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THE IMPACT OF COVID-19 ON THE ORTHOPAEDIC AND TRAUMATOLOGY DEPARTMENT: AN ITALIAN HOSPITAL EXPERIENCE.

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ABSTRACT

A novel strain of coronavirus (SARS-CoV-2) is challenging the global healthcare system. It has affected about 100,000,000 people to date, resulting in about 2,300,000 deaths worldwide. This study aims to evaluate the impact of coronavirus disease 2019 (Covid-19) on the activity of the Orthopaedic and Traumatology department in an Italian Covid-hospital. A retrospective descriptive analysis was performed using monthly data collected in 2019 and 2020 to compare data from: orthopaedic emergency room attendance, number and type of surgeries, and orthopaedic outpatient attendance. A specific focus on the 8-week timeframe of Italian lockdown and the same period of Italian lockdown in 2019 was also performed. Moreover, data collected during Italian lockdown was analysed with respect to Covid-19 incidence. Massive changes were observed in all of the variables analysed, in particular, trauma activities did not stop and, in some cases, experienced an increase.

1. Introduction

On January 7th 2020, Chinese authorities announced that a novel coronavirus strain was identified as responsible for the Severe Acute Respiratory Syndrome (SARS) affecting the Wuhan population (1). The virus has been named SARS-CoV-2 and the associated disease Covid-19 (coronavirus disease 2019) (2). The disease has spread very rapidly: first in China and then worldwide. Within Europe, Covid-19 was first diagnosed in France on January 24th, (3) and few days later on January 30th in Italy (Rome) (4). On January 31st, the Italian government declared a state of emergency due to the uncontrolled Covid-19 spread and increasing mortality rate (5). Since then, Italy has been significantly affected by the Covid-19 outbreak. Specifically, the disease occurred in two waves. During the first one, the highest number of cases was recorded in the northern regions, especially in Lombardy and Emilia Romagna. Several areas were quarantined and a lockdown was announced on March 8th, 2020 for Lombardy region and for fourteen districts (6).

The lockdown was extended to the entire country on March 9th (7) through May 3rd. The second Covid-19 wave started in September, no lockdown was established, but, starting from October 26th, different directives were provided to each region based on the recorded RT index (8).

In this new scenario, hospitals had to change their organization and management to manage the Covid-19 disease. To guarantee physicians' safety and workers' and patients' healthcare, several adequate and appropriate precautions had to be taken, including the creation of a dedicated path for triaging Covid-19 patients. Despite the emergency and the new rules and procedures implemented by the hospitals, the Orthopaedic and Traumatology department had to keep guaranteeing the level of service for the traumatic and oncologic patients. Elective activities were performed only within the time frame between the two Covid-19 waves.

This study aims to evaluate how Covid-19 has changed the Orthopaedic and Traumatology department activity at San Giuseppe Moscati Hospital, in Avellino. This is a Covid-hospital in the area of one of the quarantined zones of Campania (9), a region in Southern Italy with 5,800,000 residents.

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It should be noted that a Covid-Hospital is a re-arranged hospital with an emergency department dedicated to Covid-19 patients and intensive care units dedicated only to infected patients.

2. Material and Methods

To achieve the goal of this study, the evaluation of the difference in the level of activity of the Orthopaedic and Traumatology department, a retrospective descriptive and comparative analysis was performed using monthly data collected in 2019 and 2020. In particular, data from Orthopaedic Emergency Room (E.R.) attendance, number and type of surgeries, and orthopaedic outpatient attendance were analysed. A specific focus on data collected during Italian Lockdown Period (LDP), from March 9th to May 3rd 2020, were compared to data collected from the same Lockdown Period in the Previous Year (PYLDP), from March 9th to May 3rd 2019. Weekly data were used, and data referring to ward admission from the E.R. were also recorded. Furthermore, LDP data were compared considering the incidence of Covid-19. The MyHospital information system was used to record the data of interest; the database from the Italian Ministry of Health was used as reference for the weekly incidence of Covid-19 (10).

3. Results

Data concerning Orthopaedic and Traumatology department activity for both 2019 and 2020 are listed in Table 1.

