SLOBOZHANSKYI HERALD OF SCIENCE AND SPORT

UDK 615.825/616-001.45

ISSN (English ed. Online) 2311-6374
2018, №2(64), pp. 17-21

Some results of physical rehabilitation of victims with consequences of mine-blast injury of lower extremities

Hassan Dandash
Denis Podkopai
Tetiana Podkopai
Charbel Youssef

Kharkiv State Academy of Physical Culture, Kharkiv, Ukraine

Purpose: *increase the effectiveness of physical rehabilitation of victims with the consequences of mine-explosive injury of the lower limbs at the polyclinic stage.*

Material & Methods: *a study of the effectiveness of the physical rehabilitation of the victims with the consequences of the mine-explosive injury of the lower extremities at the polyclinic stage was carried out at the clinic of the Dorra-Center Medical Center in Belbek (state of Lebanon) on the basis of the physical rehabilitation department.*

Results: *results of use in the study of the Minor sample, Schober's test, and the modified S. D. Tumyan technique are presented and indicate the effectiveness of the proposed program of physical rehabilitation of victims after a mine explosion injury.*

Conclusion: *the analysis of the results of the study showed that with positive dynamics of changes in the functional state of the victims of both clinical groups, the best results were obtained precisely from the victims of the main group who underwent physical rehabilitation according to the program proposed by us. In addition, in the affected main group at the same time and volume of observation, these indicators were better than the control group.*

Keywords: *mine-blasting injury, physical rehabilitation, polyclinic stage, lower extremities, oriental massage, Arab bath.*

Introduction

In military operations in modern local military conflicts, the most common means of destruction are explosions of various origins. According to statistics, they are also decisive damaging factors [1; 2].

In recent decades, damage from explosive devices and ammunition has been among the top ten leading causes of death from the use of weapons in the World. And this process continues to grow progressively in armed confrontations around the world.

A special feature of an explosive (mine-explosive) injury is a significant severity of bone and surrounding soft tissue injuries, primary microbial contamination of the wound, the presence of foreign bodies in the wound and a high incidence of early and late complications [4; 5].

For doctors, mine-explosive lesions represent an increased complexity due to the presence of distinctive features of pathogenesis, diagnosis, treatment of such patients, and for rehabilitation specialists of such victims, due to a combination of disruptions in several body systems, the problem of creating complex physical rehabilitation programs, physical recovery [6; 7; 8].

As many authors note, the consequences of a mine-blast injury are particularly difficult to accurately diagnose, they are characterized by high lethality (67,8–79,3%), frequent complications (69,3–77,3%), disability of the victims. In 85,7% of the victims of mine and blast injury, it is the lower limbs that are injured [9; 10].

The main objective of physical rehabilitation, as an integral part of medical rehabilitation, is an integrated approach to the restoration of health and the maximum possible working capacity of victims after a mine blast injury [12; 13]. The need to return the wounded soldiers and officers of the security services to perform their official duties, and the civilian population to active work, is necessary both in the military and in peacetime. At the same time, the improvement of the system of organization of medical and sanitary measures and the improvement of the mandatory complex of rehabilitation measures at all stages of treatment and especially in the early period after the provision of specialized medical care can really reduce the human losses and material costs of the state [3; 6; 11].

Therefore, to date, the problem of effective organization and conduct of medical and physical rehabilitation of victims with the consequences of mine explosion injury is one of the most urgent issues of extreme medicine, physical and psychological rehabilitation.

Purpose of the study: increase the effectiveness of physical rehabilitation of victims with the consequences of mine-explosive injury of the lower limbs at the polyclinic stage.

Material and Methods of the research

The study was conducted in the clinic of the Dorra-Center Medical Center in Belbek (state of Lebanon) on the basis of the physical rehabilitation department. The overwhelming majority of the victims were residents of rural areas and suburbs. Belbek.

All the victims were male at the age of 23 to 44 years. Among

the victims were persons of working age, servicemen and law enforcement officers of the state of Lebanon.

A total of 48 men participated in the study, which were divided into two equivalent clinical groups – the main group and the control group (24 victims each). The duration of the trauma ranged from 6 months to 3 years, while the victims of both clinical groups underwent a course of rehabilitation treatment for the first time. By localization of the injuries received, age and manifestations of functional disorders, the main and control groups were identical.

The victims of group I (control) received a complex of rehabilitation measures under the traditional program of physical rehabilitation, accepted in the clinic of the Medical Center "Dorra-Center". The victims of group II (main) complex of rehabilitation measures received according to the program proposed by us.

