ABSTRACT

Purpose. To evaluate the utility of blood cultures in the assessment of early postoperative fever in hip fracture patients with no other indicators of sepsis.

Methods. 101 blood cultures were drawn on postoperative days 0 to 5 to investigate 84 febrile episodes in 31 women and 30 men (mean age, 80 years) whose body temperature measured via the tympanic route was ≥38°C. Culture results of these 61 patients were divided into culture-positive and culture-negative groups for comparison.

Results. Of the 101 blood cultures, only 2 were positive: one was obtained 5 days after dynamic hip screw fixation, and the other 4 days after hemiarthroplasty. Both blood cultures grew coagulase-negative staphylococcal species, which were deemed to be skin contaminants not requiring change of patient management. 44 of these patients were treated with oral or intravenous antibiotics for a period of time.

Conclusion. The risk of bacteraemia in patients with postoperative fever but no other symptoms of infection is low. Routine procurement of blood cultures in such patients is ineffective and of limited utility.

Key words: blood; femoral neck fractures; fever; orthopedics

INTRODUCTION

Postoperative fever in the absence of other indicators of sepsis is common and can pose a diagnostic dilemma. Increases in body temperature are a manifestation of peri-operative stress in response to tissue injury, and routine investigation in otherwise well patients is not warranted. Nonetheless, extensive workup (blood and urine cultures, urinalysis, complete blood counts with differentials, and chest radiographs) is still performed.1-3 This can pose burdens to patients, clinicians, and the health system, and cause discomfort and anxiety to patients. Although blood cultures are the gold standard for detection of bacteraemia, their yields are
low. Particularly in the fields of general surgery and obstetrics/gynaecology, blood cultures for patients with fever in the early postoperative period are not cost-effective and do not alter management. After elective orthopaedic arthroplasty, early postoperative fever in otherwise well patients is generally benign, and thus blood cultures are of low utility. Nonetheless, patients with femoral neck fractures are often old and decrepit and have co-morbidities that predispose to impaired healing and infection. This leads to low thresholds for blood cultures. We therefore evaluated the utility of blood cultures in the assessment of early postoperative fever in hip fracture patients with no other indicators of sepsis, so as to recommend guidelines for future clinical practice.

MATERIALS AND METHODS

Ethics approval was obtained from our institutional review board. Records of 483 patients who underwent femoral neck fracture fixation between April 2010 and August 2011 using cannulated screws (12%), dynamic hip screws (33%), intramedullary nails (15%), hemiarthroplasty (30%), total hip arthroplasty (8%), other procedures (e.g. girdlestones) [1%], or conservative treatment (1%) were retrospectively reviewed. Postoperatively, all patients received 24 hours of antibiotic prophylaxis (intravenous cephazolin or based on sensitivities if previously known to be colonised).

From these patients, 265 blood cultures (entailing aerobic and anaerobic sampling) were drawn. 164 cultures were from patients with sepsis on admission in receipt of antibiotics, or having severe immunosuppression secondary to disease or therapy, or with unclear documentation of the rationale for blood culture and were excluded (Table 1). The remaining 101 blood cultures were drawn on postoperative days 0 to 5 to investigate 84 febrile episodes in 31 women and 30 men (mean age, 80 years) whose body temperature measured via the tympanic route was ≥38°C.

Of the 61 patients, 23 resided in a care institution and 38 lived independently. 18 of the patients had cognitive impairment. The procedures these patients underwent included cannulated screw fixation (n=3), dynamic hip screw fixation (n=16), hemiarthroplasty (n=25), intramedullary nailing (n=11), and total hip arthroplasty (n=6).

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One blood culture set was collected in 67 febrile episodes, and 2 sets were procured in 17 episodes. According to the day of blood collection (range, 0 to 5), the number of blood cultures collected was as follows (Table 2):

**Table 2**

<table>
<thead>
<tr>
<th>Day of blood collection</th>
<th>No. of blood cultures collected</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>12</td>
</tr>
<tr>
<td>1</td>
<td>31</td>
</tr>
<tr>
<td>2</td>
<td>23</td>
</tr>
<tr>
<td>3</td>
<td>10</td>
</tr>
<tr>
<td>4</td>
<td>13</td>
</tr>
<tr>
<td>5</td>
<td>12</td>
</tr>
</tbody>
</table>

**Table 3**

Clinical parameters of patients

<table>
<thead>
<tr>
<th>Clinical parameter</th>
<th>Mean±SD (range)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature (°C)</td>
<td>38.3±0.3 (38.0–39.7)</td>
</tr>
<tr>
<td>Heart rate (beats/min)</td>
<td>95.5±17.5 (65–166)</td>
</tr>
<tr>
<td>Respiratory rate (breaths/min)</td>
<td>20.4±5.5 (14–42)</td>
</tr>
<tr>
<td>Oxygen saturation (%)</td>
<td>96.2±2.6 (89–100)</td>
</tr>
<tr>
<td>Systolic blood pressure (mm Hg)</td>
<td>139.6±24.9 (82–222)</td>
</tr>
<tr>
<td>Diastolic blood pressure (mm Hg)</td>
<td>72.3±10.6 (49–111)</td>
</tr>
</tbody>
</table>

