ORIGINAL ARTICLE

Outcomes of primary repair in penetrating colonic injuries

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Abstract:
Primary repair in penetrating colonic injuries is the term used for surgical joining of colon (anastomosis) at the first operation without any intervening stage which was injured as a result of penetrating abdominal trauma caused by firearms, stabs and pellets of blast.
Objectives: To determine the outcomes of primary repair in patients with penetrating colonic injuries.
Study design: This is case series study
Setting of study: Department of Surgery, Sandeman Provincial Hospital, Quetta.
Duration of study: One year from15th of December 2015 to 15th of December 2016
Material and methods: 266 patients presenting to Surgical Department through emergency were studied for outcomes of primary repair of colon in penetrating colonic injuries. Data was recorded on specially designed proforma and was analyzed by using SPSS version 17.
Results: 266 patients presenting to surgical department Sandeman Provincial Hospital with penetrating colonic injury during a period of one year. The outcome of primary repair of our study shows that among 266 patients 209(78.5%) patients had uneventful recovery during their hospital stay. Among these 209 patients 193(92%) were males and 16(7.6%) were females. 57(21.4%) patients who developed complications after primary repair in which 53 (93%) were males and 4(7%) were females. Out of 57 patients who developed complications, 32(12%) patients developed wound infection, in which 30(11.27%) males, 2(0.75%) females. 10(3.7%) patients developed wound dehiscence, all were males.15(5.6%) patients developed intra-abdominal collection among them 13(86.7%) were males and 2(13.3%) were females.
Conclusion: Single stage management like primary repair in majority of penetrating colonic injuries is definitely better option.

Keywords: Penetrating colonic injury, primary repair (anastomosis) of colon.

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Introduction:

Abdominal trauma is source of significant mortality and morbidity with both blunt and penetrating mechanism.[1] Penetrating wounds are common in both military and civilian practice. Such injuries are frequently serious but a reduction in mortality in recent years reflects improved therapy. Patients with penetrating abdominal trauma are at risk of harboring life threatening injuries. Many patients are in need of emergent operative intervention. The frequency of penetrating abdominal injuries varies across the globe, relates to industrialization of developing nations, the weapons available and significantly to the presence of military conflicts so its frequency varies.[3] The most commonly injured organ is reported to be gut worldwide.[5]

The colon is the second most frequently injured organ after small bowel in penetrating abdominal trauma. In contrast, colonic injuries resulting from blunt trauma are rare and occur in 2-5% of patients.[5] Colonic trauma occurred in patients aged 19-28 years among them 83.5% were male in contrast to small group of female patients.[6]

Gunshot injury and stabbings are the most commonly quoted etiology, accounting for 67- 92% and 5-30% of colonic injuries, respectively.[7] Penetrating injuries of abdomen are at rise in Pakistan due to increasing violence interpersonal and communal clashes, robberies and increasing domestic violence. Colon because of its size and anatomical fixity is prone to injuries in these cases.[8]

The management of colonic injury has undergone progressive evaluation during last century, based in large part on the military experience during World War-II, surgeons returned to civilian practice from the battle field with the understanding and practice of universal fecal diversion.[9]

Management of penetrating colonic injuries in civilian trauma population has evolved away from diversionary stoma to primary repair or resection anastomosis.[10] It has been favored over colostomy as it carries advantage of avoidance of colostomy, post-operative colostomy care and re-hospitalization and reoperation in terms of cost and morbidity.[11]

For approximately 30 year time period, several international studies on the treatment of traumatic colonic injury showed that primary repair as well as resection and anastomosis became rapidly emerging method.[12] Previous studies have identified advancing age, associated injuries, rectal trauma, penetrating injuries and higher Injury Severity Score (ISS) to be associated with a worse outcome in colorectal trauma.[13] In penetrating injuries, the presence of destructive colonic injury has been associated with a fourfold increased incidence of death, while shock on admission and degree of fecal contamination are reported predictors of mortality.[14] Almost all complications are related to infectious agents due to colon wall destruction.

