



ORIGINAL ARTICLE / ОРИГИНАЛНИ РАД

Management of resources for orthopedic oncology and trauma patients during the COVID-19 pandemic – a retrospective cohort study

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SUMMARY

Introduction/Objective This study aims to evaluate changes in surgical strategy and orthopedic epidemiology, and to compare the frequency of surgeries before and during the COVID-19 pandemic.

Methods For periods from April 1 to May 31 in years 2019 and 2020, retrospective data on patient demographics and types of orthopedic surgical procedures were obtained from hospital databases in a tertiary referral hospital.

Results During the COVID-19 pandemic, the most common orthopedic surgical procedures performed were trauma surgery (n = 81), while other procedures were referred to oncology (n = 19), biopsy (n = 11), debridement (n = 10), amputation (n = 6), surgery of dysplastic hip (n = 5), and knee ligament repair (n = 1). The majority of trauma cases were hip fracture surgeries (n = 23). The mean age of the patients was 70.5 years. Sixty-three patients were female and 70 were male. Only one patient had a history of COVID-19 infection. In the same period during the year before the pandemic, 86 patients had trauma surgery, while 49 had oncological surgery and the mean patient's age was 54.5 years. Sixty-two patients in this group were female, and 73 were male. The number of tumor surgeries before the pandemic was higher compared to the same period during the pandemic (p < 0.05).

Conclusion During the pandemic, although all orthopedic surgeries decreased, the rate of osteoporotic hip fractures surgery was similar to that of the pre-pandemic state. This finding emphasizes the increased need to implement preventive measures regarding hip fractures during lockdown periods. The relation of hip and spine osteoporotic fractures surgery was not different before and during the pandemic.

Keywords: COVID-19; orthopedics oncology; trauma; surgery

INTRODUCTION

The new strain of coronavirus emerged in Wuhan, China in December 2019. Of unknown etiology, it primarily affects the respiratory system [1]. Widespread cases of pneumonia were reported in patients presenting at hospital and it seemed that linking them was the recent consumption of seafood or products from the city's live animal market [2]. This new disease was not completely unfamiliar but emerged as a novel mutation of the coronavirus. However, it was understood that this was much more contagious than the previously seen strains of this virus, namely severe acute respiratory syndrome (SARS), and Middle East respiratory failure syndrome (MERS) [1, 2].

Coronavirus is an RNA virus family that can affect many animal species and targets the respiratory tract. For unexplained reasons, mutations can occur and the virus can spread to humans [2].

On January 30, 2020, the World Health Organization announced the identification of this new type of coronavirus, then known as SARS CoV-2 [1]. As the virus spread to many countries, the World Health Organization

declared a pandemic on March 11, 2020, and the disease was named COVID-19 [3]. Following the exponential spread of the disease, there was a change in hospital activities in all clinics, primarily in infectious diseases departments. Normal life came to a halt in many countries in Europe, which led to the need to change the distribution of the workforce within hospitals and to use resources more appropriately [4, 5].

Just as it was for all hospital departments, guidelines were issued to orthopedics and traumatology departments [6]. Elective cases were postponed, and surgical interventions were planned only for emergency cases that could not be delayed. The intention behind limiting the number of operations was to reduce the bed and manpower density across each hospital and protect both patients and healthcare personnel from infection [5]. In many countries all over the world, strict precautions were taken, including curfews, quarantines, and social distancing measures.

Although trauma cases reduced following the introduction of such precautions, a significant number of patients continued to present at their emergency departments with various

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fractures [7]. Even though orthopedics and traumatology clinics were not at the forefront in combating COVID-19 infections, they undertook a very important function in the treatment and planning of bone trauma along with the treatment of other patients requiring emergency treatment, especially bone / soft tissue infections and musculoskeletal system tumors [5]. Moreover, in many countries, orthopedists took on duties in other departments, most often in emergency departments or caring for infected patients on wards [4].

