

War Wounds of Extremities Experience with 480 Wounded Extremities

**Antun Matic, Ivan Hudolin,
Miroslav Kasic, Marija Švagelj,
Josip Kiš, Mirjana Petrović, Vje-
koslav Čuljak, Željko Hodalić,
Josip Dolanski, Luka Kuruc and
Zlatko Ante Kokaj**

Stručni rad
UDK 616.728-089
Prispjelo: 15. studenog, 1993.

Vinkovci General Hospital

There are 1186 casualties, victims of the 1991-1992 war in Vinkovci, Eastern Slavonija, Croatia, represented in this text. Out of them, 480 were operated on for a war wound of an extremity.

Types of wounds and their distribution, methods of surgical treatment and the results have been analyzed.

Key words: extremities, war wound, treatment

MATERIALS AND METHODS

The total of 1186 casualties was treated at the General Hospital in Vinkovci from the 1st July, 1991 to 30th June, 1992. Operated on were 624 (52.6%) of them, whereas the rest of the casualties were treated ambulatory.

Out of 624 operated patients, 480 (40.47% of all casualties) had a war wound of an extremity. There were 577 (96.04%) with multiple location trauma and only 47 (3.96%) had an isolated wound.

There were 50 children (4.21%) under the age of 15, 122 women (10.28%) and 1014 men (85.49%).

The youngest casualty was 5 months and the oldest one was 83 years old. The average age was 32 years.

Soldiers of the Croatian Army were 526 of the wounded (45.19%), 215 (18.98%) were policemen, 437 (37.17%) were civilians and 8 (0.64%) were enemy soldiers.

Distribution according to the type of wound showed

that 50 (4.18%) casualties were wounded by firearms, 101 (8.48%) by mine fragments, 1012 (85.28%) by shell and missile pieces, whereas 23 (1.92%) had burns, regularly of the third degree.

The patients were analyzed according to their age, sex, type of wound, wounded body region and method of surgical treatment.

DISCUSSION

The treatment of war wounds has three aims: to cure fracture, to prevent infection and to regain function. To achieve those aims, it is necessary to use external fixation whether as a temporary or definitive stabilization, because the method is simple and quick on condition that the surgeon is familiar with technical and tactical aspects. It is rather useful since it allows other surgical procedures (nephrectomy, plastic, etc.) that may be necessary later on as well as in the condition of fracture stabilization (Fig.1). Each major artery wound is to be treated primari-

FIGURE 1.
EXPLOSIVE FRACTURES OF HUMERUS, RADIUS AND ULNA. FREE LOCOMOTION AFTER EXTERNAL FIXATION.

SLIKA 1.
EKSPLOZIVNE FRAKTURE HUMERUSA, RADIJUSA I ULNAE. SLOBODNO POKRETANJE NAKON VANJSKE FIKSACIJE.