The national census in many studies, have concluded that primary repair of traumatic colonic injuries can be performed safely in almost all cases even warfare injuries.[8] As, post-operative complications like wound infection and intra-abdominal collection in primary repair is 14.28%, 2.85%[15] and wound dehiscence is 0%.[16]

Isolated colonic injury is rare. Signs and symptoms are not specific for colonic injury but early development of peritonitis with radiological evidence of free gas in the peritoneum may be suggestive. Diagnosis is often delayed when retroperitoneal colonic injury is present.[16] Large bowel injury requires immediate recognition to minimize mortality from blood loss and fecal contamination.[17] Sufficient resuscitation by fluids and transfusion is required, and efforts should be made to reduce hypothermia, hypotension, shock and acidosis, all of which can influence the morbidity and mortality rates. Next, tests and evaluation that assess colorectal injuries are required.[12]

As, no regional census among the expert surgeons exists for the repair of colonic injury by primary repair. Therefore, it is long being realized that primary repair of colonic injury in our setup should be adopted. If the studies show that healing with primary repair occur with less complication rate in terms of intra-abdominal collection, wound dehiscence and wound infection then, primary repair will be adopted by expert surgeons in our setup as method of choice in management of penetrating colonic injuries. As it has the advantage of avoidance of colostomy, post-operative colostomy care, re-hospitalization and re-operation in terms of cost and morbidity.

Material methodology:
Objectives: To determine the outcomes of primary repair in patients with penetrating colonic injuries.

Operational defination:

1. Penetrating Colonic injuries: There is history of penetrating abdominal injury with identification of colonic injury on laparotomy, and spillage of formed fecal matter from injured portion of the colon.

2. Primary repair: Surgical joining between two hollow or tubular organs at the first op-

eration without any intervening stage.

Outcomes:

1. Wound infection: Wound is characterized as infected if it shows any of the following characteristics i.e. pain (by visual analogue scale that is 0-3 mild, 3-7 moderate, 7-10 severe. Moderate to severe will be considered as pain), redness, pus discharge, bad odor or non-healing of wound (no granulation).

2. Wound dehiscence: It is the parting of all layers of surgical wound. Wound shows any of the following characteristics i.e. serosanguinous discharge, gut or omentum protruding through the wound.

3. Intra-Abdominal collection: Intra-abdominal collection is a pocket of infected fluid and pus located inside the abdominal cavity. Patient with clinical suspicion of intra-abdominal collection will have any of the following signs and symptoms like fever (> 100^0F), abdominal distention, hiccups, change in bowel habits (diarrhea).

Material and Methods:

Study design: Case series study.

Setting of study: Department of Surgery. Sandeman Provincial Hospital Quetta.

Duration of study: study was conducted for one year from 15th of December 2015 to 15th of December 2016.

Sample size: Sample size is calculated by taking P = 2.85%, d = 2% and n = 262.

Sampling technique: Non probability consecutive.

Inclusion Criteria:

All patients, male and female of age 15-50 years with single or multiple penetrating abdominal injuries either by gunshot, stab or blast pellet injury admitted through emergency department will be included in the study.

Exclusion Criteria:

1. Patients having pre-existing chronic illness like diabetes, tuberculosis, jaundice and chronic renal diseases will be excluded.

2. Patients with penetrating abdominal trauma having associated injuries to head, neck and chest will be excluded.

Methodology:

Primary Survey: Primary survey is a systematic rapid evaluation of the injured patient. The duration of study was 6 months. During study period, 266 patients came to emergency department. The study was conducted in Sandeman Provincial Hospital Quetta. There are two units in Surgical Department working on daily basis seven days a week. Sandeman Provincial Hospital, Quetta is the only tertiary care hospital providing health care facilities not only to the people of Baluchistan, but to some parts of Sindh and refuges from Afghanistan. Due to raised inter communal clashes, deteriorating law and order situation in Baluchistan and war in Afghanistan results in large influx of patients presented with penetrating abdominal injuries. Patients meeting the inclusion criteria that are all male and female patients age 15-50 years with penetrating abdominal injury suspicious of colonic injury were included in the study. Willing appropriate patients were admitted to the ward. Their hospital registration numbers were recorded and received by the staff on duty. In history special attention was paid to the mode of injury and weapon used. Patients were properly examined. Initial hospital care has two main components, the primary and secondary surveys.

