

## Intra-abdominal Hypertension and its Outcome in Patients Admitted in Surgical ICU after Laparotomy

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### ABSTRACT

**Objective:** To assess the frequency of intra-abdominal hypertension and its relationship with outcomes among patients of laparotomy admitted to the intensive care unit.

**Study Design:** Comparative cross-sectional study

**Place and Duration of Study:** Combined Military Hospital, Rawalpindi Pakistan, from Apr to Sep 2021.

**Methodology:** Two-hundred patients who underwent laparotomy admitted to the intensive care unit of Combined Military Hospital were recruited in our study. Intra-abdominal pressure was measured after every 8 hours for 72 hours after admission to the intensive care unit. In addition, patients were followed up for two weeks from admission in the intensive care unit to assess the outcome.

**Results:** Out of two hundred patients, 150(75%) had good outcomes, while 50(25%) had poor outcomes. The mean age of patients who underwent the surgery was  $40.63 \pm 9.448$  years. 171(85.5%) patients did not have raised intra-abdominal pressure, while 29(14.5%) had intra-abdominal hypertension. High Body mass index and poor outcome had a significant association with the presence and severity of intra-abdominal hypertension among study participants ( $p$ -value $<0.05$ ).

**Conclusion:** Considerable number of patients had intra-abdominal hypertension during their stay in the critical care unit after laparotomy. A high grade of intra-abdominal hypertension was associated with poor outcomes in our study participants.

**Keywords:** Intensive care unit, Intra-abdominal hypertension, Laparotomy, Outcome.

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### INTRODUCTION

Surgical centres across the globe cater for a large number of abdominal surgeries, including both elective and emergency surgeries.<sup>1</sup> In controlled settings where surgical protocols are well followed, the complication rate is usually low, with good short-term and long-term results.<sup>2,3</sup> Still bleeding, wound herniation, or wound infection may occur in a few cases depending upon various peri-surgical, surgical or post-surgical factors.<sup>3</sup> Patients of laparotomy sometimes get admitted to the critical care unit due to several indications.<sup>4,5</sup> Course of illness and occurrence of complications during critical care unit admission is crucial for these patients' short- and long-term outcomes.<sup>6,7</sup> Intra-abdominal hypertension is an emerging phenomenon in critical care patients and is limited to patients with abdominal surgeries and any condition.<sup>8</sup>

Surgical intensive care has been an evolving speciality in our part of the world.<sup>9</sup> The outcome of patients having multiple complications or compromised organ systems depends on several complex factors, including intra-abdominal pressure. A local

study published by Murtaza *et al.* concluded that intra-abdominal is a poorly recognized clinical entity with a potentially devastating impact on patient outcomes.<sup>10</sup> Limited local data has been available. Therefore, we planned this study to assess the frequency of intra-abdominal hypertension and its relationship with outcomes among patients of laparotomy admitted to the intensive care unit.

### METHODOLOGY

The comparative cross-sectional study was conducted at the Surgical Intensive Care Unit of the Combined Military Hospital, Rawalpindi Pakistan, from April to September 2021. Ethical approval (via letter no 211/10/21) was sorted before the study. The sample size was calculated by WHO Sample Size Calculator using the population proportion of intra-abdominal hypertension in critical care patients as 12.6%.<sup>11</sup> Non-probability consecutive sampling technique was used to gather the sample.

**Inclusion Criteria:** All patients aged 18 to 60 years who underwent laparotomy and were admitted to the intensive care unit were included in the study. Patients who were operated elsewhere but, due to lack of adequate post-operative services or critical care unit, were referred to our ICU were also included in our study.

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**Exclusion Criteria:** Patients with redo surgeries or a history of other abdominal surgery in the last six months. Those with any solid or haematological malignancy or metastatic disease were also not included in the analysis. Patients with chronic liver disease, renal failure, or protein-losing enteropathies were excluded.

