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Measurement of Intra Abdominal Pressure in Acute Pancreatitis and Correlation with Parameters and Outcomes

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Abstract: ***Background: Intra-abdominal pressure (IAP) is the steady-state pressure concealed within the abdominal cavity[1]. While the abdominal wall has elasticity, if intra-abdominal volume increases due to fluid, gas, pus, tissue oedema, high pressure leads to reduced blood flow and tissue ischemia which contributes to multiorgan failure. It is affected by body weight, posture, tension of abdominal muscles, and movement of the diaphragm[2-4]. Intra-abdominal hypertension (IAH) defined as an IAP ≥12 mmHg, and abdominal compartment syndrome as an IAP ≥ 20 mmHg combined with the failure of a new organ[5]. Material and Methods: It is a prospective descriptive observation study conducted in subharti hospital Meerut, UP, on 61 participants during a period of 2 years. Intra-abdominal pressure was measured through a Foleys bladder catheter throughout their stay. Bladder pressure was compared with clinical parameters like mean arterial pressures (MAP), respiratory rate (RR), serum creatinine (SC), Blood pressure (BP), Abdominal girth (AG), SOFA and APACHE 2 SCORE, abdominal perfusion pressure (APP) and also with outcome. Result: Mean IAP score was 18.74 in BAT subjects. At the time of admission, mean Systolic blood pressure, and Hemoglobin(Hb) was 135.10mmHg and 10.44 gm/dl respectively. Mean serum creatinine was 5.37. In our study mean SOFA and APHACHE 2 score was 10.14±8.91 and 9.38±3.95 respectively. Mean ICU and Hospital Stay (in days) was 6.30±4.06 and 11.97±7.15 respectively. Mortality was reported among 8 subjects in our study out of which 1, 3, 1 and 3 subjects were having IAP grade 1, 2, 3 and 4 respectively. Mean SPO2% decreases as the IAP grade increases with statistically significant difference (p<0.01). Indicate subjects having IAP >20 cm of water underwent exploratory laparotomy. Conclusion: We found in this study, that high IAP in critically ill patients with acute pancreatitis correlates with the degree of organ dysfunction and length of intensive care. Also, frequent measurement of IAP during intensive care in patients with acutepancreatitis could be important in optimizing APP and recognizing patients potentially benefiting from early decompressive laparotomy. We recommend its use/ measurement as a mandatory tool in management of severe cases of acute pancreatitis.***

1. Introduction

Intra-abdominal pressure (IAP) is the steady-state pressure concealed within the abdominal cavity[1]. While the abdominal wall has elasticity, if intra-abdominal volume increases due to fluid, gas, pus, tissue oedema, high pressure leads to reduced blood flow and tissue ischemia which contributes to multiorgan failure. It is affected by body weight, posture, tension of abdominal muscles, and movement of the diaphragm[2-4]. Intra-abdominal hypertension (IAH) defined as an IAP ≥12 mmHg, and abdominal compartment syndrome as an IAP ≥ 20 mmHg combined with the failure of a new organ[5].

Patients with severe acute pancreatitis appear to be at an increased risk of IAH due to the several mechanisms that occur in pancreatitis as well as the treatment they receive. IAH and ACS are major factors responsible for significant morbidity and mortality among the critically ill patients and their role has been appreciated in last 15 years[6-9]. The abdominal perfusion pressure, similar to the usual concept of cerebral perfusion pressure, is defined as the difference between the mean arterial pressure and the Intraabdominal pressure and implies that as the intra abdominal pressure rises, the perfusion of organs or vessels in or near the abdomen decreases even in the absence of a drop in Mean arterial pressure[7]. The abdominal perfusion pressure in patients with Intra abdominal hypertension should be kept at 60 mm Hg or greater.

Aim: To measure the intra-abdominal pressure in patients of pancreatitis.

Objectives: Its feasibility to be used as an independent entity for measurement of adequateness of resuscitation in patient management. To correlate intra-abdominal pressure with parameters like abdominal girth, urine output, pulse rate, blood pressure, SpO2, serum creatinine and clinical response.

2. Materials and Methods

Setting: Patients of intra-abdominal hypertension due to Acute pancreatitis who will be admitted in IPD of Department of General Surgery, Subharti Medical College and Hospital, Meerut UP.

Type of study: The study will be a prospective observational study.

Duration: From December 2018 To August 2020.

Sample size: Study will include a sample of 61 participants calculated using the formula [21]

Inclusion criteria: All adult (>18 years of age) patients admitted to the Subharti hospital, Meerut with a bladder catheter in-situ, who are diagnosed of pancreatitis and are willing to participate in the study voluntarily.

Exclusion criteria: Patients not giving consent to participate,Death of the participant prior to intra-abdominal pressure measurement,Pregnant females,Discharge prior to intra-abdominal pressure measurement,No intra-abdominal pressure measurement within 24 hours of admission, organ donors and post – operative patients.

