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Early postoperative fever workup in children: utilization and utility

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ABSTRACT

Background: Early postoperative fever is common. Adult data indicate that workup is unnecessary in the early postoperative period, but comparable data in children is limited. The objectives are to determine the incidence of fever and the utilization and yield of tests ordered in children.
Methods: Single-institution, retrospective analysis of surgical patients undergoing an elective inpatient/observational surgery between 2011 and 2015 was performed. Early fever was defined >38.0 °C within two days post-procedure. Encounters were queried for all blood cultures (BC), urinalysis (UA), urine cultures (UC), chest radiographs (CXR), and respiratory viral panels (RVP) obtained.
Results: We identified 6943 patients, of whom 30.6% developed fever. UA was positive in 19.8% of patients tested. UC was positive in 15.7% of patients and 92.0% had a urinary catheter during surgery. BC was positive in 0.69% of patients, all with a central venous catheter. CXRs were considered infectious in 3.0% of patients tested. Patients with PICU stay and/or fever ≥38.9 °C were more likely to undergo BC and UC, but no more likely to have a positive result compared those without PICU stay and/or fever <38.9°.
Conclusion: Early postoperative fever is common in pediatric surgical populations and rarely associated with an infectious source. Workup should be applied selectively.
Level of evidence: Level IV.

Early postoperative fever is common following all types of operations, occurring in anywhere from 25% to 75% of adult patients depending on the definition used [1–9]. A variety of non-infectious factors commonly contribute to fever in these postoperative patients, including the normal inflammatory cytokine response to surgery, perioperative medications, hematoma reabsorption, and the tissue trauma associated with surgery [8,10–12]. Nonetheless, many febrile patients will undergo a battery of laboratory and radiographic testing in search for an infectious etiology within the first few postoperative days. This extensive workup typically includes urinalysis, urine culture, blood culture, and a chest radiograph. Among those who undergo this broad evaluation, only 8–28% are found to have an infectious source of their fever [1,3,4,7]. The cost of the evaluation can range between $700 and $1800 depending on the tests ordered. Also, the invasive nature of these tests should not be overlooked as they often require venipuncture, catheterization, and radiation exposure. Despite the proven low yield of these evaluations, adult surgical patients are frequently subjected to this non-targeted, costly, and invasive fever evaluation [2,4,6,8,11].

The majority of data guiding postoperative fever evaluation and management arises from the adult gynecology, orthopedic, and colorectal literature. The pediatric literature is extremely limited in scope and isolated to small institutional studies from individual surgical subspecialties [3,8,9]. Without comprehensive data across a broad range of specialties, operation types, and age groups, it remains unclear whether adult practices are applicable to the pediatric population.

The goals of this study were therefore to determine the incidence of postoperative fever in the elective pediatric surgical population, describe current utilization of laboratory and radiologic studies in this cohort, and assess the yield of these evaluations at a large, quaternary pediatric hospital across multiple surgical sub-specialties.

1. Methods

1.1. Study design

Study approval was received from the Ann & Robert H Lurie Children's Hospital of Chicago's Institutional Review Board (IRB#2016–448). Across every sub-specialty, all operations associated with an inpatient or observational stay between 1/1/2011 and 12/31/2015 were queried. Same-day surgery procedures were thus excluded.

Abbreviations: BC, Blood culture; CFU, Colony forming unit; CXR, Chest radiograph; PICU, Pediatric intensive care unit; POD, Postoperative day; RVP, Respiratory viral panel; UA, Urinalysis; UC, Urine culture; WBC, White blood cell.

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Each calendar date in which the patient went to the operating room was considered as one operative encounter, regardless of whether multiple operations were performed or multiple surgical specialties were involved. Further analysis was limited to patients who had an elective admission type, had surgery on hospital day zero or one, and had a documented wound class of clean (I), clean-contaminated (II), contaminated (III), or dirty (IV). Elective procedures were identified using an 'elective' case classification code in the medical record which excluded 'urgent' procedures such as appendectomy.

1.2. Data collection and outcome measures

Information captured from the electronic medical record for each operative encounter included demographic information, operative details (date of surgery, services involved, wound class), and maximum temperature on postoperative days (POD) zero, one and two. If multiple procedures with different wound classes were performed on the same day, the highest wound class was selected for analysis as higher wound classifications may be associated with an increased risk of postoperative fever. We defined early postoperative fever as a temperature ≥38.0 °C on POD zero, one and/or two.

