

The impact of covid-19 pandemic on the emergency room and orthopedic departments in Piacenza: a retrospective analysis

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Abstract: *Introduction and Aim:* The Coronavirus pandemic represents one of the most massive health emergencies in the last century. Aim of the study is to evaluate the trend of E.R. accesses and orthopaedic events during the pandemic of Covid-19. *Materials and Methods:* we retrospectively analysed all data related to patients admitted to the E.R. Department of the Hospital of Piacenza from August 26th 2019 to August 23rd 2020, splitting this period on February 23rd 2020. *Results:* Our analysis shows a reduction of -18.0% in E.R. accesses. We calculated a growth of deaths in the E.R. equal to +220%. Our orthopaedic pathway recorded a drop of -26.8%. Traumas occurred at home increased (+19.1%). We note an actual drop only on proximal femur fractures (weighted average of -17.7%), while all the others underwent an increase. *Discussion:* The amount of E.R. accesses registered a drop -18.0%, while the pathway dedicated to emergency cases underwent an increase. The major complexity of clinical conditions influenced the number of hospitalizations and the fear of the infection increased hospitalization refusals. There has been a zeroing of school traumas, a reduction in sport, transfer home-work/work-home, work, roadside, injuries. Total amount of fractures strongly increase after the end of the lockdown. *Conclusion:* our data confirmed the decrease of retirement houses, sports, works and roadsides traumas and a zeroing of schools ones, while those occurred inside domestic environment underwent a consistent raise. We noticed a reduction in femur fractures and significant spread of all fractures after the end of the lockdown.

Introduction

At the beginning of 2020 the Italian and World population was stricken by one of the most massive health emergencies in the last century: the Coronavirus pandemic [1]. The first identification of the novel coronavirus (Sars-Cov-2) took place in December 2019 in Wuhan, Hubei Province, China in patients affected by a viral form of pneumonia; its pathogenicity allowed the virus to spread across China and all over the World in extremely short time, causing a deep

global health crisis. On January 30th, 2020 the WHO declared CoVID-19 as the sixth public health emergency of international concern [2].

Coronavirus can cause very different clinical scenario. In young, healthy people it generally presents without any clinical manifestation or with common self-limiting flu-like symptoms such as cold, headache, fatigue, or in addition vomit, diarrhea and abdominal pain [3,4]. Peculiar signs can be dysgeusia and anosmia, frequently reported by CoVID-19 patients [5,6]. On the other hand, especially in older subjects or those

affected by comorbidities, the infection can lead to interstitial pneumonia [7,8] which can further evolve in acute respiratory distress syndrome (ARDS) with high risk of death from multiorgan failure (MOF). Literature extensively reports that the most frequent complications developed by these patients are respiratory failure (96.8%), acute kidney injury (22,1%), bacterial super-infection (13.3%) and acute myocardial damage (10.9%) [9].

As mentioned before, elderly people are significantly exposed to higher risk of being infected by CoVID-19 and to its potentially fatal consequences, particularly when affected by blood hypertension and diabetes [7,10] or suffering from 3 or more pathologies. The percentage of deaths related to the virus in people aged over 80 years old is assessed by literature at 84.1%.

On 21st February 2020, the first Italian citizen affected by Covid-19 was transferred from the Hospital of Codogno to the Intensive Care Unit (ICU) of the Policlinico San Matteo of Pavia because of an acute worsening of his clinical conditions. That moment marked the crossroad for a massive change in the social-economic scenario and hospital's entire organization throughout Northern Italy [11]. The establishment of the so called "Red Zone" first (from February 24th) [13] and later the Italian national lockdown (in force from March 9th to May 3rd 2020) [14] imposed traffic restrictions, closure of all the schools and universities, many commercial activities, companies and factories, and stopped all the sports activities, definitely reducing people's movements and, as consequence, the risk of bone fractures [8,9]. Previous studies show an important decrease in traumas during this period [10,11], reporting the reset of sports traumas and a very significant drop in road and work traumas. Also, an unexpected reduction of retirement houses injuries was registered in many hospitals, although we still can't find the reason.

Our city, Piacenza (Emilia-Romagna) has been one of the major epicenters of the first wave of the Italian pandemic and, because of the exponential daily growth of cases, the local hospital – "Guglielmo da Saliceto" – through a huge effort from all the health-care staff, quickly became a "CoVID-19 hospital" [12]. In order to deliver regularly the most needful services and to avoid the complete collapse of our local health

system, deep internal changes were put in action and new protocols, object of constant changes, were drafted daily.

The aim of the study is to evaluate the trend of E.R. accesses and orthopaedic events during the pandemic of Covid-19, comparing two periods before and after the outbreak in Piacenza.

