



CLINICAL EXPERIENCE IN MANAGEMENT OF WAR INJURIES CAUSED BY ARMAMENT DURING THE NATO AGGRESSION

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Summary. *We present 109 wounded treated at the Department of Surgery in Military Hospital Nis during the NATO aggression on FR Yugoslavia. All the patients were male, 19 to 45 years old. Primary surgical wound management, management of injured blood vessels, external fixation of bones, management of injured inner organs were done on terrain by surgeons from Military Hospital-Nis, and by surgeons from regional medical centers. All patients, after primary surgical wound management and resuscitation, are directed to Military Hospital Nis for the continuation of surgical treatment.*

Explosive weapons (mines, bombs and cluster bombs) caused 58.7% injuries and 41.3% of injuries are caused by firearms. Solitary injuries are represented in 71.5% and simultaneous injuries in 24.5 %. Injuries of extremities (in solitary injuries and simultaneous injuries) have the highest incidence 85.4%. Injuries of inner organs (solitary or simultaneous) and CNS are relatively rare (13.7%)

We directed 23.8% of the wounded to Medical Military Academy, because of the complexity of injuries and needs for long term and specific intensive care.

Delayed primary wound closure and reconstruction were done in 75.9%; secondary wound closure or reconstruction in 19.2% and amputations in 3.6% of the wounded. Secondary reconstruction was indicated in 3.6% of the wounded (leg bony defects and ulnar nerve repair). In 8.4% of the patients complications were found: infection, flap necrosis and stress duodenal ulcer. Lethal exits are not found.

Key words: *War wounds, surgery, weapons*

Introduction

Armament can be classified in two basic groups (1,2):

1. Firearm (automatic rifle, semiautomatic rifle, sniper)
2. Explosive weapons (bombs, mines, shells)

Most of modern firearms have projectiles with high initial speed (more than 750 meters per second) which make hard tissue destruction. Tissue destruction caused by projectile can be divided in 3 zones (according to a degree of destruction):

- a) zone of traumatic necrosis
- b) zone of contusion
- c) zone of tissue commotion

Irreversible changes in area of contusion proceed to tissue necrosis with consequential effects.

Explosive weapons have a dual effect:

1. Effects of parts of explosive vapors
2. Effects of explosion.

The parts of explosive weapons act as high-speed projectiles at relatively short distance (20 meters).

Explosion causes air blast injury.

As a special type of explosive weapons we must

point out cluster bombs. The cluster bomb is a container filled with several hundreds of bombs used for destroying land forces.

All war wounds caused by projectiles of armament need to be treated according to universal principles of war-surgery doctrine including the following:

All wounds are primarily contaminated. Surgical wound management is the most effective way for the prevention of infection.

A 6-8 hours period after injury is optimal for primary surgical wound management. Surgical management of war wounds is a two- step procedure: The first step is primary wound management and the second step is delayed wound closure. Primary wound closure is not permitted, but there are clearly defined exceptions. Primarily delayed wound closure is a rule for war wound management and could be performed 3 to 7 days after primary wound management (3-).

We present the structure of injuries and ways of management and results in the management of the wounded in Military Hospital Nis during the NATO aggression.

Material and Methods

We present 109 wounded treated at Department of Surgery in Military Hospital Nis. The wounded were from Kosovo, injured by Albanian separatists and the NATO air forces and from regions of the south Serbia: Leskovac, Vranje, Kursumlija, and Prokuplje injured by the NATO air forces. All the patients were male, 19 to 45 years old. Eighty-three were younger than 30 (76.1%) and 26 were older than 31 (23.8%).

Results

Firearm and explosive weapons (Table 1) produced injuries.

Table 1. Structure of injuries according to the type of armament

Type of armament	No	%	No	%	
Firearm	automatic rifle injuries	36	33.0	45	41.2
	sniper self-injuries	8	7.3		
	sniper	1	0.9		
Explosive weapons	mine	30	27.5	64	58.7
	airplane bombs	9	8.2		
	cluster bombs	25	22.9		

Patients were divided into two categories: solitary injuries and simultaneous injuries (Table 2).

