

Original Research Article

A prospective study of outcome in patients with intra-abdominal hypertension

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ABSTRACT

Background: Intra-abdominal hypertension (IAH) and Abdominal compartment syndrome (ACS) is increasingly recognized in critically ill patients, and the deleterious effects of increased intra-abdominal pressure (IAP) are well documented. It is known to affect almost all the system in the body, but mainly the renal, cardiovascular and pulmonary systems. The purpose of this study is to prospectively observe the outcome of IHP in patients admitted in ICU, acute surgical and emergency wards over three years and give our recommendations based on the outcome in such patients.

Methods: We measured intravesical pressure using simple manometry to measure IAP.

Results: We observed cardiac dysfunction in 16.30%, renal dysfunction in 10.86%, respiratory dysfunction in 21.74% and mortality of 15.2%. Significant mortality was associated with IAH grade II (55.6%) and grade III (100%).

Conclusions: Due to the contribution towards mortality and common occurrence we suggest that intra-abdominal pressure be measured in ICU conditions.

Keywords: IAH, IAP, ACS, Intravesical pressure, Manometry

INTRODUCTION

Abdominal compartment syndrome (ACS) is increasingly recognized in critically ill patients, and the deleterious effects of increased IAP are well documented. Increased intra-abdominal pressure is seen in clinically diverse situations such as intestinal obstruction, ascites, intra-abdominal bleeds, pneumoperitoneum, laparoscopy etc.¹ It is known to affect almost all the system in the body, but mainly the renal, cardiovascular and pulmonary systems.² The compartment syndrome is a condition in which increased pressure in a confined anatomical space,

adversely affects the circulation and threatens the functions and viability of the tissue.³⁻⁵ The deleterious effects of elevated intra-abdominal pressure have received renewed attention in recent years.⁶ The abdominal compartment syndrome has been defined as an intra-abdominal pressure of > 25 mm Hg, complicated by one of the following: Peak air way pressure >40 cm H₂O, oxygen delivery index <600 ml O₂/min/m², or urine output <0.5 ml/kg/hr.^{6,7} Intravascular pressure has been found to have good correlation with the intra-abdominal pressure (IAP).^{8,9} The gastric pressure measurement has also been studied especially in patients with acute renal failure.^{10,11}

Intraventricular pressure measurement has been accepted as the most objective method to determine the intra-abdominal pressure in clinical practice.¹²⁻¹⁴

Clinical implications

The clinical pictures of raised intra-abdominal pressure is characterised by decreased cardiac output, hypoxia, progressively increasing airway pressure and oliguric renal failure in a patient with tensely distended abdomen.

Grading

The most widely accepted grading used is attributed to Meldrum shown in Table 1.

Table 1: The grading system of the IAP (Meldrum et al).¹⁵

Grades	Bladder pressure (mmHg)	Recommendation
I	10-15	Maintain normovolemia
II	16-25	Hypervolemic resuscitation
III	26-35	Decompression
IV	>35	Decompression and re-exploration

Aims and objectives

The purpose of this study is to prospectively observe the outcome of IAH in patients admitted in ICU, acute surgical and emergency wards over 3 years and give our recommendations based on the outcome in such patients.

METHODS

Study

Prospective observation, data collection and analysis.

Patients

Patients found to have raised IAP were selected as the subjects for the study. All patients were selected during a time period of 03 years from 01 June 2016 to 30 June 2019 at tertiary care centres of New Delhi and the national capital region (DDUH and ESI Faridabad).

Data

Patients were studied during their admission in the ICU and acute high dependence wards. IAP values were measured every 24 h.

Organ dysfunction was defined as under: Cardiovascular-Hypotension requiring vasoactive medication (Dopamine, nor epinephrine, dobutamine at any dose), Renal-serum

creatinine above 2.0 mg/dl and Pulmonary-requirement of mechanical ventilation

These parameters were followed till the clinical outcome after the IAP was normalised by conservative or surgical interventions. All patients were telephonically contacted after 01 year of discharge and general well being assessed through verbal communication.

Inclusion criteria

All patients admitted to ICU, acute surgical and medical wards for more than 06hours with IAP more than 10 mmHg are selected.

Exclusion criteria

Pregnant women, mentally unstable persons, patients who did not complete the investigations/refused investigation, patients lost in the follow up (due to refusal to continue treatment), paediatric age group (less than 18 years old), cardiac tamponade, tension pneumothorax, status asthmaticus, bladder outflow obstruction, Pre-existing end organ failure and those not consenting to participate in the study are excluded.

Outcome

Outcome after surgical/medical (conservative) management will be studied as an improvement in urine output and renal function tests (blood urea nitrogen and serum creatinine levels) and respiratory function. Clinical improvement of organ function will be assessed by maintenance of mean blood pressure (derived after monitoring the blood pressure) to 80 mm of Hg and above without ionotropic support, serum creatinine levels below 2.0 mg/dl, urine output of more than one litre /day and maintenance of respiratory function without ventilator assistance.

