The Risk of Sepsis in the Asplenic Adult*

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The risk of postsplenectomy sepsis in children is well established. The risk of sepsis following splenectomy in the adult remains unknown. This study provides data on this important subject. All adults (ages 16–91) who underwent splenectomies in three hospitals of the Louisiana State University Medical Center between 1965 and 1975 were identified. There were 298 patients included in the study. Postsplenectomy information was collected on 256 patients. The mean period of observation was 45 months (960 patient years). There were seven deaths from fulminant sepsis (incidence rate: 2.7%). Data were collected on 250 patients who had either a gastrectomy or cholecystectomy without splenectomy. The mean period of observation was 61 months (1270 patient years). There were no deaths due to fulminant sepsis ($p < 0.05$). When postsplenectomy sepsis was compared with the risk of sepsis in the population at large (0.001%), the difference is significant ($p < 0.001$). In the subgroup of 69 patients with hematologic or malignant disease, there were three deaths from sepsis (4.3%). In 187 patients with no underlying diseases, four patients developed sepsis, which is an incidence of 2.2% ($p < 0.05$ when compared with the population at large and control group). The risk of sepsis appears to be greater in patients with chronic disease, but has no relationship to age. These data speak for the conservation of splenic tissue when possible.

In 1952 KING AND SCHUMAKER suggested that children who had undergone splenectomies were at risk for the development of bacterial infections.[1] This risk in the pediatric population has been confirmed by others.[2] While isolated case reports of postsplenectomy sepsis in adults have been reported, little information is available concerning the incidence of this complication in adults. This retrospective review was undertaken in order to identify this risk in a random population of adults following splenectomy.

Materials and Methods

The hospital records from January 1, 1965 to December 31, 1975 at the Louisiana State University Medical Center in Shreveport, the Veterans Administration Hospital in Shreveport, and the E. A. Conway Memorial Hospital in Monroe, Louisiana were reviewed and 298 postsplenectomy patients were identified. Forty-two patients were excluded from the study either because they died in the immediate postoperative period or because they were followed for less than one month after their operation. As a control group, 100 charts of patients who underwent gastric operations and 150 charts of patients who underwent cholecystectomies at the Louisiana State University Medical Center during the same time period were also reviewed. Information regarding infection and further hospitalization was obtained by a review of the clinic records, by questionnaires mailed to the last known address of each patient, and/or by telephone contact of patients or relatives. Thus, 256 asplenic patients were followed for an average of 45 months, and 250 surgery patients who retained their spleen were followed for an average of 61 months. The term "postsplenectomy sepsis" for the purpose of this review is defined as septicemia documented by positive blood cultures occurring months to years following removal of the spleen.

Results

The splenectomy group consisted of 97 white and 159 black patients, 181 patients were male and 75 were female. The patients ranged in age from 16 to 91 years, with an average of 41 years. The control group consisted of 95 white and 155 black patients, 93 were male and 157 were female. These patients ranged in age from 20 to 94 years with an average age of 50 years.

Indications for splenectomy were divided into two general categories. Trauma necessitated surgery, in 74% of all patients. In this group, splenectomy was performed in association with other operations in 23% of the patients. Splenic injury in the course of gastric sur-

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TABLE 1. *Indications for Splenectomy*

Trauma		
incidental to other surgery	59	(23%)
motor vehicle accident	56	(22%)
gunshot wound	48	(19%)
stab wound	11	(4%)
other	13	(5%)
Subtotal	187	(74%)
Association with other disease		
malignant extension from other organ	21	(8%)
thrombocytopenia	13	(5%)
staging for Hodgkins	11	(4%)
other hematologic disorders	24	(9%)
Subtotal	69	(26%)
Total	256	(100%)

TABLE 2. *Indications for Surgery without Splenectomy*

Indications for gastric surgery	
ulcer disease	
gastric	32%
duodenal	59%
Subtotal	91%
malignant disease	9%
Total	100%
Indications for cholecystectomy	
chronic cholecystitis	83%
acute cholecystitis	15%
penetrating abdominal trauma	2%
Total	100%

gery accounted for 22%, gunshot wounds 19%, stab wounds 4%, and all other trauma prompted 5% of the splenectomies. The second major indication for splenectomy related to pre-existing hematologic or malignant diseases. Direct extensions of the carcinoma from an adjacent organ prompted 8% of these splenectomies. Four per cent of the splenectomies were performed for staging Hodgkins lymphoma, 5% for thrombocytopenia, and the remaining 9% had other hematological disorders (Table 1).

Indications for gastric surgery in the control group were divided into two categories. Ulcer disease was the most common indication with about 1/3 gastric ulcers and 2/3 duodenal ulcers. The remaining 9% of the patients in the control group underwent gastrectomies for carcinoma of the stomach. Cholecystectomies were performed for chronic cholecystitis and cholelithiasis in 83% of the patients. Fifteen per cent of the patients underwent cholecystectomies for acute cholecystitis and the remaining 2% had penetrating abdominal trauma requiring gallbladder removal (Table 2).

From the total group of 256 asplenic patients, seven instances of lethal infection were noticed. There was no apparent predilection for race or sex. The patients' ages ranged between 18 and 72 years, with an average of 51 years. Splenectomies were performed for trauma incidental to other surgery in four patients. Two other patients had direct extension of cancer from an adjacent organ, while the last had her spleen removed during a staging procedure for Hodgkins disease. The intervals between splenectomy and the onset of sepsis ranged between one and 72 months, with an average of 26 months. The organisms isolated included: pneumococcus two times, pseudomonas in two others, streptococcus once, staphylococcus alone once, and the last patient was found to have both staphylococcus and escherichia in her blood culture. The overall incidence of lethal sepsis in the study group was 2.7%. From the control of 100 gastrectomy patients and 150 cholecystectomy patients there were no cases of septicemia (Table 3).

