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The Incidence of and Risk Factors for Postoperative Fever after Cleft Repair Surgery in Children

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ABSTRACT

Purpose: The characteristics of postoperative fever after cleft repair surgery in children are unknown. Thus, the purpose of this study was to determine the incidence of and risk factors for postoperative fever.
Design and methods: We retrospectively assessed 328 children who underwent cleft surgery at our hospital between March 2016 and April 2017 and were followed up for at least 3 days postoperatively. Fever was defined as a body temperature ≥38.0 °C.
Results: Seventy-one percent (n = 233) of patients developed fever within 72 h postoperatively, and most cases of postoperative fever were benign. Patients most frequently developed fever within 24 h postoperatively, and the occurrence of fever significantly decreased between 24 and 72 h postoperatively ($p < 0.001$). The incidence of fever with temperatures between 38.0 °C and 39.0 °C was higher than that of fever with temperatures ≥39.0 °C ($p < 0.001$). The mean duration of an episode of fever was 4 h. The type of surgery, method of anesthesia, and duration of anesthesia and surgery were found to be correlated with postoperative fever after cleft surgery.
Conclusions: Most cases of postoperative fever after cleft surgery were benign occurrences. Postoperative fever after cleft repair surgery was characterized by a low grade, an early onset and a short duration in children. The method of anesthesia, duration of surgery and duration of anesthesia were risk factors for postoperative fever.
Practice implications: Our results could help healthcare providers to gain increased knowledge of the risk factors for fever and when and how to treat postoperative fever.

Introduction

Postoperative fever is a common complication after all types of surgery, and the rate of postoperative fever can range from 10 to 40% (Lesperance, Lehman, Lesperance, Cronk, & Martin, 2011). Young patients are likely to suffer from a higher incidence of postoperative fever because of immature temperature regulation in children (Kinoshita et al., 2014), and the incidence of fever in children is 30.6% and might even be as high as 84.4% (Corkum, Hunter, Grabowski, & Lautz, 2017; Kinoshita et al., 2014). The causes of fever can involve both noninfectious and infectious factors (Andres, Taub, Gurkan, & Wenz, 2003). Increasing evidence has suggested that most fever responses are due to a physiological response to tissue trauma and the discharge of inflammatory cytokines (Andres et al., 2003; Christabel et al., 2015). Postoperative fever is generally associated with considerable morbidity and mortality in children (Chen, Changchien, & Tang, 2008).

Cleft lip and/or palate is a birth defect that manifests as an opening in the lip and/or palate. Approximately 1 in 700 babies have a facial structure affected by cleft lip and/or palate because of variation in reference to geographic origin and ethnicity, and the majority of children with a cleft lip or palate undergo an operation during the first year of life (Sarmiento, Valencia, Gracia, Hurtado-Villa, & Zarante, 2018). Multiple and complex factors influence the outcomes of cleft repair. Complications after cleft surgery are clinically unavoidable, and some complications in the early postoperative period appear to be acceptable (Adesina, Efunkoya, Omeje, & Idon, 2016; Zhang et al., 2014). Dehiscence and infection are the most common types of complications, and 4.4% of patients had one or more complications among 2062 patients with follow-up who underwent cleft repairs (Schonmeyr, Wendby, & Campbell, 2015). Postoperative fever seems to be a common complication of cleft repair surgery and can be associated with these complications (Schonmeyr et al., 2015). However, to the best of our knowledge, no reports have described in detail the characteristics of fever that commonly occurs after cleft repair surgery. The incidence of and risk factors for postoperative fever after cleft lip and/or palate repair

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surgery in children are unknown. The purpose of this study was to determine the incidence and clinical significance of postoperative fever and the risk factors for postoperative fever, as well as to summarize the timing of fever occurrence and the magnitude of fever after cleft lip and/or palate repair surgery. A better understanding of postoperative fever would help healthcare providers to understand the risk factors for fever and recognize when and how to treat postoperative fever.

Materials and methods

Design

This retrospective study was based on the charts of children who underwent cleft lip and/or palate surgery at our hospital between March 2016 and April 2017 and were followed up for at least 3 days postoperatively. This study was approved by the Institutional Review Board of Guangzhou Women and Children Medical Center. Children who did not undergo the minimum 3-day follow-up after surgery were excluded. Children with fever or signs of infection prior to surgery were excluded. Data, including demographic information, surgical details, nursing notes, and discharge summaries, were gathered retrospectively based on available medical records. All of the children's data, including forehead temperature, sex, age, weight, height, type of surgery (cleft palate (CP) and cleft lip and palate (CLP)), method of anesthesia, duration of anesthesia and surgery, use of a urinary catheter, volume of blood loss, volume of infusion, hemoglobin levels, method of postoperative analgesia, blood culture, urine culture, use of antibiotic therapy, chest radiography, and postoperative pediatric intensive care unit (PICU) stay and hospital stay were collected by three trained surgical nurses using the same prepared checklist from electronic medical records.

