

Hand injuries in polytrauma patients

Urazy ręki u pacjentów z obrażeniami wielonarządowymi

Authors' Contribution:

A – Study Design

B – Data Collection

C – Statistical Analysis

D – Manuscript Preparation

E – Literature Search

F – Funds Collection

Andrzej Żyłuk^{1ABDEF}, Filip Fliciński^{1B}, Cezary Pakulski^{2B}¹Department of General and Hand Surgery, Pomeranian Medical University in Szczecin, Poland; Head: prof. Andrzej Żyłuk MD PhD²Polytrauma Center, Pomeranian Medical University in Szczecin, Poland; Head: Cezary Pakulski MD PhD

Article history:

Received: 25.02.2021 Accepted: 17.03.2021 Published: 19.03.2021

ABSTRACT:

Introduction: Hand and forearm injuries are relatively rare in polytrauma patients; their incidence is estimated at 2–5%. Hand and forearm injuries are usually not life threatening, and, therefore are considered of secondary importance, replaced by serious injuries of other body parts. However, they should be treated immediately after stabilization of the general condition of patients, as their delayed management may result in serious dysfunction of the hand.

Aim: The aim of this study was to determine the incidence, distribution and methods of treatment of hand and forearm injuries in patients treated at the Polytrauma Centre of the SPSK 1 in Szczecin over the period of 4 years. Medical records of 16 patients, 11 men (65%) and 5 women (35%) with a mean age of 34 years (range 19–62) who were treated at the Polytrauma Centre and sustained an additional injury to the hand and/or forearm were analyzed.

Material and methods: Medical records of 16 patients, 11 men (65%) and 5 women (35%) at the mean age of 34 years (range 19–62) who were treated in Polytrauma Centre and sustained an additional injury to the hand and/or forearm were analysed.

Results: The most common component of polytrauma with associated hand injury was major bone fractures (spine, pelvis and extremities) – 12 cases (70%), followed by chest – 11 (65%), maxillofacial – 9 (53%), brain – 8 (47%) and abdominal injuries – 5 (29%). The most common injury of the distal upper limb was fracture of the distal radius – 9 patients (53%). Two patients sustained excessive crush-degloving injuries which were the primary cause of their admission to the Polytrauma Centre. Nine patients required surgery, predominantly fixation of the distal radius with a plate. All patients survived.

Conclusion: The importance of the correct management of hand injuries performed promptly after stabilization of the general condition of polytraumatized patients was emphasized.

KEYWORDS:

epidemiology, polytrauma, upper limb trauma

STRESZCZENIE:

Wstęp: Urazy ręki i przedramienia są stosunkowo rzadkie u pacjentów z obrażeniami wielonarządowymi; ich częstotliwość jest szacowana na ok. 2–5%. Zwykle nie stanowią zagrożenia życia i dlatego są traktowane jako drugorzędne, ustępując miejsca poważniejszym obrażeniom innych okolic ciała. Jednak powinny one być leczone niezwłocznie po ustabilizowaniu stanu pacjentów, ponieważ zbyt późne ich zaopatrzenie może skutkować poważną dysfunkcją ręki.

Cel: Celem pracy była analiza częstotliwości występowania, spektrum i metod leczenia urazów przedramienia i ręki wśród pacjentów Centrum Leczenia Urazów Wielonarządowych (CLUW) SPSK 1 w Szczecinie przez 4 lata.

Materiał i metody: Materiał badawczy stanowiły dane medyczne 17 chorych, 11 mężczyzn (65%) i 6 kobiet (35%), w wieku śr. 34 lat (zakres 19–62) leczonych w CLUW, którzy dodatkowo mieli uraz ręki i/lub przedramienia.

Wyniki: Najczęstszą składową urazu wielonarządowego, któremu towarzyszył uraz ręki, były złamania dużych kości (kręgosłup, miednica i kończyny) – 12 przypadków (70%), urazy klatki piersiowej – 11 (65%), twarzoczaszki – 9 (53%), czaszkowo-mózgowe – 8 (47%) i brzucha – 4 (29%). Najczęstszym urazem kończyny górnej było złamanie dalszego końca kości promieniowej – 9 chorych (53%). Dwie chore doznały rozległego zmiążdżenia z oskalpowaniem kończyny górnej, który to uraz był głównym powodem przyjęcia do CLUW. Dziewięciu chorych wymagało leczenia operacyjnego, najczęściej zespolenia kości promieniowej płytką. Wszyscy pacjenci przeżyli.