Table 2. Structure of wounded according to type of injuries

Type of injuries	No	%	No	%	
Solitary injuries	CNS	1	0.9	78	71.5
	scalp and face	4	3.6		
	abdomen	1	0.9		
	chest	4	3.6		
	upper extremity	15	13.7		
	lower extremity	51	46.7		
	burns	2	1.8		
Simultaneous injuries	upper and lower extremity	9	8.2	31	28.4
	face and extremities	9	8.2		
	face chest and extremities	1	0.9		
	chest, abdomen and extremities	2	1.8		
	abdomen and extremities	2	1.8		
	chest and extremities	3	2.7		
	CNS and extremities	1	0.9		
multiple soft tissue injuries	4	3.6			

According to the type of the injured tissue, the wounded were divided into several groups (Table 3)

Table 3. Classification of injuries according to the type of tissue

Type of injured tissue	No	%
soft tissue	51	46.7
soft tissue and bones	40	36.6
soft tissue and inner organs	6	5.5
soft tissue, bones, inner organs or CNS	9	8.2
injuries of extremities with lesion of blood vessels and nerves	3	2.7
Total	109	100.0

Primary surgical wound management, management of injured blood vessels, external fixation of bones, management of the injured inner organs were done on terrain by the surgeons from Military Hospital Nis (the wounded from Kosovo), and by the surgeons from regional medical centers (the wounded in South Serbia-Prokuplje, Leskovac, Vranje, Kursumlija).

All the patients, after primary surgical wound management and resuscitation, are directed to Military Hospital Nis for the continuation of surgical treatment, or directed to other medical institutions (Military Medical Academy, Belgrade). Primary surgical management was done in 6 hours after the injuries for 88 (80.7%) wounded, and after 6 hours in 21 (19.3%). In our series 26 (23.8%) wounded are directed to Military Medical Academy and 83 (76.1%) are treated in Military Hospital Nis.

Table 4 presents the number of patients directed to Military Medical Academy. Values in the % column shows in percent how many wounded of the absolute number with this injury accepted in Military Hospital Nis are directed to Military Medical Academy.

Table 4. Number of patients directed to Military Medical Academy

Type of injuries	No	%	
Solitary injuries	CNS	1	100.0
	scalp and face	3	75.0
	chest	1	25.0
	upper extremity	4	26.6
	lower extremity	6	11.7
	burns	1	50.0
	Simultaneous injuries	upper and lower extremity	4
face and extremities		2	22.2
chest, abdomen and extremities		1	50.0
abdomen and extremities		1	50.0
CNS and extremities		1	100.0
multiple soft tissue injuries	1	25.0	
Total	26	23.8	

We present 83 wounded whose treatment is finished in Military Hospital Nis.

Second look procedure was done in 35 (42.1 %) patients. The procedures used in treatment are shown in Table 5.

Table 5. Procedures for wound management

Procedure	No	%
delayed primary closure	47	56.6
secondary closure	12	14.4
delayed primary reconstruction with skin graft	8	9.6
delayed primary reconstruction with flap	8	9.6
secondary reconstruction with skin graft	2	2.4
secondary reconstruction with flap	2	2.4
amputation	3	3.6
dressing of burn wound	1	1.2
Total	83	100.0

In 3 (3.6%) wounded secondary reconstruction was indicated (leg bony defect in 2 (2.4%) and ulnar nerve in 1 (1.2%) patient). In 1 (1.2%) patient closure of temporary colostomia was indicated.



Fig.1. The patient with simultaneous injuries of the left hip and left forearm caused by the cluster bomb. The wound on hip was managed by delayed primary closure, and the forearm is amputated.

We found complications in 7 (8.4%) patients: in 5 (6%) wounded infection occurred, in 1 (1.2-%) patient flap necrosis and 1 (1.2-%) patient developed stress duodenal ulcer. Lethal exits are not found in our series of 83 patients treated in Military Hospital Nis.

