Talar neck fracture: prevalence of Hawkins sign in patients submitted to surgical treatment

Prevalência do sinal de Hawkins em pacientes submetidos ao tratamento cirúrgico para fratura do colo do tálus

Otaviano de Oliveira Júnior[1], Philipe Melgaço Mendes[1], Mateus Martins Marcatti[1], Bruno Vieira Medeiros[2], João Carlos Pereira Salomão[2], Fabrício Melo Bertolini[1]

ABSTRACT

Objective: To evaluate the prevalence of Hawkins sign in patients with talar neck fracture and characteristics of individuals admitted for surgical treatment of this injury. **Methods:** We analyzed medical records of 18 patients with talar neck fracture admitted between October 1, 2010 and October 3, 2015 to the Hospital Universitário Ciências Médicas in Belo Horizonte/MG. Analyzed variables were sex, age, mechanism of trauma, time between date of fracture and date of the surgery, Hawkins classification, Hawkins sign, presence of osteonecrosis and AOFAS score. **Results:** We found a prevalence of 55.6% of Hawkins sign in surgically treated patients. Of these, all evolved without osteonecrosis of the talar body. **Conclusion:** Talar neck fractures are more common in young men. Patients who hadpositive Hawkins sign did not evolvewith osteonecrosis. However, those with negative Hawkinssign, 50% of them evolved with this complication.

Keywords:

Talus/injuries; Fractures, bone/complications; Fractures, bone/classification

RESUMO

Objetivo: Avaliar a prevalência do sinal de Hawkins nos pacientes com fratura do colo do tálus e as características epidemiológicas dos indivíduos internados para o tratamento cirúrgico desta lesão. **Métodos:** Foram analisados prontuários de 18 pacientes com fratura do colo do tálus internados no Hospital Universitário Ciências Médicas, em Belo Horizonte (MG), no período entre 1º de janeiro de 2010 e 10 de março de 2015. As variáveis analisadasforam: sexo, idade, mecanismo de trauma, tempo entre a data da fratura e da realização da cirurgia, classificação de Hawkins, sinal de Hawkins, presença de osteonecrose e pontuação na escala AOFAS. **Resultados:** A prevalência do sinal de Hawkinsfoi de 55,6% nos pacientes tratados cirurgicamente. Destes, todos evoluíram sem osteonecrose do corpo talar. **Conclusão:** A fratura do colo do tálusfoimais frequente em jovens do sexo masculino. Pacientes com sinal de Hawkins positivo não evoluíram com osteonecrose. Dos pacientes com sinal de Hawkins negativo, 50% evoluíram com esta complicação.

Descritores:

Tálus/lesões; Fraturas ósseas/complicações; Fraturas ósseas/classificação

Correspondence to:
Otaviano de Oliveira Júnior
Rua Curitiba, 2.258/1.002 – Lourdes
Zip Code: 30170-122 – Belo Horizonte, MG, Brazil
E-mail: ooliveirajr@hotmail.com

Conflict of interest:
none reported.

Funding:
none reported.

Received on:
September 19, 2016

Accepted on:
November 07, 2016

[1] Serviço de Cirurgia do Pé e Tornozelo, Faculdade de Ciências Médicas de Minas Gerais, Belo Horizonte, MG, Brazil.

[2] Hospital Universitário Ciências Médicas, Faculdade de Ciências Médicas de Minas Gerais, Belo Horizonte, MG, Brazil.

INTRODUCTION

Talar neck fractures are a rare and challenging injury usually referred and treated in referral orthopedic centers for foot and ankle surgery. Because of its unique anatomy, with multiple joints, large chondral surface and limited blood supply, fractures of the talus often cause postoperative complications and have permanent sequelae. This fracture corresponds to 50% of talus fractures, 6% of foot fractures and 1% of all skeletal fractures.[1-3] It is caused by high energy trauma in a dorsiflexion mechanism of the foot.

A complete medical history, including questions about the mechanism of injury, should be taken from all patients in the investigation of talus fractures. On physical examination, it is essential to assess skin conditions, ecchymosis, edema, stiffness, and deformities.

Standard foot and ankle radiographs should be requested after the initial clinical evaluation. These comprise anteroposterior (AP), lateral and oblique views of the foot, and AP, lateral and AP with 15º internal rotation mortise view of the ankle.

Canale and Kelly's view[4] is also useful for assessing fractures of the talar head and neck. It is achieved by rotating the foot internally, placing it in the plantigrade position on the X-ray chassis, and aligning the x-ray beams with cephalic inclination of 75º. It is important to use computed tomography with three-dimensional reconstruction as part of the routine in the evaluation of talar neck fractures.

