

# **Diagnostic Criteria for Endemic Osteofluorosis**

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## **Preface**

According to the General Administration of Quality Supervision, Inspection, and Quarantine: National Standards Committee Proclamation (2005, No. 146), GB 16396-1996 "Clinical Diagnosis and Classification of Endemic Osteofluorosis" shall be repealed as of the date of implementation of these Criteria.

These Criteria combine GB 16396-1996 "Clinical Diagnosis and Classification of Endemic Osteofluorosis" and WS 192-1999 "X-ray Diagnosis of Osteofluorosis" into a single standard. WS 192-1999 "X-ray Diagnosis of Osteofluorosis" shall be repealed as of the date of implementation of these Criteria.

The major changes included in these Criteria relative to GB 16396-1996 "Clinical Diagnosis and Classification of Endemic Osteofluorosis" and WS 192-1999 "X-ray Diagnosis of Osteofluorosis" are as follows:

The name is changed to "Diagnostic Criteria for Endemic Osteofluorosis"

Joint pain and body motion dysfunction which affect patients ability to work and live normally have been included as diagnostic and classificatory criteria

Clinical manifestations (symptoms, signs) of osteofluorosis are listed

X-ray manifestations of osteofluorosis are also listed, including diagnostic and classificatory criteria

An emphasis is placed on the fact that clinical symptoms, clinical signs as well as bone and joint x-ray changes may all be used for diagnosis and classification. When there is a conflict between clinical diagnosis or classification and x-ray diagnosis or classification, the x-ray results shall be taken as the standard

Simplified the 3a, 3b, 3c, and 3d subclassification of the level 3 classification in GB 16396-1996 "Clinical Diagnosis and Classification of Endemic Osteofluorosis"; all are now classified as "severe"

Changed "increase in bone mass" to osteosclerosis, changed "decrease in bone mass" to osteoporosis or osteomalacia

Added differential diagnosis material

These Criteria includes informative annexes A and B.

These Criteria have been proposed by the Endemic Disease Standards Expert Committee of the Ministry of Health.

These Criteria have been approved by the Ministry of Health of the People's Republic of China.

These Criteria were drafted at the No. 1 Endemic Disease Prevention and Treatment Research Institute, the Endemic Disease Control Center of the Chinese Disease Prevention and Control Center, the Disease Prevention and Control Center of Guizhou Province, and the Disease Prevention and Control Center of Hunan Province.

These Criteria were primarily drafted by Huang Changqing, Liu Yunqi, Zhao Xinhua, Li Dasheng, Guo Xianchi.

The publication information for the Criteria replaced by these Criteria is: WS 192-1999.

## 1. Scope

These Criteria prescribes principles for the clinical and x-ray diagnosis and classification of endemic osteofluorosis

These Criteria shall be applied to the clinical and x-ray diagnosis and classification of endemic osteofluorosis, the surveying and monitoring of the disease, and the evaluation of prevention and treatment.

## 2. Terminology and Definitions

The following terms and definitions are used in these Criteria

### 2.1 Endemic osteofluorosis

A chronic metabolic bone disease which affects those living in areas with endemic fluoride poisoning, whose cause is the excess intake of fluoride, and whose major signs and symptoms include pain in the joints of the neck, back, and four limbs, dysfunction in body movement, and abnormalities in bone and joint x-rays

### 2.2 Major joints of the limbs

Shoulder, elbow, wrist, pelvis, knee, and ankle joints

### 2.3 Resting pain

Joints in pain even when not under stress or otherwise active

## 3. Basis of Diagnosis

### 3.1 Epidemiological Patient History

Born and resides in area with endemic fluoride poisoning, or has moved to live such an area, at least a year of exposure

### 3.2 Clinical Presentation

#### 3.2.1 Bone and Joint Pain Symptoms

Major joints of the four limbs, the neck, and the lower back manifest persistent resting pain, changes in the season or weather have no effect on the condition, may be accompanied by twitching or numbness of the limbs and morning stiffness of the joints.

