ORGAN-PRESERVING OPERATIONS IN SPLENIC INJURIES: MODERN LAPAROSCOPIC APPROACHES AND HEMOSTATIC METHODS

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Introduction

Splenic injuries are among the most frequently encountered injuries of parenchymal organs in the abdominal cavity (Coccolini F, et al. World J Emerg Surg. 2017;12:40). As an organ with rich blood circulation, splenic injury can lead to hemorrhagic shock (Renzulli P, et al. World J Surg. 2009;33:2264-2269). Therefore, rapid and appropriate treatment is of vital importance (Gaarder C, et al. Injury. 2006;37:91-97). In recent years, there has been a paradigm shift in the treatment of splenic injuries - from open splenectomy to organ-preserving operative and non-operative treatment approaches (Stassen NA, et al. J Trauma. 2012;73:1339-1345).

Currently, splenic injuries are classified mainly based on anatomical disruption, but the optimal treatment strategy should consider hemodynamic status, anatomical disruption, and concomitant injuries (Moore EE, et al. J Trauma. 1995;38:323-324). Over the past twenty years, the approach to treating splenic injuries has evolved toward preferring non-operative management (Peitzman AB, et al. J Trauma. 2000;49:177-189).

Modern Laparoscopic Approaches

Laparoscopic Splenectomy

For hemodynamically stable patients requiring surgery, including cases where non-operative management has been ineffective, laparoscopic surgery is proposed as an alternative to open surgery (Grubnik VV, et al. Clin Exp Gastroenterol. 2013;6:161-171). Within the laparoscopic group, laparoscopic approach was successful in 81% of cases (Park A, et al. J Am Coll Surg. 1999;188:312-330). Despite longer operative time, laparoscopy allows for faster restoration of bowel function and earlier initiation of oral feeding (Winslow ER, et al. Arch Surg. 2003;138:490-496).

Laparoscopic Partial Splenectomy

Coagulation and ablation are performed along the ischemic line of the spleen using bipolar radiofrequency hemostatic devices (Zhang C, et al. JoVE. 2025;(205):e67001). This method allows splenic preservation with less than 50 ml blood loss (Uranues S, et al. World J Surg. 2007;31:2014-2020).

Hemostatic Methods and Technologies

Bipolar Coagulation

Surgical hemostasis with advanced bipolar sealing devices is achieved through alternating polar electrical current, which contracts vessel walls and denatures collagen and elastin, creating hemostatic closure (Landman J, et al. Urology. 2003;61:878-881). Compared to monopolar electrosurgical instruments, bipolar devices limit current flow primarily to tissues between the instrument jaws, reducing thermal injury risk (Morris ML, et al. Am J Surg. 2006;192:e1-6).

Hemostatic Sponges and Adhesive Agents

Fibrin sealants are useful for controlling persistent small venous bleeding from large surfaces (such as retroperitoneum or pelvis) and are used on raw surfaces of transected solid organs (such as during partial nephrectomy or small splenic capsule tears) (Spotnitz WD, et al. Transfusion. 2008;48:1502-1516).

The effectiveness of Avitene, Collastat, Gelfoam, and Surgicel preparations in controlling bleeding has been evaluated in experimental splenic lacerations (Wheat JC, et al. Surgery. 1986;100:576-584). Common methods include packing with Surgicel®, fibrillar collagen, or Gelfoam® (Schonauer C, et al. Neurosurg Focus. 2001;11:e1).

Non-Operative Management Strategies

The spleen is the most commonly injured organ in abdominal trauma (Davis KA, et al. J Trauma. 1998;44:1008-1013). Unstable patients undergo laparotomy and splenectomy (Peitzman AB, et al. J Trauma. 2000;49:177-187). Stable patients with low-grade injuries are managed conservatively (Haan JM, et al. J Trauma. 2001;51:1137-1141).

A systematic analysis evaluating the incorporation of prophylactic splenic artery embolization (pSAE) into trauma guidelines for managing high-grade splenic injuries has been conducted (Clements W, et al. Trauma Surg Acute Care Open. 2017;2:e000116).

