International Journal of Surgery 19 (2015) 67–71

Contents lists available at ScienceDirect

International Journal of Surgery

journal homepage: www.journal-surgery.net

Original research

Intra abdominal hypertension; incidence, prevalence and outcomes in a mixed intensive care unit: Prospective cohort study

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HIGHLIGHTS

- In this study, incidence and prevalence of IAH is 10% and 35%, respectively.
- IAH was detected in 23/83 (28%) at the time of admission.
- All ventilated patients admitted to ICU should have screening IAP measurement at the time of admission.

ARTICLE INFO

Article history:
Received 16 September 2014
Received in revised form
23 April 2015
Accepted 7 May 2015
Available online 15 May 2015

Keywords:
Intra-abdominal hypertension
Abdominal compartment syndrome
Mortality
Acute renal failure

ABSTRACT

Background: This study was conducted primarily to determine the prevalence and incidence of intra-abdominal hypertension (IAH) in a mixed ICU (medical & surgical) population and, secondarily, to compare outcomes between patients with and without IAH.

Methods: The prospective cohort study was conducted from April to July 2011 on adult patients admitted in ICU, on mechanical ventilation and with an indwelling urinary catheter. Intra-vesicular pressure was measured. Primary endpoint was IAH and it was defined as Intra-abdominal pressure > 12 mm Hg on two consecutive readings 6 h apart.

Results: Total 83 patients were enrolled in the study; 61% from medical services and 39% from surgical services. Mean age in years ± SD was 47 ± 17.5 with male preponderance (66%). IAH was detected in 23/83 (28%) at the time of admission, while six out of remaining 60 patients (10%) developed the condition during their ICU stay; the incidence and prevalence was 10% and 35%, respectively.

Secondary end points of the study comparing outcomes between patients with and without IAH, though different in the two groups, did not achieve statistical significance. In-hospital mortality 65.5% vs. 44.4% p-value 0.054. New onset renal failure 34.5% vs. 16.7% p-value 0.054%. Difficulty in weaning from mechanical ventilation 37.9% vs. 25.9% p-value 0.008.

Conclusion: IAH is a poorly recognized clinical entity with potentially devastating impact on patient outcomes. Since majority of patients had IAH at the time of admission, all ICU patients especially on ventilator should have baseline intra-abdominal pressures measured at the time of admission and subjected to appropriate management to prevent them from developing abdominal compartment syndrome.

1. Introduction

Intra-abdominal hypertension (IAH) and Abdominal compartment syndrome (ACS) are different points in the progressive spectrum of a clinically important, but not widely recognized condition. Over the past decade and half, interest in these has grown significantly. More recently, World society on Abdominal Compartment

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http://dx.doi.org/10.1016/j.ijsu.2015.05.014
1743-9191/

Syndrome has been established to further understanding epidemiology and management of this complex condition (1).

The conditions were initially recognized in poly-trauma and abdominal surgery patients, but can involve any critically ill patient. Intra-abdominal pressure (IAP) of 12–20 mmHg on at least three occasions 4–6 h apart is termed as Intra-abdominal Hypertension (IAH), whereas IAP > 20 mm Hg with failure of one or more organ systems is termed as Abdominal Compartment Syndrome [1].

Some form of intra-abdominal pressure measurement is essential for early and correct diagnosis. At present monitoring of intra-vesical pressure through an indwelling Foley catheter is considered accurate and convenient [2,3]. Clinical diagnosis of IAH is difficult and even ACS is only appreciated in its extreme forms. Intra-abdominal hypertension (IAH) is a transition phase, which if identified and managed appropriately, can be stopped from progressing to ACS; the latter carrying an associated mortality of 40–100% [4,5]. Interventions range from changes in routine management i.e. NG decompression, rectal enema/tubes, sedation/relaxation to invasive procedures like ventilator support, drain placement and surgical decompression.

Following Institutional Ethics review committee approval (1608-Sur-ERC-10) this prospective study was conducted with the primary objective of determining the prevalence and incidence of intra-abdominal hypertension (IAH) in a mixed ICU population, at a single center. Secondary objectives were to compare outcomes (mortality, new onset acute renal failure, ICU stay, Ventilation days, difficult weaning) between patients with and without IAH.

2. Methods

This prospective cohort study was conducted over a four month period i.e. from April to July 2011 in the intensive care unit (ICU) of our hospital. Our ICU consists of, 14 beds with equal number of beds allotted to either surgical or medical specialties; patients are managed by ICU trained intensivists in collaboration with primary specialty teams. All adult patients admitted to ICU needing ventilator support, with a urinary catheter (Foley) in place were included in the study. Patients in whom Foley catheterization or pressure measurement was not possible (bladder surgery/pathology or urethral trauma) were excluded. Informed consent was taken from relatives involved in medical decision making process and the primary team involved.

