# Follow-Up Imaging Studies of Blunt Splenic Injury: Do They Influence Management?

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## Abstract

**Background:** The exact value of follow-up ultrasonography and computed tomography in the non-operative management of blunt splenic injuries is not yet defined. Although follow-up studies have been recommended to detect possible complications of the initial injury, evidence shows that routine follow-up CT scans usually do not affect management of these patients.

**Objective:** To determine whether follow-up imaging influences the management of patients with blunt splenic injury.

**Methods:** Between 1995 and 1999, 155 trauma patients were admitted with splenic trauma to a major trauma center. Excluded from the study were trauma patients with penetrating injuries, children, and those who underwent immediate laparotomy due to hemodynamic instability or associated injuries. The remaining trauma patients were managed conservatively. Splenic injury was suspected by focused abdominal sonography for trauma, upon admission, and confirmed by CT scan. The severity of splenic injury was graded from I to V. The clinical outcome was obtained from medical records.

**Results:** We identified 32 adult patients (27 males and 5 females) with blunt splenic injuries who were managed non-operatively. In two patients it was not successful, and splenectomy was performed because of hemodynamic deterioration. The remaining 30 stable patients were divided into two groups: those who had only the initial ultrasound and CT scan with no follow-up studies (n = 8), and those who underwent repeat follow-up ultrasound or CT scan studies (n = 22). The severity of injury was similar in both groups. In the second group follow-up studies showed normal spleens in 2 patients, improvement in 11, no change in 8, and deterioration in one. All patients in both groups were managed successfully with good clinical outcome.

**Conclusion:** In the present series the follow-up radiological studies did not affect patient management. Follow-up imaging can be omitted in clinically stable patients with blunt splenic trauma grade I-III.

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Experience with non-operative management of pediatric blunt splenic injuries has led to its successful use in adults, and today most blunt splenic injuries are managed conservatively with a high success rate [1]. Although the concept of non-operative management is widely accepted, it continues to be controversial. Due to the lack of well-designed randomized studies on different aspects of conservative treatment, several questions remain unresolved. Should we restrict the physical activity of the patient with a damaged spleen, and if so, for how long? Should the patient be observed in an intensive care unit and for how long? Can we manage an injured spleen non-operatively in elderly and neurologically impaired patients? Should an underlying spleen pathology be a contraindication to non-operative management? And when, if at all, should follow-up imaging studies be performed?

The precise value of follow-up ultrasonography and computed tomography in the non-surgical management of blunt splenic injuries is not yet defined [2–5]. It has been suggested that follow-up studies be performed to detect possible complications of the initial injury [6]. However, there is evidence that routine follow-up CT scans usually do not alter the management of these patients [2,3]. The aim of the present study was to determine whether follow-up imaging influenced the management of adult patients with blunt splenic injury.

## Materials and Methods

Data were collected prospectively in a computerized trauma registry and analyzed retrospectively. Between 1995 and 1999, 155 trauma patients were admitted with splenic trauma to a major trauma center. Excluded from the study were patients with penetrating injuries, children under age 14, and those who underwent immediate laparotomy due to hemodynamic instability or because of associated injuries. The remaining 32 patients were managed non-operatively and comprised the study group. Splenic injury was suspected by focused abdominal sonography for trauma upon admission and confirmed by CT scan. Computed tomography, ultrasonography or both were performed as follow-up imaging modalities according to the discretion of the attending surgeon. To grade the spleen injury we used the Spleen Injury Scale, adopted by the American Association for the Surgery of Trauma [7].

## Results

The 32 study patients included 27 males and 5 females with a mean age of 31.7 ± 13.9 years (range 14 –72). Most of the patients were victims of car crashes (n=25), 6 patients were admitted following a fall from a height, and 1 patient was the victim of an assault. All but one patient were fully conscious upon admission. Two patients with splenic injury grade III and IV became hemodynamically unstable and underwent splenectomy on the second and third day of observation with no additional imaging. The remaining patients were divided into two groups: patients with no follow-up imaging (n=8); and those who were followed with repeat studies (n=22), including ultrasonography (n=15), CT (n=5) or both (n=2).

