Infections Associated with War Injuries

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During 1992/1994, 250 injured persons were treated at the Department of Surgery of the General Hospital in Koprivnica.
The authors report their observations upon the frequency of infections by war injuries, their clinical outstandings, the most common agents isolated from bacterial specimens and their reactivity upon antimicrobial medication. The majority of patients were transferred to our hospital from other institutions.
Male patients in the age group 21-30 were predominant.
Antimicrobial prophylaxis was conducted on 192 (77%) patients.
All the infections were hospital-acquired infections.
Wound infections were dominant.
The most common agents from bacterial specimens were: Enterobacteriaceae, Acinetobacter species, Pseudomonas aeruginosa, Staphylococcus aureus, some of which showed remarkable resistance towards antimicrobial drugs.

Key words: war injury, infection

INTRODUCTION

War wounds are characterised by lacerated, compressed tissue, blood shots, the presence of foreign objects and infections caused by various microorganisms. Each of the listed elements represent the possibility of developing a further infection.
War wounds my be infected during the very wounding or secondary, at any time during treatment. Late surgical treatment, improper treatment (debriman) of the wound, detaining of foreign objects inside the wound, and primary closing of the wound are only some elements which are favourable to developing of infections.

MATERIAL AND METHODS

In the period from October 1991 to May 1994, 250 injured persons, in the age of 19 - 62, were treated at the Department of Surgery of "Dr. Tomislav Bardek" General Hospital in Koprivnica.
Patients were admitted into hospital directly from the battlefield (21) or were transferred from other institutions (241).
Specimens for bacterial analysis were taken by routine (wound swab taken immediately after the admittance to the Department of Surgery or after antimicrobial prophylaxis conductance) or through clinical indication, (local wound infection, signs of general infection) (6).
Treatment was performed in an aerobic or anaerobic manner through standard quantitative methods in the Microbiological Laboratory at the General Medical Institute in Koprivnica. Tests of the reactivity of bacterium against antimicrobial medication were conducted by the disc diffusion method (1).
Protection against infection after wounding was conducted by Penicillin + Gentamycin for the wounds of corporeal cavities' organs, or Sulfometoxazol + Trimetroprim for craniocerebral injuries. The treatment was conducted for 7 days (8,11,6,4). Patients were also given prophylaxis against tetanus (one dose of 0,5 ml Tetanus vaccine), and in case of severe injuries Tetanus Imunoglobulin in the

amount of 250 - 500 i. u. was added to the vaccine. The combination of clinical signs, laboratory tests and a single or repeated bacterium isolation from the wound were taken as a criterion for wound infection (7).
Isolation of bacterium without clinical or laboratory findings was considered colonisation.

DISCUSSION

The war events in Croatia from 1991 - 1994 have contributed to the appearance of a larger number of wounded persons, which also involved the hospital in Koprivnica in taking care of them.
262 wounded persons have been treated at the Department of Surgery of the General Hospital in Koprivnica. For the purpose of easier record keeping and with reference to the place they came from the patients are divided into convoys. The majority of the wounded were transferred from other hospitals (Vukovar, Osijek) where they had been treated primarily. The others were the citizens of Koprivničko - križevačka County, who had been wounded on various battlegrounds throughout Croatia, treated primarily and then transferred to our hospital. The least number of casualties were wounded and primarily treated on our territory.
The period from wounding to acceptance to the Surgical Department was approximately 12.8 days. (It ranged between 1 - 24 days).
Among the wounded men of younger age are predominant.
According to the records it was evident that more than a half of the wounded persons were submitted to the regular antimicrobial therapy and prophylaxis against tetanus (8,11,10,4). Some of the wounded received one antimicrobial medicament (Gentamycin, Ampicillin), while for others the data is incomplete.
Samples for bacteriological analysis were taken in most cases during clinical indication (7,5,6,9). The largest number were samples from wound swabs (6,2,9). From the 262 wounded persons treated in our hospital, 56 (21.3%) had developed 75 infections. This percentage of infections is slightly higher in comparison to data from recent wars and the data from the same period presented by Kalenić and associates (3,6,9).
The wounded from the first convoys had the largest number of infections, which is not a surprise considering the environment from which they had come, the conditions of treatment and long and inappropriate transportation.
All infections were hospital acquired infections. One third of the wounded had one infection each while the others had developed two, three or more infections consecutively.
Polimicrobial wound infections were predominant. The most common pathogens were the aerobic bacteria (Enterobacteriaceae, Pseudomonas aeruginosa, Acinetobacter species, Staphylococcus areus). The last three agents were mainly resistant to antimicrobial medicaments (6).
Osteomyelitis developed in five patients with wound infections.
One of the patients had clinical signs of gas gangrene (amputation of right leg performed in Vukovar).
All the patients with sepsis, whose agents also showed explicit resistance to antimicrobial medicaments, developed numerous metastatic foci.
The difficulties in treating infections is a best illustrated by examples of susceptibility of isolated bacteria to antimicrobial medicaments.
Despite all the difficulties (resistant bacteria, the lack of antimicrobial medicaments) we had no casualties and for the majority of patients the treatment was successfully completed.

