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Incidence and Distribution of Early Postoperative Fever in Three Hospitals in Al-Muthanna Governorate, Iraq: A Prospective Multicenter Exploratory Study

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Abstract

Early postoperative fevers are common and are often due to an inflammatory response related to surgical tissue injury rather than infection. However, the frequency rates vary according to patient population, procedure type, definition of fever and intensity of monitoring. In a purpose to estimate the incidence and distribution of fever within the first 48 h after surgery, this study gathered knowledge at three hospitals in southern Iraq. A multicenter single-arm prospective observational study of 98 patients on elective or emergency surgery was undertaken from 10 December 2021 to 10 April 2022. Body temperature ($^{\circ}\text{C}$) was measured at least twice daily on postoperative days 1 and 2 with standardized electronic thermometer orally. Fever was defined as any oral temperature of $\geq 38.0^{\circ}\text{C}$ within 48 h. Frequencies, percentages and Wilson 95% confidence intervals (CIs) were used to summarize results. All analyses were descriptive for procedures and ages with small strata; sex differences tested using Fisher's exact test. Early postoperative fever developed in 32 of 98 patients (32.7%; 95% CI 24.2-42.4). Fever occurred in 16 of 54 male patients (29.6%, 95% CI 19.1-42.8) and in 16 of 44 female patients (36.4%, 95% CI 23.8-51.1; odds ratio 1.36, 95% CI 0.58-3.17; Fisher's exact $p=0.52$). Fever after orthopedic procedures occurred in a maximum of 6/15 (40.0%) procedure groups, the corresponding estimates being: caesarean section 12/31 (38.7%), appendectomy 4/14 (28.6%), cholecystectomy 2/7 (28.6%); hernia repair 3/14 (21.4%); and other procedures; both [0/10] [0%]. The confidence intervals were generally wide, reflecting a large degree of imprecision. About one third of the patients developed fever in 48 h after surgery. The differences across procedures were exploratory and equivocal, and the study did not identify independent predictors of fever. Recommendations for local diagnostic or management algorithms will need further evidence from larger procedure-specific studies that have used standardized temperature measurement and collected perioperative confounders. Post-operative fever; pyrexia; surgery; body temperature. observational study

Keywords: Postoperative fever, postoperative pyrexia, surgical operation, Body Temperature

Citation Trends in the incidence of early postoperative febrile morbidity in Al-Najaf center literary institute (ACLI) hospital over a five-year period between 2014 – 2021.

Keywords

Postoperative Fever,
General Surgery,
Surgical Operation,
Inflammatory Response
Nigeria.



Introduction

Postoperative fever is a common clinical occurrence but reports vary significantly in their incidence estimates as a result of differences in the spectrum of procedures, patient characteristics, threshold for definition, site and duration of measurement [1-3]. Fever during the first 48-72 h post-surgery is often due to sterile inflammation, while persistent or late-separated fever with localising signs/symptoms or deterioration in physiological state should arouse concern for infection or other postoperative complications [1-3].

Surgical injury activates pathways of the innate immune system and leads to release of endogenous pyrogenic mediators (interleukin-1, interleukin-6 and tumor necrosis factor- α). These mediators elevate hypothalamic-prostaglandin synthesis and increase the thermoregulatory set-point [4,5]. Anesthetic agents and neuraxial blockade also affect perioperative thermoregulation however post-operative hyperthermia should not be interpreted solely as a pharmacologic effect of anesthesia [6,7].

The challenge clinically is to differentiate an accelerated inflammatory response from that of early infection or another acute and serious complication. Indiscriminate baseline blood cultures, [9,10] urine cultures [11] and chest radiographs [12] when no localizing features are present have repeatedly been reported to have a low diagnostic yield in both prospective and procedure specific studies during the earliest postoperative period. Similarly, the commonly attributed relationship between early fever and atelectasis also lacks support; a recent systematic review and separate study in upper-abdominal surgery found no evidence of an independent association [8,9].

Data from orthopedic, spinal, gynecological and general surgical cohorts indicate that the timing, persistency and degree of fever may be more informative than an isolated temperature reading at a single point in time. However, estimates for incidence and clinical practices differ between institutions and data published from low-resource surgical environments are still relatively few. Thus, local describing data are useful for informing adequately powered procedure-specific studies and rational fever-evaluation pathways.