Materials and Methods

We retrospectively analysed all data related to patients admitted to the Emergency Department of the Guglielmo da Saliceto Hospital in Piacenza. We considered two periods of the same length before and after the outbreak of the Covid-19 pandemic in our city; we chose February 24th 2020 as the crossroad that marked the beginning of the Italian pandemic and the related reorganizations of our health system. The first period taken into account started on August 26th 2019 until February 23rd 2020 (total of 26 weeks); the second one, used as control group, from February 24th 2020 to August 23rd 2020 (same amount of weeks). We collected data from our internal E.R. database, which gathers all information on every access: first we evaluated the entire amount of patients came to the E.R. in the analysed period, considering the pathway followed once acceded the E.R, based on priority level, Department of destination, and the results of the medical assessment. Then, we focused our attention specifically on orthopaedic events, collecting data about the location where the trauma took place and the final diagnosis (in particular, we selected fractures on proximal humerus, wrist, proximal femur and ankle).

All data are represented in tables, divided into 2 periods (six months before Covid-19 outbreak and six months after). The first two tables regard the General E.R., while the others are specifically focused on the orthopaedic pathway

Table 1: representation of the different management rooms, comparing numbers and percentage of all possible pathways followed by the patients once acceded the E.R.

- Table 2: showing the possible destinations of patients after medical evaluation.

- Table 3: location/place where the trauma took place.
- Table 4:
 - a) type of fracture diagnosed in the E.R. after X-rays and clinical examination.
 - b) focus on the 6 months after the outbreak, dividing it into 2 different subperiod (the first 13 weeks after the outbreak Vs the later 13 weeks).

- Emergency Area pathway: we detected an increase of +5.4% on the entire amount of accesses (from 1.4% to 6.7%) and a massive raise of +305.8% if considering only this specific E.R. area (from 447/32980 to 1814/27042);
- Sum of other specialties afferent to the E.R. (gynaecology, orthopaedic, otorhinolaryngology and dermatology): we found a drop of -2.4% on the entire amount of accesses (from 22.1% to 19.7%) and a decrease of -26.9% (from 7304/32980 to 5340/27042 patients) if considering only these specific E.R. areas.
 - Focusing on our specific orthopaedic pathway, we recorded a drop of -26.8% (-1073 events, from 4007/32908 patients to 2934/27042 patients).

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

From the analysed cohort it's clear that the dramatic spread of Sars-Cov-2 caused a reduction in E.R. accesses, with a drop of 5938 patients (-18.0%), which equals a mean decrement of 32.6 patients per day.

As far as the various specific areas of the E.R. Department, we evaluated both the arithmetic and the weighted average. Here, we report the results divided between each area:

- General pathway: we recorded a decrease of -5.1% on the entire amount of accesses (from 74.1% to 68.9%) and a drop of -23.7% if considering only this specific E.R. area (from 24431/32980 patients to 18641/27042 patients);
- Short Intensive Observation pathway: we registered an increase of +2.2% on the entire amount of accesses (from 2.4% to 4.6%) and an increment of +56.3% (from 798/32980 patients to 1247/27042 patients) if considering only this specific E.R. area;

As for the outcome of the clinical evaluation, the number of patients "sent to Family Doctor" underwent a reduction equal to 6843 units (-27.6%). The only other decrement we registered regards patients who left the E.R. before receiving a diagnosis: this drop is lower by unit (-450 patients), but higher once translated into percentage (-37.3%). All the other options have been subjected to increases. Data related to deaths are extremely noteworthy, in fact, we calculated a growth of +220% (+99 cases); the same trend, +95.7% (+45 patients), was reported for "transfer to other E.R. Departments". Furthermore, we documented an increase in refusals of hospitalization (+47.0%, 126 cases), in transfers to different, more specific pathways (+25.2%, +60 cases) and in hospitalizations (+16.2%, +1039 cases).

Taking into account only the orthopaedic area, the frequency order of the trauma dynamic is the same between the two considered period: first place occupied by home/domestic traumas (43.6% of cases before Covid-19 outbreak vs 62.7% after, equal to a weighted average of +5.3%); second place represented by trauma during work activities (20.7% of cases before Covid-19 outbreak vs 16.3% after, equal to a weighted average of -42.3%), third place for traumas in retirement houses (13.7% of cases before Covid-19 outbreak vs 10.8% after, equal to a weighted average of -42.2%); then, sport traumas (11.9% of cases before Covid-19 outbreak vs 4.0% after, equal to a weighted average of -75.3%); roadside trauma (4.3% of cases before Covid-19

outbreak vs 3.5% after, equal to a weighted average of -40.1%); injuries occurred during transfer home-work or work-home (2.4% of cases before Covid-19 outbreak vs 1.3% after, equal to a weighted average of -59.8%).

