

Fever after varus derotational osteotomy is common, but not a risk factor for infection

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Abstract

Postoperative fever in pediatric patients following reconstructive hip surgery is of unknown significance. This study identifies the prevalence of postoperative fever after corrective hip surgery, its relationship to infection, and whether preventative use of anti-pyretics affects patient outcomes.

Overall, 222 patients who underwent a varus derotational osteotomy (VDRO) between 11/1/2004 to 8/1/2014 with minimum 6 months follow up were retrospectively identified. Variables included diagnosis, inpatient stay, daily maximum temperature, duration of fever, fever workup, and administration of scheduled anti-pyretics. Fever was defined as temperature $\geq 38^{\circ}\text{C}$.

In total, 123/222 (55.4%) and 70/222 (31.5%) had postoperative fevers of $\geq 38^{\circ}\text{C}$ and $\geq 38.5^{\circ}\text{C}$, respectively. Average inpatient stay was 2.7 days postoperatively. Temperature (mean = 38.0°C) was greatest on postoperative day 1 (POD1), and 43.7% of patients had $T \geq 38^{\circ}\text{C}$ on POD1. Anti-pyretics did not influence the duration of fever. Anti-pyretics on the day of surgery (POD0) did not influence the incidence of fever. Acetaminophen on POD0 significantly reduced likelihood of fever on POD1 ($P = .02$). Average length of fevers $\geq 38^{\circ}\text{C}$ and 38.5°C were 8.4 and 4.2 hours, respectively. 3/18 (16.7%) fever workups administered were positive. Postoperative fever did not predict infection. 9/222 (4.1%) patients had postoperative infection - 5/123 (4.1%) with fever $\geq 38^{\circ}\text{C}$ and 4/70 (5.7%) with fever $\geq 38.5^{\circ}\text{C}$. Rates of infection in patients with and without fevers were not significantly different ($P = .97$ for $T \geq 38^{\circ}\text{C}$ and $P = .38$, for $T \geq 38.5^{\circ}\text{C}$).

Though common, postoperative fever does not increase risk of infection. The low prevalence of positive cultures indicates routine fever workups can safely be avoided in most patients.

Level of Evidence: III, retrospective comparative study

Abbreviations: ICU = intensive care unit, NSAID = non-steroidal anti-inflammatories, POD = postoperative day, VDRO = varus derotational osteotomy.

Keywords: femoral osteotomy, fever, hip surgery, infection

1. Introduction

Postoperative fevers are common, but data and knowledge of postoperative fever in pediatric patients following reconstructive hip surgery is limited. Postoperative fever, defined as temperatures $\geq 38^{\circ}\text{C}$, is a common occurrence after orthopedic

surgery, particularly in pediatric patients.^[1] Fevers often occur during the first two days of surgery due to the body's normal physiological reaction to release cytokines in response to tissue injury. However, additional factors may contribute such as infection.^[1]

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A waiver of informed consent has been granted from the CHLA IRB as this is a retrospective study.

This study has been carried out with approval from the Institutional Review Board at Children's Hospital Los Angeles.

Robert M. Kay, MD has stock or stock options in ZimmerBiomet, Johnson & Johnson, Medtronic, and Pfizer. He is on the board or editorial board for the Commission for Motion Lab Accreditation and Journal of Pediatric Orthopedics.

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Fever workups are used to detect postoperative bacteremia when body temperatures increase to ≥ 38 or 38.5°C postoperatively, though yields of such studies are relatively low.^[2] These diagnostic workups constitute urine analysis, urine culture, blood culture, wound culture, white blood cell count, and chest x-rays. Although important to identify, positive cultures from fever workups are uncommon. A study on fever workups for patients undergoing abdominal surgery found that only 10% of urine cultures were positive, 5% of blood cultures were positive, and 2% of chest x-rays were positive.^[3] Not only do these tests have low diagnostic yields, but they prolong inpatient stay and increase hospitalization costs.^[4–6] Average fever workup costs per patient can be greater than \$1800,^[10] while overall costs associated with length of stay per fever workup have been reported to be over \$3,000.^[7]

Additionally, there is limited research on the effect of early anti-pyretic administration on reducing postoperative fever and diagnostic workup. Few studies have looked at fever outcomes in patients who underwent major orthopedic surgeries. Identifying whether anti-pyretics reduce the need for fever workups can not only improve patient experience, but also potentially save the patient and hospital substantial costs. The current study identifies the prevalence of postoperative fever after corrective hip surgery in children and whether the preventative use of anti-pyretics influences patient outcomes.

