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Analysis of intra-abdominal hypertension in severe burned patients: The Vall d'Hebron experience

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ABSTRACT

Although severely burned patients are at a high risk of developing intra-abdominal hypertension (IAH: IAP > 12 mmHg) and Abdominal Compartment Syndrome (ACS) (IAP ≥ 20 mmHg), few data about its incidence and prevalence is available.

Our aim was to determine the incidence and prevalence of IAH and ACS in patients with severe burns in our geographical setting.

A pilot prospective, observational study was performed at the Burns Unit of the Plastic Surgery Department in Vall d'Hebron University Hospital (Barcelona), during a 12-month period. All patients with age ≥18 years old and burns >20% of the total body surface area (TBSA) were considered for inclusion. Patients who did not require urinary catheterization via the urethra were excluded. All patients included were followed during the first five days from their admission. Results are expressed as median (interquartile range) or frequency (percentage).

During the study period, 303 patients were admitted to the Burns Unit. Twenty-five patients were included in the study (21 [84%] male, 4 [16%] female; age 42 [30–69 years]; TBSA burned 33 [25–58]%; all patients presented deep second-degree and/or third-degree burns). Eighteen (72%) patients met criteria for IAH, but only one (4%) developed ACS. The incidence of IAH and ACS was 0.56 and 0.04 cases/patient-day, respectively. Patients with IAH presented higher number of organs failure (2 [0–2.2] vs 0 [0–0]; $p = 0.03$).

Patients with >20% TBSA burned presented a very high prevalence of IAH. Development of organ failure occurred even at moderately increased values of IAP. In this scenario, monitoring of IAP is the first step for establishing the importance of IAH/ACS in this patient population.

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1. Introduction

In any compartment in the human body, an increase in internal pressure above physiological limits causes a deterioration of perfusion of tissues and organs. The abdominal cavity and the retroperitoneum act as sealed compartments, and any change in the volume of their contents may raise the intra-abdominal pressure (IAP) [1,2]. Normal intra-abdominal pressure is <7 mmHg, and values ≥12 mmHg indicate intra-abdominal hypertension (IAH) [3].

The sustained increase in IAP and the consolidation of IAH can contribute to the appearance or aggravation of alterations in the intra-abdominal organs [2]. The existence of IAH has been reported to be an independent risk factor for renal failure and mortality [4]. In fact, changes in IAP may have a greater impact on diuresis and renal function than changes in mean arterial pressure (MAP). In addition, increased IAP reduces the abdominal perfusion pressure, generating splanchnic hypoperfusion, which may finally develop into intestinal edema, ischemia and bacterial translocation [4,5]. At cellular level, there is also an increase in neutrophil activity, with a major release of cytokines. Both these factors contribute to the appearance of secondary multiorgan failure [5].

Intraabdominal hypertension may also have consequences outside the abdominal compartment [1]. IAH reduces the compliance of the respiratory system by reducing the compliance of the chest wall without altering that of the pulmonary parenchyma. This may hamper pulmonary ventilation, even in patients without prior lung disease. The increase in intrathoracic pressure may also hinder the venous return to the heart. In fact, an IAP above 10 mmHg may cause a reduction in cardiac output due to an increase in the afterload and reductions in the preload and the compliance of the left ventricle. This increased pressure in the chest also makes it difficult to assess blood volume in patients with IAH and ACS. Finally, in severe cases, the increase in intrathoracic pressure may cause difficulties in cerebral venous return and may increase intracranial pressure [6]. Thus, the different anatomic compartments are intimately related to each other and the alterations that occur in the abdominal compartment may have serious repercussions elsewhere. Importantly, it has been shown that deleterious effects of IAP may occur at lower levels that ones that were previously considered safe [1].

A sustained increase in IAP may lead to multiorgan dysfunction. Abdominal Compartment Syndrome (ACS) occurs when the values of IAP are continuously above 20 mmHg and are associated with the appearance of a new organ failure. ACS was originally described in surgical patients with abdominal trauma, bleeding or infection [1]. Recently, it has been reported in patients with other pathologies, such as burn patients [2,7]. Recently, prevalence of IAH/ACS has been estimated in up to 50% of critical care patients [1]. In addition, the findings of clinical examinations do not indicate the presence of IAH or ACS and, therefore, clinical examination may be insufficient [8–10]. Finally, IAH/ACS apparition has been associated with significant morbidity and mortality [9,11]. For these reasons, the monitoring of IAP and the use of therapeutic measures to prevent the appearance of IAH may reduce complications in the abdomen and other sites, and may also improve prognosis [12]. Previous studies advocate the measurement and monitoring of IAP in burn patients who require significant volumes of resuscitation (>30% of total body surface area [TBSA] burnt) [2]. In 2006, the World Society of the Abdominal Compartment Syndrome (WSACS) [3] published a consensus definition of IAH and ACS, and in its latest guidelines suggests that the monitoring of IAP and ACS should be implemented in all intensive care units as a standard physiological parameter. The guidelines also recommend monitoring of IAP in all critical care patients with two or more risk factors for IAH/ACS [3]. However, in spite of these recommendations, IAP is not thoroughly monitored and there are few studies in our environment of its incidence and prevalence [12,13].

For these reasons, our aim was to determine the incidence and prevalence of IAH and ACS in patients with severe burns in our geographical setting. We hypothesized that IAH and ACS may be frequent and underdiagnosed in patients with severe burns, and they may have implications for prognosis.

2. Materials and methods

2.1. Study setting and design

A pilot, prospective, observational study over a 12-month period (1st March 2012–28th February 2013) was designed. It was performed at the Burns Unit of the Plastic Surgery Service, Vall d'Hebron University Hospital, which is a reference center with 26 beds, 6 of them for critical care patients, for the treatment of burn patients in a population of more than eight million people in Catalonia, the Balearic Islands, and Andorra. All patients with severe burns of this geographical setting are transferred to this Unit for treatment. The study was approved by the Ethics Committee of Vall d'Hebron University Hospital. Prior to inclusion in the study, informed consent was obtained from the patients or their legal representatives.

2.2. Study population

All patients admitted to the Burns Unit were screened daily for inclusion in the study. Patients with age ≥18 years old and burns >20% of the TBSA were considered for inclusion. Patients who did not require urinary catheterization via the urethra (patients carrying suprapubic catheter, bladder anomalies, cystectomy, anuria due to chronic renal failure, recent urological surgery) were excluded.

2.3. Study variables

When a patient was considered suitable for inclusion in the study, informed consent was obtained and data collection was initiated. Data were compiled over a period of five days from inclusion, since the risk of development of IAH and ACS is greatest during the initial resuscitation period. Demographic variables (age, sex, body mass index) and comorbidities were recorded. Clinical variables associated with the burn (%TBSA burnt, burn depth, mechanism of production, day and hour 0, inhalation of gases or other substances) were also recorded, as well as general monitoring data (central venous pressure,