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Fractures of Joint Ankle

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Abstract

Joint ankle represents one of the most complicated anatomic-functional structures of locomotoric apparatus. Upper joint ankle (talocruralis) bind low tip-end of shank (tibia) and fibula with joint bone (talus) and represent joint among the bones of shank and foot bones. Upper joint ankle joint together with lower ankle joint acts like functional, anatomical and clinical entity not only in physiological conditions but as well in injuries. These injuries cause not only damages of bone structure but also of ligaments and soft structures. Fractures of maleolus as the most frequent of low extremities represent 10-12% of all fractures. As the most frequent mechanism of injury of joint ankle the inversion of foot is stated when it is in supination and adduction. This analysis had 151 patient who had joint ankle fracture both sexes, age 18-45, and among them there were 102 men (67.55%) and 49 women (32.45%). The patients whose diagnosis was joint ankle fracture were observed in Orthopedic - Casualty ward of Clinical Centre in Podgorica. The research period was May 2005-May 2009. The results of our research show that the most frequently fractures of joint ankle happened while running 52 patients (34.44%) and the least by fall from the height 22 (14.57%). The most frequent fracture type was SE type 48 (31.79%) and the least PA type 25 (16.56%).

Introduction

Ankle joint represents one of the most complicated anatomic-functional structures of locomotoric system. Upper ankle joint together with lower ankle joint acts like functional entity not only in physiological terms but also in most injuries as well [1]. Injuries of ankle joint are important not only because of their frequency but as well for their polymorphy of clinical and radiographic picture. These injuries are considered to be the most frequent cured injuries in orthopaedio-casualty ward and they are also the most common injuries of locomotoric aparatus [1].

These injuries cause not only destruction of bone structure but also of ligaments and soft tissues are endangered [1, 2]. Fractures of maleolus as the most frequent fractures of low extremities are 10-12% of all fractures, together with fractures of clavicular bone and fractures of low tipend of radius represent 50% of all fractures, generally [2, 3].

Geppard and his associates say that 80-90% of all ankle joint injuries are cured with satisfactory functional

results, inoperative treatment, but 20% of patients especially after harder injuries have residual studying of joint ankle as well as of the injuries of ankles and soft tissues [2]. Lauge-Hensen, in 1942 qualified injuries of ankle joint as historical period: clinical, experimental and radiographic [5]. Watson-Jones in 1962 found six different appearances of these injuries in which volume and direction of dislocation of foot were changing [3, 4]. Cadets in West-Point Academy during four years of schooling are said to have injury of joint ankle at least once [2-4].

However, young persons till age of 35 are more exposed to these injuries due to their higher physical activities [4, 5, 7]. Ivanovski said that 50% of all injuries of shank go to injuries of ankle joint because of its functional activity, pain and operative treatment is undertaken [7, 8].

Functional Anatomy and Biomechanics

Ankle joint consist of upper and lower parts upper ankle joint (talocruralis) binds lower tip ends of shin-bone (tibia) and fibula ankle bone (talus) so it represents joint among bones of shank and foot bones. Lower ankle joint is split (sinus tarsi) into two ankles: posterior ankle which binds and hell bone (subtalaris) and front ankle which binds ankle joints, hell and conical bone (talocalcaneonavicularis) and each of these two ankles has its own capsulae. Ankle joint transfers the highest pressure of all ankles in the body and its function is tightly connected with the function of this complex [8, 9].

Transversal axes which goes through the tip of each maleolus and manes horizontal flat angle approx $20\text{-}30^0$ with transversal axle of the knee. There are the movements of flexia and extension in sagital line about it. This axle directs in the field and towards back and together with tibial axle in frontal line makes angle about 80^0 open towards medial with variations approx $68\text{-}80^0$ [8, 9].

As compared to the longitudinal axle in horizontal line they make an angle of about 84^0 opened towards medial and forward with variations of about $66\text{-}99^0$. Longitudinal axle of leg goes through the axle of shaft and around it there are movements of abduction and adduction of foot in horizontal line which is possible due to axial rotation in fractured knee. Longitudinal axle is horizontal and it is in sagital line. It goes through II metatarsal bone and around it there are movements of pronation and supination of feet. Important place in biomechanics of joint ankle belongs to tibiofibular s sindesmosys in which due to concavity of joint surfaces there is sinovial recesus in the length of 1.5 cm [8-10].