This prospective multicenter exploratory study aimed to determine the incidence of postoperative fever in the first 48 h post-operatively at three

hospitals in Al-Muthanna Governorate, Iraq. Secondary objectives were to assess incidence of fever by surgical procedure, sex and age group. Subgroup findings were interpreted as exploratory and not confirmatory due to the small cohort size and clinical heterogeneity.

Methods

2.1 Study design and setting

This was a prospective multicenter observational study carried out between 10 December 2021 and 10 April 2022 at Al-Hussain Teaching Hospital, Al-Samawa Teaching Hospital and Al-Khudhir General Hospital, Al-Muthanna Governorate, Iraq. The manuscript was organized based on the STROBE statement and the STROCCS 2024 guideline for observational surgical research [21,22].

2.2 Participants

They recruited a convenience sample of 98 patients undergoing surgical procedures across general surgery, orthopedics, urology and obstetrics and gynecology. Elective and emergency operations were included. Age of participants: 3-75years There was no formal screening log or a priori sample-size calculation available from study records, and therefore the cohort is comprised of patients enrolled during the prespecified 4-month study period with all subgroup analyses exploratory.

2.3 Variables and outcome definition

Administered variables, included: Age, Sex, Surgical procedure and Anesthetic technique. The main endpoint was early post-operative fever (defined as ≥ 1 oral temperature reading of ≥ 38.0 °C during the first 48 h after surgery). Age was summarized as a continuous variable and presented descriptively in 10-year age categories. Surgical procedures (as is in the source dataset).

2.4 Temperature measurement

During postoperative days 1 and 2, oral temperature was assessed at least twice per day using a standard electronic thermometer (Boso, Germany).

2.5 Statistical analysis

The continuous age variable could only be reported as aggregate values for manuscript revision, so median (range) were used to summarize age. Variables were summarized as counts and percentages for categorical values. Methods Pulse survey is a tool which collects clinical information on a day-to-day international level for diseases and syndromes like fever, chronic fatigue syndrome. We have collected data between January 2012 and

October 2013 in the Indian sub-continent through the mobile application on sick patients with or without fever. Comparisons were descriptive for procedures and ages with fewer than five observations, and multiple pairwise tests would have led to unstable and potentially misleading results. The abstraction connecting sex and fever was abstracted as an odds ratio with a 95% aplomb interval, and addressed with a two-sided Fisher's accurate test. A two-sided p value <0.05 was considered statistically significant. SAMPL recommendations were followed for statistical reporting [23]. Analyses were conducted on the sums reported in the source manuscript and recalculated here for consistency.

2.6 Ethical considerations

Approval from the ethical & scientific committee of college of medicine at Al-Muthanna university, Iraq. The ethics committee waived the requirement for individual informed consent on account of the modest risk of monitoring and analysis of anonymized routine clinical data through non-invasive temperature recording.

Results

3.1 Participant characteristics

Seabrooks et al²⁸ 98 (3-75; 29*) *Median age. There were 54 men (55.1%) and 44 women (44.9%). General anesthesia was documented for 81 patients (82.7%) and spinal anesthesia in 17 (17.3%). The variety of surgical procedures is illustrated in Table 1.

Table 1. Participant characteristics

Characteristic	Category	Value
Age	Median (range), years	29 (3-75)
Sex	Male	54 (55.1%)
	Female	44 (44.9%)
Anesthetic technique	General	81 (82.7%)
	Spinal	17 (17.3%)
Surgical procedure	Caesarean section	31 (31.6%)
	Orthopedic procedures	15 (15.3%)
	Appendectomy	14 (14.3%)
	Hernia repair	14 (14.3%)
	Other procedures	10 (10.2%)
	Cholecystectomy	7 (7.1%)
	Intestinal obstruction	3 (3.1%)
	Varicocele	3 (3.1%)
	Disc herniation	1 (1.0%)

Disc herniation 1 (1.0%) Values are n (%) unless indicated otherwise. Anesthetic technique represented descriptively; fever by anesthesia analysis requires Data Source Reconciliation.