Discussion

Is the incidence of postsplenectomy sepsis greater than that of sepsis in the population at large? Few data

TABLE 3. *Cases of Lethal Sepsis in Study Group*

Reason for Splenectomy	Interval Between Splenectomy and Sepsis	Infection	Outcome
72 WF Iatrogenic splenic tear—gastric surgery	11 mo.	Streptococcus	Death
18 WF Staging for Hodgkins	23 mo.	Pseudomonas	Death
42 WM Iatrogenic splenic tear—gastric surgery	72 mo.	Pneumococcus	Death
49 BF Iatrogenic splenic tear—gastric surgery	2 mo.	Staphylococcus & Escherichia	Death
68 WF Whipple procedure for carcinoma of pancreas	1 mo.	Pseudomonas	Death
58 BM Extention of carcinoma of stomach and spleen	3 mo.	Pneumococcus	Death
52 WM Iatrogenic splenic tear—gastric surgery	65 mo.	Staphylococcus	Death

are available to establish comparison. The available figures are based on the annual incidence of fatal infectious disease. In the general population of the South Central United States, including all ages, the annual incidence of death due to sepsis is 12.8 per 1,000,000 people or 0.001%.[3]

Comparison of the mortality data from the population at large with data from the asplenic population is statistically significant to the 0.001 level. This comparison is, admittedly, subject to error, but it may serve as a rough approximation of the hazard of postsplenectomy sepsis. Using these data, the risk of lethal sepsis in the group of asplenic patients was 540 times greater than that of the population at large. Comparison of the asplenic population with the control group was statistically significant to the 0.05 level.

The primary disease for which the spleen was removed has been reported as a factor which influenced postsplenectomy sepsis in children. According to the pediatric literature, the mortality rate due to sepsis in children who underwent splenectomies for trauma was 0.56%, and when incidental to other surgery the mortality rate due to sepsis was 0.86%. The mortality rate due to sepsis after splenectomy for thalassemia, however, was 11%.[4] The patients in this study were, therefore, divided into patients with and without existing hematologic or malignant disease. Of the 69 patients with malignancies or hematologic disorders, three patients developed postsplenectomy fulminant sepsis which is an incidence rate of 4.3% ($p < 0.01$). In 187 patients with no underlying diseases, four patients developed postsplenectomy sepsis, which is an incidence rate of 2.2% ($p < 0.05$ when compared with the population at large and control group). This suggests that all splenectomy patients are at risk of sepsis, but those with underlying disease may be at a greater risk.

The interval between splenectomy and the onset of sepsis ranged from one to 72 months, with an average of 26 months. There seems to be no limit beyond which an asplenic person may be considered safe from infection.

According to the pediatric literature, the most commonly responsible organism was pneumococcus.[5] The organisms responsible for sepsis in this study group included pneumococcus two times, pseudomonas two times, staphylococcus two times, and one each of streptococcus and escherichia. The number of cases from this study is too small to compute relative frequency of organisms responsible for postsplenectomy sepsis in adults, but initial results are generally consistent with the pediatric literature, although pneumococcus is seen less frequently.

Splenectomy is responsible for numerous alterations in host defense, which may help to explain the increased incidence of bacterial infections. Patients who undergo splenectomies have low serum IgM,[6] a decreased immunologic response to some antigens, and a failure to switch from IgM to IgG synthesis following secondary immunization.[7] Asplenic animals have an increased susceptibility to experimentally produced pneumococcal infection, which is probably related to an impaired intravascular clearance of pneumococci.[9] Finally, the human spleen is the production site of peptides, such as Tuftsin, which promote phagocytosis,[10] and the absence of these substances may further compromise the asplenic host.

What can be done to prevent or lessen the risk of developing postsplenectomy sepsis? The recently developed polyvalent (serotype 14) pneumococcal vaccine has provided significant protection, but it has many drawbacks, including other bacterial species responsible for sepsis and impaired immune response to vaccination.[11] The Prophylactic administration of penicillin has been recommended, but has too many disadvantages, including poor compliance, inadequate dosage,[12] emergence of penicillin-resistant pneumococci,[13] and failure to cover all organisms responsible for postsplenectomy sepsis. Conservative management, surgical repair, or partial splenectomy, are options available to surgeons in case of splenic trauma.

Summary

Postsplenectomy sepsis is infrequent, but appears to be a genuine hazard that should be anticipated in all patients, regardless of age or reason for removal of the spleen. In this analysis of 256 adult patients, postsplenectomy sepsis occurred in seven, which is an incidence rate of 2.7%. Death from sepsis in these asplenic adults was 540 times as prevalent as death due to sepsis in the population at large. In the subgroup of 187 patients with no underlying disease, four patients developed sepsis which is an incidence of 2.2% ($p < 0.05$). Adults, as well as children, with underlying hematologic or malignant diseases may be at greater risk of sepsis than other patients who undergo splenectomies. There seems to be no time limit beyond which an asplenic person can be considered safe from infection. The data from this study are certainly subject to criticism; however, this study of 256 adult asplenic patients followed for a total of 11,327 patient months provides the most comprehensive data available. It, therefore, seems prudent to assume that splenectomy carries an increased risk of sepsis in the adult, as well as the child. Efforts to conserve splenic tissue seems justified whenever possible.

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