Discussion

In our study we present a group of the wounded treated in Military Hospital Nis. All the patients were male, younger than 45 years and all of them were in military service. In etiology we found that explosive weapons are a dominant factor (58.7%) This is in correlation with the facts that modern armament (trench mortars and cluster bombs) used in the NATO aggression against FR Yugoslavia has a high destructivity. Higher incidence of injuries (56.2%) caused by explosive weapons in modern wars is referred in literature (4,5). High incidence of self-injuries by firearms (negligence) (7.3%) is the result of inexperience in han-

dling with firearms at the beginning of the war. The structure of injuries according to the type is very interesting and a large number of injuries (71.5%) are solitary injuries. Solitary injuries of lower extremity are the most frequent (46.7%). Injuries of upper extremities have incidence of 13.7%. These data are in agreement with literature data: 48% of injuries are on lower extremities and 16.9% on upper extremities in the wars in the former Yugoslavia (6); 50-70% of all injuries are on extremities (7). Injuries of extremities are most frequent in the group of simultaneous injuries, and injuries of extremities (in solitary injuries and simultaneous injuries) have incidence 85.4%. Simultaneous injuries of face and extremities are frequent (8.2%) and are rare on other locations (abdomen and extremities 1.8%, chest and extremities 1.8%). These data are in agreement with literature data (8-11).

Generally, inner organs injuries (solitary or simultaneous) are relatively rare (9.1%), but literature data refer to higher incidence: chest injuries 15-20% (12) or 6-10% (11), abdominal injuries 8-10% (4) or 4% (8,9). Injuries of CNS have a very low incidence (0.9%), but in literature data we found 6% (13,14). A high incidence of simultaneous injuries (28.4%) and a low incidence of inner organ injuries and injuries of CNS are the result of explosive weapons with highly destructive power and a



Fig. 2. The patient with injuries of the lower extremities caused by bomb.

high mortality rate at place of accident or during transport.



Fig. 3. Both defect were treated by delayed primary reconstruction with skin grafts.

A high incidence of the wounded directed to Medical Military Academy (23.8%) is the result of the complexity of injuries and needs for long term and specific intensive care, personal wish of the wounded and limited capacities of Military Hospital Nis.

In 42.1% of 83 patient treated in Military Hospital Nis we performed "second look" surgery. This incidence is in agreement with literature data (40%) (3). This high incidence of "second look" surgeries is the result of a highly destructive power of the weapons. "Second look" surgeries must be performed despite excellent primary wound management. Delayed primary wound closure, as a method of war wound closure, is done in more than a half of the wounded (56.6%) and delayed primary reconstruction with skin graft or flap in 12%; secondary wound closure or reconstruction with skin graft and flaps in 19.2%, and amputations of extremities in 3.6% the wounded. We present that delayed primary wound closure or reconstruction with flaps or skin grafts are the most frequent ways of war wound management. This approach is currently relevant in

modern war surgery. Secondary wound closure and secondary reconstruction are done for infected wounds with massive tissue destruction. Other authors describe these indications for secondary wound closure and secondary reconstruction (15-17).

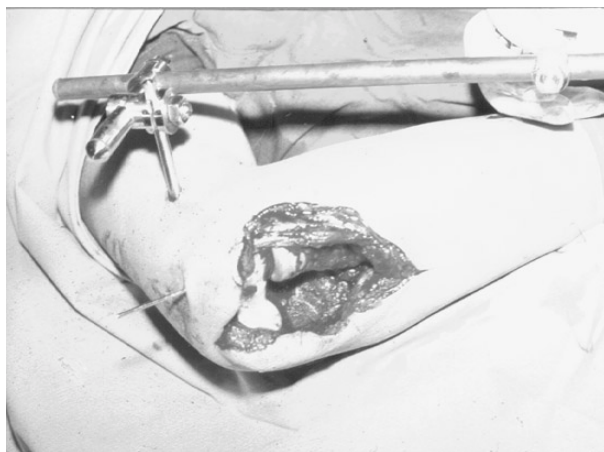


Fig. 4. The patient with injury of left arm and elbow with exposed bones caused by firearm. External bony fixation was done.

We must point at the low incidence of complications (8.4%). This is an excellent success. This success arises from good primary wound management and excellent entire treatment of the wounded in Military Hospital Nis. Infection is the most frequent complication (6%). We must remember that for 83.3 % of the treated wounded primary wound management was not attended in the first 6 hours after the injury. This fact asserts and points out the rule of war surgery that the suitable primary wound management in due time is the most important factor in the treatment of war wounds.

