

Liver Laceration in an Intercollegiate Football Player

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ABSTRACT: Serious abdominal injuries in athletics, including liver trauma, are relatively rare. When they do occur, the athletic trainer and the team physician must be able to recognize the signs and symptoms and employ the appropriate first aid and follow-up care. In this paper, we present a case study of a football player who suffered a lacerated liver as a result of a forceful blow to the right side of the chest. Although his case was typical of most isolated liver injuries and he did not experience massive internal bleeding, the potential for life-threatening exsanguination exists and must be recognized by sports health care practitioners. Most isolated liver injuries

can be treated nonsurgically. However, those patients with multiple organ trauma, deteriorating vital signs, or diminishing hemodynamic stability generally require immediate surgery. Athletes with persistent right upper quadrant pain, especially when accompanied by referred pain to the right shoulder, abdominal rigidity, guarding, or rebound pain should be considered to have a liver injury until ruled out by CT scan and liver enzyme studies. Our subject was typical of most athletic liver patients and he was able to resume light exercise after 5 weeks and full activity after 3 months.

The violent nature of contact and collision sports places high school, college, and professional athletes at risk for a variety of impact-related injuries. Although relatively rare,^{7,12,18} abdominal injuries are increasing in frequency,³ and now comprise 7% to 10% of all athletic injuries.^{2,4} The liver is involved in fewer than 5% of sports-induced abdominal injuries.² Athletic trainers and team physicians must remain familiar with the signs, symptoms, and emergency procedures for the treatment of liver trauma, however, since this injury is one of a few in sports medicine that can be life-threatening. Indeed, because it is so rare, most athletic trainers are unlikely to be confronted by this injury more than once or twice during their careers. We present here a case of an intercollegiate athlete who suffered a lacerated liver under circumstances typical of normal play in football.

HISTORY

A 19-year-old white male football player in good health was struck forcefully over the right posterior chest wall by a tackler's helmet while extending to catch a pass. He fell immediately to the ground in obvious pain. When we reached him, his diaphragm was in spasm and he was clutching the right side of his chest. He was conscious and alert. Several seconds after we arrived, he vomited once. After approximately 15 seconds, the diaphragm spasm subsided, but his breathing became rapid and shallow. Upper and lower extremity neurological exam was normal. The pulse was strong and steady. After the athlete began to calm, he was assisted to the sideline and examined in greater detail.

PHYSICAL EXAMINATION

Visual examination of the chest and abdomen was unremarkable. Palpation of the ribs revealed tenderness, but no

deformity or crepitus, at levels 6 to 8 on the right side. The right upper quadrant of the abdomen was tender to palpation, but there was no guarding or rebound. His lungs were clear and bowel sounds were normal. Blood pressure and pulse were within normal limits, but respiration remained shallow and rapid.

DIAGNOSTIC STUDIES

An ice pack was applied to the right ribs and right upper quadrant of the abdomen and the athlete's feet and legs were placed in an elevated position. After several minutes, it became clear that his pain and elevated respiration rate were not returning to normal, so he was transferred to the local hospital. Anterior-posterior radiographs of the chest were unremarkable for either rib fracture or pneumothorax. The CT with gastroenteric and intravenous contrast revealed a curvilinear tear coursing from the posteromedial margin of the posterior segment of the right hepatic lobe and extending anterolaterally, terminating approximately 3 cm from the right liver margin (Fig 1). No other visceral damage was identified. Hemoglobin was 15.5 g/dL; hematocrit was 40.8%. Packed cell volume was not obtained. All liver enzymes, except GAMMA GT (19 u/L), were elevated (SGPT [ALT] 186 u/L, SGOT [AST] 178 u/L, LDH 371 u/L). (NOTE: GAMMA GT, SGPT, and SGOT are liver repair enzymes. LDH is a tissue repair enzyme often associated with liver trauma.) One hour after injury, blood pressure was 136/72, pulse was 80, and respiration rate had stabilized at 12. The diagnosis was liver laceration with associated right-side rib contusion.

TREATMENT AND CLINICAL COURSE

The subject was admitted to the hospital and an IV with lactated Ringer's was begun. A surgical consultation was obtained. Because the subject was hemodynamically stable, the decision was made to treat the injury nonsurgically. The patient remained in the hospital under close observation for 5 days. He

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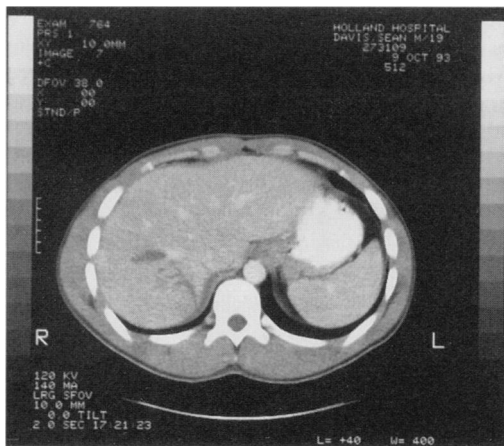


Fig 1. CT scan 60 minutes postinjury. Note decreased density in curvilinear pattern in right lobe of the liver indicative of liver laceration.

was limited to intravenous fluids for the first 24 hours and resumed a normal diet thereafter. His chest and abdomen pain was controlled with IM Demerol for the first 4 days and Vicodin thereafter. IM Visteril was administered to control intermittent nausea. Hemoglobin level dipped to a low of 14.4, but rose to 16.5 at time of discharge. Liver enzymes remained slightly elevated, but were improving at time of discharge.

