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Title

Epidemiology of hand traumas during the Covid19 confinement period

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Conflict of interest

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Ethical approval

Since this study was a retrospective chart review, no formal approval from the IRB of our institution was required. All investigations were conducted in accordance with the 1964 Declaration of Helsinki ethical standards and the MR-003 reference methodology*; the study was registered in the National Committee for the Computer Sciences and Liberties (Commission Nationale de l'Informatique et des Libertés – CNIL) database register (number 2217606 v 0) and all patients were individually informed and gave his/her consent before any data collection and analysis.

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Running title

Hand injuries under Covid-19 lockdown

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Epidemiology of hand traumas during the Covid19 confinement period

Abstract

Introduction: hand injuries are a common emergency mainly caused by domestic accidents or sport injuries. During the Covid-19 pandemic confinement period, with a cut off in transportation as well as in occupational and physical activities, we observed a decrease in medical and elective surgical activities but emergency cases of upper limb and hand surgery increased.

Materials and methods: we conducted a retrospective epidemiological study to analyze two periods between the same dates in 2019 and 2020, for all the duration of the confinement period. We compared the numbers of consultations in the emergency department, elective surgeries, hand and upper limb emergency cases in our center and urgent limb surgeries in the nearby hospital. Then we compared the mechanisms and severity of injuries and the type of surgery.

Results: between 2019 and 2020 there was a decrease of consultations in the emergency department in our institution of 52%, a decrease of total elective surgeries of 75%, a decrease in surgeries for urgent peripheral limb injuries of 50%, whereas the hand and upper limb emergency remained stable or even increased by 4% regard to occupational and domestic accidents.

There was a significant difference in the mechanism of injury with an increase of domestic accident and a decrease of occupational, road traffic and sport accidents. Severity of the injuries increased, with augmentation of the number of tissues involved and longer expected time of recovery.

Conclusion: during the confinement period of the Covid-19 pandemic, despite an important reduction of medical activities, the amount and severity of hand emergency cases increased. A

specific plan regarding duty shift organization for hand trauma should be maintained regardless of the sanitary situation.

Keywords

Epidemiology, hand injury, confinement, emergency, hand surgery, Covid19

Introduction

Hand injuries are common emergency situations, requiring surgical management in specialized centers on a daily basis [1,2]. More than a quarter of all unintentional injuries are hand injuries [3,4]. They are mainly caused by accidents in daily life situations while other traumatic injuries of the upper limb are often observed in the context of sports injuries or road traffic accident [3,5]. There are two main types of hand injuries requiring surgical treatment. Wounds with potential complex lesions of major structures in the deep tissues (e.g., tendons, nerves, arteries, ligaments and joint, bones), which require emergency management in order to save the hand function (e.g., devascularization, open fractures, flexor tendons lesions...) [6,7]. The second category includes all closed injuries involving bones and joints but without skin lesions, such as closed fractures and sprains, which require an urgent care but can be deferred for 7 to 10 days.

The orthopedic surgical activity finds a majority of wounds on hand trauma, while on the rest of the upper limb we reported a greater number of closed fractures [8].

In 2020, during the confinement period secondary to the Covid-19 pandemic, there was a significant decrease in professional activities, physical activities and transportation. We then hypothesized that despite the confinement of the population and the decrease in most of the medical and elective surgical activities, traumas of the hand operated in emergency would continue [9]. In addition, we expected a significant reduction in closed trauma of the

peripheral limb treated with osteosynthesis, and an increase of number and severity of complex cases.

Materials and methods

We conducted a retrospective epidemiological study in our center to analyze the medical and surgical activities, along with hand and upper limb injuries within the period of lockdown of the population related to the Covid-19 pandemic inducing a cutback in all professional work activities, physical activities and transportation. Our center is a provincial town with a population of about 210,000 inhabitants. It drains a large population base from the northern French Alpine massif, south of Geneva, north of Grenoble and east of Lyon.

