



## Ambulatory hand emergency: 2 years-experience in an public university hospital center

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Hand emergencies represent the most frequent traumatic injuries and outpatient surgery is still improving. It will achieve 70% of total surgeries by 2022.

Our hand trauma center has been able to set up an emergency day surgery department in a university hospital center.

With this article, we would like to report the ambulatory care management and practice for hand emergencies in our university hospital center over 2 years. 892 patients suffering from hand traumas and managed in our day surgery department, were retro-spectively reviewed between January 2016 and December 2017. Patients' demographic data, anesthetic data, trauma's circumstances, medical care and surgical outcomes have been disclosed. A descriptive analysis and a statistical assessment was realized.

Cut injury was the most recorded case, followed by impactions. Tendon injuries were the most frequent (32%), followed by fractures (26%), and exposed joints (18%). 13% of injuries were nil findings. Average patient care delay was 1.16 days. Mean of hospitalization was 7.5 hours. 16/892 patients needing intravenous antibiotics required hospitalization. 41 complications including 27 secondary surgeries were reported.

Hospital facilities are forced to reassess their entire procedures to achieve efficiency and improvement for healthcare. Progress in outpatient surgery permits emergency management in hand surgery, improving patient cares both medically and economically.

**Keywords :** hand emergency ; public ; outpatient ; traumatology ; hand surgery.

## INTRODUCTION

Hand trauma represents the first consulting cause in emergency department with a frequency of 2.142.393 hand traumas per year (1). An initial optimal patient care leads to a decrease of both public health costs and trauma consequences (2,3).

Since 1979, the hand emergency department federation (FESUM) operates and accredits the emergency centers in order to improve patient care in hand traumas. In 2019, 65 centers were certified "Emergency center" (aka "SOS main" in French), providing an optimal patient care day and night for hand traumas (4).

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Currently, the French health care system has to decrease its costs and increase its efficiency. In this regard, development of outpatient surgery is essential.

Global activity of outpatient surgery is improving in France : it accounted the 32.3% in 2007, the 37.7% in 2010 and the objective is to reach 70% by 2022 (5).

In most cases, Hand surgery permits an ambulatory care. In order to allow this patient care, a Resident on-call for hand emergencies, guided by a Senior Hand surgeon, is able to take care of patients upon their arrival.

Through an initial specialized clinic exam, resident in hand surgery can coordinate patient's care in the ambulatory department. The responsible Resident and Senior surgeon, after proper medical cares, will be in charge of the patient's follow-up. In this optic, the patient will be received by the same medical staff, and residents will improve their medical education.

In addition, the development of a "delayed hand emergency" department is achievable within a university hospital center (UHC) in order to reduce the emergency flow and improve patient's care.

We would like to report a retrospective epidemiologic study of the ambulatory care management for hand emergencies in our university hospital center over the first 2 years.

## MATERIAL AND METHOD

We performed a retrospective observational study on hand emergency patients treated within the new outpatient hand emergency department at Charles Nicolle UHC (Rouen, France) between the 26th January 2016 and the 31st December 2017. Patients undergone surgery during a dedicated outpatient surgery vacation, from Monday to Friday.

The study involved adults over 16 years old with eligible hand trauma for an ambulatory care. Exclusion criteria were : patients under supervision or guardianship, with pathologies requiring hospitalization (revascularization, open and complex fractures, deep infections and/or clinical contests requiring intravenous antibiotherapy, polytrauma patients.

The following parameters were collected :

- Demographic data : age, gender, dominant hand, employment sector
- Trauma parameters : date, number of fingers impacted, location, injury mechanism, type of accident (workplace or domestic accident)
- Patient medical history : ongoing antiplatelet treatment or anticoagulant treatment
- Patient anesthetic characteristics : physical status score (PSS), anesthetic procedure
- Surgery procedure : delay and duration of surgical procedure, number of lesions, surgical gesture performed, tourniquet duration and need, need for fluoroscopy or microsurgery equipment
- Postoperative care : analgesic treatment, antibiotic therapy, immobilization, rehabilitation, duration for cessation of work, delay to postoperative consultation, patient discharge procedure
- Postoperative complications : secondary surgery, surgery complications or anesthetic complications, leading to a standard hospitalization

Statistical review has been performed by the biostatistics service of our UHC. One analysis was performed through binomial exact test and additionally analysis of complications was performed through student's test.

## RESULTS

Over this 2-years period, 892 patients have been included in our study, 8 have been excluded. Population studied included 909 surgical hands, 17 patients undergoing bilateral surgery.

