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ORIGINAL ARTICLE

Retrospective study in clinical governance and financing system impacts of the COVID-19 pandemic in the hand surgery and microsurgery HUB center

A . Leti Acciaro[1] · S. Montanari[1] · M. Venturelli[1] · M. Starnoni[2] · R. Adani[1]

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Abstract

Introduction The authors presented a retrospective study in the surgical activity of the HUB center for Hand Surgery and Microsurgery in Emilia-Romagna comparing the data between March and April 2020, in the peak of Covid pandemic, with the same period in 2019.

Materials and methods During the two months period of March–April 2020 versus 2019 the authors analyzed the surgical procedures performed in elective and emergency surgery with hospitalization and Day or Outpatient surgery regime. Surgical treatments with no hospitalization were planned in the Day-Surgery Service. The financing system impacts were analyzed according to the Diagnosis Related Groups (DRG), the costs accounting method mostly used in European countries.

Results An overall reduction of 68.5% was recorded in surgical procedures, with a more relevant reduction of 92.3% in elective surgery and a significantly less relevant reduction of 37.2% in urgent one. Replantation did not present a reduction in number of cases, while cutting lesions of tendons at the hand and fingers increased such as the bone and ligament injuries during domestic accidents. The negative impact in the financial system recorded a reduction of 32.5%.

Discussion The epidemiology of hand trauma looks not only at the artisanal and industrial injuries, but also mostly at the accidents in daily life activities. The data of the study evidenced the significantly increase in the injuries occurring in the domestic environment. Elective surgery was canceled. The 86% of surgical procedures performed were urgent ones and the 72.8% of these were possible in Day and Outpatient surgery with significantly reduction in hospitalization. All procedures followed a rigid process for patient and healthcare workers with regard for personal protection and safety. Telemedicine was arranged in emergencies, and economic damage was analyzed also in the following rebound effect during summer period.

Conclusions The significantly less reduction recorded in urgent surgery vs the more relevant reduction in elective one showed how the hand injuries remained a major issue also during the lockdown. The data highlighted the relevant role of the organizational aspects of the surgical procedures and planning in hand trauma. Despite the financial impact of the elective surgery, the presence of a functional and skill Emergency Service and Day-Surgery Service resulted fundamental in the efficacy and efficiency of the patient management and in containment of economic damage. The telemedicine was significantly limited by liability and risk management issues.

Keywords COVID-19 · Hand surgery · Epidemiology · Coronavirus · Telemedicine

Introduction

The first hospitalized severe case of Covid-19 in South-Lombardia was confirmed by test result on Thursday night the 20th of February, with symptoms starting the 16th, and in less than three days the coronavirus has spread quickly also in the neighboring North-East of Emilia-Romagna. In Modena, the first patient, working in the hotbed of contagion in Lombardia, was confirmed on Sunday the 24th of February with symptoms starting on the 19th. The outbreak area

✉ A . Leti Acciaro
andrealetiacciaro@libero.it

[1] Department of Hand Surgery and Microsurgery, Azienda Ospedaliero Universitaria Modena, Largo del Pozzo, 71, 41125 Modena, Italy

[2] Department of Plastic Surgery, Azienda Ospedaliero Universitaria Modena, Largo del Pozzo, 71, 41125 Modena, Italy

in Lombardia was isolated and people are not allowed to enter or leave it, on the other hand the Governor of Emilia-Romagna, together with the Health Minister and the others neighboring Governors, took an immediate lockdown of the Region, along with previous closure of schools and universities since to the social and work lockdown on Monday 3 March. On this base, the emergence of Covid-19 pandemic has severely affected not only the medical treatment protocols but also the epidemiology and incidence of the trauma and diseases, because of the relevant modifications both in working and daily activities, and in contagion of healthcare workers and patients. The various technical committee of specialists defined and constantly upgraded specific protocols to ensure the safety of patients and healthcare staff during the spreading of the pandemic. Guidelines were enacted in terms of preoperative screening, according to aerosol generating maneuvers, or admitting screening to emergency or operative rooms, such as social distancing and personal protective devices, waiting areas before hospitalization and Covid areas for hospitalization or treatment of positive patients [1]. The majority of upper extremity injuries reported in literature occurs at home (45.4%), while 16.2% are work-related. Other common sites are school (6.6%), other public property (4.1%) and street (2.5%). However, a substantial number of locations was not recorded (25.1%) [2, 3]. According to the Hub and Spoke in the Emergency/Urgency System, in Italy the microsurgery and surgery of the hand are organized in referral centers available 24 h a day for three million people on average. Thus, meaning a referral Center for each Region in the North of Italy. The Hand Surgery and Microsurgery Complex Structure of Modena represent the HUB Center in Emilia-Romagna, operating more than 4000 cases/year. Telematic solutions allowed for a remote diagnosis and assisted treatment of patients through telecommunication technology. Nevertheless, important limitations in telemedicine approach were found due to inexperience in this field the Hub Center have identified the potentialities of telemedicine application in emergency network [4].