Two periods of eight weeks were compared. The first from Wednesday the 18th of March in 2020 to Tuesday the 10th of May in 2020. The time of inclusion was the same as the confinement period as it corresponds to a period during which information emanating from the local health authorities (i.e., hospital direction comity, regional medical council and medical insurance companies) were unanimous (i.e. surgical activity restricted to critical emergencies, trauma, infections, tumors). After the 10th of May 2020, information regarding the authorized activity in hospitals and health care centers authorized a partial resumption of medical activity.

The second was a control period of two months from the 18th of March, 2019 to the 10th of May, 2019. For these two periods, we retrospectively collected the number of patients coming to the emergency department of our hospital for other motives than Covid-19-related symptoms, the number of elective cases managed in our hospital and the number of patients operated for upper limb and hand injuries; regarding those cases, we looked more precisely at the energy of the accidents.

In addition to our private clinic in Annecy, Rhône-Alpes, France, we collected the data regarding orthopedics traumas, which were operated at the trauma center of the local public hospital, Annecy, Rhône-Alpes, France, as the regional health organization (Agence Régionale de Santé) of our area distributes the traumas management between our private center (i.e., hand traumas and microsurgical reconstruction) and the public hospital (i.e., polytrauma and peripheral traumatology).

In France, during the two month of lockdown, social policies were defined with few authorized activities. Only authorized movements were those: in the professional context only if essential and that cannot be carried out by telework; to make purchases of basic necessities; for medical reasons, administrative or judicial summons; recreational and individual activity within the limit of 1 kilometer and 1 hour around the home.

- **Analysis criteria**

The primary analysis criterion was the comparison of the number of patients between these two periods.

The secondary analysis criteria were the difference between the type, mechanism and severity of the hand and upper limb injuries operated at our institution. We also analyzed the influence of the age in the group of patients operated for peripheral limb trauma in the public hospital.

- **Definitions**

A hand injury was defined as any closed or open injury to the wrist and/or the hand, substantially involving skin, muscle, tendon, bone and joint, nerve and/or vessels [10].

An upper limb injury was defined as an injury to the forearm, elbow, arm and shoulder.

A high-energy injury was defined by road, ski and mountain accidents, industrial machine and “do it yourself” tools accidents.

Peripheral limb trauma was defined as the traumas to the musculoskeletal system, excluding spine and skull and could include the upper limb, excluding hands.

Combined injury criteria was analyzed by looking at the number of structures damaged. The skin was considered only in case of a skin loss requiring a flap. Nerves and arteries from a collateral pedicle were considered as one tissue (i.e., neurovascular bundle) on fingers. We described a severity score as the mean of 3 criteria: high-energy injury, combined injury and expected delay before resuming manual daily activity longer or equal to 3 months, marking 1 point for each criteria.

- **Inclusion and exclusion criteria**

For the primary analysis criteria, we included all patients coming to the emergency department of our institution for a motive of consultation other than Covid-19-related symptoms, and all patients who underwent surgery at our institution regardless of the specialties. For the analysis of the epidemiological data about upper limb and hand emergencies, inclusion criteria were all upper limb injuries that happened during the period of confinement and required surgical management within the 10 days following the initial trauma.

The same criteria were applied to the group of patients managed in the public hospital for peripheral limb injuries.

The epidemiological data collected were gender, age, job, type of surgery, mechanism of injury and time between the date of injury, the first consultation and surgery. The type of surgery was separated into three categories: osteosynthesis and ligaments suture; wound with soft tissues lesions (skin, muscle, tendon, bone and joint, ligaments, nerves, vessels); infections and hematoma. The mechanism of injury was separated into four categories: occupational accidents; home accidents; motor vehicle accident (MVA) and sports traumatism.

