Recent changes in the management of blunt splenic injury: effect on splenic trauma patients and hospital implications

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ABSTRACT

INTRODUCTION Management of blunt splenic injury has been controversial with an increasing trend towards splenic conservation. A retrospective study was performed to identify the effect of this changed policy on splenic trauma patients and its implications.

PATIENTS AND METHODS Data regarding patient demography, mode of splenic injury, CT grading, blood transfusion requirement, operative findings hospital stay and follow-up were collected. Statistical analysis of the data was performed using non-parametric Mann–Whitney tests

RESULTS Over an 8-year period, only 21 patients were admitted with blunt splenic injury. Ten patients were managed operatively and 11 non-operatively. Non-operative management failed in one patient due to continued bleeding. Using Buntain's CT grading, the majority of grades I and II splenic injuries were managed non-operatively and grades III and IV were managed operatively ($P = 0.008$). Blood transfusion requirement was significantly higher among the operative group ($P = 0.004$) but the non-operative group had a significantly longer hospital stay ($P = 0.029$). Among those managed non-operatively (median age, 24.5 years), a number of patients were followed up with CT scans with significant radiation exposure and unknown long-term consequences.

CONCLUSIONS Non-operative management of blunt splenic trauma in adults can be performed with an acceptable outcome. Although CT is classed as the 'gold standard', initial imaging for detection and evaluation of blunt splenic injury, ultrasound can play a major role in follow-up imaging and potentially avoids major radiation exposure.

KEYWORDS

Blunt trauma – Splenic injury – Blunt splenic trauma

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Until recently, the accepted treatment for splenic trauma, even for minor injuries, used to be splenectomy. This aggressive approach was based on the belief that, in adulthood, the spleen does not contribute any major function and conservative treatment was associated with potential life-threatening haemorrhage. With increasing recognition of the spleen's role in immunological function and awareness of overwhelming post-splenectomy sepsis (OPSS), there has been an increasing trend towards conservative treatment and splenic salvage procedure.¹ However, this changed policy towards splenic conservation requires careful risk–benefit analysis in the face of potentially life-threatening haemorrhage from delayed splenic rupture and the possibility of transfusion-induced viral infections. Furthermore, the increasing availability of reliable and good quality radiological imaging including ultrasound, computerised tomography (CT) scanning, and magnetic resonance imaging (MRI) have greatly improved the information available with

regard to the nature of the splenic injury and this may well help to identify the suitable patients for conservative management,² but at the expense of patient radiation.

We have reviewed the outcome of splenic injuries from our institution with the main aim of examining the effect of this changed conservative policy on patients and its implications.

Patients and Methods

We have undertaken a retrospective study of patients with blunt splenic injury admitted to our hospital between January 1997 and December 2005. Patients were identified with the help of clinical coding department querying on coding data on PAS (Patient Administration System). Coding data are extracted from various source documentation found in the patient case-note and theatre register. Data regarding patient demography, mode of splenic injury,

Table 1 Buntain classification of splenic injury

Grade	Description of injury
Grade I	Subcapsular haematoma or localised capsular disruption without significant injury to the parenchyma
Grade II	Single or multiple capsular and parenchymal disruptions that do not involve the hilar vessels
Grade III	Deep fractures into the hilum and involving the vessels
Grade IV	Shattered or fragmented spleen or hilar avulsion

pre-operative investigations, operative findings and follow-up were collected. For each patient, an injury severity score (ISS)⁵ was calculated. All CT scans performed at admission were blindly and retrospectively reviewed by an otherwise uninvolved radiologist to give a grade of splenic injury between I and IV, based on the Buntain classification⁴ of increasing splenic injury (Table 1). Transfusion requirements, length of stay and the use of imaging in follow-up were also recorded. Follow-up status reports of all patients were obtained from their general practitioner. Patients were placed into one of two groups depending on intervention – operative group and non-operative group.

Statistical analysis of the data was performed using non-parametric Mann–Whitney tests (for ISS, hospital stay, CT grade, transfusion requirement).

Results

We were surprised that despite cross-references of admissions, there was only a total of 21 patients admitted with blunt splenic trauma during the study period. These cases included isolated splenic injuries as well as

polytrauma. The median patient age was 26 years (range, 12–81 years). The median age of the operative and non-operative groups was not significantly different ($P = 0.65$). As expected, the male to female ratio was 6:1. All injuries resulted from blunt trauma. Nine patients sustained injury due to road-traffic accidents, nine due to falls and three due to assault. All patients were under the care of a consultant surgeon and evaluated by an on-call team clinically and a decision regarding management was taken. Ten patients were managed operatively and 11 were managed non-operatively. Out of the 11 non-operative patients, one became unstable with increasing abdominal pain, tachycardia, hypotension and a drop in haemoglobin on the third day of admission. He underwent an urgent laparotomy and splenectomy. At laparotomy, there was a large posterior splenic tear with a haemoperitoneum. Of the 11 patients managed operatively (including the one delayed operation), 10 patients underwent splenectomy and one patient a splenic salvage procedure.