Average age of patients was 38.3 years old (min : 16 ; max : 97 ; DS : +/- 16.2). 5.9% of patients were minors (n= 52/892). Gender ratio was men :women = 3.6 :1. 90.4% of total patients were right handed (n=807/892). The dominant hand was involved in 49.4% of total cases (n=440/892).

Among 892 patients, 52.4% (n=467/892) were manual workers. Workplace accidents occurred in 32.7% of total cases (n=290/892).

In two-third of total cases, the trauma was related to a cut injury (n=548/892). Fractures accounted for 26.1% of total cases (n=233/892).

Lesions facing a joint were predominant with 70% of total cases (n=624/892), as well as the palmar lesions in 49.7% of total cases (n=442/892).

Table I. — Overview of trauma mechanisms

Mechanism	Cases N (%)
Cut	548 (61,4)
Fracture	233 (26,1)
Crushing	97 (10,9)
Tearing	54 (6,1)
Sepsis	53 (5,9)
Foreign substance	26 (2,9)
Bite	24 (2,7)

Table II. — Location of trauma

Location	Cases N (%)
Palmar	443 (49,7)
Dorsal	320 (35,9)
Facing joint	624 (70)
Multiples	129 (14,4)
I	221 (24,8)
II	239 (26,8)
III	176 (19,7)
IV	174 (19,5)
V	178 (20)

129 patients showed multiple wounds. The index was affected in 26.8% of total cases (n=239/892).

Data are summarized in Table I, II.

10 patients were under antiplatelets, 3 under oral anticoagulant treatment. No stopping and no relay treatment was required during patient care.

84% of patients classified as ASA 1 (n=752/892), 14% as ASA 2 (n=127/892) and 1.5% ASA 3 (n=13/892) ; no patient was classified ASA 4.

98.9% of total patients have been through surgery under Loco-regional anesthesia (LRA) (n=882/892), 10 under local anesthesia (LA) and 5 under general anesthesia (GA) following an LRA failure. For 5 patients, anesthesia procedure was multimodal : 3 patients benefited from a GA after LRA and 2 patients benefited from a LA after LRA (bilateral damages).

The average patient care delay was 1.16 days (DS : +/- 0.96).

The maximum waiting period before surgery was equal to 14 days (5<sup>th</sup> metacarpal fracture with secondary displacement).

The average surgery duration was equal to 27min (min : 3min, max : 139min). The tourniquet was needed in 95% of total cases (n=846/892) during

Table III. — Panorama of discovered lesions

Type of lesions	N (%)
Tendon damage	288 (32,3)
Osteoarticular damage	255 (28,6)
Sheath opening	162 (18,2)
Articular exposure	160 (17,9)
Nerve damage	133 (14,9)
No lesions findings	115 (12,9)
Soft tissue defects	100 (11,2)
Sepsis or Abscess of soft tissues	48 (5,4)
Arterial damage	47 (5,3)
Paronychia	22 (2,5)
Phlegmon	9 (1)
Arthritis	8 (0,9)

26min in mean, with a maximum duration of 139min.

All discovered lesions and related surgery procedures are further detailed in Table III.

The average hospital stay was 7.5hours (DS : +/- 0.9).

Analgesics of level 1 have been prescribed for all patients (100%) ; analgesics of level 2 for 98.6% of total patients (n=880/892). No patient was discharged with analgesics of level 3.

56,3% of patients received post-operative antibiotics.

Return to work in mean after 23.06 days (maw : 90 days).

The average delay of the first follow-up of 9,89 days (DS : +/- 6.53), in 772 patients (86,5%).

In 82% of cases (n=94/115), nil findings did not consult after surgery.

1.9% of total patients (n=17/892) were discharged benefiting of a medical transportation (light health vehicle or ambulance).

2% of patients required a hospitalization (n= 18/892) within conventional sector after surgery, either for setting up an intravenous antibiotic therapy treatment or due to anesthetic effect (pain, cardiac dysrhythmia).

Complications were found for 4.6% of total patients (n=41/892) and are detailed in Table IV. A revision surgery was needed in 3% of total patients (n=27/892).