Method

Patient is made to lie in supine position. Insert foleys bladder catheter and empty the bladder. Connect intravenous infusion set to normalsaline,threeway stopcock and a disposable CVP Manometer. Connect CVP manometer and 50 ml syringe to foleys by a3way stopcock. Flush infusion set with saline and zero the pressure in CVP Manometer at level of symphysis pubis. Inject 30ml saline into the urinary bladder. Measure intra-abdominal pressure during endexpiration. The reading was taken one minute later, providing time for detrusor muscle relaxation. The measurements were taken in the absence of active abdominal muscle contraction and at the end of expiration. Measurements were made at regular intervals, usually varying from 4 to 6hr.

Statistical analysis

Data so collected was tabulated in an excel sheet, under the guidance of statistician. The means and standard deviations of the measurements per group were used for statistical analysis (SPSS 22.00 for windows; SPSS inc, Chicago, USA). For each assessment point, data were statistically analyzed using factorial ANOVA. Difference between two groups was determined using chi square test and the level of significance was set at $p < 0.05$.

Table 1: Gender and age distribution among the Pancreatitis subjects

Variables	Pancreatitis
Gender	
Male	44
Female	17
Age Group (in years)	
18-30	6
31-40	16
41-50	12
51-60	13
>60	14
Total	61

Table 2: Mean SPO2%, PR, SBP and DBP comparison according to IAP grade

IAP Category		SPO2 %	Pulse pressure (/min)	Systolic blood pressure (mmhg)	Diastolic Blood pressure (mmhg)
Grade 1	Mean	97.60	100.72	130.79	84.91
	SD	1.87	17.83	14.61	8.85
Grade 2	Mean	97.29	116.56	114.36	76.41
	SD	1.70	19.54	12.62	8.08
Grade 3	Mean	96.49	127.14	98.86	66.83
	SD	2.42	8.71	10.12	7.36
Grade 4	Mean	93.45	137.64	89.31	61.69
	SD	5.41	18.76	16.51	10.01
Anova Test		7.32	15.13	5.77	2.13
p value		<0.01*	<0.01*	0.002*	0.12

Table 3: Mean serum creatinine, HB, TLC, Platelet, Bilirubin (mg/dl) and Blood Urea according to IAP grade

IAP Category		Hemoglobin (gm/dl)	Total leucocyte count (10^3/mm^3)	Platelet (lac/ml)	Bilirubin (mg/dl)	Blood Urea (mg/dl)	Serum Creatinine (mg/dl)
Grade 1	Mean	10.86	8.70	4.06	2.85	35.74	3.47
	SD	.90	3.34	1.06	2.17	16.18	3.19
Grade 2	Mean	10.72	8.87	3.86	3.93	52.97	6.33
	SD	1.32	2.38	1.38	2.02	34.54	3.96
Grade 3	Mean	9.60	11.57	3.68	7.11	67.86	8.58
	SD	1.42	3.78	1.39	3.10	19.51	3.61
Grade 4	Mean	8.55	15.45	1.94	8.27	85.55	6.71
	SD	1.92	5.13	1.74	2.69	61.19	1.87
Anova Test		7.49	14.23	5.87	15.01	8.39	8.67
p value		<0.01*	<0.01*	0.001*	<0.01*	<0.01*	<0.01*

Table 4: Mean APHACHE 2, SOFA and Abdominal Girth according to IAP grade

IAP Category		APHACHE 2	SOFA	Abdominal Girth(cm)
Grade 1	Mean	6.96	2.96	90.93
	SD	2.55	2.91	4.51
Grade 2	Mean	9.38	11.71	98.56
	SD	4.21	5.28	12.77
Grade 3	Mean	12.49	16.94	101.45
	SD	3.16	11.99	4.16
Grade 4	Mean	14.11	22.08	109.71
	SD	1.63	3.69	8.28
Anova Test		9.83	42.52	19.48
p value		<0.01*	<0.01*	<0.01*

Table 5: Mean ICU and Hospital Stay according to IAP grade

IAP Category		ICU Stay	Hospital Stay
Grade 1	Mean	5.56	11.88
	SD	3.92	5.68
Grade 2	Mean	7.46	13.67
	SD	4.25	7.40
Grade 3	Mean	6.45	10.18
	SD	4.23	10.06
Grade 4	Mean	4.14	5.86
	SD	1.46	5.84
Anova Test		2.29	2.82
p value		0.08	0.04*

Table 6: Mortality comparison according to IAP grade

IAP Category		Mortality
		No
Grade 1	N	42
	%	97.7%
Grade 2	N	35
	%	89.7%
Grade 3	N	4
	%	36.4%
Grade 4	N	1
	%	14.3%
Chi Square Test		46.01
p value		<0.01*