Wnioski: W pracy podkreślono zasadność prawidłowego zaopatrzenia urazów ręki niezwłocznie po ustabilizowaniu stanu chorego z obrażeniem wielonarządowym.

SŁOWA KLUCZOWE: epidemiologia, uraz kończyny górnej, uraz wielonarządowy

INTRODUCTION

The prevalence of upper extremity injuries in polytrauma is estimated at about 2–5% [1], which therefore makes them relatively rare. Upper extremity injuries in polytrauma are usually non-life-threatening and are therefore given secondary priority, giving way to head, chest, abdominal and pelvic injuries as potentially fatal. According to the principles of ATLS (Advanced Trauma Life Support) and common

sense, life-threatening injuries should be prioritized in terms of diagnostics and therapy, while other injuries “can wait” [2]. Although such a gradation of priorities is easy to comprehend, it causes a significant proportion of “minor” injuries to be overlooked, recognized or treated with a delay. The consequence will be situations where the greatest problem of patients being discharged home after successful treatment of a severe, life-threatening injury, will be a painful and non-functional hand. A frequent reason for such a scenario

is a symptomatic malunion of the distal radius, wrist fractures and dislocations, less frequently metacarpal or digital fractures and dislocations. The cause of hand disability may also be an overlooked, neglected injury to tendons and nerves. Such patients later require reconstructive or corrective surgery, and thus their recovery and work will significantly extend.

Advances in emergency medical services, first aid, rapid transport to a hospital, diagnostics and treatment have resulted in an improvement in the survival rate and reduced health burden in polytrauma patients. Establishment of specialized departments (polytrauma centers) has also contributed to improving the effectiveness and quality of treatment of injuries that are directly life-threatening, but also less dangerous, and nevertheless important for the later functioning of hand injuries.

AIM

The aim of the study was to analyze the frequency and treatment methods of upper limb injuries (forearm and hand) among patients of the Polytrauma Treatment Center at CLUW SPSK 1 in Szczecin in 2017–2020.

MATERIAL AND METHODS

The material consisted of medical data of 17 patients, 11 men (65%) and 6 women (35%), aged 34 years (range 19–62) who had suffered polytrauma requiring treatment at the CLUW and had additional trauma to the upper extremity (forearm or hand). Data from four years (2017–2020) were acquired from the electronic database of CLUW patients, which was made available to the authors of the study. The focus of the analysis of this digital database was on the causes of polytrauma, the spectrum of injuries suffered, the type of injuries to the hand and forearm, and methods and timing of their treatment.

RESULTS

In the period between 2017 and 2020, a total of 272 patients with polytrauma including 17 people with accompanying trauma to the upper extremity (forearm and hand), were treated at the Polytrauma Treatment Center at SPSK 1 in Szczecin. The incidence of these injuries in the study group is 6.2%. The researched group included 17 patients – 11 men (65%) and 6 women (35%), average age 34 years (range 19–64). Two patients had such a severe injury to the upper limb which was the primary cause of hospitalization at the CLUW, while the remaining injuries were less serious. The most frequent causes of injuries were: traffic accident – 10 cases (59%), a fall from a height – 5 (29%), 1 (6%) motor boat propeller injury and 1 knife injury (6%). Four traffic injuries involved motorcyclists, 4 drivers or passengers of vehicles, 1 person struck by a car and 1 person run over by a tractor. In 5 cases (31%), the victims were under the influence of alcohol.

Range of injuries (Tab. I.)

The most common constituent of polytrauma were bone injuries (spine, pelvis, limbs) – 12 cases (70%), chest – 11 (65%), craniofacial – 9 (53%), craniocerebral – 8 (47%) and abdominal injuries

Tab. I. The specificity of injuries included in polytrauma in the analyzed group.

