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Osteoid osteoma presentation at the center of the scapula neck in an overhead athlete: a case report

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A R T I C L E I N F O

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Shoulder joint pain in overhead athletes has several etiologies including subacromial impingement syndrome and labral lesions.[6] The first treatment choice is physiotherapy to achieve functional recovery if there are no obvious structural injuries of the joint. However, nonexercise-related etiologies of shoulder pain in athletes, such as bone tumor, must also be considered.

Osteoid osteomas are benign bone tumors that commonly affect young individuals. Although 50%-60% of these tumors develop on long bones, they can occur anywhere in the body.[5,11,17] Nighttime pain and characteristic clinical findings, such as nidus, are often present. Nidus is a well-defined lytic lesion with peripheral sclerosis and cortical thickening. In some cases, typical symptoms and imaging results may be unclear; therefore, a diagnosis of osteoid osteoma may be delayed if it is not considered one of the initial possible diagnoses.[23] Treatment strategies for osteoid osteoma include conservative treatment with nonsteroidal anti-inflammatory drugs, percutaneous ablation, and surgical resection.[18] Anatomical localization is the most important factor in determining treatment, and the appropriate treatment should be selected for each case.[22] The recurrence rate of surgical resection is 3.7%, and complications such as postoperative fracture and infection are at 7.4%. Surgical resection has a slightly inferior outcome compared to percutaneous ablation, but is effective in cases where nerves run close to the tumor or in atypical locations and has the advantage of making a pathological diagnosis.[21] In this case, we experienced an osteoid osteoma at the neck of the scapula of a patient who presented with shoulder pain. Diagnosis was delayed because shoulder joint pain is a typical symptom with several etiologies. In addition, it developed at a rare location in the tumor, medial to the glenoid fossa, and attention needed to be paid to the course of the suprascapular nerve in the surgical approach. Here, we report on and discuss this case.

Case report

The patient was a healthy 19-year-old female and a competitive badminton player. Right shoulder pain appeared without an acute trauma history of 3 years prior to her visit to our clinic. Her chief complaint was pain during badminton movements, especially during overhead motions, for which she had been undergoing physiotherapy at her previous clinic for sports-related symptoms for approximately a year. She also complained of nighttime pain. However, there was insufficient improvement, and the patient was referred to our department.

The range of motion (ROM) at presentation was 170° for active elevation, 170° for abduction, 70° for external rotation with 0° for abduction, 95° for external rotation with 90° for abduction, and 70° for internal rotation with 90° for abduction, with no difference between the right and left sides. Neer and Hawkins-Kennedy impingement signs were positive. There was no muscle weakness on the manual muscle testing in any direction of abduction, external rotation, or internal rotation. The Oxford Shoulder Score was 40.[7]

Blood tests showed no elevation in inflammatory markers, and a true anteroposterior radiograph (Fig. 1, *A*) showed an

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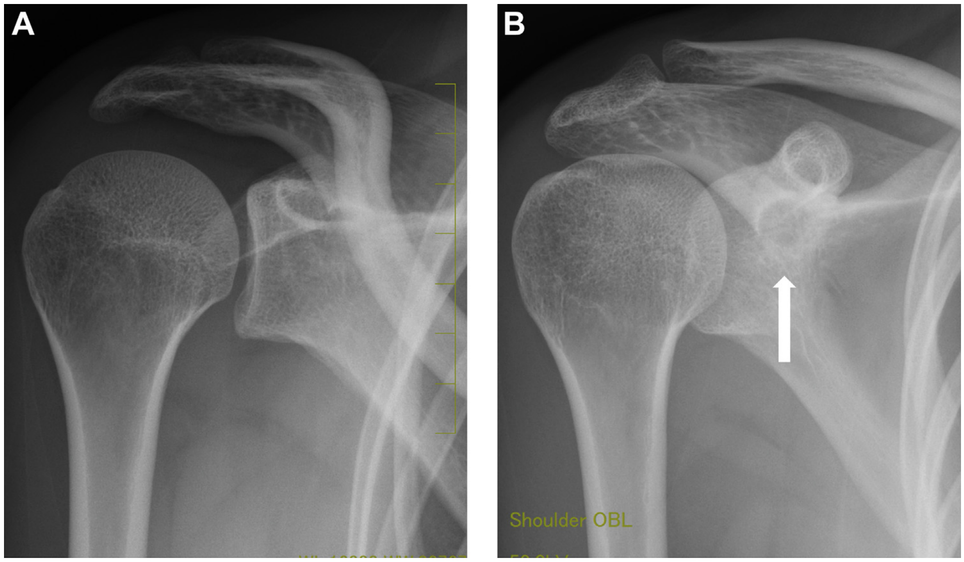

