

## General Surgery

**KEYWORDS:** Abdominal compartment syndrome, Intra abdominal Hypertension, Intra abdominal pressure, Urinary bladder pressure measurement.

## A STUDY ON ETIOLOGY AND OUTCOME OF ABDOMINAL COMPARTMENT SYNDROME



Volume - 6, Issue - 10, October - 2021

ISSN (O): 2618-0774 | ISSN (P): 2618-0766

Punith Jain\*

Junior Resident , Department Of General Surgery, SBMCH, Chennai, Tamil Nadu, India. \*Corresponding Author

Barathi raja

Assistant Professor, Department Of General Surgery, SBMCH, Chennai, Tamil Nadu, India

K S Ravishankar

Professor, Department Of General Surgery, SBMCH, Chennai, Tamil Nadu, India

INTERNATIONAL JOURNAL  
OF PURE MEDICAL RESEARCH

**ABSTRACT**

**BACKGROUND:** Intra-abdominal Hypertension (IAH) is defined as an intra-abdominal pressure (IAP) equal to or above 12 mmHg and abdominal compartment syndrome (ACS) is defined as an IAP above 20 mmHg with evidence of organ dysfunction or failure [1,2,3]. Both levels of increased intra-abdominal tension are known to cause significant morbidity and mortality among critically ill patients. Clinically significant intra-abdominal hypertension may be present in the absence of abdominal distension [15]. Therefore, increased IAP is commonly measured by recording urinary bladder pressure (IBP).

**MATERIALS AND METHODS:** Aim of study is to identify, The incidence of abdominal compartment syndrome, various etiologies that lead to the development of Abdominal Compartment Syndrome. To determine the type and various grades of Intra abdominal Hypertension in which the patients present and the management and mortality of different types of Abdominal compartment Syndrome. A total of 36 patients with features of abdominal compartment syndrome admitted in emergency ward, post-operative ward and critical care unit with raised intra-abdominal pressure in Department of General surgery at Sree Balaji Medical College and Hospital, were studied.

**RESULTS:** The overall incidence is 36 over a period of 12 months, with male predominance and majority of cases between the 20-50 years of age. Primary ACS leading with etiologies as peritonitis. Most common clinical feature being abdominal distension followed by tachypnoea for which measurement of IAP using indirect method like frequent urinary bladder pressure monitoring is used.

**CONCLUSION:** The diagnosis of Abdominal Compartment Syndrome depends on very high degree of suspicion and recognition of the patients at risk, identification of clinical syndrome and lastly measurement of Intra Abdominal Pressure. Frequent determination of urinary bladder pressure represents the "gold standard" for early recognition of Abdominal Compartment Syndrome.

**INTRODUCTION**

Abdominal Compartment Syndrome has tremendous relevance in practice of surgery and care of critically ill patients [3], because of its effects on multiple organ systems and as the patients of this syndrome are critically ill. Abdominal Compartment Syndrome occurs when pressure within closed anatomic space increases to the pressure where vascular inflow is compromised and functioning and viability of tissue within the compartment are threatened [1, 2].

Compartment syndrome occurs when pressures increase within a fixed cavity of the body, leading to ischemia, muscle damage, and organ dysfunction. These "fixed" spaces are constrained by muscular and fascial boundaries, which may have limited

compliance when they become swollen [14]. The Physiological consequences that occur affect the respiratory mechanism, hemodynamic parameters, renal and cerebral perfusion [2], A high index of suspicion is imperative for optimal outcome. If not recognized and treated in a timely manner, abdominal compartment syndrome can result in multi organ system failure and death, The adverse effects are reversible with relief of pressure, if done at proper time [4]. It is possible to divide and classify abdominal compartment syndrome into two classes, primary and secondary ACS [1].

**INTRA ABDOMINAL HYPERTENSION**

It is defined as raised Intra Abdominal pressure above normal. Normal Intra Abdominal Pressure (IAP) is 0-5 mm Hg. Intra abdominal pressure varies with position, body habitus and activity. Intra abdominal Pressure is measured in cm of H<sub>2</sub>O or mm of Hg. (1 cm of H<sub>2</sub>O (water) - 0.735 mm of Hg).

Intra abdominal pressure of between 3 to 10 mm Hg is commonly observed post operatively without adverse effects. In patients with trauma and sepsis, IAH has been shown to be an important contributor to early organ dysfunction that can cause severe impairment of the function of the renal, gastrointestinal, hepatic, respiratory, pulmonary, and central nervous systems. In cases of abdominal surgery or trauma, the pathology is much more important [11].