Conclusion

Most of modern firearms have projectiles with high initial speed (more than 750 meters per second) which causes hard tissue destruction. Because of fact that all war wounds are primarily contaminated they should be treated according with universal principles of war-surgery doctrine. An appropriate surgical wound management is the most effective way for prevention of infection.

A period 6-8 hours after injury is optimal for primary surgical wound management. The primary surgical management has been performed within 6 hours after injuries in 88 (80.7%) wounded, and after 6 hours in 21 (19.3%).

Primarily delayed wound closure is a rule for war wound management and could be performed 3 to 7 days after primary wound management. Delayed primary wound closure or reconstruction with flaps or skin grafts are the most frequent ways of war wound management. This approach is currently relevant in modern war sur-

gery. It was done in more than a half of the wounded (56.6%) and delayed primary reconstruction with skin graft or flap in 12%. In 42.1% of 83 patient treated in Military Hospital Nis we performed "second look" surgery.

Secondary wound closure and secondary reconstruction were done for infected wounds and wounds with massive tissue destruction. Secondary wound closure or reconstruction with skin graft and flaps were done in 19.2% and amputations of extremities in 3.6% of the wounded.

Injuries of extremities (either solitary or simultane-

ous injuries) have the highest incidence (85.4%).

Generally, inner organ injuries (either solitary or simultaneous) are relatively rare (9.1%). Injuries of CNS have a very low incidence (0.9%). Low incidence of inner organ injuries and injuries of CNS are the result of modern weapons with a high destructive power which lead to a high mortality rate at the place of the accident or during transport.

Low incidence of complications (8.4%) is an excellent success arising from a good primary wound management and the excellent entire treatment of the wounded in Military Hospital Nis.

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KLINIČKA ISKUSTVA U ZBRINJAVANJU RATNIH POVREDA VATRENIM ORUŽJEM U TOKU "NATO" AGRESIJE

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Kratak sadržaj: Prikazana je grupa od 109 ranjenika lečenih u Vojnoj bolnici Niš tokom Nato agresije na Jugoslaviju. Svi povredjeni su bili muškog pola starosti 19-45 godina. Primarna hirurška obrada rane, potom zbrinjavanje povreda unutrašnjih organa, fiksacija polomljenih kostiju i rekonstrukcija magistralnih krvnih sudova je rađena na terenu (na mestu povrede) od strane hirurških ekipa vojne bolnice ili hirurških ekipa regionalnih bolnica. Nakon reanimacije upućivani su u Vojnu bolnicu Niš radi daljeg praćenja i daljeg hirurškog tretmana.

Eksplzivno oružje (mine, avio bombe, kasetne bombe) je bilo uzrok povređivanja u 58,7% a ostale povrede (41,3%) su bile prouzrokovane steljačkim naoružanjem.

Izolovane povrede pojedinih organa ili delova tela su bile dominantne (71,5%) dok su udružene povrede verifikovane u 24,5 % povredjenih. Povrede ekstremiteta, izolovane ili udružene sa drugim povredama su bile daleko najbrojnije (85,4%), dok su povrede unutrašnjih organa i CNS znatno ređe (13.7%).

U prikazanoj seriji 23,8% povredjenih je premešteno u zdravstvenu ustanovu sa većim mogućnostima medicinsko sanitetske pomoći, a 76,1% je lečeno i izlečeno u Vojnoj bolnici Niš. U toj grupi je primarno odloženi šav ili rekonstrukcija rađena u 75,9% povredjenih, sekundarni šav ili rekonstrukcija u 19,2% a amputacija u 3,6% povredjenih. Kod 3,6% povredjenih je indikovana naknadna rekonstrukcija (kostiju ili živca) nakon zarastanja rane.

Komplikacije su registrovane kod samo 8,4% povređenih (infekcija, nekroza režnja , stres ulkus) a smrtnih slučajeva nije bilo.

Ključne reči: Ratne rane, hirurško zbrinjavanje, oružje

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