2. Methods

A retrospective review was performed to identify patients who underwent a varus derotational osteotomy (VDRO) between November 1, 2004 and August 1, 2014 at the authors' institution with a minimum of six months follow-up. Recorded measures included diagnosis, procedure(s), length of hospital stay, maximum daily temperature, duration of fever, fever workup, infection, and administration of scheduled anti-pyretics. Anti-pyretics recorded were acetaminophen, acetaminophen-codeine, acetaminophen-hydrocodone, and non-steroidal anti-inflammatories (NSAIDs). Fever was defined as temperature $\geq 38^{\circ}\text{C}$.

All groups were subjected to statistical analysis using the software STATA. T-tests were used to identify effect of anti-pyretics on temperature, days with fever, and total hours with fever (significance set at $P < .05$). Chi-squared tests were used to determine differences between groups of patients subjected to fever, anti-pyretics, and infection.

2.1. Ethical approval

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 *Helsinki declaration* and its later amendments or comparable ethical standards.

3. Results

In total, 222 patients met inclusion criteria. 183/222 (82.4%) patients were diagnosed with cerebral palsy. Out of these patients, 123 (55.4%) had postoperative fever $\geq 38^{\circ}\text{C}$, including 70/222 (31.5%) with fever $\geq 38.5^{\circ}\text{C}$. Mean postoperative fever was 38.5°C (range 38.0 – 40.4°C). Mean core body temperature at the end of the operation was 36.4°C (range 33.4 to 37.9°C). Development of postoperative fever was not different between

Average Temperature per Post-Operative Day

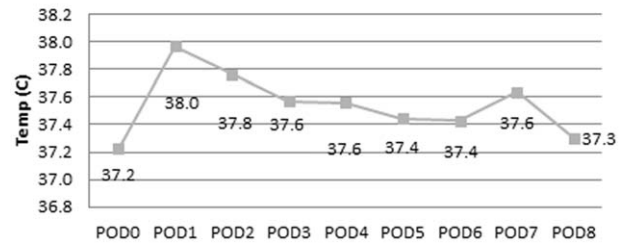


Figure 1. Average temperature per postoperative day. Reproduced with permission from the Children's Orthopaedic Center, Los Angeles.

patients who were hypothermic ($< 36^{\circ}\text{C}$) at the end of the operation vs. those who were not (45% vs 55%, $P = .38$). Additionally, body temperature at the end of the operation did not predict subsequent fever (36.4 ± 0.6 no fever vs 36.5 ± 0.5 fever, $P = .26$).

Administration of anti-pyretics did not influence number of days or total hours with fever. Anti-pyretics on the day of surgery, postoperative day (POD) 0, did not influence overall incidence of fever. Patients not administered acetaminophen on POD0 were 1.4 times more likely to develop fever on POD1 ($P = .02$).

Average length of stay was 2.7 days postoperatively. Mean intraoperative blood loss was 218.9 mL. For patients who exhibited fevers, average length of fevers $\geq 38^{\circ}\text{C}$ and $\geq 38.5^{\circ}\text{C}$ were 8.4 and 4.2 hours, respectively. Average temperatures were greatest on POD1, with a mean of 38.0°C (Fig. 1). POD1 also had the highest incidences of 97/222 (43.7%) patients with fever (Fig. 2). A negative correlation was found between postoperative day and incidence of fever (-0.84). 2/222 (0.9%) patients were admitted to the intensive care unit following surgery.

