (performed during dialysis or laparoscopy), indirect (catheters inserted through the bladder, stomach, uterus, or rectum) and continuous measurements (catheters positioned in the bladder, stomach or peritoneal) are the most used methods[11].

Due to the low cost, easy manipulation and effectiveness, the urinary bladder method was adopted as the standard by the WSACS consensus in 2006[12] and reiterated in 2013. The intermittent measurement method will be described, using the 2-way bladder probe.

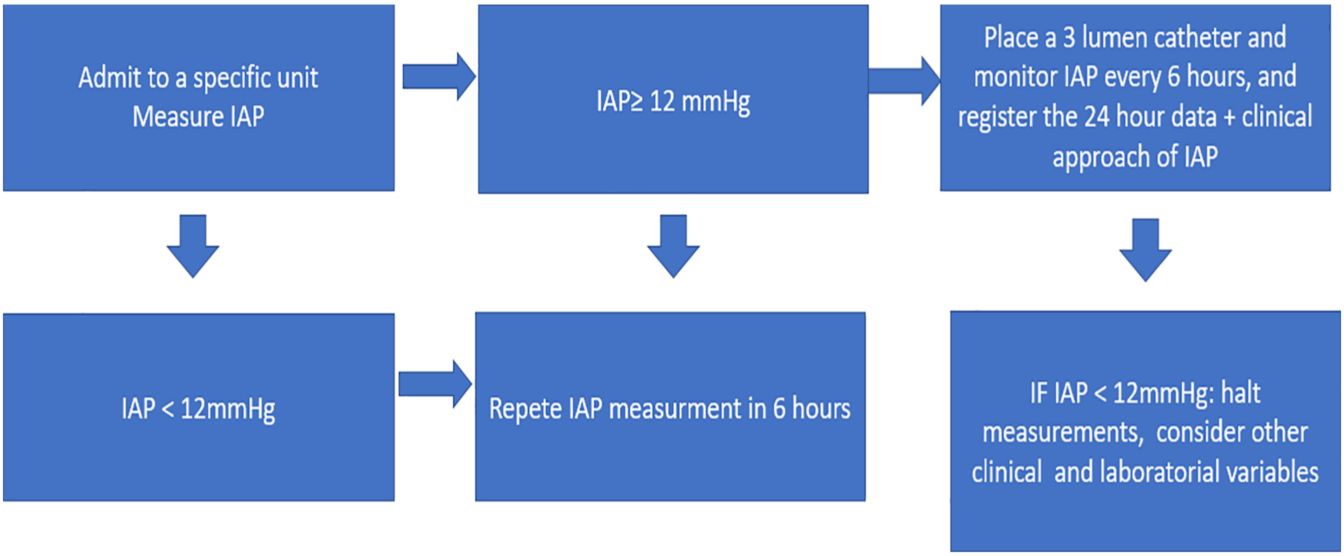

Figure 1. *Flowchart for monitoring intra-abdominal hypertension. Submitted by: Bruno Souza Caldas.*

The necessary material consists of a two-way bladder catheter; a closed urine collector system with a side portal; 20 mL of saline solution; a 20 mL syringe; a standard serum set; a 40x12 needle (pink) and a central venous pressure (CVP) measurement ruler.

The patient has been positioned on a zero degree supine position. After the introduction of the bladder catheter under aseptic technique, make sure that the bladder has been completely emptied. Clamp the collector immediately after connecting with the catheter. Puncture the side exit with the needle (Figure 2), inject 20 mL of saline, and wait between 30 seconds to 1 minute to equalize the fluid in the closed system. Connect the needle to the saline line, which will serve as the water column. Check for the absence of abdominal contractions and start the measurement at the end of expiration.

Place the saline support next to the patient with a CVP ruler, with the zero mark at the level of the patient's midaxillary line.

Figure 2. *Insertion of the 2-way bladder catheter and sterile collector system used with a puncture in the collection portal. Submitted by: Bruno Souza Caldas.*

It is possible to use a leveled wooden ruler to make sure that the zero mark on the CVP ruler coincides with the midaxillary line. When the water column stabilizes, mark the point on the CVP ruler, using its zero, as the reference. The measurement will be in cmH_20, and it will be necessary to convert it to mmHg. The conversion will be done by multiplying the obtained result by 0.74 or dividing by 1.36[13].

The described method can be used in all national intensive care units due to its simplicity and low cost, as well as it can serve as a screening to decide which patient should receive continuous monitoring of IAP.

