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Traumatic wounds to the hand and wrist treated at Brazzaville University Hospital

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Abstract

Introduction: Traumatic wounds to the hand and wrist are the result of physical aggression in developing countries. The objective of our study was to evaluate the functional outcomes of primary surgical repair of traumatic hand injuries.

Materials and Methods: Our study was retrospective cross-sectional, conducted from January 1, 2018 to August 31, 2023. It included 49 adult patients treated surgically for traumatic wounds of the hand and wrist by the Traumatology-Orthopaedics Department of the Brazzaville University Hospital. It excluded unusable files. The lesions were classified according to the International Federation of Societies of Hand Surgery. Round tendons were repaired either by modified Kessler points and flat tendons by U-shaped points. Bone lesions were stabilized by osteosynthesis. The functional assessment of the treatment was made by the criteria of Whites and Boyes.

Results: 42 male and 7 female patients were collected. The mean age was 25.21 years (range 18 to 56 years). Eight patients (16.32%) were regular smokers. The traumatic circumstances were assault in 41 cases (83.67%), work-related injury in 6 cases (12.25%) and domestic accident in 2 cases (4.08%). The right limb was injured in 37 cases (75.51%). The mean time from injury to hospital admission was 3.67 hours (range: 1 to 17 hours) and the mean time from admission to treatment was 4.23 days (range: 0 to 7 days). The lesions were mainly located in zone V of the flexors (26.53%) and zone VII of the extensors (24.49%). The mean time to follow-up was 12.4 months (range: 7 to 19 months). Functional recovery was mostly good. Complications were residual pain in 4 cases.

Conclusion: Traumatic wounds are frequent and severe. Our series found mostly good functional results.

Keywords: Hand wounds, physical aggressions, surgery, function

Introduction

Traumatic wounds to the hand and wrist are common emergencies. As the hand is the most commonly used functional organ in everyday life, it is frequently exposed to trauma. The frequency is estimated to be approximately 15% of surgical emergencies received per year^[1, 3]. In France, it is estimated at 600,000 cases out of 1,400,000 hand injuries per year^[4]. They are the result of accidents at work in one third of cases and accidents in everyday life in two thirds of cases^[5]. In both the Democratic Republic of Congo and the Republic of Congo, the frequency of these traumatic wounds has been increasing since the 2010s^[6, 7]. This is due to a phenomenon of aggression in the neighbourhoods by young delinquents using machetes, knives and other sharp bladed weapons, called respectively "kuluna" and "black babies". The hand is made up of noble elements such as tendons, blood vessels, and nerves that make traumatic wounds serious. Initial surgical management must be of high quality in order to avoid sequelae and reduce social and occupational consequences^[8]. The quality of the initial treatment makes it possible to reduce the duration of sick leave and the total cost of care. The surgery here is a so-called functional surgery aimed at restoring manual and active workers. The objective of our study was to evaluate the functional outcomes of primary surgical repair of traumatic hand injuries.

Materials and Methods

Patient Selection and Criteria

Our study was retrospective, cross-sectional, conducted from January 1, 2018 to August 31, 2023. It included adult patients treated surgically for traumatic wounds of the hand and wrist by the Traumatology-Orthopaedics Department of the Brazzaville University Hospital. It involved 49 patients. A pre-established data collection grid was used to identify the following variables: age, sex, dominant hand, occupation, comorbidity, type of accident, nature of the lesion, lesional topography, associated lesions, therapeutic protocol, time to healing and bone consolidation, joint amplitudes, functional sequelae. The lesions have been classified according to the International Federation of Societies of Hand Surgery [9, 10]. Unusable medical records were excluded from our study. An X-ray of the hand or wrist was ordered as indicated.

Surgical techniques

Patients were operated on in the emergency room after general anesthesia or plexic block of the thoracic limb. They were placed on an ordinary table in the supine position, with their injured hand on a table. The traumatic wound was enlarged in a zigzag pattern following the rules of hand surgery [11]. A meticulous surgical exploration allowed a preliminary lesion assessment. The pulleys have been preserved as much as possible. The ends of the severed tendons were immobilized by intradermal needles after identification. The tendons were repaired either by modified Kessler points [12, 13] for round tendons, the knot buried in the section slice, the banks were tightened by an epitendinous overlock, or by U-shaped points for flat tendons. The thread used was non-absorbable Prolene or Nylon 4-0 or 5-0. Suturing was facilitated by flexion of the finger or wrist for the flexor tendons and extension for the extensor tendons. The suture area has been regularized to prevent the tendons from snagging under the pulleys. The nerves were repaired by separate points called "cardinals". The vessels were repaired by overjets after permeabilization of light with isotonic saline and calciparin. Fractures were stabilized by osteosynthesis. After skin suture, the dressing was placed by separating the corners of the fingers and always leaving the finger pads visible for monitoring the vascularity downstream of the lesions. The thoracic limb was immobilized by a plaster splint either in the intrinsic position plus for the extensor tendons, or in the posterior position the wrist flexed to 45° in the case of flexor tendon repair.

