Overwhelming Post-Splenectomy Bacteremia Due to *Streptococcus bovis* Group Organisms. Report of Three Cases and Review of the Literature

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Samuel McCollum, MD: Researched references; Wrote portions of manuscript; Abstracted cases

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Abstract.

We report 3 cases of severe post-splenectomy infection due to members of the *Streptococcus bovis/Streptococcus equinus* group, formerly called the *Streptococcus bovis* group, and review the literature for other cases associated with this organism.

Introduction.

There are approximately one million people residing in the United States with anatomic or functional asplenia.[1] Approximately 100,000 of these people have sickle cell disease and an estimated 25,000 people/year undergo surgical splenectomy for traumatic injury or for a variety of benign or malignant hematologic diseases.[1,2] The most feared complication of asplenia is overwhelming post-splenectomy infection (OPSI). Risk for OPSI is higher during the first three years after splenectomy and the overall calculated risk/asplenic patient/year is approximately 0.25%.[3,4] In published series, *Streptococcus pneumoniae* is the most commonly reported microorganism isolated from blood in OPSI.[5-7] Historically, other encapsulated bacteria such as *Haemophilus influenzae* and *Neisseria meningitidis* have been touted as significant pathogens, but recent studies have found these organisms only infrequently.[5-7] *Streptococcus bovis* Group organisms (SBGO) have been reported only rarely. We found one large series in which SBGO was responsible for 1 of 47 episodes of OPSI (no details given)[7] and 4 separate case reports giving patient details of SBGO in OPSI.[8-11] We report three patients with SBGO-associated OPSI and review these and the four cases noted above.

Materials and Methods.

As part of two consecutive IRB-approved Quality Improvement Projects at Summa Health, Akron, Ohio, we reviewed all patients with *Streptococcus bovis* Group (SBG) bacteremia from 2006 to 2017 (12 years) and from 2018 to 2022 (5 years). In the 2006-2017 group, we identified two patients with SBGO-associated OPSI and in the 2018-2022 group, we identified one patient with SBGO-associated OPSI. We then performed both Google Scholar® and PubMed® searches using a combination of all combinations of "overwhelming post-splenectomy infection" OR "OPSI" OR "post-splenectomy sepsis" OR "asplenic sepsis" AND one of the following: "*Streptococcus bovis"* OR *"Streptococcus bovis* group" OR "*Streptococcus gallolyticus"* OR "*Streptococcus equinus"* OR *"Streptococcus lutetiensis"* OR *"Streptococcus infantarius"* OR *"Streptococcus gallolyticus."* All cases with detailed patient information were recorded. One patient found in this literature search was reported within a series for which no detailed patient data were available.[7]

Results.

The Google Scholar® and PubMed® searches identified five previously reported cases of *Streptococcus bovis* group bacteremia in aplenic patients. Four of the five patient reports provided details of the patients' illnesses and past history. One patient was reported in a series of 47 patients with OPSI with no detailed patient information available for review. **Table 1** summarizes the characteristics of the four case reports with detailed patient information together with our three cases reported below.

Case Reports.

***Patient No. 1*.** A 70-year-old man presented to the Emergency Department (ED) with altered mental status, headache and abdominal pain that began one day prior to admission. His past medical history included aortic stenosis with known aortic regurgitation, diabetes mellitus, smoldering multiple myeloma (on carfilzomab and dexamethasone), penicillin allergy and surgical splenectomy incidental to surgical resection of pancreatic pseudocyst 10 years previously. He had received 13-valent conjugated pneumococcal vaccine, meningococcal ACY vaccine, and *Haemophilus influenzae* b vaccine remotely at time of splenectomy. In the ED he developed fulminant sepsis with hypotension (BP = 80/34 mmHg), lactic acidosis (7.6 mmol/L), acute kidney injury (creatinine = 3.5 mg/dL) and leukocytosis (WBC = 23,300/μL) and required fluid and pressor resuscitation. Based upon Surviving Sepsis Campaign guidelines[12], he initially received renal failure-dosed parenteral vancomycin and cefepime 1g intravenously every 12 hours. 48 hours later, when *Streptococcus bovis* was isolated from 2 of 2 blood cultures drawn in the ED, he was changed to intravenous ceftriaxone 2g every 24 hours. Lumbar puncture revealed normal CSF and eventually negative cultures. Transthoracic echocardiography showed no evidence of endocarditis. Source of bacteremia was thought to be gastrointestinal tract bacterial translocation as no other source was discovered. He completed 14 days of parenteral ceftriaxone via PICC line and remains well one year later.