#### 3.2.2 Limb Malformation and Movement Dysfunction Signs

- a) Limited neck movement: flexion, extension, and rotation limited.
- b) Limited upper limb movement: with elbow bent, the middle finger cannot touch the corresponding shoulder; reaching behind the head, the middle finger cannot touch the auricle of the opposite ear; reaching behind the back, the middle finger cannot touch the opposite shoulder blade; the arm cannot be raised to 180 degrees.
- c) Limited lower back movement: flexion, extension, and rotation limited, malformation of the spinal column.
- d) Limited lower limb movement: legs cannot be fully extended, difficulty squatting, genu varum or valgum, decreased walking speed, paralysis.

### 3.3 Bone and Joint X-ray Presentation

Osteosclerosis, osteoporosis, osteomalacia, bone turnover, ossification of the periosteum, or articular degeneration may occur. For the various X-ray signs, see annex A.

## 4. Principle of Diagnosis

Diagnosis should be based on the epidemiological patient history, clinical signs and symptoms and/or bone and joint x-ray changes. Where there is inconsistency between the clinical and x-ray diagnosis, the x-ray diagnosis shall have priority.

## 5. Criteria for Diagnosis and Classification

### 5.1 Clinical Diagnosis and Classification

#### 5.1.1 Light

Major joints of the four limbs, the neck, and the lower back manifest persistent resting pain (3 or more locations), changes in the season or weather have no effect on the condition, may be accompanied by twitching or numbness of the limbs and morning stiffness of the joints, stiffness of the lower back. Other symptoms not present.

#### 5.1.2 Moderate

In addition to the above pain symptoms, includes movement dysfunction of the joints of the neck, back, upper limbs, and lower limbs. Ability to work and live normally is diminished.

#### 5.1.3 Severe

Includes bone and joint pain symptoms, severe movement dysfunction of the joints of the neck, back, upper limbs, and lower limbs, limb malformation, clearly diminished or loss of ability to work and live normally, paralysis.

### 5.2 X-ray Diagnosis and Classification

#### 5.2.1 Light

Those patients with any of the following signs may be classified as light:

- a) Abnormal trabecular structure, manifesting as gravel or grain-like bone structure; osteopoikilosis.

- b) Trabeculae thin or sparse, disorganized or indistinct structure, or sclerosis of the metaphysis with light ossification of the periosteum of the forearm or crus.
- c) The radius has an enlarged crest, sclerosis of the borders, rough surfaces
- d) Calcification of the interosseous membrane of the forearm or crus forms small “sprouting” protrusions

#### 5.2.2 Moderate

Those patients with any of the following signs may be classified as moderate:

- a) Obvious abnormal trabecular structure manifesting as dense, fine, coarse, or partially fused trabeculae.
- b) Generalized bone rarefaction and ossification of the interosseous membrane of the forearm or crus.
- c) Clear disorder or indistinctness in the trabecular structure of the metaphysis of the four limbs, softening of the cortical bone at the attachment site of the pronator teres.
- d) Clear ossification at the attachment sites of muscles and ligaments of the pelvis, or the interosseous membrane of the forearm or crus.

#### 5.2.3 Severe

Those patients with any of the following signs may be classified as severe:

- a) Wide-spread fusing of trabeculae, “ivory” osteosclerosis
- b) Clear osteoporosis or osteomalacia with ossification of the interosseous membrane of the forearm or crus
- c) Ragged trabeculae, focculent bone structure, softening of the cortical bone, increased bone density with deformities
- d) Severe degeneration or deformity of multiple joints, clear ossification of the periosteum.

For signs and classification of endemic osteofluorosis x-rays, consult Annex A

## 6. Requirements for bone and joint x-ray examinations

- 6.1 For a general survey, anteroposterior x-rays of the forearm (including the elbow) should be taken.
- 6.2 For disease detection or epidemiological investigations, anteroposterior x-rays of the forearm (including the elbow) and crus (including the knee) should be taken.
- 6.3 For treatment or appraisal of the effectiveness of preventative measures, anteroposterior x-rays of the forearm (including the elbow) and crus (including the knee) as well as the pelvis should be taken.