Aftercare

The immobilization was maintained for 45 days. Treated patients were seen in consultation or contacted by telephone when they were absent. In order to detect a possible complication, the patient was seen at least twice, on D21 and D45. Functional rehabilitation was systematic and started on day 45 after skin healing and removal of the splint. It focused on the grip strength of the hand but also the thumb-index finger gripper. Recovery was declared for a resumption of the functions of the hand and wrist, without pain, without sensory or motor nerve deficit and a resumption of socio-professional activities. Complications were investigated. Whites and Boyes [14] criteria allowed for the functional assessment of treatment.

Statistical analysis

After obtaining informed consent from the patients, the data collected from the medical records but also from the patient examination, were recorded on an Excel spreadsheet. SPSS 19.0 software was used for data processing. The Chi² test was used to control the independence between two characters. A level (p) of less than 0.05 was selected as the level of statistical significance.

Results

Epidemiology

During the study period, we collected 42 male and 7 female patients, i.e. a sex ratio of M/F of 6. The mean age was 25.21 years (range 18 to 56 years). Patients were unemployed in 35 cases (71.43%), manual workers in 6 cases (12.24%) and students in 8 cases (16.33%). Regarding their lifestyle habits, 8 patients (16.32%) were regular smokers, 11 patients (22.45%) were alcohol users, 3 patients (6.12%) consumed Indian hemp, 6 patients (12.24%) admitted to taking Tramadol in excess as self-medication for disinhibition purposes. The traumatic circumstances were assault in 41 cases (83.67%), work-related injury in 6 cases (12.25%) and domestic accident in 2 cases (4.08%). Onset times were 10 p.m. to midnight in 33 cases (67.35%). The mean time from injury to hospital admission was 3.67 hours (range: 1 to 17 hours).

Diagnostic

The injury was on the right side in 37 cases (75.51%) and on the left side in 9 cases (18.36%). It was bilateral in 3 cases (6.13%). In 23 cases (46.94%), there were wounds from other associated locations: Head 12, Abdomen 7, Thorax 2, Lower Limb 2. The topography of the lesion according to the International Federation of Societies of Hand Surgery mainly concerned flexor zone V (26.53%) and extensor zone VII (24.49%) (Figure 1). The associated lesions were bone in 11 cases (22.45%), vascular in 6 cases (12.24%), nerve in 9 cases (18.37%). Vascular lesions involved the radial artery in 2 cases, the ulnar artery in 1 case, and the posterior veins of the hand in 3 cases. Nerve damage was median nerve damage in 6 cases (Figure 2), ulnar nerve in 2 cases, and radial nerve sensory branches in 1 case. Bone injuries were fractures of the forearm bones in 4 cases and metacarpals in 7 cases (Figure 3).



Fig 1: Hand wound in flexor zone III before tendon repair (A) and after tendon repair (B)



Fig 2: Wrist wound in flexor zone V with median nerve section. A: image before median nerve repair. B: image after median nerve repair.



Fig 3: Complex traumatic wound to the hand with fractures of the phalanges. A: Image before processing. B: Image of the fluoroscopic control of the skewer



Fig 4: Clinical appearance 4 months after traumatic wound repair with severing of the flexor tendons of the fingers and median nerve in a 27-year-old patient

Treatment

The mean time from admission to treatment was 4.23 days (ranges 0 to 7 days). All tendon and nerve sections were repaired. Fractures of the forearm were stabilized by screwed plates in 1 case and by external fixator of the radius and pin of the ulna in 3 cases. Metacarpal fractures were stabilized by pins in 7 cases. Vascular lesions were repaired in 3 cases and ligated in 3 cases.

Evolution

The mean time to follow-up was 12.4 months (range: 7 to 19 months). At the greatest loss, the results were considered satisfactory with cure in 76.3% (Figure 4) of cases and unsatisfactory in 23.7% of cases. There was no correlation between smoking and unsatisfactory outcome ($p=0.067$). However, there was a correlation between the short time to treatment (less than 24 hours) and the occurrence of cure ($p=0.00003$). According to White and Boyes' criteria, functional recovery was mostly good (Table 2). Complications were surgical site infection in 3 cases, secondary gangrene in 2 cases, residual pain in 4 cases.

Discussion

Hand trauma is a common reason for admission to the emergency department [2]. While in developed countries these injuries are the prerogative of accidents at work or in everyday life, in developing countries they are most often the result of aggression. Significant social inequalities encourage the expansion of crime among the population. The frequency is increasing in our country with the phenomenon of "black babies" [7] who are young people, often unemployed and out of school, who attack people in neighbor hoods with machetes or other bladed weapons. This results in traumatic wounds to the hands and wrists used by patients to defend themselves and exposed to impacts. Wounds, which are generally clear, are characterized by sections of the underlying noble elements, especially the tendons. Patients are either victims or perpetrators. Our series is comparable to that of most authors [15-17]. Indeed, they were mostly male, right-handed and young subjects. The majority were related to assaults, but the causes were also work accidents and domestic accidents. The hand is regularly exposed to trauma during its use. The hours of occurrence were from 10 p.m. to midnight, which corresponded to the usual hours of assault. The complex lesions in our series, with bone, vascular and nerve damage, testify to the violence of the traumas. The lesions were mainly located in the V zone of the flexors in our case as in the Thangavelu series [2].

