

Epidemiology of Distal Radius Fractures in Children and Adults During the COVID-19 Pandemic – A Two-Center Study

Jarosław Olech

Provincial Specialist Hospital in Legnica

Mariusz Ciszewski

Opole University

Piotr Morasiewicz (✉ morasp@poczta.onet.pl)

Opole University

Research Article

Keywords: distal radius, fracture, Covid-19, Epidemiology, Lock-down, Pandemic, Sars-cov-2

DOI: <https://doi.org/10.21203/rs.3.rs-132986/v1>

License:  This work is licensed under a Creative Commons Attribution 4.0 International License.

[Read Full License](#)

Abstract

Background: The purpose of our study was a comprehensive assessment of the impact of the COVID-19 pandemic on distal radius fractures (DRF) epidemiology, including both children and adults and various fracture fixation methods in two large trauma centers in Poland.

Methods: This study compared the data on the treatment of distal radius fractures in Poland in two periods: the period of the COVID-19 pandemic and the corresponding period prior to the pandemic. We assessed detailed data from two trauma centers for pediatric and adult patients. We compared epidemiological data, demographic data, treatment type, and hospital stay duration.

Results: The total number of patients hospitalized due to DRF during the pandemic was 15.1% lower than that from the pre-COVID-19 pandemic period. In the case of adult patients, the total number of those hospitalized during the pandemic decreased significantly (by 22%) from 132 to 103 patients. Analysis of the individual treatment methods revealed that the number of adults who underwent conservative treatment was considerably (by 30.3%) significantly lower in the period of the COVID-19 pandemic. Compared to the figures from the pre-pandemic period, the number of surgically treated adults was significantly higher (by 53.8%). Our analyses showed hospitalizations of surgically treated adults to be shorter by 12.7% during the pandemic, with the corresponding hospitalizations of surgically treated pediatric patients to be shorter by 11.5%.

Conclusions: Our study showed decreased numbers of pediatric and adult patients with DRFs during the COVID-19 pandemic. The pandemic caused an increase in the number of children and significantly increase adults undergoing surgical treatment for DRFs, a decrease in mean patient age, shorter significantly durations of hospital stay, and an increased number of men with DRFs.

Background

Distal radius fractures (DRFs) constitute 15–21% of all fractures and are the third most common location of osteoporosis-related fractures [1–14]. The estimated risk of DRF is 9–139/10,000 people per year [3, 4, 8, 11, 12]. There are different DRF fixation methods used in children and adults [2, 6, 7, 9, 10, 11].

The COVID-19 pandemic altered the healthcare in the whole world in the year 2020 [13–24]. Although the causative coronavirus (SARS-CoV-2) can infect both adults and children, the majority of children have mild or asymptomatic course of the disease [13]. The COVID-19 pandemic has impeded general access to specialist care and altered the daily clinical practice and admission routines (in both emergency and primary-care settings) [14–17, 19, 21, 22]. Some physicians contracted COVID-19, some shortened their office hours to limit the risk of infection. Some trauma and orthopedic units and some emergency wards have also altered their admission criteria [16, 17, 22]. Despite having suffered an injury, some patients, particularly the elderly and those with comorbidities, have avoided seeking medical help at emergency or trauma and orthopedic wards due to the fear of contracting COVID-19 [13, 22].

There have been few studies evaluating the important issue of the impact of the COVID-19 pandemic on DRF epidemiology in children and adults [13, 15].

The sparse available literature on the effect of the COVID-19 pandemic on DRF epidemiology focuses on pediatric patients and has a limited scope, since the authors typically assess the number of patients with specific fracture locations presenting at emergency departments [13, 15].

Nonetheless, there are no detailed data on the possible changes in the epidemiology and treatment of DRFs in children and adults. Such data may prove useful in preparing resources.

The purpose of our study was a comprehensive assessment of the impact of the COVID-19 pandemic on DRF epidemiology, including both children and adults and various fracture fixation methods in two large trauma centers in Poland.

Methods

Distal radius fracture epidemiology was evaluated in two large trauma centers for pediatric and adult patients in Poland. Outpatients seeking medical attention at emergency departments and inpatients undergoing surgery at trauma-orthopedic wards were evaluated. The analysis included the period of the COVID-19 pandemic in Poland (from March 15 to October 15, 2020), and the obtained data were compared with those from the corresponding period prior to the COVID-19 pandemic (from March 15 to October 15, 2019).