On completion of the survey, the patient have established airways with cervical spine control, adequate ventilation and oxygenation, proper intravenous access and control of hemorrhage and inventory of the patients neurologic status and disability. All the patients undergone complete exposure with environmental control, privacy provided to all the patients. During the survey a rudimentary history was obtained from vitally stable patients.

Secondary Survey: The secondary survey followed the primary survey which is the complete head to toe examination of the patient designed to inventory all injuries sustained in the trauma.

After thorough examination, routine investigations were sent to the hospital laboratory and grouping and cross matching done. A proforma was attached to the history sheet. It includes the preliminary information such as name, age, gender, hospital registration number and time since injury was carefully recorded in the proforma.

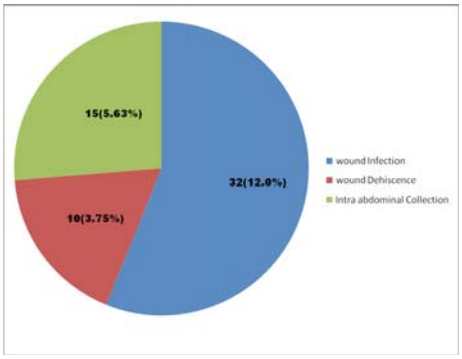
The patient as per our department protocol was re-evaluated by senior surgeon having experience of more than five years. The final decision to operate was made by them on their clinical judgment. Written informed consent was taken. These patients were educated and nature of study explained. Patients were made realize the importance of study for future planning. Nasogastric (NG) tube and Foley's catheter was passed. Patient was shifted to operation theatre (OT), when the patient, OT and anesthetist were ready. Patient was laid on theatre table. Anesthetist gave general anesthesia and muscle relaxant and passed endotracheal tube. At the time of induction, first dose of third generation cephalosporin 1gm and Metronidazole 0.5 gm intravenous (IV) given. Anesthesia was maintained by anesthesia assistant and anesthetist was available when help needed. Senior surgeon and assistant scrub their hands, wear sterile gowns and gloves. Patient is positioned supine; abdomen is exposed from nipple to mid-thigh, scrubbed with pyodine solution and methylated spirit and dried. Draping was done properly.

Surgical details of procedure: Midline skin incision was given from xiphisternum to pubic symphysis. Haemostasis of the wound is done. Peritoneal cavity opened in the line of incision. All blood and fecal contents in the peritoneal cavity were mopped. All the abdominal solid and hollow viscera and retroperitoneum were examined thoroughly for any injuries. Injured part of colon was identified; soiling of faecal matter was controlled by applying non crushing intestinal clamps. Non-viable margins were resected, haemostasis secured, and colon repaired in single layer interrupted, extra mucosal stitches by using Vicryl 2-0. Peritoneal cavity washed with 6 liters normal saline, mopped and single drain placed in pelvis and abdomen closed in layers and aseptic dressing applied. Then reversal was given to the patient, extubated and patient recovered from anesthesia, he/she shifted to the ward. And patient is kept nill per oral (NPO) for 5 days. During this period, patient was kept on IV fluids, IV antibiotics. Daily intake and output chart was maintained. Vitals recorded daily. Daily dressing of entrance and exit wound done and examined for infection. Renal function tests (RFTs) were done on alternate days and electrolytes balance maintained. On third post-operative day, dressing of the laparotomy wound changed. NG tube removed on 5th post-operative day after patient has passed flatus and stools. They were allowed to take oral sips of clear fluids on 6th post-operative day and semi-solids allowed on next day. On 9th post-operative day, patient was allowed to take full diet. During their stay in hospital, patients were examined for developing any complications like wound infection, intra-abdominal collection and wound dehiscence and data recorded on proforma. On 10th post-operative day, skin stitches were removed and patients were discharged if they recovered un eventfully.

