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Original article

Pediatric traumatology in “green zone” during Covid-19 lockdown: A single-center study

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ABSTRACT

Introduction: The 8-week lockdown for the Covid-19 epidemic in France restricted travel, and interrupted schooling and sports. The study hypothesis was that this exceptional situation temporarily altered childhood trauma epidemiology.

Material and method: A prospective study was performed during the 8 weeks of lockdown. Pediatric traumatology emergency activity was compared to that during the same period in the previous 3 years.

Results: During lockdown, emergency consultations decreased by 50%. The number of patients operated on was 86% of that in the previous 3 years. Patients operated on during lockdown had a mean age of 7.6 years (median, 7.5 years) compared to 9.3 years (9.4 years). The rate of domestic accidents (59% versus 23%) and trampoline accidents (16% versus 5%) increased, while those of sport and locomotion-related accidents decreased. Wounds were more frequent, at 35% of procedures, versus 13% previously. The rate of surgery for upper-limb fracture decreased, while that of lower-limb fracture was unchanged. Distal forearm fracture was less frequent, as was distal tibial fracture.

Discussion: The present study found a 50% decrease in pediatric traumatology emergency activity during lockdown, without decrease in surgery. In case of renewed lockdown, we recommend reorganizing emergency admission to free teams for management of Covid-19 patients, while maintaining operative rooms for emergency surgery. A general public information campaign could help prevent domestic accidents and risk related to use of trampolines.

Level of evidence: III.

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1. Introduction

Childhood fracture has been the focus of many epidemiological studies [1–4]. The 8-weekend Covid-19 lockdown in France changed children's living patterns, restricting travel and interrupting schooling and sport. These 3 activities are the most frequently implicated in pediatric traumatology [1]. As well as breaking the chain of viral transmission, lockdown also reduced accident rates, freeing up emergency departments. This exceptional situation thus likely altered the epidemiology of trauma in children.

We performed a prospective study of pediatric traumatology activity in our emergency department and operating room, to assess the impact of lockdown.

The study hypothesis was that pediatric traumatology activity decreased during lockdown, with changes in frequency and type of pathology and age distribution, compared to the same periods in the previous 3 years.

The aim was to collect epidemiological data to frame recommendations for the organization of pediatric emergency departments and operative rooms in any new epidemic episode.

2. Material and methods

This prospective study began on the first day of lockdown (March 17, 2020) and concluded on May 10: i.e., a period of 8 weeks.

The study was conducted in the specialized pediatric surgery emergency admissions and treatment department of the University Hospital of Toulouse, France, which manages emergencies in 0–15 year-olds. An emergency physician is present around the clock, to deal with all surgical emergencies, and a pediatric orthopedic surgeon is on-call for traumatology and orthopedic surgery.

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At start of lockdown, it was decided not to change the management of trauma patients. Protocols were unchanged. Unlike with adults, there were no transfers toward the private sector. No backup plan was set up, as the need was not at any point felt.

We made a daily count of patients presenting in emergency and of those operated on. The target population was trauma cases to be managed by the pediatric orthopedic and traumatology team. Non-traumatic surgical emergencies such as infection and traumatic surgical emergencies operated on by other specialists (visceral, neurosurgical, head and neck, ophthalmic and maxillofacial surgeons) were excluded.

A control group was constituted of patients managed during the same periods in the previous 3 years (2017, 2018 and 2019), with the same inclusion criteria.

The study comprised 2 levels: presentation in emergency, and surgery.

Age and gender were reported; χ^2 and Student tests were used to compare data with sample sizes > 5. Statistics used Excel® software. As the study was conducted during the Covid-19 epidemic to make up for the lack of relevant data and provide specific information regarding the situation, IRB approval was not required.

3. Results

3.1. Emergency consultations

3.1.1. Number of emergency consultations

During lockdown, there were 1421 surgical emergency consultations, compared to an average 2854 for the same period in previous years (50%: a significant difference) (Table 1). Numbers increased as of week 4 of lockdown (Fig. 1); over the first 3 weeks, the average was 40% of previous years, compared to 55% over the following 5 weeks.

3.1.2. Causes of trauma

Accident types treated in the operating theater differed under lockdown, with a proportional increase in the rate of domestic accidents: 46 patients in 2020 (59% of surgery patients), versus an average 67 (23%) previously ($p < 0.05$); increase in trampoline accidents: 13 (16%) versus 11 (4%) ($p < 0.05$); decrease in sport

Table 1
 Pediatric emergency traumatology consultations per week.