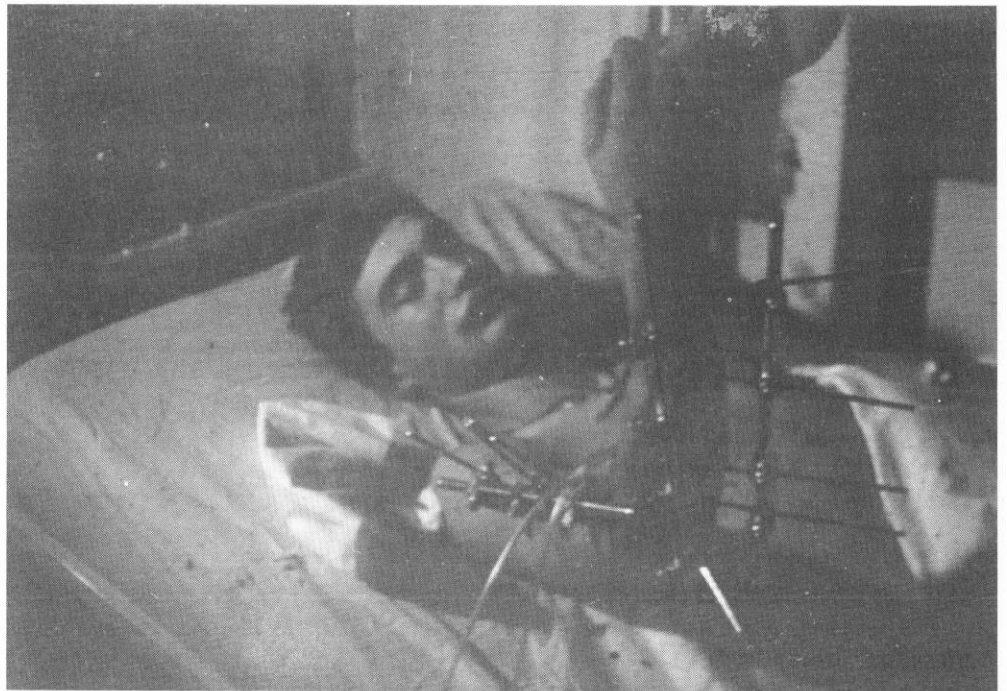
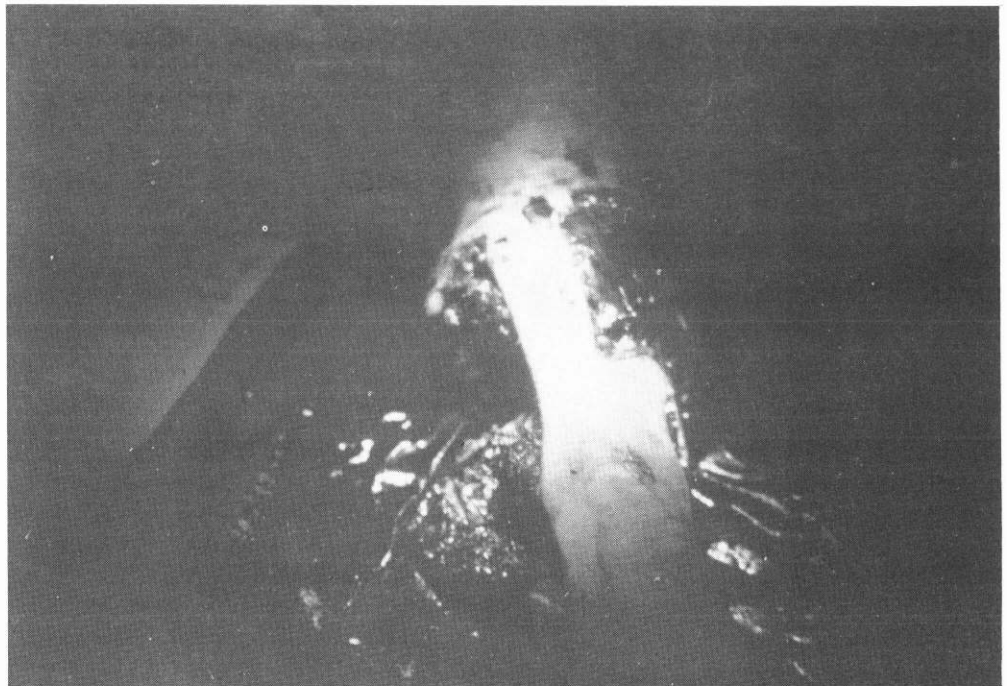


FIGURE 2.
EXPLOSIVE DESTRUCTION OF FOREARM. IMPOSSIBLE LIMB SALVAGE.

SLIKA 2.
EKSPLOZIVNO RAZARANJE PODLAKTICE. BILO JE NEMOGUĆE SPASITI UD.



ly, since in war conditions the ways of evacuation are rather insecure and every delay may result in the loss of limbs, especially because most casualties have two or more regions injured.

Each major nerve wound has to be explored and, in case of discontinuity, marked. In some cases (low velocity missiles, nerve wound with no defects), primary treatment is to be done. War injuries of the limbs as consequences of wounding by missile (high energy transfer) often include all anatomic structures and are so voluminous that it is practically impossible to preserve limbs (Fig.2). The treatment of such

wounds aims at rescuing life of the casualty, so that the only right way to do this is to perform amputation. Each war amputation has to be open and sparing.

RESULTS

Operations of the upper and lower limbs made 76.91% of all surgical procedures (480 of all casualties).