3.2 Incidence of early postoperative fever in total

31 (31.6%) of 98 patients developed at least one oral temperature ≥ 38.0 °C within the first 48 h (incidence, 32.7%; 95% confidence interval, 24.2-42.4). Figure 1 Summary of study workflow and assessment of outcome.

Study workflow and outcome assessment

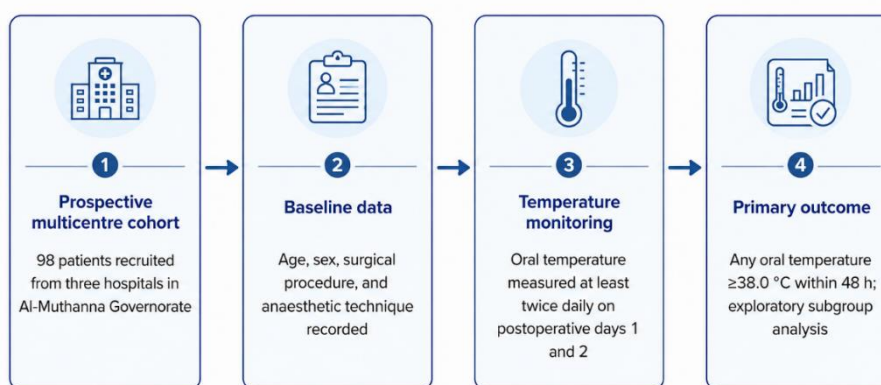


Figure 1. Early postoperative fever is the occurrence of fever that develops within 48 hours post-surgery.

3.3 Number of authorities reporting fever by surgical procedure

Table 2 Differences in fever proportions descriptively across procedures. The largest observed proportions were reported after surgical treatment for intestinal obstruction [3/3 (100%)] and disc herniation [1/1 (100%)], but such estimates only applied to very small groups and had extremely wide confidence intervals. In groups with more than

six patients, the recorded frequency was 40.0% associated with orthopaedic procedures, 38.7% after caesarean section 28.6% following appendectomy, 28.6% after cholecystectomy and (with groups $n \geq 4$) 21.1% associated with hernia repair, but none in classification 'other'. Because of sparse cells and multiple comparisons, no procedure-specific hypothesis test was considered interpretable.

Table 2. Defining postoperative fever by surgical procedure

Surgical procedure	Total, n	Fever, n	Incidence, %	95% CI
Intestinal obstruction	3	3	100.0	43.9-100.0
Disc herniation	1	1	100.0	20.7-100.0
Orthopaedic procedures	15	6	40.0	19.8-64.3
Caesarean section	31	12	38.7	23.7-56.2
Varicocele	3	1	33.3	6.1-79.2
Appendectomy	14	4	28.6	11.7-54.6
Cholecystectomy	7	2	28.6	8.2-64.1
Hernia repair	14	3	21.4	7.6-47.6
Other procedures	10	0	0.0	0.0-27.8
Total	98	32	32.7	24.2-42.4

Confidence intervals were estimated using Wilson method. NOTE: Data are for procedure-specific estimates. No multiplicity-adjusted global or pairwise test were performed.

3.4 Fever Incidence by Sex

Fever was observed in 16/54 male (29.6%; 95% CI 19.1-42.8) and 16/44 female patients (36.4%; 95% CI 23.8-51.1). There was no statistically significant difference between the odds of fever among female and male patients (odds ratio 1.36, 95% CI 0.58-3.17; Fisher's exact $p=0.52$).

Table 3. Early postoperative fever by sex

Sex	Total, n	Fever, n	Incidence, %	95% CI	Effect estimate
Male	54	16	29.6	19.1-42.8	Reference
Female	44	16	36.4	23.8-51.1	OR 1.36 (0.58-3.17)

OR, odds ratio. Two-sided Fisher's exact $p=0.52$.

3.5 Age Group Incidence of Fever Part 1

Estimates of age compared across groups were heterogeneous but imprecise, especially in the youngest and oldest categories with very few individuals (Table 4). Fever incidences presented in

the 20-29 and 30-39 years age groups were the two largest, at 25.0% and 34.2%, respectively. We did not hold a formal test of trend because we revising the analysis lacked individual-level age data, and several age strata were sparse.