Figure 1 (**A**) True anteroposterior radiography: the tumor is indistinct. (**B**) An anteroposterior view of the nidus below the coracoid process (*arrow*).

acromiohumeral interval of 7 mm and a curved acromion (Bigliani type II). An anteroposterior radiograph showed a nidus, an osteolytic lesion surrounded by an abnormally ossified lesion, with a diameter of 10 mm below the coracoid process (Fig. 1, *B*). Computed tomography (CT) showed a nidus with a diameter of 10 mm located 11 mm medial to the articular surface of the glenoid fossa (Fig. 2). It was located at the base of the coracoid process and scapular spine. In the sagittal view, it was observed at the center of the Y-shaped area of the outermost scapular spine. No tumor protrusion from the scapular cortex was observed. T2*WI and diffusion weighted imaging magnetic resonance imaging (MRI) showed low intensity inside the tumor, high-intensity margins, and surrounding bone marrow edema (Fig. 3). From the above findings, the diagnosis was osteoid osteoma located at the base of the coracoid process and medial to the glenoid fossa of the scapula. Surgical excision was selected as the treatment.

Surgery was performed under general anesthesia; the patient was placed in the lateral position, and a posterior approach was used. A skin incision was made parallel to the scapular spine, 1 cm below the scapular spine as a landmark, and 4.5 cm to 1 cm medial to the lateral margin of the acromion. The deltoid muscle was split in the direction of the fibers, and the bony surface of the scapula was reached between the transverse and oblique fibers of the infraspinatus muscle. The infraspinatus muscle fibers were partially detached and flipped from the scapula to protect the suprascapular nerve using lateral and inferior traction (Fig. 4, *A*). A k-wire was inserted 10 mm medial to the glenoid fossa and 5 mm caudal to the scapular spine while confirming the nidus image of the tumor on fluoroscopy, and a small bony hole was created along it, gradually enlarging to a diameter of 7 mm (Fig. 4, *B*). The bone cortex was firm, and its structure was preserved. The lesion was a slightly viscous fluid with a soft reddish-brown substance. The tumor was curetted away from the bony cavity as much as possible and filled in with β-TCP (Superpore Glanure; Hoya, Tokyo, Japan) as artificial bone. After curettage, the internal surface was ablated using the electrocautery spray mode. The operative time was 56 minutes, and blood loss was 5 ml.

Pathology revealed osteoid bone, fibroblasts, and osteoblasts, which grew with wide sporulation around the fibroblasts. The pathological diagnosis was an osteoid osteoma (Fig. 5).

Immediately after the surgery, the nighttime pain disappeared. Active ROM examination was started 4 weeks after surgery, and strength training was started 8 weeks after surgery. The patient returned to competition 4 months postsurgery. One year after the surgery, radiography and CT showed that the bony foramen was filled with bone, and there was no recurrence (Fig. 6). The patient had no subjective symptoms, muscle weakness, or ROM limitations. However, the patient complained of mild discomfort around the posterior shoulder, and her Oxford Shoulder Score was 46.[26]

Discussion

We treated an osteoid osteoma in the neck of the scapula of an overhead athlete. The patient was diagnosed with subacromial impingement syndrome at a previous clinic, and it took several years to reach a diagnosis of osteoid osteoma. The tumor was located medial to the glenoid fossa of the scapula, where the suprascapular nerve runs; therefore, the surgical approach required consideration. We selected the posterior approach and performed curettage and artificial bone filling. One year postsurgery, new bone filling was observed at the tumor site.

Osteoid osteoma is a benign bone tumor that develops in the 10-30-year-old age group and accounts for approximately 5% of bone tumors and 11% of benign bone tumors.[11,23] It usually occurs at the cortex or periosteum near the epiphysis of long bones, and 80% occur in the lower extremities, mainly in the femur and tibia, with a rare occurrence in flat bones.[5,15] In particular, only a few cases of osteoid osteoma of the scapula have been reported in the literature.[2,12,16,19,25] In the Japanese Bone Tumor Registry from 1974 to 1995, only five cases (0.61%) occurred in the scapula.[13] Based on these facts, osteoid osteoma of the scapula is rare.

