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Research Article

Role of Protective Stoma in Destructive Colon Injuries in Gunshot Victims and Predictors of Post-Operative Morbidity in a Developing Country

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Abstract

Introduction: Primary repair is becoming a rapidly emerging method for destructive colon injury. There is paucity of data regarding protecting stoma.

Methods: Retrospective review of Adult patients with penetrating destructive colon injuries at Aga Khan University Hospital, Pakistan was carried out.

Results: There were a total of forty two patients. The (group A) comprised of patients who had resection with end colostomy formation. While, (Group B) underwent resection and anastomosis with a protective stoma.

Morbidity: Post-operative outcomes were compared in both groups. There was no significant statistical difference in postoperative morbidity (40% versus 26%, p-value 0.57). However, length of stay and time to stoma reversal were significantly different between both the groups. Uni-variate and regression analysis was done to find out determinants of post-operative morbidity. Logistic regression analysis was done to find the extent of association between determinants and post-operative morbidity. Significant association was seen between pH < 7.35, age > 45 years, > 4 packed cell transfusion within 24 hours, post-operative inotropes and occurrence of post-operative morbidity.

Conclusion: Based on our findings and literature review we conclude that Post-operative morbidity is independent of operative procedure i.e. resection with end stoma or resection and anastomosis with a protective stoma. In high risk patients where the surgeon is uncomfortable with primary repair, Resection and Anastomosis with protective stoma which has seldom been mentioned in trauma literature has acceptable morbidity and mortality with relatively less morbid and early reversal of stoma when compared to end stoma.

Keywords: Colorectal trauma; Protective stoma

Introduction

Colon injury is present in 20% of penetrating abdominal traumas. Approximately 90% of the deaths related to penetrating abdominal injuries are caused by gunshot wounds [1]. Current management of penetrating colon injuries has evolved from warfare. In the U.S. Civil War (1861-1865) standard treatment for colorectal injuries was non-surgical; with mortality rate as high as 90%. With the introduction of anesthetic techniques and sterile surgical manipulation during the First World War (1914-1918), primary repair was mainstreamed with mortality still crossing 60%. Ogilvie [2] enforced compulsive proximal diversion; consequently, a noticeable reduction of the mortality rate (35%) was shown.

Surgeons continued to show interest in primary repair as avoidance of stoma reduced morbidity, cut down cost associated with stoma-care and re-hospitalization for a repeat laparotomy for closure. In 1951, Woodhall and Ochsner [3] reported a study on primary repair and proximal diversion performed for traumatic colorectal injury and the mortality rates were 9% and 40%, respectively. Thus, the primary repair showed noticeably good results during peace time. A landmark prospective non-randomized 19 center study by Demetriades et al [4] favored resection & anastomosis over resection & colostomy formation regardless of risk factors. For approximately three decades several prospective studies on the treatment of traumatic colorectal injury showed that primary repair as well as resection and anastomosis had become rapidly emerging methods [5]. In recent trends high velocity bullet injuries have been increasing in peace times. Keeping that in mind as well as the fear of anastomotic leak and its consequences many surgeons still give preference to diversion over primary repair.

Over the years we at the Aga Khan University Hospital, Pakistan have progressed from resection and end stoma formation to resection and anastomosis with a protective stoma formation. It was due to the fear of overwhelming sepsis secondary to anastomotic leak and to avoid another laparotomy for end stoma closure that this technique was performed. There is paucity of data in literature regarding protecting stoma in trauma setting. Therefore we decided to review our outcome with change in management of gunshot victims with destructive colon injuries. We believe that this change in practice is an alternative to end colostomy when a surgeon has doubts about doing primary repair and gives patients a protected anastomosis. The

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Table 1: Characteristics on Presentation.

