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Heterotopic Ossification of Left Hip after Sport Injury; Imaging Techniques and Features in Early and Late Presentation

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Authors' contributions

This work was carried out in collaboration between both authors. Author AJA discovered the case, managed the literature searches and wrote the first draft of the manuscript. Author OMA interpreted the radiological features of the images and proof read the first draft of the manuscript. Both authors read and approved the final manuscript.

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Case Study

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ABSTRACT

Aim: This report is aimed at highlighting the plain film features in late presentation of heterotopic ossification and other imaging features as well as raise awareness about heterotopic ossification, an uncommonly diagnosed and neglected sequalae of traumatic injuries in Nigeria.
Presentation of Case: A 43-year old man who had been experiencing post recreational sport recurrent dull pain and worsening limitation of movement in his left hip following an initial sports injury he sustained three years before presentation.
Discussion: Plain radiograph features were consistent with matured heterotopic ossification of the left hip. This was observed in the 4th decade of life though commoner in younger people.
Conclusion: Plain film is still a useful modality in the evaluation of matured heterotopic ossifications. It should be considered among differential diagnosis of recurrent joint pain following history of trauma by attending physicians, to prevent the possible sequalae of improperly treated traumatic joint injuries, to aid early treatment and avoid long term complications.

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1. INTRODUCTION

Heterotopic ossification (HO) is an ectopic formation of matured lamellar bone in extra-skeletal soft tissues where it normally should not exist [1]. The common sites of occurrence are the skin, subcutaneous tissue, muscle, tendons, ligaments and periarticular fibrous tissue [2]. Other less common sites are the walls of blood vessels and mesentery within the intra-abdominal cavity [3]. In the joints, HOs commonly occur at the hip, elbow and the shoulder [3].

HO is classified based on the clinical setting into acquired and hereditary forms. The acquired form is further sub-classified into post-traumatic and neurogenic forms. Post-traumatic HO develops secondary to soft tissue injury varying from repeated minor to severe injury, and may be associated with bony injury, such as fractures and dislocations. Other causes of traumatic HO include invasive surgery especially joint surgeries in the extremity joints, blast injuries and burns [4]. Sports related post traumatic HOs mostly occur in contact sporting activities [5].

Neurogenic form of acquired HO occurs following injury to the central nervous system (CNS). It usually develops in the setting of traumatic brain injury or spinal cord injury. Other documented CNS causes are stroke, brain tumors, tetanus, encephalitis and poliomyelitis [6,7].

While hereditary HO develops in rare, progressive and life-threatening genetic diseases such as fibrodysplasia ossificans progressive, progressive osseous heteroplasia and Albright's hereditary osteodystrophy [8].

The clinical features of HO may be early non-specific symptoms of inflammation such as pain, fever, swelling, erythema and decreased joint mobility. But in a number of patients HO is asymptomatic and may presents several months after initial injury with complications of heterotopic ossification [9].

2. CASE REPORT

A 43-year-old man who had acute left hip pain episode of 3 days duration. Pain started after engaging in a sporting activity 3 days earlier.

Patient regularly engages in recreational sports and was playing football about 3 years ago with his friends, when he fell on the left hip region during a hard tackle. There was severe pain at the left hip region and inability to stand or walk due to severe pain. He was hospitalised at a private health facility and had parenteral analgesic and bed rest for 3 days. Plain X-ray although not provided by the patient was said to have revealed no fracture and diagnosis of ligamental injury was entertained by the managing physician. The left hip pain was said to have resolved after about a week on oral analgesics. No other radiological imaging of the Hip was done. He has been having recurrent dull pain at the left hip precipitated by sports activities and worsening .limitation of movement and mild soft tissue swelling at the left hip region, There was no fever or discharges noted from the hip.

On examination, patient was a middle aged man well oriented, not in painful distress and afebrile. The pulse rate, respiratory rate and the blood pressure were all normal.