Figure 1 shows the percentage change in studied dimensions referring to 2020 *versus* 2019. Within the March-to-May timeframe the data shows a drastic reduction in surgeries performed, E.R. attendance and orthopaedic outpatient attendance. On the other hand, a substantial increase in surgeries performed was recorded between July and August. Regarding the orthopaedic outpatient attendance, a positive trend was steadily recorded after the aforementioned decrease.

Noteworthy, the total number of surgeries performed in 2020 decreased by 1% compared to 2019. In particular, the number of elective surgeries decreased by 43%, while the number of trauma surgeries increased by 26%. Additionally, compared to 2019, the orthopaedic outpatient attendance increased by a total of 5%, while E.R. attendance decreased by a total of 18%.

Weekly LDP data concerning Orthopaedic and Traumatology activity are listed in Table 2.

As can be inferred from Table 2, orthopaedic E.R. attendance in LDP decreased by 54% compared to PYLDP. On the contrary, the percentage of patient admission from the E.R. to the ward was 42% in LDP and 18% in PYLDP. The total number of surgeries decreased by approximately 33% compared to PYLDP. When analysing only traumatology surgeries, there was an increase in LDP compared to PYLDP (+16 surgeries performed). The list of surgeries performed during the LDP is presented in Table 3 categorized according to Biggi et al. (11).

A drastic decrease was observed in regard to outpatient attendance, which was about 66% in PYLDP. In reference to LDP, the weekly number of E.R. attendance, performed surgeries and orthopaedic outpatient attendance is presented in Figure 2 together with the weekly incidence of Covid-19.

2019 vs 2020

	Jen	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Trauma surgeries													
2019	55	66	48	52	56	64	53	60	59	64	52	53	**682**
2020	69	54	46	77	65	77	79	82	67	82	86	75	**859**
Elective surgeries													
2019	35	44	37	44	44	40	14	5	33	53	46	28	**423**
2020	32	48	11	0	5	14	33	12	31	43	0	11	**240**
Emergency room attendance													
2019	252	270	321	302	298	348	325	326	321	317	320	348	**3748**
2020	210	186	218	196	248	241	257	219	217	235	221	198	**2646**
Outpatient attendance													
2019	210	186	218	196	248	241	257	219	217	235	221	198	**2646**
2020	185	172	66	106	212	317	284	296	326	294	265	248	**2771**

Source: Author's elaboration

Table 1. 2019 and 2020 monthly data related to Orthopaedic and Traumatology activity recorded by means of MyHospital® information system.

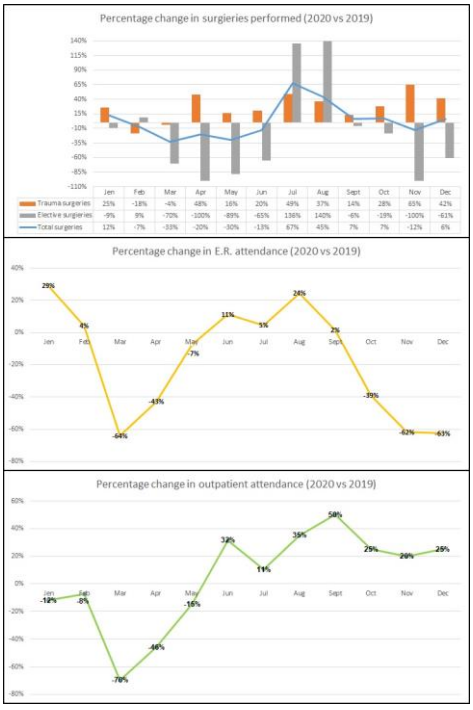

Figure 1. Percentage change in surgeries performed, E.R. attendance and outpatient attendance comparing monthly data 2019 versus 2020.

