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An opportunity for improvement in trauma care: 8-week booster vaccination adherence among patients after trauma splenectomy

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ABSTRACT

Background. Splenectomies are common after abdominal trauma, and measures must be taken to prevent infection, namely, the administration of available conjugate vaccinations against encapsulated organisms. While initial immunization is frequently completed prior to discharge, the Advisory Council on Immunization Practices recommends administration of an 8-week vaccination booster against *S. pneumoniae*, and compliance with this practice is unknown. We hypothesized that patients undergoing splenectomy for trauma would not routinely receive the recommended immunization and subsequent booster.
Methods. All trauma admissions at our center who required splenectomy secondary to trauma between 2010 and 2015 were included. Demographic and injury data, splenectomy dates, immunization documentation, subsequent boosters received, and outcomes were collected from the medical record.
Results. Of the 9,965 patients observed, 44 patients underwent splenectomy, with 31 patients meeting inclusion/exclusion criteria. Two patients received subsequent boosters during office or hospital visits; however, no patient received any booster within Advisory Council on Immunization Practices' recommended timeframe with median time to subsequent boosters of 22 months. Seven patients have had a subsequent admission for infection or sepsis, with one presenting with *S. pneumoniae* meningitis. None of the patients subsequently admitted for infection or sepsis had received boosters.
Conclusion. While trauma patients at our institution receive recommended immunizations after splenectomy prior to discharge, they receive boosters at a suboptimal rate and beyond the advised timeframe. We speculate that this phenomenon is widespread in the American trauma population. These data suggest a need for improved patient and provider education and coordination with primary care practitioners to ensure ideal defense against infectious complications. (Surgery 2017;160:XXX-XXX.)

The spleen is one of the most frequently injured solid organs[1] and the most frequently removed organ secondary to abdominal trauma.[2] After total splenectomy, the patient must be advised on the proper care and maintenance to increase longevity and quality of life. As the spleen plays a significant role in immune surveillance and defense against encapsulated bacteria,[3] certain measures must be taken postsplenectomy to supplement the patient's defenses. Typically, this includes three specific immunizations while in recovery: *Streptococcus pneumoniae, Neisseria meningitidis,* and *Haemophilus influenzae*. While less of a threat to the immunocompetent, these encapsulated species can cause devastating infections in patients after a splenectomy, and failure to recognize and properly care for these patients can result in progression to a life-threatening condition. Because the spleen is the largest lymphoid organ in the body, the loss of function secondary to splenectomy means that patients are at risk for development of overwhelming postsplenectomy infection (OPSI).[4,5] OPSI is characterized by the rapid progression of acute infection to life-threatening fulminant sepsis.[6]

The species of particular importance to postsplenectomy patients is *Streptococcus pneumoniae*, as it is implicated in >50% of cases of OPSI.[7,8] This highlights the need for patients to receive conjugate vaccinations to combat streptococcal infections. Conjugate vaccination variants are required to immunize patients successfully against encapsulated organisms, by joining polysaccharide targets to more immunogenic protein units.[9] The Advisory Council on Immunization Practices (ACIP) currently recommends the 13-valent pneumococcal conjugate vaccine (PVC13 [Prevnar 13]) be administered to immunocompromised patients, followed by a booster vaccination administration of 23-valent pneumococcal polysaccharide vaccine (PPSV23 [Pneumovax 23]).[10-12] Additionally, ACIP currently recommends that patients receive the quadrivalent conjugate meningococcal

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Table 1
Vaccination schedules indicated for adults based on asplenia.

Vaccine	Indication
Pneumococcal 13-valent conjugate (PCV13)	1 dose recommended
Pneumococcal polysaccharide	1 dose recommended (revaccination 5 years after first dose)
Meningococcal 4-valent conjugate (MenACWY) or polysaccharide (MPSV4)	2 doses recommended (revaccination 5 years after first dose)
Meningococcal B (MenB)	2 doses recommended
Haemophilus influenzae type b (Hib)	1 dose recommended

Adapted from the CDC Advisory Council on Immunization Practices recommendations for patients with asplenia.[10,11,13-16]

vaccine (serotypes A, C, W-135, and Y), followed by a meningococcal booster (MenB). Table 1 shows current the vaccination schedule recommendations according to ACIP's guidelines.[13-15] Patients are also advised to receive a conjugate vaccination against *Haemophilus influenzae* type B postsplenectomy.[16] In elective splenectomy, patients should receive their first vaccinations prophylactically 2 weeks prior to surgery. Because this is not an option for patients requiring emergent splenectomy secondary to trauma, vaccinations are administered after recovery.[10,11,17] Patients should then receive the booster 8 weeks after initial vaccination.

