

Proximal humerus fractures in covid-19 lockdown: the experience of three orthopedics and traumatology departments in the first ten weeks of the italian epidemic

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Abstract. *Introduction:* Coronavirus disease (CoVID-19) is causing millions of deaths worldwide and the crisis of the global healthcare system. *Aim of The Study:* evaluate the preliminary impact of CoVID-19 in three Italian Orthopedics and Traumatology Departments in the first 10 weeks of the national lockdown. We focused on proximal humerus fractures, analyzing data and results in comparison with the same period of 2019. *Materials and Methods:* From February 22nd to May 3rd 2020, 55 patients were admitted to our departments for proximal humerus fractures. Our cohort of patients is composed by 13 males (23.6%) and 42 females (76.4%), with an average age of 73.8 ± 11.7 years (range 44 - 94). Trauma occurred at home in 43 cases (78.2%), by the roadside in 10 cases (18.2%), in a retirement home in 1 case (1.8%), and at work in 1 case (1.8%). We proposed surgical treatment in 15/55 cases, but 4 patients refused hospitalization, mainly because of the risk of contracting n-CoV19 infection. *Results:* We noticed a decrease in proximal humerus fractures compared to 2019 (-37.5%). Particularly, we observed a significant drop in traumas occurred on the road and at work respectively 23.9% and 3.4% in 2019, and 18.2% and 1.8% in 2020, probably due to the consequences of the national lockdown. Sports traumas had a reset during the pandemic (6 cases in 2019, 0 in 2020). As consequence, surgical treatment had a decrease due to the reduction in number of fractures, indications and patient's consent. *Conclusion:* The incidence of proximal humerus fractures had a significant reduction during CoVID-19 spread. We assume that the reasons of this reduction are to be found in the national lockdown (since March 10th, 2020) and Ministerial Decrees that limited the access to the E.R. only in case of severe traumas in order to avoid CoVID-19 spread.

Key words: CoVID-19, proximal humerus fractures, Italian epidemic, Italian lockdown

Introduction

The new Coronavirus (2019 n-CoV) spread all over the world since the early months of 2020 [1- 3]. It can cause respiratory disorders with flu-like symptoms, anosmia, ageusia and diarrhea. In some case, it might lead to severe acute respiratory distress syndrome (ARDS), multiorgan failure (MOF) or even death [4-7]. In Italy, the first case of coronavirus disease (CoVID-19) was diagnosed on February 21st in Codogno (Lodi, Lombardy, Northern Italy) [8]. The Italian epidemic started in here. On February 23rd 2020, the Italian Government defined a so-called “Red Zone” in Codogno and the neighboring cities, trying to stem the first epidemic outbreaks. On March 11st 2020, the Italian Prime Minister declared the national lockdown for the dramatic number of infected people and deaths, particularly in two cities in the Northern Italy: Piacenza (Emilia-Romagna) and Bergamo (Lombardy). In Piacenza, a survival strategy aimed to avoid the collapse of our healthcare system was developed, as recently reported by Maniscalco et al. [9].

During the “Phase 1” 210,717 CoVID-19 infections were detected throughout Italy, 81,654 patients were recovered and 28,884 died for ARDS. At the end of this first phase (May, 3rd 2020), 100.179 inhabitants resulted positive to nasopharyngeal swab for 2019-nCoV; among them 18.743 have been hospitalized in CoVID-19 hospitals (1,501 in Intensive Care Unit) and 81.436 have been treated at home (Table 1).

Basing on the observation that fractures of proximal epiphysis of the humerus have a current incidence of 4-5% [10], we decided to evaluate the impact that COVID-19 had on three main Italian Orthopedics and Traumatology Departments with a different virus spread, comparing data collected during the “COVID-19 period” with those of the same period in 2019, the “no-COVID-19 period”.

Here, we report the experience of three Italian Orthopedics Departments with a different virus spread: Piacenza (Emilia-Romagna, Northern Italy, very high virus spread), Savigliano (Cuneo, Piemonte, Northern Italy, high virus spread) and Piedimonte Matese (Caserta, Campania, Southern Italy, low virus spread).

The aim of our study is to evaluate the impact that CoVID-19 had in these centers, focusing the attention on proximal humerus fractures. We analyzed data reported in the first 10 weeks of the Italian outbreak (“Phase 1”), comparing the results obtained with the specular ones of 2019.