One of the characteristic symptoms of osteoid sarcoma is nighttime pain, which occurs in approximately 80% of patients.[10,17] In this case, overhead movement was interpreted as the cause of shoulder pain since the patient did not spontaneously complain of nighttime pain. When the patient was interviewed after the CT examination and asked if she had pain at night, she responded that she was aware of it. Of note, it may also be difficult to immediately diagnose osteoid osteoma around the shoulder joint in the presence of nighttime pain because shoulder joint disease is generally associated with nighttime pain. The patient was also aware of pain during exercise, which was consistent with subacromial impingement on examination, and an MRI showed intensity changes in the

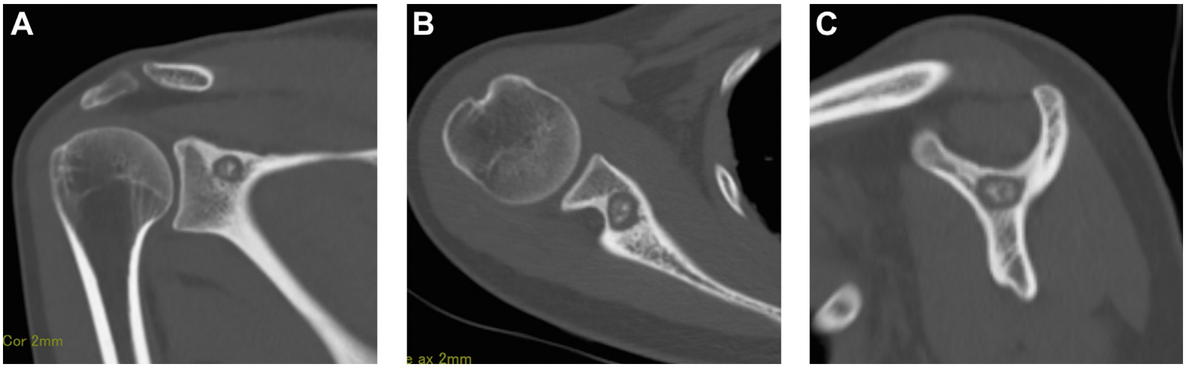

Figure 2 CT: (**A**), coronal view; (**B**), axial view; and (**C**), sagittal view. The neck of the scapular spine, 10 mm medial to the glenoid fossa, and sagittal section show a nidus image approximately 10 mm in diameter in the body of the scapula at the base of the scapular spine and coracoid process. *CT*, computed tomography.

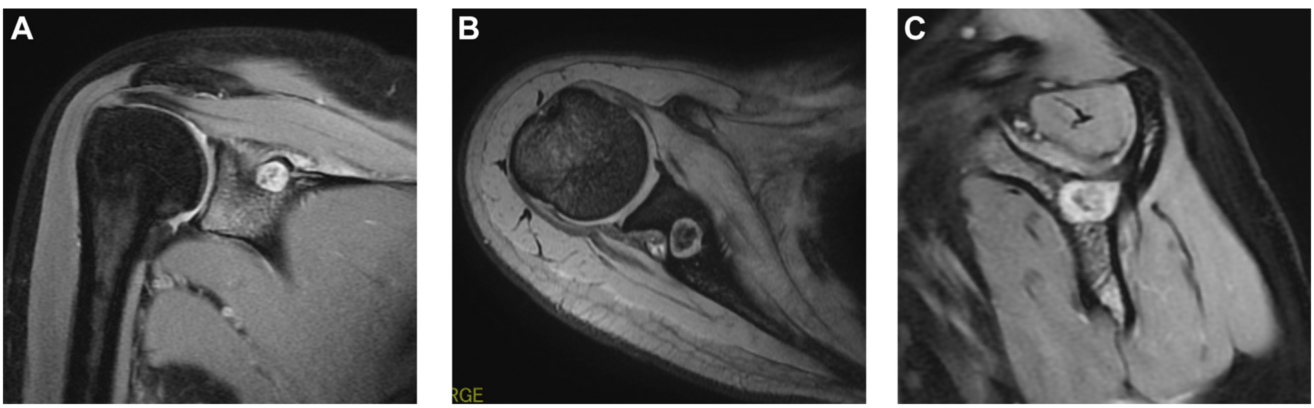

Figure 3 MRI: (**A**), PD fatsat Coronal view; (**B**), T2* Axial view; and (**C**), PD fatsat Y view. PD fatsat showed a circular, marginally high signal around the tumor and a low-signal tumor (nidus) inside it. *MRI*, magnetic resonance imaging; *PD*, proton density.