- **Statistic analysis**

R for Mac OS X (R Foundation for Statistical Computing, CRAN) and Stata (StataCorp LP,

College Station, TX, USA) were used for the statistical analysis. Data were presented as mean and standard deviation (SD). We performed paired Student *t*-tests if the sample was normally distributed and the homogeneity of variance was given. Otherwise, non-parametric Mann–Whitney tests were used. Normality was verified using Shapiro–Wilk tests and Gaussian aspects of variable distribution on histograms. Homogeneity of variances was verified using Bartlett tests. Chi-squared analyses with individual comparisons were made with Fisher exact tests and χ^2 tests, as appropriate. A *P*-value less than .05 was considered statistically significant.

The study was approved by the local review board (number 2217606 v 0), and conducted according to good clinical practice and applicable laws, and the 1964 Declaration of Helsinki. Written consent was given by each patient.

Results

Between the two periods, we observed in our private institution a decrease of only 10% of hand or upper limb injuries operated in emergency. More specifically, within the hand and upper limb injuries, when high energy injuries were excluded (i.e. transport and sport injuries) we observed an increase by 4%. Meanwhile, a decrease of 52% of the consultations in the emergency department, 75% of elective cases operated in our institution was observed.

A decrease of 50% of peripheral limb injuries operated in the nearby public hospital, was observed.

Table 1 and Figure 1 describes the repartition of epidemiologic and surgical data between the two periods and the two medical centers.

- Epidemiological data

The main epidemiological data are summarized in Table 2.

The mechanism of injury is presented in Figure 2. There was a significant difference in repartition of trauma etiology between 2019 and 2020 with a decrease by 50% of occupational accident, a decrease of sport accident by 73% and an increase of domestic injury by 40%, (fisher test, $p < 0.01$).

- **Severity score**

We observed significant augmentation of severity of hand and upper limb trauma in 2020 in comparison to 2019. The severity score increased from 0.8 ± 0.9 to 1.1 ± 0.9 between 2019 and 2020 ($p < 0.01$). Severity of trauma is presented in Table 3 and Figure 3. There was a significant augmentation of combined injury and expected delay before resuming manual daily activity from 2019 to 2020.

- **Age analysis**

In the group of patients operated from peripheral limb injuries at the local public hospital, the mean age was not different in 2020 (62 ± 28 years) and 2019 (57 ± 28 years), $p > 0.05$. When this population was separated into three groups (<65, 65-80 and >80 years old) the decrease in surgical activity were respectively by 60%, 55% and 31%.

In our private clinic, the mean age was not different between 2020 (44 ± 21 years) and 2019 (41 ± 21 years). We didn't observe any difference when the population was separated into the three same groups.

Discussion

In this study, we highlighted an augmentation of surgeries for hand emergencies, in opposition with a global medical and surgical decrease in activity. Despite a massive reduction of all surgical and medical activity in our institution and the local public hospital, with the number of patients coming to the emergency department for another reason of consultation than Covid19, the activity of the elective surgery, and the surgical trauma activity

all decreased by more than half (respectively 52%, 75% and 50%). On the contrary the amount of upper limb injuries and hand injuries requiring an urgent surgical management was almost the same (decrease of only 10%). Furthermore, the amount of hand and upper limb injuries, not related to sports and transportation, has increased. We could therefore answer to our hypothesis, stating that hand emergency activity remains equivalent independently from an overall cutback into any other activity.

As a center to which patients are referred from nearby hospitals, (being the only hand and microsurgery unit in the area), and knowing that general hospitals focused on managing Covid19, a greater number of upper limb injuries could have been expected during this period.

In our area, sports practiced take place in mountains, and accidents may be serious with upper limb injuries (proximal humerus, clavicle and elbow fractures). Indeed, many of these injuries are secondary to sports trauma or motor vehicle accidents. During this period of the year, people are usually outdoor, playing sports, which increases our upper limb trauma surgery activity. During the confinement period, people stayed at home. As a result, we have seen an increase in domestic injuries such as simple hand soft tissues injuries with knives or glass. On the contrary, there is a decrease in upper limb injuries linked to the prohibition of mountain sports (especially skiing) and the decrease in road traffic.