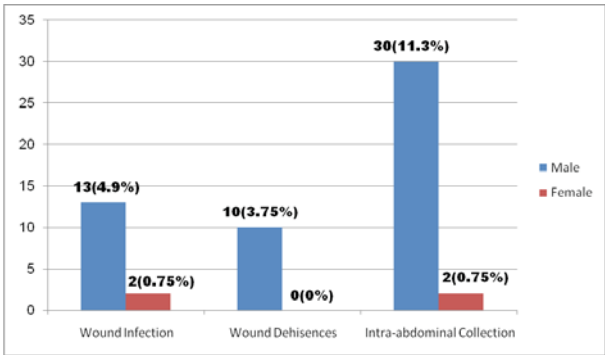
Data analysis procedure: The data was analyzed by SPSS version 17.0. Mean and standard deviation was calculated for age, frequency and percentages were calculated for gender and outcomes like wound infection, wound dehiscence and intra-abdominal collection. Value of $p < 0.05$ was taken as significant.

Results:

266 patients presented to Surgical Department Sandeman Provincial Hospital with penetrating colonic injury during a period of 6 months. Out of these 266, 246(92.5%) were male and 20 (7.5%) were female. Among both the male and female the minimum age of presentation was 15 years and maximum age of presentation was 55 with mean of 29.2 and standard deviation



Graph-1: Graphical presentation of patients distribution according to the complications



Graph-2: Outcomes with male & female distribution

of 10±28.

The outcome of primary repair of our study showed that among 266 patients, 209 (78.55%) patients went uneventful recovery during their stay at hospital. Among these 209 patients 193(92%) were males and 16(7.6%) were females. There were 57(21.4%) patients who developed complications after primary repair out of which 53(93%) were males and 4(7%) were females. It was seen that among 57 patients who developed complication, 32(12.0%) patients developed wound infection among which 13(4.9%) were male and 2(0.75%) were female. Among 10(3.75%) patients who developed wound dehiscence, 10(3.75%) were male and none of the female patient was seen. Among 15(5.63%) patients who developed intra-abdominal collections 30(11.3%) were male and only 02(0.75%) were female as shown in Graph no. 1 and 2.

Discussion:

Trauma is the most pressing public health problem, it is estimated that about 10-30% of hospital admissions in the world are due to injuries thereby increasing the burden on our health system in terms of both cost and time. Optimal care of severely injured patients requires a coordinate approach, from the point of injury to rehabilitation. It is important that the practitioners adopt a logical sequence for initial management of trauma patient to reduce morbidity and mortality; however the most significant impact on reducing the world burden of trauma will come from injury prevention.

Cases of penetrating abdominal injuries to our hospital are increasing day by day. Most patients were adult males in the age group of 15-50 years that makes the mean age of 32 years. There were 246 males (92%) and 20(7.5%) were females. Mean age among males is 36.4 years, and among females is 24.6 years. This result in double loss to country, first expenditure incurred in treatment of these victims and secondly being the most productive age group, it results in huge working hour loss. Earlier studies have reported similar incidence in affected age group18-20.

Data from Nigeria, South Africa and Saudi Arabia all show a similar predilection for high velocity firearm in their prospective series with male predominance. Maurice E et al[18] in their study on homicide and deaths in Peshawar concluded that males constitute 86.15% of the victims of homicide and 32% of the victims were in their third decade of life; Bashir et al in their 12 years study from Lahore concluded that 88% were males with 42% being in the range of 21-30 years. The higher incidence can be attributed to higher incidence of risk taking behavior of youth and having ready access to firearm in our society. As males are bread earners for the family and are therefore usually involve in outdoor activities exposing themselves to environmental diseases, war, violence and street quarrel.

During American civil war, abdominal wounds were almost fatal. In 1882, Mrion Sims emphasized the need for laparotomy but the mortality rate remained high that is 72%. It was until the end of World War-I, that operative management was replaced by expectant therapy and reduced the mortality rate down to 53.5%.[16]

Concerning civil colon injuries, in 1993 Keighley stated "in experienced hands, using a very selective policy in low risk patients, repair of single laceration in two layers, after excising any irregular edges, appears to be optimal surgical approach" thus supporting the policy of primary repair of right colon and diversion procedure for left colon injuries. Now a day, there is a definite trend towards increased use of primary repair in management of all penetrating colon injuries, independently of their location as mentioned by Lazovic RG, Barisic GI.[21]