Sindesmosys is linked by three ligaments: tibiofibular anterius, tibiofibular posterius, tibiofibular interosseum. Movements in joint ankle happen because of tetive and ligament structures which give static support. In the case of physiological overweight of the ankle in the first stage there are different degrees of soft tissues injuries and if the power still acts it can appear injury of bone structures. The main role in stability of joint ankle has the element of laterodorsal segment which consist of: anterior maleolus, tibiofibular syndesmosis and posterious maleolus as it is often called the back part of low joint surface of tibia together with the edge while medial maleolus and deltoid ligament have less importance in stability of joint ankle [8, 9].

Classification of Malleolar Fractures

If you want to understand injuries of joint ankle better you have to understand mechanism which leads to the injury. Maleolar fracture is followed by the injuries of ligament apparatus in 80-90% of cases so far their understanding it is necessary to know the order of bone and ligament lesia [9, 10].

Classification of these fractures is important as it shows choice of treatment unoperative and operative and final prognosis. Since early days of rendgen era anatomic classification was often used and it distincts unimaleolar, bimaleolar, trimaleolar fractures. This classification had a little significance in practice as it did not take into consideration ligament lesions and mechanism of injuries [10].

Maisonneuve tried in 1839 to classify these injuries as mechanism and his work was updated by Ashurs and Brower, 1922 [10, 11]. In their classification there are 4 groups: 1. outrotational, 2. abducto-pronational, 3. adducto-supinational, 4. compressive fractures [11]. Lauge-Hansen in 1942 tried use his classification in therapeutic purposes causing cadaveric joints fractures and proved that under certain circumstances emerge specific forms of fractures and lesions of ligaments. He took into consideration bone and ligament injuries explaining very precisely mechanism of fractures [5].

He divided fractures into 4 types: 1. supinatio-

eversive; 2. pronatio-eversive; 3. pronatio-abductional; and 4.supinatio-adductional. It is considered that by Lauge-Hansens classification is taken into consideration approx 93-99% of these fractures [11, 12]. Diagnosis of ankles injuries is taken on the basis of anamnesis with particular view on the mechanism of injury (the position in which there was, the time of haematoma appearances) clinical (oedema, painfully palpable sensitivity of specific points) manual tests (frontal draw, talar angled) and RTG checking. Anamnesis is not often reliable because the most of injured patients can t remember mechanism of injuring and clinical check must be undertaken before radiography [11-13].

Cedell recommends parallel picture of both joint ankles [11]. As intra articular fractures are considered, only restitution of anatomic relations of joint bodies can guarantee functional restitution. Fractures of joint ankle are very different by the form itself, and it hardens correct diagnosis so if it is not properly diagnosed it can t be cured adequately. Adequate curing of maleolar fractures mean total knowing of mechanism of their emerging. The best way give Lauge-Hansen s genetic classification which makes possible correct knowing if stable or unstable fracture matters, and give the appropriate ways of their treatment [5, 11, 12].

However, there is still dilemma which kind of treatment is better when these fractures are concerned; is it unoperative or operative? Many authors think that it is necessary try at first manual reposition and if we don t get good position of joint bodies operative procedure is undertaken [12, 13]. Besides the level of injury we have to take into consideration general health of the injured person, age, and the time since the injury if talk about the result of curing [13, 14].

Unoperative treatment means manual reposition in the shortest possible time after injury. Reposition is made by manoeuvring vice-versa of injury mechanism. After reposition it is recommended immobilisation in duration of 6 weeks. Pressure begins after 8-10 weeks [13-15]. Supporters of operative curing say that the aim of curing of all joint fractures is exact anatomic reposition, stable inward fixation and early immobilisation. Optimal time for operation is within 6-8 hours. Complications of operative treatment are: infection, fracture of fixational material, redislocation of fragments, ossification of syndesmosis and pseudoarthrosis and complications which occur in operative or unoperative way are Sudeck s distrophy and arthrosis [15-17].