The aim of this study was to complete an epidemiological examination of patients treated in the Orthopedics and Traumatology Clinic during the pandemic, to evaluate the plans made during treatment, and to determine the changes in cases by looking at similar data from the same period in the year prior to the pandemic.

METHODS

The study included patients treated at the Orthopedics and Traumatology Clinic of Istanbul Medeniyet University Göztepe Training and Research Hospital, a tertiary level center, approved by the local institutional review board. A retrospective study included surgically treated patients at the Orthopedics and Traumatology Clinic between April 1 and May 31, 2020, when social restrictions were at their most intense, and these records were then compared to the records of patients treated in the same period of year 2019.

All patients who underwent surgery between April 1 and May 31, 2020 were included in the study. Those who underwent multiple operations were only included once, and, similarly, those operated on for multiple trauma in the same session were evaluated as single cases. All patients admitted to the ward were questioned about complaints including sore throat, fever, diarrhea, myalgia, and fatigue. Those with symptoms or suspicious findings on the pre-operative pulmonary radiograph underwent a polymerase chain reaction (PCR) test preoperatively. Just one of the patients operated on (due to femoral neck fractures) had a history of COVID infection and their previous PCR test had been negative.

Only patients who had trauma and tumor surgery were included in the study for the period between April 1 and May 31, 2019. Elective cases and revision surgeries were excluded from the evaluation.

Trauma cases were separated into subgroups according to the bone or joint fracture. Tumor patients were classified as either benign or malignant.

Data from the study were analyzed statistically using NCSS 2007 software (Number Cruncher Statistical System, Kaysville, UT, USA). To determine the relations between qualitative data, the χ^2 test and Fisher's exact test were used, for $p < 0.05$ level of significance.

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

RESULTS

In April and May 2020 during the COVID-19 pandemic, a total of 133 patients had surgery at our clinic, comprising 70 males and 63 females, with a mean age of 70.5 years. The main reasons for surgery were trauma in 81 cases and tumor in 19. There were 10 debridements, 11 biopsies, six amputations, five pediatric interventions, and one patient had surgery for a sports injury (Table 1). Of the 19 tumor cases, 14 were malignant and five were benign. The benign tumor diagnoses included intraosseous lipoma in one case with severe pain, a simple bone cyst in one case and an aneurysmal bone cyst in one case (both with a risk of fracture), a giant cell localized tumor in one case, and a fibro-osseous pseudotumor of the skin in one case. In 10 patients with ongoing infection treatment started before the pandemic, debridement was planned in this period because the infection had progressed or recurred, and these patients underwent debridement more than once in this period. The treatment of five pediatric patients for developmental dysplasia of the hip was continued in this period as the treatment had already been started or there was a risk of missing the treatment window. Amputation was performed on five patients as diabetic feet had disrupted circulation, which was threatening their general condition, and amputation of the upper extremity at the proximal humerus level was made in one case secondary to trauma. Open or closed diagnostic biopsy was performed on 11 patients with a tumor thought to be clinically aggressive. Repair of the medial collateral ligament was applied in the case with a sports injury.

Table 1. Surgeries performed at our clinic during the COVID-19 pandemic

Surgeries	April–May 2019	April–May 2020
Fractures	86 (47%)	81 (61%)
Amputations	7 (4%)	6 (5%)
Biopsies	6 (3%)	11 (8%)
Malign tumors	21 (12%)	14 (11%)
Benign tumors	28 (16%)	5 (4%)
Pediatrics	2 (1%)	5 (4%)
Sports injuries	15 (8%)	1 (1%)
Debridements	17 (9%)	10 (8%)

The majority of the trauma surgery during the pandemic were performed for hip fractures. Of the 81 trauma patients, 23 were hip fractures, comprising nine femoral neck fractures and 14 trochanteric femoral fractures. A total of nine spine fracture surgeries were performed in this period, three of which were pathological.