The inclusion criteria were a history of DRF in the period between Mar. 15, 2020, and Oct. 15, 2020, or between Mar. 15, 2019, and Oct. 15, 2019; available medical records; and available demographic data. The study was approved by the local review board. All procedures were followed in accordance with relevant guidelines.

Analysis of two databases from two large trauma centers in Poland included the total number of DRF patients, total number of pediatric patients (< 18 years old) with a DRF, total number of adult patients (> 18 years old) with a DRF, total number of pediatric patients with a DRF who received conservative treatment (plaster cast), total number of adults with a DRF who received conservative treatment (plaster cast), total number of pediatric patients with a DRF who received surgical treatment, proportion of pediatric patients who received surgical treatment (total number of all pediatric patients treated surgically/ total number of all pediatric patients × 100%), total number of adults with a DRF who underwent surgical treatment, proportion of adults who underwent surgical treatment (total number of adults who underwent surgical treatment / total number of adults × 100%), total number of adults with a DRF who underwent surgical treatment involving open reduction and volar plate fixation, total number of adults with a DRF who underwent surgical treatment involving closed reduction and Kirschner wire fixation, mean age of all patients, mean age of all adult patients, mean age of all pediatric patients, mean hospital stay duration of surgically treated adults, mean hospital stay duration of surgically treated pediatric patients, and male-to-female patient ratio. All these data for the period of the COVID-19

pandemic in Poland (from Mar. 15 to Oct. 15, 2020) were compared with the corresponding data for the period prior to the COVID-19 pandemic in Poland (from Mar. 15 to Oct. 15, 2019).

The obtained data were statistically analyzed using the Statistica 13.1 program. Pearson's chi-square test and the student's t-test were used to compare the variables. The adopted significance level was $\alpha = 0.05$

Results

The results have been presented in Table 1. Our analysis showed that the total number of patients hospitalized due to DRF during the pandemic (in 2020) was 15.1% lower than that from the pre-COVID-19 pandemic period (in 2019). In the case of adult patients, the total number of those hospitalized during the pandemic decreased significantly (by 22%) from 132 to 103 patients, ($p = 0,01253$), Fig. 1. In the case of patients under the age of 18 years, the total number of those hospitalized decreased by 3.8%.

Analysis of the individual treatment methods revealed that the number of adults who underwent conservative treatment was considerably (by 30.3%) significantly lower in the period of the COVID-19 pandemic ($p = 0,03618$), Fig. 2. The number of pediatric patients who underwent conservative treatment decreased somewhat less dramatically (by 7.2%) from the first evaluated period to the second. Compared to the figures from the pre-pandemic period, the number of surgically treated adults was significantly higher (by 53.8%), ($p = 0,03618$), Fig. 2, while the number of surgically treated pediatric patients was higher by 18.2% in 2020.

The parameter that increased the most (by 275%) in comparison to its pre-pandemic value was the number of adults who underwent surgical treatment with volar plate fixation. Interestingly, the number of patients treated with Kirschner wires remained unchanged.

What also draws attention is the lower mean age of patients hospitalized due to a DRF during the pandemic (37 years and 2 months) in comparison to the pre-pandemic mean age of hospitalized DRF patients (40 years and 1 month). In adult patients, the mean age dropped from 58 years to 57 years and 9 months, while in children it dropped from 10 years and 6 months to 9 years and 8 months.

Our analyses showed hospitalizations of surgically treated adults to be shorter by 12.7% during the pandemic, with the corresponding hospitalizations of surgically treated pediatric patients to be shorter by 11.5%, ($p = 0,03857$), Fig. 3.

The COVID-19 pandemic saw a considerably increased (by 208.3%) male-to-female ratio among DRF patients.

Discussion

Distal radius fractures constitute a social problem [1-13]. The COVID-19 pandemic has had a considerable impact on the lives of both adults and children around the world [13-24]. Some schools have been closed, causing children to stay at home, and some adults work from home. Moreover, during some

of the COVID-19 pandemic period, people's ability to move about freely outdoors and do sports was limited due to government-imposed restrictions. All the above factors affected DRF epidemiology in adults and children.

There have been no studies comprehensively evaluating the important issue of epidemiology and treatment of DRFs in adult and pediatric patients during the COVID-19 pandemic.

