

Original Research Article

Intra-abdominal pressure: a predictor of severity in acute pancreatitis

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ABSTRACT

Background: Acute pancreatitis is a multisystem disease which has an unpredictable course. The major consequence of severe acute pancreatitis is usually intra-abdominal hypertension. So, abdominal compartment syndrome occurs with serve increase in intra-abdominal pressure (IAP) with organ failure. If conservative measures fail, some early interventional procedures have to be performed to reduce mortality in those patients.

Methods: The ethics committee clearance was obtained. The study included 50 patients who were admitted in our institution with acute pancreatitis (diagnosed based on clinical, radiological, biochemical parameters) from December 2022 to August 2023. Intravesical route was used to measure IAP and it was performed by bladder catheterization using a Foley's catheter which was then connected with a three-way stopcock, which further attached with a water manometer and on that same day APACHE scores was calculated, compared and analyzed.

Results: IAP was >25 cm H₂O in 48% of patients and 28% of patients developed MODS and they did not survive. The mean IAP among the survivors was 13.56 cm H₂O and in non-survivors it was 24.94 cm H₂O. Correlation studies between IAP & the clinical severity of acute pancreatitis was significant ($p<0.05$).

Conclusions: IAP seems to be a simple, reliable and single mortality predictor and helps to assess organ failure in acute pancreatitis and it also well correlates with other pancreatic prognostic scores. It also serves as a selective prognostic marker in acute pancreatitis and found to have a direct correlation between IAP and clinical severity of acute pancreatitis.

Keywords: Intra-abdominal pressure, Intra-abdominal hypertension, Severe acute pancreatitis, Abdominal compartment syndrome, APACHE, MODS

INTRODUCTION

Acute pancreatitis is a multisystem disease. Most of the studies have confirmed that intra-abdominal hypertension (IAH) is a frequent complication of severe acute pancreatitis (SAP) but it is less frequent in mild disease.¹ Acute physiology and chronic health evaluation (APACHE II) and/or sequential organ failure assessment (SOFA) score, occurrence of IAH and extension of infected necrosed pancreatic tissue are some factors that will significantly affect the prognosis in SAP.² Early detection of patients who are at the risk of developing IAH and appropriate steps has to be taken prior, to stop its

progression towards abdominal compartment syndrome (ACS) that will drastically reduce the mortality.

A significant increase in intra-abdominal pressure (IAP) progress to abdominal compartment syndrome (ACS) and sudden organ failure. Conservative measures are somewhat helpful, but invasive procedures are significantly necessary in some cases.³ Percutaneous tube drainage of significantly larger collections is usually preferred whenever possible, but in some selected cases open decompressive laparotomy will be the last option to significantly reduce the intra-abdominal pressure. Hence, IAP should be checked in all cases with SAP.⁴

Aims and objectives

Aims and objectives were to study the role of intra abdominal pressure monitoring by the intravesical route as a marker of severity in case of acute pancreatitis and its related complications

Several prognostic markers were used in the assessment of progression of disease in acute pancreatitis, such as Ranson score, BISAP score, APACHE II score, and modified ATLANTA classification. But measurement of intravesical pressure seems to be low cost/less time consuming, minimal discomfort for the patient, and a better single prognostic indicator.

METHODS

Study design

It was a single-centre observational study.

Study population

All patients with acute pancreatitis admitted to the Institute of Surgical Gastroenterology & Liver transplantation, Govt Stanley Medical College & Hospital, Chennai, Tamil Nadu

Sample size

The sample size was 50 (based on reference study).

Duration of study

The duration of the study was from December 2022 – August 2023 (9 months).

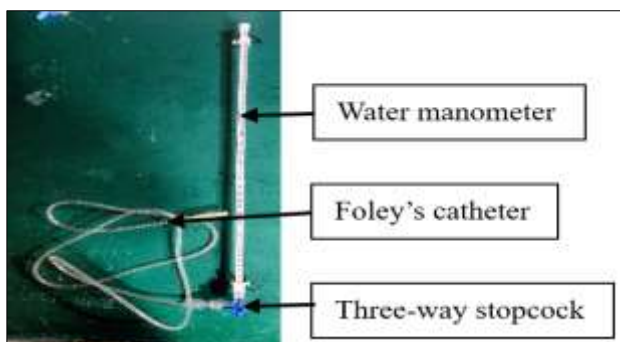


Figure 1: Materials used for the study.

