International Journal of Medical and Health Research
ISSN: 2454-9142
Received: 24-09-2019; Accepted: 28-10-2019
www.medicalsciencejournal.com
Volume 5; Issue 11; November 2019; Page No. 164-169

A clinical study of abdominal trauma with special reference to gastro-intestinal injuries

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Abstract
Background: Abdominal trauma constitutes for about 10% of all trauma deaths and out of all forms of trauma to the body, abdominal trauma is the most complicated to tackle because the abdomen harbours a good number of vital organs, which may be involved in any combination, thereby endangering the life of the patients**.** The majority of small and large bowel injuries are caused by penetrating injuries; however, blunt injuries, although infrequent, are difficult to diagnose because patients may present with subtle findings at the time of admission.
Aim: to evaluate the incidence of gastro–intestinal injuries according to age, sex and type of injury, common presenting features, frequency of its association with other injuries, its management and the different modalities of treatment, the effect of delay in treatment and the frequency of various complications
Methods: All patients above 10 years of age with gastric or intestinal injuries with or without associated injuries were included in the study. Injuries to the abdominal viscera other than stomach or intestine and injuries to rectum and anal canal were excluded from the study. 40 such cases of gastrointestinal injuries attended the hospital during the specified time period. After a rapid assessment of the patient to rule out life threatening injuries and securing a patent airway and correcting any circulatory imbalance with control of any active bleeding, a detailed history and physical examination of the patient was carried out and surgical intervention was done accordingly.
Conclusion: It can be said that morbidity and mortality associated with gastrointestinal injuries is quite acceptable if early treatment can be initiated. If appropriate surgery is performed without delay, the results are promising.

Keywords: abdominal, trauma, promising, injuries, gastro

Introduction
Trauma is the principal public health problem in every country regardless of the level of socioeconomic development. It remains the most common cause of death for individuals between ages of 1 and 44 years, and the third most common cause of death for all ages. Although, the liver and spleen are considered to be the most commonly injured organs following either blunt or penetrating abdominal trauma, injuries to the intestines and stomach with or without other associated injuries are quite common and are frequently encountered in emergency departments. Stomach and small bowel perforations are second in frequency only to liver following penetrating abdominal trauma. Moreover, the gastro–intestinal injuries are associated with a range of postoperative complications from intra–abdominal sepsis and abscess formation to intestinal fistulas and even intestinal obstruction. The operative management of colonic injuries is still controversial as to whether to carry out a primary repair or do a diversion by a colostomy.

Aims and Objectives
The present clinical study is conducted to evaluate the incidence of gastro–intestinal injuries according to age, sex and type of injury, common presenting features, frequency of its association with other injuries, its management and the different modalities of treatment, the effect of delay in treatment and the frequency of various complications. This study will also attempt to assess the overall morbidity and mortality of gastrointestinal trauma.

Materials and Methods
During the period of one year, all cases having stomach and intestinal injuries and admitted in any of the six surgical units of Assam Medical College & Hospital, Dibrugarh, were selected for the present study. The patients were personally studied from the time of admission to the time of discharge from the hospital and were followed up in their subsequent visits.
All patients above 10 years of age with gastric or intestinal injuries with or without associated injuries were included in the study. Injuries to the abdominal viscera other than stomach or intestine and injuries to rectum and anal canal were excluded from the study. Besides, children less than 10 years of age with gastrointestinal injuries were not included in this study. A total number of 40 such cases of gastrointestinal injuries attended the hospital during the specified time period. After a rapid assessment of the patient to rule out life threatening injuries and securing a patent airway and correcting any circulatory imbalance with control of any active bleeding, a detailed history, physical examination of the patient and proper investigation was carried out accordingly.

Preoperative Management
Resuscitation of patient done and patient prepared for

operation
- Intravenous fluids
- Blood transfusion as and when required
- Antibiotics
- Nasogastric intubation
- Catheterization of bladder
- Injection tetanus toxoid and immunoglobulin, anti-gas gangrene serum as necessary.
- Analgesics
- First aid treatment of associated injuries.

Type of Anaesthesia
General anaesthesia was used in all the cases.

Operation Done
Exploratory laparotomy and necessary surgical intervention carried out according to the nature of the injury.