7. Differential diagnosis

Osteoarthritis, acute rheumatic arthritis, ankylosing spondylitis, and rheumatoid arthritis have x-ray or clinical presentations which are similar to endemic osteofluorosis, therefore differentiation is required; see Annex B.

**Annex A  
(Informative Annex)**

**Endemic osteofluorosis x-ray signs and classification**

<b>Table A. 1 Endemic osteofluorosis x-ray signs and classification</b>			
<b>X-ray Sign</b>	<b>Light</b>	<b>Moderate</b>	<b>Severe</b>
Osteoclerosis	<ul style="list-style-type: none"> <li>a) gravel-like bone structure</li> <li>b) grain-like bone structure</li> <li>c) osteopoikilosis</li> </ul>	<ul style="list-style-type: none"> <li>a) dense trabeculae</li> <li>b) fine trabeculae</li> <li>c) coarse trabeculae</li> <li>d) partially fused trabeculae</li> <li>e) thickened bone</li> </ul>	<ul style="list-style-type: none"> <li>a) wide-spread fusing of dense trabeculae</li> <li>b) wide-spread fusing of fine trabeculae</li> <li>c) very thick, sparse trabeculae</li> <li>d) scale-like trabeculae in the hip bone</li> <li>e) net-like trabeculae</li> <li>f) "ivory" osteosclerosis</li> </ul>
Osteoporosis and Osteomalcia	Trabeculae thin or sparse, or indistinct	Generalized bone rarefaction and ossification of the interosseous membrane of the forearm or crus	<ul style="list-style-type: none"> <li>a) epiphyseal loosening</li> <li>b) frayed "paint brush" metaphysis</li> <li>c) "double-frame" vertebral body</li> <li>d) Looser's zones</li> <li>e) sclerosis and double concavity of vertebral body</li> <li>f) cyrtosis of the spine or limbs</li> </ul>
Mixed changes (bone turnover)	Sclerosis of the metaphysis	<ul style="list-style-type: none"> <li>a) clear disorder or indistinctness in the trabecular structure of the metaphysis of the four limbs</li> <li>b) softening of the cortical bone at the attachment site of the pronator teres.</li> </ul>	<ul style="list-style-type: none"> <li>a) softening of the cortical bone</li> <li>b) even sclerosis of the spongy bone</li> <li>c) focculent bone structure</li> <li>d) ragged trabeculae</li> <li>e) increased bone density with deformities</li> </ul>
Changes to periosteum and joints	<ul style="list-style-type: none"> <li>a) radius has an enlarged crest, sclerosis of the borders, rough surfaces</li> <li>b) calcification of the interosseous membrane of the forearm or crus forms small "sprouting" protrusions</li> </ul>	<ul style="list-style-type: none"> <li>a) ossification of the periosteum of the forearm, crus, or pelvis</li> <li>b) ossification of the common extensor tendon</li> </ul>	<ul style="list-style-type: none"> <li>a) clear ossification of the periosteum of the forearm, crus, and pelvis</li> <li>b) clear ossification of the common extensor tendon</li> <li>c) severe degeneration or deformity of multiple joints</li> </ul>

## **Annex B (Informative Annex)**

### **Differential Diagnosis of Endemic Osteofluorosis**

#### **B.1 Osteoarthritis**

Also known as joint disease, osteoarthritis consists of degeneration of the articular cartilage, and is most common above the age of 50. It generally involves the distal interphalangeal joints and weight-bearing joints (knee, hip). Major symptoms include articular pain which increases with activity or weight-bearing, and improves with rest. Common signs include joint swelling, pain when touched, pop or scraping sounds when active. X-ray examination reveals narrowing joint space, hardening of the articular surface, formation of osteophytes at joint margins, loose bodies in joint cavity, etc.