Data collection

Body temperature was measured using a forehead thermometer four or more times per day for at least 3 days postoperatively. We defined fever as a recorded body temperature ≥38.0 °C. The characteristics of postoperative fever included the time periods of occurrence, duration of fever, number of fever events and maximum temperature. Fever was evaluated separately for two classifications of temperature: maximum temperature between 38.0 °C and 39.0 °C and maximum temperature ≥ 39.0 °C. The duration of an episode of fever was defined from the time when the fever was first detected to the time when the body temperature decreased to <38.0 °C, and the normal temperature could be maintained for at least 60 min. If the body temperature had normalized after an episode of fever and then rose to ≥38.0 °C within 60 min, it was regarded as the same fever. If it rose to ≥38.0 °C after 60 min, it was regarded as another episode of fever. Two or more fever events occurring in the same patient were defined as repeated fever. The occurrences of postoperative fever were divided into several time periods according to the time of onset: within 24 h postoperatively and between 24 and 72 h postoperatively. We also analyzed the occurrence of fever within 72 h postoperatively, which included fevers that occurred at any time during the first 72 h postoperatively (Fig. 1A). We defined an infection as positive chest radiography, blood or urine culture that resulted in antibiotic therapy. Hematology tests for leukocyte counts were routinely performed within 24 h postoperatively after cleft surgery. Clinical symptoms and signs were also collected from all children with fever to determine whether they had an infection.

All of the procedures were performed under general anesthesia (GA) with intubation with or without a local block (LB) with 0.25% ropivacaine. Palatine and nasopalatine nerve blocks were used for CP surgery. An infraorbital nerve block and palatine and nasopalatine nerve blocks were used for CLP surgery. Postoperative analgesia was provided with 0.03–0.04 μg/kg/h of sufentanil by patient-controlled intravenous analgesia with or without 10 mg/kg of ibuprofen by mouth every 8 h as required.

Statistical analysis

All of the data were processed and analyzed with SPSS software, version 16.0 (SPSS Inc., Chicago, IL, USA). The results are expressed as the mean and standard deviation or numbers. Student's *t*-test was used to compare the means, and the chi-square test was used to compare categorical variables. Multiple logistic regression analysis was used to estimate the independent effects of the predictive variables on the incidence of postoperative fever and to calculate the odds ratio (OR) and 95% confidence interval (CI). A p value <0.05 was considered statistically significant.

Results

Rate of postoperative fever in children at different time points

Data from 328 children who underwent cleft lip surgery were analyzed, and 122 children were excluded because they did not receive follow-up care for at least 3 days postoperatively. The characteristics of the patients are shown in Table 1.

Sixty-four percent (n = 210) of patients experienced fever within 24 h postoperatively. Twenty percent (n = 65) of patients experienced fever between 24 and 72 h postoperatively. Patients most frequently developed fever within 24 h postoperatively, and the occurrence of fever significantly decreased between 24 and 72 h postoperatively (χ^2 = 131.638, $p < 0.001$). Thirteen percent (n = 42) of patients developed repeated fever both within 24 h postoperatively and between 24 and 72 h postoperatively (Fig. 1B); 12% (n = 40) of patients had a maximum temperature between 38.0 °C and 39.0 °C, and 1% (n = 2) of patients had a maximum temperature ≥ 39.0 °C. The incidences of fever within 24 h postoperatively and between 24 and 72 h postoperatively were combined and summarized as the incidence of fever within 72 h postoperatively. Seventy-one percent (n = 233) of patients experienced fever within 72 h postoperatively; 64% (n = 211) of patients had a maximum temperature between 38.0 °C and 39.0 °C, and 7% (n = 22) of patients had a maximum temperature ≥ 39.0 °C. The incidences of fever in the two classifications of maximum temperature are shown in Table 2.

Within 72 h postoperatively, 1% (n = 3) of the patients experienced 4 fever events, 8% (n = 27) experienced 3 fever events, 19% (n = 63) experienced 2 fever events, 43% (n = 140) experienced one fever event, and 29% (n = 95) experienced no fever events (Fig. 2). The total number of fever events was also evaluated. The total number of fever events was 273 within 24 h postoperatively and 86 between 24 and 72 h postoperatively (Fig. 3). Sixty-nine percent (n = 103) of the total children receiving ibuprofen (n = 150) for pain control experienced postoperative fever, and 73% (n = 130) of the total children not receiving ibuprofen (n = 178) experienced postoperative fever. There was no significant difference between the two different populations ($\chi^2 = 0.755$, $p = 0.395$).

