



## INTRA-ABDOMINAL HYPERTENSION AND SECONDARY ABDOMINAL COMPARTMENT SYNDROME IN MEDICAL PATIENTS – COMPLICATION WITH A HIGH MORTALITY

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### ABSTRACT

**Objective:** To determine the incidence and the severity of intra-abdominal hypertension in non-surgical patients hospitalized in the intensive care unit.

**Materials and methods:** From June 2009 to December 2012 we studied prospectively a randomized group of nonsurgical patients that remained more than 48 hours at our ICU. For the purpose of the screening the intra abdominal pressure was measured using an intravesical technique performed in the following manner: after administration of the patients in the ICU at 2 p.m., and after that at regular intervals – 6 hours later at 8 p.m., 12 hours later at 8 a.m., and then 6 hours later at 2 p.m. again. The same time intervals were kept during the second and third day

**Results:** Our study found a high incidence (34%) of intra-abdominal hypertension in this "non-traditional" for this type of patients' complications, wherein 2.5% had a level III and IV

**Conclusion:** Patients who developed IAH had a high SOFA score > 10, and high mortality - 63%. These facts indicate a recommendation for monitoring of the IAH in this patient study group, and show the necessary need for adequate treatment of the advanced intra-abdominal pathological process and the related adverse complications.

**Key words:** intra abdominal pressure, intensive care unit

### INTRODUCTION

More than 100 years after the first acknowledgement of intra-abdominal hypertension (IAH) in the pioneer studies during the 18<sup>th</sup> and 19<sup>th</sup> century, it has been rediscovered as a problem in medical patients after Irving Kron's publication of 1984, which reviews the intra-abdominal pressure (IAP) as a criteria for relaparotomy in patients that underwent surgery for complicated aneurysms of the abdominal aorta (1). In 2004 in Noosa, Australia due to the great interest and as a response to the need to standardize and unify the

definitions, classifications and protocols for monitoring and management of intra-abdominal hypertension and abdominal compartment syndrome (ACS), World Society of the Abdominal Compartment Syndrome (WASCS) was founded with President Michael Cheatham (2, 3).

Although it was initially considered as a consequence associated with trauma and damage control surgery, now intra abdominal hypertension and abdominal compartment syndrome are recognized as the main causes of organ failure, morbidity and mortality in the whole population of critically ill patients in the intensive care units. The problems of increased intra-abdominal pressure are mostly associated with pathology of the abdominal-pelvic area, and

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therefore monitoring of IAP in medical patients in the ICU is not routine (4, 5, 6).

**Objective:** To determine the incidence and the severity of intra-abdominal hypertension in non-surgical patients hospitalized in the intensive care unit.

## MATERIALS AND METHODS

From June 2009 to December 2012 we studied prospectively a randomized group of nonsurgical patients that remained more than 48 hours at our ICU. Patients who died during the study (72 hours) and those occasionally transferred into another ward (usually due to lack of available beds in the intensive care unit) dropped out of the study due to incomplete set of measurements, as well as also those to whom for some reason were not made all measurements and other patients were included in their place. Exclusion criteria: age under 18 years and contraindications for intravesical measurement of intra-abdominal pressure (IAH).

For the purpose of the screening the intra abdominal pressure was measured using an

intravesical technique performed in the following manner: after administration of the patients in the ICU at 2 p.m., and after that at regular intervals – 6 hours later at 8 p.m., 12 hours later at 8 a.m., and then 6 hours later at 2 p.m. again. The same time intervals were kept during the second and third day. A full set of 10 measured values were obtained during these 72 hours in the intensive care unit. Each time an average value of the IAP was measured and registered, followed by an average day value as well as an average value for the 72 hours interval. The IAP was registered by a validated and reproducible technique for intermittent transurethral intravesical measurement of intra-abdominal pressure with a closed system created in the clinic.

