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Concomitant hollow viscus injuries in patients with blunt hepatic and splenic injuries: An analysis of a National Trauma Registry database

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ABSTRACT

Introduction: Non-operative management has become the standard approach for treating stable patients sustaining blunt hepatic or splenic injuries in the absence of other indications for laparotomy. The liberal use of computed tomography (CT) has reduced the rate of unnecessary immediate laparotomies; however, due to its limited sensitivity in the diagnosis of hollow viscus injuries (HVI), this may be at the expense of a rise in the incidence of missed HVI. The aim of this study was to assess the incidence of concomitant HVI in blunt trauma patients diagnosed with hepatic and/or splenic injuries, and to evaluate whether a correlation exists between this incidence and the severity of hepatic or splenic injuries.

Methods: A retrospective cohort study involving blunt trauma patients with splenic and/or liver injuries, between the years 1998 and 2012 registered in the Israel National Trauma Registry. The association between the presence and severity of splenic and/or liver injuries and the incidence of HVI was examined.

Results: Of the 57,130 trauma victims identified as suffering from blunt torso injuries, 2335 (4%) sustained hepatic injuries without splenic injuries (H group), 3127 (5.4%) had splenic injuries without hepatic injuries (S group), and 564 (1%) suffered from both hepatic and splenic injuries (H + S group). Overall, 957 patients sustained 1063 HVI. The incidence of HVI among blunt torso trauma victims who sustained neither splenic nor hepatic injuries was 1.5% which is significantly lower than in the S (3.1%), H (3.1%), and H + S (6.7%) groups. In the S group, there was a clear correlation between the severity of the splenic injury and the incidence of HVI. This correlation was not found in the H group.

Conclusions: The presence of blunt splenic and/or hepatic injuries predicts a higher incidence of HVI, especially if combined. While in blunt splenic injury patients there is a clear correlation between the incidence of HVI and the severity of splenic injury, such a correlation does not exist in patients with blunt hepatic injury.

Introduction

Non-operative management has become the standard approach for treating stable patients sustaining blunt hepatic or splenic injuries [1]. In properly selected patients, the success rate exceeds 80% [2,3], thus decreasing the need for blood transfusions and the rate of abdominal complications [4–6].

Currently, computerised tomography (CT) is the imaging modality of choice for evaluating stable blunt abdominal trauma victims [7]. Although its reliability in detecting abdominal solid

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organ injuries is well established [8,9], its diagnostic value in the diagnosis of hollow viscus injury (HVI) in the immediate evaluation of trauma victims is debated. In patients diagnosed with blunt splenic and/or hepatic injuries, the reported rate of HVI ranges from 0% to 13% [3,10–12].

The wide acceptance of non-operative management in blunt splenic and hepatic injuries on one hand, and the relatively low sensitivity of CT in diagnosing HVI on the other hand [13], has generated concern regarding a possible increase in the incidence of missed HVI. This concern is underscored when taking into consideration the high reported morbidity and mortality among patients with HVI secondary to blunt trauma [14,15], with delay in the diagnosis and treatment causing morbidity and mortality to increase further [16–19]. On the other hand, overly aggressive management may result in non-therapeutic laparotomies, which are associated with increased morbidity and longer hospitalization [20,21].

The aim of our study was to assess the incidence of a concomitant HVI among patients with blunt splenic and/or hepatic injuries, and to evaluate whether a correlation exists between this occurrence and the severity of hepatic or splenic injuries.

Patients and methods

We performed a retrospective cohort study involving blunt trauma patients with splenic and/or liver injuries, between the years 1998 and 2012. The data was obtained from the records of the National Trauma Registry maintained by Israel's National Center for Trauma and Emergency Medicine Research, in the Gertner Institute for Epidemiology and Health Policy Research. This institute records information concerning trauma patients hospitalised in 19 hospitals of which six are Level I and thirteen are Level II trauma centres. Close to its foundation in 1998, the National Trauma Registry included 8 trauma centres and with gradual accreditation, in 2012 it incorporated 19 trauma centres.