Outcome of postoperative fever and risk factors for fever

The mean duration of an episode of fever was 4 h. There was no significant difference in leukocyte counts between patients with and without fever within 24 h postoperatively after cleft surgery (Table 1). Five percent (n = 17) of all of the children had PICU stays, including 15 children with fever and 2 children without fever. Among these 17 patients, one child spent 7 days in the PICU, 2 children spent 2 days, and 14 children spent one day. Blood cultures were obtained from 3 children during their PICU stays, and one child was positive for a bacterial infection. Chest radiography and urine cultures were obtained from 3 children during their PICU stays, all of which were negative. Most cases of postoperative fever were benign and were rarely associated with an

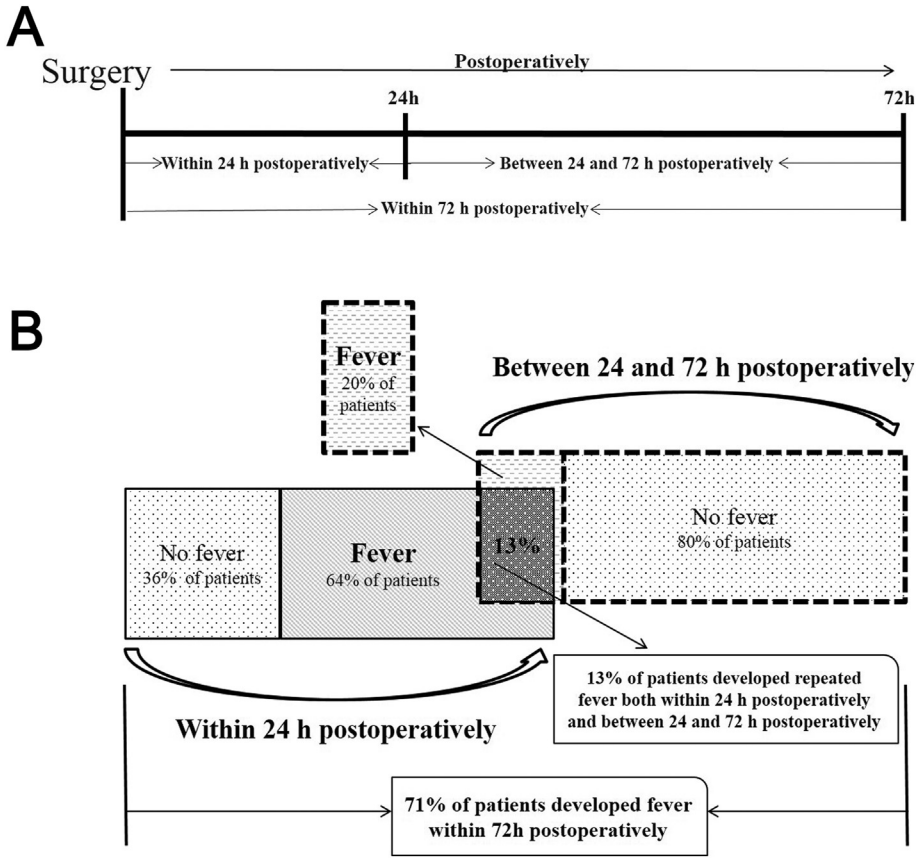

Fig. 1. Occurrence of fever within 24 h postoperatively, between 24 and 72 h postoperatively and within 72 h postoperatively.

infection. Only one child had an infection and underwent antibiotic therapy because the blood culture was positive for *Staphylococcus epidermidis*. The child spent 7 days in the PICU and developed a palatal fistula following CLP surgery.

The mean duration of urinary catheterization was 2 h, and urinary catheters were mainly used during surgery and removed before the child awakened from anesthesia. Use of a urinary catheter (OR = 1.905, $p = 0.505$) was not a risk factor for the occurrence of postoperative fever. Other predictive factors, including sex, age, weight, height, volume of blood loss and infusion, hemoglobin levels and method of postoperative analgesia, were not independently associated with the occurrence of fever (Table 3). The type of surgery (OR = 0.259, $p = 0.026$), method of anesthesia (OR = 0.209, $p < 0.001$), duration of surgery (OR = 1.082, $p < 0.001$) and duration of anesthesia (OR = 0.969, $p = 0.003$) were found to be correlated with the rate of fever after cleft surgery using logistic regression (Table 3).

Table 1
Demographic and characteristics of the patients with or without fever.

Variables	All subjects (n=328)	Fever (n=233)	No fever (n=95)	P values (Fever : no fever)
Age(month)	15.2(10.1)	14.7(9.7)	16.3 (10.9)	0.212
Weight(kg)	9.9(2.5)	9.8(2.3)	10.2(2.9)	0.172
Height(cm)	75.7(10.8)	75.4 (10.6)	76.5(11.3)	0.403
Gender(M/F)	188/140	132/101	56/39	0.714
CP/CLP	273/55	189/44	84/11	0.142
GA/GA with LB	218/110	178/55	40/55	<0.001*
Blood loss(mL)	7(3)	6.8(2.8)	6.7(3.1)	0.834
Volume of infusion(mL)	177(59)	177(59)	178(59)	0.816
Anesthesia time(min)	82(24)	84(25)	78(20)	0.028*
Duration of surgery (min)	58(24)	62(25)	49(19)	<0.001*
Hemoglobin(g/L)	92(10)	92(10)	92(9)	0.830
Leukocyte count (*10^9/L)	13.0(4.0)	13.2(4.1)	12.7(4.0)	0.338
Hospital stay(days)	4(1)	4.0(1.2)	3.8(0.9)	0.150

Values are expressed as the number or the mean (SD). Note: GA, general anesthesia; LB, local block; CP, cleft palate; CLP, cleft lip and palate. * p <0.05.