The discrepancy established between the great decrease of activity in the emergency department and the elective cases and the less significant decrease in the amount of upper limb injuries managed in our institution can also be explained by the fact that while many healthcare professionals had to manage Covid19 infection related cases (explaining the general decline in medical activities), our institution focused on the management of hand and upper limb injuries which became the main reason for consultation in our department, and in the emergency department of our institution [11,12].

During the confinement, the trend of the amount of major structure lesions, and the severity of the damaged caused by domestic accidents seemed to highlight an increase compared to the previous year. Consequently, we designed a severity score showing an increase of combined injury and an augmentation of the expected delay before resuming manual daily activity.

We believe, since people were confined at home, there were more accidents as they performed handy or “do it yourself” work, manipulating tools they were not used to, such as chain or circular saws.

The most severe lesions affecting many tissues (tendon, artery, nerve, and skin-loss lesion mainly) were indeed mainly due to gardening activities (wounds by chainsaw or hedge trimmer) and do-it-yourself activities (circular saw).

The distribution of the mechanism of accident in 2019 is similar to those reported in other studies particularly with regard to occupational activities (between 25 and 30%) [4,5,13,14]. Sports injuries are less represented compared to the literature, because in this study we only evaluated the number of injuries requiring surgery, whereas many are managed in the emergency department or in our clinic. Domestic accidents are comparable to the literature and as shown by Campbell, falling and punching were the commonest mechanisms of fracture whereas glass, knives and "do-it-yourself" materials were most frequently implicated in wounds [15].

Domestic accidents were responsible for the majority of the traumas observed during this period. We have observed a decrease of work accident during this time. This is consistent with the cutback in professional activity linked to confinement. Sorock showed that hand injuries during occupational activities are mainly due to industries [16]. As they almost all closed, we observed a decrease in occupational hand injuries.

Rettig showed that most sport injuries at the hand appear to be associated with competition as opposed to the practice arena [17]. This explains the great decrease in sport injuries during

confinement. Despite the fact that sports injuries are mostly closed injuries (sprain or fractures) [18,19], and that the number of sport injury decreased, we did not observe any decrease on closed injury of the hand. This is explained by the fact that closed hand injuries are mainly caused by domestic accidents (falls, punching) and are only few sports injuries. [15].

When we separated the population of the public hospital into three groups (<65, 65-80 and >80 years old) there seems to be a tense to a greater decrease in general orthopedic surgery activity in the youths than in the elderly. Even though we could not statistically demonstrate this constatation, it is easily explained since the injuries of the elderly are mainly home accidents. Conversely, many sports injuries and motor vehicle accident (MVA) of young people have decreased. In our institution we did not highlight such a population difference because in hand injuries the population remains the same.

A strong point of our study is to take into account the entire duration of confinement. Even if this duration is only two months and on only two center in Annecy, it was long enough to highlight a specific trend regarding the augmentation of hand traumas compared to the decrease of the rest of the surgical and medical activity. Still we acknowledged that in order to increase the power of our conclusions, a further retrospective, multicentric study, with a larger population, more representative of the country should be performed [20,21].

We agree with Wilson that traumatic emergencies are linked to weather conditions [22]. Consequently, we chose the same period than the previous year in order to obtain similar weather conditions over weather and season. In order to avoid any selection bias, we chose a duration of inclusion long enough to have a comparable weather conditions between the two periods.

Selection bias could also appear if a different population had been referred to us over the period of inclusion. However, as our institution remains the only hand emergency center in the area, this parameter could not influence the hand injury population. Indeed, we usually receive thoroughly all hand emergencies.

Regarding the emergencies of peripheral limbs which could have been referred to our institution, as the nearby hospital kept part of its surgical activity, our population was not changed.

Conclusion

During the confinement period caused by the Covid19 pandemia, most elective medical and surgical activities sustained a severe drawdown. However, the amount of upper limb injury related surgeries declined less than the rest of the other hospital activities, and the amount of hand traumas which required surgical care increased. Despite the decrease of all medical activities more than half, the amount of upper limb and hand injuries remained stable or even increased regarding to occupational and domestic accidents.

