EXPLORATION OF INJURY CHARACTERISTICS, WITH CLASSIFICATION AND TREATMENT OF THORACIC SPINE FRACTURES WITH STERNAL FRACTURES IN SANDA ATHLETES

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ABSTRACT

Introduction*: This paper aims to investigate and analyze injury characteristics, as well as classifications, and treatment of thoracic spine fractures with sternal fractures of Sanda athletes.*

Methods*: A total of 180 cases of Sanda athletes with thoracic spine fractures and sternal fractures were studied. Clinical data of all cases were analyzed, which included age, gender, site of thoracic spine fractures, thoracic injury segment and type, extent of the spinal cord injury, etc. As many as 120 patients underwent surgical treatment, and 60 patients received non-surgical treatment.*

Results*: The fracture types included thoracic spine compression fractures, fracture dislocation, burst fractures, and burst dislocation, with 36 (20.00%), 52 (28.89%), 60 (33.33%), and 32 cases (17.78%), respectively. According to the ASIA classification of spinal cord injuries, grades A, B, C, D, and E included 30 (16.67%), 20 (11.11%), 26 (14.44%), 15 (8.33%), and 34 cases (18.89%), respectively. Besides, the rate of spinal cord injuries was 69.44% (125/180). In the follow-up stage of the patients' neurological recovery, among cases of spinal cord injuries, the rate of spinal cord injuries was 8.89%, with 3 (1.67%), 4 (2.22%), 4 (2.22%), 3 (1.67%), and 2 cases (1.11%) for grades A, B, C, D, and E, respectively. Results of the investigations and statistics of the patients' daily self-care ability before and after the treatment showed a significant difference in the ADL score ($P < 0.05$).*

Conclusions*: The main clinical features of thoracic spine fractures with sternal fractures were severe traumatic violence, spinal fractures, and severe spinal cord injuries, which could easily lead to multiple injuries. After the in-depth analysis of injury characteristics and classification of thoracic spine fractures with sternal fractures, as well as following the adoption of active and effective measures to start treatment, spinal cord injuries improved significantly, and recovery of nerve functions was promoted.*

Keywords: *Sanda athletes, thoracic spine fractures, sternal fracture, injury characteristics, classification, treatment.*

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Introduction

Thoracic spine fractures with sternal fractures have a high incidence rate in severe traumas, which can cause neurological dysfunction in patients. Thoracic spine anatomical structures are very special, and causes and characteristics of the injuries and treatment programs vary, being different from spine fractures of other positions. Thus, their treatment is more difficult[1]. After sternal fractures, patients are prone to local severe pain because the lower sternum can have migration or post-shifts, thereby seriously affecting patients' quality of life.

In Sanda athletes, the incidence of thoracic spine fractures with sternal fractures (Fig. 1) is higher due to their special occupation. Besides, they are more prone to spinal cord injuries. Thoracic spine fractures with sternal fractures often have a poor prognosis (Fig. 2). Moreover, the presence of multiple rib fractures (Fig. 3) exerts a greater impact on the thorax breathing exercise in Sanda athletes.

It is essential to take active and effective measures to treat thoracic spine fractures with sternal fractures in Sanda athletes to enable them to have a normal life and to work as soon as possible. Accordingly, this study analyzes injury

characteristics of thoracic spine fractures with sternal fractures and makes a reasonable classification to undertake individualized treatment initiatives. The detailed report contents will be presented as shown in the following parts.

Fig. 1: Thoracic spine fractures with sternal fractures.

Fig. 2: Spinal cord injury.

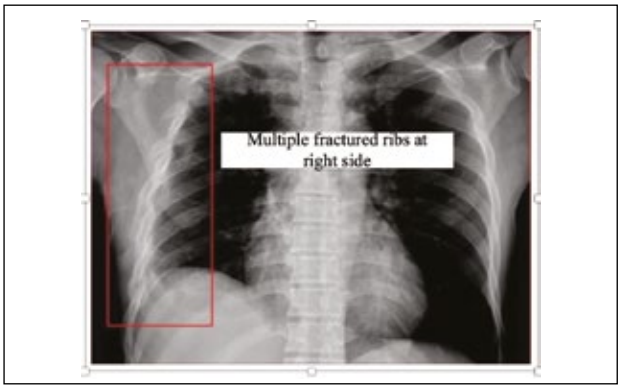

Fig. 3: Rib fracture.