Differences in clinical parameters and laboratory testing between children with or without fever

As shown in Table 1, the results from the subanalysis of patients who experienced fever or no fever demonstrated that the duration of hospital stay after surgery was similar between patients who experienced fever and patients who did not experience fever. The methods of anesthesia (GA/GA with LB), duration of surgery and duration of anesthesia in patients with fever were significantly different from those in patients without fever (Table 1).

Differences in clinical parameters and laboratory testing between the CP and CLP groups

Data from 273 children who underwent the CP procedure and 55 children who underwent the CLP procedure were analyzed. There was a significant difference in the rate of fever between the CP and CLP groups within 24 h postoperatively ($\chi^2 = 4.368$, $p = 0.045$) but not in the rate of fever between 24 and 72 h postoperatively or within 72 h postoperatively (Table 4). Our results indicated that the type of surgery was correlated with the incidence of fever within 24 h postoperatively.

Table 2
Number of children who developed fever after cleft surgery at different postoperative time periods.

Variables	All fever	≥38.0 °C < 39.0 °C	≥39.0 °C	*p* values
Within 24 h postoperatively [n(%)]	210(64)	190(58)	20(6)	<0.001*
Between 24 and 72 h postoperatively [n(%)]	65(20)	61(19)	4(1)	<0.001*
Within 72 h postoperatively [n(%)]	233(71)	211(64)	22(7)	<0.001*

Values are expressed as the number (percentage).
* $p < 0.05$.

Differences in clinical parameters and laboratory testing between the GA and GA with LB groups

Two hundred and eighteen children who underwent the cleft surgery received only GA with sevoflurane, and 110 children underwent sevoflurane anesthesia combined with an LB. The rate of fever in children who underwent sevoflurane anesthesia combined with an LB was significantly lower than that in children who underwent only sevoflurane anesthesia within 24 h postoperatively (79%: 35%, $\chi^2 = 62.442$, $p < 0.001$) and within 72 h postoperatively (82%: 50%, $\chi^2 = 35.598$, $p < 0.001$) but not between 24 and 72 h postoperatively (Table 5). Our results suggested that the use of an LB could decrease the incidence of postoperative fever in children who undergo GA.

Discussion

Postoperative fever is a common occurrence in children, but no prior studies have focused on postoperative fever following CLP procedures. In the present study, most cases of postoperative fever were benign, and only one child developed an infection. Patients most frequently developed fever within 24 h postoperatively, and the occurrence of fever significantly decreased between 24 and 72 h postoperatively. Postoperative fever after CLP surgery tended to be characterized by a low grade with a maximal temperature between 38.0 °C and 39.0 °C, an early onset within 24 h postoperatively, and a short duration (4 h). Hence, in the present study, postoperative fever was more commonly a benign occurrence, with only a small proportion of cases caused by an infection.

In the present study, the main finding was that there was an association between the use of an LB and the incidence of postoperative fever in children who underwent GA. The human core body temperature is usually maintained by thermoregulatory defense mechanisms, such as shivering and vasoconstriction or sweating and vasodilatation, and this thermoregulation is inhibited and impaired during GA in a dose-dependent manner (Lenhardt, 2010). Cytokine synthesis and discharge, including of IL-6 and TNF-a, are the earliest responses to surgical trauma, and fever is a response to this inflammatory cytokine discharge (Alsina, Matute, Ruiz-Huerta, & Gilsanz, 2014; Andres et al., 2003). Systemic inflammatory responses are stimulated by GA during surgery, and the levels of inflammatory cytokines were increased in patients who received GA (Alsina et al., 2014; Celic-Spuzic, 2011; Jin, Zhao, Li, Wang, & Wang, 2013; Tylman, Sarinowski, Benqtson, Kvarnstrom, & Benqtsson, 2011). GA combined with regional anesthesia during surgery reduced the systemic inflammatory response compared with GA alone in this analysis (Celic-Spuzic, 2011; Fares, Mohamed, Hamza, Sayed, & Hetta, 2014; Hadimioqlu et al., 2012; Wolf, 2012). Local anesthetic blocks inhibit the afferent and efferent pathways, causing profound inhibition of the inflammatory response to surgical trauma and GA (Beloeil & Mazoit, 2009; Wolf, 2012). Hence, the use of an LB might have decreased the incidence of postoperative fever in children who received GA in the present study.