Essential findings on systemic examination were in the musculo-skeletal system. There was moderate soft tissue swelling over the left hip in its antero-lateral region. No differential warmth was however observed. There was mild tenderness over the antero-lateral aspect of the left hip region. There was pain during flexion and abduction movement of the hip and limitation of range movement of the hip in flexion and abduction.

He was placed on oral ibuprofen 300 mg twice daily and plain X-ray of the pelvis and left hip requested.

The plain radiographs of the pelvis; the antero-posterior view and the lateral view of the left hip showed a huge well corticated, claw-like/ triangular shaped bony outgrowth with normal corticomedullary differentiation arising from the left iliac bone and growing caudally but away from the hip joint. It measures about 6cm x 2.5cm in its length and width at its base. Its base is seen to extend transversely, from a level just below the anterior inferior iliac spine to the superior acetabular rim. The adjoining iliac bone show dense sclerosis (Fig. 1a). This bony outgrowth extends inferiorly towards and to the level of the greater trochanter, which is seen to be superimposed by the apex of the bony outgrowth (Fig. 1b). The lateral view of the hip shows the anterior origin of the bony growth

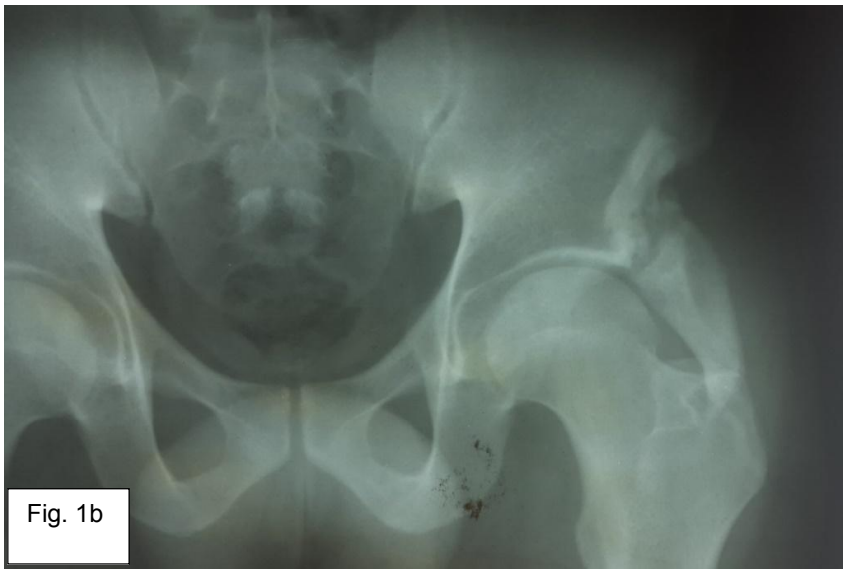

Fig. 1a. Antero-posterior (AP) view of the Pelvis and 1b. (AP coned to left hip) showing a huge claw-like bony outgrowth from a level just below the anterior inferior iliac spine. There is dense sclerosis of the adjacent iliac bone. This bony outgrowth extends inferiorly towards and to the level of the greater trochanter, which is superimposed on its apex, indicating its anterior location. ** The dark patches superimposed on the left pubic bone are artefactual

from the anterior inferior iliac spine and the apex to be anterior to the greater trochanter (Fig. 2). All in keeping with features of a matured heterotopic ossification of the straight and reflected heads of the rectus femoris tendon. No other bony outgrowth, fracture or evidence of hip dislocation was seen. Patient was lost to follow up after Magnetic resonance imaging was requested.