The mean Injury Severity Score (ISS) of the operative group was 17.8, significantly higher ($P = 0.001$) than the non-operative group (10.7; Table 2). Fourteen patients had CT scans at admission (6 from the operative group and 8 from the non-operative group) and the remaining 7 had ultrasound. Out of these 14 patients who had CT scan, 3 patients had a grade I injury, 5 had grade II injury, 4 had grade III injury and 2 patients had grade IV injury according to the Buntain CT grading (Table 1). Both grade IV patients and three out of four grade III patients underwent operative management. All three grade I patients and four out of five grade II patients were successfully managed non-operatively (Table 3). Not surprisingly, CT grading was significantly higher in the operative group ($P = 0.008$). Patients were transfused overall an average of 1.9 units. Transfusion requirement in the operative group (3 units) was significantly higher ($P = 0.004$) than the non-operative group (0.5 units).

There were no deaths in the non-operative group. In the operative group, one patient who sustained polytrauma remained unstable, developed asystole and died in ITU on the first postoperative day. The remaining 10 patients including

Table 2 Comparison between operative and non-operative group

	Operative group	Non-operative group	P-value
Number of patients	11	10	
Median age (range) [years]	34.0 (17–80)	24.5 (12–81)	0.65
Injury severity score	17.82	10.7	0.001
Blood transfusion requirement (units)	3.36	0.3	0.004
Mean hospital stay (range) [days]	8.4 (5–12)	13.9 (3–25)	0.029

One patient of failed non-operative treatment is included in operative group.

Table 3 CT grading and outcome

CT grading	Operative group (<i>n</i> = 6)	Non-operative group (<i>n</i> = 8)
Grade I	–	3
Grade II	1	4
Grade III	3	1
Grade IV	2	–

CT grading was significantly higher in the operative group (*P* = 0.008).

the one delayed surgery were discharged well. The overall mean hospital stay was 11.1 days. Mean hospital stay in the non-operative group (13.9 days) was significantly longer (*P* = 0.29) than the operated group (8.4 days). Of the 10 patients managed non-operatively, six patients were followed up with serial ultrasonograms and four patients with repeat CT scans. Among these four patients, two had one CT, one had two CT and one had three CT scans.

At follow-up, out of 10 patients were successfully discharged in the operative group, one patient died 3 months after operation without an identifiable cause (post-mortem examination did not reveal a cause death and specifically death was not due to a secondary bleed or complication due to his original splenic injury). The remaining nine patients are alive. Among 10 patients in the non-operative group, one patient died 6 months after discharge due to a myocardial infarction. The remaining nine patients are alive.

Discussion

The incidence of splenic trauma has decreased presumably following the introduction of strict traffic rules and the mandatory wearing of seat belts. In a busy general hospital like ours, we were surprised to identify only 21 patients over a 7-year period.

The optimum management of adult blunt splenic injury remains a controversial subject in surgery. Until recently, the standard treatment, even for minor splenic injury, was early surgical intervention and splenectomy due to potential life-threatening haemorrhage from the injured spleen. With greater understanding of splenic function and its role immunologically, increasing numbers of surgeons are adopting a conservative approach, that favours splenic salvage operations and, where possible, non-operative treatment. The decision for operative or non-operative treatment depends on careful risk-benefit analysis for each individual case.^{1,2} It is generally agreed that, for the patient with cardiovascular instability and unequivocal abdominal signs of bleeding following blunt trauma, urgent laparotomy is indicated.

Bed-side ultrasound scans in this situation can sometimes detect free fluid and may be helpful in management.⁵ Splenectomy is the standard operation in most cases depending on the stability of the patient, type of injury and availability of expertise. In our study, of the 11 patients undergoing operation (including one delayed operation), only one patient underwent splenic conservation surgery and the rest had total splenectomy.