Our results demonstrated that the type of surgery, duration of surgery and duration of anesthesia were independent risk factors for fever. In our study, the duration of surgery and anesthesia were dependent on the type of surgery. Generally, the operative time for CP surgery is less than that for CLP surgery. The duration of surgery has been suggested to be correlated very strongly with postoperative fever (Biddle, 2006). Additionally, some studies have suggested that a long operative time, especially a duration longer than 108 min, would increase the risk of postoperative fever (Nakanishi et al., 2014; Nomura et al., 2017; Seo et al., 2017). However, other studies have found no association between operative time and postoperative fever (Ahn, Paick, & Kim, 2014; Andres et al., 2003; Hobar et al., 1998). This discrepancy could be attributed to different types of surgery and the narrow differences in operative time between the longest and shortest surgeries in their studies. Our results suggested that, in cleft surgery, a long operative time would increase the incidence of postoperative fever.

Our results demonstrated that age was not an independent risk factor for fever. Some previous studies have suggested that age is related to

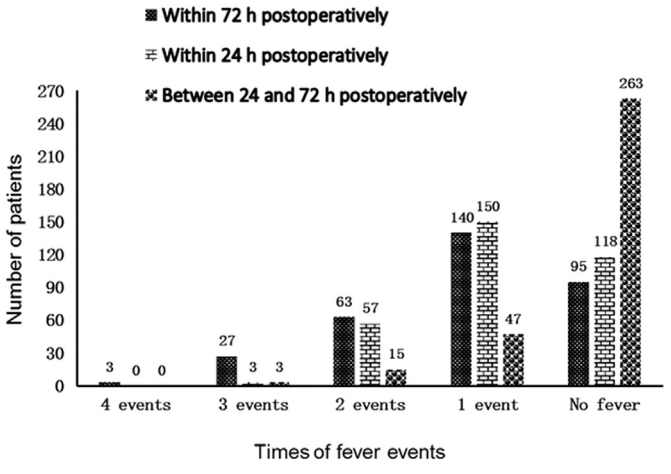

Fig. 2. Number of patients who had different times of fever events during the postoperative periods.

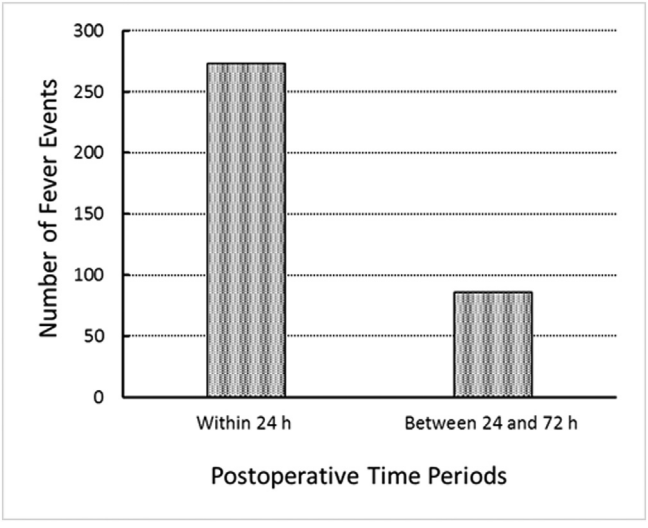

Fig. 3. Total number of fever events within 24 h postoperatively and between 24 and 72 h postoperatively.

Table 3
Multiple logistic regression analysis of risk factors for postoperative fever.

Variables	OR	95% CI	*p* values
Age	0.999	0.947–1.054	0.975
Gender	0.980	0.540–1.778	0.946
Weight	0.988	0.779–1.254	0.923
Height	1.017	0.960–1.077	0.571
Type of surgery	0.259	0.079–0.852	0.026*
Method of anesthesia	0.209	0.120–0.366	<0.001*
Use of urinary catheter	1.905	0.286–12.688	0.505
Blood loss	0.971	0.871–1.082	0.594
Volume of infusion	0.996	0.990–1.002	0.211
Duration of anesthesia	0.969	0.949–0.989	0.003*
Duration of surgery	1.082	1.052–1.113	<0.001*
Hemoglobin levels	1.001	0.972–1.031	0.951

Statistical significance was tested by logistic model. OR: odds ratio; CI: confidence interval.
* $p < 0.05$.

postoperative fever following different types of surgery (Hobar et al., 1998; Kinoshita et al., 2014; Nakanishi et al., 2014). It has been suggested that age, especially in patients younger than 2 years old, is largely correlated with postoperative fever following craniofacial surgery (Hobar et al., 1998). In other types of surgery, patients younger than 10 years old tended to have postoperative fever (Kinoshita et al., 2014; Nakanishi et al., 2014). However, other studies have reported opposite viewpoints and have suggested that age is not significantly associated with the occurrence of postoperative fever (Ahn et al., 2014; Andres et al., 2003). Most of the patients in this study were infants, and our finding that there was no association between age and fever might be attributed to this factor.

