Osteosynthesis in a Pubic Stress Fracture. Case Report and Literature Review

Miguel Carabajal Mattar, Francisco Schumacher
Orthopedics and Traumatology Department, Sanatorio Allende, Córdoba, Argentina

ABSTRACT
Background: Pubic stress fracture (PSF) is a rare condition, described in long-distance runners and military recruits. One hundred and ninety-three conservatively managed cases have been documented in the literature. The purpose of this paper is to report an alternatively resolved case and to review previously reported cases, associated pathologies, diagnosis, and treatment. We report a case of an elderly patient, sportingly active, with PSF, who did not respond to conservative treatment and was surgically treated. Follow-up of the patient was favorable with remission of pain and return to activities. The indication for treatment should not be limited only to the degree of instability of the fracture, but should also take into account the medical and social context of the patient.
Keywords: Stress fracture; pubis; osteosynthesis.
Level of Evidence: IV

Osteosíntesis en una fractura por estrés del pubis. Reporte de un caso y revisión de la bibliografía

RESUMEN
La fractura por estrés del pubis es un cuadro poco frecuente, se ha descrito en corredores de larga distancia y reclutas militares. Se han publicado 193 casos que fueron tratados de forma conservadora. El objetivo de este artículo es presentar un caso resuelto de manera alternativa, analizar los casos ya publicados, las enfermedades asociadas, el diagnóstico y el tratamiento. Se presenta el caso de una paciente añosa, deportista, con fractura por estrés del pubis, que no respondió al tratamiento conservador y fue tratada con cirugía. La paciente evolucionó favorablemente, retornó a sus actividades y el dolor desapareció. La indicación del tratamiento no solo debe limitarse al grado de inestabilidad de la fractura, sino que también se debe considerar el contexto médico y social del enfermo.
Palabras clave: Fractura por estrés; pubis; osteosíntesis.
Nivel de Evidencia: IV

INTRODUCTION

Stress fractures are frequent injuries within sports traumatology and are more common in runners and young adults. Most are located in the lower limb; the tibia, the distal third of the fibula, and the metatarsals are the most common locations.[1] Stress fractures of the pubis are rare. Mostly seen in long-distance runners and military recruits, they account for about 4% of all stress fractures and are considered low-risk.[1-3]

Stress fractures are the result of fatigue or insufficiency of the affected bone.[4] Fatigue fractures occur after a physiological, cyclical, and repetitive overload that leads to microtraumas in normal bone tissue that lacks sufficient time and capacity to undergo bone remodeling, adapt to a new condition, and repair its corrosion. On the other hand, insufficiency fractures occur after a low-intensity load on a bone undergoing a systemic condition that compromises its architecture (corticosteroids, smoking, radiotherapy, prolonged immobilization, hyperparathyroidism).[4-7]

Received on October 1st, 2020. Accepted after evaluation on December 4th, 2020 • Dr. MIGUEL CARABAJAL MATTAR • miguelcarabajalmattar@gmail.com https://orcid.org/0000-0002-0301-0867
How to cite this article: Carabajal Mattar M, Schumacher F. Osteosynthesis in a Pubic Stress Fracture. Case Report and Literature Review. *Rev Asoc Argent Ortop Traumatol* 2021;86(4):XXXX. https://doi.org/10.15417/issn.1852-7434.2021.86.4.1214

Numerous factors contribute to the development of this entity. Extrinsic factors are related to the sports regimen, the type of sport, nutritional habits, and the type of terrain.[1,8,9] Intrinsic factors include hormonal states, low bone mineral density, low body mass, inadequate physical fitness at the start of sports activity, anatomical variations, muscle conditions, sex, ethnicity, and age.[1,10,11] Stress fracture of the pubis is clinically presented as an inguinal pain of high sensitivity and edema in the affected area after abrupt or repetitive sports practice with insufficient rest intervals.[4]

There are few published series documenting this lesion (Table) and, in all cases, the problem was resolved by conservative treatment. We present a case of an elderly patient who did not respond to this treatment and underwent surgery, which allowed the symptoms to be resolved. We analyze the associated diseases, the diagnosis, and the treatment of the published cases.