In the 123 patients with fever, 18 fever workups were administered. Out of the 18 fever workups, three (16.7%) resulted in positive tests. In total, nine (4.1%) patients developed infections. Similarly, 5/123 (4.1%) patients with fever $\geq 38^{\circ}\text{C}$ developed infections. Of patients with $\geq 38.5^{\circ}\text{C}$ fever, 4/70 (5.7%) developed infections. The differences in rate of infection between patients with and without fevers of $\geq 38^{\circ}\text{C}$ and $\geq 38.5^{\circ}\text{C}$ were not significant ($P = .97$ and $P = .38$, respectively).

Number of Fevers per Post-Operative Day

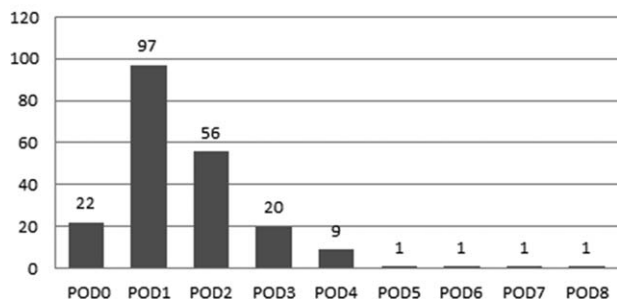


Figure 2. Number of fevers per postoperative day. Reproduced with permission from the Children's Orthopaedic Center, Los Angeles.

Patients administered acetaminophen-hydrocodone on POD0 exhibited higher rates of $\geq 38.5^{\circ}\text{C}$ fever on POD1 compared to those not administered acetaminophen-hydrocodone (34.2% vs 20.2%), although this comparison did not reach statistical significance ($P = .06$).

4. Discussion

There is a paucity of information regarding postoperative fever after hip surgery in pediatric patients. The current study is by far the largest such study, with more than 50% of patients having fevers $\geq 38^{\circ}\text{C}$ and more than 30% with $\geq 38.5^{\circ}\text{C}$.

Our findings support previous reports of postoperative fever following hip surgery. The rate of fever in this study (55.4%) is similar to previously reported values of 58% in pediatric patients undergoing hip surgery.^[8] The mean and range temperature of fever in this study (mean: 38.5°C , range: 38.0 to 40.4) are almost identical to that of Yousef et al (mean: 38.6°C , range: 38.0 – 40.3).^[9]

The frequency of fever workups undertaken in this study was much lower than in previous studies. Workups were performed in 18/123 (14.6%) of patients with fever $\geq 38.0^{\circ}\text{C}$ and in 18/70 (25.7%) of those with fever $\geq 38.5^{\circ}\text{C}$, while other authors report performing fever workups in 56% to 80% of pediatric orthopedic patients with postoperative fever.^[9,10] When diagnostic fevers workups were undertaken for postoperative fever, the rate of positive workups in this study (16.7%) was similar to rates of 10.7% and 15.2% found in previous studies in the pediatric orthopedic literature,^[9,10] and somewhat higher than the 2.4% to 14.8% rates reported by Blair et al. in a recent review of the broader orthopedic literature.^[4] However, the overall rate of positive fever workups was 2.4% (3/123) in patients with fever $\geq 38.0^{\circ}\text{C}$ and 4.3% in those with fever $\geq 38.5^{\circ}\text{C}$, and there was no increased risk of surgical site infection in the patients with fever compared to those who did not. Underlying conditions in 2 of the 3 patients in this study may have contributed to the marginally higher positive fever workup rate.

Contrary to the study by Yousef et al including both hip and spine surgery patients,^[9,10] patients in this current study exhibited a much shorter inpatient stay of 2.7 days compared to 6.6 days. Some of this difference may be to the fact that only 2/222 patients in this series (0.9%) were admitted to the ICU, despite the fact that 82.4% of patients had a diagnosis of cerebral palsy. The longer inpatient stay in Yousef et al may also be attributed to the greater estimated blood loss of 866.9 mL compared to 218.9 mL in our study.^[8,9] Further, the low rate of ICU admissions in this series may contribute to the larger portion of the patients in Yousef et al that received diagnostic workups (34.3% vs 8.1% of all patients and 56.1% vs 14.6% of those with fevers), and the larger number of diagnostic workups administered (146 vs 18).

