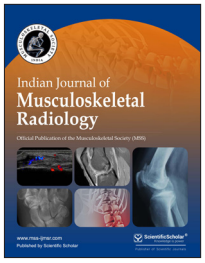
ScientificScholar®
Knowledge is power
Publisher of Scientific Journals

www.mss-ijmsr.com

Indian Journal of Musculoskeletal Radiology



Original Article

Isolated Ischial Lesions – Demographics and Imaging Features

Ahmed Saad[1], Shekhar Kalia[2], Louis-Romee Le Nail[1], Mark Davies[3], Steven James[3], Rajesh Botchu[3]

Departments of [1]Orthopedic Oncology, [3]Musculoskeletal Radiology, Royal Orthopedic Hospital, Birmingham, West Midlands, England, [2]Department of Radiology, Fortis Hospital, Noida, Uttar Pradesh, India.

***Corresponding author:**
Dr. Rajesh Botchu,
Department of Musculoskeletal Radiology, The Royal Orthopedic Hospital Bristol Road South Northfield, Birmingham, UK.

drbrajesh@yahoo.com

Received : 03 August 19
Accepted : 05 August 19
Published : 18 August 19

DOI
10.25259/IJMSR_22_2019

Quick Response Code:

ABSTRACT

Introduction: Ischial lesion is considered rare.

Aim: In this study, we review the patient demographics, imaging appearances, and pathological entities which arise in the ischium with the aim of facilitating a differential diagnosis. This allows appropriate management to be instigated in a timely fashion, enabling lesion to be stratified into those that can be managed locally or referred to a specialist center.

Materials and Methods: A retrospective search of our oncology and radiology database was performed to identify primary ischial lesions.

Results: The search revealed 82 cases with primary involvement of ischium. The most common benign tumor was aneurysmal bone cyst in patients under 40 years and osteochondroma in patients over the age of 40 years. Metastasis was the most common malignant tumor in both cohorts (<40 years and over 40 years).

Conclusion: We present the patient demographics, imaging appearances of pathological entities which arise in the ischium with the aim of facilitating a differential diagnosis.

Keywords: Ischial, Lesion, Imaging

INTRODUCTION

The pelvis is a common site of origin of several primary and secondary musculoskeletal tumors as well as a range of other pathologies. These lesions may develop in any part of the pelvis. Ischial lesion is considered rare. In this study, we review the patient demographics, imaging appearances, and pathological entities which arise in the ischium with the aim of facilitating a differential diagnosis. This allows appropriate management to be instituted in a timely fashion, enabling lesion to be stratified into those that can be managed locally or referred to a specialist center.

MATERIALS AND METHODS

A retrospective search of our tertiary orthopedic oncology and radiology databases was performed to identify isolated lesions of the ischium over the past 30 years (1989–2018). Lesions which unambiguously arose in the ischium were included in the study. We reviewed the databases for demographics, diagnosis, and imaging features. All ischial lesions identified in our cohort

were subclassified into two groups according to age (<40 and more than 40 years of age). Age is an essential diagnostic tool in categorizing bone pathologies as many lesions are age specific.[1]

RESULTS

We identified 522 cases of lesions using the search criteria on our oncology (1989–2018) and radiology database. Of these, 82 cases (16.4%) were reported as isolated lesions predominantly involving the ischium. The mean age of our patients was 52 years (7–78 years) and there was a female predominance with a female-to-male ratio of 1.2:1.

Malignant tumors were the most common lesions identified comprising 62.7% of all cases (n = 52). In this group, there was a male predominance of 1.4:1. Metastatic deposits formed the bulk of these cases (n = 34). Other malignant tumors comprised four chondrosarcomas, four spindle cell sarcomas, and four Ewing's sarcoma. Three of the Ewing's sarcomas were found in patients over the age of 40 years.

There were also three plasmacytoma cases identified; two were in patients over the age of 40 years. Other malignant tumors detected are summarized in Table 1.

Benign tumors were detected in 23.2% of all cases (n = 19).

In patients under the age of 40 years (7–40), aneurysmal bone cysts were the most common, comprising 21.1% of all cases (n = 4).

In comparison to patients over 40 years (age range of 41–78), osteochondromas were the most common comprising 21.1% of all benign tumors (n = 4). Giant cell tumors (GCTs) were identified in three patients in this age group.