## RESULTS

**Table 1** and **Figure 1** present the demographic characteristics and description of the patient study group.

**Table 1.** Demographic characteristics and description of the patients

Number	n=80	Age (years)	62,39±12,31
Sex - male (n/%)	57 (71, 25%)	BMI (kg/cm <sup>2</sup> )	26,88±10,18
Respiratory failure (n=40)	Bacterial pneumonia (n=16) Chronic obstructive pulmonary disease (n=13) Marseilles fever (n=3) Influenza (n=4) Myasthenia gravis (n=2) Guillain-Barré syndrome (n=1) Myotonic dystrophy – Steinert disease (n=1)	Heart failure (n=20)	Left ventricular failure (n=14) Congestive heart failure (n=3) Acute transmural myocardial infarction (n=3)
Liver failure (n=10)	Acute hepatitis B with hepatic coma (n=4) Alcoholic cirrhosis of the liver (n=6)	Coma (n=10)	Hemorrhagic stroke (n=3) Ischemic stroke (n=2) Coma of unknown origin (n=5)

**Table 2** and **Figure 2** show the incidence and rate of intra-abdominal hypertension in the patient study group.

## DISCUSSION

The static pressure within the abdominal cavity is called intra abdominal pressure. The persistent raise of this pressure IAP  $\geq$  12 mmHg is called intra abdominal hypertension. Pathologically

increased intra abdominal pressure may vary within ranges from a slight increase without any clinically significant adverse effects, to a considerable increase that causes significant changes in all organs and systems of the body. It has been a matter of debate what is the exact value of IAP which determines the presence of intra abdominal hypertension. Analyzed data

from some of the first surgical studies favor the values 15-18 mmHg (20-25 cmH<sub>2</sub>O). Burch et al. (1996) published a grading system for IAH/ACS, which was used as an indication for medical treatment (grade I, 7.5-11 mmHg (10-15 cmH<sub>2</sub>O); grade II, 11-18 mmHg (15-25 cmH<sub>2</sub>O);

grade III, 18-25 mmHg (25-35 cmH<sub>2</sub>O); grade IV, more than 25 mmHg (> 35 cmH<sub>2</sub>O). Burch et al. suggested that most patients with stage III hypertension and all patients with stage IV hypertension underwent abdominal decompression (7).

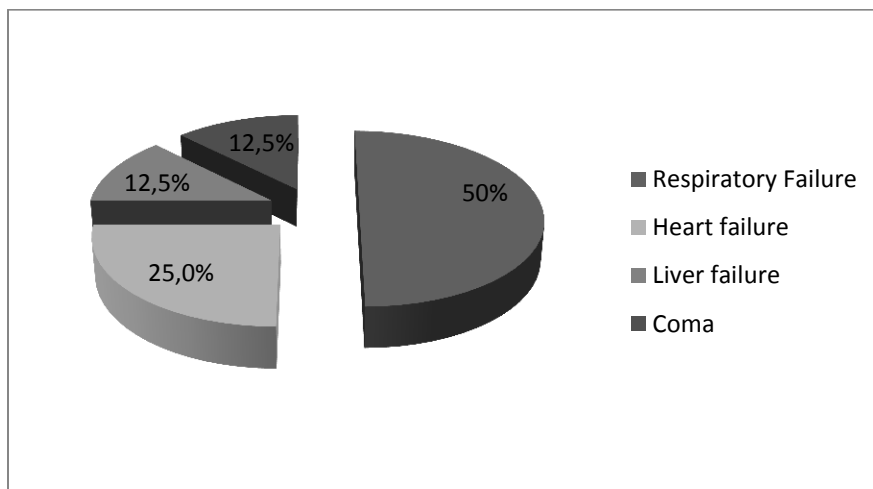


Figure 1. Patient study group (n=80)

Table 2. Distribution of IAH in the patients study population

IAH	Patients (n=80)
Normotensive	46 (57,5%)
I stage	24 (30%)
II stage	8 (10%)
III stage	1 (1,25%)
IV stage	1 (1,25%)
Total with IAH	34 (42,5%)