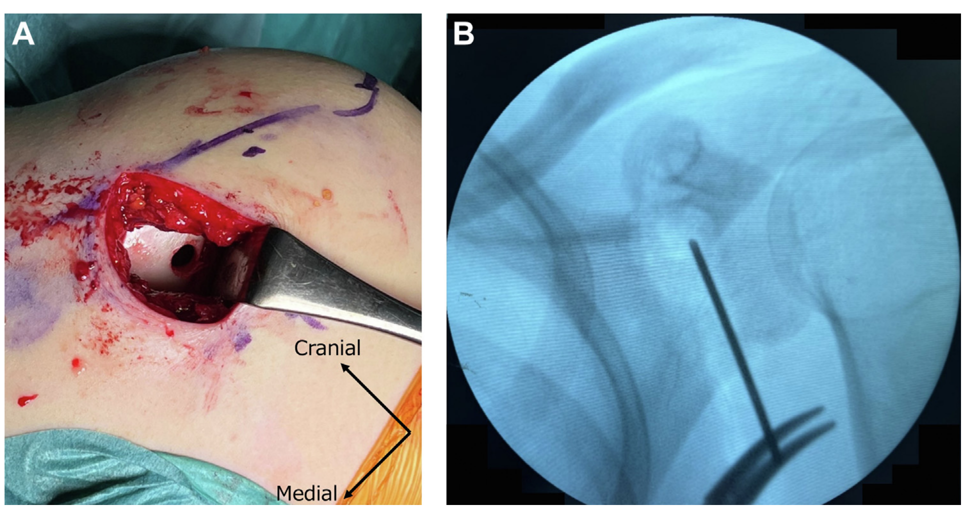

Figure 4 (**A**) Operation findings: suprascapular nerve protected by lateral traction. (**B**) During surgery, fluoroscopy was performed to confirm tumor position.

supraspinatus tendon, indicating tendinopathy. She had been diagnosed with subacromial impingement at a previous clinic and had undergone physiotherapy in the past year. Therefore, the actual diagnosis took time.

Radiographic examination revealed a nidus, in which reactive osteosclerosis surrounded a small osteolytic lesion. Swee et al reported that 75% of patients with osteoid osteoma show some changes on X-ray examination, and the remaining 25% cannot be distinguished on X-ray examination alone.[23] In this case, the tumor was not clear on the frontal view of the shoulder joint, and the nidus was seen only on the oblique view (Fig. 1). CT and MRI are more sensitive and useful for diagnosis.[3,5,9] MRI showed high intensity on T2-weighted images and slightly lower intensity on T1-weighted images. It also showed the surrounding bone marrow

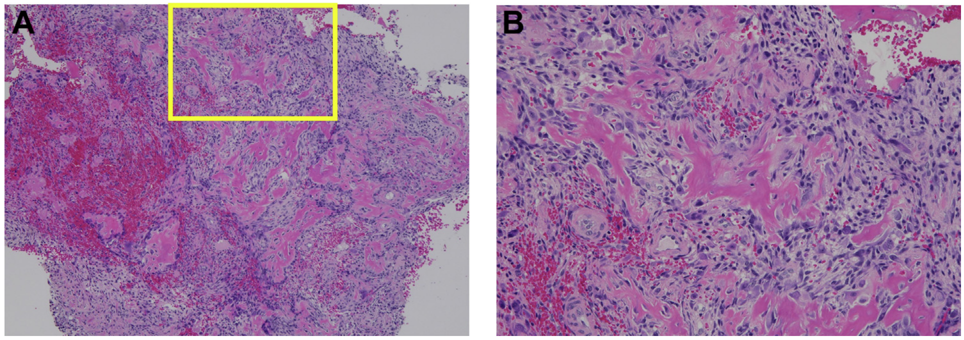

Figure 5 Pathological findings. (**A**) 40× magnification. (**B**) 100× magnification of border area. Pathology revealed osteoid bone, fibroblasts, and osteoblasts, which grew with wide sporulation around the fibroblasts. The pathological diagnosis was an osteoid osteoma.