The patient was discharged on the fifth day postinjury and spent an additional week resting at home. He then returned to school and finished the semester without incident. Follow-up CT at 1 month demonstrated a significant improvement in the liver laceration (Fig 2). The athlete was withheld from football for the remaining month of the season. After 5 weeks, he was placed on a progressive cardiovascular exercise program that included stationary cycling and swimming, every other day, at 60% to 80% of maximum heart rate. He returned to running and weight training approximately 12 weeks postinjury. He was cleared to play football the following season and participated without incident.

DISCUSSION

Because of the risk of massive internal bleeding, injuries to the abdomen pose a potentially life-threatening scenario. Ath-

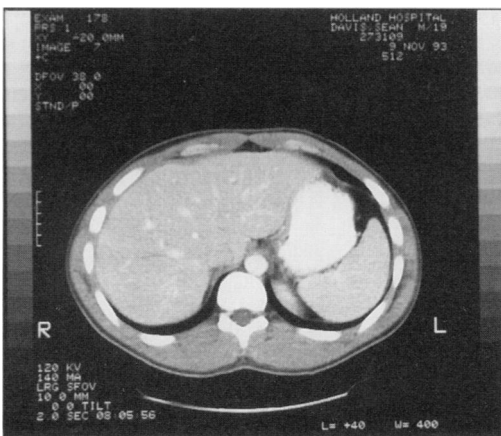


Fig 2. Follow-up CT scan at 1 month demonstrates significant healing.

letic trainers and team physicians who work with contact and collision-sport athletes, especially football, ice hockey, soccer, and lacrosse players, are exposed to mild abdominal trauma on a regular basis. Most of these injuries are minor and resolve spontaneously. Diaphragm spasm and mild abdominal wall and rib contusions are so common that more serious pathology is often initially overlooked. The fact that many internal injuries bleed slowly can contribute to the lack of suspicion for these conditions by athletic health care providers. Many cases of minor abdominal trauma leading to serious injury have been reported in the literature.²⁻⁴

Spleen, kidney, and liver injuries account for the majority of sport-related abdominal injuries.^{4,7,19} Direct blows to the abdomen have also been reported to result in injury to the stomach, intestines, gall bladder, and diaphragm.⁷ Kidney injuries are commonly caused by blows to the flank and are recognizable because of flank pain and hematuria.¹² Spleen injuries are second only to kidney injuries in athletics and are a potential source of catastrophic bleeding if not recognized immediately. Spleen injuries can result in subcapsular hematoma, simple contusion, or rupture. The bleeding can occur slowly, resulting in acute distress weeks after the injury. Most spleen injuries occur following a blow to the upper left quadrant of the abdomen. The athlete with active mononucleosis is at increased risk for spleen rupture due to the distension that can occur during this infection. Spleen trauma may result in referred pain in the left arm and shoulder (Kehr's sign).¹⁷

Most liver injuries are caused by a direct blow to the upper right quadrant of the abdomen. The possibility of a contracoup mechanism has been postulated, based on the experiences of some authors.¹⁸ The liver is often involved in multiple organ accidents that result in a significant increase in intra-abdominal pressure. Like most victims of liver injury, our subject suffered an injury to the right lobe. Right lobe injuries account for approximately 80% of all liver lacerations.¹⁶ This finding is thought to be due to the larger size of the right lobe and its juxtaposition to the ribs.¹⁸ Although the lacerated liver is certainly capable of massive bleeding, it often does not.⁹ There has been an increased trend toward nonoperative management of this injury.^{5,10,16} Surgeons have discovered that in approximately 70% of cases, the bleeding has stopped by the time the wound is explored in the operating room.¹⁴ Patients with deteriorating vital signs and unstable hemodynamics require immediate surgical intervention.¹⁴

Differential diagnosis in this case included rib fracture, abdominal wall contusion, pneumothorax, rupture of the diaphragm,⁸ and hematoma or rupture of the stomach or other elements of the gastrointestinal system. The diagnostic tools of choice for detection of liver injury include CT scan^{1,5,10,11} and liver enzyme profile.¹⁸ Diagnostic peritoneal lavage and scintigraphy have also been used to detect liver injury.⁶ Although they are sensitive tests, they do not help the clinician establish the extent of the damage.¹⁶ Standard radiographs helped rule out rib fracture, pneumothorax, and diaphragm rupture in this case. Lack of blood in the vomitus, along with the presence of normal bowel sounds helped reduce GI trauma as a source of concern. Abdominal wall contusion, although potentially quite painful, usually result in discomfort only over the contusion,

often when the muscle is contracted,⁷ and do not present with rebound, guarding, or rigidity.¹²

Our patient experienced an uneventful recovery from his injuries. Many complications to nonoperative management of liver trauma have been reported, however. Persistent bleeding, infected hematoma, hemobilia,¹³ subhepatic fluid collection, ruptured subcapsular hematoma, pneumonia, and bile leaks are among the most commonly reported complications.¹⁵ Although most complications occur within 10 days, some have been reported to occur up to 4 weeks postinjury. MacGillivray and Valentine¹⁵ have reported a case of psuedoaneurysm and arteriovenous fistula 56 days following liver injury.

CONCLUSION

Liver laceration is one of the most serious injuries an athlete can suffer. If these athletes remain hemodynamically stable and are able to successfully avoid postinjury complications, however, they can usually resume light exercise at about 4 weeks with return to sports between 3 and 6 months.^{5,18} Athletic trainers and team physicians should assume a high degree of suspicion when athletes under their supervision experience trauma to the abdomen. Even minor blows can have serious consequences, many of which may not be evident for days.¹⁷ Although sports health care professionals have been trained to remain wary of spleen injury following abdominal trauma, our experience has taught us that attention to signs and symptoms associated with liver injury is of vital importance as well.

ACKNOWLEDGMENTS

The assistance of Dr. Phil Vanderwoude, MD, in the management of this case and the preparation of this manuscript is acknowledged with gratitude.

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