Each victim from both groups underwent primary and re-examination before rehabilitative treatment and at the end, 30 days after the beginning, which allowed to obtain data on the dynamics of the parameters of the musculoskeletal and other body systems, changed during the treatment according to the traditional and original complex program of physical rehabilitation of victims after a mine-blast injury of the lower extremities at the out-patient stage of treatment. Also for the victims of both groups, there was ongoing monitoring of the somatic state during exercise therapy and during physiotherapeutic procedures.

Analyzing some results of the study, within the framework of this article, the dynamics of the measurement parameters of the amplitude of movements in the joints of the lumbar spine with the Minor test and the Shober test was examined, and the effectiveness of rehabilitation treatment of the victims after the mine explosion was analyzed according to the data of the technique of S. D. Tumyan 1983) in the modification.

Since the patients were referred to the rehabilitation center for the first time, all physio-functional measures were conditionally divided into 4 phases for all clinical cases. Each phase corresponds to a weekly protocol of rehabilitation measures and schedule. The schedule of rehabilitation measures for the affected control group is presented in Table 1.

Table 1
Schedule of treatment for patients in the control group

Weekday	Treatment
Monday	Exercise therapy, magnetotherapy
Tuesday	Therapeutic massage (back, leg), laser therapy
Wednesday	Exercise therapy, magnetotherapy
Thursday	Therapeutic massage (back, leg), laser therapy
Friday	Exercise therapy, magnetotherapy
Saturday	Therapeutic massage (back, leg), laser therapy
Sunday	Rest

The tasks of exercise therapy in the affected groups were: optimization of tissue function, gradual increase in cardiovascular load, increase in static and kinematic loads on the musculoskeletal system as a whole, and purposefully on the muscles of the back and lower limbs, exercises to restore proprioception, exercise with an open and a closed kinematic chain, exercises to restore proper posture and gait, training a rapid change in direction and coordination.

The injured control group was prescribed a therapeutic massage of the spine muscles, taking into account the main and special parts. It should be noted that 18 patients had muscular hypertonicity in the paravertebral and remote zones of the affected segment, 6 myogloeoses and myofibrosis sites were detected. The therapeutic massage of the affected limb was intended exclusively in the regime of the main part, activation of blood and lymph flow was due to the involved technique of lymphatic drainage massage.

Magnetotherapy in the control group was intended for 3 sessions with magnetic field induction up to 30 mT. Laser therapy in this phase was used for all patients 3 times in view of the type of monochromatic radiation on the knee or ankle and reflexogenic zones, but, as a rule, in a constant mode with a power of up to 25 mW for 15–30 seconds each, the total time of the procedure was 3 minutes.

It should be noted that the curative gymnastics program, the selection of exercises and their dosages, as well as the technique of therapeutic back massage, which were used in the main group, did not differ from the program that was used in the control group.

For the victims of the main group, the protocol of each phase consisted of therapeutic gymnastics, classical back massage for local elimination of the primary manifestations of spinal osteochondrosis, a modified technique for oriental massage of the injured limb and an Arab-based oriental bath procedure. Physiotherapeutic treatment was not used – it was replaced by the above-mentioned hydrobionic procedures.

The protocol of each phase was different from the complex of exercise exercises and met all the general provisions of the physical rehabilitation program.

The criteria for the transition to the second phase of treatment in both groups were: complete passive flexion and extension in the ankle joint, complete passive extension and flexion to 130 degrees in the knee joint, minimized pain syndrome and edema of the limb, restoration of functional activity of the quadriceps femoris muscle.

The criteria for the transition to the third phase were: full axial load, correct posture, full active flexion and extension in the ankle joint, complete active extension in the knee joint without resistance and complete passive flexion, there is no pain syndrome and swelling of the limb.

By the fourth phase passed after the restoration of the walking stereotype, full active flexion and extension in the ankle joint with resistance, full active extension and flexion of the knee joint, restoration of muscle strength to 80% of the strength of the healthy limb and in the absence of manifestations of pain syndrome.

A comprehensive program of physical rehabilitation for the affected groups was also developed, consisting of 4 phases, each of which corresponded to a protocol that was implemented in accordance with the schedule for all phases (Table 2).

Table 2

Schedule of treatment for patients in the main group

Weekday	Procedure
Monday	Bath + oriental massage
Tuesday	Exercise therapy (classical back massage)
Wednesday	Bath + oriental massage
Thursday	Exercise therapy (classical back massage)
Friday	Bath + oriental massage
Saturday	Exercise therapy (classical back massage)
Sunday	Rest

The transition criteria for the next phase of rehabilitation were the same as for the affected control group.