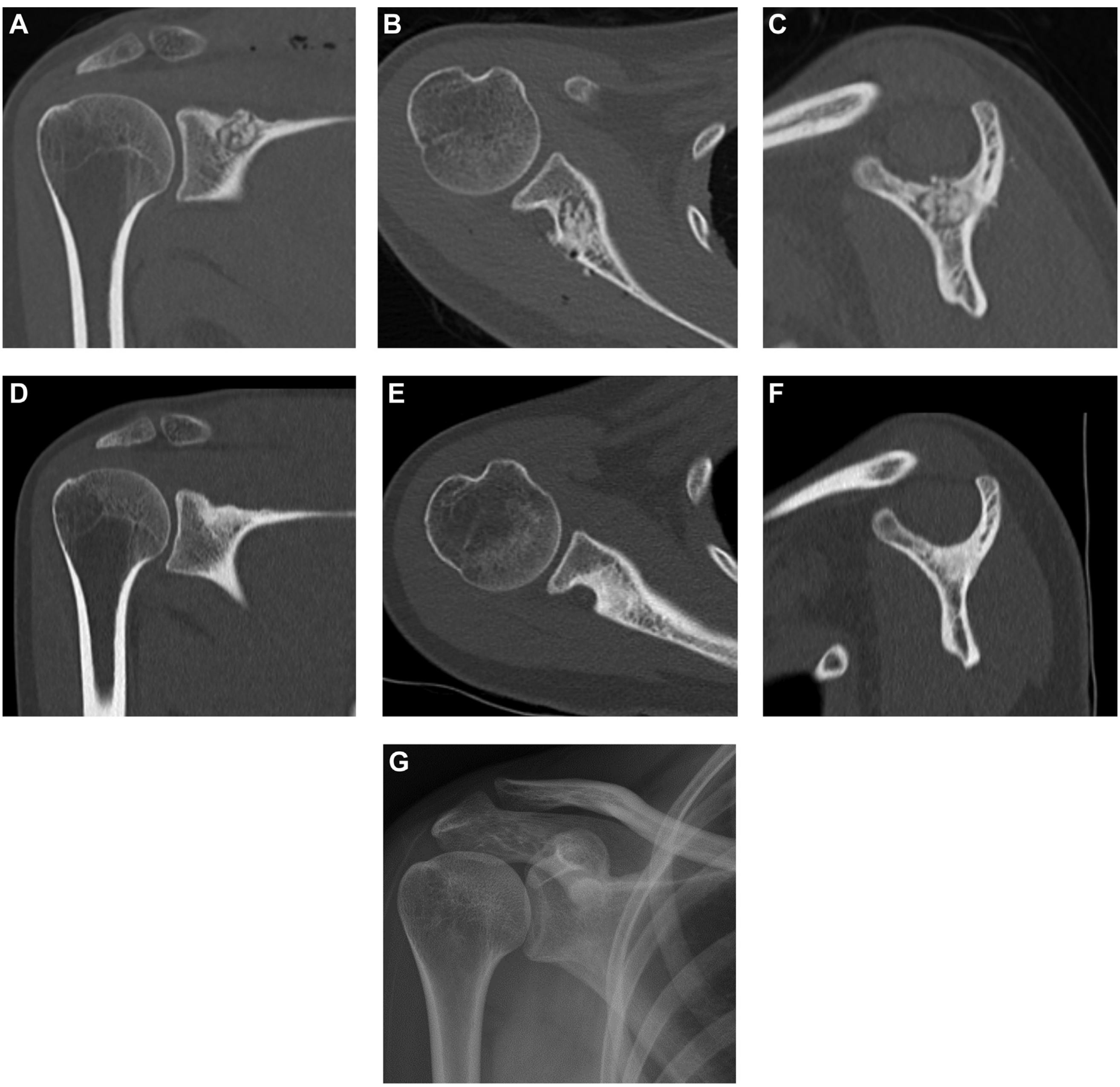

Figure 6 (**A**) CT coronal view just after operation. (**B**) CT sagittal view just after operation. (**C**) CT axial view just after operation. (**D**) CT coronal view 1 year postoperatively. (**E**) CT sagittal view 1 year postoperatively. (**F**) CT axial view 1 year postoperatively. (**G**) Frontal radiography, 1 year postoperatively. There has been no tumor recurrence, and the tumor is filled with new bone. *CT*, computed tomography.

