CLINICAL NOTE

Delayed Toxic Shock Syndrome After Functional Endonasal Sinus Surgery

Ramzi T. Younis, MD, Rande H. Lazar, MD

Toxic shock syndrome (TSS) is an uncommon, severe, multisystem illness that may follow any surgical procedure. It usually occurs in the immediate postoperative period and is manifested by the sudden onset of a high fever and a variety of other signs and symptoms. The reported incidence of TSS after nasal surgery is 16 cases per 100 000 patients. We report five unusual cases of delayed TSS that occurred after functional endonasal sinus surgery in which no packing was used. Toxic shock syndrome developed in three children and two adults 5 days to 5 weeks postoperatively. All patients were treated successfully with no sequelae. The pathophysiologic features, clinical manifestations, and treatment of TSS are described in detail. *(Arch Otolaryngol Head Neck Surg. 1996;122:83-85)*

Toxic shock syndrome (TSS) is a rare, acute, multisystem illness that is usually characterized by the sudden onset of high fever, vomiting, diarrhea, and muscle ache, followed by hypotension, and, in severe cases, shock. Desquamation, especially of the soles and palms, and a sunburnlike rash occur during the acute phase.

Toxic shock syndrome probably has existed for many years but was considered only as an unusual complication of staphylococcal infections. The potentially fatal syndrome was first formally described in 1978 by Todd and associates,[1] who reported a series of seven children with TSS. During the 1980s, TSS was linked to the use of superabsorbent tampons during menstruation.[2,3] As more cases were reported and analyzed, it became clear that at least 11% of all cases of TSS were nonmenstrual and that all children and adults with any focal staphylococcal infection or colonization were potentially at risk for developing TSS given the appropriate conditions.[4,5]

Toxic shock syndrome may occur after any surgical procedure in which packing, splints, catheters, or other devices are used that provide the local conditions that can encourage the growth of pathogenic organisms.[6,7] The nose is one of the surgical sites in which TSS toxin-1–producing *Staphylococcus aureus* has been described.[8,9] The few reported cases of TSS after sinus or nasal surgery have developed soon after the procedures and have been linked to the use of packing.[6,10,11]

We report unusual cases of delayed TSS in three children and two adults who underwent functional endonasal sinus surgery (FESS) for which no packing was used, and we describe the pathophysiologic features, clinical manifestations, and treatment of TSS.

From Yale University Medical Center, New Haven, Conn (Dr Younis), and LeBonheur Children's Hospital, Memphis, Tenn (Dr Lazar). Dr Younis is now with the Otolaryngology Consultants of Memphis.

REPORT OF CASES

We reviewed the records of five patients who developed TSS 5 days to 5 weeks after they underwent nasal endoscopic surgery.

CASE 1

A 5-year-old white boy presented 10 days after FESS with fever, myalgia, headache, abdominal pain, hypotension, rash, and hematuria. The patient was receiving cefaclor therapy at the time of presentation. Direct sinus cultures revealed toxin-producing *S aureus*, but the blood culture was negative for organisms. Nasal endoscopy demonstrated mucopurulent drainage in the maxillary sinuses. The patient was treated and discharged 1 week later.

CASE 2

A 7-year-old white girl presented 5 days after nasal endoscopy with fever, headache, abdominal pain, vomiting, arthralgia, myalgia, diarrhea, syncopal attacks, rash, con-

Criteria for the Diagnosis of Toxic Shock Syndrome (TSS)

Definite TSS	Probable TSS
Temperature >38.9°C	Temperature >38.9°C
Diffuse macular erythroderma or maculopapular rash	Rash
Desquamation of palms or soles 1 to 2 wk after onset of illness	Hypotension, syncope, or orthostatic dizziness
Hypotension	Myalgia
Systolic pressure <90 mm Hg	Vomiting and/or diarrhea
Orthostatic pressure, a decrease of 20 mm Hg	Mucous membrane inflammation (conjunctivitis, pharyngitis, or vaginitis)
Syncope or orthostatic dizziness	Clinical or laboratory abnormalities in more than three organ systems
Clinical or laboratory abnormalities in more than three organ systems	Reasonable evidence for the absence of other causes
Reasonable evidence for the absence of other causes	

junctivitis, and pharyngitis. The patient was receiving cefaclor therapy at the time of presentation. The results of the liver function test were elevated. Nasal endoscopy was unrevealing. The blood culture was negative for organisms, but sinus cultures revealed toxin-producing *S aureus*. The patient was treated and discharged 6 days later.