***Patient No. 2*.** A 65-year-old woman with past medical history of hypertension, chronic obstructive pulmonary disease, deep venous thrombosis and surgical splenectomy 4

years previously for splenic artery aneurysm presented to the ED with foot swelling, fever to 104.0ºF, rigors, chills, nausea, vomiting, and lightheadedness. In the ED, vital signs were: Temperature = 103.1ºF; Pulse = 119 beats/min; Blood Pressure = 82/57 mmHg; Respirations = 20 breaths/min; Oxygen saturation = 89% on room air. She had leukocyte count = 17,000/μL with 14% bandemia, lactic acidosis (lactate = 4.0 mmol/L), acute kidney injury (creatinine = 2.3 mg/dL) and persistent hypotension and was admitted to the intensive care unit where she received intravenous fluid resuscitation and intravenous vasopressor support and, per Surviving Sepsis Campaign recommendations[12], renal failure-dosed intravenous vancomycin as well as intravenous piperacillin/tazobactam, 3.375 g every 8 hours.. On day 3, when *Streptococcus bovis* group was isolated from 2 of 2 blood cultures drawn at admission, she was changed to intravenous ceftriaxone 2g every 24 hours for 8 days. Upon discharge, treatment was completed with oral linezolid 600 mg every 12 hours for 6 more days to complete a total of 2 weeks of treatment. Transthoracic echocardiography was unremarkable. No source for bacteremia was identified and therefore the source was considered secondary to bacterial translocation via gastrointestinal tract. Prior vaccination history was unknown. She remained well 8 weeks after completion of oral linezolid therapy.

***Patient 3*.** A 78-year-old man with past medical history of abnormal heart rhythm, permanent dual-chamber pacemaker placement, diabetes mellitus and non-Hodgkin's lymphoma status post therapeutic splenectomy for the lymphoma four years previously presented to ED via rescue squad with unresponsiveness, hypotension (BP = 82/44 mmHg), lactic acidosis (lactate = 5.3 mmol/L), and acute kidney injury (creatinine = 6.6 mg/dL with baseline 0.8 mg/dL). Patient had received 13-valent conjugated

pneumococcal vaccine, types B and ACY meningococcal vaccines and *Haemophilus influenzae* b vaccine after splenectomy. Per Surviving Sepsis Guidelines[12], patient received intravenous fluids, intravenous vasopressors and intravenous vancomycin (1.5g single dose) and piperacillin/tazobactam 3.75 g every 8 hours. On hospital day 3, after isolation of *Streptococcus gallolyticus* subspecies *pasteurianus* from 2 of 2 admission blood cultures, antimicrobial therapy was changed to ceftriaxone 2g intravenously every 12 hours. Patient required hemodialysis and requirement for dialysis extended to the outpatient arena after discharge. No source for bacteremia was found making bacterial translocation from the gastrointestinal tract the most likely site of bacteremia origin. Because of the presence of intravascular dual-chamber pacemaker, patient was treated for 30 days after discharge (6 weeks total antimicrobial therapy) with cefazolin 2g IV every Tuesday and Thursday after hemodialysis and 3g IV every Saturday after hemodialysis. Transesophageal echocardiogram was negative for valvular vegetations and pacemaker lead vegetations. The presence of the intravascular pacemaker device, however, mandated total treatment of 6 weeks for possible pacemaker endocarditis. The patient recovered successfully after completion of cefazolin therapy and no relapse occurred during one year of follow-up. Unfortunately, he remained on long-term hemodialysis.

Discussion.

The global incidence of splenectomy is approximately 6.4-7.1 patients per 100,000 people per year.[13] Splenic salvage therapy is now employed in most patients with traumatic splenic injury.[13] However, splenectomy for certain leukemias or lymphomas, polycythemia vera, myelofibrosis, primary splenic malignancy, splenic

metastatic disease, hemolytic anemias, hereditary spherocytosis, thalassemia, splenic abscess and immune thrombocytopenic purpura are still not uncommon.[13] Added to this is the large burden of functional splenectomy that occurs in sickle cell disease thereby making medical encounters with anatomically or functionally asplenic patients not unusual.[1] Asplenia likely influences the risk of infection and severity of infection via a variety of mechanisms including reductions in IgG, fibronectin, IgM, neutrophil migration and phagocytic activity. Any one or all of these factors would help explain the increased propensity for infection in this patient population.[1,14]

Over the last two decades, there have been numerous changes to the classification and nomenclature system of the previously designated *Streptococcus bovis* group of organisms.[15-17] These organisms are commensals of the gastrointestinal tract of humans and other mammalian species. The currently preferred nomenclature is *Streptococcus bovis/Streptococcus equinus* complex (SBSEC) which refers to non-enterococcal group D *Streptococcus* spp. complex.[15-17] This classification system includes numerous individual species as follows: *Streptococcus infantarius* subvsp. *infantarius, Streptococcus equinus, Streptococcus alactolyticus, Streptococcus lutetiensis,* and three subspecies of *Streptococcus gallolyticus: S. gallolyticus* subsp. *macedonicus, S. gallolyticus* subsp. *gallolyticus,* and *S. gallolyticus* subsp. *pasteurianus*. Regardless of nomenclature changes, the association of various members of this group of organisms with colon and other gastrointestinal tract cancers, with non-malignant gastrointestinal tract anatomic abnormalities, and with infective endocarditis remains unchanged.[18] Increased specificity of classification has revealed unique characteristics between certain species/subspecies, including varying propensity

for different organ systems and types of infections. For instance, *S. gallolyticus* subsp. *gallolyticus* seems to be predominantly responsible for the well-known association with infective endocarditis and bacteremia associated with colorectal cancer.[19]