Table 4. Postoperative fever early by age group

Age group, years	Total, n	Fever, n	Incidence, %	95% CI
0-9	3	1	33.3	6.1-79.2
10-19	6	4	66.7	30.0-90.3
20-29	40	10	25.0	14.2-40.2
30-39	38	13	34.2	21.2-50.1
40-49	6	3	50.0	18.8-81.2
50-59	3	1	33.3	6.1-79.2
60-69	1	0	0.0	0.0-79.3
70-79	1	0	0.0	0.0-79.3

Confidence intervals were calculated with the Wilson method. Estimates for groups with $n \leq 6$ are highly unstable and should not be interpreted as comparative evidence.

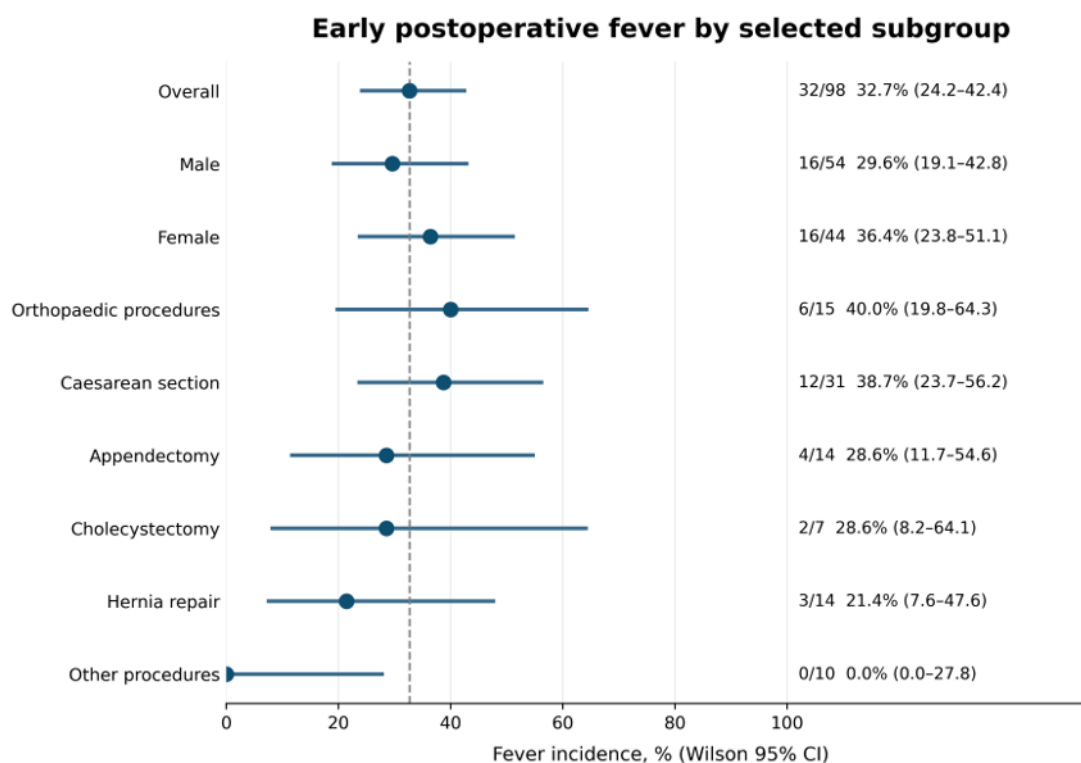


Figure 2. Forest plot of early postoperative fever incidence in the entire cohort and selected subgroups
Vertical dashed line: Overall cohort estimate We have excluded procedure groups where fewer than seven participants were eligible for inclusion in the plot but are reported (as required by transparency practice) in Table 2.

Discussion

4.1 Principal findings

In this observational cohort, around a third of patients had fever in the first 48 h post-operatively. The estimate of 32.7% lies within the wide range reported within general and procedure-specific surgical cohorts [1-3,10-16]. However, the confidence interval means that this incidence may be between a quarter and two-fifths in such a population, and the heterogeneity of procedures precludes direct comparison with single-procedure studies.

