Fever Is Common Postoperatively Following Posterior Spinal Fusion: Infection Is an Uncommon Cause

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Objective To determine the frequency and clinical significance of postoperative fever in pediatric patients undergoing posterior spinal fusion (PSF).

Study design A retrospective chart review was performed for consecutive patients undergoing PSF at a single institution between June 2005 and April 2011, with a minimum of 2-year follow up. Exclusion criteria were previous spine surgery, a combined anterior-posterior approach, and delayed wound closure at the time of surgery.

Results Two hundred and seventy-eight patients with an average age of 13 years (1-22 years) met inclusion criteria, with the following diagnoses: adolescent idiopathic scoliosis 43%, neuromuscular/syndromic scoliosis 39%, congenital scoliosis 11%, spondylolisthesis 4%, and Scheuermann kyphosis 3%. Seventy-two percent (201/278) of patients had a maximum temperature (T_{max}) >38° postoperatively, and 9% (27/278) T_{max} >39°. The percentage of febrile patients trended down following the first postoperative day. Infection rate was 4% (12/278). There was no correlation between T_{max} >38° or T_{max} >39°, and timing of fever, positive blood or urine cultures, pneumonia, or surgical site infection.

Conclusion Seventy-two percent of pediatric patients undergoing PSF experienced postoperative fever, and 9% of patients had T_{max}>39°. There was no significant correlation between fever and positive blood culture, urine culture, pneumonia, or surgical site infection. This information may help relieve stress for families and healthcare providers, and obviate routine laboratory evaluation for fever alone. *(J Pediatr 2015;166:751-5)*.

Postoperative fever is a common feature of orthopedic surgery.[1,2] Pediatric patients undergoing orthopedic surgery experience postoperative fever more frequently than the adult population.[3] Although postoperative fever has been attributed to atelectasis historically, there is growing evidence that the febrile response is due to a physiological response to tissue trauma.[4-6] Despite this evidence, many patients with early postoperative fever continue to be investigated in search of an infectious etiology, at a significant cost.[5] Prior series have suggested that there is no association between postoperative fever and infection in most pediatric patients undergoing general orthopedic procedures.[3,6,7] Two factors that commonly trigger evaluation for bacterial infection are fever after the third postoperative day and temperature above 39°C,[5] but this practice has not been validated by research.[8,9]

The significant morbidity associated with postoperative spinal wound infection raises particular concern,[10] but to date, the relationship between postoperative fever and infection in patients undergoing posterior spinal fusion (PSF) has not been investigated. This study aims to define the correlation between fever in the first postoperative week and infection in pediatric patients undergoing PSF. The secondary aims are to evaluate the efficacy of evaluation for fever and to define criteria for pursuing infectious etiology for postoperative fevers.

Methods

After obtaining institutional review board approval, we retrospectively reviewed the charts of consecutive patients who underwent PSF for spinal deformity at a single institution between June 1, 2005, and April 1, 2011, and had at least 2 years of postoperative follow-up. All patients who did not have the minimum 2-year follow-up were excluded. Patients with the following diagnoses were included: adolescent idiopathic scoliosis, neuromuscular/syndromic scoliosis (NMS), congenital scoliosis, spondylolisthesis, and Scheuermann kyphosis. Exclusion

CXR	Chest radiograph
NMS	Neuromuscular/syndromic scoliosis
PSF	Posterior spinal fusion
T_{max}	Maximum temperature
UTI	Urinary tract infection

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criteria included anterior or combined anterior/posterior spinal fusion, growth-friendly procedure (growing rods, vertical expandable prosthetic titanium rib, Shilla, posterior tether), history of previous spine surgery, treatment for spinal instability because of tumor removal or traumatic injury, and nonprimary wound closure at the time of surgery. All patients were given prophylactic antibiotics preoperatively (just prior to the incision) and perioperatively and during this time period our protocol was to continue antibiotic prophylaxis until surgical drains were removed. Postoperative pain protocol includes the use of acetaminophen and narcotics (either oxycodone or dilaudid), which all patients received.