Other than tumors, pathologies which were identified in the ischium included seven cases of infection, four avulsion injuries, and one inflammatory case involving the ischium. There was no significant gender or age predilection after reviewing these cases. The infective cases included four cases of osteomyelitis, one case of chronic recurrent multifocal osteomyelitis, and one case of tuberculosis (TB). There were four chronic avulsion injuries, three of which were found in patients over the age of 40 years. There was a solitary case and was a spondyloarthropathy (n = 1) which was found in a patient under the age of 40 years.

Table 1: Our cohort of isolated lesions of the ischium.

Pathology	<40 years	>40 years
Malignant tumors (n)		
Bone metastasis	12	22
Chondrosarcoma	0	4
Ewing's sarcoma	1	3
Multiple myeloma	2	1
Spindle cell sarcoma	1	0
Sarcoma radiation induced	1	0
Osteosarcoma	1	0
Paget's sarcoma	0	1
Benign tumors		
Aneurysmal bone cyst	4	0
Giant cell tumor	1	3
Osteochondroma	0	4
Osteoid osteoma	1	0
Hemangioma	1	0
Fibro-osseous lesion	0	1
Fibrous dysplasia	0	2
Hemangioendothelioma	1	0
Intraosseous schwannoma	1	0
Infective		
Osteomyelitis	2	4
Tuberculosis	1	0
Bony injuries		
Avulsion injury	1	3
Inflammatory lesions		
Spondyloarthropathy	1	0

DISCUSSION

Anatomy of the ischium

The ischium is an important weight-bearing bone that forms the posterior inferior aspect of the pelvis, articulating with two other bones; the ilium and pubis. The ischium is composed of a body and ramus. The body of the ischium is fused with the ilium and pubis and has three surfaces; the dorsal, pelvic, and femoral surface. The dorsal surface forms the ischial tuberosity and constitutes approximately two-fifths of the acetabulum. The posterior aspect of the dorsal surface is important in separating this area into the lesser and greater sciatic notches which are converted into foramina by the sacrospinous and sacrotuberous ligaments. These two structures are important in providing access to major nerves, vessels, and muscles. The femoral surface faces downward, forward, and laterally forming the lateral limit of the ischial tuberosity, which gives rise to the hamstring muscles. The pelvic surface is rather smoother and forms part of the lesser pelvis extending backward into a thin and pointed triangular eminence known as the ischial spine. The ramus of the ischium extends medially from the body and ischial tuberosity. It is divided into superior and inferior parts which serve as part of the origins of the adductor muscles. The superior ramus projects downward and backward from the body and continues to fuse with the inferior ramus of the pubis to form the ischiopubic ramus.

The ischium serves as an important area for muscular and ligamentous attachment. The sacrotuberous ligament

(arising from the sacrum and attaching to the posterior ischial spine and medial aspect of the ischial tuberosity), sacrospinous ligament (originating from the sacrum and attaching to the ischial spine), and ischiofemoral ligament (ischiofemoral ligament blends with the fibers of the hip joint capsule and attaches at the intertrochanteric line of the femur) are all important in providing reinforcement to the hip joint.

Malignant tumors of the ischium

Tumors of the pelvis are a rare entity with an incidence of 5.6% of all bone lesions. Tumors predominantly affecting the ischium are even less common and account for 0.4% of all cases.[2] Metastatic lesions usually disseminating from lung, breast, or prostate cancer are the most common secondary malignant neoplasm of the pelvis[3] [Figure 1]. Picci *et al*. showed that 1.8% of metastatic lesions of the pelvis are located in the ischium and this correlates well with our study.[4]

Chondrosarcoma and Ewing's sarcoma were the most common primary malignant tumors identified within our cohort. Chondrosarcomas arise from cartilaginous tissue that is characteristically without osteoid and are distinguished from other tumors by the production of cartilage matrix from the tumor cells. They comprise a heterogeneous group of neoplasms and account for approximately 20% of all bone sarcomas.[5] They affect the pelvis in approximately 40–50% of all cases and frequently involve the ilium and the pubis.[6] The exact incidence within the ischium specifically is not known. Chondrosarcomas most commonly affect adults above the age of 50 years and are almost absent in children.