The aim of this work is: 1) to determine the most frequent type of joint ankle fractures; 2) to determine the most frequent mechanism of injuring joint ankle; 3) to determine specific fractures at joint ankle.

Material and Methods

Analysis included 151 patients (or examinees) of different profession, with ankle joint fractures. The patients were males and females (age between 18-45 years), who came into ortopedo-casualty ward, after the injury of joint ankle. The group consisted of 102 men (67.55%) and women 49 (32.54%). The patients who undergo clinical and radiographic were diagnosed fracture of joint ankle were observed in urgency ward as well as in Ortoped Casualty Ward of Clinical Centre in Podgorica. The research was undertaken in period of May 2005-May 2009.

The patients were examined in order to find the most often type of fracture and the most frequent way of occurrence of fracture. In this work we used Lauge-Hansen s method of classification which represents four types of joint fractures as we mentioned above [5].

Results

There were 102 men (67.55%), 49 women (32.45%) in examined group that is shown in Table 1.

Table 1: Distribution of patients by sex.

SEX	N	%
Men	102	67.55
Women	49	32.45
Total	151	100.00

The most frequent fractures were supinatio-eversional 48, (31.79%) then pronatio-eversional 45 (29.80%), or supinatio-adductive 33 (21.85%) and the smallest percentage was at pronatio-abductive 25 or (16.56%).

Table 2: Distribution of some types of joint ankle fractures.

Type of fractures	N	%
PE	45	29.80
PA	25	16.56
SE	48	31.79
SA	33	21.85
Total	151	100.00

Presence of some fractures of joint ankle is shown in Table 2.

When distribution of sextype is questioned we concluded: women had PA types of fractures 16 (32.65%) and the least SE fractures 9 (18.37%). At men the most frequent fracture was SE type 39 (38.24%) and the least PA types 9 (8.82%). Differences were statistically important and they are shown in Table 3.

Table 3: Distribution of some types of fractures by sex division.

Type of fractures	Sex Men		Sex Women		Total	
	N	%	N	%	N	%
PE	32	31.37	13	26.53	45	29.80
PA	9	8.82	16	32.65	25	16.56
SE	39	38.24	9	18.37	48	31.79
SA	22	21.57	11	22.45	33	21.85
Total	102	100.00	49	100.00	151	100.00

X^2=15.73; p=0.0013; p<0.001.

When the most frequent occurrence of fracture is concerned we have following results. The most frequent fractures of joint ankle occurred while running 52 (34.44%), then at landing and while walking 31(20.53%) and the least the fall from the height 22 (14.57%) (Table 4).

Table 4: Presence of some ways in which occur fracture of joint ankle.

The way of occurrence of the injury	N	%
Running	52	34.44
Walking	31	20.53
Fall from the height	22	14.57
Landing	31	20.53
Etc.	15	9.93
Total	151	100.00

The way of occurrence of the injury: running walking, fall from the height, landing etc. Running-SE type of fracture 18 (34.62%) and the least SA type 8 (15.38%). While walking the most frequent is SE type 11 (35.49%) and the least PA and SA type 6 (19.35%). When the fall from the height is in question equally occurred PE, SE and SA type fracture 4 (18.18%).

At landing occurred PE fractured type 12 (38.71%) and the least PA type 2 (13.33%). In this case of research important statistic differences were not found, p>0,05 (Table 5).

We compared the way of emerging of joint ankle fractures of men and women. The men injured mostly while running 33 (32.35%) and the least by the fall from the height 16 (15.69%). The women injured while walking 12 (24.49%) and the least by fall from the height 6 (12.24%). The differences were not statistically significant (Table 6).

Table 5: The frequency of some types of fractures of joint ankle compared to occurrance of injury.

The way of occurrence of the injury	Type of fractures PE		PA		SE		SA		Total	
	N	%	N	%	N	%	N	%	N	%
Running	15	28.85	11	21.15	18	34.62	8	15.38	52	100
Walking	8	25.81	6	19.35	11	35.49	6	19.35	31	100
Fall from the height	6	27.27	4	18.18	6	27.27	6	27.27	22	100
Landing	12	38.71	2	6.45	9	29.03	8	25.81	31	100
Etc	4	26.67	2	13.33	4	26.67	5	33.33	15	100
Total	45	30.00	25	16.00	48	32.00	33	22.00	151	100

X^2=7.06; p=0.8536; P>0.05.