With endemic osteofluorosis, there is history of residence in an endemic area, persistent resting pain in multiple joints accompanied with limb twitching, numbness, and morning stiffness. There is often movement dysfunction in multiple joints including the neck, shoulder, elbow, lower back, hip, and hand. X-rays reveal signs of fluorosis of the bone and periosteum.

#### **B.2 Acute Rheumatic Arthritis**

This disease often occurs in young adults, there is generally a history of prior respiratory tract infection. Multiple joints are affected, with redness, swelling, heat, pain, pressure, and restricted movement; symptoms are present symmetrically, and migrate throughout the body. There is a clear connection to changes in weather, and no permanent deformities after the acute period runs its course. It is often accompanied by carditis, and elevated levels of antistreptolysin O. An X-ray examination reveals no abnormalities.

Endemic osteofluorosis is a slow developing disease, with no acute period. Articular pain is not accompanied by redness, swelling, heat, or pressure; the location of pain is stable, and there is no connection to changes in weather. X-rays of the bones and joints may reveal signs of osteofluorosis.

#### **B.3 Ankylosing Spondylitis**

Ankylosing Spondylitis is a chronic nonspecific inflammatory disease with no obvious cause, resulting in progressive spinal rigidity. The disease generally presents between 15 and 30, and very rarely after 40. It primarily affects the sacroiliac joints and may progress up the spinal column, often leading to bony ankylosis. In its early stages there is a dull pain of the lower back which is difficult to locate exactly and, when severe, difficult to tolerate; it is accompanied by stiffness in the same area. The pain is worse in the morning, and in wet, humid weather. In the late stages, the hip joint shows flexion contracture, a fixed gait is characteristic. An x-ray examination reveals the sacroiliac joints as the initial onset location, in the early stages the margin of the subchondral bone is blurred, with damage that appears like insect bites, and localized, corrosive sclerosis; as the disease develops, the joint space narrows and the sacroiliac joints fuse (bony ankylosis). When the disease progresses to the spinal column, it presents as wide-spread osteoporosis of the vertebrae, with the joint space of the zygapophysial joint blurring and narrowing, vertebrae becoming square in shape. In the late stages, there is calcification (ossification) of the intervertebral disk and the surrounding ligaments, forming a "bamboo" spine.

The onset of endemic osteofluorosis generally occurs after the age of 30, and does not have the characteristic progression described above. The clinical presentation involves pain and movement dysfunction of multiple joints, fibrous ankylosis is characteristic. An x-ray examination reveals osteoporosis, abnormal bone density, and ossification of the periosteum of the interosseous membrane of the forearm, wrist, etc.

#### **B.4 Rheumatoid Arthritis**

Rheumatoid Arthritis is a multisystem autoimmune disease, mostly affecting the joints of the finger and palm, often symmetrically. It presents clinically as articular pain, stiffness, heat on the surrounding skin, gradual swelling, enlarged joints, and reduced function. Stiffness is particularly pronounced in the morning, often persisting for more than an hour. There is swelling of the joint fusiform which results in joint deformity and morning stiffness as a particularly clear, characteristic presentation. X-ray examinations in the early stages of the disease reveal swelling of the soft tissue around the joint, rarefaction of the articular epiphysis, cystic changes under the articular cartilage or corrosion of the joint margin are sometimes visible. As the disease progresses, there are deformities such as clear cystic damage under the cartilage, narrowing of the joint space, corrosive damage of the bony joints, muscle atrophy, and joint subluxation. In the late stages, fibrosis and bony ankylosis may appear.

Endemic osteofluorosis presents with pain and dysfunction of multiple joints throughout the body, there is no redness or swelling of the joints, though there is occasionally brief morning stiffness, commonly accompanied by twitching and numbness. X-ray examination reveals osteosclerosis, osteoporosis, or osteomalacia of the pelvis and other locations, and ossification of the periosteum in the limbs.