Ethical committee approval was obtained and the intravesical method of IAP measuring was done by connecting a urinary Foley catheter to a three-way stopcock that was further fixed to a water manometer, as shown in (Figure 1a). The patient was placed in a supine position, urinary Foley catheter was inserted, residual urine from the bladder was drained. Later, the urinary Foleys Catheter clamped at a point that was distal to the point of measuring bladder pressure.^{5,6} For all 20 degrees

of upward tilt of head, the IAP increases to 2 mmHg. The urinary Foley's catheter was then connected to a water manometer for pressure reading and on the iliac crest at the mid-axillary point was taken as a reference point. The IAP value was zeroed at that point. It was read 30 to 60 seconds later, allowing time for the detrusor muscle of bladder to relax. In addition, all the reading should be done when there was no active abdominal muscle contraction and towards the end of expiration. Readings were usually taken at particular time intervals.⁷ Based on the IAP, the management modality was planned. The urinary Foleys catheter has to be clamped before each reading.

Data analysis was done by continuous variables and was expressed as mean $\pm$ SD. Continuous variables was compared using the student-t test. Multivariate regression and logistic regression were used to study the effect of the studied variables on mortality (end result).

Inclusion criteria

Patients who were admitted in the Institute of Surgical Gastroenterology & Liver transplantation, Govt Stanley medical college and hospital as a case of acute pancreatitis. Patient giving consent to participate in the study were included.

Exclusion criteria

Patients who have already undergone some interventional procedure, and patients with neurogenic bladder, bladder injury, tense pelvic hematoma, and bladder outlet obstruction were excluded.

RESULTS

From the study of 50 patients, it was found to be male predominance with about 74% (37 patients) of the cases and 26% (13 patients) found to be female. Most of the patients was in the age group of 31-40 years and very less between less than 20 and more 61 years (Figure 2). Most common etiology was found to be ethanol related pancreatitis. Rest being biliary, idiopathic, pancreatic divisum and traumatic causes (Figure 3). Out of 50 patients, 32% (16 patients) patients required inotropic supports and 28% (14 patients) patients developed MODS and all the 28% (14 patients) of the patients who developed MODS resulted in death. 32 patients had an intra-abdominal pressure more than 20 cm H₂O out of which 24 patients undergone intervention in the form of PCD, laparoscopy and drainage and open decompressive laparotomy. The remaining 8 patients we couldn't do any intervention since these patients had severe refractory coagulopathy. Out of 24 patients 18 patients recovered and 6 patients resulted in death (Figure 4). APACHE-II score was more than 23 in 21 patients, of which 14 patients resulted in death and 7 survived. And the score was less than 23 in 29 patients, of which all of them survived (Figure 5). The mean IAP was more than 25 in 24 patients, of which 13 patients resulted in death and 11 survived. And

the mean IAP was less than 25 in 29 patients, of which 1 patient resulted in death and 28 survived (Figure 6). The mean APACHE score among the survivors was 9.67 and among the non survivors it was 36.50. And the mean IAP among the survivors was 13.56 cm H₂O and among the non survivors it was 24.94 cm H₂O (Table 1). 5 patients whose mean IAP was in the range of less than 10 and their APACHE score was in the range of 5-9 cm H₂O. 8 patients whose IAP between 21-25 cm H₂O and their APACHE was in the range of 16-26. And 24 patients with mean IAP more than 25 had their APACHE score between 29-46 (Figure 8) out of 50 patients, 36 patients discharged and 14 patients expired (Table 2). And the comparative studies between the IAP and clinical severity of acute pancreatitis says that the r value 0.91 and p value of 0.00071 which is significant (Figure 7). Hence there was a definite correlation between IAP & Severity of acute pancreatitis.

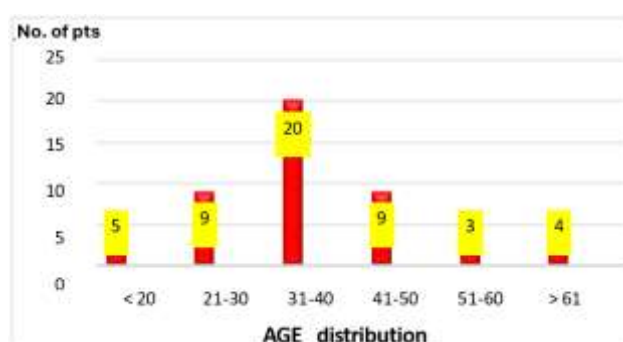


Figure 2: Age distribution among the patients.