Due to the need to perforate the collector system and to manipulate it by instilling saline into the bladder (a fundamental part of the measurement), for each repetition, it is necessary to change the collector system, making this method inadequate for long monitoring periods.

The ideal method for continuous monitoring of the patient is the insertion of the 3-way bladder catheter, with one way being exclusively used for the measurement of IAP, which can be connected to sensors for monitoring mean arterial pressure (MAP) or even by direct monitoring of IAP. This is available in the Brazilian market.

Reducing the risk of abdominal compartmental syndrome

Once increased intraabdominal pressure is identified, clinical protocols are recommended to prevent the onset of the abdominal compartment syndrome. Below, a list of the main protocols to be implemented is depicted.

Correct the positive fluid balance

- After performing volemic resuscitation under shock states, it is fundamental to compensate for the excess of infused fluids (the use of diuretics can be considered;
- The use of colloids and hypertonic fluids should be considered;
- Consider hemodialysis and ultrafiltration to handle excess fluids.

Improve abdominal compliance

- Optimize sedation and analgesia;
- Consider neuromuscular block;
- Avoid raising the head of the bed above 30 degrees;
- Optimize mechanical ventilation. Consider alveolar recruitment.

Mechanical ventilation strategies to better manage abdominal hypertension

- Use the transmural airway plateau pressure (Pplato transmural = Pplato - 0.5xPIA);
- Consider using preload indexes;
- If pulmonary artery occlusion pressure or central venous pressure is used, consider using transmural pressure (PAOPtm = PAOP-0.5xPIA, PVCtm = PVC-0.5xPIA).

For patients with excess abdominal fluids, consider:

- Relief paracentesis;
- Percutaneous drainage by interventional radiology.

For patients with distended hollow viscera, consider:

- Placement of nasogastric tube;
- Rectal decompression;
- Use of prokinetic agents and medications to accelerate gastric emptying;
- Interrupt the enteral diet, if in use.

The suggested protocols were based on the last WSACS 2013 consensus, and should be adopted as soon as an increase in the abdominal pressure above 12 is identified (grade I hypertension) (Figure 3).

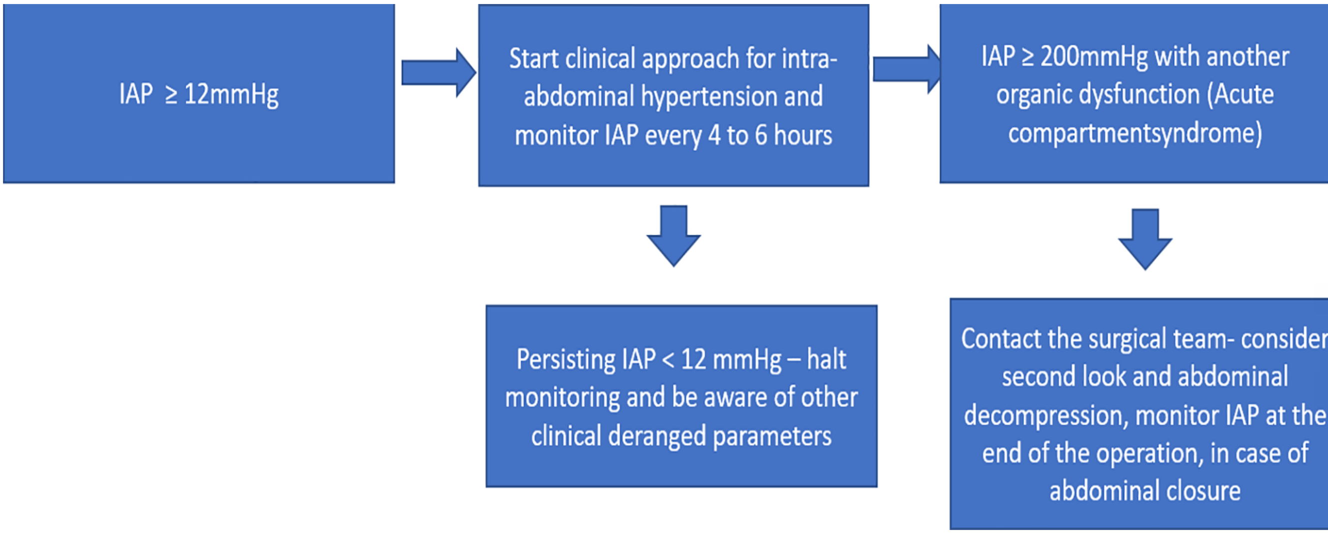

Figure 3. *HIA and SCA management protocol. Submitted by: Bruno Souza Caldas.*

Some measurements are general and recommended in all patients with elevated abdominal pressure[8].