NUMBER OF PATIENTS	N = 17
Age	av. 34 years (range (19–64))
Sex	M = 11, K = 6
Bony injuries	n = 12
Pelvis	5
Thigh	5
Shank	5
Arm	4
Spine	2
Requiring surgical treatment	n = 11
Chest injuries	n = 11
Rib fractures	7
Pulmonary contusion	7
Pneumothorax	5
Sternal fracture	2
Extrapleural hematoma	1
Nobody required surgery	n = 0
Craniofacial injuries	n = 9
Multiple bone fractures	9
Requiring surgical treatment	n = 6
Craniocerebral injuries	n = 8
Cerebral contusion	4
Subdural hematoma	4
Epidural hematoma	3
Subarachnoid hemorrhage	2
Skull fracture	1
Requiring surgical treatment	n = 3
Abdominal trauma	n = 5
Liver	2
Intraperitoneal bleeding	2
Spleen	1
Mesentery	2
Small intestine	1
Requiring surgical treatment	n = 3
Survival/Death	17/0
Time of stay at the CLUW	av. 15 days (4–40)

– 5 (29%). The most common bone injuries were lower extremity fractures – 10 cases in total, pelvic – 5 cases, and humeral – 4 cases. Almost all patients with bone injuries required surgical treatment, of which the most common was the stabilization of comminuted pelvic fractures, the fixation of femoral fractures and the lower leg bones. The most common chest injuries were multiple rib fractures, pulmonary contusion and pneumothorax. None of the patients required thoracotomy, and 5 patients were treated with pleural drainage. Craniofacial injuries usually involved multiple fractures of the maxilla, mandible and eye orbit, whereby most of these fractures (n = 6) required surgical intervention. The most common head injuries were intracranial hematomas – 7 cases, and contusions – 4 cases; 3 patients required surgical treatment – craniectomy and evacuation of the hematoma. Five people were diagnosed with abdominal injuries, 3 of which required laparotomy due to intraperitoneal bleeding; 1 patient had a rupture of the mesentery and of the liver, and another patient had rupture of the liver and the spleen; three other patients had stab wounds to the mesentery and small intestine.

Hand and forearm injuries (Tab. II.)

The most common trauma was distal radius fracture, which was found in 9 patients (56%). Four patients had a displaced fracture with an unstable configuration, which required surgical treatment

Tab. II. Types of upper limb injuries, method and time of treatment.

TYPE OF INJURY	NUMBER OF PATIENTS	SURGICAL TREATMENT	CONSERVATIVE TREATMENT	TIME FROM INJURY TO SURGERY
# der	9	4	5	day 3, 4, 23 and 23
# metacarpal bones	3	–	3	-
# bones of the forearm (shafts)	2	2	–	day 4 and 10
Crush-degloving injury of the upper limb	2	2	–	On the day of injury
# of the scaphoid and perilunate dislocation	1	1	–	day 8
# deu and the scaphoid	1	1	–	day 23
Finger dislocation in PIJ	1	–	1	–
Injury to the tendons of the deep finger flexor	1	–	1	–

The total number of injuries is 20, because 3 patients with der had additional injuries within the arm.

– fracture; der – the distal end of the radius; deu – the distal end of the ulna; PIJ – proximal interphalangeal joint

– fixation with a titanium plate using the palmar approach in three, and external fixation in one (Fig. 1A.–C.). After being discharged from the CLUW, this patient underwent a final surgery by fixation of the fracture with a palmar plate (Fig. 1D.). The second most common injury was a fracture of a metacarpal bone, with slight displacement, qualifying for conservative treatment. Two patients had shaft fractures of forearm bones, one of both bones, and the other one only the ulna; both were operated on, and the fractured bones were fixed with titanium plates. One patient sustained a perilunate dislocation which required surgical stabilization and fixation of a concomitant scaphoid fracture with a cannulated screw. Another patient had a fracture of the distal end of the ulna and scaphoid; both were treated surgically. The last patient suffered an injury to the deep digital flexor tendons of the third and fourth digit of the left hand due to stab wounds. The injury was missed during the patient's stay at the CLUW and later at the surgical ward, therefore the patient has not been operated on and requires delayed reconstruction of these tendons. Surgical repair of hand and forearm injuries was usually performed after the patient's condition has been stabilized, from 3 to 23 days after the injury. Two patients with extensive crush-degloving injury of the upper limb were operated on the day of injury. These cases will be discussed separately.

Case 1.