Radiologically, chondrosarcomas are identified by the presence of lytic lesions with granular calcifications, endosteal scalloping, and invasion of the cortex involved. This is typically seen in computed tomography (CT) scans. On T1-weighted magnetic resonance imaging (MRI), a gray homogeneous signal can be identified contrasting clearly with normal marrow, while on T2 weighted or fat suppressed. Short-tau inversion recovery (STIR) imaging, a distinctive hyperintense lesion with unexpected medullary extension can be seen usually on a coronal projection[7] [Figure 2].

Ewing's sarcoma is the second most common malignant primary bone tumor that most commonly affects young adults.[8] It is an aggressive metastatic neoplasm that arises from hematopoietic marrow, typically arising from the medullary cavity and invading the Haversian system of the bone.[9] The pelvis is involved in approximately 20% of all cases, and as far as, we are aware, the exact incidence in the ischium has not previously been reported. Very rarely does Ewing's sarcoma affect older patients and when it does, this is usually extraskeletal[10-12] [Figure 3]. The tendency for these neoplasms to involve bone in the middle aged and elderly is due to the changing distribution of red marrow that occurs with advancing age.[11] Interestingly, in our study, most patients identified with Ewing's sarcoma were over the age of 40 years.

Ewing's sarcoma is often challenging to diagnose and this is primarily due to the inconsistency in the appearances of both primary and secondary pelvic tumors. MRI is more sensitive and remains superior to CT in evaluating the involvement of soft tissue, marrow, and neurovascular structures; however, definitive diagnosis is usually confirmed with a biopsy and histological examination.[13,14]

Another primary malignancy we identified in our cohort was plasmacytoma. Multiple myeloma (MM) is the most common primary bone tumor of the elderly and usually affects patients above the age of 50 years.[15] It is a systematic malignant tumor originating from monoclonal B-lymphoid cells differentiating in plasma cells. When isolated, MM is known as solitary plasmacytoma and is a very rare entity comprising <5% of plasma cell dyscrasias [Figure 4]. MM usually involves the axial skeleton. In the pelvis, it is most commonly found affecting the ilium (11.6%) and sacrum (1.5%). Again, the incidence in the ischium is not known. MM presents with non-specific symptoms such as pain at the site of involvement, hypercalcemic or hyperuricemic syndromes, and, occasionally, pathological fractures.[16]

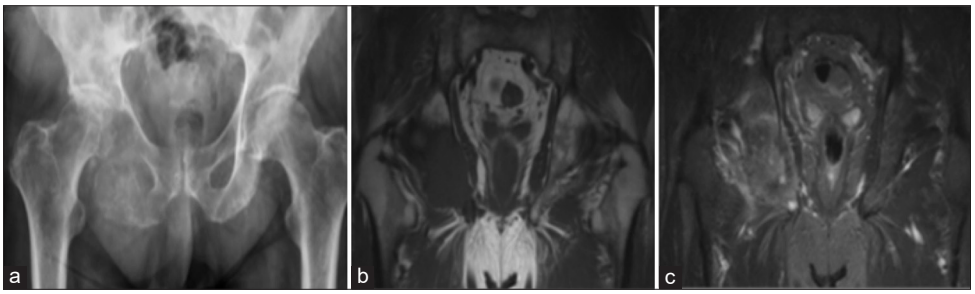


Figure 1: Metastasis from bronchogenic carcinoma. Radiograph (a), coronal T1 (b), and short-tau inversion recovery (c) demonstrating destructive lesion involving the right ischium.

The diagnosis of MM involves a series of different investigations. Classically, 90% of cases have a spike in serum and/or urinary immunoelectrophoresis, due to the excess of production of a monoclonal protein with the presence of Bence Jones proteinuria. Imaging also plays a major role in aiding diagnosis of MM and its use is recommended by the International Myeloma Working Group.[17] Although not definitive, the use of imaging techniques such as CT, MRI, and PET scans helps to analyze and define osteolytic lesions.[18] MRI remains the most sensitive imaging modality, identifying the diffuse and nodular appearances in cancellous bone that is linked with MM.[19]