A subgroup analysis (Table V) allowed us to discover that the group showing complications was

Table IV. — Recorded complications

COMPLICATIONS	NUMBER	REVISION SURGERY	TYPE OF REVISION SURGERY
<b>SECONDARY DISPLACEMENT</b>	4	3	
<b>TENDON</b>	9	8	
<i>Suture elongation</i>	3	3	
<i>Stiffness</i>	5	4	<i>Tenolysis</i>
<i>Boutonniere deformity</i>	1	1	<i>Arthrolysis</i>
<b>SKIN</b>	6	3	
<i>Necrosis of skin flap</i>	3	2	<i>Necrosectomy and full thickness skin graft, Amputation</i>
<i>Retracted scars</i>	2	1	<i>Z-plasty</i>
<i>Skin graft lysis</i>	1	0	
<b>NAIL</b>	2	2	
/	1	1	<i>Ingrown nail surgery</i>
<i>Nail regrown following trans-P3 regularization</i>	1	1	<i>Matrix sterilisation</i>
<b>REGIONAL PAIN SYNDROME TYPE I</b>	8	0	
<b>GRANULOMAS</b>	4	4	
<b>NEUROMAS</b>	2	1	
<b>PSEUDARTHROSIS</b>	1	1	<i>Pseudoarthrosis cure</i>
<b>INFECTION ON IMPLANTED MATERIALS</b>	5	5	
<i>Chronic infection with osseous exposition</i>	1	1	<i>Amputation</i>
<i>Septic arthritis on materials</i>	3	3	<i>Materials retreat</i>
<i>Osteitis on materials</i>	1	1	<i>Materials retreat</i>
<b>TOTAL</b>	41	27	

epidemiologically targeting an older population (mean : 38 years old vs 42.9 years old ;  $p=0,05$ ) and more frequently female gender (39% vs 20% ;  $p=0,05$ ). No difference between the 2 groups was found related to the lesions location. Crushing traumatic mechanism was more frequent in the group with complications (31% vs 9.8% ;  $p=0,00005$ ). Flap surgery type was more frequent in the group showing complications (29% vs 10% ;  $p=0,0001$ ).

On anesthetic level, there was no difference between the 2 groups for the levels ASA 1 and 2, but most likely a trend for the ASA 3 with 4.8% within the group with complications vs 1% for the group without complication ( $p=0,06$ ).

## DISCUSSION

Our study is mostly composed of young adult men and manual workers, according to literature reviews related to hand traumas (6,7). Workplace accidents occurred for one third of patients similarly to Dubert and Angermann's series (7,8).

For this population, an inappropriate initial patient care can lead to heavy professional and social consequences. An initial optimal patient care is therefore needed (2,3), because unfortunately hand wounds are still too often disregarded (9).

In our sample, we discovered only 12.9% of "nil findings" hands (without any specific lesion). This shows the quality of primary clinical examination. Consequently 87.1% of all patients showed lesions requiring a specialized surgery care. This ratio strengthens the consensus established by the scientific groups (Hand Emergency Department Federation (FESUM), National Society of Emergency medicine (SFMU)), supporting the need of exploration under surgical procedure of every palmar hand and dorsal facing joint wounds (10-13). This ratio also supports the value of a quality initial clinical examination, that in our cases is conducted by formed residents in hand surgery. This number differs significantly from Dubert's series with « nil findings » occurring in more than 50% of operated cases over 8 days (7).

Table V: Analysis of complications

	Group without complication (n=851)	Group with complication (n=41)	
Age	38 (+/- 16) year old	43 (+/-15) year old	<i>P=0.05</i>
Gender ratio (M/F)	675/176	25/16	<i>P= 0.005</i>
Delay before surgery	1.17 days	1.12 days	<i>P= 0.76</i>
Palmar surface injury	418/851	25/41	<i>P=0.14</i>
Flap surgery	88/851	12/41	<i>P=0.0001</i>
Anesthetic score :			
– ASA1	719/851	33/41	<i>P=0.49</i>
– ASA 2	121/851	6/41	<i>P=0.94</i>
– ASA 3	11/851	2/41	<i>P=0.06</i>
Anticoagulant	28/851	2/41	<i>P= 0.82</i>
Antiplatelet	50/851	0/41	<i>P=0.31</i>
Mechanism			
– Cut	529/851	19/41	<i>P=0.04</i>
– Tearing	50/851	4/41	<i>P=0.31</i>
– Crushing	84/851	13/41	<i>P&lt;0.001</i>
– Fracture	219/851	14/41	<i>P=0.23</i>
– Bite	22/851	2/41	<i>P=0.37</i>
– Foreign substance	24/851	2/41	<i>P=0.44</i>
– Sepsis	49/851	4/41	<i>P=0.29</i>
Finger			
– Thumb	211/851	10/41	<i>P=0.9</i>
– Index finger	225/851	14/41	<i>P=0.36</i>
– Major finger	171/851	5/41	<i>P=0.21</i>
– Ring finger	163/851	11/41	<i>P=0.22</i>
– Little finger	170/851	8/41	<i>P=0.94</i>
Mechanism			
– Cut	529/851	19/41	<i>P=0.04</i>
– Tearing	50/851	4/41	<i>P=0.31</i>
– Crushing	84/851	13/41	<i>P&lt;0.001</i>
– Fracture	219/851	14/41	<i>P=0.23</i>
– Bite	22/851	2/41	<i>P=0.37</i>
– Foreign substance	24/851	2/41	<i>P=0.44</i>
– Sepsis	49/851	4/41	<i>P=0.29</i>
Operative revision:			
– Phlegmon	9/851	0/41	<i>P=0.5</i>
– Arthritis	8/851	0/41	<i>P=0.5</i>