The proportions of observed fevers were greatest for the smaller procedure groups, for example intestinal obstruction and disc herniation. Caution in interpreting these 100%-point estimates as high risk is warranted since they were based only on three and one patient, respectively. Confidence intervals were wide, even for larger procedure categories. EG: Eg, 40.0% after orthopedic procedures (95% CI 19.8–64.3). This imprecision demonstrates why effect estimates and confidence intervals carry more information than one-off percentages or p values in small exploratory datasets.

4.2 Comparison with previous research

Early febrile episodes have also been reported in general surgical cohorts, comprising 23.7% of 1,032 procedures reported by Lesperance and colleagues; meanwhile the experience with fever after orthopedic and spine surgeries is limited but ranges from around 12 to nearly up to 50 percent depending on cohort characteristics and temperature threshold [2,10-15].

The current hypothesis of a 40.0% estimate is consistent with the best evidence from arthroplasty populations, but too small and procedurally heterogeneous for an absolute comparison within our local group [1021]. Procedure specific more recent evidence also shows significant heterogeneity; half of patients developed fever after liver resection, common but not independently predictive of infection following pediatric varus denotational osteotomy and differed according to perioperative factors in total knee arthroplasty and orthopedic trauma cohorts [24-27]. A systematic review comparing perioperative febrile complications after percutaneous nephrolithotomy also demonstrated significant variability in fever (as a complication) and

risk factors at both the procedure- and patient-level [28].

Finally, the lack of a statistically significant sex difference is also in line with the suggestion that early fever is influenced more by overall surgical injury or procedure duration or exposure to transfusion, antibiotic and anesthetic drug than by sex per se [14-16]. As the present study did not capture these perioperative covariates, it cannot ascertain whether the observed subgroup variation corresponds to procedural severity, emergency presentation, anesthetic management or other confounding factors. Prospective cohorts of caesarean-section patients also show that multiple host, obstetric and perioperative factors rather than a single socio-demographic characteristic predict postoperative infectious morbidity in resource-poor settings [29,30].

These findings must not be taken to mean that early fever is invariably harmless. Instead, in fact, they reinforce the long-standing notion that any single early temperature rise should be interpreted within the clinical setting. Minic et al have demonstrated a low yield of non-targeted testing for infection during the early postoperative period despite ongoing febrile responses, as any persistent fever, higher peak temperature, late onset after surgery and significant co-morbidities (hemodynamic instability or localizing symptoms) [2,8-16]. The evidence also does not favor atelectasis as a default explanation for postoperative fever [8,9].

4.3 Clinical and research implications

The study gives some preliminary local estimate of early postoperative fever, but does not allow to characterize a diagnostic algorithm. Histories and physical examinations should focus closely on the operation and the postoperative course, whilst testing should be carried out according to clinical findings. Our data do not support performing routine cultures or imaging solely based on a single temperature reading within the first 24 hours.

In the future, larger procedure-specific cohorts that prospectively document preoperative temperature, emergency status, ASA physical

status, comorbidities, operative duration, blood loss/transfusion/antibiotic prophylaxis/anesthetic duration/active warming/antipyretic exposure/catheter use/maximal temperature/fever duration/workup/convolved infection and clinical outcomes are needed. Temperature trajectories would be more meaningful if instead of stratifying patient by a single threshold, we model the trajectory through repeated measures. Future protocol harmonization should also provide for validated temperature monitoring practices and synchronization of investigation of suspected infection with standard-of-care practices in case management, perioperative monitoring, and surgical-site infection guidelines [31,32].

4.4 Strengths and limitations

Strengths included prospective data collection, inclusion of patients at three hospitals, and a clearly defined 48 h observation window. The revision also presents confidence intervals, and refrains from making unsupported causal statements. Several limitations are important. First, this was a small convenience sample distributed across many surgical procedures with one to three patients in some strata and insufficient power for stable comparative analysis.

