

ASSOCIATION BETWEEN INTRA ABDOMINAL HYPERTENSION AND ACUTE KIDNEY INJURY

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Abstract

Background: IAH/ACS is an important cause of acute renal failure in critically ill patients. Among medical patients, sepsis and severe acute pancreatitis have been increasingly associated with IAH. Prolongation and exacerbation of SIRS result in activation of various inflammatory mediator cascades, and the activation of these cascades may cause organ dysfunction. The present study was to validate the association between intra-abdominal hypertension and acute kidney injury in patients with sepsis and acute pancreatitis. **Materials and Methods:** The study was conducted in the ICU of Govt. T.D Medical College, Alappuzha, Kerala over a period of 12 months from February 2015. The sample size was 95 patients. Male and female patients in the age group of 18 to 60 years with sepsis or acute pancreatitis fulfilling the inclusion and exclusion criteria were taken for the study. Of the total of 95, 79 patients were with sepsis and 16 were with acute pancreatitis. Clinical and biochemical parameters needed for this study were taken and evaluated. **Results:** The overall prevalence of IAH in the study was 82.1% with a prevalence of 81% among sepsis and 87.5% among pancreatitis. Of the total of 95 patients, 81.3% of patients had IAH at the time of admission. The percentage of patients who developed ACS was 43.2%. Prevalence of AKI in patients with IAH in the present study was 65.6% in sepsis and 78.6% in acute pancreatitis. The percentage of patients who developed ACS in IAH group was 48.4% and 71.4% in sepsis and pancreatitis respectively with a total of 52.6% in the overall group. **Conclusion:** IAH/ACS are more common among sepsis and acute pancreatitis. AKI develops in more than half of patients with IAH/ACS. Development of AKI adversely affects the clinical outcome in patients who develop IAH or ACS. It is important to recognize IAH/ACS early in the time of admission to prevent multiple potentially fatal complications of IAH.

INTRODUCTION

Compartment syndrome occurs whenever increasing pressure within a confined anatomic space undermines the normal cellular function.^[1] Most commonly, compartment syndrome involves the extremities. Increased pressure within the abdomen, impairing organ function is known as intra abdominal hypertension (IAH) and can lead to the development of abdominal compartment syndrome (ACS).^[2] Abdominal compartment syndrome refers to organ dysfunction caused by Intra-abdominal hypertension.^[3,4] It may remain under-recognized because it primarily affects patients who are already quite ill and whose organ dysfunction, may be incorrectly ascribed to progression of primary illness.

Intra-Abdominal Hypertension (IAH) & Abdominal Compartment Syndrome (ACS) have shown an increasing association with morbidity and mortality in many patients admitted in medical and surgical intensive care units. Among medical patients those with sepsis and severe pancreatitis are at particular risk.^[5,6]

Acute Kidney Injury (AKI) is an early and frequent consequence of intra-abdominal pressure /abdominal compartment syndrome. Oliguria generally develops at an intra-abdominal pressure of approximately 15 mm Hg. Anuria usually develops at an intra-abdominal pressure of approximately 30 mm Hg.^[7] Medical Management of IAH/ACS include reduction of intra-abdominal volume through evacuation of abdominal fluid collections and intra luminal contents.^[23,24] This is achieved by measures to

improve abdominal wall compliance, sedation, analgesia, neuromuscular blockade and antibiotic therapy in septic patients. Surgical decompression is done for all patients whose intra-abdominal pressure is more than 25 mm Hg.^[25]

The present study is to validate the association between intra-abdominal hypertension (IAH) and acute kidney injury (AKI) in patients with sepsis and acute pancreatitis.

MATERIALS AND METHODS

It was an Observational study done for a period 12 months from February 2015. Patients admitted in ICU of TD MCH Alappuzha satisfying inclusion criteria were considered as sample size in the age group of 18 to 60 years during the study period. TD MCH is a tertiary care centre in the Govt. sector.

Inclusion Criteria

All patients in the age group of 18-60 years of age, admitted in ICU with sepsis and acute pancreatitis that are all willing to consent.