A 22-year-old woman was involved in a car rollover accident. During the accident, her right limb was resting with her elbow against an open window, and was therefore crushed with partial degloving. After arrival to the Emergency Room in a serious condition, the patient was conscious and in traumatic shock (RR = 80/60, pulse 126/min); she had a bruised head wound, a nose injury, ecchymosis across the chest and right lower limb. CT revealed no internal injuries or fractures with the exception of a nasal bone fracture. The right upper limb was partially degloved from the middle of the arm to the wrist, and the peeled skin was bruised. Radial pulse was not palpable, but the blood supply to the fingers was normal. After admission to the CLUW and quick stabilization, the patient was operated on. The wounds were debrided, ischemic tissue was excised, and the exposed muscles were covered with detached skin. Fasciotomy was performed on the palmar side of the forearm to prevent possible compartment syndrome. During the next week, the patient was

reoperated for partial necrosis of the detached skin. After 8 days at the CLUW, the patient was awoken from a medically induced coma and transferred to the authors' department, where she underwent two more operations: coverage of the residual defects with local flap and split thickness skin graft. The entire limb was covered with skin and the patient regained full finger mobility. On day 25 after the injury, the patient was discharged to home in good condition.

Case 2.

A 59-year-old woman fell into the water from a large moving motorboat, and her left upper limb was crushed by a screw. In addition, she probably choked on water because she remained underwater for about one minute. At presentation at the Emergency Department she was in a serious condition, unconscious, in traumatic shock (RR = 90/50, pulse 112/min), intubated. Her left upper limb was crushed, with a visible deformation within the elbow, indicating fractures. Skin was partially separated from the distal part of the arm to the wrist, shredded and bruised. There was no radial pulse, but the blood supply to the fingers appeared normal, though the hand was cooler than the right, healthy one. CT revealed no significant internal injuries or fractures of other bones, except for the fracture of both bones of the left forearm and a left-sided crush fracture of the condyle of humerus with an elbow dislocation (Fig. 2A.).

After admission to the CLUW and initial stabilization, the patient was operated on by an orthopedic team and a hand surgeon. The fracture of the shaft of the radius was fixed with a plate, and the ulna was fixed with intramedullary K wires. The distal humerus fracture was fixed with an external fixator (Fig. 2B., C.). Debridement and excision of ischemic tissues were performed, and the exposed muscles were covered with detached skin. Fasciotomy was not performed because the fascia on forearm was torn. Towards the end of surgery it was revealed that the left-hand digits were clearly cool and the pulse oximeter showed no saturation thereof. Therefore, the unawakened patient was transported to the Radiology Department, where angio-CT of the extremities revealed no arterial flow from the distal part of the brachial artery. After returning to the operating room, the brachial artery in the proximal part of arm and the cubital fossa were exposed, revealing bruising, but no fracture. Because arterial thrombosis



Fig. 1. (A) Comminuted, crush distal radius fracture in a patient with polytrauma, immobilized in a plaster cast. (B) Fracture from Fig. 1A. treated with external fixator: p-a projection. (C) Fracture from Fig. 1A. treated with external fixator: lateral projection. (D) Fracture from Fig. 1A. fixed with a plate: p-a projection. (E) Fracture from Fig. 1A. fixed with a plate: lateral projection.

was suspected, the artery was incised, revealing no blood outflow. After the catheter was inserted into the proximal and distal parts, the clots were evacuated on both sides and a blood outflow was obtained, but it had a rather weak intensity for an artery of this size (in the patient's RR of 90/70 mmHg). After suturing the artery, the blood supply to the fingers did not improve, and oxygen saturation was at zero. Therefore, the ulnar artery was exposed and incised in the distal part of the forearm, and a Fogarty catheter was inserted into its proximal and distal parts; the clots on both sides were evacuated. After thrombectomy, blood was drained from the proximal part of the ulnar artery, which was then sutured. After this procedure, the fingers turned slightly pink, but the pulse oximeter still showed no saturation. In spite of the above, the operation was completed and the patient was transferred back to CLUW. The next morning, the operated hand had adequate blood supply, with 98% oxygen saturation in the digits. The patient stayed at the CLUW for a total of 18 days due to pneumonia, respiratory failure and the need for prolonged mechanical ventilation. Her condition slowly improved and on day 16 she was awakened from a coma and transferred to the orthopedic ward. The wounds on the limb healed.

