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Research Article

No Association Between Fever and Uninfected Postoperative Hematoma in Orthopedic Surgery and Traumatology

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Abstract

Objective: According to widespread belief or clinical experience, uninfected hematoma can cause fever. However, epidemiological data regarding this assumption are scant. We assess the epidemiology of uninfected hematoma and fever in the postoperative orthopedic context.

Methods: Single-center prospective observational study among adult orthopedic patients. All patients have anti-inflammatory medication and many have blood transfusions. Fever is defined as any axillary temperature ≥ 38°C (104°F); subfebrile temperatures as ≥ 37.2°C.

Results: Among 405 patients in the study, 164 had (40%) fever, 221 (55%) subfebrile temperatures, and 166 (41%) yielded visible hematomas. Overall, fever was not associated with hematoma (67/164 vs. 99/241; Pearson-χ^2, p=0.96). We equally found no association when analyzing only the subfebrile level (156/385 vs. 10/18; p=0.21) or when analyzing the temperatures only on Day 4 (p=0.95), Day 7 (p=1.00), or solely for cases requiring surgical re-intervention for hematoma (4/10 vs. 6/9; Fisher-exact-test, p=0.37). As continuous variables, the maximum temperatures on each of the seven postoperative days were not higher for patients with hematoma (Wilcoxon-ranksum-tests; all p>0.10).

Conclusion: Within the time frame of one week postoperatively and real-life conditions, we failed to establish an epidemiological association between postoperative fever and the presence of an uninfected hematoma in a large prospective observational study among adult orthopedic patients under anti-inflammatory drugs.

Keywords: Postoperative fever; Orthopedic surgery; Hematoma

1. Introduction

According to widespread belief or clinical experience, uninfected hematoma in orthopedic surgery can cause (resorption) fever. Pyrogenic cytokines such as interleukins or tumor necrosis factors have been described after traumatic conditions, even though there is no infection [1-3]. For example, author groups describe fever, even shaking chills [4, 5], after uninfected aortic dissection [5], embolisms, allergy, intracerebral hemorrhage [6, 7], rectus sheet hematoma [8], renal biopsy-related hematoma [9, 10], post-caesarian hematoma [11], or soft-tissue hematoma [12]. We do not doubt that in selected cases, postoperative fever is provoked by uninfected hematoma. However, epidemiological data linking surgical hematomas to fever are very scant. We advocate an investigation on this topic, because fever often leads to unnecessary antibiotic prescriptions, and invasive work-ups, for suspicion of postoperative infections [13]. Moreover, it is worth to investigate possible medical myths, let alone for academic reasons.

2. Methods

In 2011, we published a one-year's prospective, observational study assessing postoperative fever [14] in the context of the epidemiology of postsurgical wound complications [13]. We now use this database to link postoperative temperature with the occurrence of hematoma (retrospective analysis of a prospectively assessed cohort). All patients have anti-inflammatory medication (mostly ibuprofen and paracetamol) and many have blood transfusions. We notified the occurrence of hematoma and daily temperatures for up to one week postoperatively and defined fever as any axillary temperature ≥ 38°C (104 F°) and, subfebrile temperatures as ≥ 37.2°C; independent of antipyretic medication. Exclusion criteria were: infection in the surgical site and/or remote (excluding infected hematomas), skin rash, malignant hyperthermia, thrombosis, phlebitis, withdrawal syndromes, allergy, atelectasis, pancreatitis, acute crystal-related inflammations such as gout, and incomplete data.

We performed a literature search using the English MeSH terms "hematoma", "surgery" and "fever" in PubMed and internet. For group comparisons, we used the Pearson-χ^2, Fisher-exact or the Wilcoxon-ranksum-tests. Because of potential confounding, we added a multivariate logistic regression analysis with the outcome fever. *P* values ≤ 0.05 (two-tailed) were significant. We used STATA™ software (9.0, STATA Corp, College Station, USA).

3. Results

Among 405 patients in the study, 164 had (40%) fever, 221 (55%) subfebrile temperatures, and 166 (41%) yielded visible hematomas. Overall, fever was not associated with hematoma (67/164 vs. 99/241; Pearson-χ^2, p=0.96). We

equally lacked association when analyzing only the subfebrile level (156/385 vs. 10/18; p=0.21), when analyzing the temperatures day by day (Table 1, Figure 1), or solely for cases requiring surgical re-intervention (4/10 vs. 6/9; Fisher-exact-test, p=0.37). As continuous variables, the maximum temperatures on each of the seven for hematoma postoperative days were not higher for patients with hematoma (Wilcoxon-ranksum-tests; all p>0.10).

n=405	**Fever (≥ 38.0°C)**	**No fever**	**Total**
Visible hematoma	67	99	166
No hematoma	97	142	239
Total	164	241	404

All patients and throughout the hospitalisation (Pearson-χ-test; p=0.96)

n=403	**Subfebrile (≥ 37.2°C-38.0°C)**	**No subfebrile temperatures**	**Total**
Visible hematoma	156	10	166
No hematoma	229	8	237
Total	385	18	19

All patients and throughout the hospitalisation (Pearson-χ-test; p=0.21)

n=138	**Fever (≥ 38.0°C)**	**No fever**	**Total**
Visible hematoma	11	42	53
No hematoma	18	67	85
Total	29	109	138

