Case Report

Role of radiotherapy in the management of heterotopic ossification

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ABSTRACT

Heterotopic ossification (HO) is a process of pathological bone formation in non-osseous tissue. Frequently, it is a complication that occurs from various causes such as traumatic, neurogenic, or genetic disorders, where trauma is the most common cause. HO is of major concern as it can lead to functional disorders, pain, and even to joint ankylosis. Non-steroidal anti-inflammatory drugs and radiotherapy (RT) are preferred in the treatment of HO. RT serves as an important modality for the management of HO because RT potentially inhibits osteoprogenitor cell proliferation. This is a case report of an 18-year-old girl, who developed grade 4 HO at her right hip joint following a fall from height. She, then, underwent excision of heterotopic bone and RT to the right hip joint at a dose of 8 gray (Gy) delivered in 1 fraction, within 48 h of excision. The patient did not report any acute adverse effects related to RT and demonstrated clinical improvement in her range of motion without any recurrence of HO at her 3 and 6-month follow-ups.

Key words: Heterotopic ossification, Myositis ossificans, Radiotherapy

Heterotopic ossification (HO), a frequent non-malignant disorder, is defined as the ectopic formation of mature lamellar bone in non-osseous soft tissue known as myositis ossificans, neurogenic osteoma, ossifying fibromyopathy, or heterotopic calcification. Initially, it was described by Riedel and later, reported by Dejerine and Ceillier in 1918 during World War I [1]. The hip is the most common site of involvement followed by the elbows, shoulders, knees, or other soft tissues associated with joints. It occurs due to a variety of causes such as trauma, neurogenic, or genetic disorders, where trauma is the most frequent [2]. Symptomatically, it presents with local pain, reduced range of motion which may lead to stiffness or complete ankyloses of the joint. Few rare cases may present with signs and symptoms of local inflammation such as erythema and edema when it approaches the skin. HO is classified according to the Broker's Grading Scale scoring system in the lower extremities and Hastings and Graham Grading Scale scoring system in the upper extremities [3]. The treatment options include physical therapy to protect the range of motion, drug therapy non-steroidal anti-inflammatory drugs (NSAIDs), radiotherapy (RT), and resection of ectopic bone tissue in joints with severe dysfunction. Early mobilization is important in these patients. RT plays a major role in the prophylaxis of the recurrence of HO [4]. However, the role of radiation in the management of HO is less known in the healthcare community.

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Hence, we present the case of an 18-year-old girl who developed HO after an accidental fall 4 years ago and was subsequently treated with RT.

CASE REPORT

An 18-year-old girl presented to our hospital with restricted movement of the hip joint along with severe impairment to do daily activities, and difficulty in walking after an accidental fall, 4 years ago.

On general physical examination, the patient was conscious, cooperative, and well-oriented to time, place, and person. No signs of clubbing, pallor, icterus, cyanosis, pedal edema, or generalized lymphadenopathy were present.

On local examination, she had restricted movements in both lower limbs. Power is 4/5 in the right lower limb and 5/5 in the left lower limb.

X-ray pelvis of the hip joint (anteroposterior view) showed fusion of the head of the femur with acetabular cavity noted in bilateral hip joints with loss of contour of the femoral head and sclerosis of their articular margins, suggestive of bony ankylosis of femur and acetabulum (Fig. 1). Magnetic resonance imaging (MRI) of the hips reported pathological ossification around the head, neck, proximal shaft, and intertrochanteric region of the right femur more than the left femur and lateral margin of the right acetabulum, inferolateral iliac crest, and focally superior

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margins of ischium showing predominantly fatty marrow changes with minimal peripheral intermediate signal. Bony spurs were completely opposing the articular surfaces likely suggestive of HO with complete bony ankylosis.

She was diagnosed as Grade 4 HO of the right hip joint on the basis of MRI findings. She underwent an excision of heterotopic bone on the right hip. The post-operative period was uneventful. She received RT of 8Gy in 1 fraction to the right hip joint within 48 h of the surgery. Radiation portals are depicted in Fig. 2. The left hip was managed conservatively. The patient did not report any acute adverse effects related to RT and demonstrated clinical improvement in her range of motion at the right hip without any recurrence of HO at 3- and 6-month follow-ups.

