



The Mycetoma Research Center,  
University of Khartoum  
WHO Collaborating Center  
on Mycetoma & Skin NTDs

## **Standard Operating Procedures for Mycetoma Imaging Diagnosis**



MYCETOMA

MYCETOMA  
RESEARCH CENTRE

UNIVERSITY OF MALAYA

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## **Standard Operating Procedures for Conventional X-ray Examination for Mycetoma Diagnosis**

### **Introduction**

This Standard Operating Procedure (SOP) outlines the steps for performing a conventional X-ray examination for the diagnosis of mycetoma. Mycetoma is a chronic granulomatous infection that affects the skin, subcutaneous tissue, and bone. X-ray imaging is an important diagnostic tool for assessing the extent of soft tissue and bone involvement and planning appropriate treatment.

### **Purpose**

- To provide a consistent, safe, and effective method for performing X-ray examinations of mycetoma lesions.

### **Scope**

- This SOP applies to all healthcare professionals involved in the X-ray examination of patients with suspected or confirmed mycetoma lesions.

## **Responsibilities**

### **Radiologist/Physician**

- Interprets the X-ray images and provides diagnostic insights.

### **Radiologic Technologist**

- Performs the X-ray examination.

### **Nurse/Assistant**

- Assists with patient preparation and care.

### **Infection Control Officer**

- Ensures adherence to infection control protocols.

## **Equipment and Materials**

- X-ray machine with appropriate settings for soft tissue and bone imaging
- Lead aprons and thyroid shields for patient protection
- Lead gloves and aprons for healthcare personnel
- Patient identification and consent forms
- Radiographic film or digital imaging system
- X-ray contrast media (if needed)
- Sterile dressing materials (if required for wound protection)

## **Procedure**

### **Pre-Procedure Preparation**

#### Patient Identification and Consent

- Verify patient identity using at least two identifiers (e.g., name and date of birth).
- Explain the procedure, including risks and benefits, to the patient and obtain informed consent.

### **Patient Preparation**

- Position the patient comfortably on the X-ray table, ensuring the area of interest (affected limb or site) is easily accessible and properly exposed.

### **Site Preparation**

- Remove any clothing, jewellery, or other objects that may interfere with the imaging.
- Cover any open wounds with sterile dressing to prevent contamination and ensure clear imaging.

### **Equipment Preparation**

#### **X-ray Machine Setup**

- Turn on the X-ray machine and select the appropriate settings for the examination (e.g., kVp, mA).
- Ensure the machine is functioning correctly and calibrated according to the manufacturer's specifications.

## **X-ray Examination**

### **Positioning**

- Position the patient according to the standard views required for mycetoma diagnosis (e.g., anteroposterior [AP], lateral, and oblique views).
- Ensure the affected area is centered in the X-ray beam.

### **Image Acquisition**

- Take the required X-ray images, ensuring proper alignment and exposure.
- Check the images for clarity and diagnostic quality before concluding the procedure.

### **Repeat Imaging (if necessary)**

- If the initial images are not satisfactory, reposition the patient and retake the images as needed.

## **Post-Examination Procedures**

### **Patient Care**

- Assist the patient in getting off the X-ray table and ensure their comfort.
- Provide the patient with any necessary post-examination instructions.

### **Image Handling**

- Develop the radiographic film or process the digital images.
- Ensure all images are correctly labelled with patient details and the date of the examination.

## **Documentation**

- Document the procedure in the patient's medical record, including details of the X-ray views taken and any observations during the procedure.

## **Follow-Up**

### **Image Review**

- The radiologist or physician should review the X-ray images and provide a detailed report on the findings.
- Discuss the results with the patient and plan further diagnostic or therapeutic steps based on the findings.

## **Quality Control and Safety**

- Ensure regular maintenance and calibration of the X-ray equipment.
- Adhere to radiation safety protocols to minimise exposure to both patients and healthcare personnel.
- Maintain up-to-date knowledge on best practices and guidelines for X-ray imaging in mycetoma diagnosis.