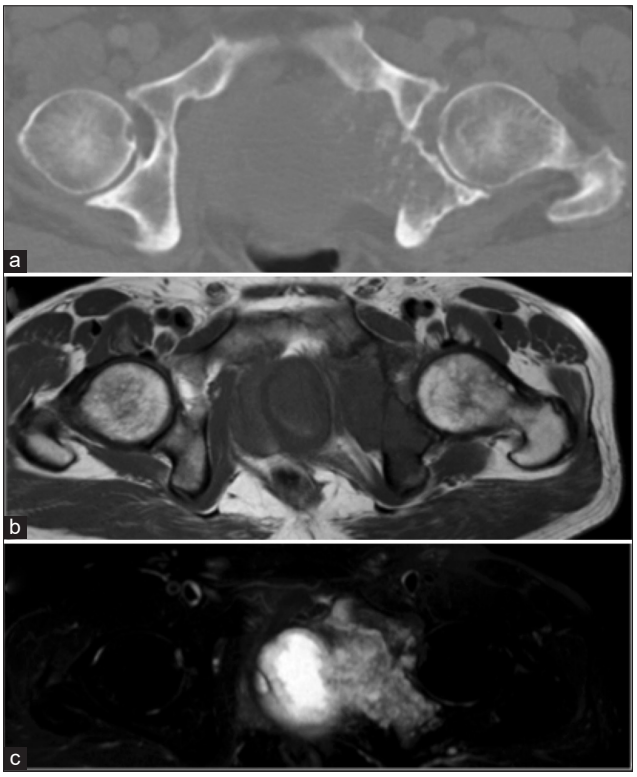


Figure 2: Chondrosarcoma. Axial computed tomography (a), T1 (b), and coronal short-tau inversion recovery (c) demonstrating the left ischial chondrosarcoma.

Benign tumors of the ischium

GCTs are regarded as the most common benign bone lesions.[20,21] They are defined as intramedullary lesions characterized by the presence of multinucleated giant cells and account for approximately 5% of all bone tumors. They are rarely found in the pelvis and in the ischium represent <0.05% of all GCTs [Figure 5].[22] They most commonly affect young adults, where 65% of cases present between 20 and 40 years of age. About 1–3% of cases are found in the immature skeletal bone.[23,24] GCTs are best seen on MR imaging, as it provides the ability to define the lesions, identify the soft tissue extension, and plan the mode of treatment.[25]

Aneurysmal bone cysts are defined as benign expansile tumors made up of numerous blood-filled channels [Figure 6]. They most commonly affect younger individuals with up to 80% of cases found in patients <20 years of age,

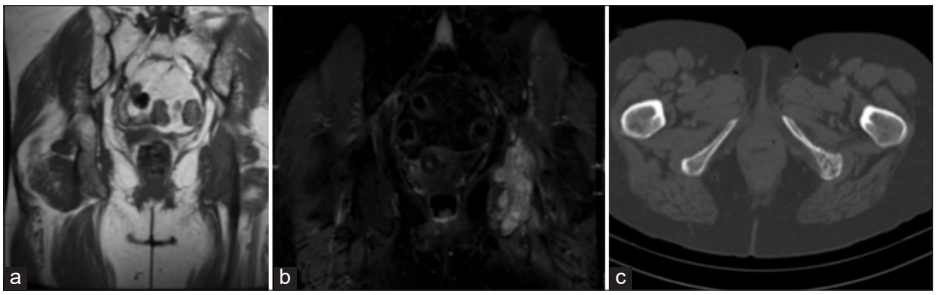


Figure 3: Ewing's sarcoma. Coronal T1 (a), short-tau inversion recovery (b), and axial computed tomography (c) showing Ewing's sarcoma of the left ischium.

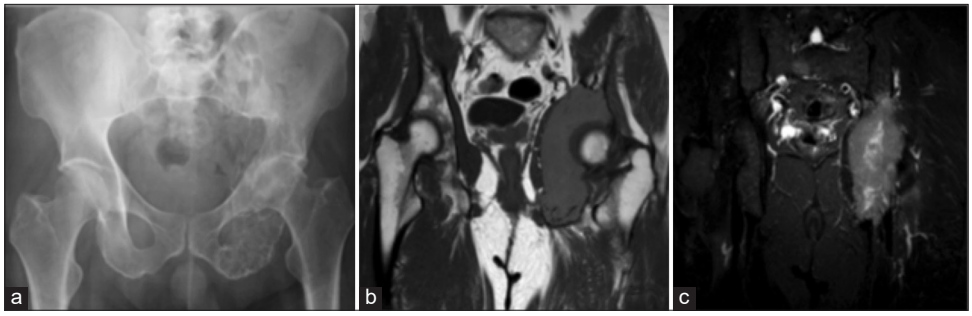


Figure 4: Plasmacytoma. Radiograph (a), coronal T1 (b), and short-tau inversion recovery (c) demonstrating large destructive lesion of the left ischium and acetabulum.