Incisions
Incision placed according to the demand of the situation.
They were
- Midline incision
- Midline incision with extension laterally
- Paramedian incision

Postoperative Care
During the postoperative period. Special attention was given to the administration of intravenous fluids and blood transfusion in selected cases for correction of hypovolaemia, electrolyte deficiencies and anaemia.
Broad spectrum antibiotics were used routinely in all cases. Combinations of Cephalosporins like Ceftriaxone, Sulbactum and Metronidazole was used in most of the cases.
Analgesics were administered intravenously.
Nasogastric aspiration was carried out at regular intervals with the help of a Ryle's tube and urinary catheter was kept in situ to monitor the urine output.
Oral feeding was started after return of peristaltic sounds, initially with liquids and gradually allowing semisolid to solid foods.
Skin stitches were removed on 8—10 postoperative days. Drains removed when discharge was absent or minimal discharge was present.

Complications
Continuous monitoring of the patient from time to time was done in an attempt to detect postoperative complications, if any at the earliest possible. Recording of pulse rate, blood pressure, temperature, respiratory rate and pattern, input output charts, abdominal and cardiovascular system examinations was done at regular intervals. Complications when detected were managed promptly.

Discharge of Patients from Hospital
The following parameters were evaluated before discharging the patient from the hospital:
- General condition of the patient and his / her well-being.
- Condition of the operative wound and injury site.
- Examination of the abdomen for any complications.
- All the cases were advised to report for follow–up at surgical outpatient department after 2 weeks, 1 month, 3 month and 6 month intervals.

Results and observations

Table 1: Type & Mode of Injury in the Present Series

Types & mode of injury	Number of cases	Percentage (%)
Blunt Trauma:	18	45.0
▪ Road Traffic Accidents	6	15.0
▪ Fall from Height	5	12.5
▪ Assaults	3	7.5
▪ Sports Injury	2	5.0
▪ Others	2	5.0
Penetrating Trauma:	22	55.0
▪ Stab Injuries	14	35.0
▪ Firearm Injuries	3	7.5
▪ Arrow Injuries	1	2.5
▪ Gored by Animal	1	2.5
▪ Fall on Sharp Object	1	2.5
▪ Others	2	5.0

In the present study, stabbing was the commonest mode of injury in penetrating trauma cases. 14 cases out of 22 cases of penetrating trauma in the present series sustained trauma by stab injury (63.63%). Other modes of injuries were firearm injuries, arrow injuries, fall on sharp objects, animal induced injuries.
Amongst the blunt injury cases, road traffic accidents (RTA) were found to be the commonest mode of injury in the present study. Out of a total of 18 blunt trauma cases, 6 cases were due to RTA (33.33%). The next common mode of injury in this group was fall from a height. 5 cases out of total 18 cases sustained injury by falling from a height (27.7%). Other modes of injuries like physical assaults, sports injuries, stamped by animal were also observed in the present study.
In the present study, 14 patients were under the influence of alcohol during the occurrence of trauma. Thus 35% of the trauma victims were under the influence of alcohol according to the present study.

Age Incidence
The present series includes all the cases of gastrointestinal injuries in patients above 10 years of age. The highest number of cases were found in the age group of 20—29 years, followed by the age group of 31—39 years. From Table–2, it is evident that about two–thirds of cases of gastrointestinal trauma occur in the second and third decades of life.

Table 2: Age Distribution of Patients in Present Study

Age Group (in years)	Number of Cases	Percentage (%)
10—19	7	17.5
20—29	17	42.5
30—39	11	27.5
40—49	3	7.5
≥ 50	2	5.0

Sex Incidence
The present study reveals a male preponderance with 36 male patients (90%) against only 4 female patients (10%). The ratio of male: female was 10: 1.

Table 3: Sex Distribution

Sex	Number of Cases	Percentage (%)
Male	36	90.0
Female	4	10.0

Delay in Treatment

In the present series, out of 40 patients, 21 patients reached the hospital within 6 hours and 19 patients were late for treatment.

Table 4: Time lag between occurrence of injury and Hospitalization

Duration (Hours)	Blunt	Penetrating	Total	Percentage (%)
Within 6	11	10	21	52.5
After 6	7	12	19	47.5
TOTAL	18	22	40	100.0

Presenting Features

The presenting symptoms of the patients in the present study are tabulated below:

Table 5: Common Presenting Symptoms in the Present Series

Presenting Symptoms	Blunt	Penetrating	Total	Percentage (%)
Pain Abdomen	18	22	40	100.0
Distention	11	15	26	65.0
Nausea & Vomiting	10	4	14	35.0
External Wound	—	18	18	45.0
Evisceration	1	6	7	17.5
Shock	7	13	20	50.0
Constipation	10	4	14	36.0

From the above Table–5, pain abdomen was the commonest presenting symptom and was complained by all the 40 cases in the present study. Distention or fullness of abdomen is the second common presenting feature manifested by 65% of cases in the present series. External wounds and evisceration of organs were the presenting features in some of the cases of penetrating trauma. 50% of the patients in the present series came with features of shock.