Materials and methods

General Information

In this study, 180 Sanda athletes with thoracic fractures with sternal fractures were studied, who had different degrees of rib fractures as well. The treatment period started in October 2014 and ended in October 2016. A total of 122 male athletes and 58 female athletes participated in this study, who aged between 22 and 36 (28.7 ± 2.9 years). The distribution of the fractures was determined. Accordingly, T2-T10fracture sites had 18, 22, 30, 26, 28, 14, 12, 15, and 15 cases, respectively. Besides, there were 239 vertebrae involved in the statistics. There were 96 cases of sternal fractures in the mesosternum, 28 cases in the manubrium, 30 cases in the manubrium separation, and 26 cases in the xiphoid. The associated injuries were pulmonary contusion (Fig. 4), clavicular fractures, mediastinal injuries, abdominal organ injuries, left olecranon comminuted fractures (Fig. 5), and right distal radius fractures (Fig. 6), with 40, 58, 29, 32, 10, and 11 cases, respectively. However, all patients had comparable clinical data ($P > 0.05$).

Fig. 4: Lung injury.

Fig. 5: Left olecranon comminuted fracture..

Fig. 6: Right distal radius fracture.

Treatment method

During the treatment, the patients' thoracic spine fracture compression displacement, thoracic kyphosis deformity, combined injuries, and spinal cord injuries were considered comprehensively, with the best treatment selected[2].

For cases approached with the non-surgical treatment program, slight thoracic spine injuries, insignificant manubrium, and body fractures were considered. Besides, a 'cross-shaped' wide tape was placed at the patients' anterior sternum for fixture purposes, and appropriate hyperextension of the spine was made, followed by a short-term bed rest[3, 4]. The patients were guided on correct breathing and functional exercise, with symptomatic treatment implemented. Besides in two weeks or more, the patients could sit or carry out activities in a wheelchair with brace protection[5]. For patients with severe associated injures and inability to undergo surgery, the associated injury was firstly treated, the bed rest time was appropriately extended, and scientific nursing started[6].

For the cases with surgical treatment, preoperative and intraoperative application of the C arm machine was provided for location purposes, general anesthesia with end tracheal intubation was provided[7], the patients were kept in a prone position, and the posterior midline approach was adopted. Concerning the patients' fracture type, with spinal cord nerve injuries regarded as the basis, total laminectomy or total spinal canal, subtotaled compression, and bone graft fusion in parapophysis and vertebra were conducted, with instrumental fixation treatment provided[8, 9].

For associated injuries, hemopneumo thorax patients were provided with closed thoracic drainage or ventilator support treatment. In addition, pulmonary contusion patients were provided with initiatives, such as aerosol inhalation, anti-infection, dieresis, infusion of whole blood or plasma, and oxygen uptake[10]. Besides, patients with abdominal organ injuries were provided with abdominal laparotomy[11]. In addition, non-surgical treatment was provided for clavicle and distal radius fractures. Furthermore, patients with left olecranon comminuted fractures were provided with open reduction and internal fixation surgery.

Results

Fracture types

Thoracic spine fractures were classified according to Hanley-Eskay, and sternal fractures were classified based on anatomical positions. Table 1 shows classifications of the fracture types. Accordingly, there were 58 (32.22%), 30 (16.67%) and 92 cases (51.11%) of complete nerve injuries, incomplete nerve injuries, and no nerve injuries.

ASIA classification of spinal cord injuries

According to the ASIA classification of spinal cord injuries, there were 30 (16.67%), 20 (11.11%), 26 (14.44%), 15 (8.33%), and 34 cases (18.89%) for grades A, B, C, D, E, respectively. Besides, the rate of spinal cord injuries was 69.44% (125/180).

Recovery of neurological function

Table 2 shows results for the comparison of neurological function recovery and the rate of spinal cord injuries before and after the treatment[12]. After the treatment, neurological function of most of the patients improved, and there were significant differences from the situation before the treatment ($P < 0.05$).

