Camurati-Engelmann disease, or progressive diaphyseal dysplasia, is an uncommon condition characterized radiographically by symmetrical diaphyseal sclerosis involving the tubular bones. The onset of the disease is usually during childhood. Most patients present with limb pain, muscular weakness, a waddling gate, and easy fatigability. Systemic manifestations—such as anaemia, leukopenia, and hepatosplenomegaly—occur occasionally. Abnormal values for several markers of bone formation and resorption have been reported in a few patients.

In differential diagnosis, Paget’s disease, infantile cortical hyperostosis, syphilitic periostitis, hypervitaminosis A, hypertrophic osteoarthropathy, and venous stasis with periostitis can all be ruled out by clinical or laboratory tests and/or radiographic distribution. Chronic sclerosing osteomyelitis can be excluded by the bilaterality of involvement.1 Diaphyseal bone infarcts of
sickle cell disease are excluded clinically. Van Buchem’s disease, a disease involving epiphyses as well as diaphyses of tubular bones with characteristic mandible involvement should be ruled out.

Bone scintigraphy shows areas of increased osteoblastic activity in the skull and diaphyseal parts of the long bones. Bone scan is useful in demonstrating disease activity diffusively to all bones.

**CASE REPORT**

A 52 year old female with CED, first seen at another institution, complaining intermittent severe bilateral leg pain, fatigue and muscle weakness was referred for Tc-99m MDP bone scintigraphy to detect the skeletal uptake localizations. She first became symptomatic when she developed mild, intermittent leg pain. Enlargement of the mandible and legs was evident at physical examination. Medical history in the past was unremarkable. Radiographs of the extremities demonstrated cortical thickening in the long bones. Bone imaging was performed three hours after intravenous administration of Tc-99m MDP (740 MBq). On whole body imaging, performed with a gamma camera (Siemens, ECAM) equipped with low energy high resolution collimator, the anterior and posterior planar views demonstrated bilaterally, symmetrical tracer uptake of the femora, lower legs, humeri and forearms, clavicles, pelvic bones, ribs, mandible, frontal, parietal and occipital bones (Figure 1a). Diffusely increased activity was present in the distal halves of the femora, the proximal halves of the tibiae, along the humeri and proximal forearms. Lesser patchy radionuclide accumulation as present in distal radii, pelvic bones, claviculas, ribs, mandible, and skull. Figure 1b shows mandible involvement. Vertebrae, hands, feet and distal lower extremity were normal. The patient is being treated symptomatically.

**DISCUSSION**

The syndrome was first described by Cockayne in 1920 and further defined by Camurati in 1922. In 1929, Engelmann reported a patient with diaphyseal sclerosis associated with abnormal gait, neurological disturbances, growth retardation and poor muscular development. The name “progressive diaphyseal dysplasia” emphasises the progressive nature of the hyperostosis and the ever present involvement of the diaphyses, but currently, the eponym Camurati-Engelmann disease is widely accepted. In 1949, Ribbing described very mild form of diaphyseal sclerosis of the femora and tibiae which was not always symmetric.

The cortical thickening of the diaphyses of the long bones is characteristic for the disorder. Hype-
rostosis is bilateral, symmetrical and usually starts at
the diaphyses of the femora and tibiae, expanding
to the fibulae, humeri, ulnae and radii. As the
disease progresses, metaphyses may become affected
as well, but the epiphyses are spared.\(^8\) Involvement
of the mandible is less common but can occur
in more severe instances as in our case.

