

# Effect of the COVID-19 pandemic on foot surgeries

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## Abstract

**Background.** Musculoskeletal dysfunction due to deformities and injuries of the foot is a common orthopedic problem.

**Objectives.** To analyze the effect of the COVID-19 pandemic on both elective and emergency foot surgeries.

**Materials and methods.** This study analyzed the effect of the COVID-19 pandemic on elective and emergency foot surgeries. The comparison included data collected in 2019 (March 15–October 15, when the epidemic did not influence the Polish healthcare system or patient demographics) and in a corresponding period in 2020. This study was conducted in the trauma and orthopedic surgery wards and the emergency departments of 2 regional Polish hospitals.

**Results.** The analysis of the data from the orthopedic wards showed a reduction in the total number of admissions in 2020 by 55%. The number of elective and emergency interventions was differently related to the pandemic, with elective interventions declining by 72% and emergency interventions increasing by 27% in 2020 compared to 2019. The total number of elective foot surgeries in children decreased by 59% in 2020. The mean duration of hospital stay was approx. 2.5 days shorter in adults and 1.7 days shorter in children during the 2<sup>nd</sup> evaluation period. The emergency department data showed a decline of 32% in the number of patients presenting with injuries during the pandemic. Nonetheless, the pandemic did not affect the mean age of patients and the female-to-male ratio.

**Conclusions.** The global COVID-19 pandemic affected the epidemiology of foot injuries as well as the prevalence of foot surgeries in children and adults.

**Key words:** COVID-19, pandemic, epidemiology, foot surgery, lockdown

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## Background

Musculoskeletal dysfunction due to deformities and injuries of the foot is a common orthopedic problem.<sup>1,2</sup> According to the Illinois Podiatric Medical Association, approx. 6% of the USA population are affected by foot injuries, forefoot deformities or flat feet (*pes planus*). The global spread of severe acute respiratory syndrome coronavirus type 2 (SARS-CoV-2) infections has had an impact on many aspects of everyday life, including changes in people's habits, lifestyles and fears regarding their health and the health of their loved ones.<sup>2–19</sup>

The COVID-19 pandemic unquestionably affected the functioning of national healthcare systems.<sup>2–19</sup> This included changes in the character of hospitals, including conversions of surgical wards into infectious wards, limiting the number of elective admissions and reducing the number of medical staff. The latter was due to temporary quarantines placed on those who had a contact with patients suspected of having COVID-19 infections and the furloughing of elderly or chronic disease-burdened staff.<sup>3–5,10</sup>

The available literature has a limited number of reports on the effects the COVID-19 pandemic has had on foot surgeries in adults and children.<sup>2,4,5</sup> The available reports assess the number of surgeries for foot injuries during the pandemic to a limited extent<sup>2</sup> or estimate elective foot surgery restrictions based on surveys conducted among orthopedic surgeons.<sup>4,5</sup>

## Objectives

The purpose of this study was to analyze the effect of the COVID-19 pandemic on foot surgery in both elective and emergency settings.

## Materials and methods

### Study design and patients

The study was conducted in the trauma and orthopedic surgery departments and the emergency departments of 2 Polish regional hospitals. Adult and pediatric patients were included in this study. The compared periods were March 15–October 15, 2019, when the (at that time non-existent) COVID-19 epidemic did not influence the Polish healthcare system or patient demographics, and the corresponding period in 2020 (March 15–October 15, 2020). Informed consent was obtained for experimentation with human subjects. The study was approved by the local ethics committee (approval No. 4/PNDR/2021).

## Evaluation of epidemiological parameters

This study analyzed the number of elective foot surgeries most commonly performed in the surgical wards, i.e., correction of forefoot deformities, including bunions (*hallux valgus*) and hammertoes. A large group of patients presented with multiple forefoot deformities, which were corrected simultaneously during a single procedure. Other elective procedures included arthrodesis, planovalgus foot surgery and removal of implants. The total number of elective foot surgeries in children was assessed. The procedures performed on children were divided into those most frequently performed in our departments (correction of the planovalgus foot, correction of clubfoot).

Injury interventions were divided into 2 groups. The 1<sup>st</sup> group comprised interventions for foot fractures, defined as fractures involving any bone in the foot from the talus to the phalanges. The 2<sup>nd</sup> group comprised interventions for injuries such as wounds, dislocations and sprains within the foot (excluding those of the ankle joint).

The groups were analyzed in terms of the number of surgeries, distribution of the sexes, age distribution, and mean duration of hospital stay. The data from 2019 were compared with the data collected in 2020.

## Statistical analyses

Statistical analyses were performed using Statistica v. 13.1 software (StatSoft Inc., Tulsa, USA). The Shapiro–Wilk test was used to assess distribution normality. The variables did not follow a normal distribution; therefore, Pearson's  $\chi^2$  test and Mann–Whitney test was used. The level of significance was set at  $\alpha = 0.05$ .