Nabian et al. presented an epidemiologic model of pediatric injuries during the COVID-19 pandemic based on data from a tertiary trauma center in Iran [13]. Those authors observed an increased proportion of DRFs in children (from 28% of all fractures from the pre-pandemic period to 30% of all fractures during the COVID-19 pandemic [13]. Nabian reported no changes in either the mean age of patients or the male-to-female patient ratio during the COVID-19 pandemic [13]. Bram et al. assessed the effects of the COVID-19 pandemic on the epidemiology of injuries in pediatric patients [15]. According to their report, the total number of fractures decreased by 61%, there were no changes in the male-to-female ratio, and the mean age of patients decreased from 9.4 to 7.5 years [15]. Bram et al. noted a decreased incidence of injuries due to sports and other outdoor activities, with an increased incidence of high-energy injuries due to falls from trampolines and bicycles [15]. Hashmi reported a 50% decrease in both elective and emergency admissions to orthopedic wards, with no changes in either the mean age or male-to-female ratio in patients in the COVID-19 pandemic period in comparison with the relevant pre-pandemic figures [16]. Yu et al. observed a 42% decrease in the number of patients with fractures seen at one of the orthopedic wards in China during the COVID-19 epidemic [17]. Poggetti et al. reported a 28.6% decrease in the number of patients undergoing surgery due to hand and wrist trauma in one of Italian hospitals during the COVID-19 pandemic [18]. In one of Turkish hospitals, the total number of fractures recorded during the COVID-19 pandemic was by 61.6% lower than the number of fractures recorded in 2019 [20]. Our retrospective study showed reduced numbers of pediatric (by 3.8%) and adult patients (by 22%) referred to emergency departments due to DRFs during the COVID-19 pandemic. Similar, or even more pronounced decreases over the COVID-19 pandemic period (compared to period prior to the COVID-19 pandemic) have been reported in other countries (19–69%) [13,15-22,24].

The reduced numbers of DRF-associated hospitalizations can be explained by lockdown measures, limited exercise opportunities, and the necessity to stay indoors during the pandemic. As a result of having to stay at home under adult supervision, children and adolescents under the age of 18 years were less prone to suffer injuries, which are typically exercise-related in this age group. Hence the less pronounced difference observed in this age group. Young adults limited their exercise by staying at home; this made them less prone to injuries/falls, which are the most common mechanism of DRFs. The elderly stayed mostly at home due to fears of infection. Some of them did not seek medical attention despite their injury and let it heal without any orthopedic intervention.

We expected to see a trend towards lower numbers of DRF patients due to social distancing measures and instances of self-quarantine, which altered people's behaviors and lifestyles [13,18,19,20,22,23,24]. Approximately 25% of injuries in children are due to sports [15]. Sports activities and training sessions

were mostly canceled, with schools, kindergartens, and nurseries partly or completely closed. The amount of traffic also declined dramatically due to the COVID-19 pandemic. These factors, as well as the patients' and their guardians' fears of infection during a visit to the hospital affected the epidemiology and treatment of DRFs in children and adults [13-17,23,24]. Some authors reported falling numbers of traffic accidents, sports-related injuries, and outdoor injuries during the pandemic, which would lead to lower numbers of high-energy fractures [14,17,18,19,22,24]. However, the number of low-energy fractures remains unchanged [14,18,19]. On the other hand, the period of COVID-19 pandemic saw increased numbers of indoor injuries and alcohol-related injuries [14,17,18,19,22,24].

Evaluating the individual treatment methods, we assumed that most high-energy fractures would require surgical treatment, with most low-energy injuries managed conservatively. Turgut et al. observed an 89% increase in the proportion of children undergoing surgery due to fractures during the COVID-19 pandemic, with no corresponding increase in adults undergoing surgical treatment [20]. Pichard reported an increased proportion of patients undergoing surgery (from 36.9% in 2019 to 51.2% during the COVID-19 pandemic) [24]. We observed increased numbers of patients undergoing orthopedic surgery treatment during the pandemic (an 18.2% increase in the number of children and a 53.8% increase in the number of adults). This may have been a result of the increased numbers of high-energy injuries due to falls from a trampoline or bicycle [15].