Table 7: IAP correlation with abdominal perfusion pressure (APP) in Acute Pancreatitis

IAP Grade	Low Abdominal perfussiom pressure (APP) =MAP- IAP (<60 mmhg)	Normal abdominal perfusion pressure (APP)= MAP - IAP (>60 mmhg)
Grade 1	0	28
Grade 2	02	18
Grade 3	05	04
Grade 4	03	01

Table 8: Mean fluid resuscitation according to IAP grade in Acute Pancreatitis

IAP Category		Fluid Intake (in ml)
Grade 1	Mean	3782.52
	SD	281.90
Grade 2	Mean	4389.18
	SD	237.31
Grade 3	Mean	5202.14
	SD	219.23
Grade 4	Mean	6361.48
	SD	201.83
Anova Test		15.78
p value		0.005*

3. Discussion

In our study total 70 subjects were enrolled but 9 subjects were in exclusion criteria . So total 61 subjects were in this study. Forty four percent (44%) and seventeen percent (17%) of the males and females respectively were having Acute pancreatitis. Acute Pancreatitis was reported maximum among subject's having 31-40 year of age (16%) followed by >60 year (14%). ***Paivi Keskinen et al*** reported similar findings too[10]. In our study, mean SPO2% decreases as the IAP grade increases with statistically significant difference (p<0.01). Parameters like Pulse Rate shows increasing trend, but Systolic blood pressure and Diastolic blood pressure shows downword trend along with the IAP grade. In our study, mean Hemoglobin, platelet cells decreases as the IAP grade increases with statistically significant difference (p<0.01). Parameters like, Total Leucocyte Count, Bilirubin and blood urea ,serum creatinine shows upward trend along with the IAP grade. When serum creatinine, Total Leucocyte Count, Bilirubin and blood urea was compared statistically according to IAP grade, it was found to be statistically significant as p<0.05 in the present study. These results are in accordance with the study done by **Iberti et al**[11]. Mean APHACHE 2, SOFA and Abdominal girth was reported maximum among IAP grade 4 subjects followed by IAP grade 3. When APHACHE 2, SOFA and Abdominal girth was compared statistically according to IAP grade, it was found to be statistically significant (p<0.05) in the present study. ***Paivi Keskinen et al***[12] reported similar results in their study. In our study, only two subject with high (24) APHACHE 2, one subject with high (36) SOFA and three subjects with high(>122cm) Abdominal girth did not have IAP grade 4.In earlier studies, an increase in IAP has been shown to be associated with increased mortality in surgical and trauma patients. In trauma patients and liver recipients, acute ACS was associated with multiorgan failure and increased mortality. In a recent multicenter study, the prevalence of IAH in critically ill patients was more than 50%[10]. In another study in a mixed ICU population, IAH during intensive care was an independent outcome predictor. Mean ICU and Hospital Stay (in days) was found maximum among grade 2 subjects while least among grade 4 subjects with statistically significant difference in our study.

Mortality was reported among 85.7%, 63.6%, 10.3% and 2.3% of the subjects with IAP category grade 4,3,2 and 1 respectively with statistically significant difference as p<0.05similer study by ***Kumari Neelam et al***[13].In this study mean fluid resuscitation in grade 1, 2, 3, 4 was 3782.52ml, 4389.18 ml , 6202.14 ml, 7361.48 ml respectively ,with statistically significant (p <.005) .In our study in grade 1 no low APP found, but in grade 2,2 subjects had low app and 18 subjects had normal APP. In grade 3, 5 subject had low APP and 04 subjects had normal APP. In grade 4, 03 subjects had low APP and 01 subjects had normal APP. Similar study in **Aggarwal A, Manrai M el al**[14].Our study found that IAP is a good predictor of decompressive laparotomy, mortality and organ failure in acute pancreatitis and compares favorably with other validated prognostic scores. The limitation of present study is its sample size. So the author recommends further studies with large sample size to further validate the efficacy of IAP in management of acute pancreatitis. In this study mean fluid resuscitation in grade 1,2,3,4 was 3782.52ml, 4389.18 ml , 6202.14 ml, 7361.48 ml respectively ,with statistically significant (p <.005), similer study in ***Aakash Aggarwal, Manish Manrai, Rakesh Kochhar[14].***

4. Conclusion

We found in this study, that high IAP in critically ill patients with acute pancreatitis correlates with the degree of organ dysfunction and length of intensive care. Also frequent measurement of IAP during intensive care in patients with severe acute pancreatitis could be important in optimizing abdominal perfusion pressure and recognizing patients potentially benefiting from early decompressive laparotomy. We recommend its use/ measurement as a mandatory tool in management of severe cases of acute pancreatitis.

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