Daily self-care ability improvement

Table 3 shows results for the comparison of ADL scores of all cases before and after the treatment. Accordingly, the degree of improvement in the inpatients' daily self-care ability was significantly higher than that before the treatment ($P < 0.05$).

Follow-up results

In non-surgical cases, fracture healing and nerve function were restored in patients with thoracic spine fractures. Two cases (1.11%) with thoracic spine fractures had delayed kyphosis and neurological impairment after discharge for one year[13]. The anterior and posterior approaches were combined in the treatment. In the surgery treatment cases, results of X-ray and the CT examination showed that thoracic sequences recovered well, there was no compression of the spinal cord, and internal fixation had high stability. Besides, there were 4 patients (2.22%) with postoperative infection problems, who were cured by the negative pressure suction system treatment.

Discussions

In the anterior thoracic position, the sternum serves as the main pillar that axially stabilizes the thoracic ring. Sanda athletes, due to the special nature of their profession, are mostly prone to thoracic

spine fractures and sternal fractures. Accordingly, their condition is serious, which can easily cause damage to nerve function[14]. According to different points of violence, thoracic spine fractures with sternal fractures could be divided into two top-down and bottom-up types[15, 16]. If the violence is top-down, the head, the neck, and the upper back withstand the violence, then they rise to the sternal site, thereby causing sternal fractures. If the violence is bottom-up, the lower spine first bears the brunt of the violence, thereby causing spinal flexion and ultimately causing thoracic spine fractures([17, 18].

For the surgical or non-surgical treatment of thoracic spine fractures with sternal fractures[19], if there is an open sternal fracture or another cardiothoracic surgery, the use of surgical treatment for sternal fractures will be better[20-24]. According to the results, surgical or non-surgical treatment programs could exert positive effects according to characteristics and types of thoracic spine fractures with sternal fractures. Accordingly, they significantly improved quality of life and made Sanda athletes return to the training ground very soon.

Conclusion

In summary, in patients with thoracic spine fractures and sternal fractures, the spinal cord could cause a certain degree of injury (the spinal cord), thereby leading to neurological dysfunction. When the patients entered the hospital, providing active and effective surgical treatment or adopting non-surgical treatment measures, according to characteristics and classifications of the injury as the basis, could help them rehabilitate early so that the athletes could resume training as soon as possible.