CLINICAL CASE

A 72-year-old woman, ex-smoker, with a history of glaucoma, controlled arterial hypertension, osteoporosis diagnosed by bone mineral densitometry and a body mass index of 21, consulted in the Department of Orthopedics and Traumatology of our institution for right inguinal pain of 12 months of evolution, of insidious onset, without a history of direct trauma. In addition, she reported that she practiced tennis and golf weekly.

Upon physical examination, pain is detected at the internal and external rotation of the right hip, at palpation of the right pubis, and at the counter-resistance adduction of the right lower limb. This picture was initially diagnosed as insertional tendinitis of the adductor muscles. A pelvis radiograph (Figure 1A) was requested, in which a radiopaque area was observed in the area of the pubic symphysis. Due to the sports history, the low bone mineral density, and the time of evolution of the symptom, an MRI was requested (Figure 1B and C) where a stress fracture of the right pubis was confirmed. The initial treatment consisted of analgesic and anti-inflammatory agents, together with rest from sports activities and physical rehabilitation. The patient was referred to the Clinical Service of our institution to assess her clinical status and detect any risk factors that could influence the treatment. After six months of physical rehabilitation, the patient returned to the consultation with limitations when walking and pain of the same characteristics, so it was decided to repeat the imaging studies. Again, increased radiopacity was observed in simple radiographs, as well as an identical focus of increased intensity with bone edema in the right pubis on magnetic resonance imaging (Figure 2).

After discussing the diagnosis and therapeutic options with the patient, it was decided to perform an osteosynthesis of the pubic symphysis with a 3.5 mm stainless steel flat bone reconstruction plate (Stryker® Trauma) and six 3.5 mm self-tapping cortical screws (Figure 3). Stable fixation was achieved and there were no technical complications related to the application. The patient began rehabilitation therapy 15 days after surgery, and progressed favorably, with progressive improvement of pain until complete remission 12 weeks after the operation. At three months, she started gym activities and, at six months, she returned to sports activity without symptoms.

DISCUSSION

Stress fracture of the pubis is a known problem in sports medicine and has a low frequency.[12] It mainly affects young people and adults between 18 and 55 years old who practice intense sports activities and is more common in females. It has been described in military recruits, long-distance runners, and football and rugby players. It also affects women >60 years old, with osteoporosis, after low-energy trauma or those who perform a moderate-intensity sports activity.[13,14] It can be detected isolated or associated with a stress fracture of the sacrum, which causes greater instability of the pelvic ring. Aretxabala et al. reported a 78% rate of association of these two fractures; therefore, the orthopedist should consider it at the time of diagnosis.[15] In the literature review, 193 cases were found (Table). Dummar et al.[16] reported a case of stress fracture of the pubis in a 22-year-old woman, associated with neurofibromatosis type 1, which we interpret as a finding given that there is not much literature affirming the direct association of these two diseases. Marshall and Gringmuth[17] published the case of a 16-year-old boy who suffered a stress fracture of the pubis after a sports practice. This patient had Crohn's disease, which provides a nutritional disorder that can alter bone biology.

Figure 1. A 72-year-old woman. **A.** Anteroposterior pelvis radiograph. An increase in radiopacity is observed in both pubic rami. **B.** Pelvic MRI, coronal plane, STIR sequence. Bone edema is visualized in the right pubic ramus. **C.** Pelvic MRI, T1-weighted sequence. The hypointense fracture trace is observed.