Hawkins classification is based on the talar neck fracture and is made according to deviation and congruence with the subtalar, tibiotalar, and talonavicular joints. This classification was initially described as consisting of three types and was later modified to a fourth type: (4) type I if vertical fracture of the talus without deviation; type II if neck fracture with subluxation/dislocation of the subtalar joint; type III if fracture of the neck with tibiotalar and subtalar luxation; type IV if fracture of the neck with talonavicular, tibiotalar and subtalar dislocation.

Despite advances in implants, understanding of the biology of bone healing and the new concepts of osteosynthesis, complications after surgical reconstruction of the talar neck are still common. The most anticipated complication described is osteonecrosis of the talar body, which occurs when there is interruption or significant reduction in bone blood supply. Venous insufficiency leads to death of the organic part of the bone tissue, which reduces its mechanical resistance and favors the occurrence of microfractures, with consequent joint destruction.[5] It is closely correlated with the Hawkins classification, with type I ranging from zero to 13%; type II, from 20 to 50%; type III, from 75 to 100%; and type IV, approximately 100%.(4) It does not always progress to collapse of the talus, and some patients are even asymptomatic.

There is a relationship between osteonecrosis of the talar body and the Hawkins sign. This sign is seen on the AP radiograph as a radiolucent line in the subchondral region of the talar trochlea (Figure 1). It typically appears between 6 and 8 weeks after the occurrence of the fracture.[2,6] It represents a subchondral atrophy due to revascularization, and is a radiographic indication of the viability of the talar body.[7]

A positive Hawkins sign rules out the diagnosis of talar osteonecrosis.[2,5] Daniels and Smith pointed out that the Hawkins sign has high sensitivity but low specificity. Its presence is a reliable indicator of good progress, and its absence does not rule out the possibility of late onset[8] (Figure 2). Its prevalence is approximately 48% in international studies,[9] but these records do not exist in the Brazilian literature.

The aim of this study was to evaluate the prevalence of Hawkins sign in patients with a talar neck fracture and the epidemiological characteristics of individuals hospitalized for the surgical treatment of this injury.

Figure 1 | Positive Hawkins sign. Radiolucent line in the subchondral region of the talus.

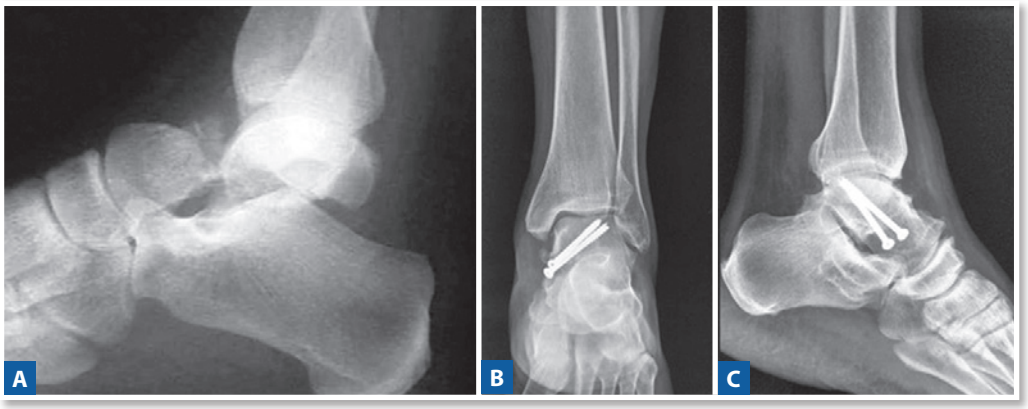

Figure 2 | A) Hawkins fracture; B) Post-osteosynthesis radiograph in anteroposterior view without Hawkins sign; C) Post-osteosynthesis radiograph in lateral view without signs of talar collapse.

METHODS

All the medical records of patients hospitalized with a talar neck fracture at the Hospital Universitário Ciências Médicas, in Belo Horizonte (state of MG) from January 1, 2010 to March 10, 2015 were collected. The inclusion criteria were surgically treated talus fractures. Associated or previous foot and ankle fractures and talus fractures not treated surgically were excluded.

After a detailed review of these records, 18 patients were selected without being separated according to the surgical technique used or the route of access. Pre- and postoperative radiographs (immediate, 1, 2 and 6 months postoperative) were used for evaluation. The parameters analyzed were sex, age, mechanism of injury, time between the date of the fracture and the date of surgery, Hawkins classification, presence of the Hawkins sign, presence of osteonecrosis and American Orthopedic Foot and Ankle Society (AOFAS) scale.[10]

This study was approved by the Institutional Review Board of Fundação Educacional Lucas Machado (FELUMA) of the Hospital Universitário Ciências Médicas, under number 1.149.247.