Tables 1 and 2 show in details the wounds of upper and lower extremities. There are clear discre-

TABLE 1.
War wounds of upper extremities
TABLICA 1.
Ratne ozljede gornjih udova

Type of wounds Tip ozljede	Number Broj	% of upper extr. wounds % ozljeda gornjih udova	% of all wounded % ukupnih ozljeda
Closed Zatvorena	2	1.12	0.17
Open Otvorena	176	98.88	14.83
With fracture Sa frakturom	43	24.15	3.62
Without fracture Bez frakture	135	75.85	11.38
With major blood vessel wound S ozljedama velikih krvnih žila	11	6.18	0.93
Without major blood vessel wound Bez ozljeda velikih krvnih žila	167	93.82	14.07
Total Ukupno	178	100.00	15.00

TABLE 2.
War wounds of lower extremities
TABLICA 2.
Ratne ozljede donjih udova

Type of wounds Tip ozljede	Number Broj	% of lower extr. wounds % ozljeda donjih udova	% of all wounds % ukupnih ozljeda
Closed Zatvorena	3	0.99	0.25
Open Otvorena	299	91.01	25.21
With fracture Sa frakturom	118	39.07	9.95
Without fracture Bez frakture	184	61.93	15.51
With major blood vessels wound S ozljedama velikih krvnih žila	63	20.86	5.31
Without major blood vessels wound Bez ozljeda velikih krvnih žila	239	79.14	20.15
Total Ukupno	302	100.00	25.46

TABLE 3.
Traumatic ampu-
tation of extre-
mities
TABLICA 3.
Traumatska am-
putacija udova

Amputation Amputacija	Number Broj	% of all amputations % svih amputacija	% of all wounded % ukupnih ozljeda
Forearm and fist Podlaktica i šaka	7	11.67	0.59
Upper arm Nadlaktica	9	15.00	0.76
Foot Stopalo	14	23.33	1.18
Leg Potkoljenica	13	21.67	1.10
Femur Femur	17	28.33	1.43
Total Ukupno	60	100.00	5.06

FIGURE 3a.
ANCELE REGION EX-
PLOZIVE FRACTURE
OF THE III DEGREE
-HIGH ENERGY
TRANSFER.

SLIKA 3a.
EKSPLOZIVNA FRAK-
TURA ZGLOBNOG
PODRUČJA III STUP-
NJA - VELIKI PRIJE-
NOS ENERGIJE.

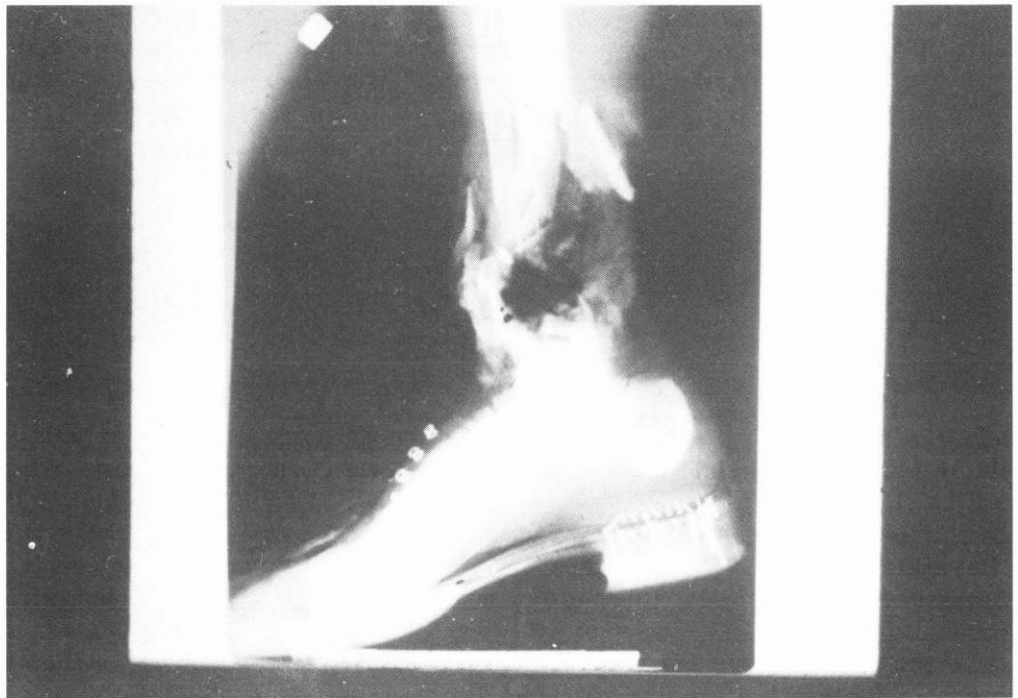
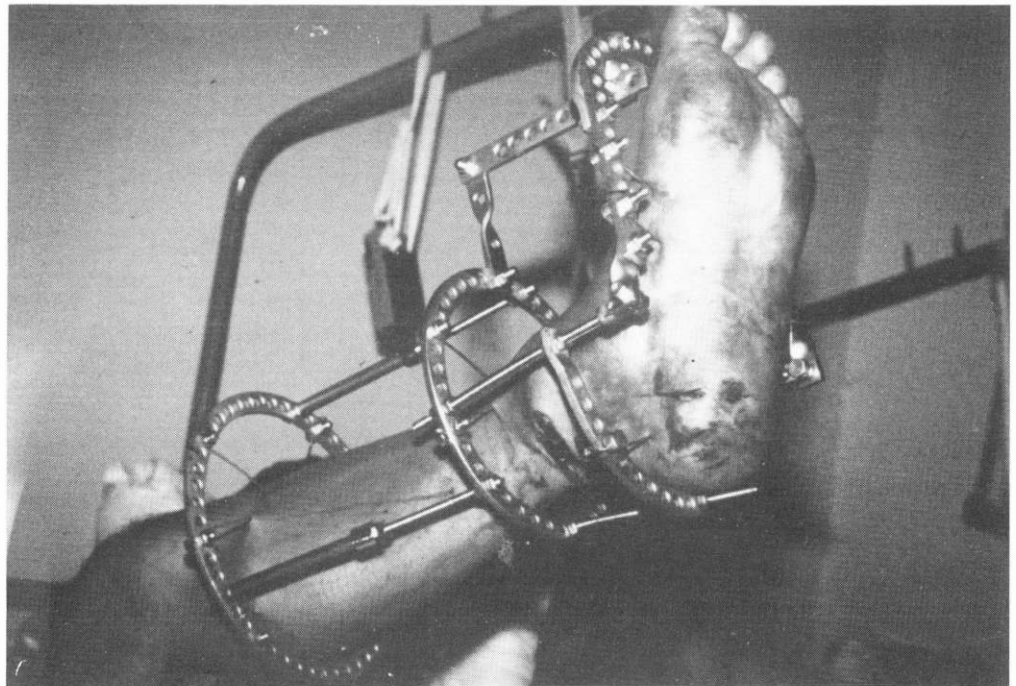


