



Abstract

Open fractures of the long bones of the extremities are among the most severe injuries to the musculoskeletal system. The article discusses the classification of open fractures of long bones

Keywords: Open fractures, bone, trauma, method, treatment.

Introduction Despite the great attention [1, 2, 3, 4,] paid to open trauma in recent years, various aspects of this problem require detailed study and further scientific development. One of them is the classification of open fractures of long bones, which is of great importance for the prevention of complications, statistics of open injuries, determination of tactics, as well as for subsequent study of treatment results.

MaterialsAndMethods Many different classifications of open fractures have been proposed, some of which are outdated, while others have undergone significant changes. When familiarizing yourself with these works, attention is drawn to the discrepancy in points of view on the main issues: do the existing classifications of open fractures of long bones reflect the dynamics of the post-traumatic period and is it possible to develop specific treatment tactics on their basis? I.F. Bialik conventionally divides all classifications existing in the literature into simple and complex. According to the author

[1], the Vives, Wehner, Voorhoeve, Ritter, Knapp, Widenfalk classifications refer to simple ones, where open fractures are divided into two or three groups according to the severity of injuries: 1. perforation of the skin from the inside by bone; 2. skin bruise or perforation from the outside; 3. rupture of skin and soft tissues with or without damage to blood vessels and nerves. The above classification did not reflect the degree of damage to soft and bone tissues, the size of the skin wound and the nature of the open fracture.

ResultsAndDiscussionThe complex category includes the classification of open fractures proposed by P.P. Zhukov, who identifies five groups of soft tissue wounds: 1. Soft tissue wounds up to 1 cm, puncture from the inside - do not resort to surgical treatment. 2. Medium-sized wounds from 1 to 4 cm, which always require surgical treatment. 3. Large wound sizes from 4 to 8 cm with significant contamination.

4. Wounds over 8 cm are extensive with severe contamination. 5. Wounds that impair the viability of the limb.

However, the Kaplan-Markova classification has become widespread in the CIS (Table 1).

Table 1 Classification of open fractures of long tubular bones (according to A.V. Kaplan and O.N. Markova)

Fracture location The upper or lower metaepiphysis of the humerus, ulna, radius, femur, tibia and fibula. Upper, middle, lower third of the diaphysis of the humerus, ulna, radius, femur, tibia and fibula	Fracture location The upper or lower metaepiphysis of the humerus, ulna, radius, femur, tibia and fibula. Upper, middle, lower third of the diaphysis of the humerus, ulna, radius, femur, tibia and fibula			
Type of fracture transverse, oblique, helical, large-fragmented, finely fragmented, double (without displacement and with displacement)	Type of fracture transverse, oblique, helical, large-fragmented, finely fragmented, double (without displacement and with displacement)			
Nature of soft tissue damage	Wound size			IV Special (extremely severe)
	I (up to 1.5 cm)	II (from 2 to 9 cm)	III (from 10 or more)	
A. cut and chopped	I-A	II-A	III-A	With a violation of the viability of the limb (crushed bones and crushing of soft tissue over a wide area, damage to large main vesselsarteries)
B. bruised and torn	I-B	II-B	III-B	
C. crushedandcrushed	I-C	II-C	III-C	

At one time A.V. Kaplan, O.N. Markova and V.M. Melnikov [3], before introducing the classification into practical activities, held a discussion and discussed it on the pages of the journal "Orthopedics, Traumatology and Prosthetics". During the discussion, some authors [2] noted that the classification of A.V. Kaplan et al. does not reflect the full variety of open fractures; in particular, it does not take into account or does not fully take into account combined injuries, the severity of the fracture, the degree of contamination and infection of the wound, and the viability of the damaged organ. Later, the authors themselves agreed with this recommendation: "We believe that in reality our classification could not take into account all the various factors that determine the severity of the fracture, but it is essential to highlight the leading ones, objectively and easily determined, influencing the clinical course and on the outcome of an open fracture (location, type of fracture, size of the wound and nature of soft tissue damage)" [3]. In addition, one of the discussion participants A.F. Baturin proposed his



