

# The Effect of Abdominal Binders on Mobilization and Pain in the Postoperative Period after Emergency Laparotomy

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## ABSTRACT

**Background:** In order to augment the postoperative recovery process in patients undergoing laparotomy, various methods have been evaluated in the past. One such strategy is the use of postoperative abdominal binder.

**Objective:** We compared the efficacy of abdominal binder use in patients undergoing emergency laparotomy by objective comparison of 6-minute walk test and pain on visual analogue scale.

**Place of study:**

Departments of Surgery in both Benazir Bhutto Hospital and District Head Quarter Hospital affiliated with Rawalpindi Medical University, Rawalpindi

**Material and Methods:** It was a randomized controlled trial that was carried out at Departments of Surgery of Rawalpindi Medical University, from October 2021 till May 2022. It included 100 patients, 50 in binder group and 50 in non-binder group. The study included patients from 18 to 65 years of age undergoing emergency exploratory laparotomy for acute abdomen or abdominal trauma having ASA Class I-II. In the postoperative period mobility was assessed by 6-minute walk test (6MWT) and pain was assessed using the VAS. Data was analyzed using SPSS version 20. The mean 6 MWT distance and pain score (VAS) was compared between the binder and no-binder group using the independent samples t-test. Results were considered statistically significant if the p value was < 0.05.

**Results:** The 6MWT distance and the pain scores of patients in the binder group did not differ significantly from the pain scores in the non-binder group on first, third, fifth and fourteenth postoperative day (p>0.05).

**Conclusion:** We did not find a statistically significant difference between the patients using binder and the patients not using binder after surgery with respect to mobilization and pain in the postoperative period.

**Keywords:** major abdominal surgery; exploratory laparotomy, abdominal binder; 6-minute walk test; visual analogue scale

## INTRODUCTION

In major abdominal surgeries (MAS) surgeons usually perform gut manipulation resulting either in resection, end to end anastomosis or small (jejunal or ileal) gut or large gut (colonic) stoma formation. Complications are common after these surgeries<sup>1</sup>. Good preoperative and postoperative practices can reduce morbidity and mortality after these surgeries<sup>2</sup>. Use of abdominal belts or binders in the postoperative period can potentially improve and hasten the recovery process<sup>3,4</sup>.

Various surgeries have been found to benefit in terms of better recovery after using binders. Studies have been carried out about use of binders after laparotomies, caesarean sections, hysterectomies, spinal surgeries and bariatric surgery<sup>5</sup>. In the past a number of studies have been conducted on use of abdominal binders and they have shown to improve pain relief, lung function, coughing, psychological stress, intra-abdominal pressure, mobility, wound dehiscence, seroma formation and general well-being<sup>6,7,8,9</sup>.

By promoting early recovery we can minimize the risk of development of deep venous thrombosis, hypostatic pneumonias and muscle atrophy<sup>10</sup>. Abdominal binders improve recovery process by different mechanisms; especially by reducing postoperative pain, distress, psychological stress; as was shown by Ghana et al<sup>11</sup>. in a study on patients who underwent caesarean section. Some studies also claim that binders can reduce the risk of abdominal dehiscence<sup>12</sup>.

Yet other studies claim that reduced breathing excursion of chest due to use of abdominal binders can increase the risk of respiratory complications like atelectasis and pneumonias.<sup>Error!</sup>

Most of this data comes from western countries and there is paucity of local data on this subject. In our country the use of abdominal binders is not very popular and hence its use for improving post-operative recovery parameters has not been widely studied.

The current study aimed to study the effect of using abdominal binders after emergency laparotomies on two key

recovery parameters such as mobility and postoperative pain; which were objectively measured using the 6 MWT and VAS.

## MATERIAL AND METHODS

We conducted a randomized controlled trial at Departments of Surgery of Rawalpindi Medical University in both Benazir Bhutto Hospital and District Head Quarter Hospital. The study was carried out over eight months from October 2021 till May 2022. It included 100 patients, fifty (50) were in the binder group and fifty (50) were in the non-binder group. The study included patients from 18 to 65 years of age who underwent emergency exploratory laparotomy for acute abdomen or abdominal trauma. They belonged to either ASA class I or II. A surgical operation in which the abdomen is opened through a midline incision to access the peritoneal cavity and the each quadrant of abdomen and abdominal organs are examined for injury or disease.