During the months of April and May 2019, the year prior to the pandemic, a total of 135 patients had surgery at our clinic due to trauma or tumor, comprising 73 males and 62 females, with a mean age of 54.5 years. There were 86 trauma and 49 tumor-related cases. Of the hip fracture patients in year 2019, 17 had a femoral neck fracture and 15 had a trochanteric fracture. In this period, six patients had surgery for spine fracture (Table 2). We had also performed seven amputations unrelated to tumoral conditions, six

biopsies, surgeries relating two developmental dysplasia of the hip, 15 sports trauma injuries (anterior cruciate ligament ruptures and meniscal tears), and 17 debridements in this period. Of the 49 patients having tumor surgery in the year before the pandemic, the tumor was malignant in 21 patients and benign in 28 patients (Table 3).

Table 2. Comparison of fracture distribution during the pandemic lockdown and before the pandemic

Fracture type	April–May 2019	April–May 2020	p
Hip	32 (37%)	23 (28%)	0.226*
Elbow	2 (2%)	12 (15%)	0.004*
Hand and wrist	14 (16%)	12 (15%)	0.794*
Foot and ankle	8 (10%)	7 (9%)	0.881*
Shoulder	6 (7%)	/	/
Periprosthetic	1 (1%)	2 (2%)	0.612**
Mid-shaft	8 (10%)	11 (14%)	0.384*
Knee	7 (8%)	5 (6%)	0.623*
Pelvis	2 (2%)	/	/
Spine	6 (7%)	9 (11%)	0.350*
Total	86	81	

* χ^2 test;

**Fisher's exact test

Table 3. Influence of the COVID-19 pandemic on the number of malign and benign tumor surgeries

Tumor	April–May 2019	April–May 2020	p
Malign	21 (43%)	14 (74%)	0.022*
Benign	28 (57%)	5 (26%)	

* χ^2 test

Surgeries performed during the pandemic were in 61% related to trauma, and in 15% related to tumor. The rates of other surgeries are presented in Table 1. In trauma surgery, the rate of hip fractures was 28% during the pandemic and 37% in the corresponding period in 2019. The rate of spine fracture surgery was 11% during the pandemic and 7% in the corresponding period in 2019. No significant difference was determined between the two periods regarding hip–spine relation in trauma surgery ($p > 0.05$) (Table 4).

Table 4. Influence of the COVID-19 pandemic on the number of hip trauma and spine trauma surgeries

Trauma	April–May 2019	April–May 2020	p
Hip	32 (84%)	23 (72%)	0.237*
Spine	6 (16%)	9 (28%)	

* χ^2 test

Of the malignant tumor surgical treatment, 14 patients had surgery during the pandemic and 21 patients had surgery in the corresponding period in 2019. Malignant tumor surgery frequency was lower during the pandemic than in the same two-month period of the previous year ($p < 0.05$). Of the benign tumor surgeries, five patients had surgery during the pandemic, which is significantly lower than 28 patients in the corresponding period of the year 2019 ($p < 0.05$) (Table 3).

DISCUSSION

When compared with the corresponding period in the previous year, the trauma surgery frequencies (number of cases) in years 2019 and 2020 were generally similar despite the curfew (state of emergency) due to the COVID-19 pandemic. The majority of surgeries during the pandemic were related to the treatment of fractures as a result of osteoporosis. In addition to the mean age of all patients being 70.5 years, the rate of trauma patients with osteoporotic hip or spine fracture was 39% of the total number of patients indicating that elderly patients are present at orthopedics and traumatology clinics even in periods of pandemic. Even though difference in hip fractures surgery rates was not statistically significant between years 2019 and 2020, this difference would be approved as significant if the number of cases were higher.

It has been scientifically shown that the elderly infected with COVID-19 have a more severe course and higher mortality rates than young and middle-aged patients. COVID-19 is also more severe and more often fatal in those with comorbidities than in healthy individuals [8]. In light of this knowledge, another important point is that a prolonged preoperative preparation period for patients presenting at hospital with a hip fracture could be a cause of increased mortality rates, due to higher risk of COVID-19 infection [9, 10].