DISCUSSION

The analysis shows that hand and forearm injuries are moderately common in patients with polytrauma. Fractures of the distal radius were the most common, accounting for more than half of all injuries. The most frequent main injuries in patients with hand and forearm trauma were fractures of other skeletal bones – 12/17 cases (70%), including the femur, pelvis, lower leg and humerus. Next were injuries to the chest – 11/17 cases (65%), craniofacial injuries – 9/17 (53%) and craniocerebral injuries – 8/17 (47%). This is consistent with the literature data, where the most prevalent trauma in patients with upper limb injuries is chest trauma [1–3]. The most common cause of polytrauma was traffic accident – 10/17 cases (59%), including motorcycle accidents in 4 (23%). Falls from a height caused 5/17 injuries (29%). Hand and wrist injuries were diagnosed in all cases except for one during the first 2 days of stay at the CLUW, while the necessary operations were performed immediately after the patients' condition was stabilized. Surgical treatment was required in 10 out of 16 patients (62%), the most common cases were fractures of the distal end of the radius. In one patient, damage to

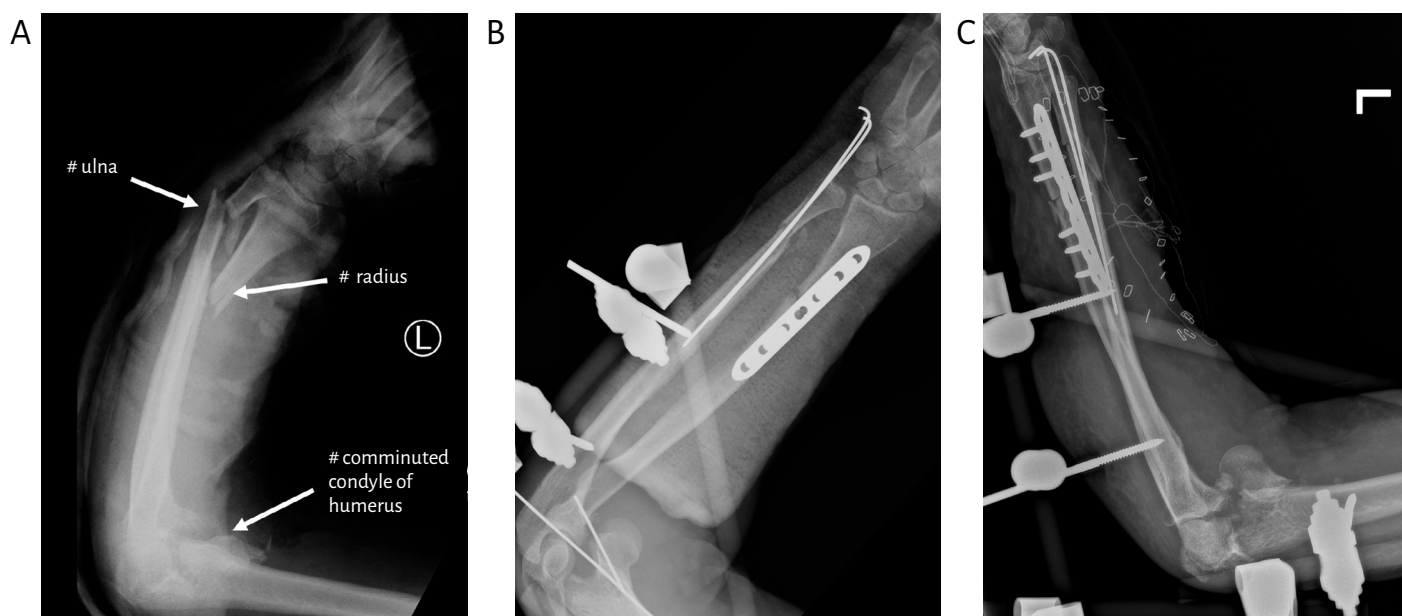


Fig. 2. (A) Fracture of both bones of the forearm and comminuted, crush fracture of the condyle of humerus. (B) Fractures from Fig. 2A., managed surgically: p-a projection. (C) Fractures from Fig. 2A., managed surgically: lateral projection. # – fracture.

the flexor tendons of the fingers was overlooked. The issue of missed hand injuries in patients with polytrauma is presented in the publication by Fitschen-Oestern et al., which will be discussed later in [3]. Two patients had a main injury in the form of severe crush of the upper limb and were underwent vital surgery on the day of injury. One patient had flexor tendon injury, and another had an injury of the brachial, radial and ulnar arteries, resulting in traumatic thrombosis and acute ischemia of the hand. All patients from the analyzed group survived and were discharged from the CLUW. Unfortunately, the final outcomes of the treatment of hand injuries were not assessed in this paper.