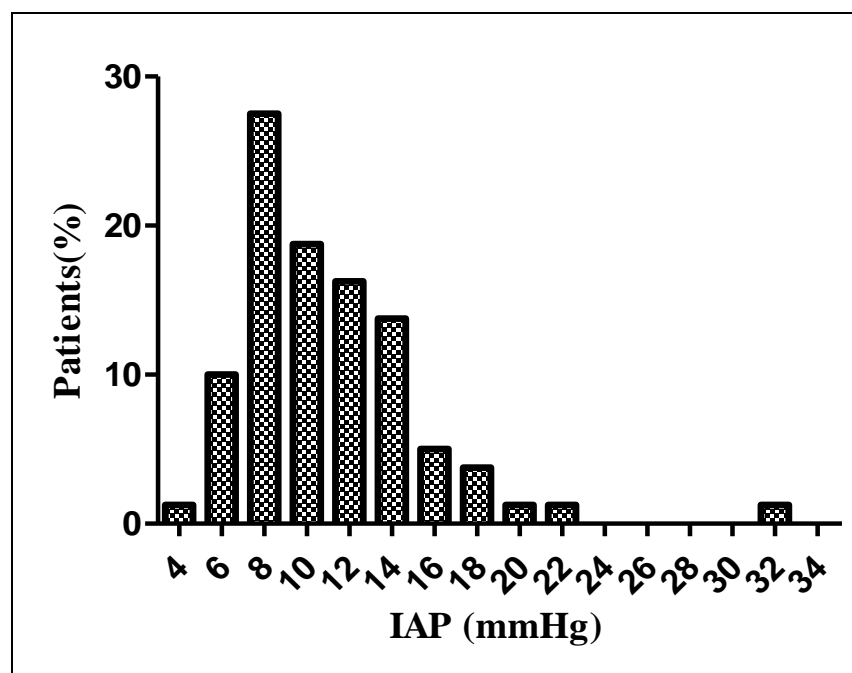


Figure 2. Incidence of IAH in the study population

Malbrain et al. (2005) did recent studies in order to establish the prevalence, causes and predisposing factors associated with IAH, in a mixed population of patients in intensive care units, and determined a reference level of intra-abdominal pressure of 12 mmHg. This value of intra-abdominal pressure is considered acceptable mainly due to the occurrence of side effects upon the kidney, heart and gastrointestinal function, registered in case of higher or even lower measured values of IAH (10-15 mmHg). In most patients, the value of intra abdominal pressure at which a definite organ dysfunction occurs, is appropriate when considering IAH (8).

The most severe increase of IAP requires urgent decompression of the abdomen (surgical or non surgical) to eliminate the harmful pressure effect. Based on our current knowledge of IAH/ACS, now we use a modification of the original grading system of Burch et. al., which is suitable for conducting therapeutic actions.

Classification of intra-abdominal hypertension: Level I: IAH 12-15 mmHg; Level II: IAH 16-20 mmHg; Level III: IAH 21-25 mmHg; Level IV: IAH > 25 mmHg.

The abdominal compartment syndrome (ACS) is a condition in which the IAP persists over 20 mm Hg (with or without ABP < 60 mm Hg) and it is associated with newly discovered organ dysfunction/ failure.

The critical level of IAP for most patients is somewhere between 10 and 15 mm Hg. This pressure leads to reduced microcirculation blood flow and induces the development of organ dysfunction and failure. If not recognized and treated on time, the increase of IAP naturally results in abdominal compartment syndrome. Even though the critical value of IAP for the progression of ACS still remains a subject of debate, of greater importance for the development of organ dysfunction and failure is the absolute value of IAP (9, 10, 11).