In addition, we registered a total reset of school traumas (from 2.0% to 0.0%, weighted average -100.0%), a reduction in injuries linked to violence outside the domestic environment (from 0.8% to 0.2%, weighted average -81.8%) while, on the other hand, we recorded a growth of injuries inside the domestic environment (from 0.4% to 0.8%, weighted average +27.8%) and animals' bites (from 0.1% to 0.3%, weighted average +80.0%).

Finally, we analyzed the four main sites of fractures recorded in our Hospital causing access to the E.R., which are in order of frequency: proximal femur, wrist, ankle and proximal humerus. It's evident that the total amount of these fractures decremented after Covid-19 outbreak (-4.5%, equal to 25 fractures less). If we consider only the precise segments, we note an actual drop only on proximal femur fractures (from 215 to 177 events, equal to a weighted average of -17.7%), while all the others underwent an increase: wrist from 164 to 169 events, +3.0%; ankle from 93 to 94 events, +1.1%; proximal humerus from 81 to 88 events, +8.6%.

Discussion

What happened in our neighbouring cities from the end of February 2020, deeply influenced the trends we registered in our E.R. Department: the institution of the so called "Red Zones" and the lockdown, combined by an increasing fear of contracting the disease, caused a significant limitation in people's activity and circulation, leading to a reduction of those risk factors which normally play major roles in traumas. As we are up to discuss, at the end of the lockdown (on May 4th) people used their renewed freedom to slightly return to their daily life (work, sports, travels), this determined a parallel increase in orthopedic injuries.

Analyzing data represented in Table 1, we understand that during the six months after Covid-19 outbreak, the amount of E.R. accesses registered a significant drop (-18.0%), equal to a mean decrement of 32.6 patients per day. We can easily justify this trend considering the numerous indications provided by the Government and mass media, suggesting people to accede the E.R. only for severe not-delayable reasons, in order to avoid contagions and, at the same time, save the healthcare structures from the collapse. Obviously, this consideration is not applicable to the pathway dedicated to emergency cases: in fact, the weighted

Table 1

MANAGEMENT ROOM	Pre Covid-19		Post Covid-19		Variation		
	N.	%	N.	%	N.	Aritmetical average	Weighted average
General E.R.	24431	74,1%	18641	68,9%	-5790	-5,1%	-23,7%
Short Intensive Observation	798	2,4%	1247	4,6%	449	2,2%	56,3%
Emergency Area	447	1,4%	1814	6,7%	1367	5,4%	305,8%
Ginecology E.R.	3273	9,9%	2135	7,9%	-1138	-2,0%	-34,8%
Orthopedic E.R.	4007	12,1%	2934	10,8%	-1073	-1,3%	-26,8%
Otorhinolaryngology E.R.	19	0,1%	210	0,8%	191	0,7%	1005,3%
Dermatology E.R.	5	0,0%	61	0,2%	56	0,2%	1120,0%
Total	32980		27042		-5938		

average of the Short Intensive Observation and of the Emergency Area show a clear growth (totally equal to +145.9%), explainable by the huge amount of critical Covid-19 patients, needful of immediate help during those weeks. As far as we are concerned, observing only the orthopaedic pathway the number of patients came to the E.R. underwent a decrease (-26.8%), corresponding to a mean decrement of 6 patients per day (from 22.3 to 16.3 patients per day). If we split the post outbreak period in two more sub-periods, we notice that, actually, in the first 13 weeks after the beginning of the pandemic we registered only 1190 access (i.e. to 13.2 patients per day, -41.0% if compared to pre Covid-19 period), while in the successive period 1744 access (i.e. to 19.4 patients per day), with an increment of 46.6%. This last percentage can be explained by the different scenario presented between the two considered period: the first one characterized by lockdown and restrictions, while the second one featuring the

contagion decrease and the chance to return to a quite normal routine.

Considering the outcome of the medical assessment [Table 2], the reduction in the number of patients “sent to Family Doctor” (-27.6% in the weighted average) and the increment in “hospitalization” can be justified by the increase of the severity of clinical conditions combined with the complexity of therapies and devices required for the survival of these patients, who unfortunately often passed away inside the E.R. before acceding wards (+220.0% of death). Since Piacenza has been one of the first and most stricken cities of the Country at the beginning of the pandemic, we soon ran out of free Intensive Care Unit (I.C.U.) beds, leading us to send many patients to different hospitals. The increase of 95.7% in “transfer to different E.R.” can be understood by this forced management. The last interesting data that Table 2 shows us is the raise in “hospitalization refusals”, probably due to the fear of

Table 2

RESULT OF ASSESSMENT	Pre Covid-19		Post Covid-19		Variation		
	N.	%	N.	%	N.	Aritmetical average	Weighted average
Sent to Family Doctor	24751	75,1%	17908	66,2%	-6843	-8,9%	-27,6%
Hospitalization	6422	19,5%	7461	27,6%	1039	8,1%	16,2%
Left the E.R. before diagnosis	1208	3,7%	758	2,8%	-450	-0,9%	-37,3%
Hospitalization refusal	268	0,8%	394	1,5%	126	0,6%	47,0%
Transfer to specific E.R. pathway	238	0,7%	298	1,1%	60	0,4%	25,2%
Transfer to different E.R.	47	0,1%	92	0,3%	45	0,2%	95,7%
Death	45	0,1%	144	0,5%	99	0,4%	220,0%
Total	32979		27055		-5924		

contracting the infection manifested by many patients whose hospitalization wasn't essential for their survival and preferred to handle their conditions by themselves at their safe domestic environment.