Table 6: Common Physical Signs in the Present Series

Signs	Blunt	Penetrating	Total	Percentage (%)
Anaemia	16	15	31	77.5
Tenderness	18	20	38	95.0
Muscle Guarding	11	20	31	77.5
Liver Dullness Obliteration	8	4	12	30.0
Shifting Dullness	6	7	13	32.5
Absent or Sluggish Peristaltic Sound	15	18	33	82.5
Tachycardia	4	20	27	60.0

In the present study, tenderness could be elicited in 38 out of total 40 patients. Pallor was present in 31 cases and abdominal guarding felt in 38 patients. Other signs like obliteration of liver dullness, shifting dullness, absent or sluggish peristaltic sounds and tachycardia were observed in many cases in the present study as shown in the table above.

Table 7: incidence of isolated g.i. Injuries and associated injuries in the present study

Injury	Number of Cases	Percentage (%)
Isolated G.I. injuries	24	60.0
G.I. injuries & Associated injuries	16	40.0

Table 8: Distribution of Associated Injuries in the Present Study

Injuries	Number of Cases	Percentage (%)
Extremity Injuries	7	43.75
Head Injuries	4	25.0
Chest Injuries	3	18.75
Liver	1	6.25
Spleen	1	6.25
Pancreas	1	6.25

Of the extremity injuries in the present series, 3 cases had femur fractures, 1 case sustained fracture to both bones of leg, 1 had Colles fracture, 1 had fracture patella and 1 sustained a penetrating injury to the left thigh. All of the patients were treated adequately.

Chest injuries were observed in 3 patients with hemothorax in 2 patients and diaphragm injury in one in the present study. Intercostal water sealed drainage was employed in these patients and diaphragm repaired. Associated rib fractures were treated conservatively.

Injuries to other intra–abdominal visceras were treated at the same operation. The injury to the liver could be repaired by primary sutures. The splenic injury was treated by a splenectomy and the pancreatic injury was managed conservatively.

Findings at Laparotomy

All the 40 cases in the present study had injuries to the stomach or intestine. The relative frequency of their involvement as observed in the present study is tabulated below:

Table 9: Relative Frequency of Organs Injury in the Present Series

Organ Injury	Blunt		Penetrating	
	No.	(%)	No.	(%)
Jejunum, Ileum & Mesentery	16	88.0	10	45.0
Duodenum	—	—	1	4.5
Stomach	—	—	3	13.6
Colon	2	12.0	5	22.7

Table–9 shows that in the present study on gastrointestinal injuries, jejunum, ileum & mesentery injuries were found to be most common; both after blunt and penetrating trauma. Stomach injuries were seen in 3 cases of penetrating trauma. Colon injuries were observed in both penetrating and blunt trauma groups. Only 1 duodenal injury was seen during the course of the present study.

Injuries to abdominal visceras other than the stomach and intestines and without any associated injury to these structures were not included in the present study.

Complications

The complications observed in the present series were wound infection in 8 cases, fistulas in 2 cases; respiratory tract infection in 4 cases, generalized peritonitis in 1 case and wound dehiscence in 2 cases.

Table 10: Incidence of Complications in the Present Series

Complications	Number of Cases	Percentage (%)
Wound Infections	8	20.0
Respiratory Tract Infection	4	10.0
Fistulas	2	5.0
Generalized Peritonitis	1	2.5
Dehiscence	2	5.0

Mortality

In the present study, 3 patients expired. Thus rate of mortality in the present series is 7.5%.

Table 11: Relation between Type of Abdominal Injury and Mortality

Type of Injury	Number of Cases	Number of Cases Expired	Mortality (%)
Blunt Trauma	18	2	11.1
Penetrating Trauma	22	1	4.5

Hospital Stay

All the patients in this series were admitted to the hospital. The highest duration of stay was 60 days and average hospital stay was 14.5 days. Presence of associated injuries to extra–abdominal organs and postoperative complications were the leading factors in prolonging the hospital stay.