In the stable patient with a suspected splenic injury, the management is more challenging. Although the efficacy of non-operative treatment and splenic conservation is well documented in children, it is far less convincing in adults and this has generated a debate over last few years.¹ Availability of modern imaging techniques including CT scan and ultrasonography have greatly improved defining the extent of the splenic injury, active bleeding and other visceral damage in the traumatised patient. Management decisions regarding operative and conservative treatment are still very much dependent on the individual clinician's experience. The complications of splenectomy have been well documented. The major complications that can be avoided by splenic conservation are thrombocytosis and overwhelming post-splenectomy infection (OPSI).⁶ In our study, 11 patients (52%) were given initial non-operative treatment. The obvious disadvantage of non-operative management is the possibility of sudden, severe, delayed haemorrhage leading even to death before surgical intervention can be arranged.⁷ In our series, only one of 11 patients deteriorated in the conservative group and needed urgent splenectomy. Other problems for non-operative management highlighted in the literature include the greater requirement of blood transfusions and transfusion-related complications including hepatitis.² In our study, transfusion requirements for the non-operatively treated patients was significantly lower than their operative counterparts. Another consideration for non-operative management is the possibility of missing other associated intra-abdominal injuries.^{8,9} None of our patients, to date, has presented with late associated injuries.

It is quoted that hospital stay for non-operatively managed patients is shorter than patients undergoing operative management.^{10,11} In our study, hospital stay for non-operatively managed patients was significantly longer than for the operated group. Ten of 11 patients (91%) were successfully discharged following non-operative treatment, a similar figure to that quoted in the literature.^{9,11} The small number of patients in our group limits interpretation of the risk-benefit ratio of this method of management. Although there are several criteria being used by clinicians to choose non-operative management, there remains a problem in selecting the right patient and there are no completely reliable criteria to exclude the need for a laparotomy. Once non-operative management is chosen, the patient requires frequent monitoring, laboratory assessment and re-evaluation of the management plan as the situation indicates.

The evolution of imaging techniques including ultrasonography and CT scanning has helped to identify and define the extent of splenic injuries. However, the incidence of under- or over-reporting of the splenic injury remains high and this discourages over-reliance on imaging techniques.^{12,15} In our study, we have used Buntain CT grading because of its simplicity and ease of reproducibility.⁵ Although patient numbers are small, it is clearly evident that the majority of grade I and II injuries were managed non-operatively and grade III and IV patients required operation (which is statistically significant [$P = 0.008$]).

A dilemma for the non-operatively managed patient is the role of the imaging and its frequency, particularly in the stable patient without any change in clinical signs. Two different phases of follow-up imaging have been described. One is early in the course of non-operative treatment to evaluate the development of pseudo-aneurysms that may indicate failure of non-operative treatment.⁵ Pseudo-aneurysm formation has been reported to occur in 10% of cases and may result in catastrophic haemorrhage if left untreated. These aneurysms can be detected as well-defined, hypo-echoic lesions on ultrasound. Colour Doppler confirms the diagnosis by demonstrating hypervascularity.¹⁴ Another important early complication is the formation of an abscess within the haematoma. This presents as an irregular hypo-echoic area within the spleen with no flow on Doppler.⁵ The other use of follow-up imaging is to identify the progress of splenic injury. Routine follow-up imaging in the stable patient responding appropriately without clinical suspicion of bleeding is debatable. Some authors have suggested further imaging adds little to the clinical decision making as most of non-operatively managed splenic injuries are of low-grade type.¹⁵ Although CT is considered the gold standard for detection and evaluation of blunt splenic injuries, ultrasound remains an essential tool for evaluation in both acute setting and follow-up. In our study of the 10 patients managed non-operatively, 6 were followed up with serial ultrasonograms and 4 patients with CT scans. Of these 4 patients, two had one CT, one had two CT and one had three CT scan. Abdominal CT scan does give substantive radiation exposure to the patient. Shiralkar *et al.*¹⁶ have shown that the amount of radiation exposure in patients undergoing abdominal CT is equivalent to 400 chest X-rays. This highlights the fact that non-operative patients (average age of 35 years) undergo a significant radiation exposure and this may have long-term consequences. Whether follow-up imaging is valuable in higher grade injuries is difficult to confirm or refute. The role of follow-up imaging to document complete healing prior to the patient's return to unrestricted physical activity is a practice of some but not substantiated by hard data. Ultrasound can be a practical alternative to CT scan in those patients who need follow-up imaging without the risks of radiation but accepting its reduced accuracy in defining complex anatomy compared to CT.

Conclusions

Splenic trauma is now unusual. In our experience, we found non-operative management of splenic trauma can be performed with an acceptable outcome. Selection of patient for operative versus non-operative treatment is difficult. Although CT is described as the gold standard initial imaging for detection and evaluation of blunt splenic injury, ultrasound can play a major role in follow-up imaging and potentially avoids major radiation exposure.

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