CASE REPORT

The use of arthrography in the diagnosis of temporomandibular joint synovial chondromatosis

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Synovial chondromatosis (SC) involving the temporomandibular joint (TMJ) is very rare and can occur in either or both cavities. Differentiation of the affected cavity in SC is therefore as important as making the diagnosis. This report presents a case of SC in which both cavities were thought to be affected, but arthrography using cone beam CT (CBCT) allowed us to see that involvement was limited to the superior joint cavity. In addition, we describe the usefulness of arthrographic CBCT for diagnosis and treatment planning in SC of the TMJ. *Dentomaxillofacial Radiology* (2013) **42**, 15388284. doi: 10.1259/dmfr/15388284

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Introduction

Synovial chondromatosis (SC) is a benign tumour-like disease, characterized by metaplastic change within the fibrous connective tissue of the synovium. This leads to the formation of cartilaginous nodules which may become pedunculated and then detached from the synovium, producing a number of loose bodies within the joint cavity.^{1,2} SC with calcified loose bodies has been termed synovial osteochondromatosis. Although various terminologies (SC, synovial osteochondromatosis and synovial metaplasia) have been used to describe the condition,² the term SC is generally the most accepted. The aetiology of the lesion has not been completely

clarified. However, some authors have suggested that both primary SC in the temporomandibular joint (TMJ), which is thought to be aggressive in behaviour, and secondary SC may be associated with previous trauma, repetitive microtrauma, degenerative arthritis and chronic abnormal loading leading to the detachment of chondrocytes.^{3,4} The role of microtrauma in the development of secondary SC has been demonstrated in an animal model by Helmy et al.⁵ Similarly, Cai et al.⁶ reported trauma as an aetiological factor in SC.

The epidemiology of SC is unclear and the disease occurs in the TMJ much more rarely than in large joints. Nearly all cases of SC involving the TMJ occur in the superior joint cavity; few have affected the inferior joint cavity or both cavities.^{7,8} Differentiation of the affected cavity in SC is therefore as important as making the diagnosis.

SC in the TMJ is commonly accompanied by pain, swelling, restriction of jaw movement and joint noise, and patients may have some or all of these symptoms.⁹ Patients with TMJ disorders (TMD) also have pain, trismus and joint sound; however, pre-auricular swelling

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Figure 1 Rotational panoramic tomography shows bilateral symmetry of the condyles and clustered calcifications around the right condyle (arrow)

is not observed. In addition, SC must be differentiated from other diseases such as tumours, condylar hyperplasia, arthritides, pseudogout and parotid swellings.¹⁰ Imaging is therefore considered the most important diagnostic modality to differentiate SC from other conditions of the TMJ. Plain X-ray, tomography, arthrography, arthroscopy, CT and MRI are widely used for the diagnosis of TMJ disease including SC.^{2,6,7-12}

The purpose of this report is to present a case of typical SC involving the superior joint cavity in which MRI and CT could not identify the pathological joint cavity. This was determined using TMJ arthrography with cone beam CT (CBCT). In addition, we describe the usefulness of arthrographic CBCT for diagnosis and treatment planning in SC of the TMJ.

Case report

A 34-year-old woman was referred to our department with pain in the vicinity of the right TMJ, which started approximately 1 month before her initial consultation with us. She had experienced discomfort around the right auricular region for 10 years but had not sought medical attention. There was no history of facial trauma. At presentation to the department of oral and maxillofacial surgery, she had mild spontaneous pain of the right TMJ region. Mouth opening was 42 mm and mouth movement was accompanied by joint noise and pain. The facial configuration was symmetric and pre-auricular swelling was not observed.

Rotational panoramic tomography showed bilaterally symmetrical condyles with clustered calcifications around the right condyle (Figure 1). CT (Asteion Super 4, Toshiba, Japan) was performed without contrast enhancement and showed high-density areas around the right condyle. There was no deformity of the right condyle or abnormality of the skull base. CBCT (3D Accu-I-tomo, Morita, Japan) was performed for a more detailed observation of the morphology of the loose bodies and TMJ components (Figure 2). This showed many nodules near the right condyle and a large loose body with low calcification resting on the inner surface of the condyle. This raised the suspicion of pathology in both cavities. The patient then underwent MRI (Intera 1.0 T, Philips, Netherlands). T_1 weighted sagittal images demonstrated enlargement of the anterior portion of the superior joint cavity and scattered low