As for the dynamic of orthopaedic traumas [Table 3], our data get along with previous studies [11], showing that the frequency order maintained even if the restriction kept people inside their houses, giving a significant transfer of cases on home injured (+19.1% of total arithmetical average) and a less consistent transfer on domestic violence injuries (+27.8% on weighted average).

To contain the spread of the virus, the Government proceeded closing all schools, most commercial activities and many factories, also forbidding all sport activities. Of course, the immediate impact was a zeroing of school related traumas (-100%) and a remarkable reduction in sport (-75.3%), transfer homework/work-home (-59.8%), work (-42.3%), roadside (-40.1%) injuries. Finally, a consistent decrease was registered in retirement houses traumas (-42.2%): our

hypothesis is that new measures advising people to access the E.R. only for severe situations, forced doctors to manage injuries in their structures. This assumption was confirmed in subsequent months, when some patients with pain and/or stiffness to articulations and positive anamnesis for trauma developed during the pandemic, were diagnosed with pseudoarthrosis due to an incorrect management of fractures.

As far as data concerning the four type of fractures we considered [Table 4], it may appear that they haven't been influenced by the spread of Sars-Cov-2: in fact, we recorded a difference of only -4.5%, mainly linked to proximal femur fractures decrease. To better understand the trend, we reused the split of the post-outcome period we explained before, which allowed us to notice that although the trend relating to proximal femur fractures is stable during the entire period, the one representing the other three site of fracture undergoes important variations. In fact, comparing the two post Covid-19 sub-periods, in the second we registered

Table 3

LOCATION OF TRAUMA	Pre Covid-19		Post Covid-19		Variation		
	N.	%	N.	%	N.	Aritmetical average	Weighted average
House	1749	43,6%	1841	62,7%	92	19,1%	5,3%
Retirement Houses	548	13,7%	317	10,8%	-231	-2,9%	-42,2%
Work	829	20,7%	478	16,3%	-351	-4,4%	-42,3%
Sport	477	11,9%	118	4,0%	-359	-7,9%	-75,3%
Roadside	172	4,3%	103	3,5%	-69	-0,8%	-40,1%
Transfer	97	2,4%	39	1,3%	-58	-1,1%	-59,8%
School	79	2,0%	0	0,0%	-79	-2,0%	-100,0%
Domestic Violence	18	0,4%	23	0,8%	5	0,3%	27,8%
Outside Violence	33	0,8%	6	0,2%	-27	-0,6%	-81,8%
Animal Bite	5	0,1%	9	0,3%	4	0,2%	80,0%
Total	4007		2934		-1073		

Table 4

SITE OF FRACTURE	Pre Covid-19		Post Covid-19		Variation		
	N.	%	N.	%	N.	Aritmetical average	Weighted average
Proximal humerus	81	14,6%	88	16,7%	7	2,1%	8,6%
Wrist	164	29,7%	169	32,0%	5	2,3%	3,0%
Proximal femur	215	38,9%	177	33,5%	-38	-5,4%	-17,7%
Ankle	93	16,8%	94	17,8%	1	1,0%	1,1%
Total	553		528		-25		

an increase of +76.5% in ankle fractures (34 Vs 60), of +44.9% in wrist fractures (69 Vs 100) and +37.8% of proximal humerus fractures (37 Vs 51).

Conclusion

From his outbreak, Covid-19 deeply influenced our Local Health System, forcing a reorganization of pathways and activities. In Piacenza, the hardest stricken city, the fear of becoming infected by CoVID-19 had, without any doubt, a major role and the E.R. was invaded mainly by severe or critical cases acceding those areas of the Department reserved for acute patients, with a growth in percentage of recoveries and deaths.

Our data confirmed the decrease of retirement houses, sports, works and roadsides traumas and a zeroing of schools ones, while those occurred inside domestic environment underwent a consistent raise [11]. Moreover we noticed a reduction in proximal femur fractures, as other studies previously demonstrated [10] and very significant spread of all fractures after the end of the lockdown.

This study is preliminary and further investigation are necessary to confirm our data, but surely it shows the changes that the pandemic immediately caused on the healthcare system and on people's approach to hospitalization.

We are slowly learning to live with this enemy, hoping that an effective cure or a vaccine will be found as soon as possible.

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