J of Nuclear Medicine Technology, first published online June 25, 2015 as doi:10.2967/jnmt.115.158691

Bone Scintigraphy SPECT/CT Evaluation of Mandibular Condylar Hyperplasia

Zhiyun Yang, Tameron Reed and Becky H Longino

Department of Radiology

Louisiana State University Health Sciences Center/University Health,

Shreveport, Louisiana.

For correspondence or reprints contact:

Zhiyun Yang, M.D.

Department of Radiology

LSU Health Sciences Center/University Health

1501 Kings Highway - P.O Box 33932

Shreveport, LA 71130 U.S.A.

zyang@lsuhsc.edu

Office (318) 675-6214

Cell (314) 922-5758

Abstract

Mandibular condylar hyperplasia (CH) is a complex deformity originating from developmental asymmetries of the hyperplastic condyle. Bone scan single photon emission computed tomography (SPECT) is a sensitive and accurate method of detecting the growth activity of this disorder. This method can be used to quantitate the radio-nuclide uptake differences between the left and right condyles. Uptake differences of 10 or more percent between the left and right condyles, with increased uptake in the CH side, are considered to be evidence of active growing CH. Quantitative assessment of CH is important in order to choose an appropriate treatment course. Degenerative arthropathies of the temporomandibular joints (TMJs) may result in altered uptake, but this mostly is associated with the contralateral side of the CH. The computed tomography (CT) modality available from SPECT/CT is useful to assess the condylar dimensions and underlying bony changes.

Introduction:

CH is a complex developmental deformity leading to asymmetries of the hyperplastic condyle. It causes facial asymmetry and malocclusion and can be associated with pain and dysfunction. Accurate assessment of condylar growth and establishing whether the disease is active or inactive provide guidance for treatment. Bone scan SPECT has demonstrated superior performance in this application compared to planar imaging through providing data leading to accurate and quantifiable assessment of the mandibular condyles' growth (1-3). The CT modality of SPECT/CT provides detailed anatomic information associated with growth activity.

Case Report:

A 40-year-old female (who gave permission to use data from her study for our submission) presented with a 20-year history of pain in the TMJs. The left side was more painful. A bone scintigraphy was ordered to evaluate growth in the left condylar hyperplasia.

A limited examination of the TMJs consisted of radionuclide angiography and immediate post-injection images with 3-hour delayed planar image collection following intravenous administration of 740 MBg (20 mCi) of ^{99m}Tc-methylene diphosphonate (MDP). Subsequent SPECT/CT was obtained using a GE-640 SPECT/CT camera.

Discussion:

The CT 3D volume reconstruction image showed the patient's chin tilted to the right (Figure 1), consistent with the presentation of the patient's facial asymmetry found in the physical exam.

The SPECT results showed increased ^{99m}Tc-MDP uptake in the mandibular condyles compared with that of the clivus. Additionally, asymmetric MDP uptake was observed, with the right increased over the left side (Figure 2, 3). Calculated uptake was 55% on the right (right condyle counts divided by the sum of right and left condyle counts) and 45% on the left side. The 10% difference observed with increased uptake in the contralateral side of the CH was indicative of inactive growth. This asymmetric ^{99m}Tc-MDP uptake was not observed in the planar images (not shown).

The low-dose CT showed that the left mandibular condyle was larger, (21.4 x 22.5 x 12.2 mm) than the right mandibular condyle (17.8 x 16.1 x 9.8 mm) in the axial, coronal and sagittal reconstruction images respectively. The TMJ spaces were narrowed with sclerosis (particularly on the right side) (Figure 5). These findings led to two conclusions: 1) the left mandibular condyle was larger with less ^{99m}Tc-MDP uptake indicating an inactive left mandibular condylar hyperplasia, and 2) the TMJs, narrowed with sclerosis had increased ^{99m}Tc-MDP uptake, indicating degenerative changes, with the right side being more advanced.

Patients with CH often present to an orthodontist with malocclusion and mandibular asymmetry (deviation of the chin to the unaffected side). CH is a self-limiting process that can cease active growth at any time, generally between the ages of 11 and 30 (4).

Bone scans can highlight areas of increased osteoblastic activity aiding in diagnosis of active or inactive CH. This can guide treatment decisions: partial condylectomy for active CH or definitive operations for inactive CH. Definitive interventions may involve osteotomies to correct any residual malocclusion or facial asymmetry. Post-surgical deformity may develop if osteotomies are carried out while CH is in an active phase (1).

