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Observational Study

PPE used for COVID-19 and cautions decrease the prevalence and duration of non-infection-related post-operative fever after 4 days after surgery

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ABSTRACT

Post-operative fever is a common finding in the post-operative period in orthopedic trauma surgery, with an incidence between 10% and 40%. The aim of this study is to compare the prevalence of post-operative fever in patients who were hospitalized in the Department of Orthopedics of the "S. Salvatore" Hospital in L'Aquila for two periods between 01/01/2019 and 01/12/2019 (the first post-covid-19), and the period from 01/01/2021 until to 31/12/2021, during the welfare activities in the same department.

We observed a decreased incidence of post-operative fever in patients admitted for trauma surgery during the second period probably because of the application of stronger measures to prevent the covid-19 diffusion, such as the continuous use of surgical, FFP2, and FFP3 masks by nurses, physicians, and patients, and, above all, why visiting procedures in the hospital were restricted or prohibited.

Keywords: *post-operative, fever, incidence, risk, orthopedic, COVID-19*

INTRODUCTION

Post-operative fever is a common complication following orthopedic trauma surgery, with an incidence between 10% and 40% depending on definitions (1-3).

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The challenge is focused on the underlying causes like acute infection or general inflammatory response.
Since the Covid-19 infection became a pandemic, the use of PPE has become daily, especially within the hospital.

In our department, access to external visits was restricted and limited; only one relative was admitted at a time. These restrictive measures and cautions have shown a decrease in post-operative fever in the first period of the pandemic (3), clinically resulting in a significant decrease in post-operative fever but not infections. This made it possible to reduce empirical antibiotic therapies and diagnostic tests and also made it possible to identify infections related to post-operative fever earlier. The aim of this study is to confirm the decrease in the prevalence of post-operative fever during the Covid-19 pandemic, comparing the data of hospitalized in our ward in 2019 with those of 2021.

MATERIALS AND METHODS

We analyzed 826 patients admitted Department of Orthopedics of "Ospedale Regionale S. Salvatore" of L'Aquila in the period from 01/01/2021 to 31/12/2021. We excluded 74 patients with open fractures, revisions in hip periprosthetic infection, implant removal, and curettage of the wound because these cases could be confused with the prevalence of post-operative fever; we also excluded patients who tested positive for COVID-19 and reviewed 752 records of patients admitted for trauma surgery, 403 for major involving the lower limb, 349 for trauma involving upper limb.

We recorded temperature measurements twice a day. We reviewed the records of the hospitalized, and in the same period during 2019, 872 patients were admitted in this period. We excluded 182 patients with open fractures, revisions in hip periprosthetic infection, implant removal, and curettage of the wound because these cases could confound the prevalence of post-operative fever and reviewed 690 records of patients admitted for trauma surgery, 387 for trauma involving the lower limb, 303 for trauma involving upper limb.

We considered the post-operative fever with the temperature cut-off of 37.5°C and recorded the duration of post-operative fever during hospitalization Statistical analysis was performed.

Statistical analysis

Statistical analyses were performed using SataMP 15 Software. After ascertaining the skewed distribution of all data with the Shapiro-Wilk test, the Wilcoxon rank-sum test was used to compare continuous variables, while proportional differences were assessed using the chi-square test. A p-value of <0.05 was considered significant.

RESULTS

During the considered period, there were a total of 1442 admissions; there were 700 (48,54%) males and 742 (51,46%) females, with an average age of 63.2 ± 22.3 years (range, 4 to 99). Comparing the two years, the number of admissions increased from 690 in 2019 to 752 in 2021 (8,98%) (Table I).