CASE 3

A 32-year-old white man presented 5 weeks after FESS with fever, chills, headache, vomiting, diarrhea, hematuria, conjunctivitis, lethargy, hypotension, myalgia, and rash. The patient was receiving erythromycin therapy at the time of presentation. Nasal endoscopy revealed mucopurulent drainage in the left ethmoid and maxillary sinus cavities. Blood and sinus cultures revealed toxin-producing *S aureus*. The patient was treated and discharged 10 days later.

CASE 4

An 8-year-old white boy presented 1 week after FESS with fever, abdominal and palmar rash, conjunctivitis, hypotension, chills, vomiting, diarrhea, myalgia, lethargy, and hematuria. The results of the liver function test were elevated. The patient was receiving amoxicillin trihydrate therapy at the time of presentation. Endoscopy revealed a stenotic right antrostomy with pus in the right maxillary sinus. The blood and nasal cultures revealed toxin-producing *S aureus*. The patient was treated and discharged 10 days later.

CASE 5

A 27-year-old white man presented 10 days after FESS with fever, severe headache, syncope, myalgia, arthralgia, abdominal pain, vomiting, lethargy, diarrhea, rash, and pharyngitis. The results of the liver function test were elevated. The patient was receiving cephalexin monohydrate therapy at the time of presentation. There were no unusual findings on nasal endoscopy. The blood culture was negative for organisms, but nasal cultures revealed toxin-producing *S aureus*. The patient was treated and discharged 6 days later.

METHODS

Management of these patients included immediate hospitalization in the intensive care unit, close monitoring, and fluid replacement. Before any treatment was started, all patients signed informed consent documents. The advice of an infectious disease consultant and other specialists was sought. The results of clinical examination, laboratory tests, and cultures allowed a presumptive diagnosis of TSS, and treatment with cefuroxime and vancomycin was begun.

Nasal endoscopy was performed immediately after each patient was stabilized. This approach helped to obtain direct sinus cultures and to clean and drain the site of infection. No other sites of infection were found. All patients were discharged with a 3-week regimen of oral amoxicillin and clavulanate potassium on the recommendation of the infectious disease consultant. The patients recovered without residual sequelae or complications.

RESULTS

All five patients presented several days after nasal or sinus surgery. The procedures had been conducted by two different surgeons in three different hospitals or surgical centers. No packing had been used, and all patients were given 3-week courses of broad-spectrum antibiotics postoperatively. Our five patients were selected from a series of 1230 patients who underwent FESS sometime during a 6-year period.

Three of the five patients who presented with TSS had purulent nasal or sinus drainage. The results of the liver function test were elevated for three patients, and the results of the renal function test were also elevated for three patients. Two patients had prolonged prothrombin times and partial thromboplastin times. The nasal cultures of all patients yielded toxin-producing *S aureus*, and two blood cultures were positive for *S aureus*. All five patients had elevated leukocyte counts. All patients recovered without sequelae after treatment with immediate fluid replacement, antistaphylococcal antibiotics, and immediate nasal endoscopy with sinus irrigation.

COMMENT

Toxic shock syndrome is a potentially life-threatening illness that involves multiple organ systems in the body. If TSS occurs after nasal sinus surgery, it is usually within 24 hours and it is commonly associated with the use of packing after surgery.[7] However, we have now treated five patients with delayed staphylococcal TSS who underwent nasal surgery without the use of packing and we think that nasal surgeons should be aware of this uncommon possibility.

The conditions associated with the development of nonmenstrual TSS are listed below.