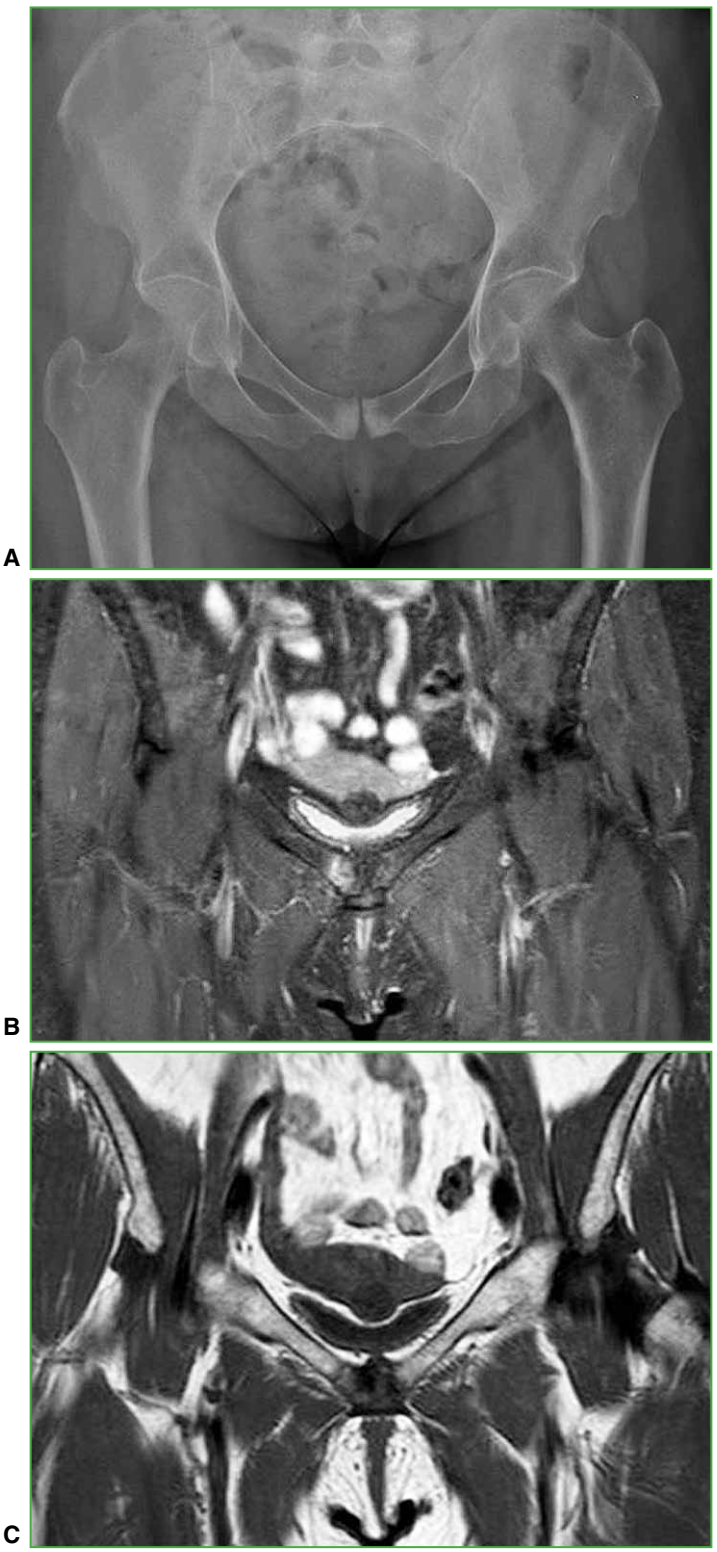

Figure 2. Patient at 8 months. **A.** Anteroposterior pelvic radiograph with identical features after conservative treatment. **B.** Pelvic MRI, coronal plane, STIR sequence. Bone edema can be observed in the right pubic ramus, a sign of absence of fracture consolidation. **C.** Pelvic MRI, T1-weighted sequence. The fracture trace in the right pubic ramus is still observed.