Table I. *Results table and comparison between the two groups. Statistically significant data in bold (p<0.05). [1] Wilcoxon rank-sum test; [2] Chi-square test.*

		2019	2021	*p*
Age (years)		63,36 ± 22.6	63.61 ± 21.1	0,8281[1]
Gender	**M**	337 (48,85%)	363 (48,27%)	0.8290[2]
	F	353 (51,15%)	389 (51,73%)	
Duration of the surgical procedure (minutes)		120 ± 70.3	114 ± 61.4	<0.0839[1]
Length of hospitalization (days)		10.33 ± 8.7	9.86 ± 7.4	0.2681[1]
Post-surgical operation fever		285 (41,3%)	183 (24.3%)	**<0.0001[2]**
Length of fever (days)		3.5 ± 2.2	2.1 ± 1.2	**<0.0001[1]**
Post-op fever 4 days after surgery		23.3%	8.2%	**<0.0001[2]**
Prevalence of infective complications		8,3%	6.7%	0.2484[2]
Prevalence of infective complications in post-op fever after 4 days of surgery		35.5%	75.4%	**<0.0001[2]**

The different gender distribution in the years considered was not significant: in 2019, there were 337 (48,85%) males and 353 (51,15%) females; in 2021, there were 363 (48,27%) males and 389 (51,73%) females. The age of the 2021 group was 63.61 ± 21.1 years; instead, the age of the 2019 group was 63.36 ± 22.6 years, and the difference was not statistically significant. The average duration of the intervention was not significantly different between 2019 and 2021 (Tab.1). Similarly, there were no statistically significant differences in the average duration of hospitalization (p=0.2681). In 2021, much less post-operative fever was recorded than in 2019 (p<0.0001). In addition, the average duration of post-operative fever in 2021 was significantly shorter than in 2019, by 1.4 days (p=0.0001).

In the 2021 group, fever was observed in the first post-op period in 16,2% (122) patients, while after 4 days, fever was observed in 8.2 (61) patients. In the 2019 group, 18% (124) of the fever cases were in the first post-op period, while 23.3% (161) were after 4 days.

Regarding the onset of fever, in the 2021 group, we observed that 66,7% (122) of post-op fever appeared in the first 4 days after surgery and 33,3% (61) 4 days after surgery (8.2% of the total number of hospitalized patients; N = 752). Totally, 49 had infective complications like pneumonia, cystitis, or surgical wound infections (6,51% of the total number of hospitalized patients (N = 752), 26,78% of total post-op fever (N = 183), and 75.4% of the total 4 days post-op fever patients (N = 61).
In the 2019 group, we observed that 60.35% (172) of post-op fever appeared in the first 4 days after surgery and 39,65% (113) 4 days after surgery (16,37% of the total number of hospitalized patients; N = 690). In total, 57 had infective complications like pneumonia, cystitis, or surgical wound infections (8.26% of the total number of hospitalized patients (N = 690), 20% of total post-op fever (N = 285), and 35,4% of the total 4 days post-op fever patients (N = 161).

Therefore, during 2021 we observed a reduction in global post-op fever (24,3% vs. 41.3%), a reduction in post-op fever 4 days after surgery: from 23.3% of patients in 2019 to 8.2% in 2021 (p = 0.0001). However, the prevalence of infective complications remained unchanged over the two years (8.5% in 2019 vs. 6.51% in

2021; p = 0.2484). Considering the infective complications that occurred in patients with post-operative fever after 4 days of surgery, the proportion increased statistically significantly in 2021 (35.4% in 2019 vs. 75.4% in 2021; p = 0.0001) (Fig. 1).

