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Justification for an abbreviated protocol in the management of blunt spleen and liver injury in children

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Abstract

Objective(s): The current management of blunt spleen/liver injury in children requires a number of days of bed rest equal to the grade of injury plus 1. This protocol is used even when there is no clinical indication of ongoing bleeding. To establish a prospective protocol with an abbreviated period of bed rest, we conducted a retrospective review of our blunt spleen and liver trauma experience to examine the safety of such an attenuated protocol.

Methods: A retrospective analysis of our most recent 10-year experience (January 1996 to December 2005) with blunt spleen or liver injury was performed. Patient demographics, vital signs, hemoglobin levels, need for transfusion, operations, and outcomes were measured. An abbreviated protocol using 1 night of bed rest for grades 1 and 2 injuries and 2 nights of bed rest for higher grades was designed. This protocol was then applied to our patient population to assess its safety. Data are expressed as mean ± SD.

Results: During the study period, 243 patients were admitted with blunt spleen and/or liver injury. The mean patient age was 9.0 ± 4.6 years, and the mean weight was 35.3 ± 19.3 kg. Sixty-three percent were male. The spleen was injured in 148 (61.2%) patients and the liver in 121 (50.0%), and 26 (10.6%) had both. The mean grade was 2.0 ± 1.1, for which the mean bed rest was 3.5 ± 1.1 days. This resulted in 5.6 ± 6.5 days of hospitalization. There were 9 patients who died, 7 with severe brain injury and 2 with massive liver hemorrhage on presentation. No patient required an operation or transfusion after 2 nights of observation who did not have clinically obvious signs of ongoing blood loss. Implementation of the abbreviated protocol would have affected 65.8% of our patients and would have saved a mean of 2.0 ± 1.5 hospital days per patient.

Conclusions: According to our data, an abbreviated trauma protocol with overnight bed rest for grades 1 and 2 injuries and 2 nights for higher grades could be safely used. This protocol would immensely improve current resource use. Based on these retrospectively collected data, we have initiated a prospective consecutive controlled series to assess the safety of such an attenuated protocol.

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The initial clinical evidence, in the form a case-control series, advocating nonoperative management of blunt splenic injury in children was published in 1968 [1]. However, these data were not immediately accepted. Many institutions continued to perform routine splenectomy as the preferred means of managing blunt splenic injury for another decade. By 1980, the importance of preserving the injured spleen to prevent future overwhelming systemic infections was recognized by pediatric surgeons [2,3]. However, these patients were managed with strict bed rest, at times even using sedation, for up to 2 weeks in the hospital. Over the past decade, evidence-based guidelines have emerged to homogenize care and limit the financial costs associated with a prolonged hospitalization [4]. Based on these guidelines, days of bed rest is recommended to equal the grade of injury plus 1. Thus, a grade 4 injury requires a course of bed rest equal to 5 days. These guidelines have been prospectively validated as being safe [5]. Within these data, it has been recognized that patients requiring an operation for their solid organ injury will usually do so within the first 12 hours. Recognizing this clinical phenomenon within our own patient population, as well as the questionable efficacy of bed rest in small children beyond 3 days, has led us to question whether the protocol could be further abbreviated. Therefore, we audited our experience over the past decade to assess the possibility of revising the bed rest protocol to further enhance optimal use of resources.

1. Methods

Approval was obtained from the Children's Mercy Hospital Internal Review Board (IRB 06 06-098X), Kansas City, Mo, before reviewing medical records for this study.

The study population consisted of children admitted to our hospital with the diagnosis of spleen or liver injury as diagnosed by computed tomography (CT) scan from January 1996 through December 2005.

Patient demographics, vital signs, hemoglobin levels, need for transfusion, operations, and outcomes were recorded. Grade of injury was determined from the notes recorded by the surgical team caring for the patient. When a grade was not recorded in the chart, the CT scans were reviewed by 2 surgeons who agreed on a grade. The previously published standard grading scale was used to grade the injuries [6].

The medical records were carefully analyzed in an attempt to identify any patients who underwent an operation or readmission to the hospital after an initial period of stability. After this was done, an abbreviated management protocol was designed. This protocol consisted of overnight bed rest for grades 1 and 2 injuries with 2 nights of bed rest for higher grades. The abbreviated protocol was then applied to our population of patients to assess its safety. Data are expressed as mean ± SD.

2. Results

During the 10-year study period (January 1996 to December 2005), 243 patients were admitted with spleen and/or liver injury. The mean age and weight of this population were 9.0 ± 4.6 years and 35.3 ± 19.3 kg, respectively. Sex distribution was 63% male and 37% female. The spleen was the only solid organ injury in 148 patients (61.2%), whereas 121 patients (50.0%) had an isolated liver injury, and 26 patients (10.6%) had both. The mean grade of injury was 2.0 ± 1.1. The mean period of bed rest was 3.5 ± 1.1 days. The mean length of hospitalization was 5.6 ± 6.5 days.

Nine patients died. Seven had severe brain injury, and the other 2 had massive liver hemorrhage on presentation. Only one patient required an operation or transfusion after 2 nights of observation. This patient had a grade 4 splenic injury with ongoing tachycardia and decrease in hemoglobin values. He required 2 transfusions and eventually underwent splenectomy on the morning of his third hospital day. In addition, no patient admitted initially to the surgical floor required an operation. Five patients did require an operation for their solid organ injury, of which there were 3 splenectomies (one combined with distal pancreatectomy) and 2 operations to control hepatic bleeding.