Period	Lockdown	Control	Ratio lockdown/control
Week 1 ^a	143	337	42%
Week 2 ^a	131	348	38%
Week 3 ^a	143	355	40%
Week 4 ^a	194	371	52%
Week 5 ^a	187	397	47%
Week 6 ^a	192	350	55%
Week 7 ^a	189	362	52%
Week 8 ^a (6 days)	242	334	72%
Total ^a	1421	2,854	50%

The "Lockdown" column shows week-by-week consultations under lockdown. The "Control" column shows the average for the same weeks in 2019, 2018 and 2017. The "Ratio" column shows the ratio between the two.

^a Significant difference between lockdown vs. control ($p < 0.05$).

accidents: 2 (2%) versus 68 (24%) ($p < 0.05$); and a trend for fewer non-motorized locomotion accidents (kick-scooter, roller-blade, bicycle, hoverboard): 9 (11%) versus 52 (15%) ($p > 0.05$) (Table 2). The rate of road accidents tended to decrease, but numbers were too small for a significant difference to emerge: 1 in 2020 versus an average of 3.5.

3.2. 2 Surgery patients

3.2.1. Typology of surgery patients

Under lockdown, the number of patients managed surgically was 86% of that in previous years; this difference was not significant: traumatologic surgery activity was maintained (Table 3).

The proportion of patients managed surgically was 6% in 2020, versus 3% previously.

The mean age of patients managed surgically was 7.9 years, versus 9.2 years previously ($p < 0.05$). The sex ratio was unchanged: 60% boys, 40% girls.

3.2.2. Typology of lesions managed surgically

Wounds were more frequent during lockdown, with 28 patients, or 35% of procedures, versus 13, or 13%, previously (Table 4).

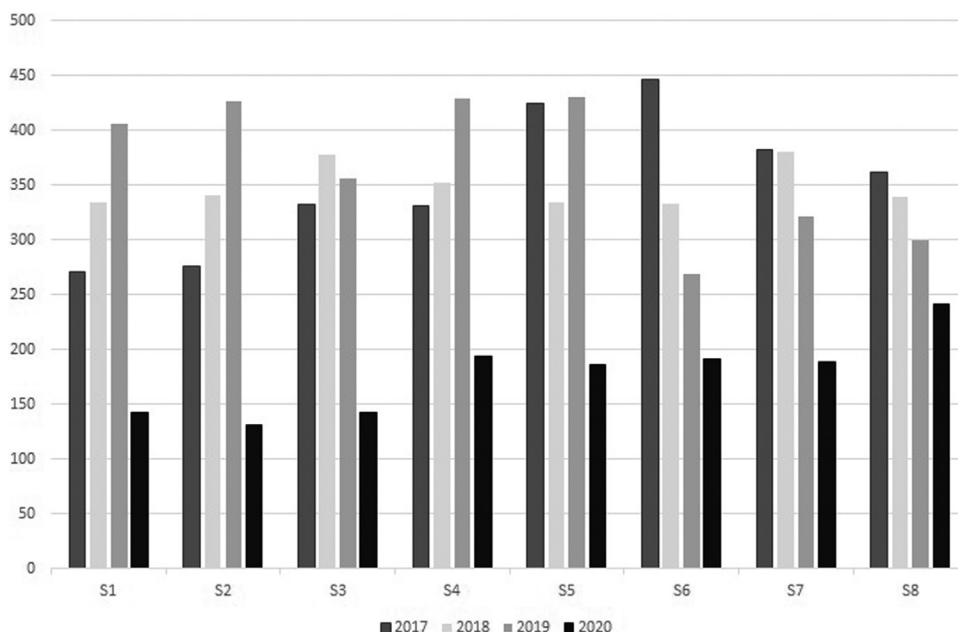


Fig. 1. Pediatric emergency traumatology consultations per week.

Table 2
 Patients treated surgically. Trauma causes under lockdown and in control period.

Period (n)	Domestic accident (%) ^a	Locomotion accident (%)	Trampoline accident (%) ^a	Sport accident (%) ^a	Other (%)
Lockdown (81)	46 (59%)	9 (11%)	13 (16%)	2 (2%)	11 (12%)
Control (281)	67 (23%)	52 (15%)	11 (4%)	68 (24%)	96 (33%)

^a Significant difference between lockdown vs. control ($p < 0.05$).