The lower by 30.3% number of adult patients receiving conservative treatment can be attributed to limited exercise and recreational activities, whereas the dramatic 98% increase in the proportion of surgically treated adults can be attributed to the work and renovations done around the house during the lockdown period and the maintained high level of activity on the part of construction businesses, which were exempt from lockdown restrictions. This can be best seen while analyzing the number of patients treated with a volar plate. These were mostly patients with high-energy injuries due to falls from a height associated with work done in or around the house and with construction activities.

Our analysis revealed a 7.2% decrease in the mean age of patients during the pandemic, which may have been a result of elderly people's fears of visiting an emergency department during the pandemic and the more effective measures to prevent injuries in the elderly. On the other hand, Lv et al. reported a significant increase in the mean age of patients presenting with fractures during the pandemic in China [23]. The lower mean age of patients hospitalized due to DRF can be attributed to the nature of the SARS-CoV-2 virus, which is more virulent in the elderly [13]. Because of their fear of infection, elderly patients submitted more eagerly to lockdown restrictions. Moreover, some of the oldest patients never reached a hospital due to fears of infection and allowed their fractures to heal without seeking medical attention.

Our analyses were based on data collected from hospital departments performing elective and emergency procedures. The observed shorter mean hospital stays of patients undergoing surgery during the lockdown period was a result of elective procedures being cancelled, patients with injuries being treated more speedily, and the hospital stays being limited to a minimum due to the epidemiological

situation in hospitals. This also applied to pediatric patients who were hospitalized together with an adult guardian.

The increased number of DRFs in males in comparison to that in females can be attributed to uninterrupted work involving physical labor in construction, mining, and smelting industries, despite lockdown restrictions elsewhere.

The increased male-to-female ratio among DRF patients is also associated with the differences in the type of work done by men and women. Jobs requiring physical labor, which tend to be more commonly held by men were exempt from lockdown restrictions, which increased the proportion of men who incurred injuries. Moreover, men who self-quarantined at home remained actively involved in work around the house and in renovations. In comparison, the women who stayed at home were more likely to engage in low-energy activities, such as cleaning or childcare, which to a lesser extent predispose to DRFs.

Our study showed the effect of the COVID-19 pandemic on the epidemiology of DRFs in adults and children.

The general tendency for DRFs to occur decreased during the pandemic; however, the observed increase in the proportion of patients who underwent surgical treatment may be an important warning sign, indicating that the pandemic was responsible for the increased number of high-energy DRFs requiring surgery.

The results of our analysis can be useful in taking appropriate measures and securing the resources necessary for the treatment of DRFs, especially since the COVID-19 pandemic saw increased numbers of DRF patients undergoing surgical treatment.

Moreover, this study suggests the need to inform men about the risk of DRFs, as evidenced by the dramatic increase in the number of male patients with this type of injury.

Conclusions

Our study showed decreased numbers of pediatric and adult patients with DRFs who were referred to trauma centers during the COVID-19 pandemic.

The COVID-19 pandemic caused an increase in the number of children and significantly increase adults undergoing surgical treatment for DRFs, an increase in the number of adults treated with a volar plate, a decrease in mean patient age, shorter significantly durations of hospital stay in children and shorter durations of hospital stay in adults undergoing surgical treatment, and an increased number of men with DRFs.

Declarations

Ethics approval and consent to participate:

The study was approved by the Bioethical Commission at the Lower Silesian Medical Chamber in Wrocław (2/PNDR/2020). Informed consent was obtained from all the participants and also from legal guardians of the participants as pediatric patients data is taken in the study.

Consent for publication:

Not applicable

Availability of data and material:

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

Competing interests:

The authors declare no potential conflict of interests.

Funding:

There was no sources of founding.

Authors' contributions:

JO and PM designed the study. JO, MC, PM collected analyzed and interpreted the data. JO and PM drafted the manuscript. JO and PM revised it critically for important intellectual content. JO and PM final revision of the manuscript. All authors read and approved the final manuscript.