Although many reports have been published on the procedure to be applied in colon injury, a solid algorithm has not yet been established. While colon injuries were managed conservatively before the world war-I, with experience gained in consequent wars, efforts were made to apply an improved surgical strategy. American surgeons association established colostomy as the gold standard in management of all colon injuries in 1943; this approach decreased the mortality rate from colon injury to 30-35%. Mortality rate was then declined to 10-15% with advances in resuscitation, antibiotic use, patient transfer in intensive care unit, colostomy was accepted as the main surgical treatment protocol in colonic injuries until late 1970s. Later, a landmark prospective study by Stone and Fabian published in 1979 suggested that several patients suffering from colon injuries who do not possess various risk factors could be managed successfully by primary repair. This study was followed by similar randomized prospective studies by Chappuis et al. in 2002 who all found that none of the factors for primary repair indeed affected the success of anastomosis and that all colonic injuries could be managed by primary repair.[22]

Numerous prospective randomized trials compared primary repair to diversion procedure, and demonstrated no significant difference in complication rates between groups. Several recent reviews analyzed the role of primary repair in the treatment of colon injuries and pointed out that in conditions of similar intensity of general and local trauma, and similar intraoperative findings, primary repair had better results regarding complications, deaths and final outcome. Controversy remains only in cases of destructive colon injuries requiring resection, whether they should be treated with or without diversion procedure. According to AAST results of prospective multicenter trial, three risk factors for intra-abdominal septic complications, independent from the method of repair were identified as severe fecal contamination, transfusion of more than four blood units and single antibiotic prophylaxis. However the concept of severe fecal contamination has not been clearly determined yet. The same author comparing data from other reports could not strongly support even these three criteria.[23] In our study there are only two main contraindication for performing primary repair of colonic injury, when it is combined with head, neck and chest trauma and patients with chronic illness like diabetes mellitus, tuberculosis, jaundice and chronic renal diseases because they could add bias to our results.

All patients received prophylactic antibiotics pre-operatively and additional post-operative antibiotics governed by ward protocol.

The outcome of primary repair of our study shows that among 266 patients 209 patients who make 78.5% had uneventful recovery during their stay at hospital. Among these 209 patients, 193 were males (92%) and 16 were females (7.6%). There were 57 patients (21.4%) who developed complications after primary repair in which 53(93%) were males and 4(7%) were females. In study conducted at department of surgery, University of Kansas, the overall morbidity was 23%,[24] which is almost similar to our results.

In our study, out of 57 patients who developed complications, 32(12%) patients developed wound infection, in which 30(11.27%) males, 2(0.75%) females. Wound infection was the most common complication; the incidence was comparable to other studies. This was due to contamination of intestinal contents because of colonic injury.[25]

In our study, 10(3.7%) patients developed

wound dehiscence, all of them were males. This is lower than the study previously performed by Chand S at el which was 4.87%.[8] 15(5.6%) patients developed intra-abdominal collection. Among them 13(86.7%) were males and 2(13.3%) were females. This is again lower than the study previously performed by Chand S at el which was 6%.[8] The abdominal collection after resection and end to end anastomosis was 2% in a study done by Clark and Conrad JK[26] which is comparable to our study.

Conclusion:
Single stage management like primary repair in the majority of penetrating colonic injuries is definitely better and recommended. Proper debridement or resection of damaged colon in case of lacerated wounds of colon affects the outcome of primary repair of colonic trauma. The proper peritoneal lavage also affects the primary repair. All the four quadrants of abdomen should be thoroughly washed with normal saline and mopped up.

Our study, suggest that the policy of primary repair of colonic injuries can be applied more liberally in majority of patients with high success rate. It was evident from the result of our study that primary repair is better option in penetrating colonic injuries in terms of reducing the miseries of the patients. It reduces the hospital stay, bed occupancy and with the short convalescent period. It has advantages of avoidance of colostomy, post-operative colostomy care and buying expensive colostomy rings and bags, hospitalization and re-operation in term of cost and morbidity.

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Role and contribution of authors:
Dr. Shoaib Ahmed Quershi, conceived the idea and wrote the initial write up.

Dr. Riffat Arbab, collected the data and references and help in writing the article.

Dr. Muhammad Iqbal Khan, collected the data and references and helped in the discussion writing

Dr. Maria Mehmood, also collected the references and helped in writing discussion and results.

Miss Hafsa Jaffar, collected the data and references

Dr. Aisha Arshad, collected the data and references and helped in the writing of introduction and discussion.

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