If our proposed abbreviated protocol was applied to this population, it would have reduced the length of hospitalization in 65.8% of our patients. The remaining patients would have been limited from discharge by other injuries and/or other clinical delays (eg, poor oral intake, level of discomfort). In the patients who were limited from discharge because of their required period of bed rest, the abbreviated protocol would have resulted in a mean of 2.0 ± 1.5 fewer hospital days per patient.

3. Discussion

The immunologic importance of the spleen in children has been established as the basis for nonoperative management in patients with splenic trauma [7,8]. However, the resource use in the nonoperative treatment in this population has naturally evolved toward decreasing the required care of these patients. The current guidelines reflect a substantial decrease in patient investment over historic controls [4,5]. This trend continues in the same direction by the recognition of the fact that most of these patients do not require intensive care unit (ICU) admission [9]. Furthermore, the evidence regarding the uselessness of follow-up imaging because of its inability to alter the course of management in stable patients has been documented [9].

As a precedent to this study, it has been shown that a patient's course will be dictated by clinical stability and not the grade of injury identified on the initial CT scan [10,11]. Moreover, in unstable patients requiring operative intervention, intraperitoneal findings during operation do not

correlate well with the CT-based grade of injury [11]. These findings validate the basis of further attenuating the current guidelines for managing these patients.

It is worth acknowledging that the current guidelines are based on national registry data of 832 patients [4]. Such data are limited by the fact that it does not reflect an intricate portrait of each patient's hospital course. National registry data are useful for identifying trends or areas of interest that require further magnification in data collection detail. However, it is not sound to base specific treatment recommendations on national registry data. Ultimately, any protocol should be validated in a prospective model with carefully collected predetermined data points. Validation has been prospectively performed with the current guidelines showing that they are clearly safe and efficacious [5].

In addition, it is worth noting that the current recommendation for bed rest is based on what was found to be safe in 25% of the 832 patients reviewed. However, the evaluation sought to identify patients with bleeding or operative interventions rather than those patients who did not have complications. This is counterintuitive for those clinicians caring for the child with a hemodynamically stable blunt solid organ injury where the goal is to identify the patients who will not come to transfusion or operative intervention and allow for a more expedited hospital stay.

In the natural evolution of care, we must ponder the feasibility of caring safely for these patients with less social morbidity to the patient and family than is currently recommended. One trial using prospective data collection has been performed in which stable patients were observed under bed rest for 2 days [12]. In this study, patients admitted to the ICU were excluded. Unfortunately, this included half of their patients. We believe the shortened course of bed rest benefits these ICU patients as well because the patient is able to be mobilized to the chair and begin rehabilitation activities earlier. Furthermore, a second day of bed rest for minor injuries is not likely necessary. As such, we are discharging patients with grades 1 and 2 injuries the day after admission, resulting in a hospital course of less than 24 hours. We agree with the authors of this prospective study that patients can return to school upon discharge, and no follow-up imaging is necessary.

Based on our retrospective data, we have initiated a prospective consecutive controlled series under internal review board approval using our proposed abbreviated protocol. We anticipate we will be able to further reduce the social morbidity inflicted on these patients and their families by reducing the length of nonoperative hospitalization. In addition, such carefully collected valid data may illuminate avenues for even further modifications in the care of the injured child.

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Discussion

Saleem Islam, MD (Gainesville, FL): Two quick questions. A very well presented paper and a good idea. I know you are waiting for IRB approval, but have you initiated this in your patients? Have you tried this and have you had safety with this?

Scott Keckler, MD (Kansas City, Mo): Yes, we have. We have initiated the IRB approval already. We have a good relationship with our IRB because of all the prospective ….

Saleem Islam, MD (Gainsville, FL): You do not need IRB approval for treatment of patients which are not undergoing the study and have you had any problems with that? Have you sent home any patients early with spleen injury, grade 1 and 2? Have you sent them home after 1 day?

Scott Keckler, MD (Kansas City, Mo): Yes.

Saleem Islam, MD (Gainesville, FL): The second question is, where you would recommend they be observed? Like you say, they are observed overnight. Would there be any special monitoring for them, and what physiologic parameters are you looking for? Thank you.

Scott Keckler, MD (Kansas City, Mo): I think whether they go to the ICU or the floor depends on their initial presentation. If they are initially stable and say they have a grade 3 injury and they continue to be stable while in the

trauma bay or in the ER for the 4 to 5 hours that they are sometimes down there, we would be comfortable sending them to the floor.

Richard Pearl, MD (Peoria, IL): A correction and a couple of questions. When you started the talk, you said, for almost 20 years, nonoperative therapy has been the standard of care. This actually started in the sixties and has been evolving for about 45 years, with Simpson's original work in Toronto followed by a series of papers published in the seventies and eighties.

I would caution you on including grade 5 injuries in your protocol. If you look at Steve Stylianos's paper and then subsequent book chapters that Steve and I have written on splenic injuries, grade 5 injuries are different. There are papers that document rebleeding in grade 5 injuries more frequently than in others and more operative intervention in grade 5 injuries. I do not think your hypothesis should include grade 5 injuries or you might want to just take this subset to see if they actually fit the same pattern of physiologic stability in nonoperative therapy.

Scott Keckler, MD (Kansas City, Mo): Thank you. We did apply retrospectives to the grade 5 injuries, but I do appreciate your concern for our prospective series.