IAP monitoring was performed by a single dedicated research medical officer, who was trained to perform accurate IAP measurements [6,7] and his technique was reviewed fortnightly by PI or Head nurse of ICU for compliance with aseptic measures and accuracy of measurements. Pressure measurement was done in supine position with transducer leveled at pubic symphysis by yard stick. A one-time assembly of equipment was done by attaching a straight connector (with luer lock) between Foley catheter and urine bag tubing, and a three way stopper with a luer lock was attached to connector. For pressure measurement, connector & three way stoppers were sprayed with chlorhexidine BEFORE & AFTER each measurement. One port of three way stopper was attached with transducer and other was left for syringe to fill the bladder with 50 ml saline [3] after clamping the urinary bag tubing just below the straight connector. After zeroing transducer, the pressure was recorded at the end of expiration at least 1 min after the instillation of saline into bladder to let the detrusor muscle accommodate and relax.

Pressures were measured within 12 h of ICU admission and then twice daily in all the patients fulfilling inclusion criteria until extubation/discharge from ICU; diagnosis of IAH or death. If pressure of 12 mm Hg or more was recorded in any patient; measurements were performed six hourly. Intra-abdominal hypertension was diagnosed if pressure measurements on two consecutive readings 6 h apart were equal to or higher than 12 mm Hg [8]. New onset renal dysfunction was labeled if a patient's creatinine level rose above 2 mg/dl according to Sequential Organ Failure Assessment (SOFA) score [2]. Difficulty in weaning from ventilator (Table 2) was defined as ventilator requirement beyond 72 h or need for re-intubation.

Sample size was calculated on WHO software for sample size determination by the formula of estimation of population proportion for one sample with specified absolute precision. Cumulative incidence of IAH of 32% in mixed ICU setting was taken from a prior study [8]. At 95% confidence interval and 10% bound on error (absolute precision) the calculated sample size was 84.

Data was collected on a proforma, which included the demographic data i.e. age, sex, BMI; Clinical data i.e. comorbids, primary diagnosis/disease; and outcome variables i.e. IAP.

Continuous variables with normal distribution were analyzed as means ± standard deviations and student's t-test was applied to compare groups. Continuous variables with skewed distribution were analyzed as medians ± Inter Quartile Range (IQR) and Mann Whitney *U*-test was applied to compare groups. Categorical variables i.e. sex, comorbids, primary disease and IAH were analyzed as proportions and percentages, and chi-square test was applied to compare groups. P-value < 0.05 was considered statistical significant.

Prevalence was the proportion of patients with IAH at any point in time during ICU stay out of total sample. Cumulative incidence was the proportion of patients who developed IAH in ICU after a normal initial IAP reading at time of admission in ICU. Analysis was done on SPSS-16.

3. Results

Total 84 patients were enrolled in the study and one was excluded due to loss of data. Out of 83 patients analyzed, 61% were included from medical services and 39% from surgical services. Mean age in years ± SD was 47 ± 17.5 with male preponderance (66%). IAH was detected in 23/83 (28%) at the time of admission, while six out of remaining 60 patients at risk (10%) developed this later on; hence the incidence and prevalence was 10% and 35%, respectively. Demographic and clinical variables of entire cohort as well as comparison between patients with IAH and without IAH is summarized in Table 1.

We also compared patients with IAH to those with normal IAP and both groups were comparable with each other for baseline demographic and clinical variables (Table 1). Patients with IAH had higher in-hospital mortality (65.5% vs. 44.4%, p-value-0.054) and new onset ARF (34.5% vs. 16.7%, p-value = 0.060) as compared to those having normal IAP, however, the differences were statistically not significant. Difficulty in weaning off from mechanical ventilation was noted in a higher proportion of patients having IAH compared to those with pressures within the normal range (37.9% vs. 25.9%, p-value: 0.008). Differences were also seen in median ventilation days (2 vs. 4, p-value: 0.044) and median ICU stay in days (3 vs. 5, p-value: 0.045) between the two groups (Table 2).

4. Discussion

Over the past decade, intra-abdominal hypertension (IAH) and abdominal compartment Syndrome (ACS) have evolved from being obscure and poorly understood conditions of the traumatically injured patients to a recognized cause of significant morbidity and