## References

- Bahar ME, Bakheet OELH, Fahal AH. Mycetoma imaging: the best practice. *Trans R Soc Trop Med Hyg.* 2021 Apr 14;115(4):387396-. doi: 10.1093/trstmh/traa178. PMID: 33537774.
- Abd El-Bagi ME, Fahal AH. Mycetoma revisited. Incidence of various radiographic signs. *Saudi Med J.* 2009 Apr;30(4):52933-. PMID: 19370281.
- Abd Bagi ME, Fahal AH, Sheik HE, Abdul Wahab O, Taifoor MK, Osmanr EM. Pathological fractures in mycetoma. *Trans R Soc Trop Med Hyg.* 2003 Sep-Oct;97(5):5824-. doi: 10.1016/s0035-6-80036(03)9203. PMID: 15307432.
- Institutional protocols for X-ray examinations and radiation safety.
- Manufacturer's instructions for X-ray equipment and accessories.



## Examples of X-Ray appearance of mycetoma



Anterior-posterior view of the right hand showing massive soft tissue mass, a big cavity in the fourth metacarpal bone with periosteal reaction in line with eumycetoma.



Anterior-posterior view of the right foot showing massive soft tissue mass, numerous multiple small cavities affecting most of the foot bones with massive periosteal reaction in line with actinomycetoma.

### Approval

This Standard Operating Procedure has been prepared, reviewed and approved by:

Dr Mustafa EL Nour Bahar	Consultant Radiologist	<b>Mustafabahar</b>
Dr ELrayah Mustafa	Senior Consulgtant Radiologist	<i>ELrayah</i>
Prof Ahmed Fahal	Center Director	<i>Fahal</i>

On May 3, 2022.



**umber: 002/IMG/MRC/2022**

**Date: May 03 2022**

## **Standard Operating Procedures for Magnetic Resonance Imaging (MRI) Examination for Mycetoma Diagnosis**

### **Introduction**

This Standard Operating Procedure (SOP) outlines the steps for performing a Magnetic Resonance Imaging (MRI) examination for the diagnosis of mycetoma. Mycetoma is a chronic granulomatous infection affecting skin, subcutaneous tissue, and bone. MRI is a crucial diagnostic tool for evaluating the extent of soft tissue and bone involvement, providing detailed images that aid in accurate diagnosis and treatment planning.

### **Purpose**

- To provide a consistent, safe, and effective method for performing MRI examinations of mycetoma lesions.

## **Scope**

- This SOP applies to all healthcare professionals involved in the MRI examination of patients with suspected or confirmed mycetoma lesions.

## **Responsibilities**

### **Radiologist**

- Interprets the MRI images and provides diagnostic insights.

### **MRI Technologist**

- Performs the MRI examination.

### **Nurse/Assistant**

- Assists with patient preparation and care.

### **Infection Control Officer**

- Ensures adherence to infection control protocols.

## **Equipment and Materials**

- MRI scanner with appropriate software for imaging soft tissue and bone
- MRI-compatible patient table and positioning aids
- Contrast media (e.g., gadolinium-based agents) if needed

- Ear protection for the patient
- Patient identification and consent forms
- Sterile dressing materials (if required for wound protection)
- Emergency resuscitation equipment (e.g., defibrillator, oxygen supply)

## **Procedure**

### **Pre-Procedure Preparation**

#### **Patient Identification and Consent**

- Verify patient identity using at least two identifiers (e.g., name and date of birth).
- Explain the procedure, including risks and benefits, to the patient and obtain informed consent.
- Screen the patient for any contraindications to MRI (e.g., presence of metallic implants, pacemakers, or claustrophobia).

#### **Patient Preparation**

- Ensure the patient removes all metallic objects and jewellery.
- Provide the patient with MRI-compatible clothing if necessary.
- Position the patient comfortably on the MRI table, ensuring the area of interest (affected limb or site) is properly aligned with the MRI coil.