Table 3
 Epidemiologic data for surgery patients.

Year	Surgery cases (number)	Mean age (range)	Median age	Percentage of male patients
2020	81	7.6 years (1.4–17.6)	7.5 years	62%
2019	91	9.3 years (1.2–15.1) ^a	9.4 years	65%
2018	85	8.9 years (1.7–15.4) ^a	8.3 years	67%
2017	105	9.4 years (2–15.2) ^a	10 years	65%
Mean for control periods	94	9.2 years	9.5 years	66%
Percentage surgery lockdown/control	86%			

^a Significant difference between lockdown vs. control ($p < 0.05$).

Table 4
 Typology of lesions treated surgically.

	Lockdown	Control (average)
Total number of patients	81	94
Upper-limb fracture ^a	38 (48%)	65 (69%)
Lower-limb fracture	13 (16%)	16 (18%)
Wounds ^a	28 (35%)	13 (13%)

In 2020, 2 spinal fractures treated by internal fixation are not shown in the Table, but are counted, which is why the total number of patients is not the same as the sum of upper- and lower-limb fractures and wounds..

^a Significant difference between lockdown vs. control ($p < 0.05$)

Concerning fracture location, the number of upper-limb fractures was lower than previously (48% or 38 patients versus 69% or 65 patients; $p < 0.05$), while rates for lower-limb fracture were unchanged (16% or 13 patients and 18% or 16 patients, respectively; $p > 0.05$).

Wounds were caused by a broken window in 8 cases, broken crockery in 4, a knife in 5, a circular saw in 2, a bite in 2 and a sharp instrument in 5.

3.2.3. Fracture type

In upper-limb fracture, the number of distal forearm fractures decreased to 7 from 20 ($p < 0.05$) (Table 5). In the lower limbs,

Table 5
 Type of fracture managed surgically during lockdown and control periods (average).

	Lockdown	Control period (average)
Lower limb	13	21
Femoral fracture	8 (62%)	5 (29%)
Tibial fracture	1 (8%)	7 (41%)
Ankle fracture	1 (8%)	7 (41%)
Foot bone fracture	1 (8%)	1 (6%)
Foot-lawn mower	2 (15%)	1 (6%)
Upper limb ^a	39	61
Humeral supracondylar fracture ^a	16 (42%)	18 (27%)
Forearm distal quarter fracture ^a	7 (18%)	20 (30%)
Diaphyseal fracture of both forearm bones	4 (10%)	5 (7%)
Lateral condyle fracture	6 (15%)	5 (7%)
Epitrochlear fracture	2 (5%)	3 (4%)
Radial head fracture	1 (3%)	3 (4%)
Hand bone fracture	3 (8%)	4 (6%)
Humeral shaft fracture	0	1 (1%)
Elbow dislocation	0	2 (3%)

^a Significant difference between lockdown vs. control ($p < 0.05$).

distal tibial fracture decreased to 1 from 7, while femoral fracture increased to 8 from 5.

4. Discussion

The study hypothesis was not confirmed inasmuch as there was no significant decrease in the number of pediatric traumatology patients undergoing surgery during lockdown. On the other hand, there were changes in frequency, type and distribution of pathologies according to age during lockdown. Two pediatric series have so far been published regarding this exceptional situation [5], and several reports concerning adults. Zhu et al. [6] reported increased femoral fracture in the elderly during lockdown, and outlined preventive guidelines. Christey et al. reported a stable rate of fracture in the elderly, but with an increase in domestic accidents and falls at home [7], and called for measures to prevent risk of falls if lockdown were to be reintroduced. In children, this team from New Zealand reported a decrease in fracture, as in the present study. The other pediatric series reported a decrease in emergency consultations and an increase in the proportion of surgical outcome: 2.4% in 2018–2019 versus 8.4% in 2020 [8]. Nunez et al., in an epidemiological study of adult traumatology during lockdown in Spain, found no change in mean patient age [9], but a decrease in emergency consultations, with an unchanged rate of surgery; hospital admission

Table 6
Lockdown trends.

