

The New Challenge in the Management of Proximal Femur Fractures during SARS Cov-2 outbreak

Fabrizio Matassi¹, Nicola Piolanti², Gabriele Filoni², Niccolò Giabbani¹, Gianluca Nulvesu², Carlo Rostagno³, Roberto Civinini¹, Michelangelo Scaglione²

¹Orthopaedic Clinic, University of Florence, Florence, Italy; ² Orthopaedic and Trauma Clinic, University of Pisa, Pisa, Italy; ³Department of Experimental Clinical Medicine, University of Florence, Florence, Italy

Abstract. The aim of this study is to evaluate how the spread of Sars-Cov-2 has changed the epidemiology of proximal femur fractures in two major trauma centers in Italy, understanding the workload and the best allocation of the resources for the orthopedics department in such an emergency situation. The rate of patients from January 2019 to April 2020 hospitalized with femoral neck fractures (group A) and trochanteric fractures (group B) were recorded. Demographic data, timing of surgical treatment and the length of stay were recorded. Data show that the number of proximal femur fractures has remained unchanged in the COVID and pre-COVID era (ranging from an average of 91.14/month in the pre-COVID era to 76/month in March and 80/month in April). In our trauma centers, the rate of patients operated on within 48 hours has remained stable (78.19% vs 77.92%), while the length of stay has decreased during the COVID period (8.9 days vs 6.5 days in March and 6.8 days in April). Proximal femur fractures, even during the COVID period, are a constant issue and a new challenge for the healthcare system. The main goals of management are to preserve patients from viral infection, to provide early surgical treatment and fast track protocol for discharge.

Key words: COVID-19, Hip, Fractures, Proximal Femur

Background

Towards the end of December 2019, the outbreak of a new pathology (COVID-19) caused by a new strain of coronavirus (later called SARS-CoV-2) began in the Wuhan district of China and quickly spread throughout the nation and abroad (1,2). In February 2020 the disease also hit Italy and on March 12th, 2020, WHO classified the condition as a pandemic [*WHO Director-General's opening remarks at the media briefing on COVID-19 - 11 March 2020. <https://www.who.int/dg/speeches/detail/who-director-general-s-opening-remarks-at-the-media-briefing-on-covid-19--13-april-2020>*].

On March 8th, the Italian government defined the application of reinforced infection containment

measures, first limiting them to specific geographical areas and later - the next day - extending the application to the entire country. The consequent lockdown allowed movements from home only for work, health reasons or purchasing essential goods. In the following days, recreational activities were also limited and progressively banned, as were the businesses that provided occasions of mass gatherings or services that were not considered of primary necessity for livelihood of the population were closed down as well (*Coronavirus, le misure adottate dal Governo (Provvedimenti attualmente vigenti, approvati dal Governo in seguito all'emergenza sanitaria internazionale). <http://www.governo.it/it/approfondimento/coronavirus/13968>*). During this period the majority of outpatient clinics were shut down, elective surgery for non-urgent patients were

cancelled or suspended. Surgery was almost reserved for trauma or life-threatening conditions for patients in which delayed surgery would change the prognosis.

It is well known that proximal femur fractures represent one of the main issues, associated with high mortality and more importantly patient disability. Furthermore, the correct management of this pathology represents an important parameter for the assessment of the assistance quality that a health system is able to provide(3,4). However, the two main questions are, whether the number and type of these fractures changed during the pandemic and whether the health care system was able to provide an answer to this issue.

The aim of this study is to evaluate how proximal femur fractures affects the organization of the national health system evaluating number of fractures, timing of surgery, nosocomial virus infection rate and length of stay during the new scenario of Sars-Cov-2 outbreak.

Materials and Methods

In this multicentric retrospective study we have enrolled patients with proximal femur fractures, in two major trauma centers in Italy (Careggi Hospital, Hip Fracture Unit, University of Florence, Italy - Cisanello Hospital, Orthopaedic Trauma Unit, University of Pisa, Italy) over the period between 1st January 2019 and 29th February 2020 defined as pre-COVID-period and the period between 1st March – 30th April 2020 defined as COVID-period.

