A retrospective study of surgical treatment of spinal injuries with rehabilitation program

Retrospektivna studija hirurškog tretmana povreda kičmenog stuba sa programom rehabilitacije

Dijana Avdić*, Amila Jaganjac, Bakir Katana, Samir Bojičić

Faculty of Health Studies, Bolnička 25, 71 000 Sarajevo, Bosnia & Herzegovina

Abstract

Introduction: Traumatic injuries of the spinal column are among the most devastating injuries in orthopedics. The primary goals of rehabilitation of these injuries are prevention of secondary complications, maximizing physical functioning and reintegration into the community. Rehabilitation after spinal injury reqires multidisciplinary team approach. Team members include, but are not limited to, physical therapists, occupational therapists, nurses, psychologists, health care managers and social workers, with each member having role and responsibility in their area of expertise. This study aimed to determine the difference in the occurrence of spinal injuries according to gender, age, cause of injury, neurological phenomenon in injured patients, the treatment and physical procedures used in the early stages of rehabilitation.

Methods: The study was conducted as a retrospective and comparative at the Department of Orthopedics and Traumatology of Clinical Center University of Sarajevo. Medical records of 100 patients, treated at from January 1st 2007 till June 30th 2008, were processed and data about outpatient protocols and surgery protocols analyzed.

Results: The results obtained from the data showed greater proportion of women (56%) compared to men (44%). Most patients were in the age group between 41 and 60. Injuries were most often due to falls from height and make 32%, fall from a tree 25%, traffic accidents 12% (χ^2=17.94, p=0.0061). 88% of patients were without neurologic events, while the neurological disturbances occurred 12% (χ^2=3.397, p=0.3343). 56% of patients with spinal injuries were treated surgically, while 41% were treated conservatively (χ^2=7.264, p= 0.00153). 73% patient had physical therapy program of early rehabilitation exercises, with at least at least only a massage in 4% of patients (χ^2 = 6.573, p = 0.04270).

Conclusion: The adoption of national protocols is necessary for future treatment of patients with spinal fractures.

Keywords: spinal injuries, rehabilitation, physical therapy.

Sažetak

Uvod: Traumatske povrede kičmenog stuba spadaju među najviše razarajuće povrede u ortopediji. Primarni ciljevi rehabilitacije ovih povreda su prevencija sekundarnih komplikacija, maksimiziranje fizičkih funkcija i reintegracija u zajednicu. Rehabilitacija nakon povrede kičme zahtjeva multidisciplinarni timski pristup. U članove tima uključeni su fizioterapeut, radni terapeut, medicinske sestre, psiholog, zdravstveni menadžer i socijalni radnik, svaki sa svojom ulogom i odgovornošću u svojoj oblasti stručnosti. Ova studija ima za cilj utvrditi razlike u pojavi povreda kičmenog stuba prema spolu, starosnoj dobi, uzroku povrede, pojavi neuroloških ispada, načinu liječenja i korištenih fizikalnih procedura u ranoj fazi rehabilitacije.

Metode: Istraživanje je provedeno kao retrospektivno i komparativno na Klinici za ortopediju i traumatologiju KCU Sarajevo. Historije bolesti 100 bolesnika, tretiranih od 01.01.2007. do 30.06.2008. su obrađeni i podaci o ambulantnim i hirurškim protokolima analizirani.

Rezultati: Rezultati su pokazali veći udio žena (56%) u odnosu na muškarce (44%). Većina pacijenata je bilo u starosnoj grupi između 41 i 60 godina. Najčešće uzrok povreda je bio pad sa visine (32%), pad sa drveta (25%), saobraćajna nezgoda (12%) (χ^2=17,94, p=0,0061). 88% pacijenata je bilo bez neuroloških ispada, dok je 12% imalo takve poremećaje (χ^2=3,397, p=0,3343). 56% pacijenata sa povredom kičme je tretirano hirurški, dok je 41% tretirano konzervativno (χ^2=7,264, p= 0,00153). Od korištenih procedura fizikalne terapije u programu rane rehabilitacije su bile vježbe 73 %, a najmanje samo masaža kod 4 % pacijenata (χ^2= 6,573, p= 0,04270).

Zaključak: Usvajanje Nacionalnog protokola pružanja pomoći osobama sa prelomom kičme potrebno je za adekvatan tretman ovih pacijenata.