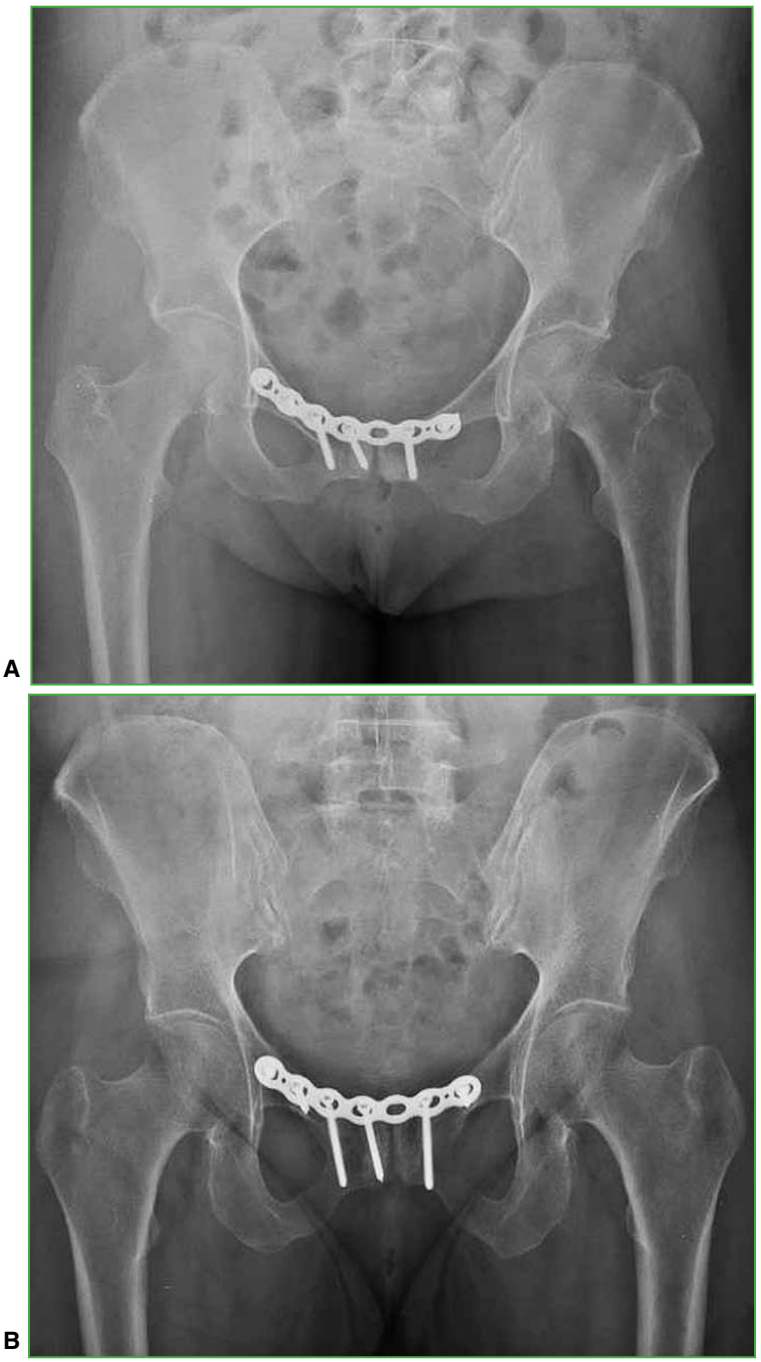

Figure 3. Postoperative clinical images. The plate osteosynthesis with six fixation screws is observed. **A.** Immediate postoperative radiograph. **B.** Radiograph at three months. The increase in radiopacity observed at the beginning of treatment is displayed.

Table. Demographic characteristics of patients reported with a stress fracture of the pubis without direct trauma or secondary to a surgical procedure.