Exclusion Criteria

Preexisting bladder dysfunction, history of nephrolithiasis, known case of hypertension, diabetes, Recent exposure to nephrotoxic drugs, Recent contrast use (< 6 months), Pregnancy, chronic ascites, peritoneal dialysis.

Study was done only after getting written informed consent from the patient. All the facts related to patients are kept confidential and no harm occurred to patients because of the study.

Methodology

From the patients admitted in ICU, sepsis was diagnosed by SIRS criteria and acute pancreatitis patients were diagnosed by clinical features and serum amylase & serum lipase values. Among the diagnosed cases, patients were selected according to the inclusion and exclusion criteria by semi-structured questionnaire. After getting written informed consent, patient information was collected using proforma and personal interview. The proforma contains age, sex, IP/OP number, sex, address, reason for ICU admission, body temperature, pulse rate, respiratory rate, position of head, mode of ventilation, blood parameters, total leucocyte count, differential count, platelet count S. creatinine, S. amylase, S. lipase, blood pressure, mean arterial pressure, intra-abdominal pressure, abdominal perfusion pressure, renal status, urine output, chest X-Ray PA view

Data Entry & Data Analysis

Data was entered in Microsoft Excel and analysed using SPSS software. All qualitative variables were summarized using proportions and percentages. Chi square test was used to find out association between age, sex, etiology, intra-abdominal pressure, and abdominal compartment syndrome mean renal status.

RESULTS

Table 1: Percentage distribution of the sample according to age

Age	Count	Percent
18 - 30 years	8	8.4
31 - 40 years	25	26.3
41 - 50 years	23	24.2
51 - 60 years	39	41.1

As per table 1 the most common age group was 51-60 years (41.1%) followed by 31-40 years in 26.3% this suggest mostly elderly patients are most commonly affected.

Table 2: Percentage distribution of the sample according to MAP

MAP	<60	60 - 79 mm Hg.	80 - 90 mm Hg	>90 mm Hg
Admission	14 (14.7)	42 (44.2)	37 (38.9)	2 (2.1)
2 hours of admission	14 (14.7)	46 (48.4)	33 (34.7)	2 (2.1)
6 hours of admission	13 (13.7)	45 (47.4)	36 (37.9)	1 (1.1)
12 hours of admission	5 (5.3)	51 (54.3)	37 (39.4)	1 (1.1)
24 hours of admission	2 (2.1)	45 (47.4)	47 (49.5)	1 (1.1)
48 hours of admission	1 (1.1)	36 (37.9)	57 (60)	1 (1.1)
72 hours of admission	1 (1.1)	33 (34.7)	60 (63.2)	1 (1.1)

As per table 2 distribution according to mean arterial pressure showed at the time of admission most of the patients belonged to range of 60-79mm hg but after 72 hours of admission 63.2% belonged to 80-90 mm hg range which suggest pressure increased after 3 days.

Table 3: Comparison of ACS in Sepsis and pancreatitis

Sepsis		Pancreatitis		χ^2	p	
ACS						
	Count	Percent	Count	Percent		
Absent	48	60.8	6	37.5		

					2.93	0.087
Present	31	39.2	10	62.5		

As per table 3 comparison of ACS in sepsis and pancreatitis is not significant. ACS is present in 41 patients.

Table 4: AKI grading in the study group

Renal status	Count	Percent
Normal	42	44.2
Risk	10	10.5
Injury	32	33.7
Failure	11	11.6

As per table 4 as per AKI grading 44.2% belonged to normal grading of renal status followed by 33.7% to injured category.

Table 5: Age based comparison on renal status for sepsis

Age	Normal	AKI	χ^2	p
	Count	Percent	Count	Percent
<=40	13	56.5	10	43.5
				1.22 0.269
>40	24	42.9	32	57.1

As per table 5 renal status for sepsis was compared on the basis of age which showed age <40 has less chances of AKI and >40 had 57.1% of AKI but this was not significant.

Table 6: Age based comparison on renal status for pancreatitis

Age	Normal	AKI	χ^2	p
	Count	Percent	Count	Percent
<=40	4	40	6	60
				0.95 0.330
>40	1	16.7	5	83.3

As per table 6 renal status for pancreatitis was compared on the basis of age which showed age <40 has less chances of AKI and >40 had 83.3% of AKI but this was not significant.

