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Disruption of Arthroplasty Practice in an Orthopedic Center in Northern Italy During the Coronavirus Disease 2019 Pandemic

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ABSTRACT

Background: The Coronavirus disease 2019 (COVID-19) outbreak has put strain on many healthcare systems around the world, with important consequences. The aim of this paper is to describe the impact of the COVID-19 pandemic on hip and knee arthroplasties in an Italian high-volume orthopedic center, located in the region of the country first and worst affected by the Coronavirus.

Methods: Data from an institutional database were retrospectively analyzed to obtain the number of hip and knee arthroplasties performed from February 24 to April 10 2020. The figures were compared with those of the same 7-week period of the last year (2019).

Results: The number of hip and knee arthroplasties showed a decrease from 706 in the same period of 2019 to 166 (76.5% less) in the current year. In 2019, a mean of 101 ± 9 hip and knee arthroplasties were performed per week compared with a mean of 24 ± 34 in 2020. Ten patients tested positive for SARS-CoV2 during their hospital stay. Two of these patients died after a regular postoperative period after developing unexpectedly COVID-19 during rehabilitation. The mortality in the 7-week period of the current year was 1.2% compared with 0% in 2019.

Conclusion: The outbreak of COVID-19 had a considerable effect in our center on the number of hip and knee arthroplasties that rapidly decreased to 0 in parallel to the worsening of the situation in the country. Efforts will be soon requested because our practice is going to deal with the after-effects of the pandemic in the near future.

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The explosion of the epidemic of Coronavirus disease 2019 (COVID-19) has been gradually hitting the Western World. Italy represented the first country forced to face this emergency. The impact of COVID-19 outbreak on the healthcare system and on the economy has been very important so far, with consequences that probably will affect these two sectors for a long time. The emergency has put a strain on the health systems of the various countries, both for the growing demand for intensive care unit (ICU) beds and for the increasing number of patients suffering from less severe disease that needs to be managed in the hospitals. Even

though orthopedics does not represent a branch directly involved in the management of the emergency in the first lines, it has experienced the spread of the pandemic and the changes that this entailed for the hospital systems as well. Moreover, depending on the situations in the various countries and in the different hospital contexts, many orthopedic surgeons have been involved in the management of patients with COVID-19. In Italy, this has been due both to the necessary management of the orthopedic emergencies including musculoskeletal injuries and to the fact that in several real emergency scenarios, the relative lack of human resources and the high number of nonorthopaedic patients with COVID-19 made it necessary to involve orthopedic surgeons as medical doctors for the management of less serious patients with COVID in support of clinicians. As a matter of fact, in several areas of our country, namely some provinces of the Lombardy region, the number of cases has been remarkably high and the available health system resources have been soon used at full capacity.

Unfortunately, in the same areas, there has been a high number of deaths caused by this until recently unknown disease [1].

Conflict of interest: Luigi Zagra is member of the American Association of Hip and Knee Surgeons. All other authors report no conflict of interest.

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Therefore, it is clear that elective orthopedic surgery has been affected by the outbreak, not only because the use of health system resources has been focused on handling the epidemic but also because there is a concrete risk of not being able to ensure the appropriate safety for patients in such a situation both for decreased staff resources and for limited resources and equipment to be used and stocked for the emergency. For these reasons, it is possible that operations on patients who are at higher surgical risk and those deemed as nonurgent might be postponed. Moreover, it is possible that measures implemented by the authorities, the travel restrictions and even the emotional concerns lead patients to be less inclined to accept elective surgeries in this period. Joint arthroplasties are perhaps one of the very fields in which these conditions may occur together in the era of the COVID-19 pandemic.

The aim of this paper is to describe the impact of the COVID-19 pandemic on arthroplasty surgeries in the Italian orthopedic center with the highest volume of hip and knee arthroplasties, located in the region of the country first and worst affected by the Coronavirus.

Materials and Methods

Overview of the Italian Healthcare System and Regional Background

Italy has a national public health system (Servizio Sanitario Nazionale [SSN]) established in 1978 with the declared goal of providing uniform and comprehensive care, financed by general taxation. Under the Italian Constitution, responsibility for health care is shared by the state and the 20 regions. The state has exclusive power to set the “essential levels of care” (Livelli essenziali di assistenza), which must be available to all residents throughout the country, while the regions have virtually exclusive responsibility for the organization and administration of publicly financed health care. The SSN combines public financing with a mixture of public and private provision. Private hospital and ambulatory care organizations may act as providers for the SSN if they obtain accredited status and have a contract with the region [2]. Almost all these providers are for-profit organizations, still providing free of charge services for citizens exactly how it happens in a public facility. All orthopedics procedures are listed in the Livelli essenziali di assistenza (including joint arthroplasties).