In a review by Janssens K et al., clinical, radia-

tological, and molecular data on 24 CED families
were collected.\(^9\) This review was based on the un-
published and detailed clinical, radiological, and
molecular findings in 14 CED families, comprising
41 patients, combined with data from 10 other pre-
viously reported CED families. For all 100 cases,
molecular evidence for CED was available, as a mu-
tation was detected in TGF\(_B1\), the gene encoding
transforming growth factor (TGF) \(_B1\). Pain in the
extremities was the most common clinical symp-
tom, present in 68% of the patients. A waddling ga-
it (48%), fatigue (44%), and muscle weakness (39%)
were other important features. Radiological symp-
toms were not fully penetrant, with 94% of the pa-
tients showing the typical long bone involvement.
A large percentage of the patients also showed in-
volve ment of the skull (54%) and pelvis (63%).
Scintigraphy detected increased osteoblastic ac-
tivity in the affected regions (limbs, pelvis, skull, spi-
ne) in 74% of the investigated patients (17/22). As
increased tracer uptake can be perceived even be-
fore sclerosis becomes radiologically visible, scin-
tigraphy is a valuable technique for diagnosing
CED in an early stage of disease.

Bone sintergrams and radiographs display diffe-
rent aspects of skeletal function. Radiography is pri-
marily an anatomic study reflecting structural change
that has occurred or is occurring; it cannot
accurately indicate duration or intensity of disease
activity. By comparison, skeletal scintigraphy is pri-
marily a physiological test that reflects alterations
in bone blood flow and/or mineral metabolism. In a
report by Kumar B et al., the authors claimed that
bone scintigraphy, however, is not specific for any
disease process. Therefore, the combination of ra-
diography with radionuclide bone imaging permits
a survey of disease distribution and activity that

could not be accomplished by either study alone.
Regions that are radiographically and scintigraphically
normal are, indeed, normal. Similarly, where both
imaging techniques show focal abnormalities, a dis-
ease process is likely. There are, however, two other
important combinations. First, a positive radiograph
and normal scintigram appear to indicate a quies-
cent or “mature” lesion. Second, a normal radiog-
raph coupled with a positive scintigram probably
indicates an early lesion, or one with activity insuf-
ficient to affect a structural change that is radiog-
raphically apparent.\(^10\) In another report by Shier C
et al., their cases of Ribbing’s disease illustrated the
advantage of isotope bone scanning in assessing the
degree of activity and distribution of the disease.\(^1\)

In this case report, a rare case of Camurati-
Engelmann Disease with a rare mandible involve-
ment was reported. Bone scintigraphy with
Tc-99m Methylene diphosphonate (MDP) was ef-
effective for evaluating disease activity and uptake
localizations.

**REFERENCES**

1. Shier CK, Krasicky GA, Ellis Bl, Kottamasu
SR. Ribbing’s Disease: Radiographic Scinti-
graphic Correlation and Comparative Analysis
with Engelmann’s Disease. J Nucl Med
1987;28:244-6.

2. Van Buchem ES, Hadders HN, Ubbens R. An
uncommon familial systemic disease of the
skeloton: hyperostosis corticalis generalisata

3. Cockayne EA. Casefor diagnosis. Proc Roy

4. Camurati M. Di un raro caso di osteite sim-
metrica ereditaria degli arti inferiori. Chir Or-
gani 1922; 6:662-5.

5. Engelmann O. Em fall von osteopathia hyper-
ostotica (sclerotisans) multiplex infantilis.
Fortschr Roent gensir 1929;39:1101-6.

6. Neuhauser EB, Schwachman H, Wittenborg
M, Cohen J. Progressive diaphyseal dyspla-

7. Ribbing S. Hereditary, multiple, diaphyseal

8. Sparkes RS, Graham CB. Camurati-Engel-
mann disease. Genetics and clinical manifes-
tations with a review of the literature. J Med

9. K Janssens, F Vanhoenacker, M Bonduelle, L
Verbruggen, L Van Maldergem, S Ralston, et
al. Camurati-Engelmann disease: review of
the clinical, radiological, and molecular data of
24 families and implications for diagnosis and


10. Kumar B, Murphy WA, Whyte MP. Progress-
ive Diaphyseal Dysplasia (Engelmann Dis-
 ease): Scintigraphic Radiographic-Clinical