The exclusion criteria included ASA Class III, obese patients having a BMI > 35, patients with a past history of abdominal surgery, patients with advanced malignancies, chronic respiratory disorders, cardiac failure of NYHA Class III or IV, presence of ascites, patients afflicted with neuromuscular or orthopedic disorders which are severe enough to prevent them from performing the 6-minute walk test.

Approval was taken from college ethical committee. Informed consent was taken from the participants on a consent form. For the purpose of randomization sealed envelope method was used.

Patients in the intervention group used an elastic compression belt that encircle the abdomen; whereas the control group did not use it. The binder was applied in the immediate postoperative period and was worn all the times. This belt had to cover the surgical incision. We had to make sure that its upper border was not higher than the lower margin of the rib cage. This was done to minimize the lateral chest expansion and not to compromise diaphragmatic excursion. For patients who had drains, stomas or other tubes, holes were cut in the binder to

prevent pressure on these devices. The tightness or tension in the binder was determined by the level of patient comfort; but for maximum benefit it had to be applied quite firmly.

Pain and mobilization status of the patients were assessed on first, third, fifth and fourteenth postoperative days. To assess mobilization we used the 6-minute walk test. It was performed indoors, in a straight corridor free of distractions. It was performed according to the American Thoracic Society recommended protocol. The patients were encouraged to walk as far as possible in 6 minutes and were also allowed to stop and take rest as required.

Visual analogue scale was used to assess pain. It consisted of a straight line with end points which define the extreme limits of "no pain" at one end and "worst pain" at the other end. Using a scale the distance is measured between the "no pain" end and the patient's mark.

Data was entered and analyzed using SPSS version 20. Numerical data included i.e. age, BMI, length of incision, 6 MWT distance, pain on VAS was presented as mean ± SD. Categorical data like gender, ASA class, indication and preoperative diagnosis was presented as percentages. The mean 6 MWT distance and pain score (VAS) was compared between the binder and no-binder group using the independent samples t-test. Results were considered statistically significant if the p value was < 0.05.

## RESULTS

We randomized 100 patients undergoing exploratory laparotomy to either the binder group or the non-binder group. Two patients expired in the binder group. Primary outcome variables assessed during the post-operative period were mobility (as assessed by the 6 MWT) and postoperative pain (as assessed on the VAS).

The mean age of patients in the binder group was 34.82±14.7 years and in the non-binder group was 31.1±12.9 years. This two groups did not differ significantly with respect to age distribution; p=0.183. The mean length of incision in the binder group was 17.32±4.34 cm and in the non-binder group was 15.76±2.9 cm.

The 6MWT results are summarized in Table 1. On day 1 the mean 6MWT distance was 30.39±19.95 m in binder group and 23.29±23.03 m in non-binder group. There was no statistically significant difference in the 6MWT distance on first postoperative day of the surgery (p = 0.294).

On day 3 the mean 6MWT distance was 71.51±45.63 m in binder group and 60.70±28.78 m in non-binder group. This difference was not statistically significant (p = 0.526).

On day 5 the mean 6MWT distance was 117.87±60.90 m in binder group and 109.82±70.42 m in non-binder group. This difference was not statistically significant (p = 0.824).

On day 14 the mean 6MWT distance was 182.5±76.21 m in binder group and 157±60.28 m in non-binder group. This difference was not statistically significant (p = 0.338).

With regards to the pain status (Table 2), the pain scores of patients in the binder group did not differ significantly from the pain scores in the non-binder group on first, third, fifth and fourteenth postoperative day. On day 1 the mean pain scores were 6.97±1.85 vs. 6.5±1.69 in binder vs. non-binder group respectively; p=0.265. On day 3 the mean pain scores were 3.8±2.05 vs. 4.3±2.19 in binder vs. non-binder group respectively; p=0.326. On day 5 the mean pain scores were 2.64±1.43 vs. 2.52±1.4 in binder vs. non-binder group respectively; p=0.664. On day 14 the mean pain scores were 1.22±1.4 vs. 1.02±0.84 in binder vs. non-binder group respectively; p=0.371.