Data collected in the registry included age, gender, mechanism of injury, severity of splenic and liver injury, Injury Severity Score (ISS), the presence of HVI and its anatomical location, and mortality. Splenic and liver injuries were independently classified as either minor (American Association for the Surgery of Trauma [AAST] grades I and II injuries), moderate (AAST grade III), major (AAST grade IV), or massive (AAST grade V for splenic injuries, and grades V and VI for hepatic injuries). The incidence of concomitant HVI was assessed among patients with blunt hepatic injury alone (H group), blunt splenic injury alone (S group), and combined splenic and hepatic injuries (H + S group). The hollow viscera evaluated included the stomach, duodenum, small intestine (jejunum and ileum), and large intestine (including rectum).

Statistical analysis was performed using the SAS statistical software version 9.2 (SAS, Cary, NC). Statistical tests performed included Chi-square test and two sided Fisher's exact probability test. Mantel Haenszel chi square test was used for trend analysis. A p-value of less than 0.05 was considered statistically significant.

Results

The registry included 321,618 blunt trauma patients, of whom 57,130 were identified as suffering from torso injuries. Of the patients with torso injuries, 2335 (4%) sustained hepatic injuries without splenic injuries (H group), 3127 (5.4%) had splenic injuries without hepatic injuries (S group), and 564 (1%) suffered from both hepatic and splenic injuries (H + S group) (Table 1).

The incidence of HVI among blunt torso trauma victims who sustained neither splenic nor hepatic injuries was 1.5% (751 of 51,104 patients), which is significantly lower compared to the S (3.1%, $p < 0.001$), H (3.1%, $p < 0.0001$), and H + S (6.7%, $p < 0.001$) groups (Table 2).

Table 1
Patients with blunt torso injuries: with and without splenic and/or hepatic injuries.

	No splenic injury	Splenic injury	Total
No hepatic injury	51,104	3127	54,231
Hepatic injury	2335	564	2899
Total	53,439	3691	57,130

Table 2
Incidence of HVI.

	No HVI	HVI	Total
No hepatic or splenic injury	50,353 (98.5%)	751 (1.5%)	51,104
S	3031 (96.9%)	96 (3.1%)	3127
H	2263 (96.9%)	72 (3.1%)	2335
S + H	526 (93.3%)	38 (6.7%)	564
Total	56,173 (98.3%)	957 (1.7%)	57,130

Overall, 957 patients sustained 1063 HVI. The distribution of HVI according to the anatomic location of the injury is shown in Table 3. The Ileum and jejunum were the most common sites of injury except for the H + S group, in which colorectal injuries were the most common.

In the S group, there was a clear correlation between the severity of the splenic injury and the incidence of HVI, as shown in Table 4. While only 1.9% of the patients with minor splenic injury had a concomitant HVI, this rate increased to 2.4%, 4.9%, and 11.6% in patients with moderate, major, and massive splenic injuries, respectively ($p < 0.0001$). Such a correlation was not found in the H group, and patients with minor, moderate, major, and massive hepatic injuries had similar a incidence of HVI at 2.9%, 3.5%, 3.2%, and 2.5%, respectively ($p = 0.84$).

Discussion

Among victims suffering from blunt abdominal trauma, the spleen and liver are the most frequently injured organs [22,23]. In modern trauma surgery, most blunt solid organ injuries are successfully managed non-operatively in the absence of other indications for explorative laparotomy [1]. Before the wide use of

Table 3
HVI according to anatomic location.

	Stomach	Duodenum	Ileum/jejunum	Colon/rectum
No hepatic or splenic injury	151	75	329	277
S	16	13	44	32
H	9	13	36	25
S + H	5	6	13	19
Total	181	107	422	353

Table 4
Incidence of HVI according to organ injury severity.

Organ injury severity	S		H	
	No HVI	HVI	No HVI	HVI
Minor	1436 (98.1%)	27 (1.9%)	1421 (97.1%)	43 (2.9%)
Moderate	860 (97.6%)	21 (2.4%)	519 (96.5%)	19 (3.5%)
Major	606 (95.1%)	31 (4.9%)	245 (96.8%)	8 (3.2%)
Massive	129 (88.4%)	17 (11.6%)	78 (97.5%)	2 (2.5%)
Total	3031	96	2263	72