DENTAL CONSIDERATIONS IN ASPLENIC PATIENTS

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Although it is estimated that 25,000 people undergo splenectomy each year in the United States, few publications have addressed the issues involved in managing the dental care of these patients. People who have splenectomies typically recover fully and can resume a normal lifestyle. Consequently, general dentists should be knowledgeable about the treatment needs of patients who have had such surgery.

Spleen Structure and Function

The spleen is a fist-sized spongy organ situated in the upper left abdomen, behind the lower ribs, that comprises approximately 25 percent of the body's lymphoid tissue. It consists of a white pulp, a red pulp and a surrounding fibrous capsule. The white pulp derives its appearance from the presence of white blood cells, particularly lymphocytes, that accumulate in the periarterial lymphatic sheaths and follicles. The red pulp derives its appearance from the gathering of erythrocytes in the splenic sinususes and cords (areas between the sinuses).

This highly vascular organ is perfused via the splenic artery, which enters at the hilum and branches extensively within the capsule. The blood passes through the arterioles and the surrounding lymphoid tissue of the white pulp, then proceeds to the red pulp, where it passes through an extensive network of sinusoids that are lined with phagocytic cells.

The spleen plays an important role in the body's defense mechanism against microbial infections. However, trauma or diseases sometimes make removal of this important organ necessary, which predisposes patients to certain infections. This increased risk of infection and the underlying reason for the organ's removal both may affect the provision of dental care. This article reviews the structure and function of the spleen, conditions that may require its removal or cause its dysfunction, and provides considerations for dentists who care for asplenic patients.

The spleen also is a vital component in the phagocytosis of microorganisms and subsequent antibody production. Because a large volume of blood flows past the spleen's macrophages, the organ is able to "filter" particulate or soluble foreign material from the bloodstream. The close proximity of lymphocytes allows efficient activation and expansion of a humoral response to these anti-
The spleen also has some secondary physiological functions, including extramedullary hematopoiesis in certain pathological conditions and regulation of portal blood flow. Both the spleen and the liver are integral parts of the reticuloendothelial system, which is important in removing bacteria and other foreign material from the blood. In particular, the body relies on the spleen to remove poorly opsonized bacteria that are not cleared by the liver, like pneumococci. (Opsonization is a process that prepares bacteria for breakdown during phagocytosis.)

The spleen is responsible for the production of two opsonins: tuftsin and properdin. Tuftsin is a protein that promotes phagocytosis in polymorphonuclear leukocytes; properdin is an important component of the complement system. Levels of these proteins are reduced dramatically following splenectomy; Francke and Neu reported tuftsin deficiencies in patients as many as 20 years after spleen removal.

After a person is exposed to an antigen, the spleen's white pulp initiates the IgM antibody response. Removal of the spleen reduces antibody production (IgG and IgM) and subsequent opsonization of bacteria. Normally, encapsulated organisms must be opsonized for phagocytosis to occur. When the spleen is removed, people have an insufficient number of splenic phagocytes to clear the bloodstream of bacteria. In addition, the amount of immunoglobulin available to coat the bacteria is minimal, which hinders any splenic phagocytes that may be present from mounting a sufficient antibody response. Without a sufficient antibody response in place, the liver macrophages cannot compensate for the reduced number of phagocytes.

The changes in immune function that occur after splenectomy result in increased risk of infection and predispose patients to high-grade bacteremias and overwhelming sepsis.

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### Indications for splenectomy

Various injuries or diseases can require removal of the spleen, including severe blunt abdominal trauma, iatrogenic intraoperative injury and certain hematologic conditions or diseases (see box, “Common Indications for Splenectomy”). The spleen also is removed sometimes to decrease immunological rejection of renal transplants and as an ancillary procedure during laparotomy as part of staging Hodgkin’s disease. Some individuals also can become “functionally asplenic” secondary to certain pathological conditions. Both the asplenic condition and the underlying cause of the organ’s removal can create challenges for the dental practitioners who are managing the care of these patients.

### Dental considerations

Patients who have undergone splenectomy are known to have an increased risk of overwhelming infection, with an overall mortality rate of 2.5 percent. Unfortunately, the risk of less severe infections in these patients has not been studied, and some questions remain to be answered: What is the incidence of postsplenectomy infection? How long after the surgery is a patient at increased risk of infection? What are the causative organisms of postsplenectomy sepsis? Are asplenic patients at risk of sepsis from bacteremias caused by dental procedures? Is there an indication for antimicrobial premedication before those dental procedures known to induce mucosal bleeding?

In the early 1980s, Terezhalmy and Hall supported the use of antimicrobial prophylaxis before performing dental procedures in these patients. New scientific knowledge, however, may require this position to be reevaluated.

The reported incidence of postsplenectomy sepsis varies. Green and colleagues estimated that there is a 2.7 percent chance of major postsplenectomy sepsis in asplenic adults. However, Chaikof and McCabe found that only 0.3 percent of adults who have had splenectomies developed sepsis, although they did note an increased rate of 3.7 percent among children.