Moreover, private health care does exist both for hospital and for outpatient clinics.

IRCCS Istituto Ortopedico Galeazzi is a research (which is the meaning of the IRCCS acronym) and University Orthopedic Hospital located in Milan, Lombardy (Italy). It is a private institution providing services on behalf of the regional SSN, and it is the center with the highest figures for arthroplasties performed per year in the whole nation.

COVID-19 Outbreak in Italy and Changes in Our Institution

The first cases of COVID-19 in Italy (January 31) were a couple of Chinese citizens originally from Wuhan in Rome for vacation, whereas the first Italian citizen tested positive for the severe acute respiratory syndrome coronavirus 2 virus (SARS-CoV2) was a young man (patient 1) from Codogno, a small town in the south of Lombardy, on February 21. The day after the National Government announced the quarantine of people in several municipalities in Lombardy and Veneto in the so-called “red zones.” Social distancing and the other containment measures were gradually introduced for the country until on March 7 (week 2, see the following), Lombardy and other 14 provinces of Northern Italy were declared full red zones (meaning the block of entrances and exits from these areas)

starting the day after. On March 11, considering the spread of the virus, the containment measures were extended to the whole country with the nation in lockdown.

In parallel, the hospital had to face the changes owing to the spread of the epidemic. Since week 1 (from February 24 to March 1), all people attending the hospital, but the employees, were asked to fill out a questionnaire about respiratory symptoms and suspected contacts along with travel information regarding the 2 weeks before and had their temperature checked with a thermal scanner. The temperature check at the entrance was soon extended to the employees as well.

During week 2, precautional limitations for patient selection were introduced for hip and knee arthroplasties (namely, age <75 years, American Society of Anesthesiologists score <3, and preoperative hemoglobin >13.0 g/dL), with the aim of avoiding any risk to the ICU in the postoperative phase. In the meantime, the number of patients with COVID-19 requiring respiratory assistance was increasing all over the region.

In the third week, after a regional resolution delivered establishing roles and duties of hospitals in the region to face the increasing and uncontrolled pandemic, the number of daily working operating rooms decreased by 40% in our institution. An entire floor of the hospital was isolated for patients with COVID-19, personal protection equipment for healthcare personnel at the highest level was set up, and the department was closed for relatives as per infectious disease protection protocols. A dedicated operating room for patients with COVID was also set up.

During the third week, the hospital was designed as a regional hub for minor orthopedic trauma and for selected orthopedic surgery. Furthermore, regional authorities established the list of orthopedic procedures that would have been allowed from March 14 in addition to the trauma. With regard to joint arthroplasties, the allowed operations were the following: septic arthritis (including periprosthetic joint infection), rapidly progressive arthritis with bone necrosis, total joint arthroplasty (TJA) dislocations, and severe loosening. Nevertheless, at this point, the hospital decided spontaneously to interrupt all TJAs except those related to fractures and urgencies (acute infections and malignant tumors) owing to the high risk of SARS-CoV2 infection for patients even during hospitalization or rehabilitation time.

Starting from week 5, all patients admitted to the hospital regardless the diagnosis were screened by means of nasopharyngeal swab and allocated in an observational area until the result of the test and then transferred to the COVID or NON-COVID areas in separate floors. Moreover, access to the hospital was forbidden to relatives of patients without COVID-19 too to minimize the risk of infections.

Data Source and Analysis

Approval was obtained by the institutional review board, in using an anonymized database. Data sources were internal administrative flows integrated and double-checked with the health management database of the hospital. These data were retrospectively analyzed to obtain the number of hip and knee arthroplasties performed from February 24 to April 10, 2020. TJAs for proximal femoral fractures were excluded along with one-stage revisions and implant removal for periprosthetic joint infections. The figures were compared with those of the same 7-week period of the last year (2019). The number of TJAs per week was recorded, and data were plotted on a chart. The number of patients admitted to the rehabilitation department after TJA was also recorded. The mean length of stay was recorded. The indications for surgery were classified in two groups: planned (all but urgent) and urgent (acute infections, dislocations, and rapidly progressive osteoarthritis with

bone necrosis). Information about the type of admission (direct from the emergency room, transferred from other hospitals, and outpatient clinic) for patients of the urgent group was extracted. The data of the present year were further analyzed, considering the result of the swab for patients when available, to identify the patients with SARS-CoV2 positive and the SARS-CoV2 negative among those undergoing TJA. Information about the swabs was collected to identify patients already positive before the admission and those testing positive after the admission at the hospital. In addition, mortality of the 2 periods was compared.