Ključne riječi: spinalne povrede, rehabilitacija, fizikalna terapija

* Corresponding author: Prof. Dijana Avdić, MD, PhD; Faculty of Health Studies, University of Sarajevo, Bolnička 25, 71000 Sarajevo, Bosnia & Herzegovina; Phone: +387 33 444 901; Fax: +387 33 264 821; e-mail: dijana2007@gmail.com

Submitted 17 February 2011/ Accepted 13 March 2011

Introduction

OboInjuries of the spinal column can occur in different ways. Usually occur as a result of falls from a height or traffic accidents. The treatment of these injuries, particularly the fractures of the vertebrae, is usu-

ally surgical. Different types of long and short stabilization is used and the installation of various fixations. Rehabilitation after such injuries is a long process (1). The incidence of spinal cord injury with spinal injuries is ranging from 5 to 55 million people each year, depending on the country's industrial development, transportation development, cultural habits etc. The highest incidence is in the age group of 40 to 50. The ratio men to women is 4:1. The largest number of injuries is in the level C1-C2, C4-C6 to Th11 - L1, 2. These are not just the most mobile spine parts, but also regions in which cervical and lumbar spinal cord intensely reduces the space between nerve and bone structure. It is believed that the following factors cause damage to the spinal cord by blunt injury: compression and "imprints" (bones, ligaments, hematoma, disc protrusion), over-stretching of the contact pressure and spinal cord injuries, traumatic edema, disruption of arterial and venous circulation, hemorrhage etc. Penetrant spinal cord injury with or without damage of the spinal column, arise from objects penetrating into the spinal cord, such as sharps, blades, missiles etc. Mechanical forces affects on the spinal column in the form of compression, extension, torsion and sliding disintegration "(translation). These forces cause the proper tension, deformation and migration of certain elements of spine: vertebral body, intervertebral discs, posterolateral joints and ligaments. Similar effects on these structures have forced movements of the spinal column such as flexion, extension, lateral bending and axial rotation. The effect of these mechanisms of injury depends on the anatomical structure: occipito-atlanto epistropheus complex is anatomically different from "the lower cervical spine (C3 - C7). Surgery may be indicated after attempt of closed reduction still persist "stuck" articular socket, compression of the spinal cord and spinal nerves. In the case of articular fractures and arch extensions immediately undertake operative reduction. Depending on the neurological deficits and associated injuries, the patient is allowed to get out of bed in the next postoperative day. In severe cases, requires a longer period of immobilization (2). In the thoracic spine flexion - compression fractures (wedge compression) were followed normal neurological findings or incomplete lesion medullae spinalis. Axial - compression fractures (burst), sagittal - broken fracture and anterior dislocation are accompanied by complete lesion of spinal cord injury (3). Minimal subluxation and small bending - compression fracture of thoracic spine are treated conservatively, casting (with the help of prosthetic device) in hyperextension of the thoracic spine during the 3 to 4 months. In other cases, these injuries are treated with internal fixation and operational fusion. Treatment of patients with fractures of the thoracolumbar and lumbar spine without neurological deficit contains lying in bed. If a neurological deficit more is pronounced, in the treatment of external immobilization (in hyperextension) orthopedic tools. If many signs of posterior ligament rupture occur, last fusion and fixation is performed (4). Physical therapy of patients after injury of the spinal column is divided into: early postoperative inpatient therapy and late continuing physical therapy. Early physical therapy is done in order to prevent post injury - post-operative complications (thrombosis and thromboembolism, pneumonia, prepares muscles for walking with crutches and the rapid re-socialization). Prerequisites are operated on a patient - the stabilization of the fracture was made, the funds are protected with anticoagulant and catheterized with paper diapers, eliminated primary postoperative pain. Physical Therapy in the program includes: breathing exercises, active and passive exercises, massage, electro, etc. (5-7). At a later stage (3 weeks) begins the process of mobilization of the patient (sitting and rising). Getting up and walking is performed using the additions to stabilize the patient in the form of chest corset (different types) and crutches or walkers and with neurologic defects necessary to provide and orthotics for the lower extremities. After the expiration of a period of 3 weeks of stay in surgical facility the patient was transferred to the Institute of Physical Therapy, where rehabilitation is done in a period of 4-6 weeks or longer, if it is verified neurological impairments. Due to specific spine fractures a patient is required to perform independently in a home program taught therapeutic procedure. Later, organized intensive physical therapy begins upon expiration of the primary period of fracture healing. It is necessary that from the date of injury (stabilization) passes a period of three months (10 - 12 weeks).