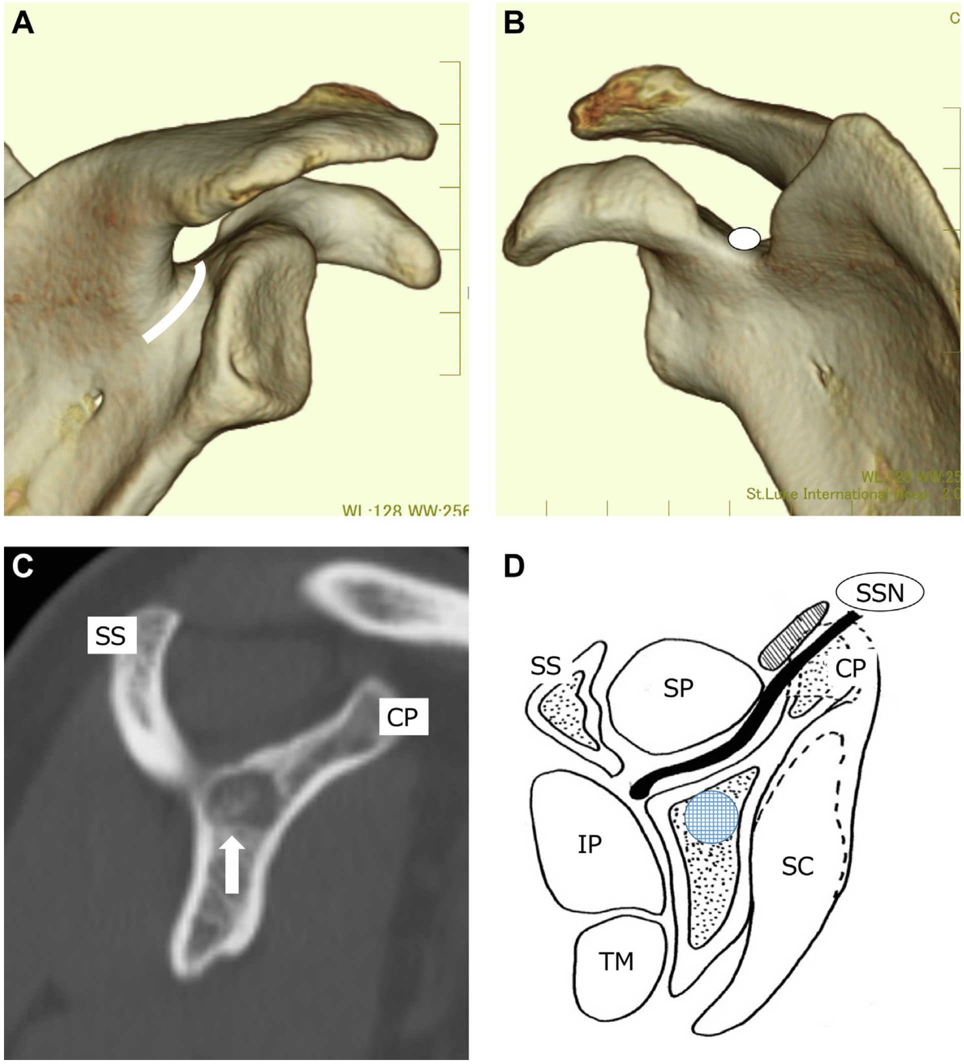

Figure 7 Suprascapular nerve runs. (**A** and **B**) 3D CT image of scapula. (**A**) Posterior lateral image of the scapula. (**B**) Upper medial image of the scapula. The suprascapular nerve passes from the superior medial to the inferior lateral of the scapular notch and runs posteriorly along the supraspinous fossa, angling posteriorly at the scapular spine. (**C** and **D**) CT and schema of the sagittal view of the scapula. Suprascapular nerve travel and tumor location. *CP*, coracoid process; *CT*, computed tomography; *IP*, infraspinatus; *SC*, subscapularis; *SS*, spinal scapula; *SSN*, suprascapular nerve; *SP*, supraspinatus; *TM*, teres minor.