FIGURE 3b.
DORSOMEDIAL VIEW
AFTER SURGICAL
PROCEDURE WITH
ILIZAROV S EF.

SLIKA 3b.
DORSOMEDIJAL-
NA SNIMKA NAKON
KIRURŠKOG POS-
TUPKA S ILIZAROV-
LJEVIM VANJSKIM
FIKSATOROM.

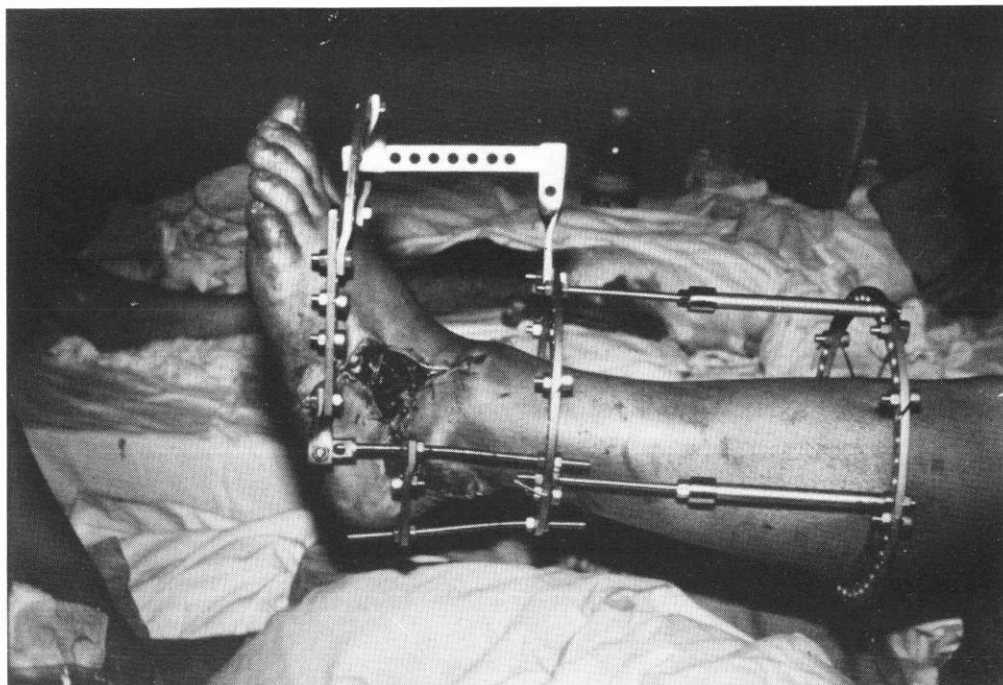


pancies in absolute and relative relations of the wound severity between upper and lower limbs. Fractures make 24.15% of all wounds on the upper limbs compared to 39.07% on the lower limbs. There were 6.18% of great blood vessel wounds on the upper limbs and 20.85% on the lower limbs. In Table 3 it can be seen that the amputations were performed on 5.06% of all casualties, dominantly on lower limbs (73.33% of all amputations). Fifty-one victims died, which gives the mortality rate of 4.3%. Beside fractures, the wounds of blood vessels and main nerves were a particular problem.

They appeared with extensive soft tissue wounds, mostly with clear defects of skin and muscles. In all such cases, after exploration and treatment, all the wounds were left open and the defects were covered with synthetic substitutes (Epigard, Corenthium). When the necrotic tissue was marked and removed secondary suture or plastic was performed. If more complicated procedures were necessary (i.e. microvascular graft), the patients were sent to specialised clinics.

All casualties got tetanus vaccine and serum as well as the antibiotic therapy according to the scheme

FIGURE 3c.
LATERAL VIEW OF
THE SAME PATIENT
SLIKA 3c.
LATERALNA SNIMKA
ISTOG BOLESNIKA



of the Medical Headquarters of the Republic of Croatia (crystal penicillin and gentamycin; with serious wounds we added methronidazol). Regarding the methods of fracture fixation, we used external fixation, mostly AO (ASIF) type, and rarely Ilizarov type (Fig.3).

Vascular wounds were treated primarily whenever it was possible, regarding the state of the patient and the number of casualties that arrived (there were 1 to 60 casualties arriving daily). In 11 cases we accomplished the resection of the wounded blood vessel and end-to-end anastomosis. In 23 cases reconstruction was performed, always with autologous saphenous graft, if available. The graft length was 5 - 60 centimeters. If we could not have used VSM, we used basilic or cephalic vein graft and in two cases femoral vein graft. All artery wounds were diagnosed in clinical examinations, since neither angiography nor Doppler were available. We always ligated the accompanying wound of main veins at artery wounds and because of that we did not lose any extremity. After reconstruction three patients died, all of them due to accompanying wounds. In 3 cases we performed amputation after angiographic treatment: in 2 because of thrombosis and in one because of the bleeding from the soft tissue which we could not solve in any other way.

Out of 480 limb wounds, there were 41 patients (8.54%) with major nerve wounds. The primary treatment was done in 13 cases, always when direct anastomosis was possible. The rest of the nerves were shown and marked. All major nerve anastomoses were done on upper limbs. In 6 cases with clinical

signs of plegia we only found nerve contusion in permanent continuity. Out of 13 anastomized nerve wounds, a great neurological recovery was registered in 6 cases. As for the patients with nerve contusion, the period of recovery was much longer (10-12 months on average) and in 2 cases out of 6 the permanent neurological loss in present even today. All patients with nerve wounds were sent to a neurosurgeon or a plastic surgeon for supervision.

LITERATURA

1. Bell MJ: The management of shotgun wounds. *J Trauma* 1971; 11:522-7.
2. Coupland RM. Amputation for antipersonnel mine injuries of the leg: preservation of the tibial stump using a medial gastrocnemius myoplasty. *Ann Coll Surg Engl* 1989; 71(6):405-8.
3. Godfrey AM. Lower limb trauma: primary treatment and reconstruction. *Ann Coll Surg Engl* 1989; 71(3): 200-3.
4. Heim D, Landman J. Gerassrekonstruktion nach Trauma. *Basler Erfahrungen von 1980-1988. Helv Chirurg Acta* 1989; 46(4):615-20.
5. Helfet DL, Howey T, Sanders R, Johansen K. Limb salvage versus amputation. Preliminary results of the Mangled Extremity Severity Score. *Clin Orthop* 1990; 256:80-6.
6. Jahn R, Heinrich P. Die traumatische Hemipelvektomis. Eine seltene überlebte Unfallfolge. *Zentralbl Chirurg* 1990; 115(10):631:4.
7. Johansen K, Daines M, Howey T, Helfet D, Hansen ST jr. Objective criteria accurately predict amputation following lower extremity trauma. *J Trauma* 1990;30: 568-72.