DISCUSSION

The pathophysiology of HO is not fully elucidated. It is suggested that HO may result from the metaplastic response of mesenchymal cells induced by the interaction between systemic factors and local, metabolic, vascular, genetic, and biochemical factors. Localized mass, pain, and limitation of movement are typical in the course of disease. These clinical symptoms are seen within 8–10 weeks [5]. HO becomes visible on direct radiographs after 1–2 months, where maturation occurs. Radiological imaging can reveal both HO localization and its relationship with adjacent tissues. Surgical removal of the HO is recommended in those presenting with clinically apparent symptoms, and excision of the HO is aimed at maximizing the function of the affected joints [6].

Figure 1: X-ray image showing features of heterotopic ossification

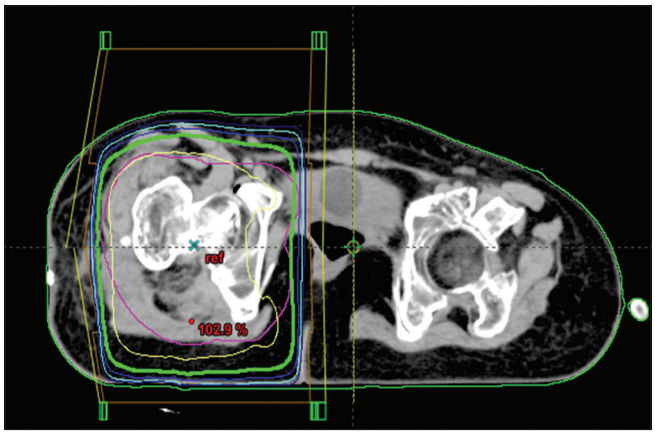

Figure 2: Radiation field with isodose distribution covering the site of heterotopic ossification

NSAIDs used in prophylaxis of low-grade HO (grade 1 and grade 2) and they work by inhibiting prostaglandin-mediated bone remodeling and also by directly inhibiting the differentiation of osteoprogenitor cells. RT serves as a useful therapy for adjuvant prophylaxis in preventing the recurrence of HO because RT inhibits the proliferation of osteoprogenitor cells [7-10]. Pakos *et al*. performed a meta-analysis comprising seven randomized studies that compared RT and NSAIDs as prophylactic modalities against the recurrence of HO and demonstrated that RT tended to be more effective than NSAIDs in preventing high-grade HO (Brooker 3 or 4 HO) (Risk ratio 0.42 with 95% CI) and addition of RT to the surgical excision increases the recurrence-free survival (RFS) [11].

In a study done by Mohamed *et al*., 39 patients with advanced disease HO underwent surgical excision followed by post-operative radiation of 7–8 Gy within 3 days of the surgery. On follow-up, the 8-year treatment failure-free rate was 79.3±9%, and the 5-year HO failure-free rate was 97.2±3%. They concluded that post-operative radiation therapy proved an effective and safe treatment for advanced-stage HO disease to prevent recurrence [10].

Regarding the radiation dose, Pakos and Ioannidis proposed increasing the RT dose to >6 Gy which was more effective than NSAIDs in the management of recurrence. These results suggest that RT is an effective modality for preventing the recurrence of HO [11]. Early post-operative RT of 8–10 Gy at a single fraction is advised. Previous studies demonstrate no difference between single and fractionated doses [12]. However, single-dose RT is more widely preferred due to its ease of application. Several studies regarding the timing, dose, and route of RT in the literature show that RT is more effective in the early post-operative period. It is recommended that RT should be given during the early post-operative period within the first 72 h after surgery [13]. Our patient received a radiation dose of 8Gy in a single fraction within 48 h after surgery. The patient demonstrated clinical improvement in her range of motion at the right hip without any recurrence of HO at 3- and 6-month follow-ups. The toxicity from radiation treatment is uncommon and most investigators agree that, usually, no side effects are expected from RT [14].

CONCLUSION

A single fraction of RT is sufficient, cost-effective, and safe treatment of HO. Our findings suggest that the addition of RT to surgical excision can improve RFS in cases of HO. However, there is a need for further clinical trials with larger sample size that assesses the effectiveness of RT in preventing HO reoccurrence.

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