All data analyzed in this study were collected by emergency room (E.R.) management and Medical Records software, taking into consideration all the proximal femur epiphysis fractures, coded in the macro area “820.xx” of the ICD-9-CM. To avoid possible mistakes, all patients were double-checked analyzing x-ray data. For each patient, a record was made according to the pattern of fractures and the AO-OTA Classification, age and sex, activity related to the trauma (fragility fractures, work related trauma, domestic trauma, sport trauma, road injuries and pathological source), type of treatment (total or partial hip arthroplasty or plain osteosynthesis), timing of treatment (within or without 48 hours) and length of hospitalization (Table 1).

All patients that required hospitalization after March 1st received a screening for SARS-CoV-2 with nasal and oropharyngeal swab tests before the admission and before the discharge.

All fractures were classified using the OTA/AO Fracture and Dislocation Classification Compendium and then subdivided into: 31A fracture or trochanteric-region fracture, as any fracture centered below the intertrochanteric line and above a horizontal transverse line at the inferior border of the lesser trochanter (hereby named as “TF”); 31B fracture or femur-neck fractures, as any fracture centered between a line drawn at the distal extent of femoral head articular cartilage and the intertrochanteric line distally (hereby named as “NF”)(5).

This study was approved by our local ethical committee and all data, involving human participants, were collected 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.

Data were analyzed using the Statistical Package for Social Sciences, Version 13 (SPSS Inc., Chicago, Illinois), data were presented as the mean standard deviation and percentage.

Results

The amount of patients with proximal femur fractures that were admitted to the ER in the period from January 2019 to April 2020 were 1432. Of those, 725 were hospitalized with the diagnosis of NF (group A) and 707 with the diagnosis of TF (group B).

The epidemiological features, the activity related to the trauma and the subsequent treatment to which the patients were subjected are reported in Table 1.

The number of patients with proximal femur fracture in the pre-COVID-era was an average of 91.14 patients/month (± 15.30 DS) compared to 76 patients in March 2020 and 80 patients in April 2020.

Regarding the specific type of fracture, NF has changed from an average of 46.85/month (± 9.16 DS) in pre-COVID period to 29 fractures in March and 40 fractures in April, while TF has changed from an average of 44.28/month (± 9.93 DS) in the pre-COVID

Table 1. Epidemiological features of patients.

<i>Age</i>	<i><30</i>	<i>31-50</i>	<i>51-70</i>	<i>>70</i>	<i>tot</i>
	1	29	166	1236	1432

<i>Sex</i>	<i>31-B</i>	<i>31-A</i>	<i>tot</i>
<i>Male</i>	213	189	402
<i>Female</i>	512	518	1030
<i>Total</i>	725	707	1432

<i>31-B</i>	<i>Conservative</i>	<i>Dead</i>	<i>Surgery</i>			
			<i>Partial Arthroplasty</i>	<i>Total Arthroplasty</i>	<i>Screws</i>	<i>Plates</i>
	3	4	386	236	35	1

<i>31-A</i>	<i>Conservative</i>	<i>Dead</i>	<i>Surgery</i>	
			<i>Plates</i>	<i>Nails</i>
	6	4	1	696

	<i>Fragility / Home</i>	<i>Road</i>	<i>Work</i>	<i>Sport</i>	<i>Pathological</i>	<i>Stress</i>	<i>Others</i>
<i>31-B</i>	622	13	4	7	4	1	74
<i>31-A</i>	628	19	6	6	3	0	45

period to 47 fractures in March and in 40 fractures in April (Table 2) (Figure. 1).

Of all patients with proximal femur fracture, 1415 underwent surgical treatment, 9 received conservative treatment (due to critical medical conditions), and 8 died before surgery from other medical conditions not related to the virus infection (Table 1).