Acknowledgements:

Not applicable

References

1. Hye-Young Kwon, Hyun-Ho Kim, Yoon -Kyoung Sung, Yong-Chan Ha. Incidence and Mortality of Osteoporotic Fracture in Rheumatoid Arthritis in South Korea Using Nationwide Claims Data. *J Bone Metab.* 2019 May; 26 (2):97-104.
2. Adeyemi A Ogunleye, Donna F Mullner, Anna Skochdopole, MiltonArmstrong, Fernando A Herrera. Remote Injuries and Outcomes After DistalRadius FractureHand (N Y). *Jan;* 14 (1):102-6.
3. Ochi K, Go Y, Furuya T, Ikari K, Taniguchi A, Yamanaka. Risk factors associated with the occurrence of distal radius fractures in Japanese patients with rheumatoid arthritis: a prospective observational cohort study. *Clin Rheumatol.* 2014 Apr;33 (4):477-83.
4. Ali M, Eiriksdottir A, Murtadha M, Åkesson A, Atroshi I. Incidence of distal radius fracture in a general population in southern Sweden in 2016 compared with 2001. *Osteoporos Int.* 2020 Apr; 31(4):715-20.

5. Talmaç MA, Görgel MA, Kanar M, Tok O, Özdemir HM. Comparison of three surgical methods in the treatment of intraarticular comminuted distal radius fractures: Volar locking plate, non-bridging external fixator, and bridging external fixator. *Eklemler Hastalıkları Cerrahisi*. 2019 Dec ;30 (3):224-32.
6. Chung KC, Malay S, Shauver MJ, Kim HM. Assessment of Distal Radius Fracture Complications Among Adults 60 Years or Older: A Secondary Analysis of the WRIST Randomized Clinical Trial. *JAMA Netw Open*. 2019 Jan ;4: 2(1).
7. Katayama T, Ono H, Omokawa S. Comparison of Five Years Clinical and Radiological Outcomes between Progressive and Non-Progressive Wrist Osteoarthritis after Volar Locking Plate Fixation of Distal Radius Fractures. *J Hand Surg Asian Pac Vol*. 2019 Mar;24(1):30-5.
8. Lameijer CM, Ten Duis HJ, Dusseldorp IV, Dijkstra PU, van der Sluis CK. Prevalence of posttraumatic arthritis and the association with outcome measures following distal radius fractures in non-osteoporotic patients: a systematic review. *Arch Orthop Trauma Surg*. 2017 Nov ;137(11):1499-513.
9. Toon DH, Premchand RAX, Sim J, Vaikunthan R. Outcomes and financial implications of intra-articular distal radius fractures: a comparative study of open reduction internal fixation (ORIF) with volar locking plates versus nonoperative management. *J Orthop Traumatol*. 2017 Sep ; 18(3):229-34.
10. Rundgren J, Bojan A, Mellstrand Navarro C, Enocson A. Epidemiology, classification, treatment and mortality of distal radius fractures in adults: an observational study of 23,394 fractures from the national Swedish fracture register. *BMC Musculoskelet Disord*. 2020 Feb 8; 21(1):88.
11. Hevonkorpi TP, Launonen AP, Huttunen TT, Kannus P, Niemi S, Mattila VM. Incidence of distal radius fracture surgery in Finns aged 50 years or more between 1998 and 2016 - too many patients are yet operated on? *BMC Musculoskelet Disord*. 2018 Mar 2 ; 19(1):70.
12. Jennifer L. Kelsey, PhD and Elizabeth J. Samelson. Variation in Risk Factors for Fractures at Different Sites. *Curr Osteoporos Rep* 2009 December; 7(4): 127–33
13. Mohammad Hossein Nabian, Fardis Vosoughi, Farid Najafi, Seyyed Saeed Khabiri, Maziar Nafisi, Javad Veisi. Epidemiological pattern of pediatric trauma in COVID-19 outbreak: Data from a tertiary trauma center in Iran. 2020 Sep 16;S0020-1383(20)30756-7.
14. Gaurav K Upadhyaya, Karthikeyan Iyengar, Vijay K Jain, Raju Vaishya. Challenges and strategies in management of osteoporosis and fragility fracture care during COVID-19 pandemic. *J Orthop*. 2020 Jun 2;21:287-90.
15. Joshua T Bram, Mitchell A Johnson, Lacey C Magee, Nishank N Mehta, Faris Z Fazal, Keith D Baldwin. Where Have All the Fractures Gone? The Epidemiology of Pediatric Fractures During the COVID-19 Pandemic. *J Pediatr Orthop*. 2020 Sep;40(8):373-9.
16. Pervaiz Hashmi, Shah Fahad, Hammad Naqi Khan, Marij Zahid, Anum Sadruddin, Shahryar Noordin. Covid-19 pandemic: Economic burden on patients with musculoskeletal injuries in a tertiary care hospital of LMIC; retrospective cross sectional study. *Ann Med Surg (Lond)*. 2020 Dec;60:5-8.
17. Pei Y, Chuanlong Wu, Chengyu Zhuang, Tingjun Ye, Yin Zhang, Jingfeng Liu. The patterns and management of fracture patients under COVID-19 outbreak in China. *Ann Transl Med*. 2020

Aug;8(15):932.