Table 12: Hospital Stay of the Patients in the Present Series

Hospital Stay (Days)	Number of Cases	Percentage (%)
1—9	2	5.0
10—19	24	60.0
20—29	10	25.0
≥ 30	4	10.0

From the above Table–12, it is clear that 60% of patients were discharged from the hospital before 20 days.

Follow–Up

Of the 37 patients discharged from the hospital, only 22 patients attended hospital for follow–up at two weeks and one month. All of them were doing well during the period. None of the patients in this group turned up at 3 months and 6 months despite being advised to do so.

Discussion

In the present clinical study, the highest number of cases were observed in age group of 21—30 years followed by the age group of 31—39 years. These findings are comparable with the studies of Collier & Grisworld [1], Davis JJ *et al* [2] who also have reported maximum number of cases in 21—30 years of age.

In the present study, males predominated, with the male: female ratio being 10: 1. 90% of the cases in the present series were males. This finding is comparable with B.W. Sathiyasekaran [3].

In the present series of 40 cases, out of 18 cases of blunt trauma, 15 cases were caused by accidents; while homicide was the most common cause accounting for 19 cases out of a total of 22 penetrating trauma cases. Thus, in blunt trauma group, accidental injuries were responsible for maximum number of cases in the present series. This finding is comparable with the studies of Hughes [4] *et al*, John Udeani [5]. In the penetrating trauma group, homicide was the major criminal status, comprising 19 out of 22 cases (86.3%).

In the present series, 22 cases of gastrointestinal injuries were caused by penetrating trauma and 18 cases by blunt trauma. Thus penetrating trauma was found to be more common in causing injuries to the stomach and intestines. Similar observations were made by Claudia E Goetter [6]. This is probably because of the relatively mobile portions of major part of intestine making them less susceptible to blunt trauma than the solid organs like liver, spleen. The stomach on the other hand is a relatively well protected structure and less than 1% of gastric wounds are due to blunt trauma.

Pain abdomen was the commonest presenting symptom observed in the present study. All the 40 patients in the present study complained of pain abdomen. This finding is comparable with the studies of Martin [7] & Loria [8]. Abdominal distention was observed in 65% of the cases in the present study. This was due to pneumoperitoneum, or ileus as a consequence of peritoneal irritation which was associated with most of the cases in the present study. Most of the patients with abdominal distention revealed hemoperitoneum in exploratory laparotomy. This tallies with the observations of the study by Salam (2003) [20]. Nausea, vomiting, was observed in 35% cases in the present series thus constituting a triad of symptoms with pain which supported the diagnosis of gastrointestinal injuries. This is comparable with the study by Loria [8]. Shock was recorded in 50% of patients in the present study which is comparable with the observations made by Webb *et al* (1985). Anemia was the commonest sign in the present series followed by abdominal tenderness, muscle guarding, obliteration of liver dullness, shifting dullness, absent or sluggish peristaltic sounds and tachycardia. These findings are in agreement with those of Loria [8], Grisworld [1] *et al.*

Various studies reveal a higher incidence of associated injuries along with gastrointestinal or abdominal injuries. But in the present study, incidence of associated injuries was found to be relatively less. The difference in the present study may be due to the smaller number of cases under study and because the above mentioned studies were carried out in industrialized cities with busy traffic where incidence of road traffic or industrial accidents were quite high. This may explain the increased incidence of associated injuries in such studies. In the present study, out of the associated injuries present in 16 patients, extremity injuries were observed in 7 cases (43.75%). This is comparable with the study by Kimura and Otsuka [9] who has reported extremity injuries in 48.6% cases. The second commonest associated injury was head injuries followed by chest injuries and injuries to other extra abdominal visceras. These findings are comparable with the study of Kimura & Otsuka[9]. Out of the 3 cases of stomach injuries observed in the present study, 2 of the cases were associated with other intra-abdominal injuries. The rarity of isolated gastric rupture has also been reported by Kumkum Singh, Samir Mehta *et al* [10].

Investigation

Hemoglobin estimations were done in all the cases in the present study. 31 cases out of the total 40 cases presented with anemia. But no relation could be established between

the degree of anemia and amount of blood loss in most of the cases. This is supported by the study by J.A. Salam one, (2003) [20] – normal hemoglobin and hematocrit results do not rule out significant intra-abdominal hemorrhage.