Comparison of lesions between series is difficult due to heterogeneity but also to treatment evaluation methods. Nevertheless, the primary tendon suture is a recent surgery. Indeed, Verdan [18] in 1960 was the first to describe the primary repair of tendons by specifying the anatomical areas where the results could be less favourable. Its classification was adopted by the International Federation of Societies of Hand Surgery after some modifications. Because of the frequent adhesions caused by tendon sutures, Bunnell [19] recommended the use of tendon grafts. Tendon suturing is recommended in our homes and in low-income structures due to the ease of execution and the low material requirements compared to grafting. The results depend on the precocity of treatment, the quality of the repair and the quality of the functional rehabilitation [20]. The vitality of the downstream tissues and the prognosis after surgical repair depends on the proper execution of the surgical procedure in the short time, the precocity of implementation, the experience of the surgical and anesthetic team [21]. Anatomical knowledge is a prerequisite for surgical management. It is important that all noble elements (vessels, bones, and nerves) be repaired in one step to improve the functional prognosis of the hand, thus requiring microsurgical skills [9, 10, 22]. Our team has opted for the treatment of all lesions in one step in order to optimize the chances of recovery but also to limit the visits to the operating room which are the responsibility of the patients. The

admission time was short in our series (3.67 hours), lower than that of Thangavelu *et al* [3] which was 18.3 hours and Ahmed [23] which was 8 hours. This could be explained by the fact that the Brazzaville University Hospital, located in the centre of the city, is the main centre for the treatment of traumatic wounds of the hand.

Post-operative management determines the favourable outcome of the treatment of these lesions. It must be conducted as well as the surgical procedure. Most authors [24, 25] recommend early postoperative mobilization. This requires a great deal of understanding and cooperation from patients. Prudence suggests temporary immobilization for the duration of skin and tendon healing, which is practiced in our study as well as in the series by Boussakri *et al* [26]. Indeed, we favor good skin healing and noble structures in order to reduce the risk of loosening of sutures and surgical revisions.

The complications found in us, in particular surgical site infection and gangrene, were respectively related to the delay in treatment and the mechanism of injury (crushing). The crushing found in workplace accidents impairs blood circulation and leads to secondary gangrene [10]. The delay in treatment was influenced by the fact that patients did not have social security coverage and that care was entirely provided by the family. The high cost of surgery therefore delayed treatment. A correlation was noted between the occurrence of cure and the short time of treatment.

The limitations of our study were the retrospective nature conducted in a single health centre. This did not make it possible to make comparisons of surgical techniques, but also to assess the evolutionary aspects. The high cost of out-of-pocket treatment has led to delayed delays in treatment.

Table 1: Distribution of lesions according to anatomical areas

	Number of employees (N)	Percentage (%)
Flexor		
Zone I	3	6,12
Zone II	3	6,12
Zone III	5	10,2
Zone IV	1	2,04
Zone V	13	26,53
Extenders		
Zone I	1	2,04
Zone II	0	0
Zone III	4	8,16
Zone IV	3	6,12
Zone V	6	12,24
Zone VI	1	2,04
Zone VII	12	24,49
Zone VIII	0	0

Table 2: Functional assessment of treatment according to White and Boyes criteria

	Number of employees (N)			p	
	6 weeks	Three months	Dernier recoil	6 weeks / 3 months	6 weeks / Last hindsight
Distal palmar pulp-fold distance					
Excellent < 1 cm	0	0	7	0,01	< 0,01
Good 1 to 1.5 cm	2	8	14	0,02	< 0,01
Medium 2 to 3 cm	8	15	6	0,01	< 0,01
Mauvais > 3 cm	13	5	3	0,01	< 0,01
Total Extension Deficit					
Excellent < 15°	0	1	4	0,03	< 0,01
Good 15 to 30°	6	9	10	< 0,01	< 0,01
Medium 30 to 50°	9	8	6	< 0,01	< 0,01
Mauvais > 50°	11	3	0	< 0,01	< 0,01

Conclusion

Traumatic injuries to the hand are common and severe. The physical assaults most of which were at issue in our study were stabbing by criminal individuals known as "black babies". In addition to the functional, social, psychological and professional repercussions of these injuries, they have a significant economic impact both in terms of care and in the loss of income in the event of sequellary disability. The success of the treatment with us was conditioned by the precocity of the treatment but also by the quality of the surgical procedure. It is important that these injuries are managed by qualified personnel. A prospective, comparative, multicenter series would allow for a better analysis of the therapeutic and evolutionary aspects.

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