The authors' department is the Consultant Hand Trauma Unit at the CLUW. Over the years of cooperation, a procedure algorithm has been developed which helps in quick diagnosis and management. Immediately after the injury, fractures are immobilized using a plaster cast, and all efforts are directed to saving patients' lives. This is a valid approach, but - as already mentioned in the introduction - a significantly displaced DER fracture or a sprained wrist must be managed immediately after the patient is stabilized.

LITERATURE REVIEW

In literature it is possible to find single works of analysis on large groups of patients with polytrauma and accompanying injuries of the upper limbs. These works are based on data from the German and Dutch national trauma registries. Some of these are detailed below.

Fitschen-Oestern et al. (2020) analyzed cases of upper limb injuries in patients with polytrauma registered in TraumaRegister DGU (Deutsche Gesellschaft für Unfallchirurgie) over the period 2007-2017. This nationwide database records data from 645 hospitals in the Federal Republic of Germany. During this period, a total of 139,931 patients with polytrauma were reported to the Registry, of which 50,459 (36%) had additional upper limb trauma, and 89,472 (64%) did not. The most common cause of polytrauma was a traffic accident - 24%. Patients with injuries of the upper limb

were statistically significantly more often victims of motorbike accidents and falls from a height (on average 23%) than those without limb injuries (on average 15%). Patients without upper limb injuries had more severe injuries to the central nervous system (Glasgow score - GCS < 8) - 22% than those with upper limb injuries - 15% ($p < 0.01$). The most common main injury in patients with upper limb injuries was chest trauma.

Out of a total of 50,459 people with upper limb trauma, in 10,971 (22%) these injuries concerned the hand, wrist or forearm. The most frequent injuries concerned the radius - 6088 (55%), ulna - 3071 (28%), metacarpus bone - 1316 (12%) and wrist fractures/dislocations - 925 (8%). There was a total of 1,329 (12%) injuries to nerves, tendons and vessels.

In 727 patients (6.6%), the diagnosis of distal limb injury was delayed or missed during the first week of ICU stay. The largest number of such cases were nerve injuries ($n = 195$, 25% of all nerve injuries), wrist fractures or dislocations ($n = 104$; 11%) and tendon injuries ($n = 54$; 11%).

The authors found that the factors contributing to the delay or omission of an injury to the distal upper limb were simultaneous injuries of several (more than two) body areas, younger age of the patients and direct transfer of the patient from the emergency department to the ICU [3].

Ferree et al. (2017) presented the results of the analysis of hand injuries in patients with polytrauma treated at one center (Utrecht) in the Netherlands in 2009-2014. During this period, 2,046 people were registered with polytrauma, 72 (3.5%) of whom had accompanying injuries (fractures or sprains) in the hand and wrist. The most common cause of injury was a traffic accident: motorcycle - 28 (39%) and car - 19 (26%); 14 people (19%) were injured as a result of falling from a height. Seventy-two patients were found with a total of 119 fractures and dislocations, whereby the majority of fractures concerned the metacarpal bones - 57 (48%), wrist fractures and dislocations - 34 (28%) and fractures of the digits

– 28 (24%). The paper did not register nerve, tendon and skin injuries, or injuries to the forearm, elbow and upper arm. Surgical treatment was necessary in 46 patients (39%); 24 (42%) metacarpal fractures, 15 (44%) wrist fractures or dislocations and 7 digit fractures (25%) were operated on. The most common main injury in patients with injuries of the upper limbs was a chest injury, found in 46 patients (64%), followed by a head injury in 38 patients (53%). Chest injuries were statistically significantly more frequent in patients with arm and wrist fractures than in the group without fractures (64% vs. 45%, $p = 0.01$), and there were statistically significantly fewer head injuries (53% vs. 70%, $p = 0.001$).