Urinary tract infections, usually increased by the use of a urinary catheter during and after surgery, are the most common hospital-acquired infections (Maday, Hurt, Harrelson, & Porterfield, 2016; Yousef, Dranginis, & Rosenfeld, 2018). In the present study, there was no association between the use of a urinary catheter and postoperative fever in children. A short duration of urinary catheterization did not significantly increase the risk of postoperative urinary tract infections (Tenke et al., 2008); thus, the use of urinary catheters was not a risk factor for postoperative fever in our study.

The present study had several potential limitations. First, it was a retrospective analysis. The methodology, indication and timing for evaluating fever were not controlled, and the management of postoperative fever was not standardized. Leukocyte counts were routinely performed within 24 h postoperatively, regardless of whether the patient had a fever or not at that time. Therefore, leukocyte counts could not truly reflect the difference between patients with and without fever. Second, the use of ibuprofen for pain control was another limitation and affected postoperative fever by reducing differences in the degree and duration of fever. However, the influence was partly mitigated by our result that there was no significant difference in the incidences of fever in two different groups of children treated with and without ibuprofen in our study. Third, the narrow difference between the highest and lowest volumes of blood loss, patient ages and volumes of infusion might underlie the lack of correlation between these factors and fever.

Practice implications

Fever causes misconceptions and baseless fears due to a lack of comprehension about the event in parents and children, and this fever phobia characterizes the improbable concerns about increased body temperature in feverish children (Schmitt, 1980). Pediatric nurses are the primary resource for parents to discuss their understanding of and ideas about postoperative fever, and they play a principal role in constructing evidence-based management and in conveying to parents the fever response in terms of a natural defense against disease and what actions to undertake. It is necessary for pediatric nurses to be up to date on the characteristics of postoperative fever. Our study implies that postoperative fever after CLP surgery tends to be characterized by a low grade, an early onset and a short duration, which could be summarized by pediatric nurses to educate parents regarding a comprehensive understanding and monitoring of postoperative fever in their children to reduce their anxiety and fever phobia after surgery.

Postoperative fever is mostly due to the medications used during the course of the operation or the result of surgical trauma during the first 24 h; postoperative fever can also be due to the surgical site itself or atelectasis during 24–72 h after the operation (Christabel et al., 2015). Our results imply that most cases of fever were benign after cleft surgery and were mainly caused by medications or the surgical site itself. In addition, these findings could help healthcare providers to gain increased knowledge of the risk factors for fever and when and how to treat postoperative fever. Despite the low risk of fever due to infection after cleft surgery in children, careful evaluation and treatment are critical when postoperative fever is present. If fever is present within 72 h postoperatively, the evaluation should focus on clinical examination prior to laboratory investigations. Additionally, based on our results, we strongly suggest that a combination of an LB and GA would decrease the incidence of postoperative fever in children who undergo cleft surgery.

Conclusions

In summary, postoperative fevers after cleft surgery are a common occurrence and are generally not associated with postsurgical infections. Postoperative fever after CLP surgery tended to be characterized by a low grade, an early onset and a short duration. In this study, the method of anesthesia, type of surgery, duration of surgery and duration of anesthesia were risk factors for postoperative fever. The combination

Table 4
Characteristics of the patients in both the CP and CLP groups.

Variables	CP (n=273)	CLP (n=55)	P values
Age(month)	16.3(10.5)	9.3(4.6)	<0.001*
Weight(kg)	10.2(2.5)	8.3(1.8)	<0.001*
Height(cm)	76.9(11.0)	70.1(7.4)	<0.001*
Gender(M/F)	154/119	34/21	0.550
GA/GA with LB	187/86	31/24	0.08
Blood loss(mL)	6.4(2.7)	8.8(3.0)	<0.001*
Volume of infusion (mL)	167.9(54.2)	222.6(59.6)	<0.001*
Duration of general anesthesia(min)	75.0(15.0)	119.2(27.4)	<0.001*
Duration of surgery(min)	49.9(13.0)	98.2(24.6)	<0.001*
Hemoglobin(g/L)	92.9(10.4)	89.5(6.3)	0.002*
Hospital stay(days)	3.6(0.7)	5.9(1.0)	<0.001*
No. of children who developed fever within 24 h postoperatively[n(%)]	168(62)	42(76)	0.045*
No. of children who developed fever between 24 and 72 h postoperatively[n(%)]	57(21)	8(15)	0.355
No. of children who developed fever within 72 h postoperatively[n(%)]	189(69)	44(80)	0.142

Values are expressed as the number (percentage) or the mean (SD). Note: GA, general anesthesia; LB, local block; CP, cleft palate; CLP, cleft lip and palate. * p <0.05.

Table 5
Characteristics of the patients in both the GA and GA with LB groups.