#### **Site Preparation**

- Cover any open wounds with sterile dressing to prevent contamination and ensure clear imaging.
- Provide ear protection to the patient to reduce discomfort from the noise of the MRI machine.

## **Equipment Preparation**

### **MRI Machine Setup**

- Turn on the MRI scanner and select the appropriate settings for the examination (e.g., sequences for soft tissue and bone imaging).
- Ensure the machine is functioning correctly and calibrated according to the manufacturer's specifications.

## **MRI Examination**

### **Patient Positioning**

- Position the patient according to the standard protocols for mycetoma diagnosis, ensuring the lesion is centered in the MRI coil.
- Use positioning aids as necessary to maintain patient comfort and immobility during the scan.

### **Initial Scanning**

- Acquire initial scout images to confirm the correct positioning of the area of interest.
- Adjust patient positioning if necessary based on the scout images.

### **Image Acquisition**

- Perform the MRI scan using the appropriate sequences (e.g., T1-weighted, T2-weighted, STIR, and post-contrast sequences if contrast is used).
- Monitor the patient throughout the procedure to ensure they remain still and comfortable.

### **Use of Contrast Media**

- If contrast media is required, explain the process and potential side effects to the patient.
- Administer the contrast media intravenously according to the prescribed dosage.
- Acquire post-contrast images to enhance visualisation of the lesion and surrounding tissues.

### **Post-Examination Procedures**

#### **Patient Care**

- Assist the patient in getting off the MRI table and ensure their comfort.
- Provide the patient with any necessary post-examination instructions.

#### **Image Handling**

- Review the images for clarity and diagnostic quality before concluding the procedure.
- Ensure all images are correctly labelled with patient details and the date of the examination.

#### **Documentation**

- Document the procedure in the patient's medical record, including details of the MRI sequences used and any observations during the procedure.

#### **Follow-Up**

##### **Image Review**

- The radiologist should review the MRI images and provide a detailed report on the findings.
- Discuss the results with the patient and plan further diagnostic or therapeutic steps based on the findings.



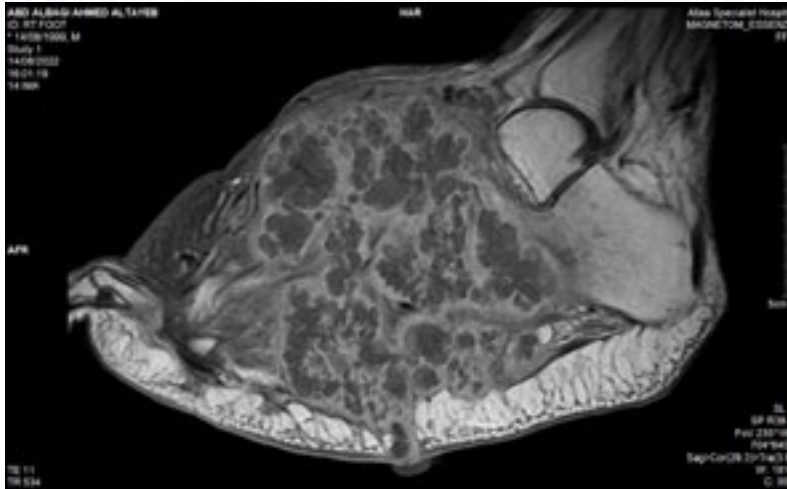
## **Quality Control and Safety**

- Ensure regular maintenance and calibration of the MRI equipment.
- Adhere to MRI safety protocols to prevent any adverse events.
- Maintain up-to-date knowledge on best practices and guidelines for MRI imaging in mycetoma diagnosis.