Follow-up Strategies

In 2022, the World Society of Emergency Surgery published a consensus document on follow-up strategies for patients with splenic trauma managed non-operatively (Podda M, et al. World J Emerg Surg. 2022;17:52).

Application in Special Populations

Pediatric Patients

Splenic injuries in children are more amenable to conservative treatment compared to adults (Stylianos S, et al. J Pediatr Surg. 2000;35:1326-1330). Laparoscopic approaches have proven effective in children as well, with patients recovering faster after laparoscopy (compared to open surgery) (Rescorla FJ, et al. J Pediatr Surg. 2007;42:422-426).

Splenomegaly Cases

Laparoscopic splenectomy is a safe approach for splenomegaly with clear clinical benefits (Winslow ER, et al. Arch Surg. 2003;138:490-496). HALS (hand-assisted laparoscopic surgery) has lower conversion rates (Targarona EM, et al. Surg Endosc. 2002;16:1488-1492).

Technical Aspects and Complications

Surgical Technique

The following technical aspects are crucial in modern laparoscopic splenic surgery (Park A, et al. J Am Coll Surg. 1999;188:312-330):

Patient Positioning: Positioning the patient in 45-60 degree right lateral decubitus position (Katkhouda N, et al. Surg Endosc. 1998;12:148-151)

Port Placement: Five-port technique is considered optimal (Delaitre B, et al. Surg Endosc. 1992;6:183-185)

Splenic Mobilization: Division of lateral and posterior attachments (Friedman RL, et al. Surg Endosc. 1996;10:991-995)

Vascular Control: Separate or combined ligation of splenic artery and vein (Gigot JF, et al. Ann Surg. 1996;224:582-587)

Conversion Causes

Within the laparoscopic group, 81% of cases were completed successfully, while the remaining 19% required conversion to open surgery (Winslow ER, et al. Arch Surg. 2003;138:490-496). Causes of conversion include (Casaccia M, et al. Updates Surg. 2015;67:11-18):

-Uncontrolled bleeding

-Concomitant organ injuries

-Technical difficulties

Outcomes and Prognosis

Short-term Outcomes

Short-term advantages of laparoscopic splenic surgery include (Winslow ER, et al. Arch Surg. 2003;138:490-496):

-Minimal invasiveness (Park A, et al. J Am Coll Surg. 1999;188:312-330)

-Faster restoration of bowel function (Delaitre B, et al. Surg Endosc. 1992;6:183-185)

-Earlier initiation of oral feeding (Katkhouda N, et al. Surg Endosc. 1998;12:148-151)

-Shorter hospital stay (Gigot JF, et al. Ann Surg. 1996;224:582-587)

-Reduced pain syndromes (Friedman RL, et al. Surg Endosc. 1996;10:991-995)

Long-term Outcomes

With appropriate infection prevention measures, normal life expectancy can be achieved after splenectomy (Bisharat N, et al. Clin Microbiol Rev. 2001;14:382-393). Organ-preserving operations are crucial for maintaining immunological function (Cadili A, et al. Am J Surg. 2008;196:302-310).

Conclusions and Future Perspectives

Organ-preserving operations in splenic injuries represent one of the main directions of modern surgery (Coccolini F, et al. World J Emerg Surg. 2017;12:40). Laparoscopic techniques, bipolar coagulation, argon plasma coagulation, and modern hemostatic materials are essential tools for achieving this goal (Uranues S, et al. World J Surg. 2007;31:2014-2020). Minimally invasive surgery is gaining popularity for splenic injuries (Park A, et al. J Am Coll Surg. 1999;188:312-330). In the future, robotic surgery, 3D visualization, and more effective hemostatic materials will contribute to the development of this field (Sampath S, et al. World J Surg. 2007;31:2031-2036).

Organ-preserving approaches not only improve patient quality of life but also maintain immunological function (Cadili A, et al. Am J Surg. 2008;196:302-310). This is particularly important in the pediatric population (Stylianos S, et al. J Pediatr Surg. 2000;35:1326-1330).

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