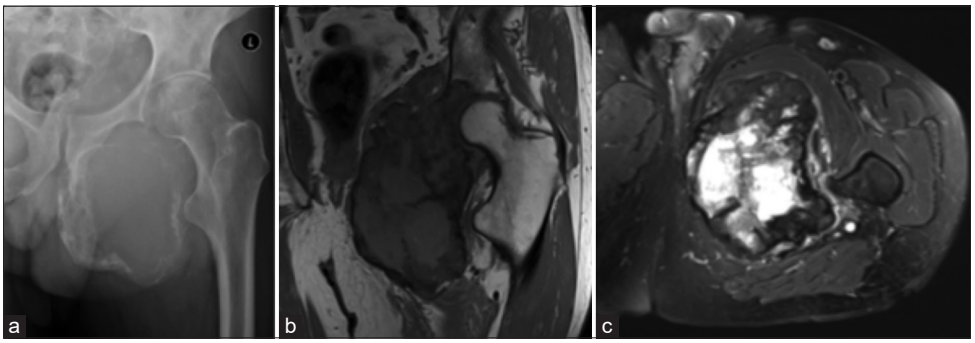


Figure 5: Giant cell tumor. Radiograph (a), coronal T1 (b), and axial short-tau inversion recovery (c) demonstrating large destructive lesion of the left ischium and acetabulum.

correlating with our study.[26] The cause of ABCs remains unknown. They usually occur in the metaphysis of long bones, and lesions found to affect the pelvis have an incidence of 8–12%. In regard to the ischium specifically, we could only find one case report in literature describing this.[27] Imaging is useful in aiding the diagnosis of ABCs. The term "aneurysmal" originates from its radiographic appearance and this reveals a sharply defined, osteolytic lesion that is present with sclerotic margins.[28] MRI demonstrates classic fluid-fluid levels.

Non-tumor ischial pathologies

Osteomyelitis was a relatively common finding in our cohort. It is defined merely as bone infection. Ischiatic osteomyelitis is extremely rare with very few case reports in literature.[29,30] It is most commonly found to affect children and adolescents.[31] In general, the most common cause of osteomyelitis is *Staphylococcus aureus*; however, in the pelvis, osteomyelitis can be polymicrobial, with *Escherichia coli* identified in a few cases.[32,33] Symptoms of osteomyelitis are non-specific and the diagnosis is dependent on MR imaging identifying bone marrow edema, cortical bone destruction, as well as soft tissue and joint complications.

Another type of infection we identified in our cohort was TB. TB is most commonly caused by *Mycobacterium tuberculosis* [Figure 7]. Involvement of the ischium is not common with a reported incidence between 0.1% and 0.43% of all cases of bony TB. Again, similar to osteomyelitis, symptoms may be variable and it may present with disseminated disease. Occasionally, TB of the ischium may also present with a discharging sinus.[34] TB can be suspected both clinically and radiologically. On radiographs, a triad (known as Phemister's triad) of radiologic abnormalities can be identified which are characteristic of TB. These include periarticular osteoporosis with marginal osseous erosion and a gradual reduction of the joint space.[35,36] Despite this, MRI remains to be the imaging modality of choice for early detection of joint TB. MR imaging demonstrates a synovial proliferation which can typically be seen on T2W images.[37,38]