Materials And Methods

We retrospectively analyzed all data relating to patients admitted to the Emergency Department with a diagnosis of proximal humerus fracture (ICD- 9-CM Diagnosis Code 812.00) and to the related surgeries performed. The considered period started on February 22nd and concluded on May 3rd 2020, referring to the first 10 weeks of the Italian CoVID19 epidemic, called “Phase 1”. The same period from February 22nd to May 4th 2019 (10 weeks) was used as control group. We ran an analysis confronting three Orthopedic and Trauma centers within areas with different virus spread: Guglielmo da Saliceto Hospital in Piacenza (Emilia Romagna, Northern Italy, very high virus spread), SS Annunziata Hospital in Savigliano (Cuneo, Piemonte, Northern Italy, high virus spread), and Piedimonte Matese Hospital in Caserta (Campania, Southern Italy, low virus spread). Data considered in this study were extrapolated by the qualified office of every participating center and rielaborated using the statistical analysis explained in the related paragraph.

Proximal humerus fractures were studied with anteroposterior, transthoracic, and axillary view (when possible) of the affected shoulder. In all cases, a CT-scan with three-dimensional (3D) reconstruction was obtained. Mechanism of injury was recorded. Indications for surgery were given by one experienced shoulder surgeon (2 years shoulder surgery fellowship and extensive experience on shoulder fractures) based on both x-ray and CT images, in addition to relevant patient characteristics such as age, functional requests (daily and recreational), and comorbidities (including osteoporosis) [11]. The device used for fixation was chosen depending on the surgeon’s preference. Fractures were classified using the Neer classification [12].

Table 1.

PCM-DPC dati forniti dal Ministero della Salute

Regione	AGGIORNAMENTO 03/05/2020 ORE 17.00									
	POSITIVI AL nCoV				DIMESSI/ GUARITI	DECEDUTI	CASI TOTALI	INCREMENTO CASI TOTALI (rispetto al giorno precedente)	TAMPONI	CASI TESTATI
	Ricoverati con sintomi	Terapia intensiva	Isolamento domiciliare	Totale attualmente positivi						
Lombardia	6.609	532	29.785	36.926	26.371	14.231	77.528	+ 526	410.857	247.176
Piemonte	2.496	169	12.973	15.638	8.640	3.152	27.430	+ 251	172.208	121.176
Emilia Romagna	1.997	197	6.851	9.045	13.329	3.642	26.016	+ 166	197.075	131.047
Veneto	955	103	6.241	7.299	9.503	1.516	18.318	+ 94	378.202	220.598
Toscana	513	112	4.703	5.328	3.363	872	9.563	+ 38	150.914	114.354
Liguria	627	68	2.856	3.551	3.599	1.209	8.359	+ 47	54.492	34.613
Lazio	1.346	95	2.944	4.385	1.916	508	6.809	+ 53	150.912	117.796
Marche	400	43	2.755	3.198	2.194	927	6.319	+ 21	64.412	42.281
Campania	455	30	2.241	2.726	1.394	364	4.484	+ 25	86.498	47.027
Trento	136	17	1.094	1.247	2.571	429	4.247	+ 66	41.095	24.085
Puglia	410	40	2505	2.955	765	424	4.144	+ 11	66.443	64.781
Sicilia	383	29	1.791	2.203	795	242	3.240	+ 27	85.955	78.409
Friuli V.G.	131	6	950	1.087	1.688	297	3.072	+ 13	74.990	48.041
Abruzzo	300	16	1.552	1.868	798	330	2.996	+ 32	40.699	29.788
Bolzano	109	11	545	665	1.590	281	2.536	+ 1	44.240	20.166
Umbria	58	13	112	183	1.143	68	1.394	0	38.823	26.973
Sardegna	92	10	587	689	511	119	1.319	+ 4	27.737	24.662
Valle d'Aosta	74	2	33	109	895	138	1.142	+ 6	8.100	6.046
Calabria	95	4	603	702	324	88	1.114	+ 2	38.835	36.874
Basilicata	48	3	143	194	167	25	386	+ 6	14.210	14.210
Molise	8	1	172	181	98	22	301	0	7.075	6.808
TOTALE	17.242	1.501	81.436	100.179	81.654	28.884	210.717	+ 1.389	2.153.772	1.456.911

ATTUALMENTE POSITIVI	100.179
TOTALE GUARITI	81.654
TOTALE DECEDUTI	28.884
CASI TOTALI	210.717

Statistical analysis

Continuous variables were expressed by the mean and standard deviation (SD) and were evaluated by Student T-test or Mann-Whitney U test. The categorical data were expressed as number and percentage (%) and were evaluated by chi-square or Fisher's exact test. The statistical test level was set as $p < 0.05$. SPSS, version 23.0, was used to perform all the tests (IBM, Armonk, NY, USA).