Patient adherence and communication with physicians are both essential to this task and careful monitoring of patients is critical to the prevention of infectious complications; however, compliance with recommended practice in the setting of trauma is unknown. We hypothesized that patients undergoing splenectomy for trauma would not routinely receive the pneumococcal immunization and subsequent booster vaccination within ACIP's recommended timeframe.

Methods

All trauma admissions to the Level I trauma center at the University of Kansas Hospital between January 1, 2010 and November 1, 2015 were reviewed. Within that population, all patients who required a splenectomy secondary to trauma were included. We excluded patients meeting these criteria: age <18 years old, >89 years old, current pregnancy, immunosuppressed status separate from splenectomy (malignancy or other known immune suppressive state), and current prisoners. For all patients, we obtained demographic information, injury data, Injury Severity Scale (ISS) scores, dates of splenectomies, immunization documentation, subsequent vaccination boosters received, date of subsequent booster, patient outcomes after discharge, subsequent readmission for infection or sepsis, the infectious diagnosis on readmission, any species isolated during the readmission, and the outcome of the admission for infection or sepsis.

The study was approved by the Institutional Review Board of the University of Kansas Medical Center in Kansas City.

Results

In the study, 9,965 Level I trauma patients were admitted during the time period studied. Of these, 44 patients underwent splenectomy, with 39 patients meeting all inclusion and exclusion criteria. Five patients were <18 years and were thus excluded. Additionally, one patient was determined to be in a functionally immunosuppressed state separate from their splenectomy secondary to a comorbid diagnosis of Hodgkin's lymphoma and also was excluded (Fig 1). Table 2 shows the demographics of the study population. The majority of patients observed in the study listed English as their primary language, with one patient listing Spanish as their primary language.

The remaining 31 patients all received ACIP's recommended initial immunizations prior to discharge. Two patients received subsequent boosters during office or hospital visits; however, no patient received any booster within ACIP's recommended 8-week timeframe, with median time to subsequent boosters of 22 months (range 12 to 32 months). Seven patients have had at least one subsequent admission for infection or sepsis. Of these, 5 patients have had multiple readmissions for infection or sepsis. None of the patients admitted

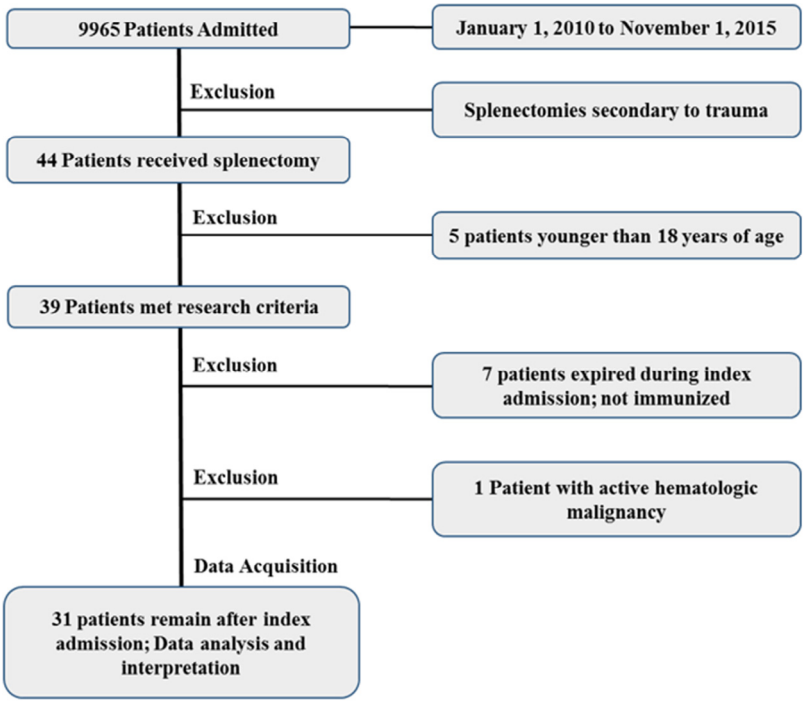

Fig. 1. Patient Inclusion Criteria.

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