Results of the research and their discussion

Long-term and progressive violation of motor stereotype and supporting function of one lower extremity lead to the appearance of pronounced and persistent orthopedic disorders (diseases of the intervertebral joints and active development of osteochondrosis of the spine), which in turn leads to a deterioration in the quality of life and manifestations of the clinical picture of osteochondrosis syndromes [9; 13].

Measurement of the results of the Minor sample in the control group showed that the initial indices were 18,79±3,35 cm ($p<0,05$), and indicate a compensatory increase in muscle tone in the lumbar spine, which results in limited flexion of the spinal column.

When the control group was re-examined, it was found that on average 16,88±3,07 cm ($p<0,05$). The findings indicate a decrease in muscle tone in the lumbar spine, which is manifested by a moderate increase in the amplitude of flexion of the spine.

Determination of the mobility of the spine in the lumbar region was carried out in the control group using the Schober test (Table 3).

Table 3

Results of the Schober test in the affected control group after a mine explosion injury

Indicators	Baseline	After treatment
Distance, cm	3,13±0,63 ($p<0,05$)	3,88±0,49 ($p<0,05$)

Table 3 shows that a moderate increase in the amplitude of flexion of the spine led to a slight increase in the distance between the spinous processes of the lumbar spine.

Amplitude of movements in the lumbar spine during the study of the main group was also determined with the Minor test. The measurement showed that the initial values have an average value 18,21±2,55 cm ($p<0,05$).

In a repeated study, the average data of 14,58±2,60 cm ($p<0,05$) were recorded in the affected group of the main group, that is, the positive dynamics of the studied parameters was revealed, which indicates an increase in the amplitude of the lumbar spine movements.

The determination of spinal mobility in the lumbar region was performed in the main group using the Schober test (Table 4).

The increase in the amplitude of flexion of the trunk forward led to an increase in the distance between the spinous processes of the lumbar spine.

Table 4

Results of the Schober test in the affected main group after a mine explosion injury

Indicators	Baseline	After treatment
Distance, cm	3,06±0,57 ($p<0,05$)	4,39±0,65 ($p<0,05$)

Comparing the data of studies of mobility of the spine in the lumbar region, it can be seen that in a second study in the affected patients of both clinical groups, the functional state and the distance between the spinal outgrowths of the lumbar spine were improved. But in the affected group, the improvement of these indicators was more pronounced, which indicates the greater effectiveness of the proposed tactic of physical rehabilitation.

The effectiveness of the rehabilitation treatment of the victims after the mine explosion trauma according to the traditional and proposed schemes was evaluated according to the methodology of S. D. Tumyan (1983) in our modification.

The essence of S. D. Tumyan's methodology is based on the assessment of the main clinical-radiological signs (total 6), each of which is estimated by the numerical expression 0; 1 or 2 points. In this case, 2 marks are signs that are considered to be quite positive, 1 point correspond to a satisfactory value, which is satisfactory only in the estimation of the nearest results. 0 points – the importance of anatomical and functional criteria, are evaluated unsatisfactorily.

Considered such criteria as the volume of movements in adjacent joints, shortening, limb deformation, X-ray data, the presence of neurodistrophic disorders and purulent-necrotic complications.

The results were considered good, in which there was no restriction of movements in adjacent joints, there is no neurodystrophic syndrome on the background of complete consolidation of the fracture, fully restored axis and segment length, absence of purulent-necrotic complications.

Satisfactory were the results in which there were contractures in adjacent joints that needed further rehabilitation and moderate neurodistrophic manifestations-edema, muscle atrophy up to 2 cm. At the same time, fracture fusion occurred, restoration or slight violation of the length and axis of the limb.

The results were unsatisfactory in which stable contractures were found in adjacent joints that needed the following surgical treatment, neurodystrophic syndrome in the form of paresis or paralysis of the muscles, revealed violations of osteorecorrection in the form of false joints, fractures of fracture or bone defect, consolidation of the fracture in functionally disadvantageous situation, the presence of purulent-necrotic complications.

All the victims who participated in the study at the time of the onset of physical rehabilitation determined the complete fusion of bone fractures, there were no purulent necrotic lesions and neuro-dystrophic disorders were expressed.

One of the most significant indicators of the quality of rehabilitation is the restoration of movements in the joints. To more accurately estimate the volume of movements, objective numerical data in degrees were used. The shortening of the segment and the degree of muscle atrophy are measured in centimeters, the deformation in degrees.