3. DISCUSSION

The process of heterotopic ossification requires a complex interplay of systemic and local factors to create a conducive tissue microenvironment that supports the differentiation of endogenous and/ or recruited pluripotent mesenchymal stem cells into osteoblastic cells [10]. HOs are either acquired or hereditary in nature [4-7]. The

Fig. 2. Lateral radiograph of the left Hip, showing the bony outgrowth growing inferiolaterally into the soft tissue. The base appears separated by a lucent line, indicating a tendinous ossification

incidence of traumatic HO type has a direct correlation with the degree of muscle contusion, with HO documented to occur in 100% of patients with severe muscle contusion [5]. This patient would have suffered a moderate to severe contusion of the affected muscle that later culminated in a matured ~~of~~ acquired, traumatic HO. The sport related traumatic injury probably led to soft tissue damage and invasion of histiocytes followed by fibroblast migration and mesenchymal cell proliferation with resultant osteoid and chondroid tissue formation [5]. The recurrent pain after sporting activities indicated some exacerbation of the injury process at the left hip that probably sustained the ongoing inflammatory process and the attendant calcium milieu disturbance. All culminating in the formation of HO over time in this case.

The early clinical features of HO are pain, fever, swelling, erythema and decreased joint mobility. At this stage it may mimic osteomyelitis, cellulitis, thrombophlebitis and deep venous thrombosis [11]. HO may also be asymptomatic in many patients and could present several months after its onset with features due to complications [11]. In this case pain, soft tissue swelling and decreased joint mobility were present after the initial hip injury but he also had recurrent pain and mild soft tissue swelling over the region after repeated sports activity. There was limitation of movement of the left hip joint, a known complication of HO that occurs several weeks after initiation of the HO process. The limitation in movement in this index case is probably due to the huge abnormal bone formation in the *rectus femoris* head. Again this index case is reported in a 43 year old man contrary to the literature reports that Traumatic HOs occur in adolescents and young adults and 50% in the 3rd decade of life [5].

3.1 Imaging

Imaging modalities for diagnosis and management of HO includes the plain film,

Computed tomography (CT), Radionuclide bone scan, Magnetic resonance imaging (MRI), and ultrasonography.

Plain film: HO shows a spectrum of features on the plain film, if left untreated. The diagnosis of HO on plain radiographs cannot be made until about six weeks after its onset. When plain radiographs demonstrate a soft tissue mass. Afterwards, a calcific density appears in this region, this gradually enlarges and transforms into a circumferential ossification with a lucent center. At about 30 months after its onset, the new bone shows corticomedullary differentiation with an appearance similar to that of young adult bone [11]. Usually, the new bone is outside the joint capsule and does not involve the periosteum. However, occasional intraarticular location or attachment to adjacent cortical bone have also been reported [12]. We observed that the bony outgrowth in this index case was extracapsular in location and showed good corticomedullary differentiation comparable to that of a matured bone in keeping with a matured HO. Certain peculiarities in our environment; unavailability of affordable imaging modalities, low index of suspicion of HO by attending physicians, alternate health/ self-medication practices and last resort hospital presentation by patients might have contributed to the formation of matured HO in this case. The interval between the initial injury and discovery of HO of the left hip (30 months) is in agreement with the average time required for formation of matured HO in the literature [11].

Computed tomography (CT): CT shows similar features as conventional radiography but can elicit the findings at a relatively earlier stage. Early CT findings include a low-density soft tissue mass or an enlarged muscle belly with poorly-defined surrounding soft tissue planes [12].

Radionuclide bone scan: Three-phase bone scan is the gold standard imaging modality for detection and monitoring of HO, detecting it as early as two weeks after its onset [13]. In early lesions, the flow and blood pool phases demonstrate increased activity of the lesion with a negative delayed phase scan, reflecting hypervascularity of the lesion. Within one week, the delayed phase images also show osseous uptake, which is considered to be diagnostic of HO in the appropriate clinical setting. Most of the bone scans return to baseline within seven to twelve months but a few remain positive, even after a year. A serial decrease or steady ratio between the normal and heterotopic bone uptake is considered a reliable marker of maturity of the HO on bone scintigraphy [14].