Materials and methods

The authors performed a retrospective study of the activities according to epidemiology, organization models and financial system during the months of March and April 2020 in the peak of Phase 1 of Covid pandemic in Italy, comparing the data with the casuistry of the same period in 2019 and considering the summer time rebound in economy. All elective surgery was deleted, but the admission to the dedicated Emergency Service and the treatment of emergencies and urgent patients were guaranteed for the entire period with drastic measures to limit contagion. The admission to the Emergency Service was limited to the patients without visitors, except for one genitor for minors, and all were checked for temperature, symptoms and risk factors. All personnel wore N95 mask and glasses and the patients wore surgical mask at all time. In case of suspected contagion, the staff wore all the specific personal protection measures put in place by the infection control department. In urgent patients needing hospitalization, surgical treatment was planned within few days following the necessity to perform Covid serology and Covid swab 24 h before surgery. In the regional Hub and Spokes network management, the visual information of Telemedicine system allowed the decision to keep or postpone the transferring or to perform the appropriate treatment in the spoke center, avoiding unnecessary transferring. In event of an emergency the serology and swab (response within three hours) were performed immediately before surgery, allowing the following hospitalization in Covid or Covid free area. The financing system of health care in many European countries and in Italy is based on Diagnosis Related Groups (DRG). All treated patients are classified into groups which calculate the costs for the payer (the central national level) and the benefits for the hospital in a similar manner.

Results

The retrospective analysis of the two months period of March–April 2020 versus 2019 (Table 1) showed a general reduction in surgeries of 68.5% (171 vs. 543) with a more relevant reduction of 92.3% in elective surgery (24 vs. 309). The reduction in urgent surgery (147 vs. 234) was significantly less relevant, amount 37.2%. The 86% of surgical procedures performed were urgent ones and the 72.8% of these were possible in Day or Outpatient regime. According the typology of lesions, the general reduction was not reported in the cutting tendon injuries, increased of 24% (31 vs. 25), and in the replantation (4 vs. 4). However, the partial or total amputations decreased of 47.6%, but 80% of these were related to circular saw injuries mainly from the mountain districts. On the same base, the overall access to hand trauma Emergency Service decreased 60.1% (449 vs. 1126) such as the emergencies requiring immediate hospitalization (12 vs. 32). In addition, two non-avascular complex lesions were treated in the spoke centers of the declared high infected red-areas of Piacenza and Parma without transferring of the patients to the HUB of Modena, and one patient with digit avascular lesion refused to be transferred to Modena. The Telematics interfaces and efforts allowed to detect and manage in the Spokes of the high infected regional red-areas almost 6 digital amputation without indications to replantation. According to the DRG mechanism of health care financing, the overall reduction in revenues at the end of the lockdowm was 32.5% respect the same data in

Table 1 Highlighting of the more significant data compared in the two months March–April 2019 and 2020

Type of Surgery		2019 (number of patients)	2020 (number of patients)	Comparison between 2019 and 2020 (%)	urgencies/ total (number of patients) in 2020	(%)	urgencies in day-service/total urgencies (number of patients) in 2020	(%)
Elective	Hospitalized	168	18	- 89,3%				
	Day-service	141	6	- 95,75%				
	subtotal	309	24	- 92,3%				
Urgency	Hospitalized	100	40	- 60%				
	Day-service	134	107	- 30,15%			107/	72,8%
	subtotal	234	147	- 37,2%	147/	86%	147	
Total		543	171	- 68,5%	171			
Specific type of injuries	Tendon injuries	25	31	+ 24%				
	Replantation	4	4	=				
	Subtotal Amputation	21	10	- 47,6%				
Emergency room accesses		1126	447	- 60,1%				
	Hospitalized emergencies	32	12	- 62,5%				
	Complex lesions not transferred	0	3					