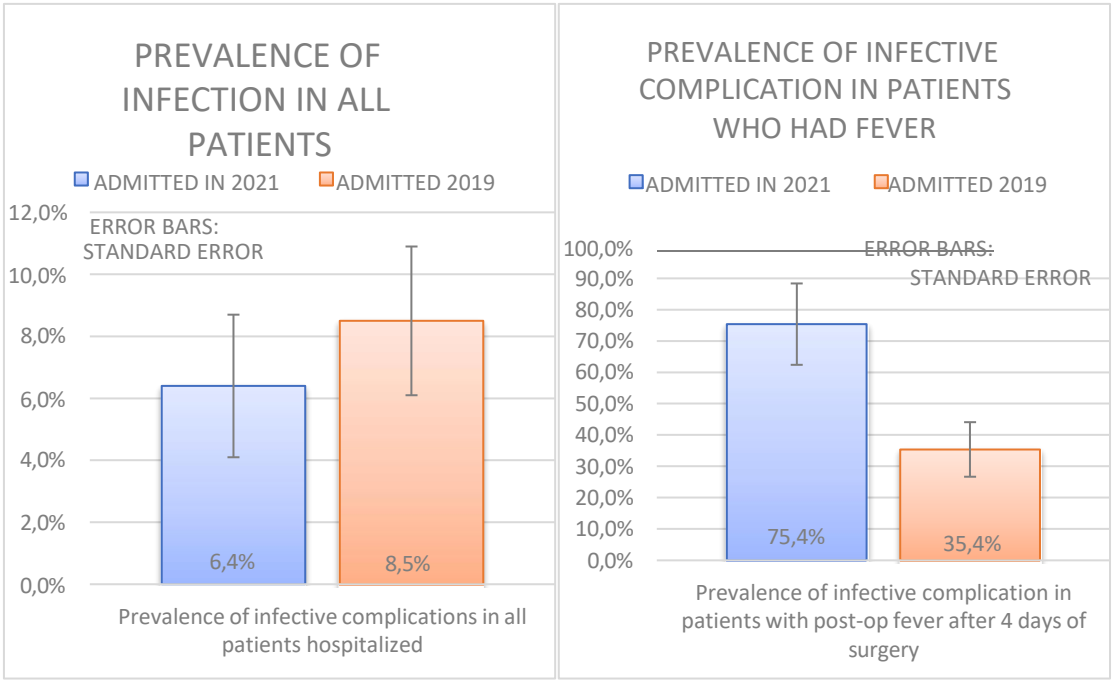

Fig. 1. *Difference between the prevalence of infective complications in all patients hospitalized and in patients who had post-op fever after 4 days of surgery.*

DISCUSSION

Our study shows a significant decrease in the prevalence and duration of post-operative fever in patients admitted in 2021 compared to those admitted in the same period in 2019 (Fig. 2). However, the difference in gender, age, and operative time are not statistically significant between 2019 and 2021. The significant decrease in the prevalence and duration of the fever is mainly due to the contagion containment measures taken for the COVID-19 pandemic according to Ministerial indications, particularly the use of surgical, FFP2 and FFP3 masks by nurses, physicians, and patients, and the restricted access to the department, during 2021, visits were only allowed to one visitor per patient in the same room and on alternate days between odd and even beds.