CONCLUSION

56 out of 250 wounded patients had developed 75 infections. All of them were hospital acquired infections, whose agents very frequently showed strong resistance upon antimicrobial medication, which made their treatment more difficult. This were primarily the patients with sepsis.
Only by rapid and correct treatment of war injuries and inclusion of antimicrobial prophylaxis at an early stage will the number of infections and the number of complications be considerably lowered, the time of treatment shortened and the number of permanent disability decreased.

TABLE 1.
Date of admittance and number of injured person in each convoy
TABLICA 1.
Datum prijema i broj ranjenika u svakom konvoju

Convoj Konvoj	Date Datum	Number of injured persons Broj ranjenika
Vukovar Vukovar	21th October, 1991 21. listopada 1991.	40
Osijek Osijek	10th November, 1991 10. studenoga 1991.	27
Osijek - Vukovar Osijek - Vukovar	21th November, 1991 21. studenoga 1991.	23
Novska - Pakrac Novska - Pakrac	1991 - 1992 1991 - 1992.	84
Odžak - Modriča Odžak - Modriča	30th June, 1992 30. lipnja 1992.	32
Bosanska Posavina Bosanska Posavina	10th July, 1992 10. srpnja 1992.	20
Bosanska Posavina Bosanska Posavina	August - November, 1992 kolovoz - studeni 1992.	24
Other parts Ostali krajevi	December, 1992 - May, 1994 prosinac 1992 - svibanj 1994.	12
Total Ukupno		262

TABLE 2.
Number of injured persons according to age and sex
TABLICA 2.
Broj ranjenika prema dobi i spolu

Age Dob	No. of injured persons Broj ranjenika
20	19
21 - 30	126
31 - 40	70
41 - 50	32
51 - 60	15
Total Ukupno	262

Sex: Male 260, Female 2
Spol: muški 260, ženski 2

TABLE 3.
Protection from infection after injury
TABLICA 3.
Žaštita od infekcije nakon ranjavanja

Prophylaxis Profilaksa	No. of injured persons Broj ranjenika
Prescribed antimicrobial prophylaxis Propisana antimikrobska profilaksa	142 (54.1%)
Antimicrobial prophylaxis Antimikrobska profilaksa	60 (31.2%)
Incomplete data Nepotpuni podaci	58 (23.2%)
Total Ukupno	202 (77.0%)

Duration: 5 - 7 days
Trajanje: 5 - 7 dana
Tetanus prophylaxis was conducted on 169 (64.4%) patients.
Profilaksa tetanusa provedena je na 169 (64,4%) bolesnika.

TABLE 4.
Specimens for bacteriological analysis
TABLICA 4.
Uzorci za bakteriološku analizu

Type of specimen Tip uzorka	No. of injured persons Broj ranjenika
Wound swab Bris rane	167 (64.0%)
Haemoculture Ae/Ana Hemokultura ae/ana	40 (15.2%)
Total Ukupno	207 (79.0%)

TABLE 5.
Frequency of infections in injured persons (No = 56)
TABLICA 5.
Učestalost infekcija u ranjenika (broj = 56)

No. of infection Broj infekcija	No. of injured persons Broj ranjenika
1	41 (73.2%)
2	12 (21.4%)
3	3 (5.3%)

TABLE 6.
Distribution of infections according to convoy
TABLICA 6.
Raspodjela infekcija po konvojima