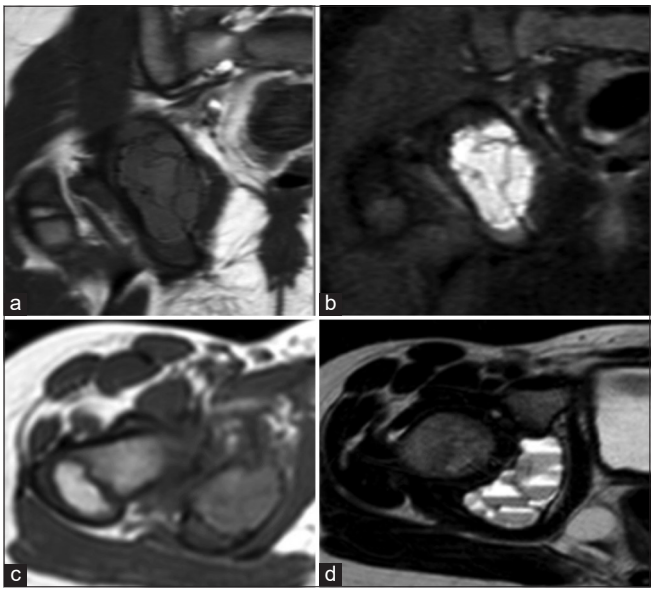


Figure 6: Aneurysmal bone cyst. Coronal T1 (a), short-tau inversion recovery, (b) axial, T1 (c), and T2 (d) demonstrating the right ischial lesion with fluid-fluid levels.

Avulsion fracture of the ischial tuberosity (AFIT) is not uncommon injuries that usually affect young athletic patients [Figure 8]. During puberty, the apophysis is the weakest link in the chain of muscle, tendon, and bone and any forcible contraction of the hamstring muscles leads to this fracture.[39] It rarely affects adults and searching literature; we were only able to identify one case report of this.[38] When AFIT is suspected, radiographs are the initial modality of choice and can easily identify significantly displaced lesions. However, when the displacement is minimal, this injury may be missed, and therefore, MRI imaging is required, possessing the ability to identify AFIT through edema such as signal intensity and surrounding subperiosteal fluid.[40]

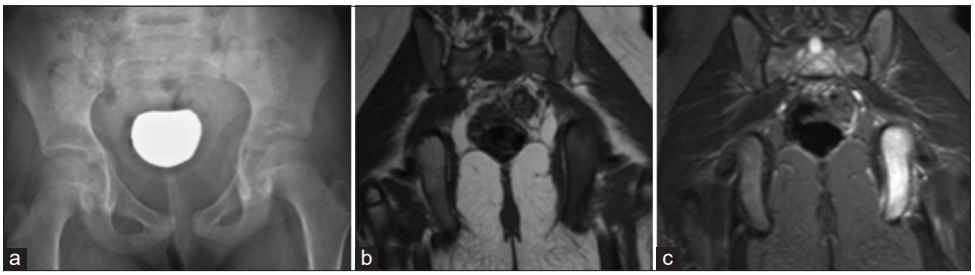


Figure 7: Tuberculosis, radiograph (a), coronal T1 (b), and short-tau inversion recovery (c) demonstrating edema in the left ischium which on biopsy proved to be tuberculosis.

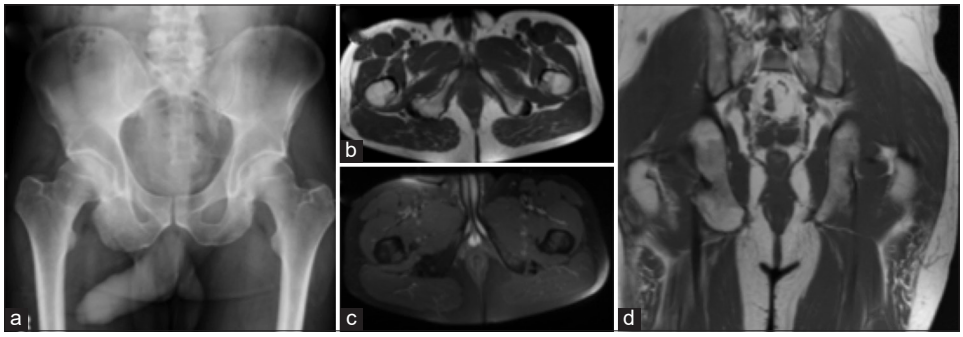


Figure 8: Chronic avulsion fracture of the ischium. Radiograph (a), axial T1 (b), short-tau inversion recovery (c), and coronal T1 (d) demonstrating chronic healed avulsion fracture of the right ischium.