edema. MRI results for osteoid osteoma may require a differential diagnosis of malignant tumors or osteomyelitis.[3,9]

Osteoid osteomas of the scapular neck, as in this case, are rare and difficult to treat. The approach had to be carefully chosen, considering the suprascapular nerve, which ran from anterior to posterior directly over the tumor. The suprascapular nerve passes through the superior transverse scapular ligament at the scapular notch, travels over the suprascapular fossa along the depth of the supraspinatus fascia, and runs backward under the inferior transverse scapular ligament to branch into the infraspinatus muscle.[24] In this case, the suprascapular nerve was located on the bony surface above and posterior to the tumor (Fig. 7). The anterior approach seems complicated because of the conjoined tendon and may require osteotomy of the coracoid process. There is also a report of arthroscopic treatment of an osteoid osteoma at the scapula, but this was a case of extraosseous exposure to the joint space.[25] The tumor had remained in the bone; thus, arthroscopic treatment was not appropriate because the location of bony hole creation could not be clearly determined.[12] The scapular notch is 30 mm medial to the glenoid fossa, and the lateral border of the base of the scapular spine is 18 mm medial to the glenoid fossa. Thus, the suprascapular nerve runs just above the tumor.[4,20] A superior approach was avoided because of the risk of injury to the suprascapular nerve, which is loosely anchored by subfascial tissue.[1,8] On the other hand, from the posterior approach, we can reach and create a bone entry hole between the transverse and oblique running fibers of the infraspinatus muscle. Both fibers receive branches from the suprascapular nerve, but each fiber is from a different branch.[14] Although percutaneous ablation under a CT guide has been reported, the localization of the tumor, in this case, to a safe area can be done to avoid injury to the suprascapular nerve; yet, the surgical technique of percutaneous insertion of a guide has the risk of nerve injury.[2,4,20]

Since this case involves a badminton athlete, artificial bone was filled in to prevent fractures at the site of the bone tumor curettage due to early physical activity. Iliac bone grafting was also considered, but it was not performed due to concerns about a temporary decrease in mobility resulting from the procedure. However, there is no evidence that filling with artificial bone results in the bone being filled at the curettage site earlier compared to doing nothing.

Conclusion

We report our experience with an extremely rare osteoid osteoma occurring in the neck of the scapula, which is difficult to diagnose and requires a careful anatomical approach for treatment.