Consequently, accurate assessment of the condyles' growth activity is crucial to guiding treatment options. Assessment and diagnosis may be difficult if limited to planar imaging methods. SPECT methods are more sensitive and accurate in detecting growth activity and offer a quantitative means to determine growth differences between the left and right condyles. A 10% or more difference in the radionuclide uptake between the left and right condyles with increased uptake in the CH side is considered to be evidence of active, growing CH (1-3).

Normally, the condyles are nearly symmetric and CT is a useful tool to measure and evaluate condylar dimensions (5).

Degenerative or inflammatory arthropathies of TMJs may complicate evaluation of growth activity as they have inherent increased ^{99m}Tc-MDP uptake. However, this is generally not problematic as patients present with CH when they are relatively young (1). Degenerative bony changes often occur more on the unaffected, short side and are more severe than on the affected, hyperplasia side (4). The CT modality of SPECT/CT can be used to evaluate the underlying bony changes to confirm degenerative changes and rule out other possible causes of increased uptake, such as a tumor or trauma.

Conclusion:

This case suggests that bone scan SPECT/CT provides accurate means for assessment of growth activity and detailed underlying anatomic information in a patient with CH. These are helpful not only for diagnosis but for choosing an appropriate treatment. Degenerative arthropathies of TMJs may complicate evaluation of comparative uptake, but these are more common and more severe on the contralateral side of the CH.

References

- Hodder SC, Rees JI, Oliver TB, Facey PE, Sugar AW. SPECT bone scintigraphy in the diagnosis and management of mandibular condylar hyperplasia. Br J Oral Maxillofac Surg 2000; 38: 87-93.
- Alyamani A. and Abuzinada S. Management of patients with condylar hyperplasia: A diverse experience with 18 patients. Ann Maxillofac Surg 2012; 2(1):17-23.
- Wen B, Shen Y and Wang CY. Clinical value of ⁹⁹Tc^m-MDP SPECT bone scintigraphy in the diagnosis of unilateral condylar hyperplasia. Hindawi Publishing Corporation, The Scientific World Journal 2014; http://dx.doi.org/10.1155/2014/256256
- Nah KS. Hyperplastic conditions of the mandibular condyles. Korean Journal of Oral and Maxillofacial Radiology 2003; 33: 207-9.
- Neto JV, Estrela C, Bueno MR, et al. Mandibular condyle dimensional changes in subjects from 3 to 20 years of age using Cone-Beam Computed Tomography. A preliminary study. Dental Press J Orthod 2010; 15: 172-181.

Figure 1. The CT 3D volume reconstruction image shows asymmetry of the mandible. The right mandibular ramus presents with a shorter vertical dimension compared to the left side (A). The corresponding lateral volume reconstruction views (B) further demonstrate the larger left condyle. These findings are consistent with the presentation of the patient's facial asymmetry found in the physical exam.



А



Figure 2. The same serial coronal SPECT images are displayed with measured counts shown on rows 2 and 3. The region of interest is put in each condyle using GE volumetric 3D quantification software to demonstrate the total counts of the right condyle, 3297.00 counts / per 1.8 cm³ shown on row 2 and the left condyle, 2684.00 counts / per 1.8 cm³ on row 3. Increased ^{99m}Tc-MDP uptake in the mandibular condyles is noted compared with that of the clivus.

The SPECT scan is obtained using the GE- optimal 640 hybrid camera with dual heads and a pair of low-energy, high-resolution collimators. The SPECT data were acquired from 120 projections over 360-degrees at 30s per projection on a matrix of 128 x 128. The 3D SPECT images were reconstructed on the GE Xeleris workstation with Volumtrix MI Evolution software for bone using the following parameters: 2 iterations, 10 subsets, Butterworth filter with the cutoff frequency at 0.48 and the power at 10. The slice thickness is 4.42 mm.



Figure 3. The serial axial fusion images of SPECT and CT show asymmetric uptake in the bilateral mandibular condyles with increased uptake on the right side over the left side.



Figure 4. The low-dose CT shows the left condyle (top row) is larger than the right (bottom row). The measurement of the left condyle is 21.4 X 22.5 X 12.2 mm, but the right side is 17.8 X 16.1 X 9.8 mm in the axial, coronal and sagittal reconstruction images respectively.



Figure 5. The serial low-dose CT coronal images show narrowed TMJ spaces with sclerosis that are worse on the right side.

The CT scan was obtained immediately following the SPECT scan using the 4-slice, lowdose, spiral CT system, at 120 kV and 20mA, with a pitch of 1.75. CT slices were reconstructed at 2.5 mm thickness using a standard kernel filter. The radiation dose of this low-dose CT is about 2.7mSv.