## Results

All results have been compiled in Table 1 and Table 2. The analysis of the orthopedic ward data showed a reduction in the total number of adult admissions by 55% in 2020.

The number of elective and emergency interventions was differently affected by the pandemic, with elective interventions declining by 72% and emergency interventions increasing by 27% in 2020 compared to 2019. These changes were statistically significant ( $p = 0.01770$ ;  $p = 0.01922$ ). In adults, arthrodesis and planovalgus foot surgeries decreased by 50% in 2020, implant removal surgeries decreased by 63% and *hallux valgus* and hammertoe surgeries decreased by 82%.

The total number of elective foot surgeries performed in children decreased by 59% in 2020 compared to 2019. This difference was statistically significant ( $p = 0.0487$ ). In children, the number of planovalgus foot surgeries decreased by 61% and clubfoot surgeries decreased by 56% in 2020.

**Table 1.** Comparison totals, means and ratios of epidemiology of foot trauma and surgery (p-value for Mann–Whitney U test)

Variables	N		Difference between the year 2020 and 2019 [%]	df	p-value
	2019	2020			
Orthopedic surgery department – surgically					
Total number of patients	86	39	−54.65	–	–
Total number of elective surgery	67	19	−71.64	–	–
Arthrodesis	6	3	−50.00	–	–
Planovalgus foot surgery	4	2	−50.00	–	–
Removal of implants	19	7	−63.15	–	–
Total number of trauma surgery	11	14	27.27	–	–
Total number of patients treated conservatively	8	6	−25.00	–	–
Mean duration of hospital stay [days]	6.77	4.28	36.77	124	0.02737
Female-to-male ratio	2.74	2.00	−26.98	–	–
Mean age of all patients	56.06	56.05	−0.01	123	0.9981
Total number of elective foot surgery in children	27	11	−59.25	–	–
Mean duration of hospital stay in children [days]	5.44	3.72	−31.61	126	0.0046
Emergency ward – conservatively					
Total number of patients	145	99	−31.72	–	–
Total number of patients treated conservatively	130	85	−34.61	–	–
Total number of patients transferred to the orthopedic ward	15	14	−6.66	–	–
Female-to-male ratio	0.59	0.57	−3.7	–	–
Mean age of all patients	41.26	45.05	9.13	242	0.0722

**Table 2.** Change in composition of epidemiology of foot trauma and surgery (p-value for Pearson's  $\chi^2$  test)

Variables	N		Difference between the year 2020 and 2019 [%]	df	p-value
	2019	2020			
Orthopedic surgery department – surgical treatment					
Elective surgery					
halux valgus and hammertoe surgery	38	7	−81.57	1	0.0177
other surgeries	29	12	−58.62		
Trauma surgery					
fractures	8	7	−12.5	1	0.01922
other injuries	3	7	133.33		
Gender					
women	63	26	−58.73	1	0.451
men	23	13	−43.47		
Surgery in children					
Trauma surgery					
planovalgus foot surgery in children	18	7	−61.11	1	0.0487
clubfoot surgery in children	9	4	−55.55		
Emergency ward – conservative treatment					
Type of injuries					
fractures	95	56	−41.05	1	0.1574
injuries	50	43	−14.00		
Gender					
women	54	36	−33.33	1	0.889
men	91	63	−30.76		

The mean duration of hospital stay for adults was approx. 2.5 days shorter in the 2<sup>nd</sup> evaluated period, which was statistically significant (Fig. 1,  $p = 0.02737$ ). The mean duration of hospital stay for children decreased in 2020 by 1.7 days compared to 2019. This difference was statistically significant ( $p = 0.0046$ ).

There was not a significant decrease in the proportion of females and males admitted to the hospital (with a female-to-male ratio of 2.74 in 2019 compared to 2.00 in 2020,  $p = 0.541$ ). In addition, the mean age of patients undergoing surgery remained unchanged ( $p = 0.9981$ ).

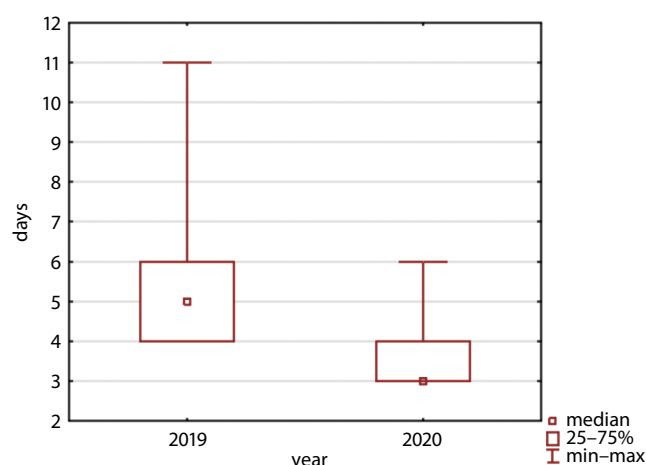


Fig. 1. Mean duration of hospital stay in days

The greatest rise in emergency procedures (133%) was observed in interventions performed due to other foot injuries (mostly soft-tissue injuries) ( $p = 0.01922$ ). The emergency department data showed 32% fewer patients presenting with injuries during the evaluated pandemic period. These changes were statistically significant ( $p = 0.0153$ ). Moreover, the number of patients with fractures showed a greater decline (41%) in 2020 compared with pre-pandemic figures than the number of patients with soft-tissue injuries (14% decline), although these differences did not reach statistical significance ( $p = 0.1574$ ).