The daily flow of “hand emergencies” patients (15 to 30% of emergency surgeries) (7,14), couldn’t be managed by our center through the only traditional emergency department. This system allows us to practice surgery the following day after their initial consultation, in most of cases, avoiding an undue bed occupancy the day before surgery and the night later. This point permit to improving the efficiency of patient care (13).

In addition, before the establishment of this new management protocol, hand trauma patients

were hospitalized while waiting for surgery in emergency operating rooms, which were frequently fully occupied by emergencies related to other specialties. This pushed backwards hand traumas into last positions on the waiting list, with a delay that might be extended to 24 up to 72 hours. Unfortunately, this old procedure is sometimes still conducted during weekends where patients are initially sent to the general emergency department. However, during weekend, the possibilities to reconvene patients for Monday ambulatory surgery

timeslot is previewed simplifying patient's care procedures. The success of a rapid and efficient management in an ambulatory department is based both on a specific dedicated organization as well as on surgery/anesthetic cooperation (15). This ambulatory management is common within private structures. Creation of such a structure within a public hospital was only possible thanks to the will and coordination of various actors. Junior doctors are essential in every step of hand patient care (preliminary exploration, pre- and post-operative consultations, surgical intervention) and this system allows a quality training for future hand surgeons.

In our study, the age of the population was not a limited factor for outpatient care : 65 years old patients accounted for 7.5%, including the oldest patient of 97 years. According to the SFAR (French Society of Anesthesia and Reanimation), old age does not represent a contraindication to outpatient treatment as aged patients' population is expected to rise (16,17). In addition, with a specific interest in elderly, outpatient care also seems to reduce impact of postoperative behavior disorders compared to a conventional hospitalization (15).

Postoperative analgesia remains the keypoint of unscheduled outpatient care for patients, especially in orthopedic surgery and hand surgery (18,19).

In our study, we haven't noticed any readmission or emergency consultation for postoperative pain. The systematic association of analgesics of level 1 and level 2 effectively reduce postoperative pain and consequently increased satisfaction rate on patients (20), thus, we believe that prescriptions of postoperative analgesics level 1 and 2 should be immediately delivered after examination at the emergency department (ER), in order to increase compliance and patients' satisfaction (21).

According to literature (7) septic hand wounds can be managed in an ambulatory mode. Only abscesses, simple arthritis and early stage were admitted in outcare patient care. The most serious infections were hospitalized in conventionnal department. We manage perioperative antibiotic treatment relying on the consensus of the SFAR (French Society of Anesthesia and Reanimation) emanating from extrapolations from orthopedic surgery and Dumontier (22,23).

Thus all surgery needing material implantation (resorbable or non-resorbable) or arthrotomy benefited from 2g Cefazolin or Clindamycin in case of allergies as antibiotic prophylaxy. This work shows us a surprescription of antibiotics. We since have been very cautious not to overprescribe antibiotics treatments in order to limit the emergence of resistant bacterial strains (24,25). In this study, we had 0,56% (n=5/892) of septic complications, not far from global rates found in literature (22). We noticed that crushing mechanisms, most of all leading surgeons to practice flap surgery, in order to cover soft tissue defects, were strongly associated with septic complications. Therefore, patients undergoing surgeries with major skin contusion as well as ones requiring flap surgery, were early examined at day 2.

Outpatient surgery presents lower costs compared with conventional hospitalization, because of absence of overnight stay. In the last two decades, public authorities have encouraged healthcare organizations to increase the outpatient surgery activity, especially since the 2010 hospital instruction law (25). For economic considerations it is not surprisingly that UK surgeons realize the 80% of surgeries through outpatient protocols (26,27). In contrast public French hospitals are in late on ambulatory health care.

## CONCLUSION

This study demonstrates that a top-quality and a rapid outpatient care of hand emergencies is achievable in a public university institution, under the conditions to have sufficient resources as dedicated structures and a multidisciplinary involvement.

Hospital facilities are forced to reassess their entire procedures towards the double objective of efficiency and improvement on healthcare. Progress in outpatient surgery permits emergency management in hand surgery, improving patient cares both medically than economically.

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