Table 1 summarizes the available clinical data for the 4 patients reported in the literature as well as that of our 3 patients.[8-11] There were 4 male and 3 female patients. Mean age at presentation was 65.6 years and the mean time of presentation after splenectomy was 8.3 years. The reasons for splenectomy in these patients were primarily hematologic and included ITP (2 patients), hairy cell leukemia (1 patient), marginal zone lymphoma (1 patient), chronic natural killer cell lymphocytosis (1 patient), splenic artery aneurysm (1 patient) and incidental resection of large myelomatous spleen during pancreatic pseudocyst resection (1 patient). One patient had definite infective endocarditis of mitral valve and one had probable device-related endocarditis of a permanent pacemaker. Two patients presented with SBG meningitis. Six of seven patients (86%) survived primary hospitalization. The one death was in a 70 year old woman with chronic natural killer cell lymphocytosis who presented with disseminated intravascular coagulation and died within hours of admission to hospital.

Table 1. Review of Literature: Patients with Splenectomy and *Streptococcus bovis* Group Overwhelming Post-Splenectomy Infection

Case No.	First Author	Year Reported	Age	Gender	Time After Splenectomy	Reason for Splenectomy	Reported Illnesses	GI Tract Workup	Endocarditis Work-Up	Primary Antibiotic Therapy	Lived/ Died	Misc.
1	Cohen[10]	1997	53	Male	5 months	ITP	HIV Disease	Colonoscopy negative	TTE negative	Intravenous Penicillin G x 2 wk.	Lived	Had SBG meningitis
2	Ben-Ami[8]	1999	74	Male	No Data	Hairy Cell Leukemia	None	"negative workup"	"negative workup"	Intravenous Amoxicillin (duration unknown)	Lived	Had SBG meningitis
3	Bigorra[9]	2015	70	Female	No Data	Chronic Natural Killer Cell Lymphocytosis	Chronic Natural Killer Cell Lymphocytosis	No Data	Mitral Valve Endocarditis	"Antibiotics"	Died (within hours)	DIC & Death
4	Wardle[11]	2018	49	Female	23 years	ITP	None	Colonoscopy negative	TTE negative	Intravenous Ceftriaxone x 4 wk.	Lived	Developed venous sinus thrombosis
5	This Series	2023	65	Female	4 years	Splenic Artery Aneurysm	Hypertension, Transient Ischemic Attack	No Data	TTE negative	Intravenous Ceftriaxone x 1 wk.; Oral Linezolid x 1 wk.	Lived	
6	This Series	2023	78	Male	4 years	Marginal Zone Lymphoma	Heart Block with Permanent Pacemaker	No Data	TTE negative but probable pacemaker-endocarditis	Intravenous Ceftriaxone x 2 wk.; then Intravenous Cefazolin x 4 wk.	Lived	Permanent Pacemaker
7	This Series	2023	70	Male	10 years	Multiple myeloma with incidental splenectomy during pancreatic pseudocyst resection	Multiple Myeloma	No Data	No Data	Intravenous Ceftriaxone x 1 wk.; then Oral Levofloxacin x 1 wk.	Lived	
Total	All	All	Mean = 65.6 yr.	4 Male/ 3 Female	Mean = 8.3 Yr.	6 with hematologic issues	As Noted	As Noted	1 with definite endocarditis; 1 with probable pacemaker endocarditis	As Noted	6 Lived/ 1 Died	2 with meningitis; 2 with endocarditis; 1 rapid death due to DIC

Abbreviations Used: ITP = Idiopathic thrombocytopenic purpura; HIV = Human Immunodeficiency Virus; TTE = Transthoracic echocardiogram; TEE = Transesophageal echocardiogram; SBG = *Streptococcus bovis* Group; DIC = Disseminated intravascular coagulation

Conclusion.

The members of the *Streptococcus bovis/Streptococcus equinus* complex group, formerly *Streptococcus bovis* group, should be added to the bacterial species associated with OPSI.[8-11] Although this appears to be a rare occurrence, publication of this organism-syndrome association may allow others to recognize OPSI due to members of the *Streptococcus bovis/Streptococcus equinus* complex group and report such cases in the literature. The presence of any of the organisms in this group should mandate and initiate a workup for both infective endocarditis and for gastrointestinal tract anatomic abnormalities including upper and lower intestinal tract malignant and non-malignant conditions.

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