Author	Publication	n	Age (years)	Sex	Activity and associated diseases
Selakovich	*J Bone Joint Surg Am* (1954)	5	20-22	M	Military recruits
Wilson	*Radiology* (1969)	1	NR	M	Military recruits
Orava	*Acta Orthop Scand* (1978)	2	NR	M 1 F 1	Runners
Meurman	*Br J Radiol* (1980)	49	18-29	M	Military recruits
Ozburn	*Mil Med* (1981)	70	21	F 67 M 3	Military recruits
Tehranzadeh	*AJSM* (1982)	1	21	M	Runner
Pavlov	*J Bone Joint Surg Am* (1982)	12	19-48	F 2 M 2	Marathoners
Noakes	*Am J Sports Med* (1985)	5	21-54	F 3 M 2	Marathoners
Thorne	*Clin Nucl Med* (1986)	1	43	F	Marathoner
Kim	*Clin Nucl Med* (1987)	1	39	M	Swimmer
Arafat	*Ann Rheum Dis* (1994)	1	62	F	Rheumatoid arthritis
Hill	*J Bone Joint Surg Br* (1996)	11	NR	F	Military recruits
Schapira	*Semin Arthritis Rheum* (1996)	7	NR	F	Osteoporosis and rheumatoid arthritis
Thienpont	*Acta Orthop Belg* (2000)	1	23	M	Marathoner, hypogonadotropic hypogonadism secondary to anorexia
Kim	*Korean J Intern Med* (2000)	1	39	F	Mixed connective tissue disease
Korpelainen	*AJSM (*2001)	4	NR	F 2 M 2	Marathoners
Iwamoto	*J Orthop Sci* (2003)	11	NR	F 7 M 4	Football, rugby and runners
Lee	*Korean J Radiol* (2005)	3	19-22	M	Military recruits
Bertolini et al.	*Rev Bras Ortop* (2011)	1	15	M	Football
Eisenstein	*BMJ Case Rep* (2013)	2	27-31	F	Military recruits
El Ghoch	*BMJ Case Rep* (2014)	1	28	F	Anorexia and compulsive sports activity
Kawano	*J Orthop Sci* (2016)	1	79	F	Parkinson's disease and osteoporosis
Marshall and Gringmuth	*J Can Chiropr Assoc* (2019)	1	16	M	Football + Crohn's disease
Dummar et al.	*J Orthop Sports Phys Ther* (2019)	1	22	F	Soldier with neurofibromatosis
Current case		1	72	F	Tennis and golf + osteoporosis

M = male, F = female, NR = not reported.

The etiology of pubic stress fracture is widely known and its diagnosis is based on clinical and imaging findings. Although it should be considered as a potential differential diagnosis of chronic or recurrent inguinal pain,[17] the imaging study is fundamental in the diagnosis of this entity. Anteroposterior pelvic MRI is the initial study due to its easy access and low cost; however, there are reports of a high rate of false-negative results.[4,18] Given the suspicion of pelvic instability, static radiographs are inadequate to detect abnormal relative movement between the two hemipelvis.

In this context, the patient should be evaluated with dynamic pelvic radiographs standing with one foot raised and, subsequently, the other (*flamingo view*). Garras et al. suggest that there is a physiological movement of 5 mm in the pubic symphysis in asymptomatic people.[19] Total bone scintigraphy has a sensitivity of 74-100% to bone remodeling and shows alterations in images three to five days after the onset of symptoms, revealing a stress fracture days or weeks before radiographs. It is also useful for differential diagnosis when metastatic lesions are suspected.[7,18] Computed tomography is used mainly when magnetic resonance imaging is contraindicated. Chronic lesions may be more evident with this study than with MRI or total bone scintigraphy; however, they should be reserved only for specific indications as they involve high ionizing exposure. Magnetic resonance imaging is the recommended study after a radiograph with no findings, it is the most sensitive and specific method for the diagnosis of this pathology and, in addition, it offers information on the severity and prognosis of the lesion.[4,7]

In order to adequately treat a pubic stress fracture, it is essential to identify the risk factors for the development of this condition. Therapy should be based on the recovery from fracture and prevention of new episodes.[4,20] The modification of activities, the correction of bad sports habits and the equipment and surface of sports practice, the optimization of nutritional habits, the recognition of hormonal and anatomical alterations as well as muscle strength and cardiovascular fitness could be of great importance to prevent new injuries. Traditional treatment includes pain management, physical rehabilitation, and minimizing the overload of the affected site without avoiding activities of daily living, including standing on both limbs from the beginning.[4,12,20] Despite early conservative treatment with the measures described above, pain relief and return to pre-injury activity may take 4 to 12 weeks.[7,20]