Intra-abdominal hypertension is graded from I to IV:

Grade I : IAP 12-15 mm Hg  
Grade II : IAP 16-20 mm Hg  
Grade III : IAP 21-25 mm Hg  
Grade IV : IAP >25 mm Hg

**AIM**

Abdominal compartment syndrome has significant clinical relevance in present surgical practice. The aim of my study is to identify,

The incidence of abdominal compartment syndrome in emergency and post operative wards.

The various etiologies that lead to the development of Abdominal Compartment Syndrome.

To determine the type and various grades of Intra abdominal Hypertension in which the patients present.

To determine the management and mortality of different types of Abdominal compartment Syndrome.

**MATERIALS AND METHODS**

**Patient selection:** Patients with features of abdominal compartment syndrome admitted in emergency ward, post-operative ward and

critical care unit with raised intra-abdominal pressure in Department of General surgery at Sree Balaji Medical College and Hospital.

**Sample size:** 36 patients

**Study area:** Department of General Surgery, SBMCH, Chennai, Tamil Nadu, India.

**INCLUSION CRITERIA:**

The inclusion criteria for my study were all cases that were admitted in.

I. Emergency ward with features of

- 1. Peritonitis
  - 2. Blunt injury abdomen.
  - 3. Penetrating injury abdomen.
  - 4. Intestinal Obstruction.
- and with raised Intra Abdominal Pressure more than 15 cm of water.

II. Post operative ward with Clinical features of Abdominal Compartment Syndrome and raised Intra Abdominal pressure more than 15 cm of water

**EXCLUSION CRITERIA:**

The exclusion criteria for my study were

- All cases with above features with Intra Abdominal pressure less than 15 cm of water.
- Patients with other comorbid conditions like
- Hypertension.
- Ascites.
- Bronchial Asthma.
- Chronic Obstructive Pulmonary Disease (COPD).
- Ischaemic Heart Disease.
- Chronic renal failure.
- Patients with neurogenic or contracted bladder.
- Patients with pelvic fracture and an abdominal Trauma

**METHODOLOGY**

Total of 36 cases with abdominal compartment syndrome studied

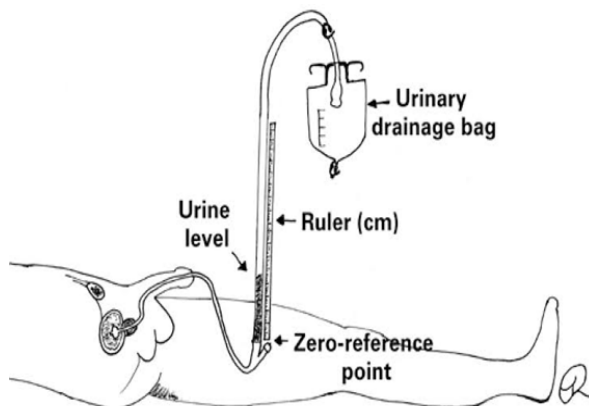
**MEASUREMENT OF INTRA ABDOMINAL PRESSURE :**

Intra Abdominal Pressure can be measured by direct and indirect techniques. Direct methods include placing a Catheter with an attached manometer or pressure transducer in to the peritoneal cavity. A commonly used example of this method is pressure measurement during laparoscopy. However direct methods are rarely used to monitor intra-abdominal pressure. Indirect methods used for pressure measurements elsewhere that reflects changes in the intra-abdominal pressure, initially this was performed by placing catheters percutaneously into inferior vena cava. This rather invasive method has been superseded by urinary bladder pressure monitoring. This has been validated against direct pressure measurements, an alternative indirect method is intragastric pressure measurement via a nasogastric tube, although this has not found wide spread use.

**BLADDER PRESSURE MEASUREMENT :**

Bladder pressure monitoring may be intermittent or continuous. It is relatively simple and does not usually require any extra invasive procedure as most patients at risk of Abdominal Compartment Syndrome will have a urinary catheter in situ. Frequent determinations of bladder pressure represent the 'gold standard' for early recognition of Abdominal Compartment Syndrome. Intra Abdominal Pressure is measured through the urinary bladder catheter connected to manometer or a pressure transducer. The catheter is disconnected from the urinary bag and about 100ml of normal saline is instilled in to the urinary bladder, Now the disconnected catheter is elevated perpendicular to the supine patient and his bed. The height of water urine column in the catheter is the Intra Abdominal Pressure in cm of water. The level will fluctuate with the patient's respiratory cycle up during inspiration and down during expiration following the movement of diaphragm. Accurate measurement is best achieved in the supine

position of the patient. The blocked catheter or the presence of pelvic hematoma may cause errors in measurements. Continuous measurement of Intra Abdominal pressure may be done via irrigation port of three way urinary catheter. Frequent measurements of bladder pressure were done to all patients included in this study [14, 15].