Chaikof and McCabe also reported that fatal sepsis can occur up to 30 years after splenectomy, but Ellison and Fabri found that 20 percent of fatal sepsis cases occurred in the first six months and 60 percent occurred within two years. It is believed that the shorter the interval between splenectomy and sepsis, the greater the risk of...
mortality and that children are more than 10 times as likely as adults to develop sepsis.\textsuperscript{16} Splenectomy in the presence of an underlying condition, such as Hodgkin’s disease, significantly increases the risk of sepsis.\textsuperscript{20}

Most cases of overwhelming sepsis following splenectomy involve pneumococcal infection. However, other bacteria have been implicated. In order of decreasing incidence, \textit{Haemophilus influenzae, Neisseria meningitidis, \beta-}\hemolytic streptococci, \textit{Escherichia coli} and \textit{Pseudomonas} species all have been shown to be the causative agent in postsplenectomy sepsis.\textsuperscript{14,31}

It is known that dental procedures that induce mucosal bleeding may cause transient bacteremias,\textsuperscript{23,24} but generally these occurrences do not overwhelm an intact immune system. \textit{Streptococcus pneumonia}, \textit{H. influenzae}, \textit{E. coli}, \textit{N. meningitidis} and \textit{Pseudomonas aeruginosa} are not endogenous to the oral cavity and have not been shown to cause bacteremias from dental procedures.\textsuperscript{26}

In reviewing the medical and dental literature, Cullingford and colleagues found one report of viridans streptococci in one of 19 isolates\textsuperscript{25} and another report of streptococci in 11 of 349 isolates,\textsuperscript{26} with one positive blood culture of \textit{Streptococcus viridans} in a patient who had postsplenectomy septicemia.\textsuperscript{26} There also is only one reported case of a concomitant oral infection—tooth abscess—in a patient who had undergone splenectomy;\textsuperscript{16} this complication was minor and did not require hospitalization. No temporal association has been demonstrated with dental visits and onset of infection in patients with asplenia.\textsuperscript{21}

Therefore, it seems that asplenic patients are not at increased risk of developing clinically significant sepsis from oral bacteria as a result of dental procedures.

Some clinicians feel that prophylactic measures with antimicrobial medications are less effective than prompt recognition and treatment of infection with aggressive antibiotic therapy when asplenic patients become febrile.\textsuperscript{22,27} There is evidence of prophylactic antimicrobial therapy failing to prevent infection in asplenic patients,\textsuperscript{28} and numerous animal studies have cast doubt on its efficacy.\textsuperscript{29,30}

Because compliance with long-term, routine antibiotic prophylaxis is unreliable and its efficacy remains unproven in prospective randomized trials, it is prudent to avoid indiscriminate use of antibiotic prophylaxis before dental procedures.

Educating adults about the prompt recognition and treatment of acute infections seems more appropriate than universally prescribing prophylactic antibiotics before dental procedures.\textsuperscript{31,32} Also, as when treating other immunocompromised patients, dentists can take certain measures during the perioperative period to minimize the chance of infection. Patient education and scrupulous oral hygiene, use of antimicrobial mouthrines before and after dental procedures, aggressive elimination of potential introral sources of infection and frequent oral health maintenance all serve to minimize infectious complications in these patients.\textsuperscript{22}

However, dental practitioners are urged to consult with the patient’s physician regarding the patient’s overall medical status. Risk of infection and sepsis is only one concern in the asplenic patient. The dental practitioner also must examine
the reason for asplenia and correlate dental therapy with the medical condition of the patient. This is particularly important with patients who have an underlying disease, young children and patients who are immunosuppressed—such as those receiving chemotherapy—or patients who have had their spleen removed within two years of dental treatment. Because of their asplenia, these patients may need to take antibiotics such as amoxicillin during their postoperative period; in such cases, patients who have active dental infections will need antibiotic coverage that can overcome amoxicillin-resistant flora such as clindamycin.

Thrombocytopenia, a condition in which there is a reduced number of platelets in the peripheral blood, is associated with a number of diseases and conditions, including leukemia, lymphoma, certain anemias, systemic lupus erythematosus, HIV infection and hypersplenism. This condition also can be autoimmune-related, drug-related or idiopathic. It is believed that in some of these diseases and conditions, platelets are attacked by antibodies and subsequently destroyed in the spleen. Initial therapy to increase the number of platelets focuses on reduction of antibody production by high-dose, long-term corticosteroid therapy. When this treatment modality fails, splenectomy is usually indicated. Therefore, asplenic patients may often suffer from underlying conditions that may alter routine dental procedures.

Specifically, there are concerns with infection and delayed healing, as well as sequelae from chemotherapy in patients with leukemia or lymphoma. When treating patients with lupus erythematosus, dentists must be aware of conditions predisposing the patient to endocarditis and adrenal suppression secondary to corticosteroid therapy. Commonly, HIV-positive patients with idiopathic or immune thrombocytopenia, or ITP, are treated with splenectomy, which will further their immunocompromised state.

People who have had splenectomies also may be more susceptible to tuberculosis, hepatitis C and some malignancies. Healthy individuals are protected against mycobacterial infections by sensitized T lymphocytes and activated macrophage-effector cells in the lymphoid tissue. Levels of these cells are reduced in asplenic patients, thus, they are more susceptible to infection with Mycobacterium tuberculosis than people who have a healthy spleen.

Patients with ITP who have undergone splenectomy also have been shown to be at increased risk of developing chronic active hepatitis. Treatment of the patient with chronic and chronic-acute viral hepatitis involves evaluation of liver function to rule out bleeding tendencies and altered drug metabolism.

Finally, cancer patients treated with chemotherapy, such as those with Hodgkin’s lymphoma, also may have splenectomies as an adjunct to therapy or as a staging procedure. The literature indicates that these patients are at greater risk of secondary
leukemia than their counterparts who have not had splenectomies.10,40

Dentists should be familiar with some of the important considerations in treating asplenic patients who may have multiple medical conditions (see box, “Summary: Management of the Asplenic Patient”).

CONCLUSION

The number of patients who undergo splenectomy annually and the long-term survival associated with this procedure suggest that the private dental practitioner will treat these patients on an outpatient basis. The burden is on the general dentist to understand the immunological condition of patients who are asplenic or have splenic dysfunction and to recognize associated underlying diseases and conditions that may require modification of dental care.


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