Radiological investigations were done in only few cases in the present study. Plain X–ray (PA) view was done in selected cases and revealed gas under the diaphragm suggesting perforation of stomach, bowel or other hollow visceras in 4 cases. Gas fluid levels was seen in 1 case. Abnormal findings on plain X–rays were seen in only 43% of patients with intestinal trauma (Raul N Uppot [11]. The observations made in the present study regarding the X–ray findings are not of much significance as the no. of patients was small and X–rays were not done in all the patients.

Ultrasonography abdomen is relatively poor for diagnosing acute hollow visceral perforation, although can provide rapid evaluation of any injury to the solid organs (Maingot, 10th Edition). So, it was done only in the very few cases where injury to solid organs was suspected.

Contrast CT scan of the abdomen is less sensitive in detecting hollow viscus or diaphragmatic injures (Kearnay PA) [12]. However, helical CT is regarded to be very sensitive in detecting hollow viscus injuries. An overall sensitivity of 94% in detecting bowel injury was reported by Killeen KL *et al* [13].

Management

Resuscitation and appropriate measures to combat shock is a priority in most of the trauma victims. The importance of combating shock was also stressed upon by Lucas [14]. This was followed by a search for other life threatening injuries in the patients in the present series. All the patients in the present series received a pre–operative dose of antibiotic in the form of Cephalosporin. David [2] *et al* also suggests use of intravenous Cephalosporin. Exploratory laparotomy was done in all 40 patients of the present series. All the patients had either injuries to the stomach and/or intestines. Jejunum, Ileum and Mesentery grouped together constituted most of the injuries following both blunt and penetrating trauma. Jejunum, ileum and mesentery was found to be commonly involved by both blunt and penetrating trauma. EE Moore [15] *et al* reported incidence of small bowel injury as 16% following blunt trauma. Raul N Uppot [11] reported that 5% of blunt trauma patients have intestinal or mesenteric injuries. But the present study has recorded involvement of the jejunum, ileum and mesentery in 88% cases of blunt trauma. This difference is due to the selection of only gastrointestinal injuries for the present study. Solid organ injuries which were more common following blunt trauma were excluded from the study which is responsible for the increased incidence of involvement of these organs in the present series.

Operative Procedures Performed

Stomach: Gastric lacerations were repaired in two layers — inner layer with 2–0 catgut or 2–0 vicryl and outer seromuscular layer with 2–0 silk. Robert A Read [16] *et al* also advocated similar procedures. Gastric resection was not required in any of the cases.

Duodenum: Only 1 case in the present study had small tear in the 2nd part of the duodenum which was repaired in two layers; inner with absorbable sutures and outer layer with 2–0 silk. Juan A. Asensio and Walter Forno[17] also reported that 75–85% of duodenal injuries can be repaired primarily which is agreeing with the present study. Extensive procedures in the duodenum were not required to be done in the present study.

Jejunum, Ileum & Mesenteric Injuries: Most of the small bowel injuries were small tears and were repaired in two layers on the transverse axis of the intestine. The mesenteric tears observed in the present study were minor and no bowel resection for mesenteric vascular injury was required. In 4 cases, resection of bowel and restoration of continuity by an end to end anastomosis had to be done. Three of these cases had multiple perforations in jejunum and/or the ileum. One case had a grossly lacerated non-viable portion of ileum.

Colon: Of the total 7 colon injuries in the present study, 2 of the patients were treated by primary repair. George[18] *et al* have also advocated primary repair of the colon. One case had complete transection of hepatic flexure and was treated by an end to end anastomosis. Exteriorization or colostomy was done in two cases because of doubtful viability. One case with gangrene of the ascending colon was treated by temporary ileostomy followed by ileotransverse anastomosis.

Associated injuries to the other intraabdominal visceras were usually dealt with at the same operations. Eviscerated omentums found in association with few of the cases were resected after cleaning with normal saline and checking for any perforation.

Complications

All the patients in the present clinical study were monitored from time to time during the postoperative period. Some of them had complications necessitating special care and management. Some of complications observed in the present clinical study are tabulated below.

Table 9: Comparison of the Incidence of Postoperative Complications with Previous Study

	Wound Infection	RTI	Fistulas	Generalized Peritonitis	Dehiscence
	Percentage (%)				
Anderson & Ballinger (1979) [19]	16.00	—	6.00	4.00	—
Present Series (2004)	20.00	10.00	5.00	2.50	5.00

Thus wound infection was the commonest complication in the present series which is comparable with previous reports by Anderson & Ballinger [19]. The variability in the incidence of other complications may be attributed to the limited number of cases in the present study.