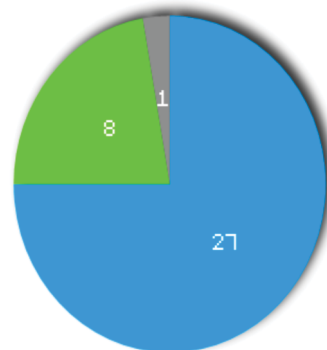
**OBSERVATIONS AND RESULTS**

Total cases - 36

**Incidence with respect to Age :**

- Less than 20 yrs. - 1
- Between 20-50 yrs - 27
- More than 50 yrs. - 8

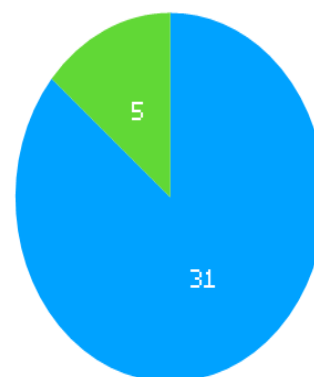
■ 20 -50 yrs    ■ >50 yrs    ■ <20 yrs



**Incidence with respect to Sex :**

- Male -31
- Female -5

■ male    ■ female

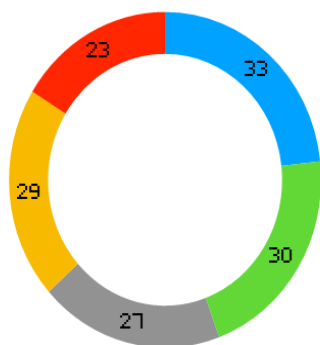


**Clinical feature:**

- | Clinical feature          | No. of cases |
|---------------------------|--------------|
| 1. Distended abdomen      | -33          |
| 2. Tachypnoea             | -30          |
| 3. Altered pulse pressure | -29          |
| (Narrow -9)               |              |
| (Wide -20)                |              |

- 4.Tachycardia -27
- 5.Oliguria -23

- Distended abdomen
- Tachycardia
- Oliguria
- Tachypnoea
- Altered pulse pressure

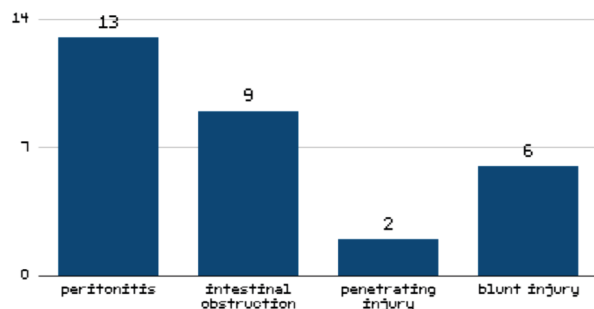


**ETIOLOGY**

- Total cases -36
- Primary ACS -30
- Secondary ACS -6

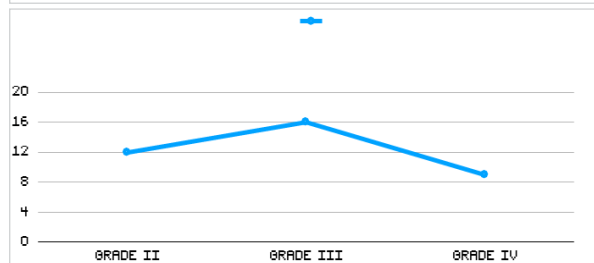
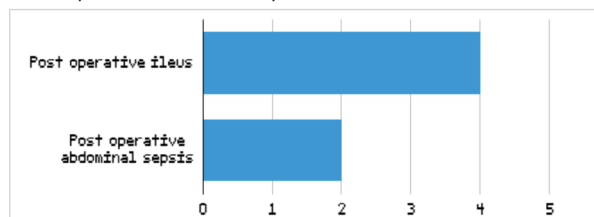
**PRIMARY ACS:**

- 1.Peritonitis -13
- 2.Intestinal obstruction -9
- 3.Penetrating injury -2
- 4.Blunt injury-6



**SECONDARY ACS:**

- 1.Post operative ileus - 4
- 2.Post operative abdominal sepsis - 2



**GRADING OF INTRA ABDOMINAL HYPERTENSION**

GRADE II	12 CASES
GRADE III	16 CASES
GRADE IV	9 CASES

**MANAGEMENT:**

- Primary ACS-30 Cases
- Laparotomy -21

- Herniorrhaphy -3
- Laparostomy -2
- Flank drainage -2
- Conservative management -2