Table 1: Postoperative 6-MWT in Binder vs. Non-binder groups

6-minute walk test distance in meters		Postoperative Day 1	Postoperative Day 3	Postoperative Day 5	Postoperative Day 14
Group	Binder	33.22±19.5	78.69±49.9	128.66±62.6	196.38±84.0
	Non-binder	28.76±21.5	72.74±42.8	125.52±76.25	180.4±79.38
p-value		0.294	0.526	0.824	0.338

Table 2: Postoperative pain of VAS in Binder vs. Non-binder groups

Postoperative pain on VAS		Postoperative Day 1	Postoperative Day 3	Postoperative Day 5	Postoperative Day 14
Group	Binder	6.97±1.85	3.8±2.05	2.64±1.43	1.22±1.4
	Non-binder	6.5±1.69	4.3±2.19	2.52±1.4	1.02±0.84
p-value		0.265	0.326	0.664	0.371

## DISCUSSION

In order to augment the postoperative recovery process in patients undergoing laparotomy, various strategies have been evaluated in the past. One such strategy is the use of postoperative abdominal binder. The benefit might be linked to early mobilizations due to use of binder. Binders disperse the sense of pain over whole abdomen and thus minimize pain sensation localized over incision site. Early mobilization prevents deep venous thrombosis, chest infections and muscle atrophy after surgeries. They also have been shown to decrease abdominal wall dehiscence<sup>13</sup>.

The ways of postoperative care mostly are determined by surgeons' beliefs, habits and traditions. For example, 94% of French surgeons tend to apply binder after abdominal surgeries. Although some surgeons order a binder for all their patients, but majority order them in selected cases especially in patients with impending dehiscence. Use of binders is more of a matter of habit rather than scientific evidence.

Current study aimed to objectively compare two postoperative recovery parameters in patients undergoing emergency laparotomy; namely mobility assessed by 6-minute walk test and pain assessed by visual analogue scale. We did not find a statistically significant difference between the patients using binder and the patients not using binder after surgery with respect to mobilization and pain in the postoperative period.

When we looked into medical literature; the first prospective randomized trial of using binders was published in 1983<sup>14</sup>. It took

another 25 years to gather more data on this issue. Some authors failed to find a benefit<sup>15</sup>; and by the year 2014 four studies were published on this subject and in the literature review by Bouvier et al. all the four trials failed to demonstrate a statistically significant benefit. Error! Bookmark not defined.

However; recent systemic reviews have shown that binders reduced pain, psychological stress and seroma formation after abdominal surgeries. Error! Bookmark not defined. A recent meta-analysis of ten RCTs and 968 patients has demonstrated that the use of abdominal binders augmented recovery in the postoperative period in terms of alleviating pain, reducing distress and facilitating mobilization<sup>16</sup>.

In the same time frame some other studies failed to confirm this benefit. For example, the review by Rothman et al, Error! Bookmark not defined. has not absolutely certified the benefit of binders.

There have also been difficulties in conducting good quality meta-analyses due to use of different binder materials, binding methods, binding strength, types of surgeries and patient types.

Since every coin has two sides, we need to take into consideration the adverse effects of using the abdominal binder as well. Their use is associated with many adverse effects as mentioned by Zhang et al. Error! Bookmark not defined. Firstly, their use may lead to increased intra-abdominal pressure (IAP) and intra-abdominal hypertension and abdominal compartment syndrome<sup>17</sup>. This in turn leads to increased intra thoracic pressure and sometimes may lead to increased intra cranial pressure. This ultimately may lead to respiratory and nervous system dysfunction.

Raised IAP renal ischemia and cardiac preload<sup>18</sup>. Secondly, increased IAP may lead to esophageal acid reflux<sup>19</sup>. Thirdly, may cause a spontaneous non-traumatic trans-diaphragmatic intercostal hernia. Finally persistently raised IAP may cause weakening of intercostal muscles<sup>20</sup>.

Contradictory to the above, study by Cheifetz et al<sup>Error!</sup> Bookmark not defined. showed insignificant changes in respiratory function by application of abdominal binder. Similar findings of lack of restriction of thoracic cage were reported by meta-analysis of Wadsworth<sup>21</sup>. Caly et al<sup>22</sup> showed that binders there is no reliable evidence that they increase IAP. Moreover, Arcini et al<sup>23</sup> showed that binders did not disturb GI symptoms.

Since there is lack of scientific evidence of significant benefit of using abdominal binder after MAS, therefore, the routine use of abdominal binders is to date a controversial practice. Under the current circumstances we need to formulate the final strategy after updating the evidence.

## CONCLUSION

Our study aimed to objectively compare two postoperative recovery parameters in patients undergoing emergency laparotomy; namely mobility assessed by 6-minute walk test and pain assessed by visual analogue scale. We did not find a statistically significant difference between the patients using binder and the patients not using binder after surgery with respect to mobilization and pain in the postoperative period.

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