RESULTS

Data from the records of the 18 patients were analyzed (Table 1).

Table1 | General records

Patient	Sex	Age	Fracture-surgery time (days)	Hawkins Sign	Osteonecrosis	Hawkins Classification	AOFAS
BBO	M	22	47	No	No	2	NS
RFS	M	32	10	Yes	No	2	45
FRSM	M	28	5	Yes	No	3	NS
DHGP	M	28	19	No	Yes	3	65
WRS	M	23	18	Yes	No	2	NS
IVCM	F	36	19	No	No	2	NS
FPS	M	37	10	Yes	No	1	66
JFS	M	28	24	No	No	1	NS
OMB	M	40	15	No	Yes	2	NS
PEM	F	14	5	Yes	No	2	NS
STFL	F	25	15	Yes	No	2	NS
CEFC	M	37	15	No	No	3	94
JAN	M	38	30	Yes	No	1	NS
JFS	M	23	5	No	Yes	3	34
BJO	M	48	NS	No	Yes	2	58
CGACL	M	28	10	Yes	No	2	69
TSL	M	38	16	Yes	No	3	49
MMM	F	29	14	Yes	No	2	55

AOFAS: American Orthopaedic Foot and Ankle Society; M: male; NS: not stated; F: female.

Of the total, 14 patients were male (ratio of 3.5:1). The patients analyzed were between 14 and 48 years of age, averaging 30.8 years. For better interpretation, the patients' ages were divided into three random age groups: up to 25 years (27.8%), 26-35 years (33.3%), and 36-48 years (38.9%) (Table 2).

High energy trauma with the foot in dorsiflexion was the most frequent mechanism (collision involving motorcycle and automobiles and fall from height) with 17 cases. Another mechanism involved was sports injuries, with one case (Table 3).

The rate of open fractures was 16.6% (three cases); two classified as Gustilo II and one as Gustilo IIIA. Of these three cases, two progressed with osteonecrosis. The time between the date of the fracture and the date of surgery varied between 5 and 47 days. The timing information was not available for one patient. Half of the patients (50%) were between 13 and 24 days post-fracture at the time of surgery (Table 4).

According to the Hawkins classification for talar neck fractures, three patients presented with a type I fracture, ten with a type II fractures and five with a type III fracture. None of the patients was classified with a Hawkins type IV fracture (Table 5).

Table 2 | Age group of the patients

Age group (years)	n (%)
Up to 25	5 (27.8)
26-35	6 (33.3)
36-48	7 (38.9)

Table 3 | Mechanism of injury

Mechanism	n (%)
Auto accident	9 (50.0)
Fall from height	8 (44.4)
Sports injury	1 (5.6)

Table 4 | Time between date of fracture and date of surgery

Fracture-surgery interval (days)	n (%)
Up to 12	6 (33.3)
13-24	9 (50)
25 or more	2 (11.1)
Not stated	1 (5.6)

Table 5 | Hawkins Classification

Hawkins Classification	Number of patients	Positive Hawkins
I	3	2
II	10	6
III	5	2
IV	0	0

The identified prevalence of Hawkins sign was 55.6%. Of the total number of patients evaluated, 22.3% presented with osteonecrosis, a number that increased when we evaluated only patients with a negative Hawkins sign. Of these eight patients, four (50%) progressed to osteonecrosis. Patients with a positive sign did not progress in the same way, as none presented with osteonecrosis (Table 6).

Table 6 | Hawkins Sign

Hawkins Sign	n (%)
Present	10 (55.6)
Absent	8 (44.4)

In regard to the AOFAS scale for hindfoot and ankle, only nine patients were reassessed. The mean score was 59.4 (Table 1).

DISCUSSION

There was greater prevalence of talar neck fracture in males (77.8%) and in youths (average age 30.8 years) in the study, similar to the results reported in the literature.[2.11] This evidences the importance of correct treatment of a fracture with high rates of complications and sequelae which are often permanent in economically active patients.

The origin of the trauma caused by the talar neck fracture in the patients studied was auto accidents, fall from height and sports injuries, which entailed a mechanism of force that displaced the bone by sudden dorsiflexion toward the anterior tibial border. If the deforming force continues after the occurrence of the fracture, subtalar subluxation/dislocation will follow. Under the influence of greater forces, the body may shift in the posterior direction.

In our series, 94% of patients had high energy trauma as a mechanism of injury of their fractures, a higher number than that found in the study by Sakakiet et al.,[12] which was 78%. The rate of open fractures was 16.6%, close to the rate found in the national literature.[12,13] 66.6% of the open fractures progressed with osteonecrosis, which implies a worse prognosis.