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References

1. Albritton MJ, Graham RD, Richards RS, Basamania CJ. An anatomic study of the effects on the suprascapular nerve due to retraction of the supraspinatus muscle after a rotator cuff tear. J Shoulder Elbow Surg 2003;12:497-500. https://doi.org/10.1016/S1058-2746(03)00182-4.
2. Amin ZHF, Al-Rasheedi RS, Sairafi MH, Alrashidi Y. Osteoid osteoma of scapular glenoid: a case report. Int J Surg Case Rep 2020;77:143-6. https://doi.org/10.1016/j.ijscr.2020.10.129.
3. Assoun J, Richardi G, Railhac JJ, Baunin C, Fajadet P, Giron J, et al. Osteoid osteoma: MR imaging versus CT. Radiology 1994;191:217-23.
4. Bigliani LU, Dalsey RM, McCann PD, April EW. An anatomical study of the suprascapular nerve. Arthroscopy 1990;6:301-5.
5. Cohen MD, Harrington TM, Ginsburg WW. Osteoid osteoma: 95 cases and a review of the literature. Semin Arthritis Rheum 1983;12:265-81.
6. Corpus KT, Camp CL, Dines DM, Altchek DW, Dines JS. Evaluation and treatment of internal impingement of the shoulder in overhead athletes. World J Orthop 2016;7:776-84. https://doi.org/10.5312/wjo.v7.i12.776.
7. Dawson J, Fitzpatrick R, Carr A. Questionnaire on the perceptions of patients about shoulder surgery. J Bone Joint Surg Br 1996;78:593-600.
8. Duparc F, Coquerel D, Ozeel J, Noyon M, Gerometta A, Michot C. Anatomical basis of the suprascapular nerve entrapment, and clinical relevance of the supraspinatus fascia. Surg Radiol Anat 2010;32:277-84. https://doi.org/10.1007/s00276-010-0631-7.
9. Ehara S, Rosenthal DI, Aoki J, Fukuda K, Sugimoto H, Mizutani H, et al. Peritumoral edema in osteoid osteoma on magnetic resonance imaging. Skeletal Radiol 1999;28:265-70.
10. Georgoulis AD, Papageorgiou CD, Moebius UG, Rossis J, Papadonikolakis A, Soucacos PN. The diagnostic dilemma created by osteoid osteoma that presents as knee pain. Arthroscopy 2002;18:32-7. https://doi.org/10.1053/jars.2002.30010.
11. Greenspan A. Benign bone-forming lesions: osteoma, osteoid osteoma, and osteoblastoma - clinical, imaging, pathologic, and differential considerations. Skeletal Radiol 1993;22:485-500.
12. Ishikawa Y, Okada K, Miyakoshi N, Takahashi S, Shimada Y, Itoi E, et al. Osteoid osteoma of the scapula associated with synovitis of the shoulder. J Shoulder Elbow Surg 2005;14:329-32. https://doi.org/10.1016/j.jse.2004.07.010.
13. JOA Musculoskeletal Tumor Committee. Bone tumor registry in Japan. Tokyo: National Cancer Center; 1995. p. 28-9.
14. Kato A, Nimura A, Yamaguchi K, Mochizuki T, Sugaya H, Akita K. An anatomical study of the transverse part of the infraspinatus muscle that is closely related with the supraspinatus muscle. Surg Radiol Anat 2012;34:257-65. https://doi.org/10.1007/s00276-011-0872-0.
15. Kayser F, Greenway G, Schweitzer M, Kindynis P. Origin osteomas in tubular bones: analysis by CT and MR imaging. AJR 1998;170:609-14.
16. Kelly AM, Selby RM, Lumsden E, O'Brien SJ, Drakos MC. Arthroscopic removal of an osteoid osteoma of the shoulder. Arthroscopy 2002;18:801-6. https://doi.org/10.1053/jars.2002.35268.
17. Laurence N, Epelman M, Markowitz RI, Jaimes C, Jaramillo D, Chauvin NA. Osteoid osteomas: a pain in the night diagnosis. Pediatr Radiol 2012;42:1490-2. https://doi.org/10.1007/s00247-012-2495-y.
18. Outani H, Hamada K, Takenaka S, Imura Y, Oshima K, Sotobori T, et al. Radiofrequency ablation of osteoid osteoma using a three-dimensional navigation system. J Orthop Sci 2016;21:678-82. https://doi.org/10.1016/j.jos.2016.05.005.
19. Rouhani A, Mohajerzadeh S, Ansari M. Osteoid osteoma in the neck of the scapula; a misleading case. Arch Bone Jt Surg 2014;2:234-7.
20. Shishido H, Kikuchi S. Injury of the suprascapular nerve in shoulder surgery: an anatomic study. J Shoulder Elbow Surg 2001;10:372-6.
21. Shu M, Ke J. The surgical management of osteoid osteoma: a systematic review. Front Oncol 2022;12:1-10. https://doi.org/10.3389/fonc.2022.935640.
22. Sim FH, Dahlin CD, Beabout JW. Osteoid-osteoma: diagnostic problems. J Bone Joint Surg Am 1975;57:154-9.
23. Swee R, McLeod R, Beabout J. Osteoid osteroma: detection, diagnosis, and localization. Radiology 1979;130:117-23.
24. Tasaki A, Nimura A, Mochizuki T, Yamaguchi K, Kato R, Sugaya H, et al. Anatomic observation of the running space of the suprascapular nerve at the suprascapular notch in the same direction as the nerve. Knee Surg Sports Traumatol Arthrosc 2015;23:2667-73. https://doi.org/10.1007/s00167-014-3129-8.
25. Ueyama H, Ito Y, Manaka T, Matsumoto I, Ichikawa K, Nakamura H. Arthroscopic treatment of an osteoid osteoma at the base of the coracoid process: a case report. J Orthop Sci 2016;21:245-9. https://doi.org/10.1016/j.jos.2015.06.010.
26. Younis F, Sultan J, Dix S, Hughes PJ. The range of the Oxford Shoulder Score in the asymptomatic population: a marker for post-operative improvement. Ann R Coll Surg Engl 2011;93:629-33. https://doi.org/10.1308/003588411X13165261994193.