Patients gave written informed consent for the study, and if they were unconscious, it was obtained from primary caregivers. Those cases where ethical or consent formalities were not completed were not targeted for the study. A consultant surgeon performed laparotomy as per the set protocol.<sup>12</sup> Intra-abdominal pressure monitoring was performed via trans-bladder measurement technique with a zero-pressure reference point in mmHg set at the hemostatic axis in the midaxillary line. Abdominal hypertension was categorized into four grades. Grade I, IAP 12-15 mmHg; Grade II, IAP 16-20 mmHg; Grade III, IAP 21-25 mmHg; and Grade IV, IAP >25 mmHg.<sup>13</sup> Good outcome was patients discharged to wards while poor outcome was prolonged stay in ICU (more than two weeks) or death.<sup>14</sup>

Data were analysed Statistics Package for Social Sciences version 24.0 (SPSS-24.0). Frequency and percentages for gender, outcome and patients with grades of abdominal hypertension during the study were calculated. Mean and standard deviation for age were also calculated for the study participants. Association of age, BMI, gender, and outcome was assessed with the presence and severity of abdominal hypertension among these diabetic patients admitted to ICU after laparotomy via Pearson Chi-square analysis. The *p*-value ≤ to 0.05 was considered significant.

**RESULTS**

A total of 200 patients who were admitted to the intensive care unit after laparotomy were included in the study. 150(75%) had good outcomes, while 50(25%) had poor outcomes. The mean age of patients who underwent the surgery was 40.63±9.448 years. 171 (85.5%) patients did not have raised intra-abdominal pressure, while 29(14.5%) had intra-abdominal hypertension. Out of 29 patients with raised intra-abdominal pressure, 6(20.7%) patients had Grade-I, 7(24.1%) had Grade-II, 8(27.5%) had Grade-III and 8(27.5%) patients had Grade IV intra-abdominal hypertension (Table-I). High Body mass index (*p*-value-0.003) and poor outcome (*p*-value-0.004) had significant associations with the presence and severity of intra-abdominal hypertension among study participants. In contrast, age (*p*-value-0.988) and gender (*p*-value-0.491) had no statistically significant association with raised intra-abdominal pressure in patients included in our study (Table-II).

**Table-I: Characteristics of Study Participants (n=200)**

| Study parameters                    | n(%)                |
|-------------------------------------|---------------------|
| <b>Age (years)</b>                  |                     |
| Mean+SD                             | 40.63±9.448 years   |
| Range (min-max)                     | 19 years - 60 years |
| <b>Gender</b>                       |                     |
| Male                                | 112 (56%)           |
| Female                              | 88 (44%)            |
| <b>Outcome</b>                      |                     |
| Good                                | 150(75%)            |
| Poor                                | 50(25%)             |
| <b>Intra-abdominal hypertension</b> |                     |
| No                                  | 171(85.5%)          |
| Grade I                             | 06(3%)              |
| Grade II                            | 07(3.5%)            |
| Grade III                           | 08(4%)              |
| Grade IV                            | 08(4%)              |

**Table-II: Association of Outcome and other Factors with Presence and severity of Intra-Abdominal Hypertension (n=200)**

| Factors                | Normal intra-abdominal pressure (n=171) | Grade I intra-abdominal Hypertension (n=6) | Grade II intra-abdominal Hypertension (n=7) | Grade III intra-abdominal Hypertension (n=8) | Grade IV intra-abdominal Hypertension (n=8) | p-value |
|------------------------|---|--|---|--|---|---------|
| <b>Age</b>             |   |  |   |  |   |         |
| <40 years              | 118(69.1%)                              | 04(66.7%)                                  | 05(71.4%)                                   | 06(75%)                                      | 05(62.5%)                                   | 0.988   |
| 30-35 years            | 53(30.9%)                               | 02(33.3%)                                  | 02(28.6%)                                   | 02(25%)                                      | 03(37.5%)                                   |         |
| <b>Gender</b>          |   |  |   |  |   |         |
| Male                   | 94(54.9%)                               | 02(33.3%)                                  | 05(71.4%)                                   | 05(62.5%)                                    | 06(75%)                                     | 0.491   |
| Female                 | 77(45.1%)                               | 04(66.7%)                                  | 02(28.6%)                                   | 03(37.5%)                                    | 02(25%)                                     |         |
| <b>Body Mass Index</b> |   |  |   |  |   |         |
| Normal                 | 133(77.8%)                              | 05(83.3%)                                  | 04(57.1%)                                   | 01(12.5%)                                    | 06(75%)                                     | 0.003   |
| Overweight or obese    | 38(22.2%)                               | 01(16.7%)                                  | 03(42.9%)                                   | 07(87.5%)                                    | 02(25%)                                     |         |
| <b>Outcome</b>         |   |  |   |  |   |         |
| Good                   | 136(79.5%)                              | 05(83.3%)                                  | 03(57.1%)                                   | 03(37.5%)                                    | 03(37.5%)                                   | 0.004   |
| Poor                   | 35(20.5%)                               | 01(16.7%)                                  | 04(42.9%)                                   | 05(62.5%)                                    | 05(62.5%)                                   |         |