We defined fever as a recorded temperature (taken by the xxx route) higher than 38°C. Data were analyzed separately for 2 temperature groups, maximum temperature (T_{max}) $\geq 38^{\circ}$ and $T_{max} \geq 39^{\circ}$. All patients had a routine chest radiograph (CXR) taken postoperatively to look for pneumothorax on postoperative day 0; our analysis considered only additional CXRs, taken in response to fever or symptoms. Early postoperative infection was defined as a positive blood, urine, or stool culture, or CXR that resulted in additional antibiotic treatment beyond prophylactic antibiotics. Patients were monitored for spine infection with scheduled clinic visits in the first 2 years postoperatively and were encouraged to seek medical attention for any symptoms that occurred between scheduled visits, including pain, erythema, and drainage at the operative site. Inflammatory markers were monitored for all symptomatic patients. Spine infection was defined as infection requiring a return to the operating room for management, as determined by the managing surgeon. We defined evaluation for fever as the ordering of cultures (blood, urine, stool) or CXR because of a fever in the postoperative period. Charts were reviewed for the presence of any concomitant symptoms (abnormal breath sounds, urinary retention, decreased urine output, wound drainage, and greater than anticipated pain around incision site) that were also considered in initiating evaluation, as well as when the results were positive and what treatment was rendered. Student *t* test was used to analyze continuous data; Pearson χ^2 and Fisher exact test were used for categorical variables. Results with a *P* value of <.05 were considered significant. Statistical analysis was carried out using STATA (StataCorp LP, College Station, Texas).

Results

Two hundred and seventy-eight patients (65% female) with average age 13 years (1-22 years) and minimum 24-month follow-up met inclusion criteria, with the diagnosis described in Table I. Seventy-two percent (201/278) of patients had $T_{max} \geq 38^{\circ}$ in the postoperative period (0-7) and 9% (27/278) had $T_{max} \geq 39^{\circ}$. Of the patients that were hospitalized for more than 4 days, 14% (31/214) had $T_{max} \geq 38^{\circ}$, and 1% (2/214) had $T_{max} \geq 39^{\circ}$ after postoperative day 4 (Tables II and III).

Table I. Study population by diagnosis

AIS	43% (119/278)
NMS	39% (109/278)
Congenital scoliosis	11% (31/278)
Spondylolisthesis	4% (11/278)
Scheuermann kyphosis	3% (8/278)

AIS, adolescent idiopathic scoliosis.

Blood cultures were obtained from 17% (47/278) of all patients during their hospital course, of which 4% (2/47) were positive. Blood culture was obtained from 6% (8/119) of patients with adolescent idiopathic scoliosis (all were negative) and 25% (39/159) of patients with all other included diagnoses, of which 5% (2/39) were positive. Blood culture was obtained from all 7 patients who had symptoms other than fever noted (including productive cough, tachypnea, as well abnormal pain or drainage about the incision site). Patients whose charts noted symptoms other than fever had a significantly higher chance of having a positive diagnostic test compared with patients who had no other symptoms noted. Of the blood cultures taken, 29% of symptomatic patients (2/7) had positive cultures, compared with 0% of 40 patients evaluated for fever alone ($P = .02$). Both blood cultures that were positive were collected on postoperative day 15. No blood culture from patients with adolescent idiopathic scoliosis was positive. Of the 35 blood cultures drawn on or before postoperative day 7, none was positive.

Urine cultures were obtained from 17% (47/278) of patients, of which 9% (4/47) were positive. The average time from surgery to diagnosis of urinary tract infection (UTI) was 5.25 ± 2.2 days. Nonroutine CXR was performed on 35% (96/278) of patients, of which 10% (9/96) were positive. The average time from surgery to diagnosis of pneumonia was 6 ± 4.5 days. All patients with positive cultures or positive CXR received antibiotic treatment. Patients with $T_{max} \geq 39^{\circ}$ or fever after postoperative day 4 were not more likely to have a positive culture ($T_{max} \geq 39^{\circ}$: $P = .37$; > postoperative day 4: $P = .33$).

In addition to routine postoperative CXR, 96 patients had an additional CXR taken as part of evaluation for fever study and was considered positive if the patient was diagnosed with and treated for pneumonia. Thirty-one percent (8/26) of patients who had symptoms noted prior to CXR (abnormal breath sounds, respiratory distress) or who were ventilator-dependent prior to surgery had positive CXR compared with only 1.5% (1/70) of patients who had no symptoms noted prior to CXR ($P < .01$). With the exception of ventilator-dependence, other pre-existing pulmonary conditions did not increase likelihood of pneumonia in asymptomatic patients. Of the 9 patients diagnosed with pneumonia, 7 had NMS and 1 had congenital scoliosis; no patient with adolescent idiopathic scoliosis was diagnosed with pneumonia during their hospitalization (Table III).

During the 2-year follow-up period, the overall spinal infection rate was 4% (12/278). The average time from surgery to diagnosis of spine infection was 136 ± 230 days. There was not a significant difference in spinal infection rate between afebrile patients and patients with either $T_{max} \geq 38^{\circ}$ or $T_{max} \geq 39^{\circ}$ in the postoperative period. Seventy-