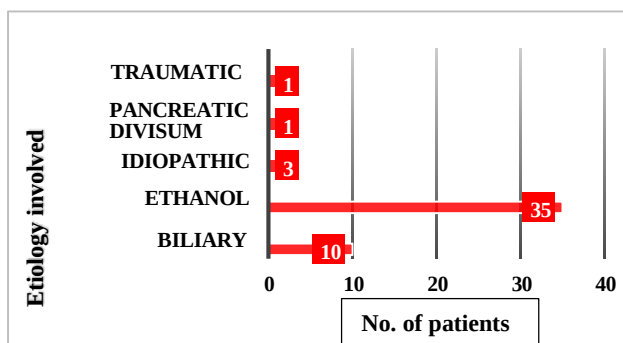


Figure 3: Etiological factors involved among the patients.

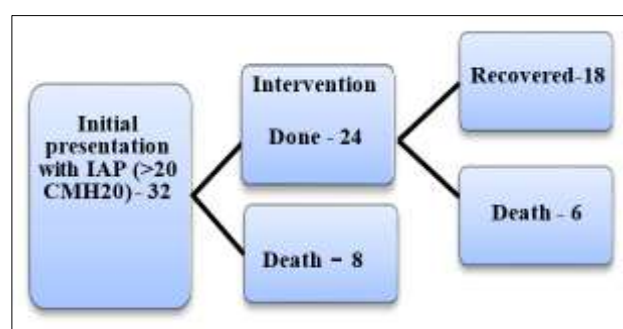


Figure 4: Recovery and death following interventions.

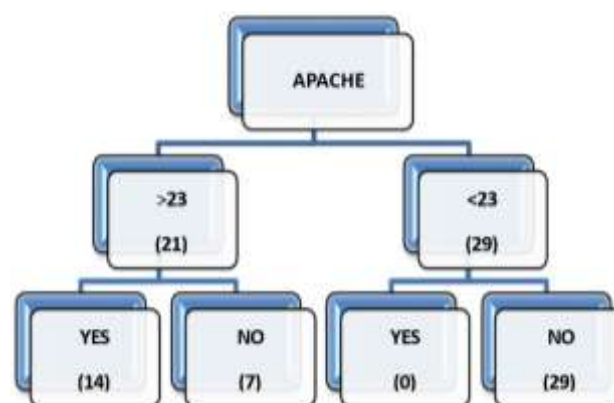


Figure 5: APACHE score range and its mortality.

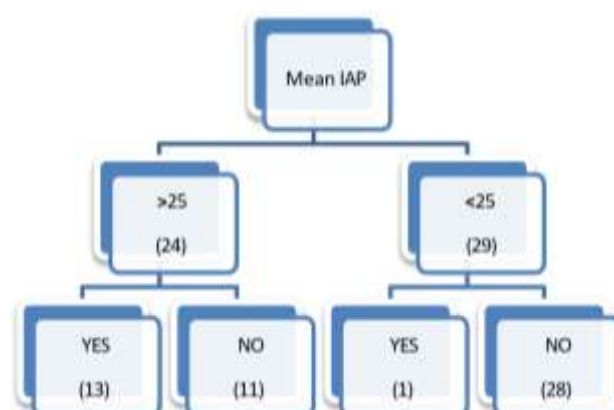


Figure 6: Mean IAP range and its mortality.

Table 1: Average mean and SD of APACHE score and IAP.

Variables	Mortality				P value
	No	Yes	Mean	SD	
APACHE	9.67	36.50	4.67	5.98	<0.0001
IAP	13.56	24.94	6.45	4.19	<0.0001

Table 2: Total no. of patients and their corresponding range of IAP and APACHE score.

IAP	Total no. of patients	APACHE
<10	5	5-9
11-15	7	8-12
16-20	6	10-19
21-25	8	16-26
>25	24	29-46

Table 3: Correlation studies between IAP and clinical severity.