Table 7: Comparison of reason for ICU admission based on renal status

Renal Status	Normal	AKI		
Reason for ICU admn	Count	Percent	Count	Percent
Sepsis	37	46.8	42	53.2
Pancreatitis	5	31.3	11	68.8

As per table 7 most common reason for ICU admission was sepsis in 79 patients in which 53.2% had AKI and 46.8% had normal renal status. ICU admission for pancreatitis is more for AKI.

Table 8: Comparison of IAH based on renal status for sepsis

Renal Status	Normal	AKI	p#	
IAH	Count	Percent	Count	Percent
Absent	15	100	0	0
				0
Present	22	34.4	42	65.6

As per table 8 IAH based on renal status for sepsis showed it was present in 64 patients and among them 42 had AKI which was high as per total study participants sample concerned and it was significant.

Table 9: Comparison of IAH based on renal status for pancreatitis

Renal Status	Normal	AKI	p#	
IAH	Count	Percent	Count	Percent
Absent	2	100	0	0
				0.083
Present	3	21.4	11	78.6

As per table 9 IAH based on renal status for pancreatitis showed it was present in 14 patients and among them 11 had AKI which was high as per total study participants sample concerned and it was not significant.

DISCUSSION

In our study, two major risk groups for the development of IAH viz, with sepsis and acute pancreatitis were prospectively studied in the ICU patients. The age group selected was between 18 and 60 years. Of the total of 95 patients, 71 were male and 24 were females. 79 patients were admitted with sepsis and 16 with acute pancreatitis. Lower respiratory tract infections, leptospirosis, dengue fever, cellulitis were the causes of sepsis among study group.

In sepsis group, AKI developed more in age above 40 years (57.1%). Older age group was found to be a risk factor for septic AKI. Sang Heon Suh et al. in his study.^[11] noted that septic AKI was independently associated with age. Vidal et al.^[12] studied the incidence of IAP in 83 critically ill patients in a single ICU. A total of 31% of the patients had IAH at the time of admission to the unit, and the condition developed in another 33% after admission. A study conducted by in 44 patients with acute pancreatitis, and IAP measurements were obtained from 27 patients. IAH was found in 21 patients (78%). and renal failure 86%. Also, IAH developed early in the course of the disease within 24 h of ICU admission.^[13] De Waele JJ et al and Al-Bahrani AZ et al noted that incidence of IAH is estimated between 60-80%, whereas incidence of ACS has been reported in 10 to 56%.^[14,15]

In sepsis, 42 out of 64 patients with IAH (65.6%) developed AKI ($p < 0.001$). In pancreatitis 11 patients out of 14 (78.6%) with IAH developed AKI ($p=0.083$). A prospective cum interventional study conducted by Melemadathil S et al. in 52 patients in a tertiary care medical ICU over a period of six months. Among this, 56% of patients who had IAH developed AKI.^[16]

In the present study 53 out of 95 patients (55.8%) were with AKI, and among the AKI group 10 patients out of 53 (18.9%) had grade 1 AKI, 32(60.4%) and 11(20.8%) patients had grade 2 and grade 3 AKI respectively. Our study has few limitations. Firstly, the sample size obtained for acute pancreatitis satisfying inclusion criteria and exclusion criteria was small. A larger sample size could have provided a greater statistical power and permitted more complete adjustment for potential confounders. Secondly, duration of follow up was short. Hence could not study the effect of septic AKI on long term survival.

CONCLUSION

Acute kidney injury may lead to chronic kidney disease regardless of the cause in long run. S. creatinine measurement helps only to identify the patients who have already gone into AKI.

Measurement of intra-abdominal pressure helps to identify intra-abdominal hypertension early in the course of disease, which is an early indicator of AKI. The early diagnosis and prompt protective strategies helps to reduce multisystem organ failure and death. The present study was a prospective study, conducted on 95 patients with sepsis and acute pancreatitis admitted in the ICU of T.D Medical College, Alappuzha. The two major causes of acute kidney injury in our patients were sepsis and acute pancreatitis. In most cases it was due to the development of IAH. AKI secondary to IAH had prolonged ICU stay and had significant mortality.

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