Second, regarding the sample size calculation and participant screening flow a priori, no formal documentation was further provided. Third, unavailable potential confounders included operative duration, emergency in nature (more common with infections), blood loss and transfusion, antimicrobial prophylaxis and other comorbidity and ASA class score along with warming and antipyretic use. Fourth, fever was defined by single oral measurement and time of measurement, specifications of thermometers and method for calibration were not well documented.

Fifth, it did not differentiate sterile inflammatory fever from confirmed infection or thromboembolic event, nor did it report the diagnostic workup or outcomes of febrile patients. Sixth, the source manuscript had contradictory anesthesia-specific fever counts that need to be reconciled before reporting any association with anesthesia. Lastly,

data were collected in 2021-2022 and therefore may not represent the most up-to-date understanding of established perioperative practice. Together, these limitations inhibit causal interpretation and generalizability.

Conclusion

Early postoperative fever was present in around 1/3rd of this robotic-based, heterogeneous multicenter surgical cohort. Subgroup estimates varied based on procedure, but sample sizes were small and should only be interpreted as exploratory descriptions. No, statistically significant links with sex were found. The results provide a rationale for additional procedure-specific studies using standardized temperature monitoring and detailed perioperative covariate acquisition, but do not in isolation support a singular pathway for the diagnostic evaluation or management of isolated fever within the first 48 postoperative hours.

Declarations

Funding: The authors declare that they received no funding for this study.

Conflicts of interest: The authors declare that there are no competing interests.

Willingness to participate: Orally reported informed consent.

Consent for publication: Not applicable, the manuscript does not have any occurred identifiable personal information.

Availability of data: The dataset supporting the findings is available from the corresponding author on reasonable request, subject to ethics and institutional approvals.

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References

1. Garibaldi RA, Brodine S, Matsumiya S, Coleman M. Evidence for the non-infectious etiology of early postoperative fever. *Infect Control*. 1985;6(7):273-277.

2. Lesperance R, Lehman R, Lesperance K, Cronk D, Martin M. Early postoperative fever and the "routine" fever work-up: results of a prospective study. *J Surg Res*. 2011;171(1):245-250. doi:[10.1016/j.jss.2010.03.009](https://doi.org/10.1016/j.jss.2010.03.009).
3. Pile JC. Evaluating postoperative fever: a focused approach. *Cleve Clin J Med*. 2006;73(Suppl 1):S62-S66.
4. Dinarello CA. Cytokines as endogenous pyrogens. *J Infect Dis*. 1999;179(Suppl 2):S294-S304. doi:[10.1086/513856](https://doi.org/10.1086/513856).
5. Netea MG, Kullberg BJ, Van der Meer JWM. Circulating cytokines as mediators of fever. *Clin Infect Dis*. 2000;31(Suppl 5):S178-S184. doi:[10.1086/317513](https://doi.org/10.1086/317513).
6. Lenhardt R. The effect of anesthesia on body temperature control. *Front Biosci (Schol Ed)*. 2010;2(3):1145-1154. doi:[10.2741/S123](https://doi.org/10.2741/S123).
7. Sessler DI. Temperature monitoring and perioperative thermoregulation. *Anesthesiology*. 2008;109(2):318-338. doi:[10.1097/ALN.0b013e31817f6d76](https://doi.org/10.1097/ALN.0b013e31817f6d76).
8. Lim L, Lee J, Hwang SY, Lee H, Oh SY, Kang C, Ryu HG. Early postoperative fever and atelectasis in patients undergoing upper abdominal surgery. *J Am Coll Surg*. 2023;237(4):606-613. doi:[10.1097/XCS.0000000000000789](https://doi.org/10.1097/XCS.0000000000000789).
9. Mavros MN, Velmahos GC, Falagas ME. Atelectasis as a cause of postoperative fever: where is the clinical evidence? *Chest*. 2011;140(2):418-424. doi:[10.1378/chest.11-0127](https://doi.org/10.1378/chest.11-0127).
10. Ashley B, Spiegel DA, Cahill P, Talwar D, Baldwin KD. Post-operative fever in orthopaedic surgery: how effective is the "fever workup"? *J Orthop Surg (Hong Kong)*. 2017;25(3):2309499017727953. doi:[10.1177/2309499017727953](https://doi.org/10.1177/2309499017727953).
11. Yoo JH, Kim KT, Kim TY, Hwang JH, Chang JD. Postoperative fever after hemiarthroplasty in elderly patients over 70 years of age with displaced femoral neck fracture: necessity of routine workup? *Injury*. 2017;48(2):441-446. doi:[10.1016/j.injury.2016.12.013](https://doi.org/10.1016/j.injury.2016.12.013).
12. Athanassios C, Samad A, Avery A, Cohen J, Chalnack D. Evaluation of fever in the immediate postoperative period in patients who underwent total joint arthroplasty. *J Arthroplasty*. 2011;26(8):1404-1408. doi:[10.1016/j.arth.2011.02.019](https://doi.org/10.1016/j.arth.2011.02.019).