Table 6: The way of occurrence at men and women in examined group.

The way of occurrence of the injury	Sex Men		Women		Total	
	N	%	N	%	N	%
Running	33	32.35	19	38.78	52	34.44
Walking	19	18.63	12	24.49	31	20.53
Fall from the height	16	15.69	6	12.24	22	14.57
Landing	24	23.53	7	14.29	31	20.53
Etc	10	9.80	5	10.20	15	9.93
Total	102	100.00	49	100.00	151	100.00

X^2=2.6; p=0.6268; P>0.05.

Discussion

This work researched 151 patient of both sexes 102 men (67.55%) and 49 women (32.45%) who after the injury came into urgency block or ortopedic-casualty ward of Clinical centre in Podgorica.

In series of C.A. Cedel, 1967 the number of women patients were 60.67%, while the men were 39.33% [11]. In recent years the number of injuries of joint ankle has grown up. There are many dates which prove this. Clanton in his book Orthopaedic Sports Medicine-weekend recreationists claim that the most frequent injuries at recreationist, and 3% of all injuries are related to foot. Depending of sports which they train depends the type and degree of injury [12]. The foot is very adjustable but vertical pressure of 0.6 times of body weight, 7.9 times at running or jumping can lead to acute injury. This is also caused by the fact that with the age the tissues lose their flexibility so if there is no preparation they also lose strength, elasticity and they are very opened to damages.

In our research the fractures of joint ankle the most frequently happened while running 52 (34.44%)

then while walking and at landing 31 each (20.53%) and the least by the fall from height 22 (14.57%). Cedel's research claim that the most often injuries happened at the fall from height (40.5%) and then fall from stairs (17.5%) and sports injuries (10.5%) [11].

When distribution of patients by the sex is regarded we got the following figures: Women had the most frequent fracture of PA type 16 (32.65%) and the least SE type (18.37%). Men had the most frequent SE type 39 (38.24%) and the least PA types 9 (8.82%). Data of different studies gave different results. Weisler et al researched connection between volume of movement in joint ankle and injuries of joint ankle at professional dancers and they did not find difference in incidence considering the sex [13]. Beynonn et al as a risk for the injury of joint ankle among 118 sportsmen (football, hockey) say that is the same for both sexes, but the risk factor at men was angled talar and at women the higher varus of tibia [3]. Benell et al show difference taking into consideration number of injuries by sexes but the leading risk factor at men is not found, and at women it was menarch, mineral consistence of bones and volume of shank [14].

The most frequent fracture type in our research was SE 48 (31.79%), then PE 45 (29.80%) then SA 33 (21.85%) and the least PA types 25 (16.56%). The most frequent fracture by Lauge-Hansen s method was SE (66.9%) then PE (27.0%) and the least PA types of fractures (5.0%) [5].

Conclusions

1) The most frequent type of fracture of joint ankle in our research was SE type 48 (31.79%) and the least 25 (16.56%).

2) The most frequent type of fracture at women was PA 16 (32.65%) and the least SE type 9 (18.37%). At men the most frequent type of fractures was SE type 39 (38.24%) and the least PA type 9 (8.82%). The differences here are not statistically significant.

3) The most frequently injuries happened while running 52 (34.44%) then at landing and walking 31 (20.53%) and the least from the fall from height 22 (14.57%).

4) When the types of joint ankle fractures are question regarding occurrence of injuries, i.e., specific characteristic of joint ankle we got the following results: running-SE types of fractures 18 (34.62%) and the least SA types 8 (15.38%); while walking there were the most frequent SE types 11 (35.49%) and the least PA and SA 6 (19.35%).

5) Fall from the height proved following figures equally PE, SE, SA fracture types each 6 (27.27%) and the least PA type 4 (18.18%); at landing the most frequent was PE fracture type 12 (38.71%) and the least PA type 2 (13.33%).

When the frequency of fractures of joint ankle is compared to the way of injury statistically important difference was not found ($p > 0.05$).

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