Variable	Group A (N=15) Resection with end Stoma	Group B (N = 27) Resection & Anastomosis with protective Ileostomy	P-Value
Time from injury to presentation	90 minutes (median) (30-180) IQ Range	100 minutes (median) (45-180) IQ Range	0.23
Tachycardia (>100/min)	12 (80%)	17 (63%)	**0.05**
Hypotension (<90mmHg)	7 (46%)	22 (81%)	**0.018**
Hypothermia	3 (20%)	3 (11%)	0.47
Acidosis	8 (53%)	12 (44%)	0.81
PATI > 25	7 (46%)	10 (37%)	0.83
Packed Cells > 4 in 24 hours	5 (33%)	12 (44%)	0.52
Inotropes	4 (26%)	8 (29%)	0.37

secondary aim was to find out factors associated with post-operative complications.

Methods

Study design

Retrospective review.

Study settings

Aga Khan University Hospital Karachi, Pakistan. A tertiary care hospital with dedicated trauma surgeon and associated team. It receives trauma patients from metropolitan city Karachi and rest of country in general.

Study duration

January 2004 till September 2016.

Selection criteria

Adult patients with gunshot destructive colon injuries and proximal rectal injuries who either underwent resection and end stoma formation or resection and anastomosis with protective stoma.

Exclusion criteria

- Missing records
- Received post-operatively from other hospitals
- Died before definitive surgery

Data collection procedure

Patients with penetrating colonic injuries were identified using ICD codes and data was retrieved from medical records. Data was collected for demographics, severity of injury, intra-operative details surgical procedure, post-operative stay and complications. Data was collected by two collectors to check and minimize for errors. Follow-up information of at least one month was recorded.

Operational definitions

Hypothermia: core body temperature of less than 36˚C [6].

Acidosis: pH of 7.35 and lower as per American Association for Clinical Chemistry (AACC).

PATI score: Penetrating Abdominal Trauma Index [7].

Post-operative morbidity: Any surgery related complication occurring within 30 days after first surgery.

Ethical considerations

Approval was sought from institutional ethical review committee (ERC).

Statistical analysis

Data entry and analysis was done in SPSS version 19. For continuous non-uniform data median with interquartile ranges were taken. Mann-Whitney-U test and Kruskall-Wallis tests were used to compare data between two and greater than two groups. For dichotomous variables proportions and percentages were taken while their analysis was done using Chi-square and Fischer's exact test. Uni-variate logistic regression analysis was run to find out predictors of post-operative morbidity in our patients. Significance was defined as p-value < 0.05.

Results

Demographics

There were a total of forty two patients. The data was split into two categories depending on surgical procedure. The (group A) comprised of patients who underwent resection with end colostomy formation (years 2004 to 2007). The (group B) had patients who underwent resection and anastomosis with a protecting stoma (years 2008 -2016). Group A had fifteen patients while Group B had 27 patients. The median age of our patients in Group A was 30 (IQ range 28-44) years and while in Group B was 36 (IQ range 25-42) years. There was a preponderance of males in both the groups with the ratio to females being 14:1 in group A and 23:4 in group B. More than two thirds of the patients were referred from other hospitals which added to the delay in presentation and definitive management.

Characteristics

Characteristics of both the groups are compared in (Table 1). A greater proportion of patients were found to be tachycardic (HR > 100/min) in resection and end stoma group when compared to those who underwent resection and anastomosis with proximal diversion (80% versus 62.9%, p-value 0.05). While proximal diversion group had greater proportion of hypotensive patients as compared to end colostomy group (81% versus 46% with p-value 0.018). There was no statistical difference found between two groups in terms of severity of injury, packed cells transfusion in first twenty four hours and need for inotropes. The parts of colon involved in both the groups are shown in Figure 1. Associated injuries are shown in Figure 2.

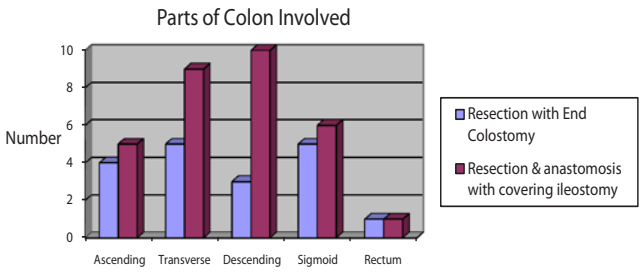

Figure 1: Parts of Colon Involved.