Variable analysed during the present study	*Periods analyzed during the present study*	
	LDP	*PYLDP*
Number of orthopaedic E.R. attendance	257	554
Number of ward admission from E.R.	108	100
Number of Total Surgeries:	110	164
- *Elective surgery*	-	*70*
- *Traumatology surgery*	*110*	*94*
Number of Outpatient attendance	139	405

Source: Author's elaboration

Table 2. Data related to Orthopaedic and Traumatology activity recorded by means of MyHospitalÒ information system in the two analysed periods. LDP: from March 9th to May 3rd 2020; PYLDP: from March 9th to May 3rd 2019.

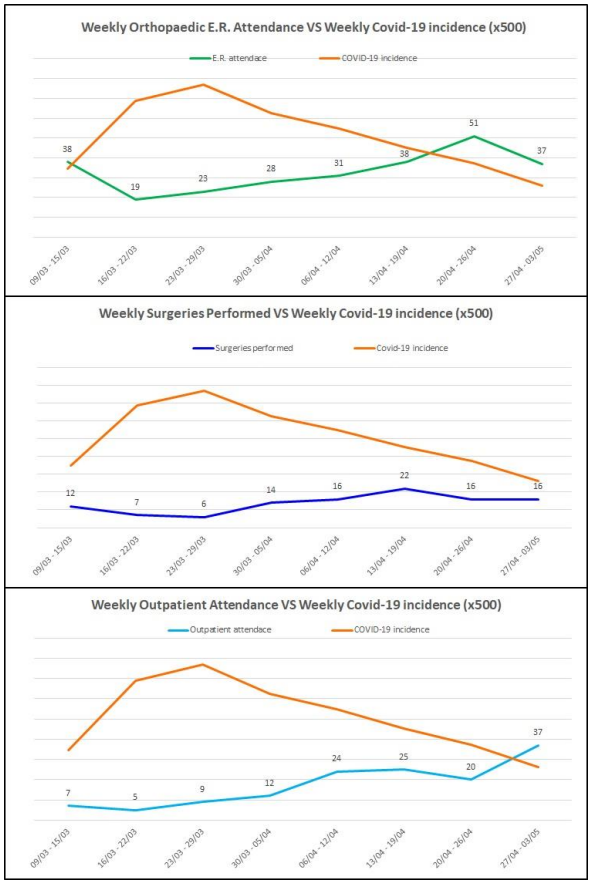

Figure 2. Weekly number of E.R. attendance, surgeries performed, outpatient attendance compared to weekly incidence of Covid-19 throughout two periods analysed: PYLDP and LDP. (PYLDP: from March 9th to May 3rd 2019; LDP: from March 9th to May 3rd 2020).

	Periods analysed during the present study	
Types of surgeries performed	*LDP*	*PYLDP*
Total number of major orthopaedic and traumatology surgeries	90	102
- *Total hip replacement*	*2*	*14*
- *Partial hip replacement*	*10*	*13*
- *Total knee replacement*	-	*9*
- *Total shoulder replacement*	*1*	*1*
- *Revision of hip replacement*	*3*	*1*
- *Revision of knee replacement*	-	*2*
- *Open and closed femur reduction with internal fixation*	*38*	*26*
- *Open and closed tibia and fibula reduction with internal fixation*	*12*	*10*
- *Open and closed humerus reduction with internal fixation*	*8*	*4*
- *Open pelvis and spina reduction with internal fixation*	-	*4*
- *Open radius and ulna reduction with internal fixation*	*5*	*2*
- *Rotator cuff repair*	-	-
- *Cruciate ligaments repair*	-	-
- *Removal of fixation device*	*8*	*13*
- *Other*	*3*	*3*
Total number of minor orthopaedic and traumatology surgeries	20	62
- *Release of carpal tunnel*	-	*6*
- *Knee arthroscopy*	-	*12*
- *Closed radius and ulna reduction with internal fixation*	*6*	*8*
- *Open and closed reduction of hand and fingers fractures*	*4*	*4*
- *Operations on muscle, tendon and fascia of the hand*	*7*	*12*
- *Excision and repair of bunion and other toe deformities*	-	*7*
- *Other*	*3*	*13*

Source: Author's elaboration

Table 3. Number of performed surgeries during analysed periods. LDP: from March 9th to May 3rd 2020; PYLDP: from March 9th to May 3rd 2019.