## DISCUSSION

Intra-abdominal hypertension emerged as a common finding and was associated with poor outcomes in patients undergoing laparotomy and admitted to the surgical critical care unit in our study. Multiple factors could lead to raised intra-abdominal pressure in patients admitted to the critical care unit, especially after any major surgery. Intra-abdominal hypertension may make the patient's condition worse and more challenging for the treating team. Worst cases may land into abdominal compartment syndrome, an emergency. Knowledge regarding high-risk patients may equip critical care physicians to diagnose this condition early and manage it effectively. Therefore, we conducted this study to assess the frequency of intra-abdominal hypertension and its relationship with outcomes among patients of laparotomy admitted to the intensive care unit of our hospital.

Khan *et al.* studied the patients undergoing laparotomy for IAH after the surgery when they were admitted to the ward or critical care setting.<sup>15</sup> They concluded that Raised intra-abdominal pressure affects various body organs and is directly associated with high mortality among laparotomy patients. Kuteesa *et al.*<sup>16</sup> revealed that the prevalence of Intra-abdominal hypertension was 25% of paediatrics and 17.4% of adults, and the cumulative incidence after surgery was 20% of paediatrics and 21% of adults. Around 14.5% of our study participants showed the presence of intra-abdominal hypertension, and 16% had either grade III or grade IV type, which could be regarded as abdominal compartment syndrome. In 2014, a systematic review highlighted that patients admitted to critical care settings are at high risk of developing complications like intra-abdominal hypertension. Furthermore, mortality increased in patients who developed this complication during admission to the critical care unit.<sup>17</sup> Around 30.8% of their patients died while being managed in the ICU. Our results support their results as 25% of patients had poor outcomes in our study, and the severity of intra-abdominal hypertension was associated with poor outcomes. A review was published in 2015 to outline the pathophysiologic implications and treatment options for intra-abdominal hypertension and abdominal compartment syndrome in patients suffering from trauma and pancreatitis.<sup>18</sup> It was revealed that patients at risk for intra-abdominal hypertension should be identified early during treatment to save them from serious consequences. Our results also support their recommendations as patients

with this condition had more chances of poor outcomes, and prevention or early detection could be useful in this context.

We found that intra-abdominal hypertension is not uncommon in patients undergoing laparotomy and requiring ICU admission. Therefore, patients with high BMI should be considered high risk, and early intervention can save the patients from grave consequences.

## LIMITATIONS OF STUDY

The indirect method of intra-abdominal pressure measurement was used, which is one of the limitations of this study. In addition, patients were only followed up for two weeks; therefore, long-term outcomes could not be determined. Future studies with more sophisticated designs may generate better results.

## CONCLUSION

Many patients had intra-abdominal hypertension during their stay in the critical care unit after laparotomy. A high grade of intra-abdominal hypertension was associated with poor outcomes in our study participants.

**Conflict of Interest:** None.

## Authors' Contribution

Following authors have made substantial contributions to the manuscript as under:

MIM: Study design, data analysis, drafting the manuscript, critical review, approval of the final version to be published.

AMKB: Critical review, approval of the final version to be published.

KA: & MRI: Data acquisition, interpretation of data, approval of the final version to be published.

AJ: Conception, interpretation of data, drafting the manuscript, approval of the final version to be published.

MA: Study design, Drafting the manuscript, interpretation of data, approval of the final version to be published.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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