Since hand injuries must be managed in specialized centers and do not decrease even when half the population of the world is confined in their homes, and despite a cutback in the activity of the emergency room and in elective or general trauma cases, medical care continuity should always be maintained for hand trauma, whatever the sanitary situation becomes. When healthcare providers focus on managing the Covid19 pandemia, sometimes despite their area of expertise, hand and orthopedic surgeons should keep providing an on-duty organization to be able to operate on hand injuries and trauma.

Conflicts of interest

No conflicts of interest and no benefits from any commercial entity related to the subject of this article.

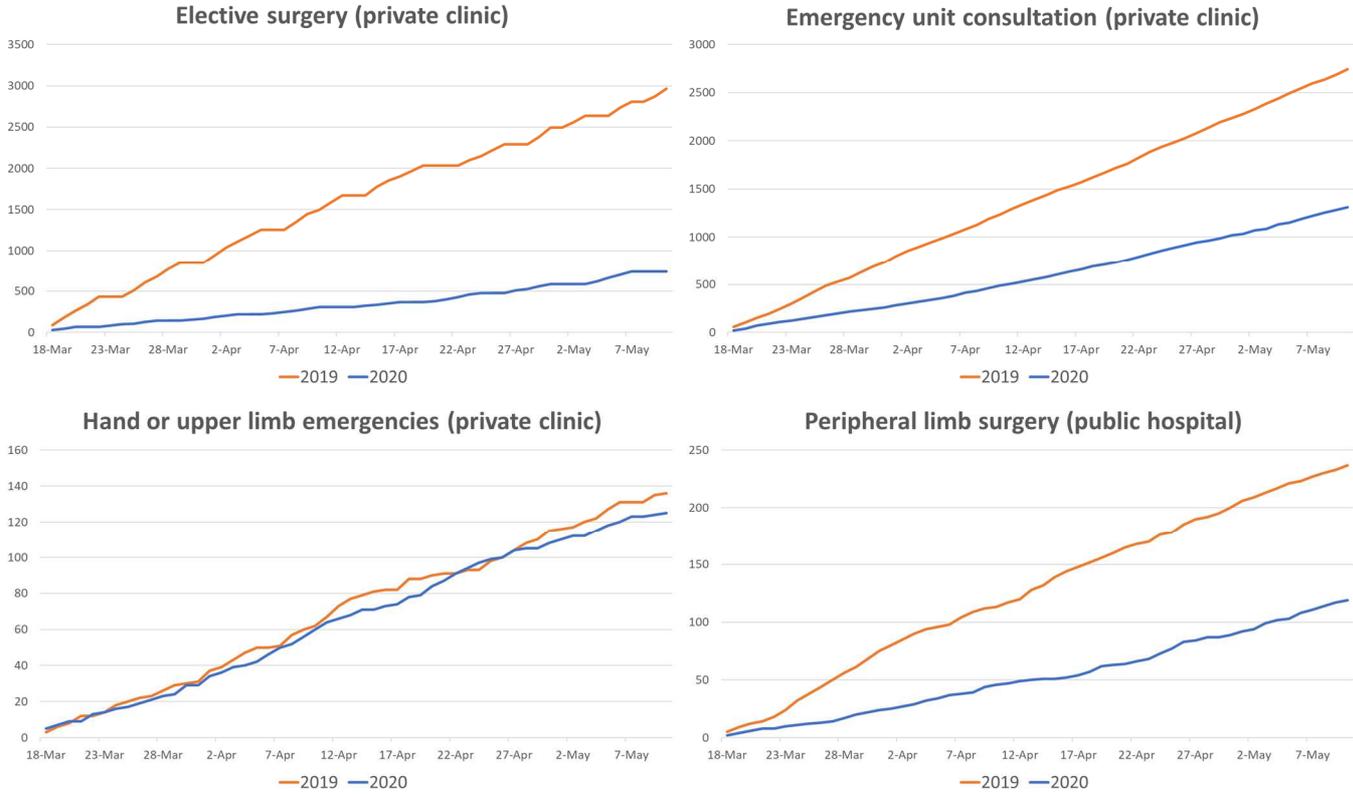
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Figure 1- Modifications of medical and surgical activities between 2019 and 2020