Mortality

There were 3 mortalities in the present series out of which 2 sustained blunt injuries. The table below shows the mortality rates of various series.

The overall mortality rate in the present series was 7.5%.The present study reveals mortality rate of 11.1% following blunt trauma. This is comparable with findings of

J.A. Salam one [20] who reported as 6% and with the report of National Paediatric Trauma Registry who reported it as 9%.

Mortality rate following penetrating trauma was found to be 4.5% in the present series. This tallies with the figure of 5% as reported from many trauma centres (Lewis Kaplan, 2003)

It was observed in the present study that morbidity and mortality was increased by certain factors like presence of shock at presentation, delay in treatment, presence of peritonitis and associated injuries.

Hospital Stay

In the present study 60% cases had to stay in the hospital for an average duration of 14.5 days. Slightly higher duration of hospital stay in the present study can be attributed to the lack of facilities as compared to bigger centres which may allow early discharge from the hospital following operations.

Conclusion

Gastrointestinal injuries comprise the majority of abdominal trauma cases which are quite frequent in this part of the country. Such injuries commonly follow penetrating wounds, which are usually homicidal in nature, the mode of injury being variable. Stabbing is a common form of violence in this part of the country and like many other places, Road Traffic Accidents (RTA) are responsible for most of the blunt injuries to the stomach and intestines. Because of the nature and mode of such type of injury young males understandably are the classical sufferers. Alcohol intake is a contributory factor towards the increasing incidence of such injuries. The presenting symptomatology is variable, but in all patients with suspected gastrointestinal injuries, exploratory laparotomy is regarded as the best diagnostic as well as therapeutic modality before embarking upon a definitive procedure. Of the gastrointestinal injuries, jejunum, ileum and mesentery were the commonest organs involved following either blunt or penetrating trauma. Associated injuries to other organs were not rare.

In conclusion, it can be said that morbidity and mortality associated with gastrointestinal injuries is quite acceptable if early treatment can be initiated. If appropriate surgery is performed without delay, the results are promising.

References

1. Grissworld RA, Collier HS. Int Abst Surg, 1961; 112:309.
2. Davis JJ, Cohn I Jr, Nance FC. Diagnosis & Management of Blunt Abd Trauma. Ann Surg. 1976; 183(6):672-8.
3. BW Sathiyasekaran. Population based cohort study of injuries. Injury. 1991; 27(10):695-98.
4. Hughes TM. Intra-abdominal gastrointestinal injuries following blunt trauma. Injury. 2002; 33(7):617-26.
5. John Udeani. Abdominal trauma, Blunt; Los Angeles County King/Drew Medical Centre, 2004.
6. Claudia E Goetter, William F Fallon Jr. Colon/rectal injuries. Trauma Management, 2000; 32:340.
7. Martin. Am J Surg, 1933; 21:17
8. Loria FL. International. Nat Abs Surg, 1958; 89:521.
9. Kimura Otsuka. Review of Annual Meeting, Western Trauma. Association Colorado, 1991.
10. Kumkum Singh, Kailash Songra, Samir Mehta. Isolated gastric perforation in blunt abdominal trauma. IJS. 1999; 61:384-86.
11. Raul N Uppot, Bowel Trauma. Diagnosis & Management, 2001.
12. Kearney PA Jr, Vahey T, Burney RE. Computed tomography in blunt abdominal trauma. Arch Surg, 1989, 124.
13. Killeen KL. Helical computed tomography of bowel & mesenteric injuries. J Trauma. 2001; 51(1):26-36.
14. Lucas CE. Surg Clin N Am, 1977; 57:57.
15. EE Moore, KL Mattox, DV Feliciano. The Trauma to the Abdomen. J Trauma, 2002.
16. Robert A Read. Blunt & Penetrating abdominal trauma. Maingots Abdominal Operations, 1997, 763.
17. Juan A Asensio, Walta Forno. Duodenal injuries. Trauma Management, 2000; 31:333.
18. George SM, Fabian TC. Primary repair of colon wounds. Ann Surg, 1989; 209:728.
19. Anderson CB, Ballinger WF. Management of Trauma, 3rd Ed, 1979, 411-13.
20. Joseph A Salamone. Abdominal trauma, blunt abdominal injuries. Kansas City School of Medicine, 2003.