Figure 2 (a) T_1 weighted sagittal images show an enlarged anterior portion of the superior joint cavity containing scattered low signal intensity areas. Another enlarged cavity is observed in the posterior portion of the condylar process. (b) The T_2 weighted image also shows that the enlarged cavity had a heterogeneous appearance, both anterior and posterior to the condylar process

signal intensity areas in the cavity (Figure 3a). Another enlarged cavity was observed in the posterior portion of the condylar process. The articular disc was anteriorly dislocated. T_2 weighted images also showed that the enlarged cavity had a medium-intensity heterogeneous appearance, both anterior and posterior to the condylar process (Figure 3b), and it was not possible to distinguish whether the pathology involved only the superior cavity or both cavities. The enlarged cavity located posterior to the condylar process was considered to be part of the inferior cavity because it was in close proximity to the condylar process. However, this could not be confirmed. Prior to surgery, the patient underwent arthrography of the superior joint cavity using CBCT. When the superior joint cavity was enhanced, all loose bodies were indirectly rimmed with the contrast medium (Optiray, Tyco Health Care, Japan) (Figure 4). Since the enlarged cavity posterior to the condylar process was also enhanced, some loose bodies including those which were not calcified and not identified on MRI were indirectly visualized.

The patient underwent arthroscopy and surgery under general anaesthesia, with a provisional diagnosis of SC affecting the superior cavity of the TMJ. Arthroscopy showed the synovium to be hyperplastic with hyperaemia and revealed many white loose bodies in the superior joint cavity (Figure 5). Some nodules were adherent to the synovial surface. Subsequently, by semi-open surgery under arthroscopic guidance, all nodules were removed and partial synovectomy was performed (Figure 6). Histopathological examination of the resected specimen showed that the isolated mass was hyaline cartilage tissue with partial calcification and synovial tissue adherence. The chondrocytes were clustered and had plump nuclei with occasional binucleated cells (Figure 7).

The patient experienced relief from the symptoms and was followed up for 1 year without signs of recurrence.

Discussion

SC with osteocartilaginous nodules in the TMJ is frequently diagnosed even from plain X-ray images

Figure 3 Cone beam CT shows loose bodies around the condyle. A large loose body is seen adjacent to the inner lower surface of the condyle

Figure 7 Haematoxylin and eosin stained images. (a) The multiple nodules are cellular hyaline cartilage covered by a fine fibrous layer. Central areas of the nodules are highly calcified (magnification $\times 2.5$). (b) The chondrocytes are clustered and have plump nuclei with occasional binucleated cells (magnification $\times 20$)

intensity in the enlarged joint cavity. Dentomaxillofacial radiologists often describe the enlarged joint cavity with high intensity on T_2 weighted images as “dumbbell-shaped”. Kim *et al*¹³ reported that a diagnosis of SC of the TMJ must be considered when the synovial fluid is abnormally abundant and the disc position is fairly normal, as seen on closed- and open-mouth MRI of the TMJ, without any associated severe changes in disc shape or bony structure.

The literature contains various reports of SC in the inferior joint cavity. Ida *et al*⁷ reported 14 cases of SC of the TMJ, 5 of which involved the inferior joint cavity. All five cases demonstrated morphological change of the condyle. Ida *et al*⁷ suggested that hypertrophic deformity is a characteristic feature of SC affecting the inferior cavity of the TMJ. Radiologists need a method to identify the location and number of loose bodies and the affected joint cavity, and this hypertrophic deformity might be a differential point in cases demonstrating no bony abnormality, as in the present case.

In the present case, it was unclear whether the pathology affected only the superior cavity or both cavities. This was unclear because (1) the enlarged cavity was located posterior to the condylar process on MRI; (2) the “dumbbell” was long anteroposteriorly and the stenosed zone of the superior cavity was narrow so that no fluid in that cavity was visualized on MRI; and (3) a

loose body was proximally positioned beneath the medial pole of the condyle on CBCT. Therefore, we performed arthrographic CBCT of the TMJ to determine which cavity was involved. TMJ arthrography has been widely applied to diagnose TMJ disease including SC but its use has recently decreased because of its invasiveness.¹⁴ Arthrography clearly demonstrated that the superior cavity was affected in the present case. In addition, it allowed us to indirectly detect some small non-calcified nodules which were overlooked by MRI. Li *et al*¹⁵ also reported the usefulness of arthrography in SC of the TMJ. A more detailed picture of the cavity could be obtained using CBCT during TMJ arthrography, thanks to the high spatial resolution of CBCT. This was useful in treatment planning and in informed consent for the patient. The surgeons could plan the operation using the MRI and arthrographic CBCT images and surgery was performed under microscopic guidance with minimal incision of the skin. We believe that these two modalities may play the most important role in the planning of TMJ surgery because they redeem each other's disadvantages.

In conclusion, we believe that arthrography of the TMJ is required for diagnosis and treatment planning in cases of SC in which the cavity is widely enlarged or there are a number of cartilaginous nodules and it is difficult to identify the affected cavities.

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