18. Poggetti Andrea, Del Chiaro Andrea , Nucci Anna Maria, Suardi Chiara, Pfanner Sandra. How hand and wrist trauma has changed during covid-19 emergency in Italy: Incidence and distribution of acute injuries. What to learn? *J Clin Orthop Trauma*. 2020 Sep 9.
19. Venkateshwar Reddy Maryada, Praharsha Mulpur, Annapareddy Venkata Guravareddy, Sudhir Kumar Pedamallu, and Bolgam Vijay Bhasker. Impact of COVID-19 Pandemic on Orthopaedic Trauma Volumes: a Multi-Centre Perspective From the State of Telangana. *Indian J Orthop*. 2020 Aug 13 : 1–6.
20. Ali Turgut , Hakan Arlı , Ümit Altundağ, Sertan Hancioğlu, Ercüment Egeli, Önder Kalenderer. Effect of COVID-19 pandemic on the fracture demographics: Data from a tertiary care hospital in Turkey. *Acta Orthop Traumatol Turc*. 2020 Jul;54(4):355-63.
21. Milan M Mitkovic, Marko Bumbasirevic, Sasa Milenkovic, Djordje Gajdobranski, Vojislav Bumbasirevic, Milorad B Mitkovic. Influence of coronavirus disease 2019 pandemic state of emergency in orthopaedic fracture surgical treatment. *Int Orthop*. 2020 Jul 29;1-6.
22. T Murphy, H Akehurst, J Mutimer. Impact of the 2020 COVID-19 pandemic on the workload of the orthopaedic service in a busy UK district general hospital. 2020 Oct;51(10):2142-7.
23. Hongzhi Lv, Qi Zhang, Yingchao Yin, Yanbin Zhu, Juan Wang, Zhiyong Hou. Epidemiologic characteristics of traumatic fractures during the outbreak of coronavirus disease 2019 (COVID-19) in China: A retrospective & comparative multi-center study. *Injury*. 2020 Aug;51(8):1698-704.
24. Rémy Pichard, Luc Kopel, Quentin Lejeune, Rafik Masmoudi, Emmanuel H Masméjean. Impact of the COronaVirus Disease 2019 lockdown on hand and upper limb emergencies: experience of a referred university trauma hand centre in Paris, France. *Int Orthop*. 2020 Aug;44(8):1497-501.

Tables

Due to technical limitations, table 1 is only available as a download in the Supplemental Files section.