The time between the date of the fracture and the date of definitive surgery ranged from 5 to 47 days, with half of the patients (50%) undergoing surgery between 13 and 24 days after the injury. Patients with provisional external fixation in the emergency department are not included in this period. This long time until definitive surgery can be attributed to other fractures and associated systemic trauma, to

foot injuries which often go undiagnosed in patients with multiple injuries, and, lastly, to soft tissue injuries, which delay definitive treatment. Although blood supply to the talus is critical in deviated talar neck fractures, the wait for definitive surgical treatment does not appear to increase the risk of osteonecrosis.[14] This complication is more closely related to the deviation and to the classification of the fracture, its comminution, and the absence of emergency reduction.[14]

The identified prevalence of the Hawkins sign was 55.6%. The result found was similar to that referred to in the international literature, which is 48%.[9] There are no data, in the national literature, on the prevalence of this sign in referral hospitals in Brazil.

All of the patients who presented with the Hawkins sign progressed without osteonecrosis, a percentage that drops to 50% when the Hawkins sign is absent. These data are consistent with the literature, which states that a positive Hawkins sign rules out the diagnosis of talar osteonecrosis, but that a negative sign does not necessarily mean poor progress (high sensitivity and low specificity).[1,2,5]

According to the AOFAS scale, we obtained only nine analyzed patients, five of whom had a positive Hawkins sign. The mean score was 59.4 points, a worse result than that found in the study by Bastos et al.,[15] which was 73 points. This data is limited, given the retrospective nature of the study evaluation, with a large number of patients not reassessed (50%), which, although common in studies evaluating the treatment outcome of traumatic injuries, makes it difficult to establish an accurate prognosis, especially when evaluating complications such as osteonecrosis.

CONCLUSION

Talar neck fractures occurred in young patients with an average age of 30.8 years who are predominantly male (3.5:1). The Hawkins sign was present in most patients. Patients with a positive Hawkins sign did not progress to osteonecrosis.

REFERENCES

1. Fleuriau Chateau PB, Brokaw DS, Jelen BA, Scheid DK, Weber TG. Plate fixation of talar neck fractures: preliminary review of a new technique in twenty-three patients. J Orthop Trauma. 2002;16(4):213-9.
2. Hawkins LG. Fractures of the neck of the talus. J Bone Joint Surg Am. 1970;52(5):991-1002.
3. Kenwright J, Taylor RG. Major injuries of the talus. J Bone Joint Surg Br 1970;52(1):36-48.
4. Canale ST,Kelly FB Jr. Fractures of the neck of the talus: Long-term evaluation of seventy-one cases. J Bone Joint Surg Am. 1978;60(2): 143-56.
5. Pearce DH, Mongiardi CN, Fornasier VL, Daniels TR. Avascular necrosis of the talus: a pictorial essay. Radiographics. 2005;25(2):399-410.
6. Adelaar RS. The treatment of complex fractures of the talus. Orthop Clin North Am 1989;20(4):691-707.
7. Newcomb WJ, Brav EA. Complete dislocation of the talus. J Bone Joint Surg Am.1948;30A(4):872-4.
8. Daniels TR, Smith JW. Talar neck fractures. Foot Ankle Int. 1993;14:225-34.
9. Tezval M, Dumont C, StürmerK. Prognostic reliability of the Hawkins sign in fractures of the talus. J Orthop Trauma. 2007;2(8):538-543.
10. Kitaoka HB, Alexander IJ, Adelaar RS, Nunley JA, Myerson MS, Sanders M. Clinical rating systems for the ankle-hindfoot, midfoot, hallux, and lesser toes.Foot Ankle Int. 1994;15(7):349-53.
11. Bucholz RW, Court-Brown CM, Heckman JD, Tornetta P. Fraturas em adultos de Rockwood e Green. 7a ed. Barueri (SP): Manole; 2013. p. 782-828.
12. Sakaki MH, Saito GH, de Oliveira RG, Ortiz RT, Silva JS, Fernandes TD, et al. Estudo epidemiológico das fraturas do tálus. Rev Bras Ortop. 2014;49(4):334-9.
13. Fonseca Filho FF, Santin RA, Ferreira RC, Sanmartin M, Guerra A. Epidemiological aspecto fractures of the talus. Rev Bras Ortop. 1996; 3(6):481-4.
14. Elgafy H, Ebraheim NA, Tile M, Stephen D, Kase J. Fractures of the talus: experience of two level 1 trauma centers. Foot Ankle Int. 2000; 21(12):1023-9.
15. Bastos LR,FerreiraRC,Mercadante MT. Análise do resultado clínico-funcional e das complicações da fratura do colo do tálus. Rev Bras Ortop. 2010;45(4):362-74.