Statistical Analysis

Data were analyzed by means of descriptive statistics for evaluating the comparisons between the corresponding weeks in 2019 and 2020: admission rates in terms of surgery cases and rehabilitation cases, planned vs urgent surgeries, and number of deaths. Statistical analyses were performed using Microsoft Excel v. 16.0 (Microsoft Corporation, Redmond, WA).

Results

The number of hip and knee arthroplasties showed a sharp decrease from 706 in the same period of the last year to 166 (76.5% less) in the current year. The line chart shows the trend of the TJAs per week in the study period (Fig. 1). While in 2019, the number of procedures was steady around a hundred per week (101 ± 9), the figures of the present year plunged from 88 in the second week to 3 in the fourth week to reach 0 in the following 3 weeks, with a mean value of 24 ± 34 procedures for the entire period and a mean value of 55 ± 31 TJAs for the first 3 weeks of the COVID outbreak. The mean length of stay in the arthroplasty department was 5 days in 2019 and 5.8 days this year (range, 4 to 6).

Patients admitted to the rehabilitation department after TJA were 323 in 2019 (46% of all TJAs) and 45 in 2020 (27%). Considering the indications for TJA, 95.6% of the operations performed last year were classified as nonurgent and also this year the percentage was similar (95.8%). A total of 7 TJAs classified as urgent in accordance with the aforementioned criteria were performed this year. All these patients were SARS-CoV2 negative. Two patients developed unexpectedly COVID-19 symptoms during the rehabilitation after a straightforward postoperative period with a progressive worsening of clinical status, and despite the efforts of the ICU staff, eventually passed away (79 and 84 years of age, operated in week 1). So, the mortality rate was 1.2% in the present year, compared with 0% in the previous year.

Discussion

The present study reported a huge impact of the COVID-19 outbreak on hip and knee arthroplasties in a high-volume Italian center that went to 0 in the last 3 weeks since March 19. This burden was inevitable because of the rising number of COVID-19 cases in the country, the continuous increase of the healthcare resources requested to face the pandemic, the direct involvement of the facilities into the management of the regional crisis but, above all, to the need to guarantee the safest conditions to the patients until the situation of contamination would have been under control. Indeed, it has become recently clear that nonurgent elective surgeries may need to be postponed [3] for several reasons: reduce the consumption of healthcare resources (including personal protective equipment, hospital beds, and ICU) and staff, preserving the access for trauma and oncologic surgery, reduce the patient traffic in the hospital, and to reduce the COVID-19 among patients and staff (both can be asymptomatic carriers).

The mean age of arthroplasty patients should be considered. These subjects are often elderly with multiple comorbidities. Caution is mandatory for elective procedures on elderly patients for the high rate of complications and mortality reported in such patients receiving surgical procedures while in the viral incubation period [4]. Moreover, these patients are the ones who require more assisted rehabilitation compared with the younger ones. During the pandemic, rehabilitation services are often at a lower capacity or even suspended in some cases both in in-patient and out-patient facilities. Postponing the surgeries for these patients can be a wise choice in this situation.

Patients requiring “semiurgent” procedures especially revisions and those in the interlocutory period of a two-stage revision need special consideration. Undeniably, postponing surgeries for these patients can be questionable, on the other hand, these subjects can also be frail or old patients. In these instances, the decision should be the result of a tailored decision-making process after carefully assessing a patient's information about risks and benefits of the procedure balanced against the local situation related to the pandemic (ie specific risk of SARS-CoV2 infection, resources availability, and standards of care).

This study has several limitations. It is retrospective but would not have been possible otherwise considering that this situation was clearly unexpected until some weeks ago. In addition, the data about patients with SARS-CoV2 undergoing TJAs can certainly underestimate the real numbers because most of the patients included were not tested for SARS-CoV2 at all. Indeed, it is possible that a certain amount of asymptomatic patients have been admitted and discharged from the hospital without any suspicion of disease. Nasopharyngeal swabbing for all patients admitted to the hospital was introduced as a standard practice only at week 5 of