Figures

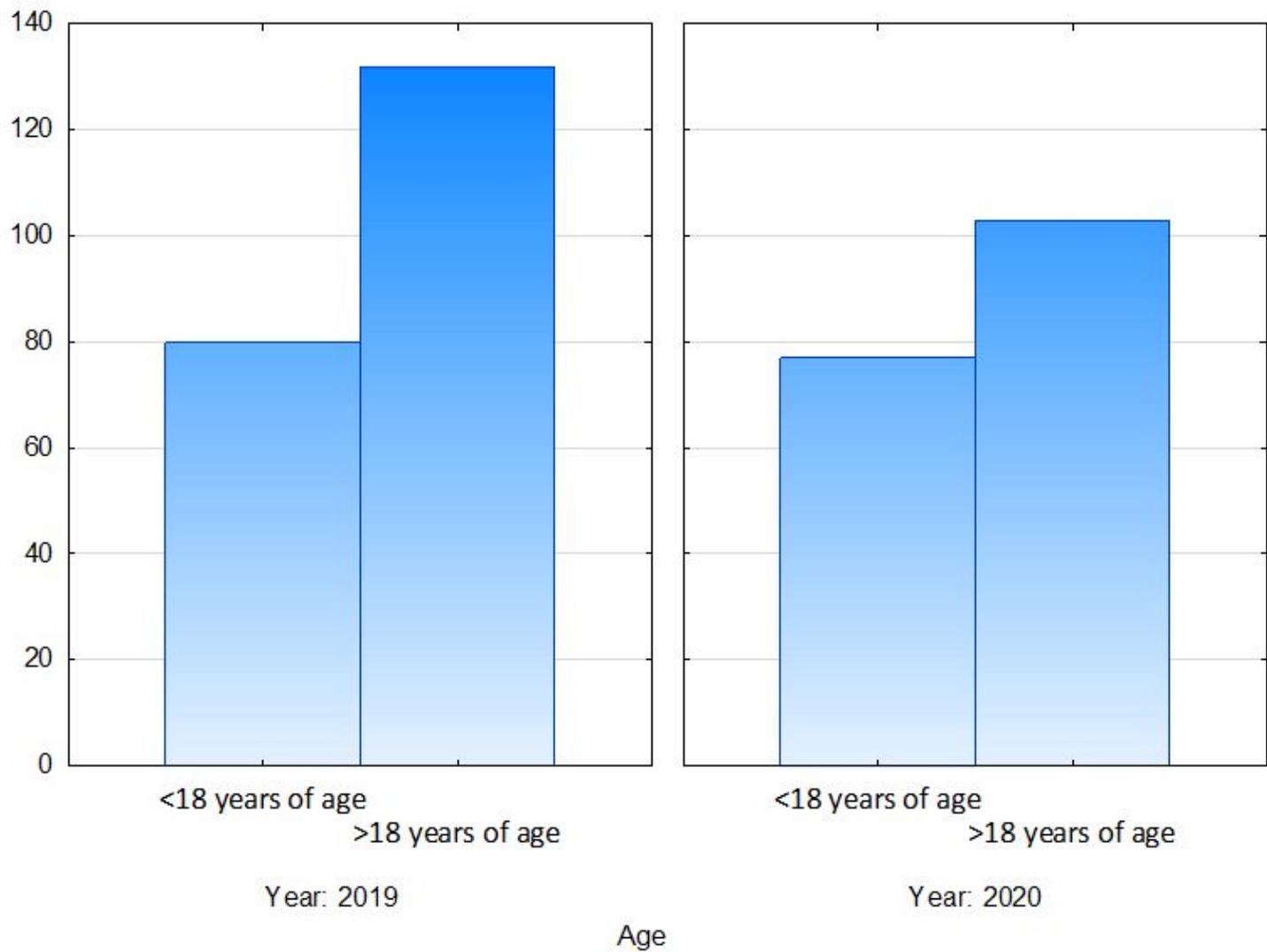


Figure 1

number of adults and children

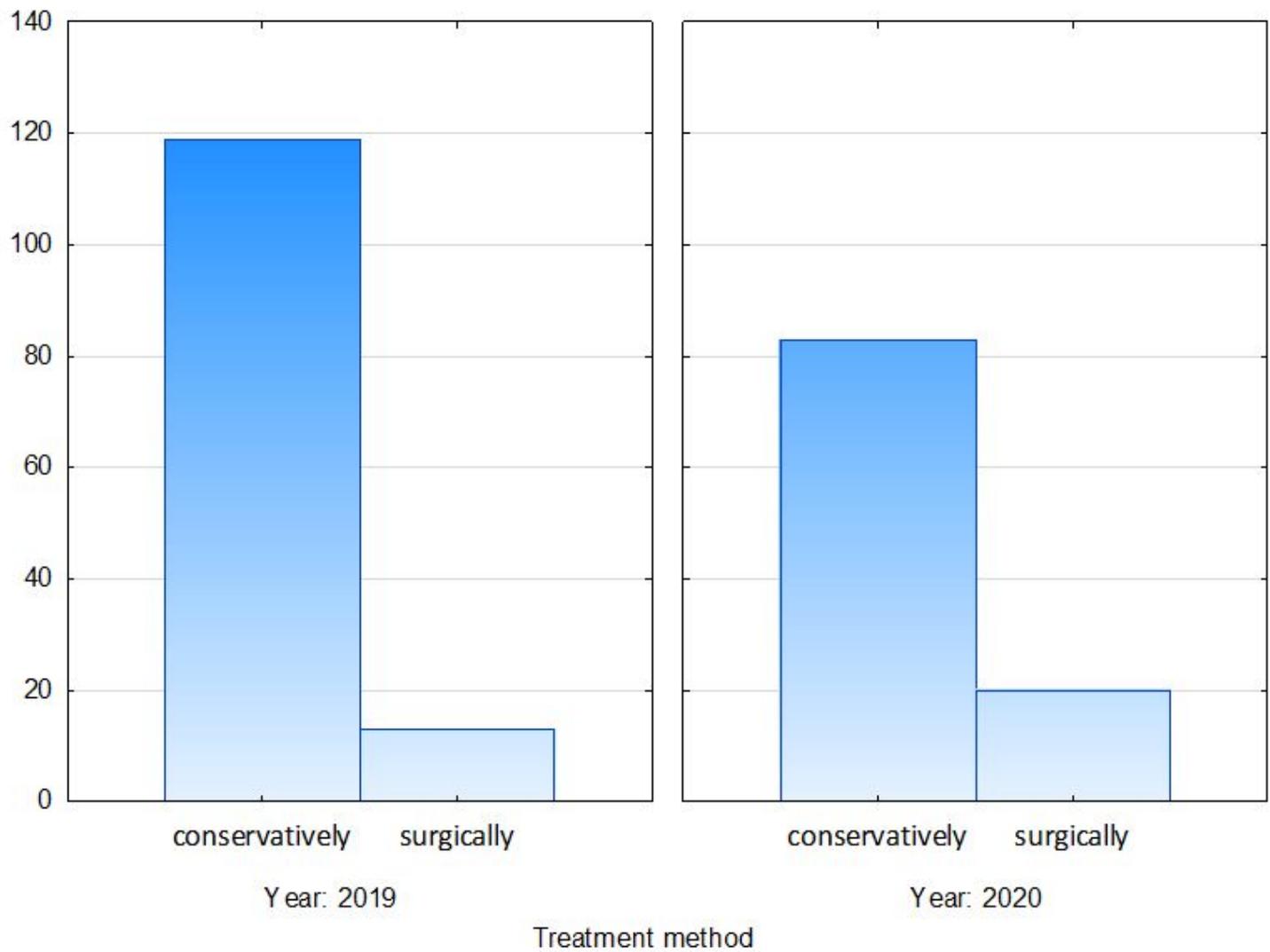


Figure 2

number of surgically and conservatively treated adults