Results

In Piacenza, one of the most stricken cities (very high virus spread), during the "no-CoVID-19 period",

42 patients were admitted to the Emergency Room for proximal humerus fractures: 8 males (19%) and 34 females (81%), average age 71 ± 13 years (range 29 - 97); during the "CoVID-19 period", 24 patients were admitted to the Emergency Room for proximal humerus fractures: 7 males (29%) and 17 females (71%), mean age of 75 ± 12 years (range 44 - 92).

In Savigliano (high virus spread), throughout the "no COVID-19 period", 31 patients were admitted to the Emergency Room for proximal humerus fractures: 6 males (19.4%) and 25 females (80.6%), average age of 75 ± 13 years (range 46 - 94); during "CoVID-19 period", 22 patients were admitted to the Emergency Room for a proximal humerus fractures: 4 were males (18%) and 18 females (82%), mean age 76 ± 10 years (range 47 - 94).

In Piedimonte Matese (low virus spread), in the “no COVID-19 period”, 15 patients were admitted to the Emergency Room for a proximal humerus fracture: 2 males (13%) and 13 females (87%), mean age of 72 ± 15 years (range 48 - 96); in the “COVID-19 period”, 9 patients were admitted to the Emergency Room for a proximal humerus fracture: 2 males (22%) and 7 females (78%), with mean age 71 ± 10 years (range 50 - 80).

For every case, we collected data about Neer’s classification of fracture (Table 2); the location of trauma (Table 3); orthopedical indication on treatment, eventual type of surgical solution and mean time between trauma and surgical procedure (Table 4) (Figures 1,2).

In the “no COVID-19 period”, the total cohort of patients was composed by 88 patients, 16 male (18%) and 72 females (82%), with an average age of 73 ± 9 years (range 29 - 97); in the “COVID-19 period”, the total cohort was composed by 55 patients, 13 males (24%) and 42 females (76%), average age of 75 ± 8 years (range 44 - 94) (Table 2,3,4).

Discussion

Comparing the “CoVID-19” and “no COVID-19” periods, a decrease of 37.5% (88 vs 55) was registered in the number of patients admitted for proximal humerus fracture. The national Italian lockdown, which imposed traffic restrictions, the closure of all the schools and universities, of many commercial activities, companies and

factories, and stopped all the sports activities, definitely reduced people’s movements and as consequence, the risk of bone fractures. In the same way, the Government and mass media as early as the end of February warned elderly people, because CoVID-19 seemed to be more aggressive towards this category. This is probably due to their immune system, more often weakened by the presence of other pathologies or recent surgical interventions. Our data confirmed what other studies had previously proposed: Benazzo et al. [13] evaluated the trend in many orthopedic centers during the first weeks of the pandemic, showing a significant decrease of all traumas (compared to the last year, E.R. trauma consultations decreased up to 71%, femoral neck fracture had a stable reduction from 15 to 20% and other trauma surgery decreased up to 50%). The orthopedic Center that recorded the most conspicuous drop is Piacenza, with 18 fractures less than the previous year (-42.9%); Caserta had a decrease of 6 fractures (-40.0%), while Savigliano a decrease of 9 fractures (-29.0%).

As far as the mechanism of injury, there was a reset of sports injuries (from 6 to 0) and a significant reduction in fractures occurred in retirement houses (from 9 to 1) and by the roadside (from 21 to 10). Furthermore, other studies [13,14] underlined an almost complete reset of sports injuries and a significant drop of traumas during work activities and by the roadside. They also showed that domestic traumas got a reduction in numbers of cases, but a raise in percentage, as well as we reported in our cohort of patients: -6 cases, but a percentage increase of +22.5%.



Figure 1.



Figure 2.

Table 2.