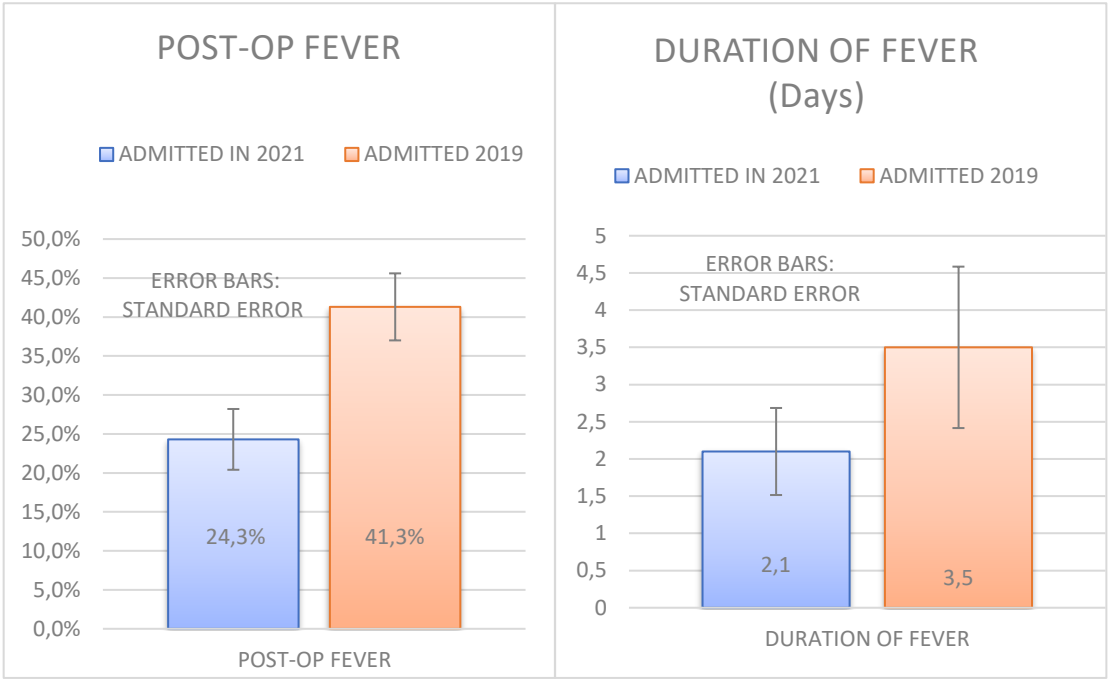

Fig. 2. *Difference between the presence of post-op fever and post-op duration of fever in 2019 and in 2021.*

Early post-operative fever is a common and infrequently associated with infection (6). Post-operative fever can have many etiologies. Andres et al. (10) evaluated serum and drain concentrations of interleukin 1β, interleukin 6 (IL-6), and tumor necrosis factor. Patients with post-operative fevers had a substantially higher drain and serum concentrations of IL-6. They determined that post-operative fevers can at least partly result from the release of endogenous pyrogens as part of the inflammatory response. (6, 10, 11). Literature suggests that any kind of work up in the absence of localizing symptoms in the third post-operative day or before is unwarranted and is an inappropriate use of hospital resources (7). Indeed, fever, even up to the seventh post-operative day, is not substantially helpful in distinguishing infection from general inflammation in clean orthopedic surgery (8). Post-operative on the fourth day, patients who experienced multiple febrile episodes, febrile episodes with temperatures of 38.5°C, or who underwent revision surgery are at the greatest risk of having an underlying infection (6). In the later post-operative period, physicians should be more suspicious of an infective source of fever because a traumatic, inflammatory etiology of fever is less likely (9).

The first data highlighted the decrease in post-operative fever following the hygiene measures adopted for COVID-19 (3). The continuation of the pandemic and the continued use of PPE made it possible to evaluate the data in a larger sample, confirming these preliminary data.

Indeed, this study showed that of the 4 days post-op fever, 75.4% of the 2021 PPE-protected patients had infective complications compared to 35.4% of 2019 ones. This suggests that under prevention of air infection by PPE, evidence of a 4-days post-op fever is of major concern for complicated infection risk and justifies more deep instrumental investigations and therapeutic measures. On the contrary, in normal clinical practice, as in the cases of 2019 patients, not PPE protected, adjunctive investigations and therapies are justified only in 35.4% of the patients. In all the other cases (64.6% of fevers), these may be unnecessary. The decrease in diagnostic tests such as chest x-ray and less use of empirical antibiotic therapy leads

to a reduction in costs of health care, with a relatively significant spare of resources and money.

CONCLUSION

Measures put in place to prevent the spread of COVID-19 infection have entered the daily routine in recent years. The use of PPE, as well as greater hand hygiene and has not only spread to all people, even non-health workers. The use of more caution within the hospital led to a significant decrease in post-operative fever. Our data highlight how particular attention in the post-operative period limits the prevalence of post-operative fever, mainly linked to an increase in inflammatory cytokines, and not necessarily related to infections. Fever at 4 days after surgery, which has the greatest predictive significance for the onset of infections, also decreased.

The decrease in fever to 4 days allows for an earlier diagnosis of infections and complications and limits the use of diagnostic tests.

Institutional Review Board Statement:

Ethics Committee or Institutional Review Board approval or informed consent are not required for this retrospective observational study because all the data have been processed and presented as aggregated data. Consequently, for all of them, it is not possible to identify any individual patient, which is in accordance with the WMA Declaration of Helsinki. Furthermore, we have not changed any of our normal procedures on patients nor performed any new ones to collect data.

All the aggregative data collected are normally acquired during hospitalization. Moreover, for any patient admitted to our institution, it is a mandatory procedure to achieve a signed approval for the processing of personal data.

Informed Consent Statement:

Informed consent was obtained from all subjects involved in the study.

Data Availability Statement:

The data presented in this study are available on request from the corresponding author.

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This research received no external funding.

Conflicts of Interest:

The authors declare no conflict of interest.

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