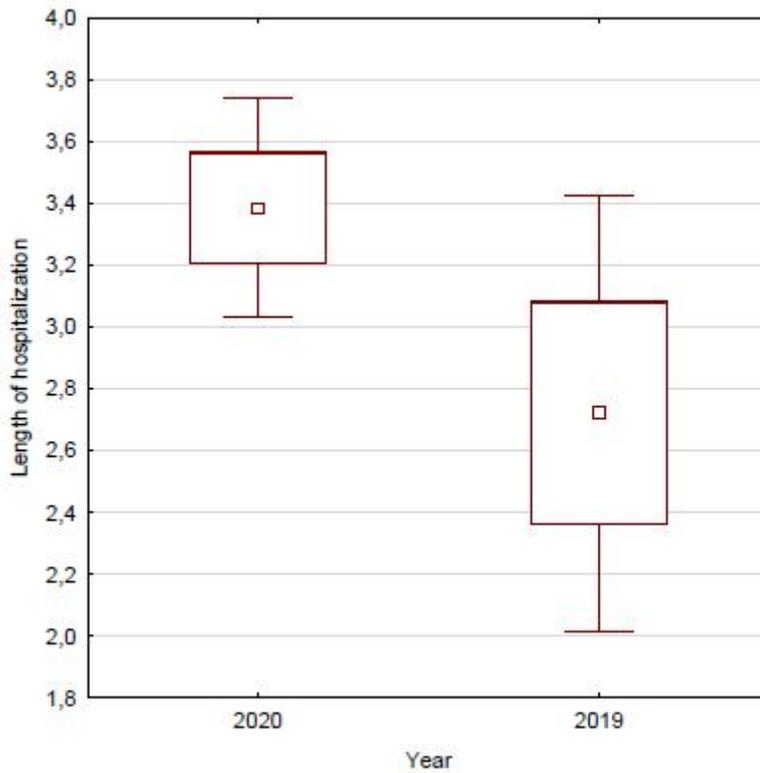


Figure 3

length of hospitalization in case of surgical treatment of children [days].

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- [Table1.xls](#)