Variables	GA (n=218)	GA with LB (n=110)	P values
Age(month)	14.6(9.2)	16.3(11.6)	0.138
Weight(kg)	9.8(2.4)	10.1 (2.7)	0.296
Height(cm)	75.6(10.4)	76.1(11.5)	0.688
Gender(M/F)	123/95	65/45	0.723
Type of surgery(CP/CLP)	187/31	86/24	0.087
Blood loss(mL)	6.7(3.0)	6.9(2.6)	0.635
Volume of infusion(mL)	173.7(58.3)	183.8(59.2)	0.143
Duration of general anesthesia(min)	82.1(23.5)	82.9(25.6)	0.795
Duration of surgery(min)	58.1(23.1)	57.9(25.2)	0.940
Hemoglobin(g/L)	93.1(9.8)	90.9(9.9)	0.064
Hospital stay(days)	4.0(1.2)	3.9(1.2)	0.740
No. of children who developed fever within 24 h postoperatively[n(%)]	172(79)	38(35)	<0.001*
No. of children who developed fever between 24 and 72 h postoperatively[n(%)]	43(20)	22(20)	0.953
No. of children who developed fever within 72 h postoperatively[n(%)]	178(82)	55(50)	<0.001*

Values are expressed as the number (percentage) or the mean (SD). Note: GA, general anesthesia; LB, local block; CP, cleft palate; CLP, cleft lip and palate. * $p < 0.05$.

of an LB and GA might decrease the incidence of postoperative fever in children who undergo cleft surgery.

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Conflict of interest

None declared.

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References

Adesina, O. A., Efunkoya, A. A., Omeje, K. U., & Idon, P. I. (2016). Postoperative complications from primary repair of cleft lip and palate in a semi-urban Nigerian teaching hospital. *Nigerian Medical Journal*, *57*, 155–159. https://doi.org/10.4103/0300-1652.184059.

Ahn, H., Paick, J. S., & Kim, S. W. (2014). The incidence of fever after subinguinal microsurgical varicocelectomy. *The World Journal of Men's Health*, *32*, 56–60. https://doi.org/10.5534/wjmh.2014.32.1.56.

Alsina, E., Matute, E., Ruiz-Huerta, A. D., & Gilsanz, F. (2014). The effects of sevoflurane or remifentanil on the stress response to surgical stimulus. *Current Pharmaceutical Design*, *20*, 5449–5468.

Andres, B. M., Taub, D. D., Gurkan, I., & Wenz, J. F. (2003). Postoperative fever after total knee arthroplasty: The role of cytokines. *Clinical Orthopaedics and Related Research*, *415*, 221–231. https://doi.org/10.1097/01.blo.0000093914.26658.55.

Beloeil, H., & Mazoit, J. X. (2009). Effect of local anesthetics on the postoperative inflammatory response. Annales Francaises d'Anesthesie et de. *Reanimation*, *28*, 231–237. https://doi.org/10.1016/j.annfar.2008.12.021.

Biddle, C. b. (2006). The neurobiology of the human febrile response. *The Journal of the American Association of Nurse Anesthetists*, *74*, 145–150.

Celic-Spuzic, E. (2011). Effect of anesthesia on the changes in the hormones levels during and after transvesical prostatectomy. *Medicinski Arhiv*, *65*, 348–353.

Chen, J. S., Changchien, C. R., & Tang, R. (2008). Postoperative fever and survival in patients after open resection for colorectal cancer: A long-term follow-up study of 2311 prospectively enrolled patients. *Diseases of the Colon and Rectum*, *51*, 1649–1655. https://doi.org/10.1007/s10350-008-9397-y.

Christabel, A., Sharma, R., Manikandhan, R., Anantanarayanan, P., Elavazhagan, N., & Subash, P. (2015). Fever after maxillofacial surgery: A critical review. *Journal of Maxillofacial and Oral Surgery*, *14*, 154–161. https://doi.org/10.1007/s12663-013-0611-7.

Corkum, K. S., Hunter, C. J., Grabowski, J. E., & Lautz, T. B. (2017). Early postoperative fever workup in children: Utilization and utility. *Journal of Pediatric Surgery*. https://doi.org/10.1016/j.jpedsurg.2017.06.019 S0022-3468, 30402-5.

Fares, K. M., Mohamed, S. A., Hamza, H. M., Sayed, D. M., & Hetta, D. F. (2014). Effect of thoracic epidural analgesia on pro-inflammatory cytokines in patients subjected to protective lung ventilation during Ivor Lewis esophagectomy. *Pain Physician*, *17*, 305–315.

Hadimioqlu, N., Uluqol, H., Akbas, H., Coskunfirat, N., Ertuq, Z., & Dinckan, A. (2012). Combination of epidural anesthesia and general anesthesia attenuates stress response to renal transplantation surgery. *Transplantation Proceedings*, *44*, 2949–2954. https://doi.org/10.1016/j.transproceed.2012.08.004.