References

1) Huang Z, Yi B, Liu H, Chen F, Huang J, Gong H, Xu T, Jian G, Wang B, Chen R, Wang J, Ye Z. Treatment and classification of thoracic spine vertebral fracture with sternal fracture. Journal of Central South University (Medical Science), 2011, 10(12): 1199-1205.
2) Peng Z. Initial clinical study of impact of sternum complex us injury on stability of thoracolumbar fracture. University of South China, 2010.
3) Manosroi A, Sainakham M, Chankhampan C, Manosroi W, Manosroi J. In vitro anti-cancer activities of Job's tears (Coix lachryma-jobi Linn.) extracts on human colon adenocarcinoma. Saudi Journal of Biological Sciences, 2016, 23(2): 248-256.
4) Liu C. Clinical research of mechanism, diagnosis and treatment of thoracolumbar chance fracture. Jilin University, 2015.
5) Cahill T, Chen XL, Lee JW, Weiss M, Chang VT, Cella D. Principles of radiofrequency ablation for cancer. Asian Pac J Surg Oncol, 2015, 1(01): 47-58.
6) Dobson PR, Brown BL, Beck D, Yang H, Zhou J, Voon YL. Management of surgical oncologic emergencies. Asian Pac J Surg Oncol, 2015, 1(02): 59-72.
7) Liu Z, Zhu Z, Zhao J, Ren W, Cai Y, Wang Q, Luan X, Zhao K, He J. Malondialdehyde: A novel predictive biomarker for post-stroke depression. J Affect Disorders, 2017, 220: 95-101.
8) Tibpromma S. Camarosporium arezzoensis on Cytisus sp., an addition to sexual state of Camarosporium sensu stricto. Saudi Journal of Biological Sciences, 2016, 23(1): 1-8.
9) Zeng Z, Luo J, Ye J, Tang G, Lai Z, Tan Tong. Surgical treatment of upper-middle thoracic spine fracture dislocation combined with incomplete spinal cord injury. Clinical Medical & Engineering, 2010, 13(08), 89-90.
10) Zhang K, Hu P. Rescue of severe multiple injuries of combined upper-middle thoracic spine fractures. Journal of Traumatic Surgery, 2013, 22(03): 265.
11) Wang H, Tan X, Xu J, Li H, Wang M, Chen S, Yang X, Liu Y, Wang F. Negative correlation between CSF lactate levels and MoCA scores in male Chinese subjects. Psychiat Res, 2017, 255: 49-51.
12) Xiao M, Wang Q, Ren W, Zhang Z, Wu X, Wang Z, Feng L, Chen S, He J. Impact of prediabetes on poststroke depression in Chinese patients with acute ischemic stroke. Int J Geriatr Psych, 2018, 33(7): 956-63.
13) Ozer A, Demirtas H, Comu FM, Erer D, Kilic Y, Mardin B, Arslan M, Kucuk A, Oktar GL. Protective effect of erdosteine on erythrocyte deformability in a rat model of lower limb ischemia/reperfusion injury. Turk J Med SCI, 2018, 48(1): 187-90.
14) Ghoneum M, Felo N, Nwaogu OM, Fayanju IY, Jeffe JA, Margenthaler DB. Clinical Trials in Surgical Oncology. Asian Pac J Surg Oncol, 2015, 1(02): 73-82.
15) Ayob FW, Simarani K. Endophytic filamentous fungi from a Catharanthus roseus: Identification and its hydrolytic enzymes. Saudi Pharmaceutical Journal, 2016, 24(3): 273-278.
16) Yung KW, Yung TT, Chung CY, Tong GT, Liu Y, Henderson J, Welbeck D, Oseni S. Principles of cancer staging. Asian Pac J Surg Oncol, 2015, 1(01): 1-16.
17) Duan FH, Hu MY, Guo CP, Song YP, Wang MH, He LH, Zhang ZH, Pettinari R, Zhou LM. Chromium-based metal-organic framework embedded with cobalt phthalocyanine for the sensitively impedimetric cytosensing of colorectal cancer (CT26) cells and cell imaging. Chemical Engineering Journal, 2020, 398: 125452.
18) Yeh CH, Huang HC, Chang KS, Chen CJ, Yang ML, Tsai SL, Lin HW, Kuan YH. Yi-Chi-Tsung-Ming-Tang reduced a beta (1-40)-induced neurotoxicity via of acetylcholine and NMDA receptors expression, ROS generation and tau phosphorylation. Indian Journal of Pharmaceutical Sciences, 2017, 79(3): 411-419.
19) Karakas Ugurlu G, Ugurlu M, Erten S, Can SS, Ulusoy Kaymak S, Caykoylu A. Effect of familial Mediterranean fever on sexual and reproductive health in women. Turk

J Med Sci, 2017, 47(2): 463-9.
20) Nassar MY, El-Shahat MF, Khalil SM, El-Moety EA. Optimization and validation of spectrophotometric and potentiometric methods for determination of lansoprazole and omeprazole in pure and capsules. Indian Journal of Pharmaceutical Sciences, 2017, 79(3): 420-430.
21) Badgujar NV, Mistry KN, Chudasama PN, Patel JS. In vitro antioxidant and cytotoxic effects of methanol extracts of vitex negundo, lantana camara, bauhinia variegata and bauhinia racemosa on human cancer cell lines. Indian Journal of Pharmaceutical Sciences, 2017, 79(3): 431-437.
22) Nair S, Mukne, A. Assessment of chemical stability of constituents in thiosulfinate derivative-rich extract of garlic by a validated HPTLC method. Indian Journal of Pharmaceutical Sciences, 2017, 79(3): 438-450.
23) Kazaura MR. Level and correlates of self-medication among adults in a rural setting of mainland Tanzania. Indian Journal of Pharmaceutical Sciences, 2017, 79(3): 451-+.
24) Cahill G, Tran L, Baker RA, Brown A, Huang YC, Ou CW. Principles of radiation oncology. Asian Pac J Surg Oncol, 2015, 1(01), 27-38.

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