8. Lange RH, Bach AW, Hansen ST jr, Johansen KH: Open tibial fractures with associated vascular injuries: Prognosis for limb salvage. *J trauma* 1985; 25(3):203-8.
9. McCorkell SJ, Harlex JD, Morishima MS, Cummings DK: Indications for angiography in extremity trauma. *Am J Roentgenol* 1985; 145:69.1245-7.
10. Murraray DS: Skin loss of the lower limb. *Injuri* 1990; 21(5):309-10.
11. Oberli H. War surgery and external fixation. *AO/ASIF Dialogue* 1991;4(11):1-7.
12. Odland MD, Gisbert VL, Gustilo RB, Ney AL, Blake DP, Bubrick MP. Combined orthopedic and vascular injury in the lower extremities: Indications for amputation. *Surgery* 1990; 108(4):660-4.
13. Pozo JL, Powell B, Andrews BG, Hutton PA, Clarce J. The timing of amputation for lower limb trauma. *J Bone Joint Surg* 1990;72(2):288-92.
14. Raju S. Shotgun arterial injuries of the extremities. *Am J Surg* 1979; 138:421-5.
15. Walker ML, Poindexter JM, jr, Stovall. Principles of management of shotgun wounds, *Surgery Gyn Obstet* 1990; 170(2):97-105.
16. Winkler H, Hochstein P, Wentzensen A. Präklinische und klinische Primatherapie von Mehrfachfrakturen der unteren Extremitäten. *Aktuel Traumatol* 1989; 19(6): 9246-54.
17. Zorita A, Vazwuez JG, Moran CF; Samos RF; ALONSO J, Ramos M, Vaquero F. Traumatismos vasculares popliteos e infrapopliteos. Un reto quirurgico. *Angiologia* 1990; 42(1):16-22.

Sažetak

RATNE OZLJEDE UDOVA ISKUSTVO SA 480 RANJENIH UDOVA

Antun Matić, Ivan Hudolin, Miroslav Kašić, Marija Švagelj, Josip Kiš, Mirjana Petrović, Vjekoslav Čuljak, Željko Hodalić, Josip Dolanski, Luka Kuruc i Zlatko Ante Kokaj

Opća bolnica Vinkovci

Prikazani su rezultati liječenja 1186 stradalih u domovinskom ratu na području općine Vinkovci, i to od 01. srpnja 1991. do 30. lipnja 1992. god. Od svih ozlijeđenih muškarci su činili 85,49% (1014), žene 10,3% (122) i djeca 4,2% (50).

Najveći je broj ozlijeđen krhotinama eksplozivnih naprava (granate, rakete) 85,48%, minama 8,48%, metkom 4,18%, a 1,92% je zadobilo opekotine, obično III stupnja.

Učinjeno je 178 (28,52%) zahvata na gornjim i 302 (48,39%) kirurška zahvata na donjim udovima.

Moderna oružja s projektilima velikih početnih brzina dovode do izuzetno ozbiljnih rana s masivnom destrukcijom tkiva.

Krhotine bombi, granata ili mina postižu brzinu i od 1800 m/sec. Razarajući učinci prijenosa velike kinetičke energije na tkiva su dobro poznati i proučeni.

Iako i nije izravno pogođena projektilom, kost će frakturirati ako se nađe unutar prostora zvanog "privremena šupljina", koja može biti i 30-40 puta veća od promjera projektila, a koštani ulomci postaju sekundarni projektili i dodatno proširuju područje tkivnog oštećenja. Najteže ozljede udova posljedica su eksplozivnog djelovanja mina ili granata.

Načela primarnog zbrinjavanja otvorenih prijeloma u ratnih rana su jasno određena:

- ekscizija kože
- ekscizija svih devitaliziranih dijelova tkiva
- odstranjenje stranih tijela
- odstranjenje fragmenata kortikalisa koji su bez kontakta s tkivom
- fragmenti spongioze se mogu očistiti i koristiti kao koštani graft
- ispiranje rane
- stabilizacija kosti (metoda izbora je vanjska fiksacija)
- rekonstrukcija magistralnih krvnih žila
- izbjegavati primarnu rekonstrukciju živaca ili tetiva

Ključne riječi: ratne ozljede, udovi, liječenje, iskustvo

Prispjelo: 15. studenog, 1993.