Postoperative fevers of $\geq 38^{\circ}\text{C}$ and $\geq 38.5^{\circ}\text{C}$ after VDRO were not found to be risk factors for infection. The low frequency of infection following postoperative fever has been supported by studies on pediatric patients undergoing major orthopedic surgery.^[11,12] Since previous reports have cited higher rates of positive fever workup and infection after postoperative day three, the low number of positive tests may be related to the short average inpatient stay of 2.7 days.^[2,3,13,14] Consequently, the low rate of positive tests in response to fever reflects the unnecessary costs associated with diagnostic workups.

This study also highlights how administration of acetaminophen can reduce the likelihood of fever after VDRO surgery and

Percentage of Patients with $\geq 38^{\circ}\text{C}$ Fever per Post-Operative Day

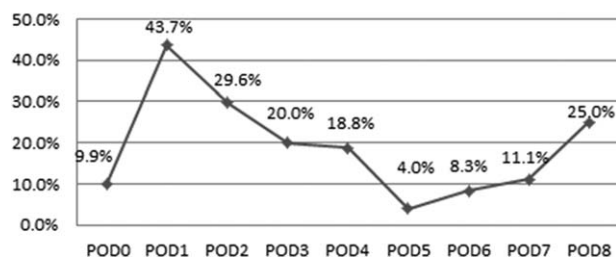


Figure 3. Percentage of patients with $>38^{\circ}\text{C}$ Fever per postoperative day. Reproduced with permission from the Children’s Orthopedic Center, Los Angeles.

length of inpatient stay in pediatric patients. The administration of acetaminophen on POD0 in this series decreased the likelihood of fever on POD1 after VDRO surgery by 30%. This is clinically relevant due to the highest fever rates and average temperatures occurring on POD1 compared to other postoperative days in both this study and previous literature (Figs. 3 and 4).^[11,15,16] Reducing fever on POD1 may improve inpatient experience due to the short average stay and negative correlation between hospital stay and prevalence of fever following the day of surgery. Additionally, fever workups are often ordered within the first three days of surgery despite early postoperative pyrexia being common and often unrelated to infection.^[4,17] Administration of anti-pyretics on POD0 may reduce subsequent administration of fever workups, saving substantial time and costs.

There are limitations to these findings. First, administration of PRN, or “as needed”, anti-pyretics during inpatient stay may have influenced the relationship between scheduled anti-pyretics and likelihood of fever, days with fever, and total hours with fever. Consequently, we are unable to determine the overall effect scheduled anti-pyretics had on inpatient stay. Second, acetaminophen-hydrocodone and acetaminophen-codeine are not primarily used to treat febrile patients but were included because of their anti-pyretic effects. As a result, the administration of these non-febrile medications may have influenced the relationship between intended anti-pyretics and postoperative fever.

Postoperative fever after VDRO surgery is not a risk factor for surgical site infection, but can lead to unnecessary tests, increased

Percentage of Patients with $\geq 38.5^{\circ}\text{C}$ Fever per Post-Operative Day

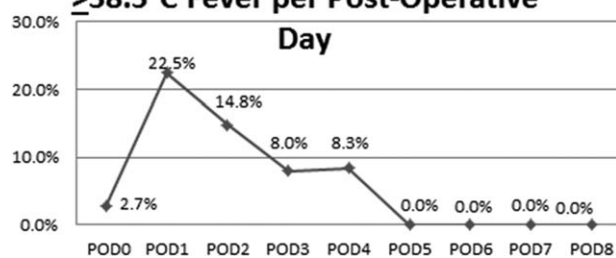


Figure 4. Percentage of patients with $\geq 38.5^{\circ}\text{C}$ fever per postoperative day. Reproduced with permission from the Children’s Orthopedic Center, Los Angeles.

cost, and prolonged hospital stay. This study identifies how anti-pyretics can reduce likelihood of fever after VDRO surgery, decreasing both costs and inpatient stay.

Author contributions

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Writing – review & editing: Deirdre D. Ryan, Rachel Y. Goldstein, Robert M Kay.

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