Measuring of IAP

Fluid column manometry method is to be employed to measure IAP. For measuring IAP, the bladder is first emptied and then primed with 50 cc normal saline using a large piston syringe aseptically.

The column of fluid in manometer is the IAP in cm H₂O. This reading is to be converted to mmHg by using the formula 1 mmHg=1.26 cm H₂O and 1 mm Hg=1.36 cm of saline. Meldrum et al grading system of IAP is used in our study.

Statistical analysis

Normally distributed continuous variables were recorded as mean and categorical variables were expressed as percentage.

RESULTS

A total of 100 patients were studied. The 08 patients were lost to follow up.

Intraabdominal pressure

Intra-abdominal pressure ranged from 4 to 25.5 of H2O with a mean of 11.8. Of all 72 patients had grade I -IAP, 18 patients had IAP grade II and 2 patients had IAP grade III. None of patients were noted to have IAP grade IV.

Age distribution

Age ranged from 12 to 80 years with the mean of 47. Age distribution of patients based on IAP grading (Table 2).

Table 2: Age distribution of patients based on IAP grading.

IAH grade	Mean age (years)
Grade I	46
Grade II	49
Grade II	51
IAH grade IV	Nil

Sex distribution

There were 61 male and 31 female patients in this study. Sex distribution of patients based on IAP Grading is as follows in Table 3.

Table 3: Sex distribution of patients based on IAP grading.

IAH grade	Male	Female
Grade I	47	25
Grade II	12	6
Grade II	2	0
Grade IV	Nil	Nil

Organ dysfunction

A total of 26 patients developed organ dysfunction, 15 patients developed features of cardiovascular system failure, whereas 20 developed respiratory failure and 10 patients developed renal failure. the 12 patients developed multi-organ failure. Organ dysfunctions are shown in Table 4.

Table 4: Distribution of patients who developed organ failure in various IAP grades.

IAH grade	Circulatory and cardiac failure	Renal failure	Respiratory failure
Grade I	0	1	6
Grade II	13	8	12
Grade II	2	1	2

Outcome

There was a total of 14 deaths in the study. IAP Grade wise distribution of patients is shown in Table 5.

Table 5: Patient outcome distribution according to IAP grading.

IAP grade	Died (%)	Survived
IAP grade I	2 (2.8)	70
IAP grade II	10 (55.6)	8
IAP grade III	2 (100)	0
IAP grade IV	Nil	Nil

As expected, highest mortality was observed in patients with IAP grade III i.e., 100%, followed by grade II i.e., 55.6%

DISCUSSION

We aimed to determine the impact of raised IAP on the outcome of patients admitted in ICU due to various afflictions through the window of involvement of various organ systems. We also are aware of the limited reading material available on the topic in the standard textbooks used by both undergraduate and postgraduate students. We used intra-vesicular pressure through simple manometry as measure of intra-abdominal pressure.^{13,16} The normal mean intra-abdominal pressure is accepted as zero. In our study, the mean IAP was found to be 11.8 attributable to the fact that the study only comprised of already diseased persons. We also found that there was a higher mortality in those patients, who had IAP >15 cm of saline. Simon et al in their study have also noted that, in the subjects with haemorrhagic shock and resuscitation, avoidance of even moderate levels of increased intra-abdominal pressure by prophylactic decompression, improves the outcome.¹⁷ Decompression could be a formal laparotomy or placement of a drain, that could relief from the raised IAP. Conservative methods include use of decongestants such as frusemide, mannitol etc. and fluid restriction.

In the present study, intra-abdominal pressure ranged from 4 to 25.5 cm of saline with a mean of 11.8. 72 patients had IAP grade I, whereas 18 patients had IAP grade II. 2 patients had IAP grade III. None of the patients were noted to have IAP grade IV.

Significant mortality was associated with IAH grade II (55.6%) and grade III (100%). This has also been noted to be associated with increased incidence of organ dysfunction in these patients. Meldrum et al have observed that the IAP when exceeds 30 mm of Hg, heightens the risk of multi-organ system failure and subsequent death.¹⁵ Kron et al in their study of 11 post-operative patients showed that with the rise in the IAP>30 mm of Hg, 36% (4 of the 11) patients died when decompression was not attempted.¹⁸ Sugrue et al in a prospective study of 100 patients have demonstrated that

there were a significant number of deaths (72% of the total deaths) if IAP was >20 mm of Hg.¹⁹ In their study, renal impairment, characterised by serum creatinine levels of >1.4 mg%, was observed in 29 of their patients, 20 (69%) of whom had the IAP >20 mm of Hg. We observed cardiac dysfunction in 16.30%, renal dysfunction in 10.86%, respiratory dysfunction in 21.74% and mortality of 15.2%.

Limitations

The study is an observational attempt at a very important topic. We recommend for a well organised randomised control trial in Indian set up and also for systematic meta-analysis of already published data.

CONCLUSION

Due to the contribution towards mortality and common occurrence we suggest that IAP be measured in ICU conditions. Early diagnosis using readily available tube manometer and Foley's catheter goes long way in reducing mortality and morbidity in ICU patients and thus can contribute in reduction of the overall financial burden.

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Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee

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