We did not take into account the social rehabilitation of the victims and the restoration of working capacity as one of the criteria for evaluating the results of treatment.

Cosmetic limb defect, pain, increased fatigue as independent criteria were not considered, because they are subjective, and the factors that lead to them are taken into account in other features.

The score in the range of 10–12 was considered as a good result, within 8–10 – as satisfactory, the indicator less than 8 points was attributed to the unsatisfactory result.

The results of treatment of the injured *control group* after a mine explosion injury according to the method of S. D. Tumyan are presented in Table 5.

Table 5

Assessment of anatomical and functional results of treatment of the affected control group after a mine explosion injury according to S. D. Tumyan

Results of treatment	Initial level		After the course of treatment	
	abs.	%	abs.	%
Good	8	33,3	15	62,7
Satisfactory	10	41,7	6	25
Unsatisfactory	6	25	3	12,3
Total	24	100	24	100

Analyzing the data obtained, it can be seen that after using the program of physical rehabilitation according to the traditional program, the results improved, namely, the number of unsatisfactory (by 12,7%) and satisfactory (by 16,7%) results was improved by increasing the good (by 29,4 %).

The results of treatment of the affected main group after a mine explosion injury according to the method of S. Tumyan are presented in Table 6,

The obtained data show that after using physical rehabilitation according to the program proposed by us, the results have significantly improved, namely – the number of good results (by 54,2%) has significantly increased due to a decrease in the number of satisfactory (by 25,1%) and, especially, unsatisfactory on 29,1%) of results.

From the data presented, it can be seen that the average value of this indicator in the affected group, whose results were assessed as good and satisfactory, not only increased in comparison with the control group, but also the number of

Table 6

Evaluation of anatomical and functional results of treatment of the patients of the main clinical group according to S. D. Tumyan

Results of treatment	Initial level		After the course of treatment	
	abs.	%	abs.	%
Good	7	29,1	20	83,3
Satisfactory	9	37,6	3	12,5
Unsatisfactory	8	33,3	1	4,2
Total	24	100	24	100

victims, whose results were assessed accordingly, increased. Although the number of victims whose rehabilitation results were assessed as unsatisfactory decreased by 5 times, the percentage of the maximum function increased, but did not differ significantly in the main group from that in the control group (41,25±1,25% та 40±5,18% respectively).

Thus, in the affected groups of the main group, there is a clear improvement in the efficiency indicators of the rehabilitation treatment, which is indicative of the severity of the effect obtained, and consequently of the pronounced positive dynamics after the physical rehabilitation program.

The analysis of the presented results of the study forms a reliable fact that, with a positive dynamics of changes in the functional state of the affected, both clinical groups are more pronounced and significantly better results were obtained in the affected group, who were physically rehabilitated according to the program proposed by us. In addition, in the affected main group we observed significantly better control group indicators of our methods and scales of results in the same time frame and scope of observation.

Conclusions

1. For physicians and rehabilitation specialists, mine-blasting lesions represent an increased complexity due to the presence of complex pathogenesis features, diagnosis, treatment of such patients due to a combination of disruptions in several body systems, which requires the creation of effective integrated programs for physical rehabilitation and psycho-physical recovery.

2. The use of the proposed program of physical rehabilitation with the consequences of mine explosion injury significantly improved the condition of the spine of the affected main group compared to the control according to the results of the Minor test and the Schober test.

3. The proposed program of physical rehabilitation was more effective for the victims of the main group according to the indices of the technique of S. D. Tumyan, which is confirmed by a significant increase in the number of good results (by 54,2%) and a significant decrease in the number of unsatisfactory (by 25,1%) compared to control group (29,4% and 12,7%, respectively).

Prospects for further research. The introduction of the proposed program of physical rehabilitation of victims with the consequences of mine-explosive trauma of lower extremities in the profile institutions of Ukraine.

Conflict of interests. The authors declare that no conflict of interest.
Financing sources. This article didn't get the financial support from the state, public or commercial organization.