CONCLUSION

Isolated ischial tumors and other pathologies are rare entity. Thorough knowledge of the anatomy of the ischial region along with imaging appearances of various disease processes involving ischium can help narrow down the differential diagnosis and also help guide a biopsy when required to reach a definite diagnosis.

Limitations

Although we identify the different number of lesions affecting the ischium, our study is biased based on the fact that this study was carried out in a tertiary referral center, limiting the number of cases that may be present within our institute.

Declaration of patient consent

Patient's consent not required as patients identity is not disclosed or compromised.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

REFERENCES

1. Girish G, Finlay K, Morag Y, Brandon C, Jacobson J, Jamadar D, *et al.* Imaging review of skeletal tumors of the pelvis part I: Benign tumors of the pelvis. ScientificWorldJournal 2012;2012:290930.
2. Garcia RJ. Diagnóstico e Tratamento de Tumores Ósseos. Rio de Janeiro: Elsevier; 2005.
3. Disler DG, Miklic D. Imaging findings in tumors of the sacrum. Am J Roentgenol 1999;173:1699-706.
4. Picci P, Manfrini M, Fabbri N, Gambarotti M, Vanel D. Atlas of Musculoskeletal Tumors and Tumorlike Lesions. Berlin, Germany: Springer; 2014.
5. Ozaki T, Hillmann A, Lindner N, Blasius S, Winkelmann W. Chondrosarcoma of the pelvis. Clin Orthop Relat Res 1997;337:226-39.
6. Donati D, El Ghoneimy A, Bertoni F, Di Bella C, Mercuri M. Surgical treatment and outcome of conventional pelvic chondrosarcoma. J Bone Joint Surg Br 2005;87:1527-30.
7. Murphey MD, Walker EA, Wilson AJ, Kransdorf MJ, Temple HT, Gannon FH, *et al.* From the archives of the AFIP: Imaging of primary chondrosarcoma: Radiologic-pathologic correlation. Radiographics 2003;23:1245-78.
8. Frassica FJ, Frassica DA, Pritchard DJ, Schomberg PJ, Wold LE, Sim FH, *et al.* Ewing sarcoma of the pelvis. Clinicopathological features and treatment. J Bone Joint Surg Am 1993;75:1457-65.
9. Parada D, Godoy A, Liuzzi F, Pelia KB, Romero A, Parada AM, *et al.* Primary Ewing's sarcoma/primitive neuroectodermal tumor of the kidney. An infrequent finding. Arch Esp Urol 2007;60:321-5.