Timing of surgical treatment was reported in Table 3. During the pre-COVID period 986 out of 1261 patients (78,19%) underwent surgery within 48 hours, while in March 62 out of 75 (82,66%) and in

April, 58 out of 79 (73.41%). Considering the whole COVID period, 120 out of the total of 154 patients were treated within 48 hours (77.92%) (for more details see Figure. 2).

Among the patients with proximal femur fractures during in the COVID-period, in 2 cases the nasal and oropharyngeal swab test for SARS-CoV-2 performed before the admission was positive and these patients were transferred in a COVID-19 dedicated medical ward. In all other cases (154 patients) the tests were negative, and they were hospitalized in the orthopedic

Table 2. Number of fractures in pre-COVID period (average) versus March 2020 and April 2020. (31-B: Neck Fractures, 31-A: Trochanteric Fractures)

<i>Date</i>	<i>Total number of hip fractures</i>	<i>31-B</i>	<i>31-A</i>
<i>Average pre-COVID 19</i>	91,14	46,85	44,28
<i>March 2020</i>	76	29	47
<i>April 2020</i>	80	40	40

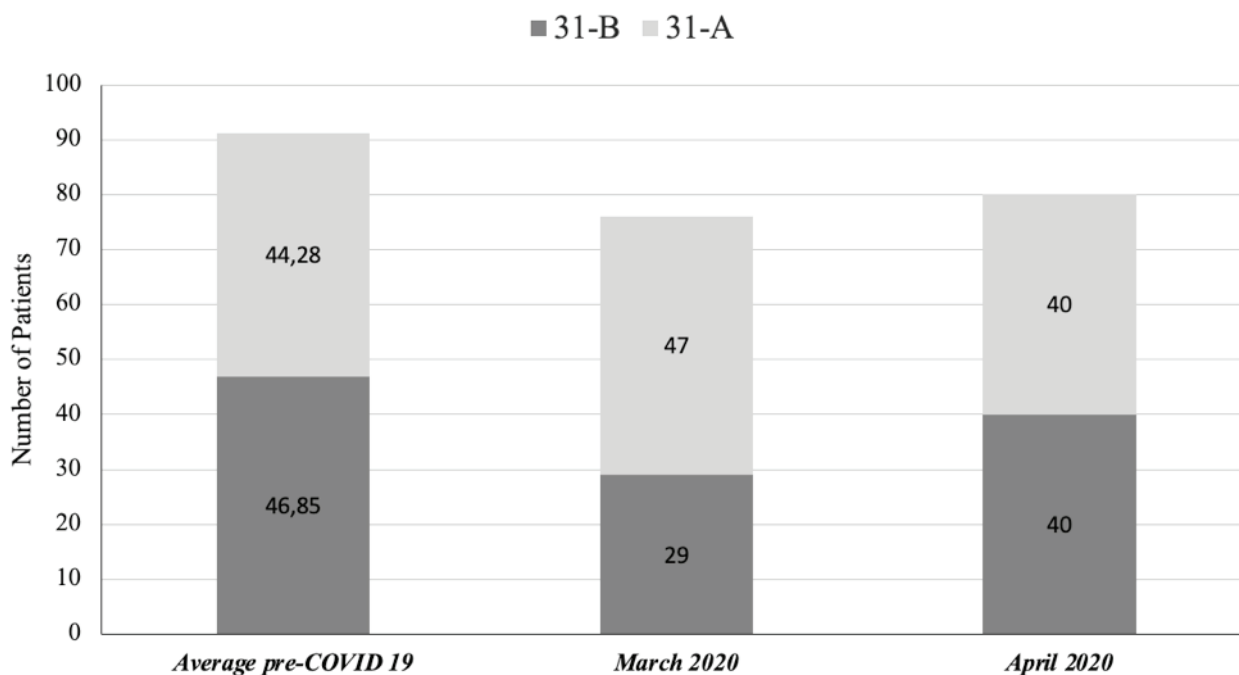


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departments. We found 155 negative cases and these patients were discharged either home or to the Rehabilitative Structures to continue the rehabilitation, while 1 patient, without any respiratory symptoms, was found positive and transferred to a COVID-dedicated ward for the adequate care.