Hobar, P. C., Masson, J. A., Herrera, R., Ginsburg, C. M., Sklar, F., Sinn, D. P., et al. (1998). Fever after craniofacial surgery in the infant under 24 months of age. *Plastic and Reconstructive Surgery*, *102*, 32–36.

Jin, Y., Zhao, X., Li, H., Wang, Z., & Wang, D. (2013). Effects of sevoflurane and propofol on the inflammatory and pulmonary function of perioperative patients with one-lung ventilation. *Experimental and Therapeutic Medicine*, *6*, 781–785. https://doi.org/10.3892/etm.2013.1194.

Kinoshita, Y., Tominaga, A., Saitoh, T., Usui, S., Takayasu, T., Arita, K., et al. (2014). Postoperative fever specific to neuroendoscopic procedures. *Neurosurgical Review*, *37*, 99–104. https://doi.org/10.1007/s10143-013-0505-7.

Lenhardt, R. (2010). The effect of anesthesia on body temperature control. *Frontiers in Bioscience (School Edition)*, *2*, 1145–1154.

Lesperance, R., Lehman, R., Lesperance, K., Cronk, D., & Martin, M. (2011). Early postoperative fever and the "routine" fever work-up: Results of a prospective study. *The Journal of Surgical Research*, *171*, 245–250. https://doi.org/10.1016/j.jss.2010.03.009.

Maday, K. R., Hurt, J. B., Harrelson, P., & Porterfield, J. (2016). Evaluating postoperative fever. *Journal of the American Academy of Physician Assistants*, *29*, 23–28. https://doi.org/10.1097/01.JAA.0000496951.72463.de.

Nakanishi, T., Araki, H., Ozawa, N., Takada, J., Kubota, M., Imai, K., et al. (2014). Risk factors for pyrexia after endoscopic submucosal dissection of gastric lesions. *Endoscopy International Open*, *2*, E141–E147. https://doi.org/10.1055/s-0034-1377274.

Nomura, K., Yamanaka, Y., Sekine, Y., Yamamoto, H., Esu, Y., Hara, M., et al. (2017). Predicting postoperative fever and bacterial colonization on packing material following endoscopic endonasal surgery. *European Archives of Oto-Rhino-Laryngology*, *274*, 167–173. https://doi.org/10.1007/s00405-016-4189-9.

Sarmiento, K., Valencia, S., Gracia, G., Hurtado-Villa, P., & Zarante, I. (2018). Clinical and epidemiologic description of orofacial clefts in Bogota and Cali, Colombia, 2001–2015. *The Cleft Palate-Craniofacial Journal*, *55*, 517–520. https://doi.org/10.1177/1055665617741062.

Schmitt, B. D. (1980). Fever phobia: Misconceptions of parents about fevers. *American Journal of Diseases of Children*, *134*, 176–181.

Schonmeyr, B., Wendby, L., & Campbell, A. (2015). Early surgical complications after primary cleft lip repair: A report of 3108 consecutive cases. *The Cleft Palate-Craniofacial Journal*, *52*, 706–710. https://doi.org/10.1597/14-158.

Seo, J., Park, J. H., Song, E. H., Lee, Y. S., Jung, S. K., Jeon, S. R., et al. (2017). Postoperative nonpathologic fever after spinal surgery: Incidence and risk factor analysis. *World Neurosurgery*, *103*, 78–83. https://doi.org/10.1016/j.wneu.2017.03.119.

Tenke, P., Kovacs, B., Bjerklund, J. T. E., Matsumoto, T., Tambyah, P. A., & Naber, K. G. (2008). European and Asian guidelines on management and prevention of catheter-associated urinary tract infections. *International Journal of Antimicrobial Agents*, *31*, s68–s78. https://doi.org/10.1016/j.ijantimicag.2007.07.033.

Tylman, M., Sarinowski, R., Benqtson, J. P., Kvarnstrom, A., & Benqtsson, A. (2011). Inflammatory response in patients undergoing colorectal cancer surgery: The effect of two different anesthetic techniques. *Minerva Anestesiologica*, *77*, 275–282.

Wolf, A. R. (2012). Effects of regional analgesia on stress responses to pediatric surgery. *Paediatric Anaesthesia*, *22*, 19–24. https://doi.org/10.1111/j.1460-9592.2011.03714.x.

Yousef, M. A. A., Dranginis, D., & Rosenfeld, S. (2018). Incidence and diagnostic evaluation of postoperative fever in pediatric patients with neuromuscular disorders. *Journal of Pediatric Orthopedics*, *38*, e104–e110. https://doi.org/10.1097/BPO.0000000000001103.

Zhang, Z., Fang, S., Zhang, Q., Chen, L., Liu, Y., Li, K., et al. (2014). Analysis of complications in primary cleft lips and palates surgery. *The Journal of Craniofacial Surgery*, *25*, 968–971. https://doi.org/10.1097/SCS.0000000000000832.