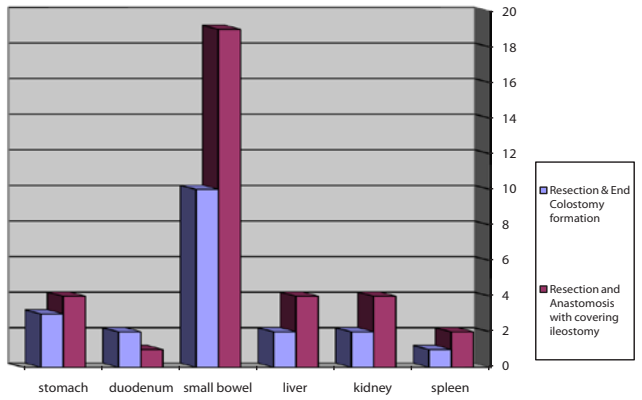

Figure 2: Other organs injured.

Management

Two (15.4%) patients in group A and seven patients (25.9%) in group B underwent damage control surgery before definitive surgery. Thus our trend of doing damage control surgeries increased with time.

Outcomes

Morbidity: Post-operative outcomes were assessed in both the groups and compared. There seemed to be no significant statistical difference in post-operative morbidity (40% versus 26%, p-value 0.57). However, length of stay and time to stoma reversal were significantly different between both the groups. For group A, median length of stay was 15 days (14-24 IQ range) and for group B it was ten days (7-15 IQ range) , p-value 0.015. Stomas in group A were reversed after a median of 9 months while protective stoma was reversed after a median of 4 months, p-value 0.010.

Further elaboration on surgical morbidity is as follows: group A wound infection occurred in six patients (40%) while in group Bit was six patients (22%). In group B there was one patient (3.7%) who had a controlled anastomotic leak. The patient was managed conservatively. Uni-variate analysis was done to find out determinants of post-operative morbidity as shown by Table 2. Regression analysis was done to find the extent of association between determinants and post-operative morbidity. It is shown in Table 3 that significant association was seen between pH < 7.35, age > 45 years, > 4 packed cell transfusion within 24 hours, post-operative inotropes and occurrence of post-operative morbidity. It is also worthy of being noticed that type of procedure performed, delay in presentation of more than one hour, gender, coagulopathy, ICU stay and severity of injury were not significantly associated with morbidity.

Table 2: Factors associted with post-operative morbidity - Univariate Analysis.

Variable	P-Value
Age > 45 years	**0.026**
> 4 packed cells in first 24 hours	**0.008**
Inotropes	**0.05**
pH < 7.35	**0.031**
Type of Procedure	0.12
Delay > 60 minutes	0.25
Referral	0.25
Gender	0.11
Type of procedure	0.67
Post-operative ICU stay	0.14
Coagulopathy	0.2
PATI > 25	0.82

Mortality: There was single mortality in each group i.e. 6.7% and 3.7%. Both the patients were above 60 years and developed severe sepsis leading to multi-organ failure secondary to ventilator acquired pneumonia.

Discussion

For over thirty decades several prospective studies on the treatment of traumatic colorectal injury have shown that resection and anastomosis has become a new trend in managing colon injuries [8]. Therefore it has started to replace end colostomy in destructive injuries in many parts of the world. High speed weapons are now becoming more common in civilian trauma and therefore some surgeons still wish to divert these injuries due to fear of anastomotic leak which is a dreadful post-operative complication. In lieu of trying to avoid a second laparotomy for an end colostomy reversal; we at the Aga Khan University Hospital over the years have adopted an oncological principle to manage our destructive colon injuries. Since the year 2008 we have had our transition from resection and end colostomy formation to resection and anastomosis with a protective stoma; the reversal of which is less morbid, with a shorter second hospital stay and does not require a formal laparotomy [9]. We have been able to achieve this by increasing the number of damage control laparotomies over the years with the intent to stabilize the patient before a definitive surgery. There is scarcity of data on resection and anastomosis with proximal diversion on patients with destructive colon injuries in developing world.