The length of stay was an average of 8.9 days in the pre COVID-era, an average of 6.5 days in March and an average of 6.8 days in April (Table 4).

Discussion

Orthopedic surgeons are not in the front line of the battle against Sars-CoV-2 outbreak. However, they play their role in the healthcare system and they must reorganize their activity, in order to preserve resource allocation during this emergency.

Due to the spread of the virus and the overload on the healthcare system, all orthopedic elective

Table 3. Number of patients treated montly within and without 48 hours, with percentage of patients treated within 48 hours.

<i>Date</i>	<i>Within 48 hrs</i>	<i>Without 48 hrs</i>	<i>Percentage of patients within 48hrs</i>	<i>Total</i>
<i>Jan.2019</i>	74	15	83,15%	89
<i>Feb.2019</i>	54	13	80,60%	67
<i>Mar.2019</i>	80	16	83,33%	96
<i>Apr.2019</i>	60	20	75,00%	80
<i>May.2019</i>	78	16	82,98%	94
<i>Jun.2019</i>	64	13	83,12%	77
<i>Jul.2019</i>	76	13	85,39%	89
<i>Aug.2019</i>	60	13	82,19%	73
<i>Sep.2019</i>	63	28	69,23%	91
<i>Oct.2019</i>	69	29	70,41%	98
<i>Nov.2019</i>	66	29	69,47%	95
<i>Dec.2019</i>	93	32	74,40%	125
<i>Jan.2020</i>	86	24	78,18%	110
<i>Feb.2020</i>	63	14	81,82%	77
<i>Mar.2020</i>	62	13	82,66%	75
<i>Apr.2020</i>	58	21	73,41%	79
<i>Total</i>	1106	309		1415

non-urgent procedures were postponed allowing conversion of professionals for the clinical activities in the Intensive Care Unit, such as anesthesiologists and scrub nurses, and to minimize the nosocomial spread of the virus. On the other hand, the trauma service has been provided as in non-pandemic circumstances in order to treat fractures and to keep the fast-track service for emergencies(6).

The lockdown in Italy introduced restrictive measures that forced a large part of the population to remain at home, changing their daily living with an important reduction of high energy trauma and

fractures distribution in the population. Nevertheless, elderly people kept falling during domestic and daily activities, making proximal femur fractures an important issue in this group of patients.

The average number of proximal femur fractures admitted to the ER was 91,14/month in the pre-COVID-era and 76 fractures in the month of March and 80 in the month of April.

The amount of NF that required hospitalization changed from a mean of 46,85 fractures/month in the pre-COVID era to 29 fractures in March and 40 in April. TF had a mean of 44,28 fractures/month in the