Variables	R-value	P value	Significance
IAP and clinical severity	0.91	0.00071	Significant

Total no. of patients (50)	
Discharged (36)	Expired (14)
Mean IAP (13.56 cmH ₂ O)	Mean IAP (24.94 cmH ₂ O)
Range (5.62-21.68)	Range (19.45-28.88)

Figure 7: Mean IAP – among the patients who were discharged and expired.

DISCUSSION

Patients with uncomplicated mild AP can be well managed in wards with closed monitoring and regular reviewing to find high-risk patients, who may deteriorate, are identified early.^{8,9} The need for intensive care may develop initially in the disease process reflecting acute physiologic changes occurring as a result of the inflammatory process from the pancreatitis triggering organ failure.¹⁰ Admission to critical care later in the disease process is usually because of superimposed infective complications and sepsis. Systemic complications like organ failure is dynamic process which can lead to sudden deterioration.^{11,12} Hence should be discussed in an early stage with the critical care team. Renal, respiratory, cardiac and gastrointestinal (GI) problems are the most common organ systems complicated in AP and careful monitoring of each of these systems is key to determining medium and long-term outcomes for these patients. Lung failure usually indicates change to the critical care unit, either for increasing non-invasive managements such as continuous positive airway pressure (CPAP) or high-flow nasal cannula or intubation and mechanical ventilation with lung.^{13,14} Cardiac compromise is tackled by volume expansion and inotropic supports if necessary. It should be managed by monitoring by invasive methods and goal-directed fluid therapy. Renal shutdown usually occurs in the background of SAP due to prolonged renal hypoperfusion causing renal tubular necrosis, IAH or nephrotoxic drugs, or computed tomography (CT) contrast.¹⁵

The two major consequences of this phenomenon are unable to tolerate nutrition enterally (EN), and bowel barrier function breakdown with sub-sequent translocation of bacteria, bacteremia and finally leading to infection of the necrosed pancreatic tissue.¹⁶ Adequate nutrition is extremely important for patients with pancreatitis because a nutritional debt will rapidly develop with muscle wasting and an increased risk of additional complications, particularly respiratory ones. ACS is a recognized complication of severe AP and has been reported to occur in approximately in 15% of these patients.¹⁷ When present, there is an associated 49% mortality. IAH indicates severity of the disease, failure of organs and death, but increased IAP indicates a poor outcome. The international

consensus guidelines suggest the following management protocol. First, in patients who are connected to mechanical ventilator with SAP, IAP measuring should be checked, mainly if the patient is drastically deteriorating. Second, medical intervention should be the treatment of choice in order to tackle the most significant contributors to IAH (volume of hollow viscera, assessing both intravascular and extravascular volume status and compliance of abdominal wall).^{18,19} At last, the invasive management for ACS in AP has to be thought after a multidisciplinary opinion, mainly for the patients with significant IAP that in higher than 25 mm Hg and sudden onset organ failure that is refractory to medical treatment and decompression by nasogastric/rectal tube.^{20,21} Invasive management modalities are percutaneous drainage of the ascites, laparostomy, or fasciotomy of subcutaneous linea alba. The significant challenges in the surgical management is that there is a significant risk in contaminating a pancreatic necrosis which is sterile previously.^{22,23} But these suggestions lack a significant evidence base and a better-quality RCTs are needed to find its benefit.²⁴

Limitations

IAP is not usually indicated as an initial prognostic marker because acute abdominal pain present even in earlier stages of the disease and also unidentified detrusor instability may also affect IAP measurements. Therefore, IAP measurement should never be performed until pain control is fully achieved. Since this is a small study, still larger randomized controlled trials are needed for further validation of the study.

CONCLUSION

This study shows that the non-survivors had significantly higher IAP when compared with survivors. IAP found to be a simple, reliable & single predictor of mortality in assessing organ failure in case of acute pancreatitis and it also correlates well with other pancreatic prognostic scores. So, measuring IAP will be an easy, effective and inexpensive method compared to other complex scoring systems. IAP found to be a definitive prognostic marker in acute pancreatitis and also explains a direct correlation between IAP and clinical severity of acute pancreatitis. Hence we therefore recommend a routine measurement of IAP not only as a prognostic indicator, but also to plan for the appropriate timing for intervention.

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Conflict of interest: None declared

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

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