4. Discussion

To support the comprehension of results showed in the previous section, it is crucial to describe how the entire San Giuseppe Moscati hospital organization has been modified since the Covid-19 outbreak.

Starting February 26th, 2020, a dedicated path was established for Covid-19 patients and the Emergency Department was split into two different areas: one for Covid-19 or suspected Covid-19 patients, and the other one for non-Covid-19 patients. Coherently with departments worldwide (12–14), from March 6th to the second week of May 2020, non-urgent elective surgeries and orthopaedic outpatients were suspended to reduce the infection risk. Due to the second Covid-19 wave, non-urgent elective surgeries were suspended again from the end of October 2020 to the second week of December 2020.

Regarding the Orthopaedic and Traumatology department, several appropriate precautions were taken in order to prevent infection spread among the staff and to protect patients (15). From March 7th onwards, orthopaedic patients were distributed in single rooms and all treated as Covid-19 positive patients until the nasopharyngeal swab results were available. From April to June 2020, the orthopaedic department was transferred to the area dedicated to non-Covid patients and, at the same time, the number of beds for ordinary hospitalization was reduced from eighteen to fourteen; the beds dedicated to day-surgery were also reduced from four to two. Since the department was moved to a non-Covid area, patients could not be admitted to the ward until obtaining a negative result of their nasopharyngeal swabs. As of June 2020, a new ward was provided for the Orthopaedic and Traumatology department with eighteen beds for ordinary hospitalization and four beds dedicated to day-surgery. Additionally, due to the closure of the nearest hospitals, the number of beds for ordinary hospitalization was increased to twenty-four from October 2020 onwards.

The above considerations may explain the results showed in Figure 1. In fact, the drastic reduction in performed surgeries is consistent with the suspension of elective surgery and this is also the reason for the increase in surgeries performed in July and August 2020, when elective surgery was allowed again. During this period, to recuperate the surgeries that had been cancelled, an increase by 136% in July and 140% in August of elective surgeries was recorded compared to the same time frame in 2019. Usually, summer months are not the preferred time to perform elective orthopaedic surgery. However, the number of this kind of surgery treatments considerably increased in 2020 based on patients' needs due to the experienced delay. Indeed, potential negative health consequences for patients whose surgery was delayed should be considered.

Regarding the orthopaedic outpatient attendance, the nearest hospitals' closure might support the positive trend that started on May 2020.

Based on the above reported considerations and the results presented in this study in regard to LDP and PYLDP data, a significant reduction of orthopaedic E.R. attendance during LDP was observed compared to PYLDP. According to Guo et al. (16), this could be caused by patients' concern on accessing the emergency department of a Covid-hospital and getting infected by Covid-19. Conversely, the number of ward admissions from the orthopaedic E.R. in LDP is higher than in PYLDP (+ 8 ward admissions in LDP). It is worth noting that during LDP, the percentage of ward admissions of the total patient access to the orthopaedic E.R. almost

doubled: it can be inferred that due to patients' concern regarding Covid-19, they only accessed the hospital in cases of actual and extreme necessity (17). This is also confirmed by monthly data collected in 2020 as an increase in the accesses to the E.R. was observed between the two Covid-19 waves.

On the contrary, at the beginning of the second wave the number of accesses decreased again.

Concerning the surgery activity in LDP, the decrease in the availability of anaesthesiologists and nurses must be underlined, due to their deployment in Covid-19 departments. Furthermore, all of the surgical activities were performed in two different operating rooms of the hospital, with a significant reduction in the time available for orthopaedic surgery. Before the Covid-19 outbreak, orthopaedic and trauma surgical activities were performed in two dedicated operating rooms five days a week. It must also be considered that, according to Italian (15) and global guidelines for orthopaedic departments (18–21), elective orthopaedic surgeries were suspended.