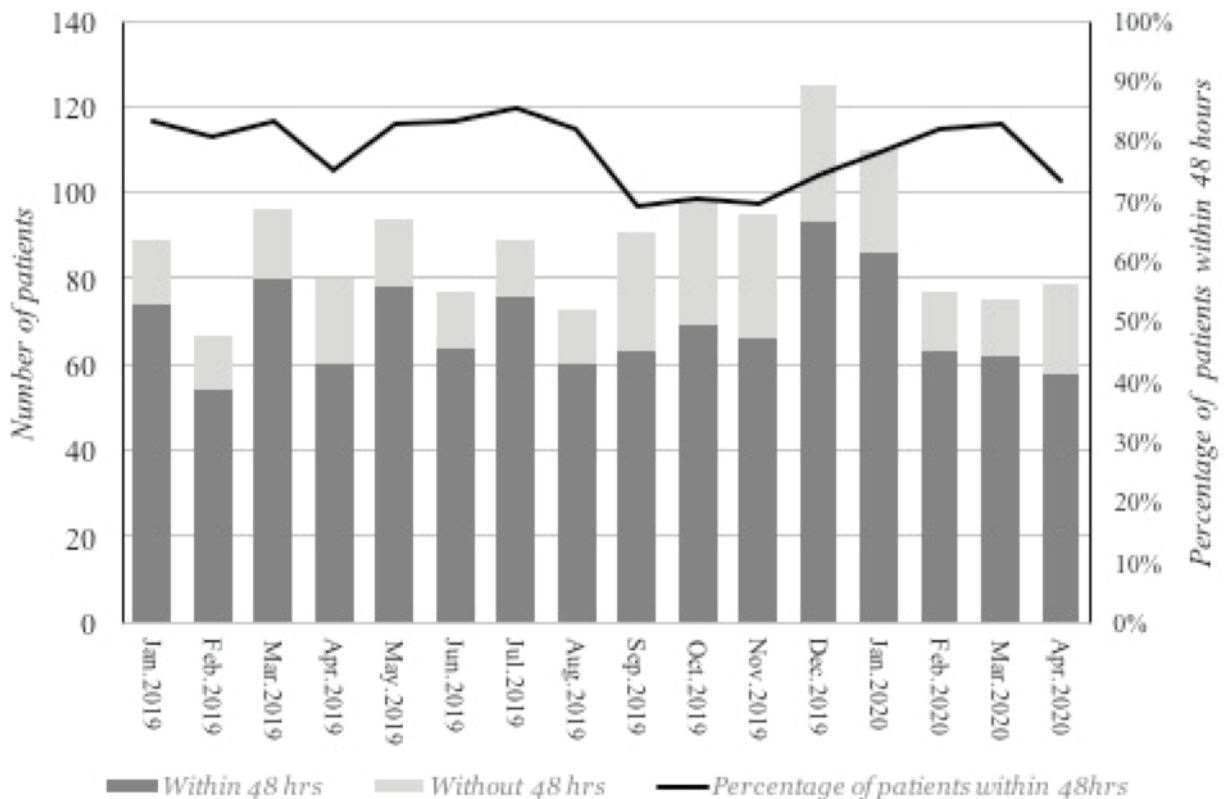


Figure 2. Number of patients treated monthly within and without 48 hours, with percentage of patients treated within 48 hours.

Table 4. Length of stay in the pre-COVID-era, in March 2020 and in April 2020.

	<i>Minimum</i>	<i>Maximum</i>	<i>Mean</i>
<i>Avg. Pre-COVID</i>	4	23	8,9
<i>March 2020</i>	3	12	6,5
<i>April 2020</i>	3	16	6,8

pre-COVID era and 47 fractures in March and 40 in April. These data show still a high incidence of proximal femur fractures during the Sars-CoV-2 outbreak even with restrictive measures that force people to stay at home changing their daily living.

One of the main goals in the management of these patients, in the COVID period, is to preserve them from viral infection, starting from the admission in the ER till the discharge. In our institutions, all patients that required hospitalization received a

screening with nasal and oropharyngeal swab tests in the ER. In case of positive nasal and oropharyngeal swab test for SARS-CoV-2 patients were transferred in a COVID-19 dedicated medical ward, in case of negative test patients were hospitalized in the orthopedic department. This separation was crucial to keep positive patients segregated from the rest of the department in order to minimize the risk of cross-contamination of other patients and health-care staff.

After surgery and before discharge, the screening with nasal and oropharyngeal swab tests were performed again. Another crucial point in the management of hip fractures in elderly, is to treat them as soon as possible, according to the clinical conditions, medications and specific circumstances, and if possible, within 48 hours from the hospitalization. Femoral fracture is indeed a life-threatening condition, especially in elderly patients, and delayed surgical treatment negatively affects the clinical outcome, with a significant increase in the risk of death and bleeding, as reported by a large meta-analysis by Moja et al. (2012) (7–9).