Even if they are not working on the front-line of the infection, it must be taken into consideration that as orthopedists are working in many areas at risk within the hospital, they may become asymptomatic carriers of the disease, able to spread it to patients. Likewise, if ward patients who are not suspected of having the virus do not wear a mask, they constitute a great risk to doctors, nurses, and auxiliary healthcare workers, as they may be asymptomatic carriers too [11].

Lockdown did not change the relation between different osteoporotic fracture types, such as hip fractures and spine fractures, in surgical practice. Almost all elderly patients who had hip or spine fracture surgery had been brought to the Emergency Department after a fall at home. Therefore, it could be concluded that if the elderly spend most of their time at home, it will not favorize any of these osteoporotic fracture types. During the pandemic, only four patients underwent surgery following a traffic accident.

Precautions to prevent falls at home are always important but are often not given sufficient attention. Falls at home can be reduced for the elderly with simple precautions [12]. This prevention is especially important during the COVID-19 pandemic, due to the lack of hospital resources.

Generally, as the warmer weather starts in April, people start to spend more time outdoors, and there is a corresponding increase in upper extremity trauma, but it starts to decrease in autumn [13]. However, there had been reported that the pandemic lockdown caused an increase in upper extremity trauma, as elderly people were home alone and unable to call caregivers due to restrictions, trying to perform tasks on their own [14]. Despite the pandemic

period and the quarantine of the elderly at home during April, the predicted increase in upper extremity trauma cases was not recorded at our clinic except for elbow fractures, being in accordance with Colen et al. [13].

Bone and adjacent soft tissue tumors are followed by severe morbidity and risk of mortality; thus, their treatment should not be neglected. It is very important for these patients to receive appropriate, timely adjusted treatment, as delayed or inappropriate treatment may be life-threatening [15, 16]. In our study, 11 biopsies were performed during the pandemic about 8% of all cases. As an oncological diagnosis can be late due to the late biopsy, these interventions were performed during the COVID-19 pandemic, to provide the start of oncological therapy on time. Tumor cases accounted for about 15% of all the cases from this study during the pandemic, and 74% of them were malignant tumors. While 14 cases with malignant tumor underwent surgery during the pandemic, 21 cases with malignant tumor had surgery in the corresponding period of the previous year. This could be explained by patients' assumption that they would not be able to see a doctor because of the pandemic and/or by their fear to come to hospital due to the risk of infection.

Benign bone tumors and cysts are very common. These tumors can cause local pain and local weakness of the bone, increasing the risk of fracture [17]. Benign bone and adjacent soft tissue tumors accounted for about 4% of all surgeries at our clinic during the pandemic. Three of these patients were thought to be at high risk of fracture, and two patients were suffering with pain. Although benign tumors are generally more common than malignant tumors, we operated on more malignant tumor cases than benign ones during the COVID-19 pandemic lockdown period. Most of the benign tumor cases were probably canceled due to the milder symptoms without the need for urgent treatment.

Ulcers in the foot are presented as the complication of the diabetes in approximately 10–15% of diabetic patients [18]. About 20% of diabetic ulcers result in amputation [19]. COVID-19 has a more severe course in patients with hypertension and vascular disease and especially in those with diabetes [20]. Therefore, a team specialized in diabetic ulcers must always be prepared, the patients must be evaluated carefully and eventual surgery has to be performed as soon as possible [21]. During the pandemic, amputation was performed on five patients with diabetic foot, thus reduced physical activity was confirmed as a risk factor for such diabetic complication.

Throughout the COVID-19 pandemic, just as for all branches in the hospital, the Orthopedics and Traumatology Clinic was affected. In addition to reduced operation capacity in operating theatres, due to the reassignment of doctors and other personnel, elective cases were cancelled, and only emergency cases were operated on, with the aim of reducing the spread of the disease [22]. In the USA, the number of primary arthroplasty patients

postponed for one week was approximately 30,000, while the number of revision cases was approximately 3,000. Thus, the planning of surgery for these patients again after the pandemic with the addition of new patients puts great pressure on healthcare systems [23]. Throughout the months of April and May, the specialists and residents from our clinic also served in the hospital's COVID wards. Planning for the elective surgery cases was postponed during the pandemic.