References

1. Office of the Chief of the Military Medical Service of the US Army (2015), *Emergency Military Surgery*, V. Chaplik, P. Oliynyk, A. Tsehelsky (ed.), translation from english A. Kordiyak et al., Nash Format, Kyiv. (in Ukr.)
2. Hoencamp, R. (2016), "Medicalas pectsand challenge sinanarmed conflict", *Militaires pectator*, Vol. 185, No. 6, pp. 264-273.
3. Peleg, K., Aharonson-Daniel, L., Stein, M. et al. (2004), "Guns hotand explosion injuries: characteristics, outcomes, and implications forcareof terror-related injuries in Israel", *AnnSurg*, Vol. 239 (3), pp. 311-8.
4. Yeloev, P.M. (2010), *Sovremennye podkhody k diagnostike i lecheniyu ognestrelnykh raneniy konechnostey: avtoref. dis. na soisk. uch. st. doktora med. nauk: spets. 14.01.17 "Khirurgiya"* [Modern approaches to the diagnosis and treatment of gunshot wounds of the extremities: Doct. of Sci. thesis], Moscow, 25 p. (in Russ.)
5. Yefimenko, H.A., Shapovalov, V.M., Dulaev, A.K. et al. (2003), "Characteristics of combat trauma and therapeutic measures in the case of gunshot fractures of long limb bones", *Voenno-meditsinskiy zhurnal*, No. 5, pp. 412. (in Russ.)
6. Bykova, I.Yu., Yefimenko, N.A. & Gumanenko, Ye.K. (2009), *Voenno-polevaya khirurgiya: natsionalnoe rukovodstvo* [Military Fields Irrigation: National Leadership], GEOTAR-Media, Moscow. (in Russ.)
7. Savvin, Yu.N. & Kudryavtsev, B.P. (2016), *Organizatsiya okazaniya khirurgicheskoy pomoshchi pri minno-vzryvnykh povrezhdeniyakh v chrezvychaynykh situatsiyakh: uchebnoe posobie dlya vrachey* [Organization of the provision of surgical assistance for mine explosive damage in emergency situations: a training manual for doctors], Zashchita, Moscow. (in Russ.)
8. Trukhan, A.P., Zhidkov, S.A., Ovsiyuk, Yu.A. et al. (2012), "Factors of thatogenesis in explosive trauma", *Meditsinskie novosti*, No. 4, pp. 69-71. (in Russ.)
9. Huriev, S.O., Kravtsov, D.I., Ordatii, A.V. & Kazachkov, V.Ye. (2016), "Clinical and nosological and clinical and anatomical characteristics of victims of a mine-and-bang injury at the early hospital stage of medical care provision in the context of modern combat operations on the example of an anti-terrorist operation in the east of Ukraine", *Khirurhiia Ukrainy*, No. 1, pp. 7-11. (in Ukr.)
10. Florikyan, A.K., Polishchuk V.T., Lurin I.A. et al. (2009), "Our views on the diagnosis and treatment of victims with a severe mine explosion multiorgan combined injury", *Kharkivska khirurgichna shkola*, No. 1, pp. 363-364. (in Russ.)
11. Yefimenko, N.A. Yenin, V.M., Kozeev & S.V. (2000), "Features of medical evacuation of injuries by special vehicles from areas of armed conflicts", *Voenno-meditsinskiy zhurnal*, No. 1, pp. 20-22. (in Russ.)
12. Sokrut, V.N. & Yabluchanskiy, N.I. (2015), *Meditsinskaya reabilitatsiya:* uchebnik [Medical rehabilitation: a textbook], Vash imidzh, Slavyansk. (in Russ.)
13. Yepifanova, A.V., Achkasova, Ye.Ye. & Yepifanova, V.A. (2015), *Meditsinskaya reabilitatsiya: uchebnik* [Medical Rehabilitation: a textbook], GEOTAR-Media, Moscow. (in Russ.)

Received: 02.03.2018.
Published: 30.04.2018.

Information about the Authors

Hassan Dandash: *Kharkiv State Academy of Physikal Cuiture: Klochkivska str. 99, Kharkiv, 61058, Ukraine.*
E-mail: frir@ukr.net
ORCID.ORG/0000-0002-0755-3682

Denis Podkopai: *PhD (Physikal Education and Srort), Kharkiv State Academy of Physikal Cuiture: Klochkivska str. 99, Kharkiv, 61058, Ukraine.*
E-mail: frir@ukr.net
ORCID.ORG/0000-0001-9845-7639

Tetiana Podkopai: *Kharkiv State Academy of Physikal Cuiture: Klochkivska str. 99, Kharkiv, 61058, Ukraine.*
E-mail: frir@ukr.net
ORCID.ORG/0000-0002-7890-0215

Charbel Youssef: *Kharkiv State Academy of Physikal Cuiture: Klochkivska str. 99, Kharkiv, 61058, Ukraine.*
E-mail: frir@ukr.net
ORCID.ORG/0000-0002-4442-9509