Pubic stress fracture represents a challenge when it occurs in elderly women with osteoporosis who maintain a regular sports practice, since consolidation on a poor quality bone becomes a problem. Conservative measures may therefore be insufficient. While the recommended treatment for a fragility fracture of the pelvis type Ia (according to the classification proposed by Rommens and Hofmann)[21] is conservative, the complications mentioned in older people range from urinary tract and lower respiratory tract infection to pulmonary thromboembolism. In addition, the hospital stay and home care services needed in this population after suffering this fracture imply a high cost burden for the health system.[22,23] Therefore, we believe that the indication of treatment depends on the general conditions and associated diseases of the patient.

Although the complications associated with medical treatment are minor compared to those of surgical treatment, Höch et al. showed that medium-term survival, after two years, was higher in patients with surgically stabilized fractures.[24]

In our case, the most relevant risk factors in the postmenopausal patient with a body mass index of 21 were osteoporosis—diagnosed by bone densitometry and treated together with the Rheumatology Service—and a history of smoking. These factors led the specialists of the medical team, together with the patient, to decide on surgical management, since, after six months, the primary treatment had not been adequate and the patient wanted to recover quickly to continue with her daily activities and sports practice. The radiographic follow-up showed a good evolution and the pain in the inguinal region disappeared three months after surgery; the patient resumed her sports activity at six months.

CONCLUSION

Pubic stress fracture is a known and rare entity associated with bone fragility and intense sports activity. Diagnosis is reached by clinical and imaging evaluation. Treatment depends on the type of fracture, general condition, and associated diseases of the patient. The indication of treatment should not only be limited to the degree of instability of the fracture but also take into account the medical and social context of the patient.

Conflict of interests: The authors declare they do not have any conflict of interests.