Vertical axes represent number of patients in absolute values
 Horizontal axes represent dates

Figure 2- Mechanism of injury

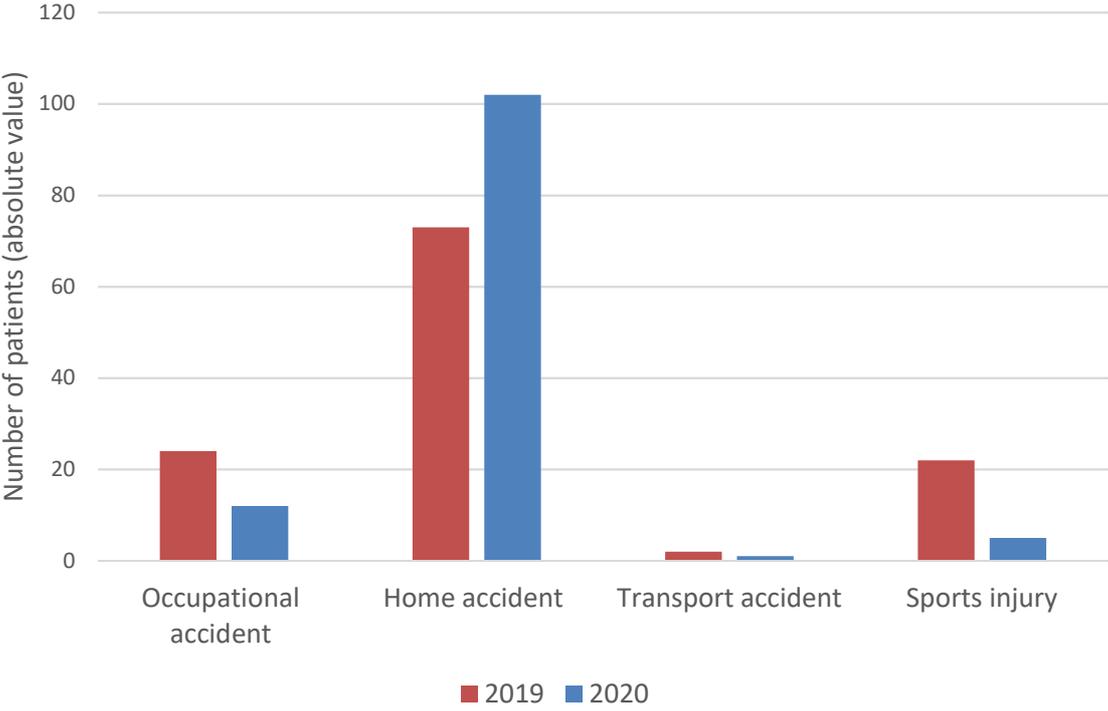


Figure 3- Severity of injury

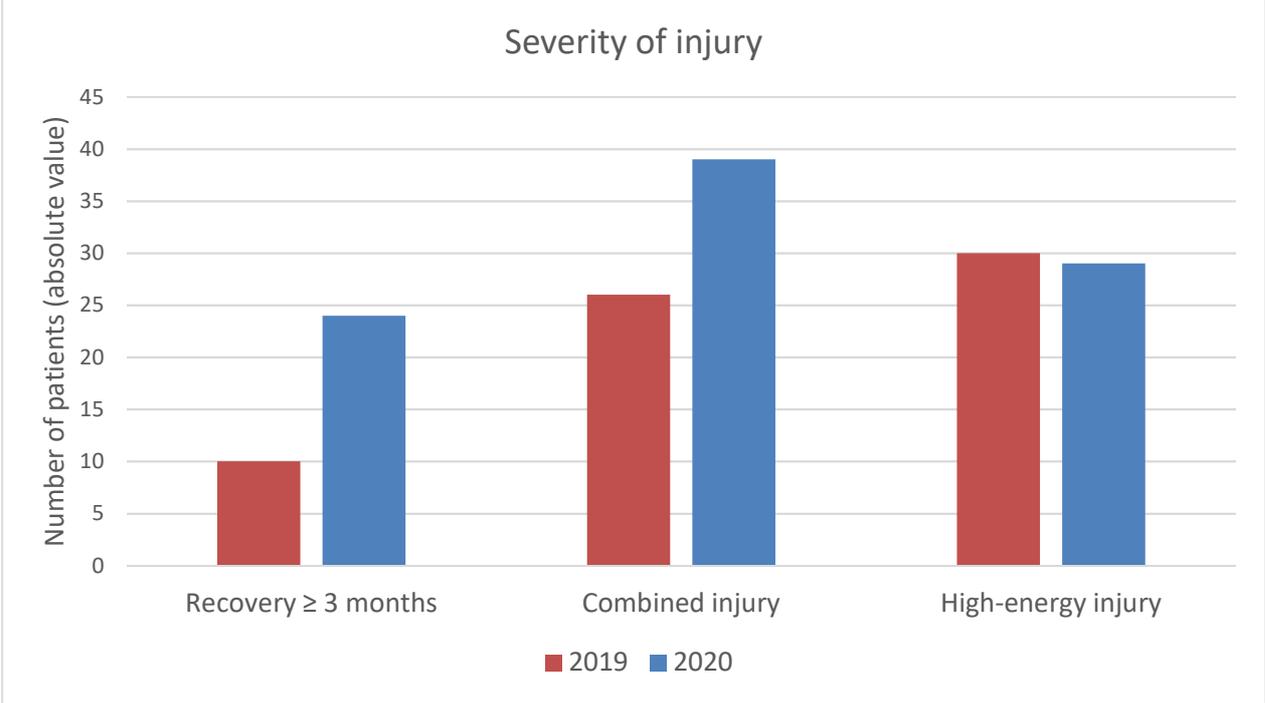


Table 1- Modifications of medical and surgical activities between 2019 and 2020

	2019	2020	Increase / decrease
Hand or upper limb emergencies ¹	136	123	-10%
Hand emergencies without road and sport injuries	112	117	+4%
Elective surgeries ¹	2964	742	-75%
Consultations in emergency unit ²	2742	1309	-52%
Peripheral limb injury ³	245	122	-50%

¹ Orthopaedic department in private clinic

² Emergency department in private clinic

³ Orthopaedic department in public hospital

Data are presented as number of patients in absolute values

Table 2- Epidemiologic data

	2019	2020	Increase / decrease	
POPULATION				
Age* (years)	41±21	44±21		
Sex ratio (=Men / Women)	2,5	2,6		
SURGERY				
Period* from consultation to surgery (days)	1,5±2,1	0,7±1,2	-50%	p<0,01
Period* from injury to surgery (days)	3,0±5,3	2,0±4,9	-32%	p>0.05
Hand osteosynthesis (No)	41	28	-34%	
Upper limb osteosynthesis (No)	12	5	-58%	
Soft tissue lesions (No)	58	73	+26%	
Infections / hematoma (No)	25	19	+24%	

* Data are presented as mean ± standard deviation, unless otherwise stated
 No: number of cases/patients in absolute values

Table 3- Severity of injuries

	2019	2020	Increase / decrease	
Expected delay ¹ before resuming manual daily activity (months)	2,0±1,5	2,9±1,9	+45%	p<0,01
Combined injury (No)	26	39	+50%	
High energy injury (No)	30	29	-3%	
Severity score value ^{1,2}	0,79±0,89	1,14±0,92	+44%	p<0,01

¹ Data are presented as mean ± standard deviation, unless otherwise stated

No: number of cases/patients in absolute values

² The severity score is calculated by scoring 1 point for each of the three previous criteria in the table (patient with expected delay before resuming manual daily activity ≥3 months = 1 point)