Convoy Konvoj	No. of injured persons - Broj ranjenika	No. of infections Broj infekcija
Vukovar Vukovar	40	19 (47.5%)
Osijek Osijek	27	16 (59.2%)
Osijek - Vukovar Osijek - Vukovar	23	11 (48.0%)
Novska - Pakrac Novska - Pakrac	84	7 (8.2%)
Odžak - Modriča Odžak - Modriča	32	2 (6.2%)
Bosanska Posavina Bosanska Posavina	44	1 (5.0%)
Other parts Ostali krajevi	12	-
Total Ukupno	262	56 (21.3%)

TABLE 7.
Distribution of infections according to location (No = 56)
TABLICA 7.
Raspodjela infekcija prema lokaciji (broj = 56)

Type of specimen Tip uzorka	No. of injured persons Broj ranjenika
Wound infections Infekcije rane	51 (91.0%)
Sepsis Sepsa	5 (8.9%)

TABLE 8.
Most common agents of wound infections
TABLICA 8.
Najčešći uzročnici infekcija rana

Agents - Uzročnici	No. of injured persons Broj ranjenika
Pseudomonas aeruginosa	6 (12.0%)
Acinetobacter species	7 (14.0%)
Staphylococcus aureus	5 (9.8%)
Enterobacteriaceae/ one type (jedan tip)	11 (21.5%)
Enterobacteriaceae/ more types simultaneously/ (više tipova simultano)	6 (12.0%)

TABLE 9.
Sepsis agents /No = 5/
TABLICA 9.
Uzročnici sepse (broj = 5)

Agents Uzročnici	No. of infections Broj infekcija
Staphylococcus aureus	1 (20%)
Pseudomonas aeruginosa	1 (20%)
E. coli	2 (40%)
Unidentified Neidentificirani	1 (20%)

TABLE 10.
Bacteria isolated from "tranquil" wound swabs (colonisational flora)
TABLICA 10.
Bakterije izolirane iz "mirnih" briseva rana (kolonizacijska flora)

Bacterium Bakterija	No. of isolates Broj izolata
Acinetobacter species	5
Pseudomonas aeruginosa	4
Enterobacteriaceae (one type) (jedan tip)	11
(more types simultaneously) (više tipova simultano)	8
Total: Ukupno	28

TABLE 11.
Reactivity of most common isolated agents upon antimicrobial treatment
TABLICA 11.
Reaktivnost najčešće izoliranih uzročnika na antimikrobsku terapiju

Acinetobacter species (No = 10)		
Antibiotic Antibiotik	No. of reactive sets - Broj reaktivnih setova	No. of resistant sets - Broj rezistentnih setova
Ampicillin / Sulbactam	3	22
Amikacin	8	17
Gentamicin	4	21
Ceftazidime	15	10
Ciprofloxacin	18	7
Imipenem	2	-
Pseudomonas aeroginosa (No = 22)		
Gentamicin	8	14
Amikacin	12	10
Piperacilin	15	7
Ceftazidime	20	2
Ciprofloxacin	11	11
Staphylococcus aureus (No = 11)		
Gentamicin	6	5
Amikacin	5	6
Piperacillin	4	7
Ceftazidime	5	6
Ciprofloxacin	7	4

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Sažetak

INFEKCIJE NAKON RATNIH OZLJEDA

Ljiljana Mišić-Majerus, Nevenka Bujić i Vlatka Janeš-Poje

Odjel za zarazne bolesti Opće bolnice "Dr. Tomislav Bardek" Koprivnica i Mikrobiološki laboratorij Općeg zdravstvenog zavoda u Koprivnici.

U razdoblju od 1991. do 1994. godine liječeno je na kirurškom odjelu Opće bolnice Koprivnica 250 ranjenika.
Autori iznose svoja zapažanja o učestalosti infekcija kod ranjenika, njihov klinički ishod, zatim najčešće izolirane bakterije i njihovu osjetljivost na antimikrobne lijekove.
Većina je ranjenika premještena u našu bolnicu iz drugih ustanova. Dominirao je muški spol u dobi od 21 do 30 godina.
Antimokrobna profilaksa je provedena u 192 (77%) bolesnika.
Najčešći uzročnici izolirani iz bakterioloških uzoraka bili su: Enterobacteriaceae, Acinetobacter species, Pseudomonas aeruginosa, Staphylococcus aureus, od kojih su neki pokazivali izrazitu rezistenciju na antimikrobne lijekove.

Ključne riječi: ratne ozljede, infekcija

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