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Gastrointestinal Injuries in Blunt Abdominal Traumas

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Rezumat

Leziuni gastrointestinale în contuziile abdominale

Scop: de a discuta eficiența scorurilor RTS (Revised Trauma Score - Scorul traumatic revizuit), ISS (Injury Severity Score - Scorul de severitate lezională) și a factorilor ce influențează mortalitatea și morbiditatea în leziunile gastrointestinale datorate contuziilor abdominale.

Metodă și pacienți: pacienții cu leziuni gastrointestinale datorate contuziilor abdominale operați în ultimii 6 ani au fost studiați retrospectiv, în ceea ce privește date demografice, mecanismul leziunii și localizarea, leziuni asociate, RTS și ISS, tehnica operatorie, morbiditatea, mortalitatea și durata spitalizării.

Rezultate: din cele 18 cazuri studiate, cauza leziunilor a fost accident rutier în 11 cazuri (61,1%), cădere de la înălțime în 5 cazuri (27%) și agresiune fizică în 2 cazuri (11%). La cei 18 pacienți s-au identificat 21 de leziuni gastrointestinale (11 la nivel intestinal, 6 la nivelul colonului, 3 duodenale, 1 la nivelul stomacului). 10 (55,6%) au prezentat leziuni intra-abdominale asociate, în timp ce numărul leziunilor extra-abdominale a fost de 12 (66.7%). Sutură primară (10), rezecție segmentară (9) și excluzie pilorică (2) au fost tipurile de operații practicate în cele 21 de cazuri. Deși fără semnificație statistică, pacienții cu leziuni asociate -13(72.2%) - comparativ cu cei cu leziuni gastrointestinale izolate -5 (27.8%) - au prezentat valori mai mici ale RTS (7,087/7,841), mai crescute ale ISS (19,4/12,2), perioadă de spitalizare mai lungă (11,5/8,4 zile), precum și rate mai crescute ale morbidității (7/1) și mortalității (2/0). Comparând scorurileRTSla pacienții cu și fără morbiditate consecutivă leziunilor (7,059/7,490) nu s-au decelat diferențe semnificative. Totuși, scorul ISS (23,9/12,2) a fost semnificativ mai crescut la pacienții care au dezvoltat morbidități (p=0,003). Scorurile RTS (6,085/7,445) și ISS (39,5/14,6) la pacienții care au supraviețuit au fost semnificativ diferite față de cele corespunzătoare pacienților care nu au supraviețuit (p=0,037, respectiv p=0,023)

Concluzii: leziunile asociate cresc, deși nu semnificativ, morbiditatea, mortalitatea și perioada de spitalizare la pacienții cu leziuni gastrointestinale datorate contuziilor abdominale, chiar și în cazurile în care s-a intervenit rapid chirurgical. Scorul ISS crescut este corelat semnificativ cu riscul crescut de morbiditate și mortalitate, în timp ce scorul RTS scăzut se corelează semnificativ doar cu riscul de mortalitate.

Cuvinte cheie: leziuni gastrointestinale, contuzii abdominale, Scorul traumatic revizuit, Scorul de severitate lezională

Abstract

Aim: To discuss the efficiency of RTS (Revised Trauma Score), ISS (Injury Severity Score), and factors that affect mortality and morbidity in gastrointestinal injuries due to blunt trauma.

Method and methods: Patients with gastrointestinal injuries due to blunt trauma operated within the last six years have been studied retrospectively in terms of demographics, injury mechanism and localization, additional injuries, RTS