13. Lu X, Jin J, Lin J, Qian W, Weng X. Course of fever and potential infection after total joint replacement. *Knee Surg Sports Traumatol Arthrosc.* 2015;23(6):1870-1876. doi:[10.1007/s00167-014-3098-y](https://doi.org/10.1007/s00167-014-3098-y).
14. Mayo BC, Haws BE, Bohl DD, Louie PK, Hijji FY, Narain AS, Massel DH, Khechen B, Singh K. Postoperative fever evaluation following lumbar fusion procedures. *Neurospine.* 2018;15(2):154-162. doi:[10.14245/ns.1836026.013](https://doi.org/10.14245/ns.1836026.013).
15. Lee JJ, Kim JH, Jeon JH, Kim MJ, Park BG, Jung SK, Jeon SR, Roh SW, Park JH. A retrospective controlled study of postoperative fever after posterior lumbar interbody fusion due to degenerative lumbar disease. *Medicine (Baltimore).* 2022;101(20):e29231. doi:[10.1097/MD.00000000000029231](https://doi.org/10.1097/MD.00000000000029231).
16. Fukuda T, Nishida M. Factors associated with physiological postoperative pyrexia. *J Obstet Gynaecol Res.* 2020;46(1):161-166. doi:[10.1111/jog.14160](https://doi.org/10.1111/jog.14160).
17. de la Torre SH, Mandel L, Goff BA. Evaluation of postoperative fever: usefulness and cost-effectiveness of routine workup. *Am J Obstet Gynecol.* 2003;188(6):1642-1647.
18. Ward DT, Hansen EN, Takemoto SK, Bozic KJ. Cost and effectiveness of postoperative fever diagnostic evaluation in total joint arthroplasty patients. *J Arthroplasty.* 2010;25(6 Suppl):43-48.
19. Kurz A, Sessler DI, Lenhardt R. Perioperative normothermia to reduce the incidence of surgical-wound infection and shorten hospitalization. *N Engl J Med.* 1996;334(19):1209-1215. doi:[10.1056/NEJM199605093341901](https://doi.org/10.1056/NEJM199605093341901).
20. Poveda VB, Oliveira RA, Galvão CM. Perioperative body temperature maintenance and occurrence of surgical site infection: a systematic review with meta-analysis. *Am J Infect Control.* 2020;48(10):1248-1254. doi:[10.1016/j.ajic.2020.01.002](https://doi.org/10.1016/j.ajic.2020.01.002).
21. von Elm E, Altman DG, Egger M, Pocock SJ, Gøtzsche PC, Vandenbroucke JP; STROBE Initiative. The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement: guidelines for reporting observational studies. *PLoS Med.* 2007;4(10):e296. doi:[10.1371/journal.pmed.0040296](https://doi.org/10.1371/journal.pmed.0040296).
22. Rashid R, Sohrabi C, Kerwan A, Franchi T, Mathew G, Nicola M, Agha RA. The STROCSS 2024 guideline: strengthening the reporting of cohort, cross-sectional, and case-control studies in surgery. *Int J Surg.* 2024;110(6):3151-3165. doi:[10.1097/JS9.0000000000001268](https://doi.org/10.1097/JS9.0000000000001268).
23. Lang TA, Altman DG. Basic statistical reporting for articles published in biomedical journals: the SAMPL guidelines. *Int J Nurs Stud.* 2015;52(1):5-9. doi:[10.1016/j.ijnurstu.2014.09.006](https://doi.org/10.1016/j.ijnurstu.2014.09.006).
24. Lai HF, Chau IY, Lei HJ, Chou SC, Hsia CY, Kao YC, Chau GY. Postoperative fever after liver resection: incidence, risk factors, and characteristics associated with febrile infectious complication. *PLoS One.* 2022;17(1):e0262113. doi:[10.1371/journal.pone.0262113](https://doi.org/10.1371/journal.pone.0262113).
25. Obana KK, Lin AJ, Yang J, Ryan DD, Goldstein RY, Kay RM. Fever after varus derotational osteotomy is common, but not a risk factor for infection. *Medicine (Baltimore).* 2020;99(1):e18613. doi:[10.1097/MD.00000000000018613](https://doi.org/10.1097/MD.00000000000018613).
26. Xu N, Xu T, Tan X, Xu L, Ye M, Pan Y, Tong P, Hu X, Xu M. Fluid homeostasis may predict the prognosis of non-infectious fever after total knee arthroplasty within 7-day: a retrospective cohort study. *Front Surg.* 2021;8:690803. doi:[10.3389/fsurg.2021.690803](https://doi.org/10.3389/fsurg.2021.690803).
27. Mastri P, Di Petrillo F, Cerone A, Muselli M, Saracco M, Logroscino G, Calvisi V. Reduction in the duration of postoperative fever during the COVID-19 pandemic in orthopedic and traumatic surgery due to PPE and cautions. *J Clin Med.* 2022;11(6):1635. doi:[10.3390/jcm11061635](https://doi.org/10.3390/jcm11061635).
28. Falahatkar R, Falahatkar S, Khajavi Gaskarei MA, Afzalipoor M, Mojtahedi A, Aligolighasemabadi N, Deilami A, Mirzaei Dahka S, Keivanlou MH, Jafari A. The global, prevalence, and risk factors of postoperative fever after percutaneous nephrolithotomy: a systematic review and meta-analysis. *Asian J Urol.* 2024;11(2):253-260. doi:[10.1016/j.ajur.2022.04.008](https://doi.org/10.1016/j.ajur.2022.04.008).