Over the years our percentage of patients who underwent damage control laparotomy increased; in lieu of adherence to the acceptable principle [10]. This also helped us offer greater number of patients definitive treatment rather than giving an end stoma and come back for anastomosis later. Demetriades et al [11] in their prospective multicenter study reported that the type of surgical method does not affect the incidence of post-operative abdominal complications; same holds true for our study that there was no significant difference between the morbidity of patients who were similar in terms of demographics but subjected to different procedures.

M Tobra et al [8] reported post-operative morbidity to be

Table 3: Factors associted with post-operative morbidity - Logistic Regression.

Variable	Odds Ratio	95% Confidence Interval (Lower-Upper)	P-Value
pH < 7.35	3.7	1.098-12.56	**0.035**
Age > 45 years	6.7	1.2-37.1	**0.029**
> 4 packed cells in first 24 hours	5.1	1.4-17	**0.01**
Inotropes	3.8	1.1-15.3	**0.05**

19.7% in primary repair group and 32% in end stoma group. In our study the post-operative morbidity was slightly higher i.e. 26% in diverted group and 40% in end stoma group. This difference can be explained by the fact that Tobra et al [8] included patients even with non-destructive colon injuries who underwent primary repair and not resection with anastomosis which may have better outcomes. In our study the wound infection, abdominal abscess and leak rate in proximally diverted group was 22%, 3.7% and 3.7%; all of which were higher in comparison to Tobra et al which were 9.3%, 1.86% and 1.86%. The difference can again be explained by the fact that only few of their patients underwent resection and anastomosis while most of them had non-destructive injuries which is favorable for a better outcome. However, over the years our wound infection rate came down from 40% to 22% which can be attributed to better sepsis control and safe surgical techniques.

It was also seen that patients who received more than 4 packed cells within first 24 hours of arrival were found to have significant correlation with post-operative complications (OR 5.1 and p-value 0.01). This finding is also consistent with Demetriades et al [11] and Girgin S et al [12]. Our study also showed acidosis (pH < 7.35) and vasopressor use to be associated with development of post-operative morbidity. These risk factors have already been identified previously by Peter et al [13] and Ordonez CA et al [14].

Time to stoma reversal was significantly different between both the groups. The reason for the delay in reversal of end colostomy was that surgeons wanted their patients to completely recover from the first surgery before undergoing a second laparotomy for reversal.

This study is an initial experience from Pakistan to address the outcomes of gunshot victims with destructive colon injury. Our study also identifies the risk factors associated with complications in our population. Therefore keeping these factors in mind we can plan definitive management and counsel patients accordingly. A new group (Resection with anastomosis + protective stoma) which has seldom been mentioned in the management of destructive colon injuries in developing world has been identified and it has lesser morbidity for reversal in terms of type of surgery, lengthy of surgery and stay compared to endcolostomy [9]. Our study has a small sample size without multivariate analysis with retrospective data collection [15].

With reference to all the above studies we are able to suggest that this new group of resection and anastomosis with a protective stoma is as good as resection and anastomosis in terms of post-operative complications.

Conclusion

Based on our findings and literature review we conclude that morbidity at our center of managing destructive colon injuries is comparable to that of literature. Post-operative morbidity is independent of operative procedure. In high risk patients where the surgeon is uncomfortable with primary repair, Resection& Anastomosis with protective stoma which has seldom been mentioned in literature has acceptable morbidity and mortality with less morbid and early reversal of stoma.. However, for future directions we would suggest a multi-center study with a larger sample size with prospective data collection. More contributions are needed for this pertinent group (resection and anastomosis with protective stoma) in destructive colon injuries in developing nations.

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