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and ISS, operative technique, morbidity, mortality and duration of hospitalization.
Findings: Of the eighteen cases, cause of injury was a traffic accident for 11 (61.1%), fall from height for 5 (27%) and physical attack for 2 (11%). Among the eighteen patients, there were 21 gastrointestinal injuries (11 intestinal, 6 colon, 3 duodenum, 1 stomach). 10 (55.6%) had additional intra-abdominal injuries while the number for extra-abdominal injuries were 12 (66.7%). Primary suture (10), segmentary resection (9) and pyloric exclusion (2) were the operations performed for the twenty-one gastrointestinal injuries. Although statistically not significant, 13(72.2%) patients with additional injuries compared with 5 (27.8%) patients with isolated gastrointestinal injuries, were found to have lower RTS (7.087/7.841), higher ISS (19.4/12.2), longer duration of hospitalization (11.5/8.4 day) as well as higher morbidity (7/1) and mortality (2/0) rates. Comparing the RTS (7.059/7.490) of patients who have and have not developed morbidity revealed no significant difference. However, ISS (23.9/12.2) was significantly higher in patients who have developed morbidity (p=0.003). RTS (6.085/7.445) and ISS (39.5/14.6) of patients who have survived were significantly different than patients who have not (p=0.037 and p=0.023, respectively)
Conclusion: Additional injuries in patients with gastrointestinal injury due blunt abdominal traumas increases, although not significantly, morbidity, mortality and duration of hospitalization even when operated early. High ISS is significantly related to the risk of both morbidity and mortality while low RTS is significantly related only to the mortality risk.

Key words: gatrointestinal injuries, blunt abdominal trauma, Revised Trauma Score, Injury Severity Score

Introduction

Even though gastrointestinal injury is common for penetrating abdominal injuries, it is less frequent for patients with blunt abdominal trauma, and is parallel to the patient volume of the trauma center (1). Diagnosis and treatment of gastrointestinal injuries are delayed mainly due to the widespread use of non-operative procedures based on CT findings and the fact that physical examination is both difficult and unreliable for most of the cases (2). Our study aims to discuss the efficiency of RTS (Revised Trauma Score), ISS (Injury Severity Score), and the factors that influence the mortality and morbidity rates in gastrointestinal injuries due to blunt trauma.

Material and Methods

Records of the 236 patients who presented to the GOP-Taksim Education and Research Hospital between January 2008 and March 2014 for blunt abdominal trauma have been analysed. 18 (7.62%) patients with gastrointestinal injury were evaluated retrospectively in terms of demographic findings, mechanism and localization of injury, additional intra-abdominal or extra-abdominal injuries, RTS, ISS, surgical technique applied, morbidity, mortality and duration of hospitalization.

Using MedCalc 13.2.2.0, comparisons were made through Mann-Whitney U and Fisher's exact tests.

Findings

Female to male ratio was 1/5. Mean age was 44.8 (13-65).

Cause of gastrointestinal injuries was traffic accident for 11 patients (61.1%), fall from height for 5 patients (27.7%) and physical attack for 2 patients (11.1%).

The injured gastrointestinal organs and the surgical management procedures are displayed on *Table 1*. 10 (55.6%) patients had additional intra-abdominal injuries, and 12 (66.6%) patients had additional extra-abdominal injuries (see *Table 2*). Upon arrival, hemodynamic situation was assessed based on systolic arterial pressure measures and pulse rate; patients whose blood pressure was lower than 90 mmHg, had higher pulse rate than 100 and who did not recover after a fast resuscitation were diagnosed to be hemodynamically instable and taken to surgery. 5 (27.8%) patients were operated

Table 1. *Localization of the gastrointestinal injury and the surgical procedures applied*

Single gastrointestinal injury (N=16, 88.9%)	**N**	**Surgery**
Small intestine resections	9	6 primary sutures, 3 segmentary
Duodenum suture	3	2 pyloric exclusions, 1 primary
Sigmoid colon	3	3 segmentary resections
Transverse colon	1	1 segmentary resection
Total	**16**	
Multiple gastrointestinal injuries (N=2, 11.1%)		
Small intestine, cecum	1	1 segmentary resection, 1 primary suture
Small intestine, stomach, transverse colon	1	1 segmentary resection, 2 primary suture
Total	**2**	
Global Total	**21**	**10 primary sutures, 9 segmentary resections, 2 pyloric exclusions**

Table 2. *Localization and distribution of additional injuries*

Intra-abdominal additional injuries:	**N**	**Extra-abdominal additional injuries:**	**N**
Spleen	3	Thorax	5
Pancreas	3	Pelvis fracture	3
Liver	2	Head trauma	3
Kidney	1	Lumbar vertebra fracture	1
Bladder	1		
Total	10	Total	12

immediately (two deceased patients were also in this group), and the remaining 13 (72.2%) were operated after the development of acute abdominal findings within 8-50 hours.

Patients only with an isolated gastrointestinal organ injury were taken to surgery within an average of 23.1 ± 16.7 (8-50) hours while those with intra-abdominal solid organ injury were operated within the first two hours of arrival.