2019, distributed, respectively, in 36.3% in the accommodation regime and 23.6% in the daily regime. During the following summer time period a rebound effect in revenues was recorded because of the reduction of only 14.5% in daily surgery. The incidence in costs/revenues was 0.15 before and during the lockdown because of reduction of both surgical procedures and consumables, and decreased to 0.12 in the following period.

Discussion

As highlighted also by the WHO organization, the incidence of hand and upper limbs trauma looks not only at the traditional field of artisanal and industrial injuries, but also to the most relevant accidents in the daily life activities [2]. The data resulting from the study are not unexpected. The significantly less reduction recorded in urgent surgery (−37.2%) respect the more relevant reduction in elective surgery (−92.3%) shows how the hand injuries remain a major issue also during the lockdown. Also, the extrapolation of specific data, according to the epidemiology, evidenced the significantly increase of the injuries occurring in domestic environment such as tendons cutting at the hand and fingers (+ 24%) or trauma during fitness activities in the house [5, 6]. The lockdown reduced the trauma related to traffic, working accidents, artisanal, industrial and forest related trauma. The more relevant reduction of emergencies (−62.5%) and urgent patients' hospitalizations (−60%) and the majority of surgical procedures in the Day-Surgery Service (72.8%) were related to a less severity in injury due

to the recurring of trauma in low threatening environments. On the other hand, children founded alternative and did not frequent usual places to play, with following unusual and infected [7, 8] wounds (Fig. 1). Despite the reduction of partial or complete amputations, the replantation did not have any reduction because of the transferring of three patients from Trentino following circular saw injuries. The network of the microsurgical emergencies suffered the closure of the borders (Innsbruck) and the unavailable private hospital of Veneto. Circular saw injuries occurred in 80% of the partial or complete amputations due to the increase of domestic hobbies and chopping wood from mountain districts and neighboring Regions.

In Telematic efforts, the utilization of the most popular social platforms was spontaneously emphasized in personal working in network from the same region or closer ones. The telemedicine may be used in order to facilitate the remote use of medical skills where the need arises and to optimize healthcare resources, but is mandatory the regulation by healthcare organizations for legal, ethical, medico-legal and risk management aspects [9, 10]. The districts of the same city just have common software and hardware in transmitting data. On the other side, in patients requiring transferring which could be served via telemedicine, certification of platform security in terms of privacy and data transmission matters is not available.

According to the organizational model, the Emergency Service and Day-Surgery Service of the HUB Center permitted a prompt and excellent response to the Covid emergency. A dedicated structure at the ground floor with easily and direct access and large spaces offered the possibility of a safe pre-admission triage and social distancing in the waiting room. There were two emergency rooms for separated visiting and conservative treatment of the trauma. Three operative rooms with a preoperative anesthetist room and postoperative room (Fig. 2). All these allowed the surgery in Day or Outpatient surgery in the 72.8% of the urgencies, both in local and wide-awake anesthesia or brachial plexus block. The use of a cartoon implemented the possibility of brachial plexus and local anesthesia also in children [11]. The protocol defined with the technical committee avoiding swab and serology in local anesthesia in patients without symptoms and suspected anamnesis allowed reduction in waiting time for the planned surgery in Day-surgery and Outpatient regime. Two suspected emergencies for Covid were operated on in the ordinary operative room with high level of personal protective devices. Following hospitalization, was in a Covid area for the patient with confirmed positive Covid test, while others exhibiting a negative test were placed in the Covid free area. Two patients treated in day-service developed a positive Covid test few days later and all the healthcare workers of the Day-Surgery Service underwent to serology screening. Only one nurse of the day-service developed during the two months, did not have severe a Covid infection. The overall surgical activities reduction of 68.5% of the Hand Surgery Center resulted less relevant than the 75.5% of the Orthopedic Center (referral provincial Center for pediatric limbs injuries) because of the higher access of hand and wrist emergencies/urgencies, which represented the 86% of the total surgical procedures of the HUB Center in the two months of 2020. A small percentage of elective surgery was related only to oncologic patients, with benign inflammatory or expanding tumors or suspected tumors, severe nerve compression or irritation [12–16] and planned removal of external or internal devices and tenolysis for rehabilitation program [17].