Over the years ACS was variable defined based on the current understanding of its pathophysiology. Fietsam et al. (1989) first described the syndrome which occurred in four surgical patients who developed oliguria, hypoxia, hypercapnia, high inspiratory pressure and tensed abdomen. In order to distinguish IAH

of ACS, Ivatury et al. (2004) characterized ACS as the presence of tensed and enlarged abdomen, increased intra-abdominal pressure and high peak airway pressure, inadequate ventilation with hypoxia and hypercapnia, renal dysfunction, and the significant improvement of these symptoms after abdominal decompression (12, 13). Therefore the ACS must be considered as a consequence of uncontrolled IAH. Meldrum et al. (2004) define ACS as IAH more than 20 mmHg, combined with the presence of one of the following: peak pressure over 40 cm H<sub>2</sub>O, oxygen delivery index below 600 ml/ min/ m<sup>2</sup> and hour diuresis under 0.5ml/kg/h (14). Similar characteristics have been also used by other authors with additional: persistent low blood pH, unstable blood pressure, decreased cardiac output, tachycardia with or without hypotension, oliguria (Balogh et al 2003, Cheatham et al., 2006). These characteristics will be used later on to form the generally accepted definition, known as "ACS triad": (a) a pathological condition caused by acute increase of IAP above 20-25 mmHg, which (b) affects negatively the organ function or causes serious complications and wherein (c) the abdominal decompression has a positive effect. Unrecognized and inadequately managed the ACS results in fatal outcome for the patient, while the prevention and / or medical treatment is associated with a significant improvement of the organ function and survival of the patient. Malbrain et al. (2006) define ACS as IAP = 20 mmHg or higher, with a failure of one or more systems, evaluated according the Sequential Organ Failure Assessment (SOFA) scale with 3 or more points. Unlike IAH, ACS should not be graded but more likely considered as "all or nothing" phenomenon.

Considering the numerous predisposing conditions that may lead to the development of IAH/ ACS, the ACS is classified as primary, secondary and recurrent depending on the duration and reason for the IAH. Regarding patient's outcome the duration of the IAH is usually of greater prognostic value than the absolute increase of IAH. Patients with long-term high levels of untreated IAH, usually due to the inadequate perfusion, end up with subsequent organ failure. Preceding underlying diseases such as chronic renal failure, chronic lung diseases or cardiomyopathy, have an important role in organ damage exacerbation, reduce the limit for IAH and cause earlier manifestation of ACS (15). The reason for the occurrence of IAH

is also important, and may be defined as intra-abdominal, when manifested in surgical and traumatic patients, or extra-abdominal when observed in medical patients.

Primary ACS is a condition associated with injury or disease in the abdominal-pelvic region that usually requires early surgical intervention. The primary ACS (previously referred to as surgical, postoperative, or abdominal) is characterized by the presence of acute or subacute IAH with relatively short duration and observed as a result of intra-abdominal pathology, such as abdominal injuries, rupture of abdominal aortic aneurysm, hemoperitoneum, acute pancreatitis, secondary peritonitis, retroperitoneal hemorrhage, and liver transplantation. Secondary ACS is a condition which does not derive from the abdominal-pelvic region. The secondary ACS, earlier described as extra-abdominal or therapeutic, is characterized by subacute or chronic IAH, which is developed as a result of extra-abdominal causes such as sepsis, increased capillary permeability, large burnings, or other conditions that require considerable infusion therapy. The recurrent ACS is a condition that develops over again after prior surgical or non-surgical treatment of primary or secondary ACS.

## CONCLUSION

Our study found a high incidence (34%) of intra-abdominal hypertension in this "non-traditional" for this type of patients' complications, wherein 2.5% had a level III and IV. Patients who developed IAH had a high SOFA score > 10, and high mortality - 63%. These facts indicate a recommendation for monitoring of the IAH in this patient study group, and show the necessary need for adequate treatment of the advanced intra-abdominal pathological process and the related adverse complications. Although the surgical approach/ management is unusual in this group of patients, non-surgical decompression laparotomy should not be delayed in time in case of abdominal compartment syndrome.

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