The aforementioned variables might explain the decrease of performed surgeries. Indeed, as listed in Table 2, an effective reduction of the entire field of orthopaedic surgery (33% less compared to PYLDP) can be observed. At the same time, when analysing data on the category of performed surgeries (refer to Table 3), it is interesting to underline that the percentage of major orthopaedic and trauma surgeries performed in LDP (about 82%) is more consistent than the other examined period (62% in PYLDP). The number of performed surgeries is quite relevant despite the mentioned limitations. Other data shows that the trauma surgeries increased in the LDP compared to PYLDP (17% more): the largest number of surgeries are related to hip and femoral fractures and they represent 48% of performed surgeries (38 femur internal fixations, 2 total arthroplasties, 10 hemiarthroplasties and 3 hip prosthetic revisions). This result is coherent with data that was reported by Zhou (22). In particular, the two hip replacement surgeries were performed on 62 and 71 year-old patients with subcapital fractures; one periprosthetic hip replacement was performed on a patient with a femoral periprosthetic fracture classified as type B2 Vancouver (23), and two periprosthetic hip replacements were performed on acetabular periprosthetic fractures with an unstable cup (Peterson/Lewallen type 2 (24)), of which one with head dislocation as well. Additionally, a reverse shoulder arthroplasty was performed on an elderly woman with a multi-fragmentary surgical neck fracture (AO/OTA type 11A2.3) (25).

The evolution in trauma surgeries performed within the analysed department is most likely due to the closure of the Emergency Departments of the nearest hospitals and the change in lifestyle during Italian lockdown. However, the changes in the type of injuries verified during this period should be studied separately.

The last variable analysed in the present study is outpatient attendance: orthopaedic outpatient activity was reduced from three times a week to once a week and it was only reserved for patients undergoing surgeries. Patients attending the orthopaedic emergency room, but not requiring hospitalization, were redirected to their attending physician for follow-ups. As a consequence, there was a reduction in orthopaedic outpatient attendance by more than 65% with reference to PYLDP.

Finally, when analysing data collected on a weekly basis with regards to emergency department attendance, surgeries and orthopaedic outpatient attendance, also considering the weekly incidence of Covid-19 in Italy (Figure 2), a negative correlation between the maximum peak of Covid-19 incidence and the performed activities was found. It was observed that when the highest Covid-19 incidence was reached, the analysed activities reached the lowest levels.

In particular, data from the first, the second and the third weeks of LDP might reveal that the information from the Media about the increasing infectiousness of SARS-CoV-2 and Covid-19 mortality, as well as the information campaign "Stay at home" (26) discouraged people from going to the hospital.

5. Conclusions

Surely, Covid-19 is a threat that is undermining the global health system. All health organizations had to modify their structures to face this emergency. This study addresses hospital organizational changes that occurred during the Covid-19 emergency. More precisely, this study aims at understanding how Covid-19 modified the activities of an Orthopaedic and Traumatology department.

Therefore, to achieve the goal of this study, a comparative retrospective analysis was performed collecting data regarding:

- orthopaedic emergency room (E.R.) attendance;
- number and type of surgeries;
- orthopaedic outpatient attendance.

A particular focus on Italian Lockdown Period (LDP) was made also collecting data on ward admissions.

All the data were collected in relation to two different years (2019 and 2020). In particular, for the lockdown analysis, the periods of interest are the 8 weeks of LDP in 2020 and the same Lockdown Period in the Previous Year (PYLDP).

The impact of Covid-19 on the Orthopaedic and Traumatology department at San Giuseppe Moscati Hospital has been multi-faceted. Orthopaedic and traumatology service provisioning was rearranged to manage the Covid-19 outbreak, resulting in a significant variation in E.R. attendance, performed surgeries and orthopaedic outpatient attendance.

It should be noted that in LDP there was a higher percentage of E.R. ward admission, demonstrating that patients preferred to go to the hospital only in case of real and extreme need. Based on this consideration, it could be that, due to the number of accesses recorded in 2019, some of them were inappropriate and could be managed by the Health Care System through the implementation of a territorial medicine system that could minimize the number of patients going to the E.R. in non-urgent cases. Moreover, regarding trauma activities, these did not significantly change despite of the global situation.

In conclusion, although the applied organizational changes are massive and adequate, orthopaedic and, above all, trauma activities did not stop; indeed, in some cases, an increase was experienced.

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