29. Ketema DB, Wagnew F, Assemie MA, Ferede A, Alamneh AA, Leshargie CT, Kibret GD, Petrucka P, Telayneh AT, Alebel A. Incidence and predictors of surgical site infection following cesarean section in North-west Ethiopia: a prospective cohort study. *BMC Infect Dis.* 2020;20(1):902. doi:[10.1186/s12879-020-05640-0](https://doi.org/10.1186/s12879-020-05640-0).
30. Mezemir R, Olayemi O, Dessie Y. Incidence, bacterial profile and predictors of surgical site infection after cesarean section in Ethiopia: a prospective cohort study. *Int J Womens Health.* 2023;15:1547-1560. doi:[10.2147/IJWH.S425632](https://doi.org/10.2147/IJWH.S425632).
31. Klein AA, Meek T, Allcock E, Cook TM, Mincher N, Morris C, Nimmo AF, Pandit JJ, Pawa A, Rodney G, Sheraton T, Young P. Recommendations for standards of monitoring during anaesthesia and recovery 2021: guideline from the Association of Anaesthetists. *Anaesthesia.* 2021;76(9):1212-1223. doi:[10.1111/anae.15501](https://doi.org/10.1111/anae.15501).
32. Berríos-Torres SI, Umscheid CA, Bratzler DW, Leas B, Stone EC, Kelz RR, Reinke CE, Morgan S, Solomkin JS, Mazuski JE, Dellinger EP, Itani KMF, Berbari EF, Segreti J, Parvizi J, Blanchard J, Allen G, Kluytmans JAJW, Donlan R, Schechter WP; Healthcare Infection Control Practices Advisory Committee. Centers for Disease Control and Prevention guideline for the prevention of surgical site infection, 2017. *JAMA Surg.* 2017;152(8):784-791. doi:[10.1001/jamasurg.2017.0904](https://doi.org/10.1001/jamasurg.2017.0904).