**Secondary ACS -6 Cases**

- Conservative management -4
- Laparostomy -2

In the present study conducted on "etiology and outcome of abdominal compartment syndrome" in Sree Balaji Medical College from October 2019 to October 2020 for a period of 12 months following were the out come.36 cases presented with abdominal compartment syndrome of which 30 cases were primary and 6 cases were secondary abdominal compartment syndrome. Most of the cases were in their middle ages between 20 to 50 years and most of the cases were male. The causes of Abdominal compartment syndrome was fairly divided with the most common etiology of Primary Abdominal Compartment Syndrome as, peritonitis - 13 cases followed by intestinal obstruction 9 cases. The most common etiology of secondary abdominal compartment syndrome was post operative ileus (4 out of 6 cases). Intra venous fluids of more than 1 litre was required in all most all cases (35 out of 36) in both who were managed conservatively or operated. Most of cases presented in Grade II & Grade III intra abdominal Hypertension. Most of cases of Primary Abdominal Compartment Syndrome needed intervention either a major surgical procedure with decompression or isolated decompression because of the morbidity status of the patient. Laparostomy was done for 4 cases to prevent tight closure of abdomen so that the patients does not develop Abdominal Compartment syndrome postoperatively

**MORTALITY :5 CASES OUT OF 36 CASES**

**DISCUSSION**

Abdominal Compartment Syndrome is defined as "adverse physiological consequences that occur as a result of sudden increase in Intra Abdominal pressure [7], and resolve following abdominal decompression". There is certainly a direct mechanical effect of the increased IAP on the blood supply of the intra-abdominal organs, which is most convincingly seen in the kidney, Elevated IAP significantly decreases renal artery blood flow and compresses the renal vein leading to renal dysfunction and failure [10]. ACS has also been characterised in patients without abdominal damage, known as secondary ACS, during the last decade[12].

**INDICATIONS OF ABDOMINAL DECOMPRESSION**

The decision to decompress the abdomen should not be taken based on isolated measurements of intra Abdominal Pressure without taking into account the whole clinical picture[5]. Early or mild physiological abnormalities caused by raised intra Abdominal Pressure can be managed by fluid administration or after load reduction[8]. Established Abdominal Compartment syndrome however mandates and emergency decompressive Laparotomy which when performed in the well resuscitated patient promptly restores normal physiology. To prevent haemodynamic decompression, intravascular volume should be restored, oxygen delivery maximized and hypothermia and coagulation defects corrected. Following decompression, the abdominal skin and facial edges are left open using one of the temporary abdominal closure devices.

**TECHNIQUES OF ABDOMINAL DECOMPRESSION IN THE DEFINITE MANAGEMENT OF ABDOMINAL COMPARTMENT SYNDROME**

Decompression involves either reopening a laparotomy incision or in patients without recent laparotomy, opening of the abdomen through a mid line incision. Decompression in the intensive care unit may be indicated in few cases, where the haemodynamic or pulmonary instability precludes safe transport to the operating room, few precautions should be take prior to decompression, to

prevent systemic reperfusion injury. Rapid infusion of few litres of crystalloids with in ten minutes of post decompression is required restore haemodynamic stability.

### SURGICAL TECHNIQUES IN THE PREVENTION AND MANAGEMENT OF ABDOMINAL COMPARTMENT SYNDROME I .

1. Laparostomy or open abdominal techniques.
2. On demand relaparotomies
3. Staged abdominal repair (STAR)

### ANTICIPATION AND PREVENTION OF ABDOMINAL COMPARTMENT SYNDROME

In severe abdominal trauma and inflammation, which require massive fluid replacement, development of abdominal Compartment Syndrome can be due to massive bowel, abdominal wall, retroperitoneal and solid organ edema. In order to avoid raised intra-abdominal pressure and abdominal compartment syndrome, forceful closure of the abdomen in patients having massive retroperitoneal haematoma, visceral edema, severe intra abdominal infection or a need for haemostatic packing should be avoided. Leaving the fascia open and closing only the skin with sutures or towel clips to protect the bulging viscera has also been recommended. Leaving both the fascia and skin open may result in maximal reduction of Intra Abdominal pressure [9]. Bridging the fascial gap with temporary abdominal closure device like zipper laparostomy and urobag zipper laparostomy is also recommended.

