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# ASSESSMENT OF ABDOMINAL COMPARTMENT SYNDROME IN PATIENTS WITH SEVER ACUTE PANCREATITIS IN EARLY STAGE

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**ABSTRACT**

**Background:** Abdominal compartment syndrome (ACS) is a severe illness seen in critically ill patients. It may be under recognized because it primarily affects patients who are already quite ill. We aimed to to estimate the incidence of ACS in patients with AP in early stage and to evaluate intra-abdominal pressure (IAP) as a marker of severity in acute pancreatitis and to ascertain the relationship between IAP and development of complications in patients with severe acute pancreatitis (SAP). **Patients and methods:** This prospective study was conducted in General Surgery Department, Faculty of Medicine, ZagazigUniversity on 18 patients with AP admitted to the Surgical Intensive Care Unit (SICU). All patients were recruited into two groups according to IAP determined during the first week after admission. Patients with IAP ≥ 20mmHg were assigned in IAH group, and patients with IAP < 20mmHg in normal IAP group.

**Results:** APACHE was distributed as 3.94±1.35 as 50% were 71> (low) and 50% were <71 (high)**.** About 72.2% of studied group had no morbidity and 27.8% had comorbidities as 2 cases with HTN and 3 cases had DM, regard previous surgery only 5 cases had history of surgery. Lipase level was distributed as Lipase mean of 959.72±103.58 with rang (800-1200)**.** ACS cases were significantly associated with longer hospital stay also with Bleeding, Septic shock and Mortality.

**Conclusion:** IAH and ACS are common finding in patients admitted to the ICU with severe acute pancreatitis. IAH may worsen the severe acute pancreatitis. Early recognition of this potentially treatable aggravating condition may lead to earlier intervention and hopefully improve the outcome.
**Keywords:** Abdominal Compartment Syndrome; APACHE; Intra-Abdominal Pressure

## INTRODUCTION

Abdominal Compartment Syndrome (ACS) is defined as sustained intra-abdominal pressure (IAP) of >20mmHg with the presence of an attributable organ failure (**1)**.

It is important to delineate abdominal compartment syndrome (ACS) from its preserver, intra-abdominal hypertension (IAH). Absent from any disease processes, the average intra-abdominal pressure ranges from 5 to 7mmHg. When evaluating the effects of IAH relative to organ perfusion, a more useful metric is abdominal perfusion pressure (APP). This is calculated by subtracting the IAP from mean arterial pressure (MAP). Hence, APP = MAP-IAP (normal = 60mmHg) (**2)**

Abdominal compartment syndrome can be divided and classified into two groups, primary and secondary ACS. Primary ACS causes include abdominal blunt or penetrating trauma, hemorrhage, abdominal aortic aneurysm (AAA) rupture, intestinal obstruction, and retroperitoneal hematoma. Secondary causes include pregnancy, ascites, ileus, burns, intra-abdominal sepsis, and large-volume fluid replacement (> 3 liters). Chronic causes of elevated intra-abdominal pressure include pregnancy, cirrhosis, obesity, intra-abdominal malignancy, and peritoneal dialysis. The presence of organ dysfunction in this setting due to compressive symptoms now confirms a diagnosis of abdominal compartment syndrome (**3)**.

Acute pancreatitis (AP) is a well-established risk factor for intraabdominal hypertension (IAH) and abdominal compartment patients with severe acute pancreatitis is approximately 60 %, while ACS may occur in approximately 30 %. The mortality of patients with severe acute pancreatitis who develop ACS is high at 50–75 % (**4)**.

Recently there have been significant advances about our knowledge of the natural course and underlying pathophysiology of severe AP and similarities between manifestations of fulminant acute pancreatitis (an early disease course characterised by pulmonary, cardiovascular, and renal insufficiency which may lead to rapidly progressive multiple organ dysfunction syndrome) and

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abdominal compartment syndrome (ACS) has increasingly drawn investigators to study relationship between the two (**5)**.

While conservative treatment still remains as standard of care in the initial phase of severe AP yet increasing evidence offers that a subgroup of patients with early severe disease may benefit from specific surgical/interventional procedures. While offering a much elusive point of therapeutic intervention, evidence is still scarce whether intra-abdominal pressure (IAP) measurements should be routine in all patients with AP or can some selectivity be maintained and how can the patient at risk for developing intra-abdominal hypertension (IAH) and ACS be identified at the earliest **(6)**.