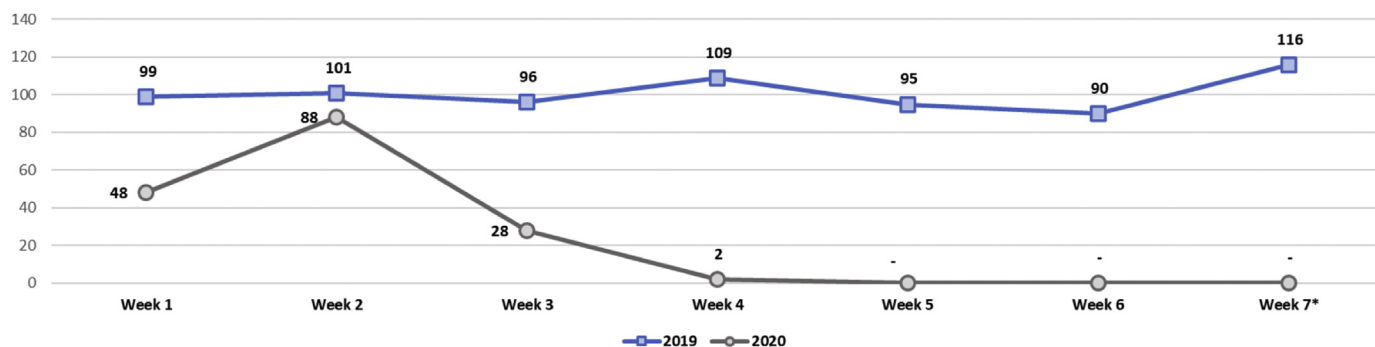


Fig. 1. The linear chart shows the number of TJAs performed per week in 2019 and 2020. TJA, total joint arthroplasty.

the study period. In addition, the consequences of the pandemic on our practice represent the context of a specific time frame. Indeed, these data come from a specialized center and are not immediately generalizable to other working realities. The fact that Lombardy was the first and worst affected region from the virus in Italy and western countries should also be taken into account. Furthermore, a selection bias toward patients at lower risk of complications could have influenced the results. However, clinical outcomes and complications were not included in the present study, which aimed primarily to report the influence of the pandemic on the number of procedures performed. In addition, outpatient TJAs are not common in our country and have not been reported in this series. This practice together with fast-track protocols could represent a suitable option for patients when limiting the hospital stay to the minimum could represent a reasonable answer to the need for limiting inpatient capacity of the hospitals. However, efforts of our institution for implementing enhanced recovery after surgery protocols are worth considering. This is confirmed by the decreased number of patients requiring inpatient rehabilitation in 2020 compared with that of the previous year.

After the worst scenario, everybody is wondering what will happen next. What we already know is the lesson learned from the previous pandemic, which presented the phenomena of multiple waves [5]. Hence, it is of paramount importance for the near future to plan at best the activities both to limit as much as possible new outbreaks of COVID-19 and to be ready to face better than before the spread of the virus and its consequence on arthroplasty

practice. Strategies for the upcoming months are also essential to address the detrimental effects that the pandemic will have on the waiting list for the future.

In conclusion, the outbreak of COVID-19 had a considerable effect at our center on the number of hip and knee arthroplasties that were completely stopped in parallel to the worsening of the situation in the country. Efforts will soon be underway for our practice to deal with the after-effects of the pandemic in the near future.

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References

- [1] della Salute M. Covid-19, i casi in Italia 13 aprile ore 18 n.d. <http://www.salute.gov.it/portale/nuovocoronavirus/dettaglioNotizieNuovoCoronavirus.jsp?lingua=italiano&menu=notizie&p=dalministro&id=4459> [accessed 14.04.20].
- [2] France G, Taroni F, Donatini A. The Italian health-care system. *Health Econ* 2005;14:S187–202. <https://doi.org/10.1002/hec.1035>.
- [3] CMS. Non-Emergent, Elective Medical Services, and Treatment Recommendations n.d. <https://www.cms.gov/files/document/cms-non-emergent-elective-medical-recommendations.pdf> [accessed 14.04.2020].
- [4] Lei S, Jiang F, Su W, Chen C, Chen J, Mei W, et al. Clinical characteristics and outcomes of patients undergoing surgeries during the incubation period of COVID-19 infection. *EClinicalMedicine* 2020. <https://doi.org/10.1016/j.eclinm.2020.100331>.
- [5] Vannabouathong C, Devji T, Ekhtiari S, Chang Y, Phillips SA, Zhu M, et al. Novel coronavirus COVID-19: current evidence and evolving strategies. *J Bone Joint Surg Am* 2020. <https://doi.org/10.2106/JBJS.20.00396>.