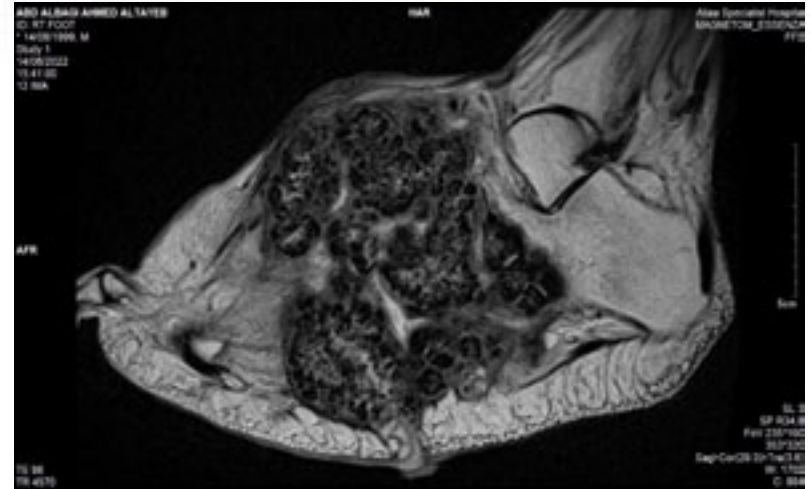
## **References**

- Bahar ME, Bakheet OELH, Fahal AH. Mycetoma imaging: the best practice. *Trans R Soc Trop Med Hyg.* 2021 Apr 14;115(4):387396-. doi: 10.1093/trstmh/traa178. PMID: 33537774.
- El Shamy ME, Fahal AH, Shakir MY, Homeida MM. New MRI grading system for the diagnosis and management of mycetoma. *Trans R Soc Trop Med Hyg.* 2012 Dec;106(12):73842-. doi: 10.1016/j.trstmh.2012.08.009. Epub 2012 Sep 14. PMID: 22981317.
- Clinical guidelines on the imaging of mycetoma.
- Institutional protocols for MRI examinations and patient safety.
- Manufacturer's instructions for MRI equipment and accessories.

## Examples of mycetoma lesion MRI examination



MRI of the foot showing multiple cavities filled with granulomatous tissues affecting the bones, subcutaneous and sole.



MRI of the foot showing multiple cavities filled with granulomatous tissues affecting the bones, subcutaneous and sole with 'dot in circle' sign (arrows).

### Approval

This Standard Operating Procedure has been prepared, reviewed and approved by:

Dr Mustafa EL Nour Bahar	Consultant Radiologist	Mustafabahar
Dr ELrayah Mustafa	Senior Consulgtant Radiologist	<i>ELrayah</i>
Prof Ahmed Fahal	Center Director	<i>Fahal</i>

On May 3, 2022.



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## **Standard Operating Procedures for Ultrasound Examination of Mycetoma Lesions**

### **Introduction**

This Standard Operating Procedure (SOP) outlines the process for conducting ultrasound examinations of mycetoma lesions. Mycetoma is a chronic granulomatous infection of the skin and subcutaneous tissues, often caused by either fungi (eumycetoma) or bacteria (actinomycetoma). Accurate ultrasound examination is essential for diagnosing, monitoring, and guiding the treatment of mycetoma.

### **Purpose**

To ensure consistent, accurate, and safe ultrasound examination of mycetoma lesions.

## **Scope**

This SOP applies to all healthcare professionals who perform ultrasound examinations on patients with suspected or confirmed mycetoma lesions.

## **Responsibilities**

### **• Sonographer/Technician**

Conducts ultrasound examinations and ensures that images are of high quality.

### **• Radiologist/Physician**

Interprets the ultrasound images and provides diagnostic insights.

### **• Nurse/Assistant**

Prepares the patient and assists the sonographer as needed.

## **Equipment**

- High-frequency linear ultrasound probe (7-15 MHz)
- Ultrasound machine with appropriate settings for soft tissue imaging
- Ultrasound gel
- Personal protective equipment (PPE) for the healthcare provider (gloves, gown, mask)
- Cleaning supplies for disinfection of equipment

## **Procedure**

### **Patient Preparation**

#### **Identification and Consent**

- Verify patient identity using at least two identifiers (e.g., name and date of birth).
- Explain the procedure to the patient and obtain informed consent.

#### **Positioning**

- Position the patient comfortably, ensuring easy access to the lesion.
- The area to be examined should be exposed and properly draped for privacy.