We aimed to toestimate the incidence of ACS in patients with AP in early stage and to evaluate IAP as a marker of severity in acute pancreatitis and to ascertain the relationship between IAP and development of complications in patients with severe acute pancreatitis (SAP)

**PATIENTS AND METHOD**

This prospective study was conducted in General Surgery Department, Faculty of Medicine, Zagazig University on 18 patients with AP admitted to the Surgical Intensive Care Unit (SICU) between July 2019 and March 2020, sample size according to ethical committee IRB All patients were recruited into two groups according to IAP determined during the first week after admission. Patients with IAP ≥ 20mmHg were assigned in IAH group, and patients with IAP < 20mmHg in normal IAP group.

**Inclusion criteria**:

Patients with AP admitted to SICU with time interval between onset of typical abdominal symptoms and study inclusion of 72 hours or less. The presence of Systemic Inflammatory Response Syndrome (SIRS) manifested by two or more of the following conditions: temperature > 38°C or < 36°C; Heart Rate (HR) > 90 beats/minute; respiratory rate > 20 breaths/minute or $PaCO_2$< 32 mmHg; WBC count > 12,000/$mm^3$ or < 4000/$mm^3$, or > 10% immature (band) forms; and at least 3-fold elevated serum amylase or lipase levels, or a APACHE II score >71, or a C-Reactive Protein (CRP) of ≥ 250 mg/L.

**Exclusion criteria:**

Patients with history of chronic pancreatitis, admission after resuscitation for cardiac arrest, or patients with significant comorbid conditions like renal failure, cardiac disease, chronic abdominal pathology and immunosuppression.

**Technical operation:**

Intravesical Pressure (IVP) measurement had been described as a standard and validated technique of indirectly reflecting IAP and rapidly recognizing ACS.

Hemodynamics and other physiologic parameters, including HR, Mean Arterial Pressure (MAP), Central Venous Pressure (CVP), Urine Output (UO), Peak Airway Pressure (PAP), arterial carbon dioxide partial pressure ($PaCO_2$), Modified Respiratory Index (MRI) expressed as the the arterial oxygen partial pressure ($PaO_2$) to fraction of inspiraed oxygen ($FiO_2$) ratio ($PaO_2/FiO_2$), arterial pH, arterial base deficits (BE) and arterial lactic acid, were registered before and after decompression of ACS.

Acute Physiology and Chronic Health Evaluation (APACHE) II score and Ranson scoring system during the first 24 or 48 hours of SICU stay were recorded respectively in the identification of the severity of pancreatitis. Total Marshall scores were computed daily and for the entire duration of the intensive care stay. All patients with AP were detected using contrast-enhanced Computed Tomography (CT) on admission.

The incidences of pancreatic infection, septic shock, MODS, and the in-hospital mortality were also recorded. Pancreatic infection included infected necrosis and pancreatic abscess. Necrosis formation of the pancreas was assessed by contrast-enhanced CT. Patients with pancreatic necrosis or large peripancreatic fluid collections who manifested clinical signs of sepsis with a non-improving or deteriorating clinical course despie a reasonable time of medical therapy underwent Fine-Needle Aspiration (FNA) of the necrotic areas or fluid collections under CT or ultrasound guidance to determine the presence of bacterial contamination or pancreatic infection.

**Statistical analysis:**

Data analyzed using Microsoft Excel software. Data were then imported into Statistical Package for the Social Sciences (SPSS version 20.0) software. According to the type of data qualitative represent as number and percentage, quantitative continues group represent by mean ± SD , the following tests were used to test differences for significance;. difference and association of qualitative variable by Chi square test ($X^2$) . Differences between quantitative independent groups by t test. P value was set at <0.05 for significant results &<0.001 for high significant result.