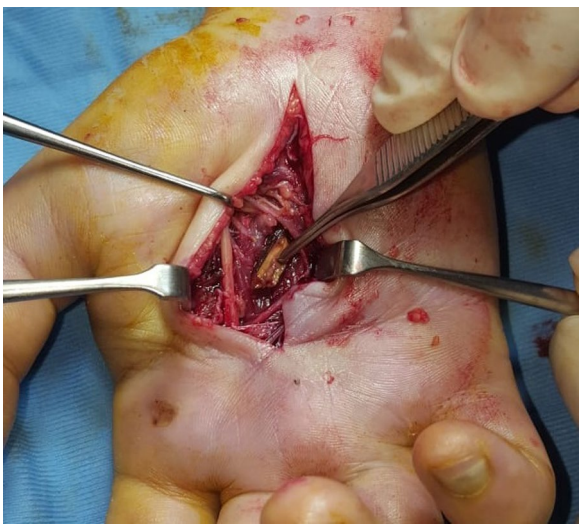

Fig. 1 Intraoperative findings in children with infection at the hand following wound and retention of a reed from stagnant water

The economic damage during the two months of lockdown was related mainly to the reduction in ordinary surgery. During the following summer period, the restart of activities had a rebound effect mostly recorded in the implemented daily setting of the Day-Surgery Service. The ordinary accommodation regime had quite the same percentage in reduction of 36.1% instead of the relevant recovery of the daily surgery with only the 14.5% of reduction. Also the incidence costs/revenues decreased from 0.15 to 0.12 due to the daily setting surgery.

Conclusions

The data recorded in this retrospective study showed a central role for the Hand surgery and Microsurgery HUB Center also during the lockdown. On the other side, this is also the limit of the study because many papers just recorded how is not surprising this matter, because of hand injuries derive from a wide range of trauma from various

Fig. 2 Hand surgery day-service with dedicated emergency room and operative rooms

environments of daily living, working and playing activities. However, despite general reduction, of activities, is important to remark how the Emergency and Day-Surgery Services of Hand Surgery maintained their relevant role and efforts also into a Pandemic event. In the overall crisis, the network for the management of microsurgical lesions transferring in the north of Italy, the Hub Center of Emilia-Romagna supported also the neighboring Regions. The average gravity of the admitted injuries was fortunately less severe than the work and traffic related ones. But not significantly less relevant in term of cases and efforts. The presence of a functional and skill organization, affined through the years, of a dedicated emergency service and day-service resulted fundamental in the efficacy and efficiency of the patient management during the phase1 Covid emergency. The 86% of the surgical procedure were dedicated to urgency/emergency and the 72.8% of these were possible in the day-service, with prompt response and reduction of contagious risks for patients and staff. The role of Telemedicine was fundamental to assess a close collaboration between the Hub Center and the Spoke Centers for the management of non-critical patients, but it involved different technical problems. Detailed traceability of operators' activities might be a risk management task such as verifying accurate training to limit possible medical error or misunderstanding. Diagnostic and/or therapeutic errors can be related to data and privacy protection and informed consent [18–22]. The retrospective analysis highlighted not only the mandatory role of drastic protocol in admission and treatment of the patients during the Covid pandemic, but also the relevant role of the organizational aspects of the surgical procedures in a daily setting in hand trauma. The implementation of the Day-Surgery Service played a relevant role in health financial care. On the other hand, the Covid pandemic exacerbated all the critical points regarding the still weak regional HUB and Spoke system and national Network of emergency/urgency system.

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Compliance with ethical standards

Conflict of interest The authors declare that they have no competing financial interests or could have appeared to influence the work reported in this paper.

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Consent to publish Not applicable.

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