

Primary Care of the Blunt Splenic Injured Adult



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ABSTRACT

The spleen is the most commonly injured abdominal organ in blunt trauma. Immediate treatment is aimed at assessing for bleeding and abating it when it is severe. Methods for the management of blunt splenic injury—associated bleeding include observation, splenectomy, and splenic salvage procedures through splenorrhaphy or embolization. After blunt splenic injury, complications commonly occur, including bleeding, infection, thrombosis, and pneumonia. If a patient undergoes splenectomy, infections can be severe. To mitigate infectious complications after splenectomy, vaccination against common pathogens remains paramount. Patients may often present to their primary care provider with complaints related to splenic injury or long-term care of their immunocompromised state. Knowledge of the spleen's function, as well as common complications and risks, is important to physicians caring for splenic injury patients. This narrative review provides clinicians an understanding of the spleen's immune function and management strategies for patients sustaining blunt splenic injury.

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The spleen is one of the most frequently injured abdominal organs in adult trauma patients. Given its high frequency of injury, blunt splenic injury is the most frequent source of major bleeding in abdominal trauma.¹ Several modalities have been used to manage bleeding in splenic injuries. These include embolization, splenic preservation procedures, and splenectomy. These life-saving management procedures may render a patient asplenic.²

The spleen plays an important role in immune function. It comprises more than 25% of the total lymphoid mass, making it the largest lymphoid organ in the body.^{3,4} The immune function of the spleen is important for opsonization of encapsulated organisms.⁴ Thus, asplenic individuals are at risk for infections, particularly encapsulated organisms.⁵

Vaccination against these organisms provides patients protection from associated infections. The pathogens that vaccinations are commonly administered against include

Streptococcus pneumoniae, *Haemophilus influenzae*, and *Neisseria meningitidis*.⁵ Recently, the US Centers for Disease Control and Prevention (CDC) has updated post-splenectomy vaccination recommendations.⁶ Here a review of the spleen's function, as well as common management strategies and complications to assist clinicians caring for blunt splenic injured patients throughout the healthcare continuum, is provided. These patients often present to their physician for ongoing care and complaints that may be related to their blunt splenic injury.

SPLEEN FUNCTION

The spleen acts as a filter for blood-borne pathogens and antigens, in addition to its responsibilities in iron metabolism and erythrocyte homeostasis. The spleen is structured in a manner to achieve these functions through regions called red pulp and white pulp. These 2 regions are separated by an interface, the marginal zone.⁷

Red Pulp

The red pulp functions to filter blood and recycle iron from maturing red blood cells. Macrophages inside the red pulp phagocytize old and damaged red cells and blood-borne particulate matter. Iron from destroyed red blood cells is either released for use in the body or stored by the spleen as

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ferritin. Larger amounts of ferritin are transformed to hemosiderin for additional storage in the red pulp.^{7,8} In addition to destruction of damaged or aging red cells, it aids in the maturation of reticulocytes.⁴ Extramedullary hematopoiesis can occur in the red pulp, particularly in early life.⁸

Immunologic function of red pulp macrophages includes secretion of molecules that interfere with certain iron-requiring pathogens' uptake of iron, thus limiting their growth. Additionally, plasma blasts and plasma cells lodge in the red pulp after antigen-specific differentiation in the white pulp. This location allows rapid entry of antibodies into the blood stream.⁷

White Pulp

The white pulp is composed of lymphocytes, macrophages, dendritic cells, and plasma cells. It is divided into T- and B- cell compartments around an arterial vessel, each attracted to their specific region by chemokines.^{7,9} In the T-cell compartment, these cells stand ready to activate and assist in pathogen elimination. In the B-cell compartment, clonal expansion of activated B cells occurs.⁷ Soluble antigens are delivered to this large collection of immunologic cells, allowing immune recognition and processing.⁴

Marginal Zone

The marginal zone is a distinct region of the spleen designed to screen the body's circulation for antigens and pathogens, as well as aid in antigen processing. The immune cells residing in this region are important for clearance of microorganisms and viruses.⁸ The marginal zone possesses aspects of both adaptive and innate immunity.⁷

MANAGEMENT OF THE INJURED SPLEEN

The goal of management of the injured spleen is to abate bleeding that could be life-threatening. Traditionally, this was accomplished through a laparotomy and splenectomy. In the late 1970s, splenic preservation through various techniques became an alternative to splenectomy.¹⁰ In recent decades, splenic preservation has been used via embolization.² Management is often dictated by the grade of splenic injury. The American Association for the Surgery of Trauma (AAST) Spleen Injury Scale is often used, based on computed tomography findings (**Table 1**).¹¹

Observation

In the hemodynamically acceptable patient who has no other abdominal injuries requiring intervention, monitoring the patient closely is a common practice.¹² The higher the

splenic injury score, the higher the failure rate of observation.¹²⁻¹⁴ For low-grade splenic injuries (AAST I-III) the failure rate remains under 5%, but it increases with grade IV (23%) and V (63%) according to one study.¹⁴

CLINICAL SIGNIFICANCE

- The spleen is the most common abdominal organ injured in trauma.
- Observation, splenectomy, embolization, or splenic salvage procedures are methods of managing blunt splenic trauma.
- Complications are common after splenic injury; often patients may present to their primary care physician for related complaints.
- After splenectomy, patients are at risk for infections, particularly encapsulated organisms; appropriate vaccination and prompt recognition of infections are needed to improve patient care.

Splenectomy

Splenectomy has historically been the treatment of choice in managing splenic injury hemorrhage. For patients suffering from exsanguination from the spleen, it remains the preferred method of management. It is also commonly performed when a patient with a splenic injury requires laparotomy for management of other injuries.¹⁵ The entire spleen is removed with the goal of bleeding cessation, to avoid life-threatening hemorrhage. It is estimated that 20%-35% of blunt splenic injuries require splenectomy. This results in the loss of the immunologic functions of the spleen.²

Splenic Salvage

One method of controlling hemorrhage from splenic trauma is splenic salvage. This method involves operative repair of the injured spleen through application of coagulants, splenorrhaphy, partial splenectomy, or a combination of all these techniques. The goal is to preserve the spleen and abate bleeding. Failure of splenic salvage that requires splenectomy is estimated between 5% and 12%.²

Splenic Embolization

Arteriography and embolization of splenic injuries has gained popularity in recent years. Arteriography is used to examine for active bleeding. When no contrast blush is seen, close observation for significant bleeding can be performed. This seems to be most effective in low-grade (I-III) injuries. Prophylactic embolization of these low-grade injuries without contrast blush did not provide advantage in several studies.^{14,16} When there is contrast extravasation, embolization is often performed. This can be accomplished by splenic artery embolization or selective branch embolization targeted to the culprit vessels. Embolization seems to have significant advantage for higher-grade injuries (IV-V). Failure rates requiring operative intervention occur in approximately $\leq 15\%$ of cases.^{12-14,17}

COMPLICATIONS

Complications associated with blunt splenic injury are not uncommon. Significant bleeding after initial management is

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