CENTRE	NEER 1	NEER 2	NEER 3	NEER 4	NEER 5	NEER 6
Piacenza 2019		2 (4.8%)	8 (19.0%)	18 (42.9%)	11 (26.2%)	3 (7.1)
Piacenza 2020		1 (4.2%)	4 (16.7%)	13 (54.2)	5 (20.8%)	1 (4.2%)
Savigliano 2019		10 (32.3%)	17 (54.8%)	4 (12.9%)		
Savigliano 2020		8 (9.1%)	10 (45.5%)	4 (18.2%)		
Pedimonte Matese 2019			1 (6.7%)	7 (46.7%)	6 (40.0%)	1 (6.7%)
Pedimonte Matese 2020			3 (33.3%)	4 (44.4%)	2 (22.2%)	
Total 2019		12 (13.6%)	26 (29.5%)	29 (33.0%)	17 (19.3%)	4 (4.5%)
Total 2020		9 (16.4%)	17 (30.9%)	21 (38.2%)	7 (12.7%)	1 (1.8%)

Table 3.

CENTRE	HOME	RETIREMENT HOUSE	ROAD	SPORTS	WORK
Piacenza 2019	17 (40.5%)	6 (14.3%)	13 (31.0%)	3 (7.1%)	3 (7.1%)
Piacenza 2020	17 (70.8%)	1 (4.2%)	5 (20.8%)		1 (4.2%)
Savigliano 2019	25 (80.6%)	2 (6.5%)	3 (9.7%)	1 (3.2%)	
Savigliano 2020	20 (90.9%)		2 (9.1%)		
Pedimonte Matese 2019	7 (46,7%)	1 (6.7%)	5 (33.3%)	2 (13,3%)	
Pedimonte Matese 2020	6 (66.7%)		3 (33.3%)		
Total 2019	49 (55.7%)	9 (10.2%)	21 (23.9%)	6 (6.8%)	3 (3.4%)
Total 2020	43 (78.2%)	1 (1.8%)	10 (18.2%)		1 (1.8%)

Table 4.

CENTRE	CONSERVATIVE	SURGICAL INDICATION	REFUSE SURGERY	SHORT NAIL	LONG NAIL	PLATE	EXTERNAL FIXATION	SHOULDER REPLACEMENT
Piacenza 2019	26 (61.9%)	16 (38.1)		11 (68.9%)	4 (25.0%)	1 (6.1%)		
Piacenza 2020	18 (75.0%)	6 (25.0%)	2 (8.3%)	3 (75.0%)	1 (25.0%)			
Savigliano 2019	30 (96.8%)	1 (3.2%)						1 (100%)
Savigliano 2020	18 (81.8%)	4 (18.2%)				2 (50%)		2 (50%)
Piedimonte Matese 2019	10 (66.7%)	5 (33.3%)	2 (13.3%)				2 (66.7%)	1 (33.3%)
Piedimonte Matese 2020	4 (44.4%)	5 (55.6%)	2 (40.0%)				3 (60.0%)	
Total 2019	66 (75.0%)	22 (25.0%)	2 (9.1%)	11 (55.0%)	4 (20.0%)	1 (5.0%)	2 (10.0%)	2 (10.0%)
Total 2020	40 (72.7%)	15 (27.3%)	4 (26.7%)	3 (27.3%)		2 (18.2%)	3 (27.3%)	3 (27.3%)

The drop of sports, work and road traumas is comprehensible, because of the lockdown that forced people to spend more time in their houses. A direct consequence of these limitations is a slight increase in the average age at the time of trauma between the two periods: 73 ± 9 years in 2019 and 75 ± 8 years in 2020.

We expected a similar trend in retirement houses and domestic injuries, but we recorded an important decrease only in the first ones (from 10% to 1.8%). Our hypothesis is that new measures adopted by the Italian Government, that advised people to access the E.R. only for severe situations, forced doctors working in retirement houses to try to manage humerus fractures in their structures and to avoid sending patients to hospitals. Our assumption found confirm in subsequent months: taking as an example our Piacenza Department, between May 2020 and September 2020, when the first wave of the pandemic was over and a normal lifestyle had slightly returned, 5 patients asked for an outpatient visit. They manifested pain and/or stiffness to the upper limb, with a positive anamnesis for trauma developed during the pandemic. X-rays and clinical evaluation demonstrated the presence of pseudoarthrosis, due to an incorrect management of these events.