Nasal or Sinus Surgery	Wound Infection
Staphylococcal empyema	Bacteremia
Fasciitis	Septic abortion
Osteomyelitis	Insulin pump infection
Peritonsillar abscess	Postpartum infection
Contraceptive sponge	Burns
Contraceptive diaphragm	Lymphadenitis
Insect bites	Pilonidal abscess
Abrasions	

Most cases of TSS have been attributed to the production of TSS toxin-1 at the site of a localized, often relatively asymptomatic, or unnoticed infection with any strain of *S aureus* capable of toxin production. Toxic shock syndrome toxin-1 is produced by strains of *S aureus* infected with a temperate bacteriophage, and the toxin production is markedly enhanced in magnesium-depleted media.

The organism has been found in mucosal (eg, nasopharynx, vagina, or trachea) or sequestered (eg, empyema or abscess) sites. The bacterial endotoxin can enter into the bloodstream through a mucosal break, but the source of contamination is often uncertain. Toxic shock syndrome may occur as a complication of a postoperative staphylococcal wound infection that can be minor, deep, or difficult to detect.

Local conditions, such as packing or stenting, appear to increase the possibility of TSS, but the exact role of the packing is unclear.[7,12] Cases of menstrual TSS have been almost invariably associated with tampon use. The superabsorbent tampon materials used in the 1980s chelated magnesium that resulted in ideal conditions for toxin production. However, the association of other materials, such as Teflon splints, with the increased risk of TSS has not been explained by this model. Other microbial products may initiate or exacerbate TSS. Staphylococcal enterotoxins and gram-negative bacterial endotoxins have been implicated as causative factors.[13,14] Streptococcal exotoxins may act synergistically with staphylococcal toxins to cause TSS or may act alone to cause a similar disease.[15] The full expression of TSS depends on the interaction of bacterial and host factors. Staphylococcal toxins, especially TSS toxin-1, prompt the release of cytokines by host cells. Toxigenic strains of *S aureus* induce the release of interleukin-1 by monocytes and tumor necrosis factor by monocyte-macrophage populations.[16,17] Many of the effects of these cytokines, such as high fever and neutrophilia, are also those associated with TSS.

Although the classic manifestations of TSS in a high-risk patient are easily recognized, the clinical spectrum of the illness is broad, and probable cases of TSS may be overlooked. Moreover, TSS may recur in as many as 30% of these patients.[18] The currently accepted criteria for the diagnosis of the syndrome are given in the **Table**. The definite diagnosis requires all six criteria. However, to better characterize patients with milder forms of TSS, a second set of diagnostic criteria were developed by Tofte and Williams[19] (Table). All five of our patients were thought to have a definite diagnosis of TSS according to these criteria. The differential diagnosis includes Kawasaki disease, erythema multiforme, Rocky Mountain spotted fever, rubeola, leptospirosis, and enteroviral infections.[5] Type A pyrogenic exotoxin–producing streptococci can produce an illness indistinguishable from staphylococcal TSS.[15] Management of the condition demands prompt intervention and immediate hospitalization. Cultures and blood studies should be performed. The removal of infected foreign bodies, drainage of infected sites, and penicillinase-resistant antistaphylococcal antibiotics are essential for eradicating the toxigenic organisms. Volume replacement, pH correction, and cardiovascular support may be needed. Renal involvement may require dialysis and the correction of mineral levels. Corticosteroids may reduce the severity and duration of TSS.[20] The patient should be carefully monitored throughout treatment.

Because the pathogenesis of TSS is still not completely understood and because there exists no specific laboratory test to define the condition, the diagnosis must be based on clinical manifestations and the physician's judgment. Toxic shock syndrome may occur several days after sinus surgery with minimal sinus complaints and despite antibiotic therapy. It may even occur after a minor procedure, such as nasal endoscopy, and subacute bacterial endocarditis prophylaxis may be warranted in all cases. Successful management requires swift and thorough teamwork among the intensivist, infectious disease consultant, nephrologist, gastroenterologist, and otolaryngologist.

Accepted for publication August 8, 1995.

Presented at the annual meeting of the Triological Society, West Palm Beach, Fla, May 11, 1994.

Reprint requests to the Otolaryngology Consultants of Memphis, 777 Washington Ave, P-240, Memphis, TN 38105 (Dr Younis).

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Printed and Published in the United States of America