Distribution of the patients according to severity of injury was similar in both groups [Table 1]. There were no patients with grade IV or V of splenic injury. Most of the follow-up studies showed improvement when compared to the initial ultrasound or CT scan (n=13). In a substantial number of patients there were no changes (n=8) and in one patient the splenic injury had worsened, as seen on CT scan [Table 2]. The clinical outcome was good in both groups [Table 3]. There were no complications of the non-operative management, no splenectomies were performed, and physical examination on at least one follow-up visit was normal in all the patients.

**Table 1.** Distribution of patients according to severity of injury

| Grade | Group I | | Group II | |
|---|---|---|---|---|
| | No. of patients | % | No. of patients | % |
| I | 2 | 25 | 5 | 23 |
| II | 4 | 50 | 13 | 59 |
| III | 2 | 25 | 4 | 18 |
| IV | – | – | – | – |
| V | – | – | – | – |

**Table 2.** Results of follow-up studies

| Results of follow-up studies | No. of patients |
|---|---|
| Normal study | 2 |
| Improvement | 11 |
| No change | 8 |
| Deterioration | 1 |

**Table 3.** Clinical outcome

| | Good | Complications | Splenectomy |
|---|---|---|---|
| Group I | All | – | – |
| Group II | All | – | – |

## Discussion

Only a few published studies have addressed the problem of follow-up imaging in blunt splenic trauma. Lawson et al. [3] compared the clinical outcome of 22 patients with blunt splenic trauma managed conservatively, who had repeat CT scans for follow-up, with that of 14 patients who had only the initial CT scan. Repeat CT scan in this study did not alter the management of any patient, and patients in both groups had a good clinical outcome. Similar results were obtained by Allins et al. [2] in 99 patients with blunt splenic and liver injuries who were treated conservatively. No difference in clinical outcome was observed between the group of 26 patients who were studied with follow-up CT scans and those who were not. Thaemert et al. [8], in a study of 62 follow-up CT scans in 49 patients with blunt splenic trauma, found only one that influenced patient management. The authors of the above publications did not find follow-up studies to have clinical utility and concluded that follow-up imaging is not routinely necessary. On the other hand, another study found routine echo-Doppler follow-up examinations very useful in detecting post- traumatic splenic pseudoaneurysms, which were detected in 2 of 15 patients followed after non-surgical management of blunt splenic trauma [9]. In a recent review [10], the indications for follow-up imaging in conservative management of blunt splenic injury were mentioned, but no supporting scientific data were presented. In that review, Knudsom and Maull recommended that CT scans be repeated in patients with decreasing hematocrit, in those with grade III or IV of splenic injury, and in patients with subcapsular hematoma or underlying splenic pathology and coagulopathy. According to that study, neurologically impaired patients and athletes should also be considered for follow-up imaging. Guidelines for non-operative management of blunt injury of the liver and spleen published on the website of the Eastern Association for the Surgery for Trauma state that there is no evidence of serial abdominal CT scans without clinical indications influencing either the outcome or the management of the patient [11].

The results of the present study are in agreement with those of the above studies, which showed no correlation between the radiological appearance of the injured spleen on the repeat follow-up studies and the clinical outcome. The conservative treatment in the present series was determined by the patients' clinical condition and mainly by their hemodynamic stability, and not by the changes in the radiological appearance of the injured spleen. Of the 22 patients followed by serial radiological examinations, there was no change in 8 and the radiological picture demonstrated a deterioration in one patient, a fact that had no influence on the management. Moreover, the clinical outcome in the patients with grade I–III splenic injury followed with repeat ultrasound or CT scans did not differ from the outcome in patients followed solely by serial physical examinations. However, only one patient had grade IV splenic injuries, and this patient underwent splenectomy because of hemodynamic instability. Therefore, the subgroup of patients with splenic injuries at a grade higher than III, who probably have a greater potential for late complications of non-operative management – e.g., "delayed" splenic rupture or pseudoaneurysm formation – may benefit from repeat follow-up imaging. In order to address this question further large-scale studies are necessary. There was only one unresponsive patient in this series, and this patient was one of the two patients who underwent splenectomy because of hemodynamic instability.

In the current series, no patients had an underlying splenic pathology or coagulopathy, and the importance of routine follow-up studies in this population of patients requires investigation. In the present series the follow-up radiological studies did not influence patient management. We conclude that follow-up imaging can be omitted in clinically stable patients with blunt splenic trauma grade I-III, with no adverse effect on outcome.

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