Surgical Management of Solid Organ Injuries

Niels V. Johnsen, MD[a], Richard D. Betzold, MD[b], Oscar D. Guillamondegui, MD, MPH[b], Bradley M. Dennis, MD[b,*], Nicole A. Stassen, MD[c], Indermeet Bhullar, MD[d], Joseph A. Ibrahim, MD[d]

KEYWORDS

• Spleen trauma • Liver trauma • Pancreas trauma • Kidney trauma • Hepatic injury • Renal injury • Angioembolization

KEY POINTS

- The management of solid organ injuries has become progressively less operative over the past 20 years. The need for initial operative management of solid organ injuries is determined by the patient's clinical status, not the extent of the solid organ injury.
- Patients presenting with hemodynamic instability and peritonitis still warrant emergent operative intervention. Intravenous contrast-enhanced computed tomographic scan is the diagnostic modality of choice for evaluating solid organ injuries in the stable patient.
- Major liver trauma with extensive parenchymal injury and uncontrollable bleeding in hemodynamically unstable patients is challenging and the adoption of a combination of effective damage control resuscitation and damage control surgery strategies have been demonstrated to be associated with improved outcomes.
- Adjunctive therapies like angiography, percutaneous drainage, endoscopy/endoscopic retrograde cholangiopancreatography, and laparoscopy remain important adjuncts to solid organ injury management.
- The status of the pancreatic duct and the location of the injury guide surgical management of pancreatic trauma whether it is diagnosed during a laparotomy or with preoperative imaging. Pancreatic head injuries typically are treated with wide drainage, whereas injuries to the pancreatic tail are most often treated with surgical resection.

Disclosure: No commercial or financial conflicts of interest related to this article.
[a] Urological Surgery, Department of Urological Surgery, Vanderbilt University Medical Center, A-1302 Medical Center North, Nashville, TN 37232, USA; [b] Division of Trauma, Surgical Critical Care, Emergency General Surgery, Department of Surgery, Vanderbilt University Medical Center, 1211 21st Avenue South, 404 Medical Arts Building, Nashville, TN 37212, USA; [c] Surgical Critical Care Fellowship and Surgical Sub-Internship, University of Rochester, Kessler Family Burn Trauma Intensive Care Unit, 601 Elmwood Avenue, Box Surg, Rochester, NY 14642, USA; [d] Orlando Health Physicians Surgical Group, Orlando Regional Medical Center, 86 West Underwood, Suite 201, Orlando, FL 32806, USA
* Corresponding author.
E-mail address: Bradley.m.dennis@vanderbilt.edu

Surg Clin N Am 97 (2017) 1077–1105
http://dx.doi.org/10.1016/j.suc.2017.06.013
surgical.theclinics.com

INTRODUCTION: THE EVOLUTION OF SOLID ORGAN INJURY MANAGEMENT

Surgery used to be the treatment of choice in patients with solid organ injuries. This approach has gradually changed over the past 2 decades as nonoperative management (NOM) has become the primary management strategy used for solid organ injuries. The improvement in critical care monitoring and computed tomographic (CT) scanning, as well as the more frequent use of interventional radiology techniques, has helped to bring about this change to NOM. Additionally, the availability of less invasive procedures has dramatically expanded the treatment options for these patients, optimizing the outcomes of initial NOM.[1–4] Even though NOM has become the standard of care in patients with solid organ in most trauma center, surgeons should not hesitate to operate on a patient to control life-threatening hemorrhage.

LIVER

Management of liver trauma is challenging and may vary widely given the heterogeneity of liver injuries' anatomic configuration, the hemodynamic status of the patient, and the settings and resources available. Hepatic injury ranges from a small capsular tear, without parenchymal laceration, to massive parenchymal injury with major hepatic vein/retrohepatic vena cava lesions[5] (**Table 1**). Expeditious initial diagnosis is paramount to the management of hepatic injury, as most Grade I-III hepatic injuries are successfully treated with NOM, whereas two-thirds of grade IV or V injuries necessitate intervention.[6] In the hemodynamically stable trauma patient without peritonitis, an abdominal CT scan with intravenous contrast should be performed to identify and assess the severity of injury to the liver. The greatest advantages of CT lie in its ability to determine the extent of the hepatic injury, document the presence of active hemorrhage, and assess for associated injuries.[7] The severity of hepatic injury (as suggested by CT grade or degree of hemoperitoneum), neurologic status, presence of a ''blush'' on CT scan, age older than 55 years, and/or the presence of associated injuries are no longer considered absolute contraindications to a trial of nonoperative management in the hemodynamically stable patient.[8–11] Improvements in intensive care monitoring and multidisciplinary treatment options have changed the philosophy of NOM even in those patients who in the recent past were consistently managed in a surgical manner. Adjunctive interventions, as well as application of endovascular,

Table 1
Routine angiogram strategy with angiograms performed on all hemodynamically stable patients with BST on admission CT

Institution	Journal	Year	Total, n	NOM, n (%)	Angiograms	AE, %	FNOM, %
State University of New York[20]	*Radiology*	1991	44	44 (100)	44 (100%)	17 (39%)	3
State University of New York[21]	*J Trauma*	1995	172	150 (87)	150 (100%)	56 (37%)	3
Kyorin University Japan[27]	*AJR*	1996	31	28 (90)	28 (100%)	15 (53%)	7
University of Maryland[18]	*J Trauma*	2001	352	136 (39)	29%	8%	8

Angioembolization was performed for those with active extravasation on angiogram and bed rest without embolization those without extravasation.

Abbreviations: AE, angioembolization; BST, blunt splenic trauma; CT, computed tomography; FNOM, failure of nonoperative management; NOM, nonoperative management.