The authors also assessed the treatment outcomes in 52 patients after an average period of 4.5 years after injury. Hand function was assessed using two standardized questionnaires: QuickDASH (Disability of the Arm, Shoulder and Hand) and PRWHE (Patient-Rated Wrist and Hand Evaluation). Both instruments are used for subjective assessment of the efficiency of the upper limb in performing activities of daily living, but also for the assessment of ailments caused by the limb. The scoring range of both scales is 0–100, where 0 means no pain and full extremity fitness, and 100 means complete incapacity (disability). The mean QuickDASH score for the entire group was 17 points, and the PRWHE score was 14 points, which meant generally good hand function. The authors found a statistically significant moderate correlation between a worse functional outcome in the treatment of hand injury and the accompanying trauma to the proximal part of the upper limb (forearm and upper arm) and more severe polytrauma expressed by higher ISS scores (Injury Severity Score). The worst results were obtained in 5 patients, 3 of whom had a brachial plexus injury, one severe CNS trauma, and the last one had an open fracture of the distal humerus [1].

REFERENCES

1. Ferree S., van der Vliet Q.M.J., van Heijl M. et al.: Fractures and dislocations of the hand in polytrauma patients: incidence, injury pattern and functional outcome. *Injury*, 2017; 48(4): 930–935.
2. van Olden G.D., Meeuwis J.D., Bolhuis H.W., Boxma H., Goris R.J.A.: Clinical impact of advanced trauma life support. *J Emerg Med*, 2004; 22(7): 522–525.
3. Fitschen-Oestern S., Lippross S., Lefering R. et al.: Missed hand and forearm injuries in multiple trauma patients: An analysis from the TraumaRegister DGU. *Injury*, 2020; 51(7): 1608–1617.
4. Banerjee M., Bouillon B., Shafizadeh S. et al.: German trauma registry group. Epidemiology of extremity injuries in multiple trauma patients. *Injury*, 2013; 44(8): 1015–1021.
5. Herzberg G., Comtet J.J., Linscheid R.L. et al.: Perilunate dislocations and fracture-dislocations: a multicenter study. *J Hand Surg Am*, 1993; 18(5): 768–779.
6. Hahn M.P., Richter D., Ostermann P.A., Muhr G.: Injury pattern after fall from great height. An analysis of 101 cases. *Unfallchirurg*, 1995; 98(12): 609–613.
7. Schaedel-Hoepfner M., Siebert H.: Operative strategies for hand injuries in multiple trauma. A systematic review of the literature. *Unfallchirurg*, 2005; 108(10): 850–857.
8. Bayer J., Lefering R., Reinhardt S. et al.: Thoracic trauma severity contributes to differences in intensive care therapy and mortality of severely injured patients: analysis based on the TraumaRegister DGU. *World J Emerg Surg*, 2017; 12: 43.
9. Ernstberger A., Joeris A., Daigl M. et al.: Decrease of morbidity in road traffic accidents in a high income country – an analysis of 24 405 accidents in a 21 year period. *Injury*, 2015; 46(Suppl. 4): 135–143.

Word count: 4350 Page count: 7 Tables: 2 Figures: 2 References: 9

DOI: 10.5604/01.3001.0014.8086 Table of content: <https://ppch.pl/issue/13873>

Copyright: Some right reserved: Fundacja Polski Przegląd Chirurgiczny. Published by Index Copernicus Sp. z o. o.

Competing interests: The authors declare that they have no competing interests.



The content of the journal „Polish Journal of Surgery” is circulated on the basis of the Open Access which means free and limitless access to scientific data.



This material is available under the Creative Commons – Attribution-NonCommercial 4.0 International (CC BY-NC 4.0). The full terms of this license are available on: <https://creativecommons.org/licenses/by-nc/4.0/legalcode>

Corresponding author: Prof. Andrzej Żyłuk MD PhD; Department of General and Hand Surgery, Pomeranian Medical University in Szczecin; Unii Lubelskiej street 1, 71-252 Szczecin, Poland; Phone: +48 91 425 3196; E-mail: azyluk@hotmail.com

Cite this article as: Żyłuk A, Flicinski F, Pakulski C.: Hand injuries in polytrauma patients; Pol Przegl Chir 2021; 93(4): 1-7