**Table 1**

Exclusion criteria

<table>
<thead>
<tr>
<th>Exclusion criteria</th>
<th>No. of excluded blood cultures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blood collected on postoperative days &lt;0 or &gt;5</td>
<td>90</td>
</tr>
<tr>
<td>Preoperative sepsis or receiving intravenous antibiotics</td>
<td>23</td>
</tr>
<tr>
<td>Non-femoral neck fracture</td>
<td>10</td>
</tr>
<tr>
<td>Pre-existing immunocompromise</td>
<td>4</td>
</tr>
<tr>
<td>Lack of documentation</td>
<td>6</td>
</tr>
<tr>
<td>Temperature of &lt;38°C</td>
<td>4</td>
</tr>
<tr>
<td>Not temperature related</td>
<td>27</td>
</tr>
</tbody>
</table>
0–5), the mode was on day one, and the mean was 2.2 (standard deviation, 1.6) days (Table 2). All clinical parameters of the patients during febrile episodes were within the normal range, except for body temperature (Table 3). Collection of blood cultures were usually authorised by after-hour junior medical staff (n=35) and after-hour medical registrars (n=25) as well as by the orthogeriatric team (n=33), followed by nursing staff (n=7) and the orthopaedic team (n=1). The source of infection was identified in 13 patients only and included the urinary tract (n=6), the lower respiratory tract (n=5), the wound (n=1), and the intravascular catheter (n=1). 44 of the 48 patients with an unidentified source of infection were treated with oral or intravenous antibiotics for a period of time.

DISCUSSION

Postoperative fever is common and generally of benign aetiology. Its incidences range from 15 to 47%.15,16–18 To evaluate early postoperative fever in otherwise well patients, white blood cell counts, urine and blood cultures, chest radiographs, and urinalysis are often obtained, although no source of infection is identified in up to 95% of febrile episodes.19 Nonetheless, fever remains the most common indication for procuring blood cultures after surgery.

A large proportion of patients with femoral neck fractures are institutionalised or demented. These patients are often unable to care for themselves, have lower hygiene, and have poorly managed co-morbidities. Their age and medical profile may mute immune responses and pose a diagnostic dilemma. In our study, the utility of blood cultures in assessing early postoperative fever in such patients with no other indicators of infection was low, and no change in patient management ensued.

In reviewing the literature, 2 large series show similar results. In 141 blood culture sets drawn from 101 patients for assessment of early postoperative fever, only 2 sets were positive and both were identified as contaminants.14 In 1100 total joint arthroplasty patients evaluated for high-yield predictors of postoperative fever, 15% had fever, with a peak frequency on postoperative day 2.15 Only 2 out of 35 cultures were positive and both patients had clinical signs of sepsis.13 Positive predictors included fever after postoperative day 4, recurrent febrile episodes, spikes of temperature >39°C, and insertion of >2 indwelling catheter devices.13 Blood cultures in patients with no signs or symptoms of sepsis were deemed ineffective.15

In smaller series, no positive cultures were encountered in 102 samples taken to investigate 51 febrile episodes in 50 patients post arthroplasty.8 In another series, only 2 positive cultures (both deemed contaminants) were obtained from a sample size of 71 patients.10 In 92 total knee arthroplasty patients,14 the mean postoperative temperature was 38.2°C; 16 of whom had blood cultures investigated but none was positive. There was no correlation between fever and deep infection after arthroplasty.9 Overall, reported rates of postoperative bacteraemia have been low, and blood cultures are of limited utility in patients with early postoperative fever.2,5,7,20–23

A single blood culture set is valued at US$31.9 at our hospital, and the price of processing is estimated to be $70 to $230, and thus the cost of identifying a single patient with bacteraemia may be as high as $3000.25,23,24 Additional expenses are also incurred when contaminants are isolated. The impact of true-positive results on treatment is variable.19 Blood culture results do not greatly alter the management of patients with cellulitis, pyelonephritis or pneumonia, as treatment is often based on other culture techniques (urine or sputum cultures, or skin swabs).25–28 Despite species and sensitivity identification, clinicians have a predilection for empiric regimens with broad spectrum cover, and therapy to narrow the spectrum of cover was undertaken in only 16% of cases.29

The aetiology of the early postoperative fever is multifactorial. Fever is a host response to inflammation involving the elaboration of various chemical mediators.19 The endogenous pyrogen interleukin-6 is associated with the post-surgical setting. It is believed to mediate the febrile response to localised inflammation, based on increased levels of this cytokine in rats developing fever after local irritation.30 Increased local production of interleukin-6 at the surgical site results in its release into the circulation and thus leukocytosis and fever.31 Serum pyrogen levels correspond to the degree of surgical trauma.32–34 Fever is a normal physiological response to surgical stress via local and systemic release of endogenous pyrogens. Greater surgical trauma produces higher levels of pyrogens and increases the risk of developing postoperative fever. Other causes include receipt of volatile anaesthetics, intravenous antibiotics, and blood transfusions. The use of polymethylmethacrylate (PMMA) as a grouting agent for fixation of prosthetic components is a specific risk. Compared to fixation without the use of PMMA, its use in arthroplasty results in postoperative alteration of serum enzyme levels (in particular gamma-glutamyl-transpeptidase) and temperature spikes, nausea, and anorexia in a proportion of patients.35
One limitation of our study was its retrospective nature, and thus it had to rely on adequate documentation. Its statistical power was limited by the small sample size. Most febrile episodes that lead to the drawing of blood cultures occurred within the first 2 postoperative days, and it may be useful to analyse results from blood cultures obtained after this time point. In addition, paracetamol was used routinely as an analgesic, which may have blunted the febrile response.

The risk of bacteraemia in patients with postoperative fever but no other symptoms of infection is low. Routine procurement of blood cultures in such patients is ineffective and of limited utility. Evidence-based guidelines should be implemented for the use of blood cultures in the early postoperative period. The yield from blood cultures is higher in patients with fever after postoperative day 4, recurrent febrile episodes, spikes of temperature >39ºC, and >2 indwelling catheters.

REFERENCES
25. Chalasani NP, Valdecanas MA, Gopal AK, McGowan JE Jr, Jurado RL. Clinical utility of blood cultures in adult patients with