The mean patient age in the emergency ward increased from 41 years in 2019 to 45 years in 2020, but the difference was not statistically significant ( $p = 0.0722$ ). The proportion of patients seen in the emergency departments who required surgical treatment or more diagnostic tests on the orthopedic ward did not change between the evaluated periods (with only a single case fewer in the 2<sup>nd</sup> period).

## Discussion

### Key results and generalizability

The COVID-19 pandemic considerably altered the organization of healthcare services across the world.<sup>2-19</sup> Elective admissions were halted or limited, medical personnel numbers decreased and patients' fears associated with hospitalization increased.<sup>3-5,10</sup> However, the impact of the COVID-19 pandemic on elective and emergency treatment of foot injuries has not been fully evaluated.

Our study confirms the impact of the pandemic in the form of lower numbers of elective procedures in children and adults, and shorter hospital stays to minimize the amount of contact between patients and medical staff, who are the potential vectors in coronavirus transmission. Similarly, other authors have reported decreases in the number of elective procedures during the pandemic by 23–100%.<sup>3-5,10</sup> An estimated 26.6–75.2% of centers

cancelled or rescheduled (postponed) foot surgeries during the COVID-19 pandemic.<sup>4,5</sup> We observed a decrease in all types of elective surgeries performed in both, adults and children. The reduction in the number of elective admissions of children during the COVID-19 pandemic, observed in our study, may have negative effects in the form of increasing the severity of deformities in patients awaiting surgery. The postponing of any musculoskeletal surgery in a growing child is particularly dangerous, and can have irreversible consequences and a significant impact on their health.

No statistically significant reduction was seen in the ratio of female-to-male patients admitted to orthopedic surgery departments in 2020, largely due to the fact that females are generally more prone to develop forefoot deformities.<sup>20,21</sup>

During the pandemic, the introduction of travel restrictions and remote work led to fewer patients presenting with pain, which undoubtedly resulted in a reduction of patients admitted for elective forefoot procedures. In many cases, patients decided to postpone their treatment due to less severe pain, and – particularly among the elderly – out of fear of the coronavirus.

In contrast to the pronounced change in sex distribution among orthopedic ward patients, the change in sex distribution among emergency room patients was negligible. Males presented nearly 2 times more frequently than females in both evaluated periods (the female-to-male ratio was 0.59 in 2019 and 0.57 in 2020), which indicates a higher incidence of foot injuries in males.

The increased number of foot injury patients transferred to the orthopedic ward from the emergency room to undergo surgical treatment was due to several factors. These include the increasingly stringent restrictions imposed by the Polish government during the period of national lockdown, which directly affected the etiology of injuries, with lower numbers of high-energy injuries and only slightly lower numbers of soft-tissue injuries. These changes were a result of travel restrictions and the consequent decline in the number of traffic accidents.<sup>13,15,18</sup> Conversely, the amount of work around the house increased due to no restrictions being imposed on hardware and DIY stores. This, combined with increased alcohol consumption, resulted in a higher incidence of injuries at home.<sup>13,15,18</sup> Moreover, heavy industry did not experience any direct lockdown measures, which was associated with undiminished injuries in this field.

### Limitations

The limitation in the assessment of the impact of the COVID-19 pandemic on foot surgery is that it was only conducted at 2 centers and on a limited group of patients. This allowed the authors to quickly assess and present the important research results. However, in the future, we plan to conduct a multicenter study on a larger group of patients.


In light of the uncertain future and lack of reliable estimates as to the duration of this pandemic, orthopedic wards and surgery scheduling must develop protocols to increase their availability and ensure the safety of patients and staff.


## Conclusions

Our analysis of the collected data showed the effects of the global COVID-19 pandemic on the types of patients, availability of elective foot surgeries in children and adults, and epidemiology of foot injuries. This study highlights the need to make elective surgeries more available, while simultaneously improving the safety for both hospital staff and patients by minimizing the risk of possible SARS-CoV-2 transmission. The COVID-19 pandemic saw a reduction in the number of all types of elective foot surgeries in children and adults, an increase in the number of trauma-related foot surgeries, and shortening of hospital stays. Nonetheless, the pandemic had no effect on mean patient age and female-to-male ratio.

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