**Results:**

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Age was distributed as 39.66±7.69 with minimum 27 and maximum 52 years, regard sex distribution. APACHE was distributed as 3.94±1.35 as 50% were 71> (low) and 50% were <71 (high) **(Table 1).**

About 72.2% of studied group had no morbidity and 27.8% had comorbidities as 2 cases with HTN and 3 cases had DM, regard previous surgery only 5 cases had history of surgery **(Table 2)**. Lipase level was distributed as Lipase mean of 959.72±103.58 with rang (800-1200) **(Table 3).**

Regarding complication, bleeding occur in 2 cases is internal bleeding in serous cavities caused by abdominal trauma regard septic shock only one case is affected by septicemia especially gram - veseptiomia lead two damage of intestinal mucosa and acute erosive gastritis **(Table 4).**

Age, serum Lipase and APACHE were significantly higher among ACS cases and also ACS cases were significantly associated with DM **(Figure 1)**. ACS cases were significantly associated with longer hospital stay also with Bleeding, Septic shock and Mortality **(Figure 2)**.

**Table1: Basic demographic and clinical data distribution among studied group**

| | | Age | |
|---|---|---|---|
| **Mean± SD** | | **39.66±7.69** | |
| **Median (Range)** | | **39.50 (27-52)** | |
| | | **N** | **%** |
| **Sex** | **Male** | **11** | **61.1** |
| | **Female** | **7** | **38.9** |
| **Co-morbidities** | **No** | **13** | **72.2** |
| | **DM** | **3** | **16.7** |
| | **HTN** | **2** | **11.1** |
| | **Total** | **18** | **100.0** |

**Table 2: Clinical history distribution among studied group**

| | | N | % |
|---|---|---|---|
| **Co-morbidity** | **No** | **13** | **72.2** |
| | **HTN** | **2** | **11.1** |
| | **DM** | **3** | **16.7** |
| **Previous surgery** | **No** | **13** | **72.2** |
| | **Appendectomy** | **1** | **5.6** |
| | **CS** | **3** | **16.7** |
| | **Laparotomy** | **1** | **5.6** |
| | **Total** | **18** | **100.0** |

**Table 3: Serum Lipase level distribution among studied group**

| | Lipase |
|---|---|
| **Mean± SD** | **959.72±103.58** |
| **Median (Range)** | **955.0 (800-1200)** |

**Table: Complication and mortality distribution among studied group**

| | | N | % |
|---|---|---|---|
| **Infection** | **-VE** | **14** | **77.8** |
| | **+VE** | **4** | **22.2** |
| **Acute pseudo-cyst** | **-VE** | **17** | **94.4** |
| | **+VE** | **1** | **5.6** |
| **Bleeding** | **-VE** | **16** | **88.9** |
| | **+VE** | **2** | **11.1** |
| **Septic shock** | **-VE** | **17** | **94.4** |
| | **+VE** | **1** | **5.6** |
| **Mortality** | **-VE** | **17** | **94.4** |
| | **+VE** | **1** | **5.6** |

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| | | | |
|---|---|---|---|
| | **Total** | **18** | **100.0** |