RTS and ISS of the 5 (27.8%) patients who had no other injuries other than an isolated gastrointestinal injury were 7.841 and 12.2 ± 5.5 (4-16) respectively. There were no mortality in these patients, and only one of them (20%) developed morbidity (wound infection).

Gastrointestinal injury patients with additional organ injuries had a mean RTS of 7.087 ± 0.870 (6.085-7.841) and ISS of 19.4 ± 10.2 (9-45). 7 (%53.8) of these patients developed 9 morbidities (wound infection: 4; ARDS: 3; colon fistula:1 1; atelactasia:1), and 2 of them were lost (2/13: 15.4%) (total mortality: 2/18: 11.1%; total morbidity: 8/18: 44.4%).

There were no statistically significant differences between the 5 patients with isolated gastrointestinal injuries and the patients with additional organ injuries in terms of RTS and ISS (p=0.09 and p=0.08, respectively).

Comparing the RTS and ISS of the patients who have and have not developed morbidity (RTS (7.059 ± 0.874) and ISS (23.9 ± 10.3); RTS (7.490 ± 0.740) and ISS (12.2 ± 4.7), respectively) revealed no statistical significance for RTS; but the difference was significant for ISS (p=0.003) RTS (6.085) and ISS (39.5 ± 7.8) of the died patients were significantly different from the RTS (7.445 ± 0.722) and ISS (14.6 ± 5.1) of the survivors (p=0.037 and p=0.023, respectively).

Mean duration of hospitalization for patients with isolated gastrointestinal injury was 8.4 ± 0.9 (8-10) days. For patients with additional injuries, it was 11.5 ± 5.3 (6-25) days. The difference was not significant (p=0.233). Mean of hospitalization length in general was 10.6 ± 4.6 (6-25) days.

FAST (Focused Assessment with Sonography in Trauma) was performed in the emergency department to 8 patients (44.4%). Findings were normal for two of these patients while the remaining 6 presented intra-abdominal pathological findings (free fluid, solid organ injury).

12 patients (66.6%) underwent Computerized Tomography (CT) scan within the emergency conditions. CT revealed no abdominal pathologies in 4 of the patients. Among the remaining 8, 10 findings including free fluid (6), solid organ injuries (2), thickening of the mesentery/hematoma (1), and free air (1) were detected.

The 4 cases which were, under the emergency conditions, initially evaluated as normal were operated with a delay of 14 to 24 hours. Only one of these cases had a control CT after 15 hours, and it revealed a change in radiological findings (free air due to duodenum second part injury was detected). The exploration decision taken for the remaining 3 patients is related to the development of acute abdominal findings. Duodenum third part injury, large mesentery injury that requires small bowel resection and perforation due to colon wall hematoma were found in these patients.

FAST and CT were able to detect free fluid in 6 patients with solid organ injuries. For one of these patients, CT also revealed the presence of free air.

Discussion

The gastrointestinal injury rates for acute abdominal traumas are usually reported as 5-17% in general while the number goes up to 70-85% for motor vehicle accidents (3,4). For the motor vehicle injuries in our series, this ratio was 61.1%. Seat belts have decreased the mortality rates, but it has increased the gastrointestinal injury rate due to the "closed loop" mechanism formed within the abdomen and the related morbidity (3).

Wilson (5), Valt (6), and later Vance (2,3,7) attempted to explain the mechanisms for gastrointestinal organ injuries in blunt abdominal traumas in three different ways. In the first mechanism, gastrointestinal organs get crushed between the spinal bones in the back and a solid surface (seat belt) in the front. Through this, lacerations in gastrointestinal organs and mesentery are observed or hematoma that may later be perforated develops at the gastrointestinal organ wall. In addition, these hematomas were argued to cause, at times, delayed narrowness (8). These types of injuries usually develop on the duodenum or transverse colon. In the second mechanism, it takes place as a result of fast deceleration especially near the fixated areas, and causes full lacerations in either the bowel or the mesentery, and bleedings in the mesentery. The third mechanism also occurs near the fixated areas, especially near the Treitz ligament (within 15-60 centimeters) or the sigmoid colon, by an explosion due to the sudden elevation of pressure within the bowel, causing laceration (5).