If the process is organized, the patient is capable of independent physical therapy in which places special emphasis on strengthening segment of paravertebral muscle. Paravertebral muscle strength is one of the prerequisites for the successful healing of creation and the reduction of residual spine gibus and compression of the spinal canal and paravertebral important structures, especially radicular nerve (8). This study aimed to determine the difference in the occurrence of spinal injuries according to gender, age, cause of injury, neurological phenomenon in injured patients, the treatment and physical procedures used in the early stages of rehabilitation. The working hypothesis suggests that there is a statistically significant difference in the use of certain procedures of physical therapy at an early stage of rehabilitation of patients with injury of the spinal column. Null hypothesis indicates that there is no statistically

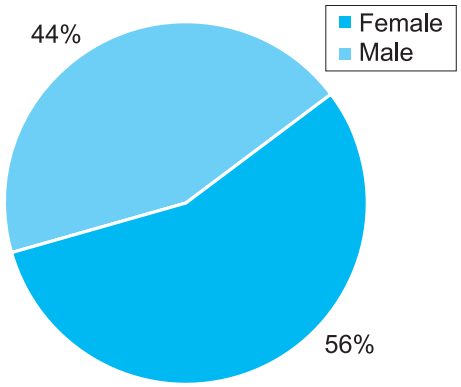

FIGURE 1. The gender distribution of patients
χ^2= 0.10 p= 0.9198

significant difference in the use of certain procedures of physical therapy at an early stage of rehabilitation of patients with injury to the spinal column.

Methods

The study was conducted as a retrospective and comparative to the department of Orthopedics and Traumatology at the Clinical Center University of Sarajevo. Hundred of patients treated at this clinic from January 1st 2007 till June 30th 2008 were processed inquiring the medical records of outpatient protocols and surgery protocols. During statistical analysis, the level of significance was determined by χ^2 - test, and correlation was analyzed using Pearson's correlation coefficient. The level of significance was defined as $p < 0.05$. Average age of patients was calculated by the arithmetic mean and the age structure is determined by the standard deviation and median. The results are presented in tables and graphs.

Results

There were accounted 44% of male and 56% of female patients, as can be seen from the tables and graphics. The average age of our patients was 50.4, with the youngest patient age 18 and the oldest 80 years old. Most patients were in the age group of 41-60, at least in the age group of 61-70 years old.

TABLE 1. Age distribution of patients with fractures of spine

Age of patients	Male		Female		Total	
	Number	%	Number	%	Number	%
18 – 30 years old	11	11	7	7	18	18
31 – 40	9	9	8	8	17	17
41 – 50	7	7	7	7	14	14
51 – 60	9	9	20	20	29	29
61 – 70	2	2	4	4	6	6
71 and more	6	6	10	10	16	16
TOTAL	44	44	56	56	100	100

χ^2= 6.687 p= 0.8238

TABLE 2. Cause of injury

Cause	Men	Women	Total
Transport accidents	7	5	12
The fall from the tree	12	13	25
Fall from height	21	17	38
Other (ladders, tumor metastasis, osteoporosis)	10	15	25
Total	50	50	100

χ^2= 17.94 p= 0.0061

Most often injuries 38%, were due to falls from a height, falling from a tree was the cause of injuries in 25% of cases of aught other causes involved made, while traffic accidents accounted for 12%.

TABLE 3. The occurrence of neurologic events in patients with spinal injury

Neurological impairments	Men	Women	Total
Without neurological impairments	41	47	88
Paresis	1	4	5
Paraplegia (paralysis)	2	5	7
Total	44	56	100

χ^2= 3.397 p= 0.3343

Without neurologic impairments were 88% of patients, while the neurological disturbances were 12% of patients.

TABLE 4. Method of treatment of spinal fractures

Type of treatment	Number of patients	Percent
Operational	56	56
Conservative	41	41
Refuses hospitalization	1	1
Deaths	2	2
Total	100	100

χ^2= 7.264 p= 0.00153

TABLE 5. Physical therapy methods used in early rehabilitation

Type of physical therapy	Number of patients	Percent
Passive and active exercises	73	73
Massage	4	4
Massage + passive exercise	10	10
Massage + active exercise	7	7
Electro stimulation	6	6
Total	100	100

χ^2= 6.573 p= 0.04270

Most patients with spinal injuries were treated surgically, 56% of them and 42% of patients treated with conservative measures.

As can be seen from the table, the most used procedures of physical therapy in early rehabilitation exercises 73%, and the only massage in case of 4% of patients. In case of all patients breathing exercises were performed.