The hospital electronic medical record was also queried for all blood cultures, urine cultures, urinalyses, chest radiographs (single view or two view), and respiratory viral panels (RVP) performed during the study period. RVP data was only available for 2012–2015. These data sets were cross-referenced against our cohort of patient operative encounters and matched based on medical record number and date of service using IBM SPSS Statistics for Windows, version 19.

In analyzing the workup for a fever, we included tests performed on the day of, or the day after a documented fever. For example, if a patient had a fever on POD1, we analyzed tests done on POD1 or POD2. Both urinalysis and urine culture were acknowledged and analyzed as separate laboratory tests. Urinalysis was considered positive if it had one or more of the following: WBC > 10 cells per high-power field on microscopy, nitrite positive, leukocytes moderate or large, leukocyte esterase 2 +, or moderate/many bacteria in the absence of squamous cells. Urine culture was considered positive if greater than 10,000 CFU were isolated and two or less organisms identified during culture. Three or more organisms identified on a urine culture was considered to be contaminated specimen. A blood culture was considered positive if there was growth of an organism within five days of obtaining the specimen without evidence of contamination. Specimen contamination was defined as the presence of coagulase-negative staphylococcus. For chest radiographs, the radiologist's impression was reviewed manually by one author (KC) and classified as (1) routine evaluation for hardware/implant, (2) normal, (3) non-infectious positive finding [e.g. effusion, atelectasis, pneumothorax], and (4) infiltrate concerning for infection. At our institution, the RVP tests for influenza, respiratory syncytial virus, parainfluenza, human metapneumovirus, human rhinovirus, and adenovirus.

We had an a priori hypothesis that patients who had a higher wound class, postoperative pediatric intensive care unit (PICU) stay, and/or a high fever (defined as ≥38.9 °C) may have a higher rate of fever evaluation than those with a lower wound classification or without a PICU stay or high fever. We therefore performed subgroup evaluation of these cohorts.

1.3. Statistical analysis

Descriptive statistics were calculated using proportions and categorical results were compared using χ^2. For all tests, $P < .05$ was considered statistically significant. Data merging and statistical analysis were performed with IBM SPSS Statistics for Windows, version 19.

2. Results

2.1. Overall results

We identified 18,612 distinct patient operative encounters during the defined study period, of which 6943 met inclusion criteria. 3579 (51.5%) were male. Demographic data and distribution of cases by surgical service are detailed in Table 1. Notably, patients undergoing orthopedic operations had by far the highest rate of postoperative fever

Table 1
Demographic characteristics of 6943 elective inpatient surgical patients between 2011 and 2015.

	Early postoperative fever	No early postoperative fever	p-Value
No. (%) of patients	2128 (30.6)	4815 (69.4)	
Age, mean (SD)	7.6 (6.6)	8.4 (6.9)	<0.001
Gender, No. (%) of patients			0.64
Male	1088 (51.1)	2491 (51.7)	
Female	1040 (48.9)	2324 (48.3)	
Race, No. (%) of patients			0.08
White	1130 (53.1)	2729 (56.7)	
Black	268 (12.6)	540 (11.2)	
Asian	111 (5.2)	233 (4.8)	
Other	564 (26.5)	1185 (24.6)	
Multiple	27 (1.3)	87 (1.8)	
Unknown	28 (1.3)	41 (0.9)	
Ethnicity, No. (%) of patients			0.1
Hispanic	569 (26.7)	1172 (24.3)	
Not Hispanic	1503 (70.6)	3520 (73.1)	
Other/unknown	56 (2.6)	123 (2.6)	
Primary Insurance, No. (%) of patients			0.05
Private	1220 (57.3)	2980 (60.4)	
Government	894 (42.0)	1875 (38.9)	
Other/unknown	14 (0.7)	32 (0.7)	
Primary service, No. (%) of patients			<0.001
Pediatric surgery	429 (20.1)	1324 (27.5)	
Orthopedic surgery	722 (33.9)	648 (13.4)	
Neurosurgery	330 (15.5)	1358 (28.2)	
Cardiac surgery	284 (13.3)	549 (11.4)	
Urology	110 (5.2)	382 (7.9)	
Plastic surgery	150 (7.0)	159 (3.3)	
Otolaryngology	76 (3.6)	341 (7.1)	
Transplant surgery	25 (1.8)	49 (1.0)	
Ophthalmology	2 (0.09)	8 (0.2)	

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