### **Equipment Preparation**

#### **Ultrasound Machine Setup**

- Turn on the ultrasound machine and select the appropriate preset for soft tissue examination.
- Ensure the linear probe is connected and functioning correctly.
- Apply a liberal amount of ultrasound gel to the probe.

### **Examination Technique**

#### **Initial Survey**

- Perform a quick survey of the affected area to locate the lesion and identify its extent.
- Note any visible or palpable abnormalities.

### **Detailed Examination**

- Adjust the depth, gain, and focus settings on the ultrasound machine for optimal image quality.
- Use a systematic scanning approach to evaluate the lesion in multiple planes (longitudinal, transverse, and oblique).

### **Identify and document the following characteristics:**

- Size and shape of the lesion
- Internal echotexture (homogeneous, heterogeneous)
- Presence of hypoechoic (fluid-filled) or hyperechoic (solid) areas
- Margins of the lesion (well-defined or ill-defined)
- Any evidence of sinuses or fistulous tracts
- Involvement of underlying structures (muscles, bones)

### **Dynamic Assessment**

- Assess the lesion's vascularity using Doppler imaging to determine the presence of increased blood flow, which may indicate active infection or inflammation.

### **Documentation**

#### **Image Capture**

- Save representative images of the lesion in different planes and with different settings (e.g., gray scale, Doppler).
- Ensure images are labelled with patient details and the date of the examination.



## **Report Preparation**

### **Prepare a detailed report including:**

- Patient information
- Description of the lesion (size, location, and characteristics)
- Findings from the dynamic assessment
- Any pertinent observations or recommendations

## **Post-Examination Procedures**

### **Patient Care**

- Clean the ultrasound gel from the patient's skin.
- Provide the patient with any necessary post-examination instructions.

### **Equipment Care**

- Clean and disinfect the ultrasound probe and machine according to the manufacturer's guidelines and infection control protocols.
- Dispose of any disposable items (gloves, gown) appropriately.

## **Follow-Up**

### **Review and Discussion**

- Discuss the findings with the treating physician or radiologist.
- Plan any additional imaging or interventions based on the results.

## Quality Control and Safety

- Ensure regular maintenance and calibration of ultrasound equipment.
- Adhere to infection control practices to prevent cross-contamination.
- Participate in continuous education and training programmes to stay updated on best practices in ultrasound imaging.

## References

- Fahal AH, Sheik HE, Homeida MM, Arabi YE, Mahgoub ES. Ultrasonographic imaging of mycetoma. *Br J Surg.* 1997; 84: 1120–1122
- Bahar ME, Bakheet OELH, Fahal AH. Mycetoma imaging: the best practice. *Trans R Soc Trop Med Hyg.* 2021 Apr 14;115(4):387396-. doi: 10.1093/trstmh/traa178. PMID: 33537774.
- Siddig EE, El Had Bakhait O, El Nour Hussein Bahar M, Siddig Ahmed E, Bakhiet SM, Motasim Ali M, Babekir Abdallah O, Ahmed Hassan R, Verbon A, van de Sande WWJ, Fahal AH. Ultrasound-guided fine-needle aspiration cytology significantly improved mycetoma diagnosis. *J Eur Acad Dermatol Venereol.* 2022 Oct;36(10):18451850-. doi: 10.1111/jdv.18363. Epub 2022 Jul 6. PMID: 35748131; PMCID: PMC9543342.
- Clinical guidelines on ultrasound imaging of soft tissue infections.
- Manufacturer's manual for the ultrasound machine and probes.
- Institutional protocols for infection control and patient care.

Mycetoma ultrasound examination video film : <https://www.youtube.com/watch?v=KyJVneVudj4>

## Example of mycetoma lesion ultrasound examination



Ultrasound examination of actinomycetoma lesion showing multiple cavities with a thick capsule and multiple hyperreflective echos in line with grains.



Ultrasound of left knee eumycetoma lesion showing multiple cavities with a thick capsule and multiple hyperreflective echos in line with grains.

### Approval

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