New methods should be considered to reach doctors as a result of postponed patient treatments. The use of telemedicine systems, which was known and used by orthopedic doctors and patients before the pandemic, increased during the pandemic period [24]. It has been noted in studies that there is no difference in patients' satisfaction between telemedicine and face-to-face examination [25, 26]. We still believe that face-to-face examinations are more successful and reduce complication rates more efficiently than telemedicine, and so we do not have any current plans to use telemedicine in the future.

To evaluate organizational difficulties caused by the COVID-19 pandemic, and to plan for similar outbreaks in the future, there is a need for multicenter studies with greater numbers of patients.

CONCLUSION

Although many areas of normal life came to a halt during the pandemic, causing a reduction in the number of patients coming to a hospital, the need for hospital treatment was still present. At our orthopedic department, these patients were predominantly with fractures and musculoskeletal tumors. The lockdown did not change the relation between different osteoporotic fracture types, such as spine and hip fractures, comparing COVID-19 lockdown period and the same calendar period in the previous year, without pandemic. Compared to the same calendar period for year 2019, the number of surgically treated malignant tumor cases was greater than that of benign tumors in 2020, possibly due to patients withdrawing from treatment related to benign bone tumors during the COVID-19 period. Difficulties in reaching hospital and a lack of organization to make sufficient interventions for patients can cause a delay in the treatment of some life-threatening diseases. Therefore, while there were collective restrictions during the pandemic, hospitals should adapt its organization to provide the continuation of some necessary treatments. Implementation of precaution measures and adequate organization of hospital service can help to avoid the progression of some disorders and to ensure better resource handling in orthopedics and traumatology departments in any future pandemics or disaster situations.

Conflict of interest: None declared.

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Управљање ресурсима за ортопедску онкологију и болеснике са траумом током пандемије ковида 19 – ретроспективна кохортна студија

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САЖЕТАК

Увод/Циљ Циљ ове студије је процена организационих и епидемиолошких промена у ортопедској хирургији, као и упоређивање потреба за различитим хируршким интервенцијама пре и током пандемије ковида 19.

Методе Ретроспективно су анализирани демографски подаци и подаци о заступљености хируршких интервенција, добијени у терцијарној здравственој установи, за период од 1. априла до 31. маја у 2019. и у 2020. години.

Резултати У наведеном календарском периоду током пандемије ковида 19 (у 2020. години) највећи број хируршких интервенција се односио на збрињавање прелома ($n = 81$), док су се остале интервенције односиле на збрињавање онколошких стања ($n = 19$), биопсију ($n = 11$), дебридман ($n = 10$), ампутацију ($n = 6$), операцију диспластичних кукова ($n = 5$) и лигаментарну репарацију колена ($n = 1$). Највећи удео трауме су чиниле преломи кука ($n = 23$). Просечна старост болесника је била 70,5 година, а полну структуру

су чиниле 63 жене и 70 мушкараца. Само један болесник је имао историју инфекције ковидом 19. У години пре пандемије (2019. год.) у истом је календарском периоду оперисано 86 болесника због трауме и 49 болесника због онколошког стања. Просечна старост болесника је била 54,5 година, а полну структуру су чиниле 62 жене и 73 мушкараца. Уочено је да је заступљеност онколошких интервенција била значајно већа у 2019. год. ($p < 0,05$).

Закључак Док је укупан број ортопедских операција био у паду током пандемије, укупан број оперативно збринутих остеопоротичних прелома кука се није значајно смањило. Ово упућује на потребу за предузимањем мера усмерених на превенцију прелома кука током кућне изолације становништва. Однос хируршки збринутих остеопоротичних прелома кука и кичме у периоду пандемије се није разликовао у односу на период пре пандемије.

Кључне речи: ковид 19; онколошка ортопедија; траума; хирургија