classification of open fractures: At one time A.V. Kaplan, O.N. Markova and V.M. Melnikov [3], before introducing the classification into practical activities, held a discussion and discussed it on the pages of the journal "Orthopedics, Traumatology and Prosthetics". During the discussion, some authors [2] noted that the classification of A.V. Kaplan et al. does not reflect the full variety of open fractures; in particular, it does not take into account or does not fully take into account combined injuries, the severity of the fracture, the degree of contamination and infection of the wound, and the viability of the damaged organ. Later, the authors themselves agreed with this recommendation: "We believe that in reality our classification could not take into account all the various factors that determine the severity of the fracture, but it is essential to highlight the leading ones, objectively and easily determined, influencing the clinical course and on the outcome of an open fracture (location, type of fracture, size of the wound and nature of soft tissue damage)" [3]. In addition, one of the discussion participants A.F. Baturin proposed his classification of open fractures:

1. Non-comminuted fracture with a puncture wound.
2. Non-comminuted fracture with a bruised wound.
3. Non-comminuted fracture with a soft tissue defect.
4. Comminuted fracture with puncture wound.
5. Comminuted fracture with bruised wound.
6. Comminuted fracture with soft tissue defect.
7. Fracture with bone defect and bruised wound.
8. Fracture with a bone and soft tissue defect.

According to the literature [5], the frequency of post-traumatic soft tissue deficits ranges from 18.0% to 44.1%. Soft tissue deficits of more than 2 cm are taken from the considerations that the edges of soft tissue wounds with a deficit of less than 2 cm are pliable and suturing after surgical treatment of the wound is possible. If there is a soft tissue deficiency of more than 2 cm, in our version from 2 to 4 cm, from 4 to 6 cm and more than 6 cm, replacement by one or another plastic method is necessary.

In accordance with the peculiarities of the mechanism of formation of open fractures of long bones, the extent and severity of damage to superficial, soft and bone tissues, we propose an improved version of the classification of open fractures of long bones of the extremities. When developing the classification, we tried to take into account the size and severity of injuries to soft and bone tissues, as well as disorders of the neurovascular trunk identified during or after the operation "Post-surgical surgery of an open fracture". In clinical practice, post-traumatic (loss of bone fragments at the time of injury, resection of contaminated ends, after removal of loose contaminated or sequestered fragments of various sections) bone defects are formed in 60% of cases [1,2]. It is generally accepted that a "bone defect" is the absence of bone for more than 2 cm. Although, according to V.I. Shevtsov and co-authors, any absence of bone should be considered a bone defect, despite the size and size of the defect. In any case, with fresh open fractures of long bones, in order to apply certain treatment tactics, it is desirable to know the exact size of the bone defect.

Conclusion As stated, with open fractures of long bones, damage to the great vessels and nerve trunks occurs in 10.0% and 12.0% of cases, respectively. Therefore, a four-grade scale indicating the specific type of damage to the neurovascular trunk of a limb is easily applicable and convenient for a traumatologist. In our opinion, the proposed classification has the

advantage that it reflects the dynamics of an open fracture of long bones of the extremities. Therefore, it will be useful in choosing the most optimal treatment method.

References:

1. Reducing the period of temporary disability and disability in patients with open diaphyseal fractures / A. V. Kaplan [et al.] // Orthopedist, traumatol. - 2018. - No. 7. - P. 1-6.
2. Schontag, H. External fixation as an alternative when treating and 3rd degree open lower leg fractures / H. Schontag // Arch. Orthop. Traum. Surg. -2010. - No. 1. - P. 13-16.
3. Askarov, T.K. The course of healing of isolated open fractures of the leg bones complicated by purulent infection when using transosseous osteosynthesis: abstract. dis. ...cand. honey. Sciences / T. K. Askarov; CITO im. N.N. Priorova. - M., 2015. - 21 p.
4. Safronov, A. A. Diagnosis, treatment and prevention of complications of open fractures of long tubular bones and their treatment: abstract. Dis... Dr. med. Sciences / A. A. Safronov. - Perm, 2012. - 23 p.
5. Khudobin, V. Yu. Treatment of purulent complications of open diaphyseal fractures of the limbs: abstract. dis. ...cand. honey. Sciences / V. Yu. Khudobin. - Kyiv, 2013. - 17 p.