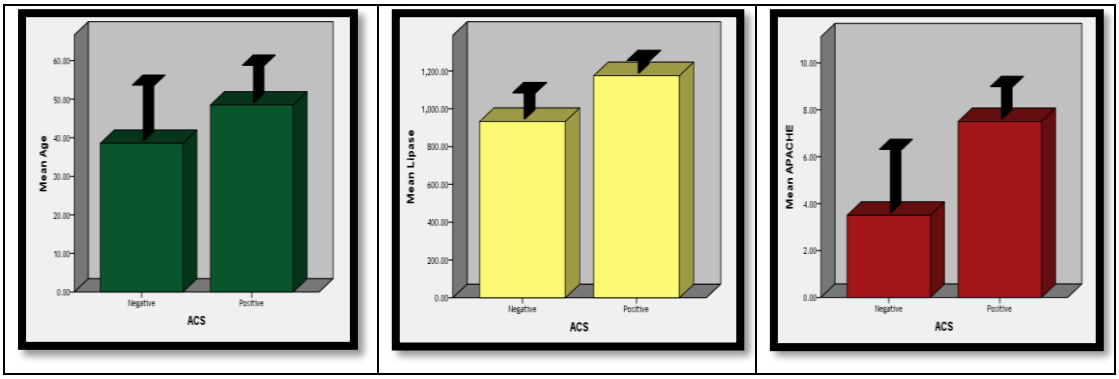


**Figure (1): Relation between ACS and other demographic and clinical parameters**

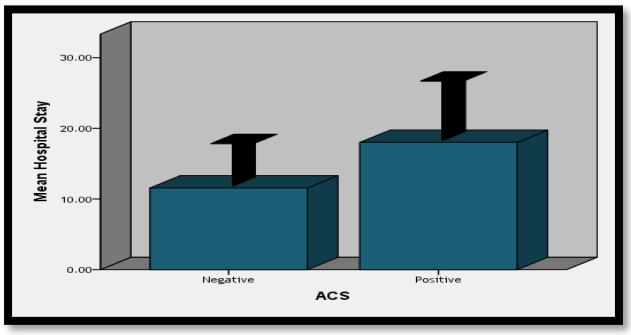


**Figure (2): Relation between ACS and outcome**

**DISCUSSION**

Acute pancreatitis is a well-established risk factor for intra-abdominal hypertension (IAH) and abdominal compartment syndrome (ACS). ACS may occur in approximately 30 %. The mortality of patients with severe acute pancreatitis who develop ACS is high at 50–75%. Respiratory, renal, and cardiovascular organ failures have been reported in patients with ACS. Furthermore, ACS may cause mesenteric hypoperfusion **(7)**.

In our study, age, serum lipase and APACHE were significantly higher among ACS cases and also ACS cases were significantly associated with DM. In contrary, **Smit et al. (8)** stated that age and Apache II scores did not differ significantly between the group where IAP was measured, compared to where no IAP measurements were done. Also, age, gender, and APACHE II scores upon admission were comparable between patients who developed ACS and those who did not.

In our study, ACS cases were significantly associated with longer hospital stay, bleeding, septic shock and mortality. **van Santvoort et al. (9)** documented that mortality in SAP typically occursin two phases: an early phase where multiple organfailure occurs with SIRS, IAH, or ACS and a later phasewhere mortality is due to secondary infection andnecrosis.

Our study found that ACS was found in severe acute pancreatitis, this was confirmed by **Chen et al. (10)**. IAH was found in approximately 60 % of the patients studied.

We fully recommended that protocolized monitoring of IAP should take place in high-risk patients, such as those with severe acute pancreatitis to allow early detection and treatment of IAH and ACS. Furthermore, we recommend international guidelines for treatment of pancreatitis patients be updated to include this recommendation.

Three commonly used guidelines by the British Society of Gastroenterology, the American College of Gastroenterology, and the American Gastroenterological Association do not yet mention the need for routine IAP measurements. Once IAH is observed, careful monitoring of IAP and organ functions needs to take place and measures should be taken in order to prevent further organ dysfunction and irreversible damage **(11)**.

**Boone et al. (4)** investigated the outcomes of patients with acute pancreatitis who underwent surgery for treatment of abdominal compartment syndrome at a tertiary referral center. Twelve patients underwent decompressive laparotomy for abdominal compartment syndrome. The median interval between onset of pancreatitis and laparotomy was 4.5 days. Nine patients underwent a laparotomy

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within seven days of onset of pancreatitis. As a result of cardiopulmonary instability, four decompressive laparotomies were performed in the intensive care unit. In 11 patients, cardiopulmonary improvement was observed. Statistically significant improvements were seen across multiple physiologic parameters. Despite this initial improvement, six patients (50%) died from multisystem organ failure. Two patients survived without need for pancreatic débridement. Abdominal compartment syndrome is an uncommon but likely underrecognized and highly lethal complication of acute pancreatitis that should be considered in patients who become critically ill early in the course of their pancreatitis.

We advise routine measurement of IAP in all patients with severe acute pancreatitis. National and international guidelines on severe acute pancreatitis need to be updated to include IAP measurements as standard of care and to alert clinicians to this potentially lethal complication that requires swift surgical intervention if conservative measures fail. Patients with IAP at approximately 10-12 mmHg and early signs of changes in physiologic variables should be seriously considered for urgent decompression to improve survival.

**Conclusion:**

This study confirmed that IAH and ACS are common finding in patients admitted to the ICU with severe acute pancreatitis. IAH may worsen the severe acute pancreatitis. Early recognition of this potentially treatable aggravating condition may lead to earlier intervention and hopefully improve the outcome. It is important to conduct large, prospective observational studies to determine optimal treatment strategies for patients with severe acute pancreatitis and ACS.

**No conflict of interest.**

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