Focusing on this issue, our study shows that the number of patients with proximal femur fractures treated within 48 hours from the hospitalization was unchanged during the COVID-era (77.92%) compared to the pre-COVID-era (78.19%). The main reason for surgical delay was represented by medical comorbidities (cardiac and renal failure), use of medications such as Warfarin and new oral anticoagulants, or the finding of massive deep venous thrombosis.

Elective theatre capacity and surgeons should be redeployed to ensure minimum pre-operative delay. The goal of early treatment must always be kept in mind and the orthopedic unit must be organized to provide this service to time-dependent fractures, in every kind of situation. However, this cannot always be accomplished, and the reason is usually patient-related and not surgeon-related.

According to the recent publication by Zhu et al.(10), the national health system in such emergency situations must guarantee the usual high standards of care for this kind of trauma, both in the operative and perioperative period.

Another target to appropriately manage elderly patients with proximal femoral fracture in the COVID-era is to minimize the length of stay in the hospital, provide and expedite rehabilitation. Hospitals represent sites of potential contamination, despite the best preventive measures, and for this reason one of the main recommendations is to reduce the length of stay and the number of visitors for these patients(11). Clinical information was provided every day by orthogeriatric or orthopedics calling by phone the relatives of each patient.

In the post-operative period, the daily hygiene and the medical examinations were performed by the staff provided with adequate PPE and the physiotherapy was accelerated to provide a faster discharge. During the recovery, patients and their parents were informed that the elective rehabilitation services were redeployed for fast track rehabilitation to reduce post-operative stay and due to these implementation we found a trend towards a reduction in the length of stay from an average of 8.9 days in the pre-COVID era, to an average of 6.5 days in March and to an average of 6.8 days in April.

To our knowledge there are only few studies that analyzes critical issues in managing proximal femur fractures during the COVID outbreak with the purposes of understanding the workload and the best allocation of the resources for the orthopedics department in such emergency situation as an epidemic spread. In our study we found that proximal femur fracture remains an issue even during the lockdown measures restriction and is crucial preserve this group of patients from virus infection during their hospital stay. Lessons learned from our findings are to scan patients for virus infection before admission, before discharge, reduce the timing of surgery and length of stay.

The major limitation of this study is represented to the heterogeneity in patients' number belonging to the pre-COVID-19 era and those to the COVID-19 era. Indeed, all the variables, both the ones that were statistically and not statistically significant, may have been a result of a small and/or different sample size comparison and therefore those results should not be taken as a milestone. However, this is strictly related to completely new scenario that orthopaedics of the new century have been recently facing against. Therefore, we can only accept this limitation aiming for further studies with bigger and more homogeneous patients' cohorts to verify the strength of our results.

Conclusion

In summary, the amount of fractures of the proximal femur during the Sars-CoV-2 epidemic have remained high in the elderly population even with block restriction measures because they are a type of

fractures that occur, in the vast majority of cases, at home, therefore not they were influenced by the prohibitions imposed by the laws enacted. Other studies demonstrates same conclusions as well(12,13). In the setting of organization and resource allocation the surgical activities for the treatment of proximal femoral fracture should be continued and resources should maintain the service of trauma care in case of epidemic emergency(14).

The patients should be protected and kept safe from the risk of cross contamination, the fractures should be treated as soon as possible, and the patients should be discharged as soon as the clinical conditions are stable. It's author's opinion, on the basis of the data illustrated above, the average reduction of the length of hospitalization, depends on various factors. Further research is needed to better understand how the recent outcome would prove beneficial, also in a non-pandemic situation.

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Correspondence:

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Gabriele Filoni,

via Paradisa 2, 56121 Pisa (PI)

Fax 050996501

E-mail: g.filoni@gmail.com