Assessment at Day 4 post-surgery (Pearson-χ-test; p=0.95)

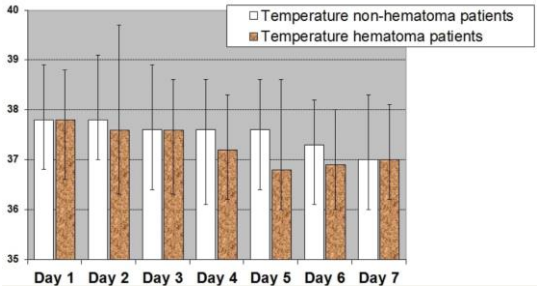
n=76	**Fever (≥ 38.0°C)**	**No fever**	**Total**
Visible hematoma	5	40	45
No hematoma	3	28	31
Total	8	68	76

Assessment at Day 7 post-surgery (Pearson-χ-test; p=1.00)

n=19	**Fever (≥ 38.0°C)**	**No fever**	**Total**
Visible hematoma	4	6	10
No hematoma	6	3	9
Total	10	9	19

All patients re-operated for lavage (Pearson-χ-test; p=0.37)

Table 1: Patients with and without fever or hematoma (exclusion of infections).



Left vertical axis- Fever (axillary) in °C (Celsuis); Bottom horizontal axis-Days; The thin lines on top of the columns represent the 95% confidence intervals

Figure 1: Occurrence of fever and hematoma during each of seven days postoperatively.

In multivariate analysis (Table 2), no parameter was associated with fever, including hematoma (odds ratio 0.9, 95% CI 0.3-2.3), emergency surgery (0.8, 0.3-2.3), or the Charlson co-morbidity index [15] (0.7, 0.3-1.9). Of note, the goodness-of-fit value of our final model was insignificant (p=0.19) and the Receiver-Operating-Curve (ROC) value was 0.75; highlighting an acceptable accuracy of our final model.

n=405	**Univariate results**	**Multivariate results**
Female sex	0.9, 0.6-1.3	n.d.
Age*	1.0, 1.0-1.0	n.d.
Body mass index*	1.0, 0.9-1.1	1.0, 0.9-1.1
Surgery in winter time	0.8, 0.5-1.4	n.d.
ASA-Score [16]*	1.0, 0.5-1.9	n.d.
Fracture surgery	1.1, 0.8-1.7	n.d.
Duration of surgery	1.0, 1.0-1.0	1.0, 1.0-1.0
Charlson morbidity index [15]*	0.8, 0.6-1.3	0.7, 0.3-1.9
Emergency surgery	1.0, 0.7-1.6	0.8, 0.3-2.3
Visible hematoma	*1.0, 0.7-1.5*	*0.9, 0.3-2.3*

n.d.=not done; ASA=American Society of Anesthesiologists Score [16]; * as continuous variables

Table 2: Multivariate unmatched logistic regression analysis with outcome fever (≥ 38.0°C axillary; results are displayed as odds ratios, with 95% confidence intervals).

4. Discussion

We failed to establish an epidemiological relation between postoperative fever and hematoma in a large prospective study of adult orthopedic patients under anti-inflammatory drugs. Even if we stratified upon different postoperative days, between fever and subfebrile temperatures, or according the clinical need for surgical revisions of hematoma, we lacked association. We think that this lack is genuine, in as much as we performed our study in the postoperative setting with 19% of postoperative fever; regardless of hematoma [14]. Scientifically speaking, hematomas certainly

provoke inflammation [1-3]. But is this enough to provoke fever under anti-inflammatory medication? Except for publications basing on single illustrative cases, surgical literature almost entirely lacks large-scale epidemiological data regarding this topic. The information has to be sought "between the lines" and, if it exists, rather supports our findings. For example, we published another prospective surveillance among polytrauma patients hospitalized in Intensive Care Units [17]. This is a population clearly suffering from severe trauma, multiple hematomas and need for blood transfusions. And yet, on a large scale, fever was only associated with true infection, but not with non-infectious causes such as hematomas or blood transfusions [17]. Gemer et al. investigated the occurrence of post-caesarian fever in the context of fifteen pelvic hematomas. Only five cases with superficial subfascial hematomas were associated with fever, while the majority of ten deep episodes of bladder-flap hematomas were not [11].

Our study has several limitations: We did not measure the hematoma size (the diagnosis was made visually and not by radiology), nor its evolution over time (e.g. progressive hematoma). Moreover, we assessed only the first postoperative week among adult uninfected patients hospitalized in our orthopedic and traumatology wards. Hence, we cannot pronounce on fever in infected hematomas, adolescents or other surgical disciplines. Finally, we are not investigating hematoma outside of the surgical site. For example, intracerebral [4, 6, 7] or subdural [2] hemorrhage is a classic example of (central) fever, which additionally might also be explained by the vicinity to the thermosensitive neurons in the preoptic area of the hypothalamus [2, 7].

5. Conclusion

In conclusion, our prospective database of adult orthopedic patients fails to link surgical hematoma and fever on a large epidemiological scale. Clearly, additional epidemiological studies are needed to drive firm conclusions. These studies should not be difficult to perform.

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Conflict of Interest

All authors declare that they have no conflict of interest.

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