### CONCLUSION

The diagnosis of Abdominal Compartment Syndrome depends on very high degree of suspicion and recognition of the patients at risk, identification of clinical syndrome and lastly measurement of Intra Abdominal Pressure. Frequent determination of bladder pressure represents the "gold standard" for early recognition of Abdominal Compartment Syndrome. Management of Abdominal Compartment Syndrome includes immediate decompression in severe cases and the key to management is anticipating and avoiding tight closure of abdomen. Temporary laparostomy may be considered instead of tight closure of abdomen in selective cases [13].

### REFERENCES

1. Newman RK, Dayal N, Dominique E. Abdominal Compartment Syndrome. [Updated 2020 Jul 10]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2020 Jan.
2. Malbrain, Manu & Cheatham, Michael & Sugrue, Michael & Ivatury, Rao (2010) The Abdominal Compartment Syndrome. 10.1007/978-0-387-77893-8\_45.
3. Principles of Critical care Gregory A. Schmidt. Jesse B. Hall.
4. Recent Advances in surgery 27 C.B. Johnson Irving Taylor, Ann R Coll Surg Engl. ISBN 9781853155710. chapter 2.
5. Schein's Common Sense Emergency Abdominal Surgery, 4th Edition By Moshe Schein, Paul N. Rogers, Ari Leppäniemi, Danny Rosin, Jonathan E. Efron. chapter 33.
6. Oxford Book of Surgery Vol. 24.
7. Backer, D.D. Abdominal compartment syndrome. Crit Care 3, R103 (1999). <https://doi.org/10.1186/cc373>.
8. Malbrain ML, Cheatham ML, Kirkpatrick A, Sugrue M, Parr M, De Waele J, Balogh Z, Leppäniemi A, Olvera C, Ivatury R, D'Amours S, Wendon J, Hillman K, Johansson K, Kolkman K, Wilmer A. Results from the International Conference of Experts on Intra-abdominal Hypertension and Abdominal Compartment Syndrome. I. Definitions. Intensive Care Med. 2006 Nov;32(11):1722-32. doi:10.1007/s00134-006-0349-5. Epub 2006 Sep 12. PMID: 16967294.
9. Kirkpatrick AW, Roberts DJ, De Waele J, Jaeschke R, Malbrain ML, De Keulenaer B, Duchesne J, Bjorck M, Leppäniemi A, Ejiike JC, Sugrue M, Cheatham M, Ivatury R, Ball CG, Reintam Blaser A, Regli A, Balogh ZJ, D'Amours S, Debergh D, Kaplan M, Kimball E, Olvera C; Pediatric Guidelines Sub-Committee for the World Society of the Abdominal Compartment Syndrome. Intra-

abdominal hypertension and the abdominal compartment syndrome: updated consensus definitions and clinical practice guidelines from the World Society of the Abdominal Compartment Syndrome. Intensive Care Med. 2013 Jul;39(7):1190-206. doi: 10.1007/s00134-013-2906-z. Epub 2013 May 15. PMID: 23673399; PMCID: PMC3680657.

10. Sugrue, Michael & Halal, Ali & D'Amours, Scott. (2006). Intra-abdominal pressure hypertension and the kidney. Abdominal Compartment Syndrome. 119-128.
11. Bains L, Lal P, Mishra A, Gupta A, Gautam KK, Kaur D. Abdominal Compartment Syndrome: A Comprehensive Pathophysiological Review. MAMC J Med Sci [serial online] 2019 [cited 2020 Nov 25];5:47-56.
12. Balogh Z, Moore FA, Moore EE, Biffi WL. Secondary abdominal compartment syndrome: a potential threat for all trauma clinicians. Injury. 2007 Mar;38(3):272-9. doi: 10.1016/j.injury.2006.02.026. Epub 2006 Nov 15. PMID: 17109861.
13. Töns C, Schachtrupp A, Rau M, Mumme T, Schumpelick V. Abdominelles Kompartmentsyndrom: Vermeidung und Behandlung [Abdominal compartment syndrome: prevention and treatment]. Chirurg. 2000 Aug;71(8):918-26. German. doi: 10.1007/s001040051156. PMID: 11013811.
14. Ali M. Abdominal compartment syndrome: the importance of urinary catheter placement in measuring intra-abdominal pressure. BMJ Case Rep. 2018 Oct 21;2018:bcr2018226786. doi: 10.1136/bcr-2018-226786. PMID: 30344152; PMCID: PMC6203075.
15. Malbrain ML. Different techniques to measure intra-abdominal pressure (IAP): time for a critical re-appraisal. Intensive Care Med. 2004;30(3):357-71. Epub 2004 Jan 17.