F. Schumacher ORCID ID: https://orcid.org/0000-0002-2528-7226

REFERENCES

1. Hosey RG, Fernandez MM, Johnson DL. Evaluation and management of stress fractures of the pelvis and sacrum. *Orthopedics* 2008;31:383-5. https://doi.org/10.3928/01477447-20080401-14
2. Snyder RA, Koester MC, Dunn WR. Epidemiology of stress fractures. *Clin Sports Med* 2006;25(1):37-52. https://doi.org/10.1016/j.csm.2005.08.005
3. Miller C, Major N, Toth A. Pelvic stress injuries in the athlete. *Sports Med* 2003;33:1003-12. https://doi.org/10.2165/00007256-200333130-00005
4. Carmont RC, Mei-Dan O, Bennell KL. Stress fracture management: current classification and new healing modalities. *Oper Tech Sports Med* 2009;17:81-9. https://doi.org/10.1053/j.otsm.2009.05.004
5. Quinteros C. Fractura por estrés de rama iliopubiana - Reporte de caso. *Revista de la Facultad de Ciencias Médicas de Córdoba* 2018;135-6. https://doi.org/10.31053/1853.0605.v0.n0.21473
6. Bennell KL, Malcolm SA, Thomas SA, Wark JD, Brukner PD. The incidence and distribution of stress fractures in competitive track and field athletes. A twelve-month prospective study. *Am J Sports Med* 1996;24(2):211-7. https://doi.org/10.1177/036354659602400217
7. Costa Astur D, Zanatta F, Gonçalves Arliani G, Moraes ER, de Castro Pochini A, Ejnisman B. Stress fractures: definition, diagnosis and treatment. *Rev Bras Ortop* 2016;51(1):3-10. https://doi.org/10.1016/j.rboe.2015.12.008
8. Dauty M, Collon S. Incidence of injuries in French professional soccer players. *Int J Sports Med* 2011;32(12):965-9. https://doi.org/10.1055/s-0031-1283188
9. Pepper M, Akuthota V, McCarty EC. The pathophysiology of stress fractures. *Clin Sports Med* 2006;25(1):1-6. https://doi.org/10.1016/j.csm.2005.08.010
10. Joy EA, Campbell D. Stress fractures in the female athlete. *Curr Sports Med Rep* 2005;4(6):323-8. https://doi.org/10.1097/01.csmr.0000306294.72578.a8
11. Henning PT. The running athlete: stress fractures, osteitis pubis, and snapping hips. *Sports Health* 2014;6(2):122-7. https://doi.org/10.1177/1941738114523381
12. Bertolini FM, Vieira RB, Araujo de Oliveira LH, Lasmar RP, Taviano de Oliveira J. Pubis stress fracture in a 15 year old soccer player. *Rev Bras Ortop* 2011;46(4):464-7. https://doi.org/10.1016/S2255-4971(15)30263-9
13. Tacettin Ayanaoğlu, O Şahap Atik, Nil Tokgöz, Murat Uçar. Sacral and pubic insufficiency fractures due to bisphosphonate treatment. *Eklem Hastalik Cerrahisi* 2015;26(2):120-4. https://doi.org/10.5606/ehc.2015.23
14. Ragnarsson B, Jacobsson B. Epidemiology of pelvic fractures in a Swedish county. *Acta Orthop Scand* 1992;63:297-300. https://doi.org/10.3109/17453679209154786
15. Aretxabala I, Fraiz E, Pérez-Ruiz F, Ríos G, Calabozo M, Alonso-Ruiz A. Sacral insufficiency fractures. High association with pubic rami fractures. *Clin Rheumatol* 2000;19:399-401. https://doi.org/10.1007/pl00011178
16. Dummar AR, Tragord B, Doherty BT. Plexiform neurofibromatosis in a woman with a pubic ramus stress fracture. *J Orthop Sports Phys Ther* 2019;49(1):37. https://doi.org/10.2519/jospt.2019.7495
17. Marshall C, Gringmuth R. Pubic stress fracture presenting as a strain of adductor longus in a 16-year-old elite soccer player with Crohn's disease: a case report. *J Can Chiropr Assoc* 2019;63(3):19-204. PMID: 31988541
18. Daffner RH, Pavlov H. Stress fractures: current concepts. *Am J Roentgenol* 1992;159(2):245-52. https://doi.org/10.2214/ajr.159.2.1632335
19. Garras DN, Carothers JT, Olson SA. Single-leg-stance (Flamingo) radiographs to assess pelvic instability: how much motion is normal? *J Bone Joint Surg Am* 2008;90(10):2114-8. https://doi.org/10.2106/JBJS.G.00277
20. Raasch WG, Hergan DJ. Treatment of stress fractures: the fundamentals. *Clin Sports Med* 2006;25(1):29-36. https://doi.org/10.1016/j.csm.2005.08.013
21. Rommens PM, Hofmann A. Comprehensive classification of fragility fractures of the pelvic ring: recommendations for surgical treatment. *Injury* 2013;44(12):1733-44. https://doi.org/10.1016/j.injury.2013.06.023
22. Taillandier J, Langue F, Alemanni M, Taillandier-Heriche E. Mortality and functional outcomes of pelvic insufficiency fractures in older patients. *Joint Bone Spine* 2003;70:287-9. https://doi.org/10.1016/s1297-319x(03)00015-0
23. Spencer JL, Lalanadham T. The mortality of patients with minor fractures of the pelvis. *Injury* 1985;16:321-3. https://doi.org/10.1016/0020-1383(85)90136-6
24. Höch A, Özkurtul O, Pieroh P, Josten C, Böhme J. Outcome and 2-year survival rate in elderly patients with lateral compression fractures of the pelvis. *Geriatr Orthop Surg Rehabil* 2017;8:3-9. https://doi.org/10.1177/2151458516681142