If the physical examination provides findings for lesions in abdominal-thoracic skin that are similar to "seat belt" lesions, gastrointestinal injury becomes a possibility. When this lesion is accompanied by free fluid in abdominal CT or fractures in thoracolumbar vertebrae (Chance fracture), the possibility becomes even greater (1, 2, 6, 9, 10). In our series, of the 3 patients with such findings, 2 were later diagnosed with a sigmoid colon while the other had injury in the proximal side of the small intestine.

Even though the use of FAST and highly developed CT devices are widespread, diagnosing a gastrointestinal injury in patients with blunt trauma is still difficult (11). FAST, used as the first evaluation method in emergency situations for patients with abdominal injuries, has two disadvantages; first, it is dependent on the interpretation of the sonographer and second, the method has low sensibility. In one study, FAST was found to show the intra-abdominal free fluid only in 34% patients who require surgery (12). Another study reported that FAST could display only the 38.5% of GIS traumas (13). In the Emergency Unit of our hospital, FAST was used for 8 patients (44.4%). Of these patients, 2 came up with normal findings, and intra-abdominal pathological findings (free fluid, solid organ injury) were detected on the remaining 6(75%).

Using CT for a trauma patient is still a controversial topic. Among the argued disadvantages are the times lost in oral contrast preparation, low rates of the expected free air and

extraluminal contrast leakage, and the aspiration hazard due to the oral intake of the contrast. On the other hand, it is also argued that, when the small intestines are properly filled, an abdominal CT could even show the mesentery and intramural hematomas (2).

CT findings that indicate gastrointestinal organ injury can be summarized as intra-abdominal free air, mesenteric thickening, leakage of the contrast substance outside lumen, intramural air, and intra-abdominal free fluid without any solid organ damage (11). The most frequent CT finding is the "free fluid"; when found alone, it leads to 67% false positives (7, 9). However, if seen without solid organ injuries, the value of the finding increases (2, 5). CT findings have a 36% true positive value when alone, but when there are multiple findings, the number goes up to 83% (2, 14). Even though free air is a specific finding, it is only observed in less than 60% of the patients with gastrointestinal injury (6, 7); this situation is thought to be related to a restricted amount of air in the gastrointestinal system, post-traumatic spasm development and early (<2 hours) CT scan (7, 15, 16). Intramural hematoma is a serious symptom that can be observed in 70-80% of the empty organ injuries (6). For patients with acute trauma, CT has 64-95% sensitivity and 97-99% specificity in showing empty organ damage (11, 7, 17, 18).

In one study, which has covered 95 centers and 85643 abdominal blunt trauma cases, Watts and colleagues have reported that, contrary to the literature, frequency of gastrointestinal organ damage was only 1.2% (19), and the most frequently damaged organ was the small intestine (14). The latter observation was repeated in our study as well.

Routine use of CT for especially hemodynamic stable trauma patients has made conservative treatments as a standard, and pushed DPL almost completely out of the routine practice because of increased nontherapeutic laparotomy; however it has a handicap causing a delay in diagnosis for acute trauma related gastrointestinal injuries. Fakhry and colleagues have conducted a study with 198 patients and reported that delays over 8 hours increase mortality and morbidity (20). Hughes and colleagues, on the other hand, studied 74 patients and concluded that diagnostic delays do not have a meaningful effect on mortality, but they increase morbidity (21). In our series, both deaths were patients who were immediately taken to surgery.

Many other studies have established that high ISS value is an efficient indicator for mortality in acute trauma related gastrointestinal injuries (19, 21, 22). In our series, extent of both the ISS and the RTS values were shown to be significantly parallel to mortality. In addition, while ISS value had a significant relationship with morbidity in our patients, RTS scores failed to provide a relationship as such.

Factors such as morbidity, mortality, duration of hospitalization, and ISS are expected to be higher in the presence of additional injuries while RTS is expected to be lower. Even though we have observed some differences in our study, the fact that these differences were not statistically significant may be due to the limited number of our cases.

Conclusion

Based on the limited number of cases studied, it can be argued that patients who have gastrointestinal injuries due to acute abdominal traumas, even if operated early, show increases in morbidity, mortality and duration of hospitalization (although statistically not significant). High ISS is found to be significantly related to morbidity and mortality risk while low RTS is only related to mortality risk.

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