Surgical approach in ACS

Some considerations when thinking about the surgical abdominal compartment syndrome approach should be considered; the first is to define it as primary or secondary[3].

Primary ACS

In this case, the etiology of ACS is related to the abdominal-pelvic cavity, often requiring specific intervention of a target organ. As examples: intestinal obstruction, intracavitary abscesses associated with infectious disease of the appendix, hematomas and intraabdominal bleeding. An abdominal operation to correct the damage is mandatory. The abdomen should be closed at the end of the operation, and before taking the patient to the ICU, it is important to check if there has been an effective reduction of the IAP; if not, the abdomen must be kept open with an appropriate dressing.

It is worth mentioning that specific cases can be solved with percutaneous drainage by interventional radiology, bearing in mind this possibility in the case of abdominal liquid collections diagnosed by computed tomography.

Negative pressure therapy

The vacuum dressing is an excellent strategy to address an open abdomen, either due to the degree of contamination (which in some cases requires several interventions) or owing to the impossibility of primary closure, considering the need for abdominal decompression[14]. The vacuum dressing keeps a sterile cavity because it is a closed and pressure system. In addition, it prevents the excessive lateralization of the aponeurosis (which happens when an open abdomen is kept). The cavity is often closed using later relaxation techniques and meshes. The use of meshes must be late in closing the wall, in order to avoid contamination of the prosthesis.

Secondary ACS

In this case, there is no abdominal disease that requires specific surgical correction, but the high abdominal pressure is associated with an organic dysfunction that requires immediate surgical decompression. Good examples are severe acute pancreatitis, severe burns or polytransfused patients after extensive hemorrhages. In this regard, less invasive techniques should be considered to prevent the abdomen from being completely open, which would increase the risk of enteroatmospheric fistulas, contamination of the abdominal cavity, as well as prolonging the hospital length of stay.

Anterior fasciotomy of the abdominal rectum

This minimally invasive technique, which can be performed conventionally or laparoscopically, is effective in reducing abdominal pressure.

A transverse incision of 2-2.5 cm is performed bilaterally in the subcostal region and 30 cm below the bilateral costal margin, creating a subcutaneous tunnel with fasciotomy of the anterior leaflet of the abdominal rectum. This technique can generate an 8 to 10 cm spacing from fascial edges, with an effective reduction of the compartment pressure leading to abdominal pressure reductions of about 10 mmHg [14].

The technical criticism is the potential risk of herniation of the ventral wall. However, under the context of an imminent risk of life, the potential incisional hernia becomes a minor problem.

CONCLUSION

The management of intraabdominal hypertension can prevent the development of abdominal compartment syndrome. The implementation of protocols in intensive care units is essential to improve morbidity and mortality rates. The general surgeon needs to be familiar with this topic and be aware of the available techniques in order not to underdiagnose the abdominal compartment syndrome and adequately treat it, as well as to avoid the associated morbidity.

RESUMO

Objetivo: *A hipertensão intra-abdominal (HIA) é uma condição mórbida comum em pacientes críticos. A síndrome compartimental abdominal (SCA) é condição grave de tratamento cirúrgico que ocorre como evolução da HIA não diagnosticada e não tratada. O objetivo deste trabalho é disseminar evidências e propor protocolos de rastreio e condutas em casos de HIA e SCA para centros de terapia intensiva (CTI)* **Métodos:** *Foram realizadas buscas sobre o tema nas principais bases de dados e utilizadas as evidências e protocolos recomendadas pela World Society of the Abdominal Compartment Syndrome.* **Resultados:** *Apresentamos protocolos sobre investigação, aferição, manejo e controle da HIA, adequadas à realidade brasileira.* **Conclusão:** *Neste trabalho, apresentamos em detalhes os principais fatos e evidências sobre o manejo em casos de suspeita de HIA e como aferir a pressão intra-abdominal (PIA), de forma simples e reproduzível para qualquer CTI do nosso país.*

Palavras chave: *Hipertensão Intra-Abdominal. Fasciotomia. Protocolo de Ensaio Clínico. Unidades de Terapia Intensiva.*

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