10. Wedde TB, Lobmaier IV, Brennhovd B, Lohne F, Hall KS. Primary Ewing's sarcoma of the kidney in a 73-year-old man. Sarcoma 2011;2011:978319.
11. De Wilde C, Bols A, van den Berghe I, Coenegrachts K. Extraosseous Ewing's sarcoma, a case report on a rare diagnosis in an 80-year-old woman with a large abdominal mass. SA J Radiol 2017;21:1-4.
12. Wenger DE. Imaging of Bone Tumors: The State of the Art. United States: American Roentgen Ray Society; 2009.
13. Halwai MA, Mir BA, Wani MM, Bashir A, Hussain A. Ewing's sarcoma of the ilium mimicking inflammatory arthritis of the hip: A case report. Cases J 2009;2:6487.
14. Edeiken J. Roentgen Diagnosis of Diseases of Bone. 3rd ed. Baltimore, MD, USA: Williams and Wilkins; 1981.
15. Dimopoulos M, Kyle R, Fermand JP, Rajkumar SV, San Miguel J, Chanan-Khan A, *et al.* Consensus recommendations for standard investigative workup: Report of the international myeloma workshop consensus panel 3. Blood 2011;117:4701-5.
16. Dimopoulos M, Terpos E, Comenzo RL, Tosi P, Beksac M, Sezer O, *et al.* International myeloma working group consensus statement and guidelines regarding the current role of imaging techniques in the diagnosis and monitoring of multiple myeloma. Leukemia 2009;23:1545-56.
17. Bannas P, Kröger N, Adam G, Derlin T. Modern imaging techniques in patients with multiple myeloma. Rofo 2013;185:26-33.
18. Derlin T, Bannas P. Imaging of multiple myeloma: Current concepts. World J Orthop 2014;5:272-82.
19. Makhson A. Extralesional resection for tumours of the pelvic bones. Int Orthop 1997;21:41-5.
20. Angelini A, Drago G, Trovarelli G, Calabrò T, Ruggieri P. Infection after surgical resection for pelvic bone tumors: An analysis of 270 patients from one institution. Clin Orthop Relat Res 2014;472:349-59.
21. Shankman S, Greenspan A, Klein MJ, Lewis MM. Giant cell tumor of the ischium. A report of two cases and review of the literature. Skeletal Radiol 1988;17:46-51.
22. Murphey MD, Nomikos GC, Flemming DJ, Gannon FH, Temple HT, Kransdorf MJ, *et al.* From the archives of AFIP. Imaging of giant cell tumor and giant cell reparative granuloma of bone: Radiologic-pathologic correlation. Radiographics 2001;21:1283-309.
23. Eckardt JJ, Grogan TJ. Giant cell tumor of bone. Clin Orthop Relat Res 1986;204:45-58.
24. Mnaymneh W, Mnaymneh LG. Giant cell tumor of the ischium: Unusual site and outcome. South Med J 1979;72:1012-4.
25. Papagelopoulos PJ, Choudhury SN, Frassica FJ, Bond JR, Unni KK, Sim FH, *et al.* Treatment of aneurysmal bone cysts of the pelvis and sacrum. J Bone Joint Surg Am 2001;83:1674-81.
26. Kim CG, Kweon SH. Primary aneurysmal bone cyst in the iliac bone: A Case report. Hip Pelvis 2014;26:202-5.
27. Saccomanni B. Aneurysmal bone cyst of spine: A review of literature. Arch Orthop Trauma Surg 2008;128:1145-7.
28. Naim F, Elessi K. Osteomyelitis of the ischium: An often missed diagnosis, case study report. Int Musculoskelet Med 2014;36:79-81.
29. Hamzaoui A, Salem R, Koubaa M, Zrig M, Mnif H, Abid A, *et al. Escherichia coli* osteomyelitis of the ischium in an adult. Orthop Traumatol Surg Res. 2009;95:636-8.
30. Klein JD, Leach KA. Pediatric pelvic osteomyelitis. Clin Pediatr (Phila) 2007;46:787-90.
31. Dudareva M, Ferguson J, Riley N, Stubbs D, Atkins B, McNally M, *et al.* Osteomyelitis of the pelvic bones: A Multidisciplinary approach to treatment. J Bone Jt Infect 2017;2:184-93.
32. Ingelrans P, Lacheretz M. Evolution of immobilization and antibiotic therapy of acute osteomyelitis in adolescents. Rev Chir Orthop Reparatrice Appar Mot 1953;39:653-5.
33. García S, Segur JM, Combalía A. Tuberculosis of the ischium. Acta Orthop Belg 1994;60:238-40.
34. De Vuyst D, Vanhoenacker F, Gielen J, Bernaerts A, De Schepper AM. Imaging features of musculoskeletal tuberculosis. Eur Radiol 2003;13:1809-19.
35. De Backer AI, Mortelé KJ, Vanhoenacker FM, Parizel PM. Imaging of extraspinal musculoskeletal tuberculosis. Eur J Radiol 2006;57:119-30.
36. Hong SH, Kim SM, Ahn JM, Chung HW, Shin MJ, Kang HS, *et al.* Tuberculous versus pyogenic arthritis: MR imaging evaluation. Radiology 2001;218:848-53.
37. Samar G, Eghrari M, Saebi E. Tuberculosis of the ischium. Indian J Pediatr 1985;52:321-2.
38. Gidwani S, Jagiello J, Bircher M. Avulsion fracture of the ischial tuberosity in adolescents an easily missed diagnosis. BMJ 2004;329:99-100.
39. Somville F, Vriends D, Feyen J. Traumatic avulsion fracture of the ischial tuberosity in an elderly patient. Acta Orthop Belg 2011;77:122-4.
40. Meyers AB, Laor T, Zbojniewicz AM, Anton CG. MRI of radiographically occult ischial apophyseal avulsions. Pediatr Radiol 2012;42:1357-63.

How to cite this article: Saad A, Kalia S, Le Nail LR, Davies M, James S, Botchu R. Isolated Ischial Lesions – Demographics and Imaging Features. Indian J Musculoskelet Radiol 2019;1(1):14-20.