Ultrasonography: Has been utilized as a screening tool for HO. Early features in the pre-radiographic phase include an irregular disruption of the normal lamellar striated pattern of affected skeletal muscle. Later in the pre-radiographic phase, a mass-like lesion showing peripheral echogenicity and hypoechoic centre is seen. In the phase where the lesion becomes visible on radiographs, the lesion shows echogenic sheets or irregular clumps of material with posterior shadowing. Mature lesions show similar features as cortical bone, appearing echogenic and casting dense posterior shadows [15].

Magnetic Resonance imaging: Recent data shows that magnetic resonance imaging (MRI) can detect HO as early as 1 to 2 days after its onset [16]. MRI in early HO shows mass-like enlargement of tissue with heterogeneous hyper-intense signal on T2 weighted images and extensive ill-defined hyper-intensity consistent with oedema. A few weeks later, a low signal rim representing cortical bone appears around the lesion. Several months after the onset, the surrounding oedema gradually decreases [17].

Only the plain film of the left hip was done in this case. The other modalities, except ultrasonography are not readily available and when available, the cost of examination is expensive and out of reach of the common man in our environment. Plain film is cheap, widely available and may give diagnostic features, particularly in the late phase of HO. This was a case of undetected HO at an early stage that was left untreated for many years diagnosed with features on plain film.

Grading of Heterotopic Ossification of HO has been based on the severity of HO. More than 15 methods has been employed to classify HO but the most widely accepted method is the Brooker's method [18]. Though designed to grade HO of the hip, it has been adapted to other areas. The Booker's classification has been solely based on the Plain film appearances in the antero-posterior view of the pelvis.

Class 1: Islands of bone within the soft tissues about the hip

Class 2: Bone spurs from the pelvis or proximal end of the femur, leaving at least (1 cm) between opposing bone surfaces

Class 3: Bone spurs from the pelvis or proximal end of the femur, reducing the space between the opposing bone surfaces to less than 1 cm

Class 4: Apparent bone ankylosis of the hip

This is a huge matured bony outgrowth from the pelvic bone towards the greater trochanter of the left. There appears to be no gap between the bony spur and the greater trochanter which suggests ankylosis on the AP view, suggesting a class 4 HO. However, the lateral view confirmed there was no ankylosis, in keeping with class 3 Heterotopic ossification. This case also showed the limitation of Brooker's classification, having considered only the AP radiographic film in HO grading. The lateral view is crucial to determine the distance of the bony outgrowth from the greater trochanter and to validate suggestion of ankylosis. We submit that the Antero-posterior and lateral views of the hip are necessary to confidently grade HOs. Altogether there is paucity of literature on HO in Africans with few cases documented in literature [19,20]. We suggest that HOs may be uncommon in Africans in line with the report of racial discrepancies as reported by David and co-workers [21].

3.2 Complications and Treatment

Complications of HO include contractures, spasticity, limitation in the range of motion of joints and increasing pain further compromising the patient's limited abilities. Other complications are pressure sores, entrapment of nerves and malignant transformation to osteosarcoma [4]. The present case had limitation of left hip movement and recurrent worsening pain. No Pressure sores, features of nerve entrapment or malignant transformation was present.

Early diagnosis of heterotopic ossification is very crucial to successful management. While early physiotherapy and non-steroidal anti-inflammatory drugs particularly indomethacin are useful. Bisphosphonates have been largely used to inhibit mineralization and calcification of soft tissue. Radiation therapy may also prevent of further formation and maturation of HO. Surgical excision and adjuvant radiotherapy is the treatment of choice for matured HO, particularly for significantly limited range or movement of involved joint [22-24].

4. CONCLUSION

This is a case of a huge matured class 3, acquired traumatic heterotopic ossification of the left hip following a sports injury. Plain film in the right clinical setting may effectively diagnose matured HO, particularly in the low income setting. Physicians should be aware that Heterotopic ossification is a possible sequalae of traumatic joint injuries that should be among differential diagnosis and early diagnosis and treatment will prevent late complications.

CONSENT

Authors declare that informed Institutional departmental consent was obtained from the patient.

ETHICAL APPROVAL

As per international standard or university standard written ethical permission has been collected and preserved by the authors.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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