	Type of population	Number of emergency consultations	Number of emergency surgeries	Percentage of surgeries	Number of fractures	Number of domestic accidents
Bram et al. [5] Zhu et al. [6]	Pediatric Adult	↘		↘	↘ Unchanged for proximal femoral fracture	↗ ↗
Christey et al. [7]	Mixed	↘			Unchanged for proximal femoral fracture, ↘ for childhood fracture	↗
Peiro Garcia et al. [8] Nunez et al. [9]	Pediatric Adult	↘ ↘	Unchanged Unchanged	↗ ↗	Unchanged for proximal femoral fracture	
Present study	Pediatric	↘	Unchanged	↗	↘	↗

rates for surgery in emergency cases doubled with respect to the reference period, in agreement with the present results. However, this was an adult population, and Nunez et al. explained their findings by the decrease in road accidents and work accidents, which is not applicable in pediatric traumatology (Table 6) [9].

The present study found a 50% decrease in emergency consultation, probably due to interruption of sport activities and schooling, which were determining risk factors according to Naranje et al. [2]. Bram et al. reported a 2.5-fold decrease in fractures in children under lockdown [5], which they attributed to a considerable decrease in playground accidents and sports accidents; on the other hand, domestic accidents and cycling accidents increased, and they suggested guidelines for cycling in case of a second wave.

The number of cases requiring surgery remained high, suggesting that some children with minor trauma may not have consulted in emergency for fear of the epidemic. Peiro Garcia et al. also found no change in the number of surgeries compared to previous years (Table 2) [8].

Analysis of surgical cases showed that interrupting sport and schooling altered the types of trauma, with a clear increase in wounds.

Regarding fractures, epidemiological studies (not under lockdown) report a two-thirds rate of upper-limb fracture, with clear predominance of distal forearm fracture [1–4]; in the lower limbs, fractures are also most often distal [4]. We found the same results in our non-lockdown control population.

During lockdown, the most notable points were a decrease in distal forearm and tibial fractures. The most likely explanation is a decrease in running with the interruption of sport and school recreation, reducing the risk of forward falls and ankle torsion.

The sex ratio was unchanged under lockdown, at 1.5:1, or about 60% boys and 40% girls, as also found in the present control population and in the literature [1,2,4].

In regard to risk factors during lockdown, age is important. For surgical cases, mean age was 7.9 years during lockdown, versus 9.2 previously ($p < 0.05$). Likewise, Bram et al. reported mean ages of 7.5 and 9.4 years respectively [5]. This may be due to interruption of sport, which is a major source of trauma in adolescents [2]. Trampolines are associated with fractures in normal times, as shown by Joeris et al. [1]. In the present series, trampoline-related trauma was considerably higher under lockdown, and we would advocate a public information campaign for this risk.

The weak points of the present study are related to the novel situation for which the population was unprepared. In a second wave, behaviors may differ, affecting interpretation of the present findings. Moreover, our local region was less impacted by the epidemic

than others, and our pediatric structure was not obliged to take in adult patients.

Worldwide, during the pandemic, some teams advocated restructuring and changes in patient management [10]. Non-operative orthopedic treatments were preferred in some centers [11]. Precise pre-, intra- and post-operative management strategies were described [12], and indications for surgery were revised in favor of faster procedures with less blood loss. Some procedures were performed at the bedside, to limit transport and transfer [12]. In our center, it was not necessary to change practices in pediatric traumatology. A MeNTS score (for Medically Necessary, Time-Sensitive procedures) was developed by an American team to assess possibilities of deferral or cancellation of surgery, but could not be applied in our series, which consisted exclusively of emergency cases; moreover, it is a score based on an adult population [13].

5. Conclusion

The present study showed that, during lockdown, there was a 50% decrease in pediatric emergency traumatology activity, although the rate of surgery remained high. Trauma rates increased in younger children. Wounds and trampoline accidents were more frequent than previously.

These findings should help health authorities and scientific societies to draw up guidelines for pediatric emergency care in such particular situations.

In case of renewed lockdown, we recommend reorganizing emergency reception to free up teams for the reception of Covid-19 patients, while maintaining surgical capacity. We also advocate public information campaigns to prevent domestic accidents in young children and accidents related to trampolines without strict surveillance.

Disclosure of interest

The authors declare that they have no competing interest.

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Author contributions

Research, data acquisition and interpretation: M. Bolzinger, G. Lopin, R. Compagnon.

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Approval of submitted manuscript: M. Bolzinger, R. Compagnon, F. Accadbled, J. Sales de Gauzy.

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