Discussion

In the period from January 2007 until June 2008, at the Clinic of Orthopedics and Traumatology there were 3600 bone fractures, of which 270 fractures of the spinal column. This survey included patients older than 18 and those with pathological fractures. Based on these data we can conclude that spine fractures represent 3.6% of total fractures. Of the total registered 100 cases of spine fractures in patients older than 18 years, who are selected randomly, 44% of fractures refer to men, while 56% of fractures refer to women. Injury of the spine mainly occurs in case of middle aged and elderly people. The highest incidence of injuries on the subject of men is ranging from 40 to 70 and for women aged 30 to 70. Our results are similar for men and women, so the most common injuries occur in the age between 40 and 45. Based on these data we can conclude that injuries arise at the time of greatest creativity in life of each individual. Injuries of the spinal column are very complicated and beside health damages, those injuries lead to frequent absenteeism and jeopardizing social - economic opportunity for the injured. Certainly, the most difficult consequence of spinal injury is a disability which leads to the psychological trauma of patients and their families, as well as society as a whole. This is particularly true for paraplegics, who need 24 - hour medical care (9). With thoracolumbar fractures and lumbar spine there is no correlation between neurological deficit and recovery pattern with the extent of canal compromise. Like other bones, vertebral fractures are also undergoing significant remodeling, so that the size and shape of the spinal canal improves with time. However, this remodeling has no impact on neurological recovery (10). Regarding the presence of fractures due to seasons, we can see that the most common fractures appear in the period of spring and winter. This phenomenon can be explained by the beginning of intensive agriculture and construction, as well as falls on the ice in winter. It is important to note that the seemingly simple falls at home (especially the female population) result in fractures of the spine. In addition to these, a common cause of spinal fractures of women is osteoporosis, which usually affects young and middle-aged women (11). The most common cause of injury is fall from height (especially tree fall) during the summer period, then after followed by traffic accidents, something more commonly men involved. Very often the injury occurs as a result of tumor metastases in the vertebral column, which secondarily damages the vertebral and spinal cord. According to data from English authors we can find the following:

- The ratio of injured men compared to women is 4:1, while in our country this ratio is approximately 1: 1.6. According to their data the most affected are men between 25 and 60 and women aged 60 and more. Our results are similar for men and women, so the most frequent injuries occur in the age between 40 and 45.
- Differences also exist in the nature of injury. According to English author most common cause of injury of males are traffic accidents, while in case of women injury was result of osteoporosis bone fractures.
- A large number of fractures are treated surgically, which is also the case with the treatment of our patients. According to English author, conservative treatment causes a high percentage of deformities of flexional type: further increase in vertebral body compression in 40% of cases, gibbous in 23%, scoliosis in 23% and spondylotic changes in 46% of cases. Also, they found that the relationship between the spine and symptoms statistically significant (12).

Conclusion

Based on the foregoing, we conclude that one of the necessary things for the future treatment of these patients is the adoption of national protocols to assist people with spinal fractures. It is necessary to educate a certain number of qualified personnel and provide funds for the purchase of necessary equipment.

References

1. Dietz V, Harkema SJ. Locomotor activity in spinal cord-injured persons. J Appl Physiol. 2004;96(5):1954-60.
2. Barker E, Saulino MF. First-ever guidelines for spinal cord injuries. RN. 2002;65(10):32-7.
3. McDonald JW, Sadowsky C. Spinal-cord injury. Lancet. 2002;359(9304): 417-25.
4. McKinley WO, Gittler MS, Kirshblum SC, et al. Spinal cord injury medicine. 2. Medical complications after spinal cord injury: Identification and management. Arch Phys Med Rehabil. 2002;83(3 Suppl 1):S58-64, S90-8.
5. Cosortium for Spinal Cord Medicine. Respiratory management following spinal cord injury: a clinical practice guideline for health-care professionals. J Spinal Cord Med. 2005;28(3):259-93.
6. Sheffler LR, Chae J. Neuromuscular electrical stimulation in neurorehabilitation. Muscle Nerve. 2007;35(5):562-90.

7. Thrasher TA, Popovic MR. Functional electrical stimulation of walking: function, exercise and rehabilitation. Ann Readapt Med Phys. 2008;51(6):452-60.
8. Dietz V, Harkema SJ. Locomotor activity in spinal cord-injured persons. J Appl Physiol. 2004;96(5):1954-60.
9. Kirshblum S. New rehabilitation interventions in spinal cord injury. J Spinal Cord Med. 2004;27(4):342-50.
10. Mohanty SP, Venkatram N. Does neurological recovery in thoracolumbar and lumbar burst fractures depend on the extent of canal compromise? 2002;40 (6):295-299
11. Leung Y, Samartzis D, Cheung KM, Luk KD. Osteoporotic vertebral compression fracture: the clinical impact of "intravertebral clefts".Spine J. 2010;10(11):1035-6.
12. Dickson R.A. et al. Hospital Episode Statistics. Department of Health, England, 2004-2005.