Considering the three Orthopedics Departments of the present study, we need to underline that Piacenza is surely the most damaged by CoVID-19 epidemic, because of the high number of infected people. The province of Piacenza counts 286,997 inhabitants and

the data issued by Italian Civil Protection at the end of lockdown indicated 4,251 infections in this province and 904 deaths; the province of Cuneo has 587,098 inhabitants, 2,535 infections and 255 deaths; the province of Caserta has 922,965 inhabitants, 424 infections and 42 deaths. Consequently, Piacenza registered an infection rate of 1.48% and a death rate of 0.31%; Cuneo an infection rate of 0.43% and a death rate of 0.04%; Caserta an infection rate of 0.05% and a death rate of 0.005%. The amount of infections and death in the province of Piacenza is one of the highest in Italy. The explanation of this data can be mainly found in two factors. The first is the close distance (15 km) between Piacenza and Codogno, the first location of the outbreak, which brought many infected patients to enter our E.R. right after the closure of their hospital [15]. The second reason is that Piacenza, where the average age is 46.2 years, is one of the cities with the oldest population in Italy and as reported in literature, elderly people are exposed to many more complications and death when infected by 2019-nCoV [16,17]. In Cuneo and Caserta, there was not any close outbreak and their population have respectively a mean age of 45.4 and 41.4 years.

Apart from the important decrease of all fractures, during the pandemic all the elective surgeries were suspended and only urgent patients were operated. In Piacenza, in 2020, elective surgery was stopped since February 23rd; in Savigliano and Piedimonte Matese since March 9th. As a consequence, having less patients

to operate, we also had a reduction in waiting times to undergo surgery. In fact, in 2019 the average waiting time was 3.7 days compared to 2.2 days in 2020.

If we compare the three cities involved in this study, it is necessary to consider the local scenario. Depending on the spread of the virus both patients and orthopedics reacted differently. Many of the patients who entered the orthopedic E.R. were afraid of CoVID-19 and of the high probability to be infected during the recovery. In some cases, they even refused hospitalization to avoid the contact with other patients. The fear of CoVID-19 was therefore greater than the possibility of ending up with a deficit in the arm [18]. This situation occurred only in Piacenza, where on average 1 patient out of 3 decided to refuse the surgical option because of the fear to be infected by n-2019CoV, while in 2019 all the patients accepted surgery. In Savigliano all “surgical” patients accepted the proposed treatment, both in 2019 and 2020. In Piedimonte Matese the same number of refusals to the surgery has been registered. Inevitably, the novel coronavirus also influenced orthopedist’s choices, who were afraid to hospitalize patients for the high-risk of intra-hospital CoVID-19 infection. In particular, in Piacenza, surgical indications was given only when the fracture was clearly surgical and the conservative alternative was not possible: 38.1% in the “non CoVID-19 period” Vs 25.0% in the “CoVID-19” period, with a drop of -13.1%. Since Savigliano and Piedimonte Matese did not face such an impressive number of infections and CoVID-19-related deaths, as counted in Piacenza, these two departments did not register any drop in surgical indications.

Conclusion

In literature, it is well known that CoVID-19 had a devastating effect on the worldwide population, especially on the elderly category, more exposed to complications like ARDS and multi-organ failure. In our experience, we noticed a straight decrease in proximal humerus fractures during the so called “Phase 1” of the Italian epidemic, probably due to the patients’ fear of contracting CoVID-19 in hospitals and to the national lockdown imposed by the Italian Government to avoid

the spread of the virus and the complete collapse of the healthcare system. Basing on these two observations, elderly people spend less time outside and had a quiet lifestyle at home, reducing the risk of fractures. Our data confirmed the reset of sports traumas and a very significant drop in road and work traumas, but we registered an unexpected reduction of injures in the retirement houses, with no apparent reason.

We are aware that study is preliminary and further investigation will be necessary to confirm our data, but surely it underlines that the different scenario in the three centers of the study modified people’s approach to hospitalization. In Piacenza, the hardest stricken city, the fear of becoming infected by CoVID-19 had, without any doubt, a major role in the reduction of hospital admissions, and it often influenced both orthopedics and patients’ decisions in the problem solving process.

Conflicts of interest: Each author declares that he or she has no commercial associations (e.g. consultancies, stock ownership, equity interest, patent/licensing arrangement etc.) that might pose a conflict of interest in connection with the submitted article.

Ethics approval: Approval for the study was obtained from our ethics committee prior to study commencement (Prot. n. 2020/0065297, May 29th 2020). Furthermore, 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.

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