

Peer Reviewed Case Report

ORBITAL FOREIGN BODY DETECTED DURING ROUTINE SCREENING FOR MAGNETIC RESONANCE IMAGING (MRI) EXAMINATIONS: A CASE REPORT TO UNDERSCORE SAFETY PROTOCOLS AND ALSO THE NEED FOR ROLE EXTENSION OF RADIOGRAPHERS IN ZAMBIA

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<https://doi.org/10.54450/saradio.2023.61.2.757>

Abstract

Magnetic resonance imaging (MRI) is a valuable imaging modality for the diagnosis and planning of treatment of diseases and injuries. Although MRI does not use ionising radiation, the examination has safety concerns due to the strong magnetic field that can attract metallic materials from individuals entering the MRI imaging room. It is important to screen patients for possible metallic materials that can be found outside and inside the body before an examination. This is done through the administration of the MRI safety questionnaire to patients. For patients suspected of a metallic intra-orbital foreign body (IOFB), orbital projections are required as part of the screening process. Subjecting a patient with an IOFB to MRI examination is risky; the magnetic field can cause the metal fragment to move which causes injury to soft tissue (even causes blindness). We report an IOFB detected during a routine MRI safety screening of a metalwork teacher referred for a brain scan. This case also highlights the importance of undertaking two occipital-mental (Waters) projections with an upward and then downward gaze. We underscore the need for role extension for radiographers that includes interpretation and reporting on radiographic images to fill the gap created due to the critical shortage of radiologists in the country.

Keywords. magnetic resonance imaging safety protocols, waters projections, role extension for radiographers

INTRODUCTION

Magnetic resonance imaging (MRI) imaging services have been available since 2010 in Zambia. Ehrlich and Coakes^[1] define MRI as a non-invasive imaging technique that uses a magnetic field and computer-generated radio waves to produce three-dimensional detailed anatomical images of the organs and tissues of the body. This imaging modality produces extremely detailed images of soft tissue and anatomical structures making it ideal for imaging the brain, spinal cord, and joints.^[1-3] It plays an important role in imaging patients with conditions such as a stroke, epilepsy, dementia, and brain tumours.^[4] MRI does not use ionising radiation, and scans are performed in all planes without moving the patient.^[1,3] The disadvantages of MRI imaging examinations include the increased length of time an examination takes, the cost of the equipment, and not all patients are suitable for the examinations such as those with a foreign body (FB) of ferromagnetic material.^[5] Like any other imaging modality,

MRI requires maintenance of the safety standard for clinical staff, patients, and members of the public.

The most important issue when dealing with MRI is its safety because the magnetic field is always present and a magnet attracts metal objects. For this reason, all patients entering the MRI imaging room must complete an MRI safety questionnaire, remove metal objects before the scan, and be screened for the metallic intra-orbital foreign body (IOFB).^[3,5-7] MRI imaging of patients with the metallic IOFB is hazardous; the magnetic field causes the metal fragment to move and causes injury to soft tissues (even blindness may occur if the optic nerve is severed).^[8,9] In 1986, Kelly et al.^[10] reported a case where a patient with a metallic IOFB underwent an MRI examination which subsequently resulted in a vitreous haemorrhage and unilateral blindness. In 2002, Vote and Fraco^[11] reported that a 31-year-old man became blind due to an IOFB injury sustained during an MRI examination. For this reason, orbital x-ray projections are

used as a screening tool for patients deemed at high risk of IOFBs, for example, individuals associated with industrial accidents.^[5,9]

This case report explores IOFBs detected during a routine pre-MRI screening in Zambia. We highlighted the importance of performing two occipital-mental (Waters) projections with an upward and then downward gaze in the diagnosis of IOFBs. To have a complete understanding of the case report, challenges experienced in Zambia regarding the provision of quality MRI services are also reviewed. It is important that consideration be given to the establishment of reporting radiographers to fill the gap created due to the critical shortage of radiologists in Zambia like other countries such as the United Kingdom and Uganda.

CASE REPORT

A 40-year male metalwork teacher, presented at the radiology department with a MRI brain request form. The clinical indication read: "assessment of intracranial tumour". As part of the MRI screening protocol, the patient was asked to complete a questionnaire (checklist): the information sup-

plied was reviewed by the MRI radiographer. Having worked with metals, including welding, the patient was considered a high-risk for an MRI scan. For this reason, he was referred for orbital projections to rule out metallic IOFBs.

In the x-ray room, the radiographer confirmed his identification (name, date of birth, and address) and assessed the justification of the radiation exposure. The erect x-ray digital detector (DR) was cleaned before positioning the patient to ensure it was free of any artefacts that could be confused with IOFB. Two occipital-mental (Waters) projections were undertaken (upward and then downward gaze). Figures 1 and 2 show the radiographic images of both orbits obtained.

Since there was a radiopaque FB demonstrated on the radiographic images as shown in the above images in Figures 1 and 2, the MRI was suspended waiting for a radiologist's report to confirm the radiographer's observation. The radiology department has no radiologist; this led to a delay in obtaining the report. A special request was made to have the radiographic images interpreted at another hospital with a resident radiologist. The diagnostic imaging report read: "Radiopaque foreign body (FB) is demonstrated at

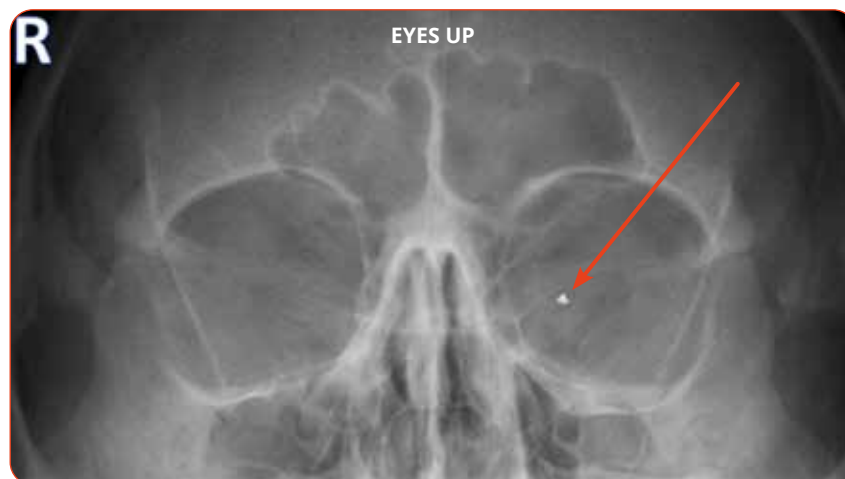


Figure 1. Image obtained with the patient looking up and the FB moved upwards.

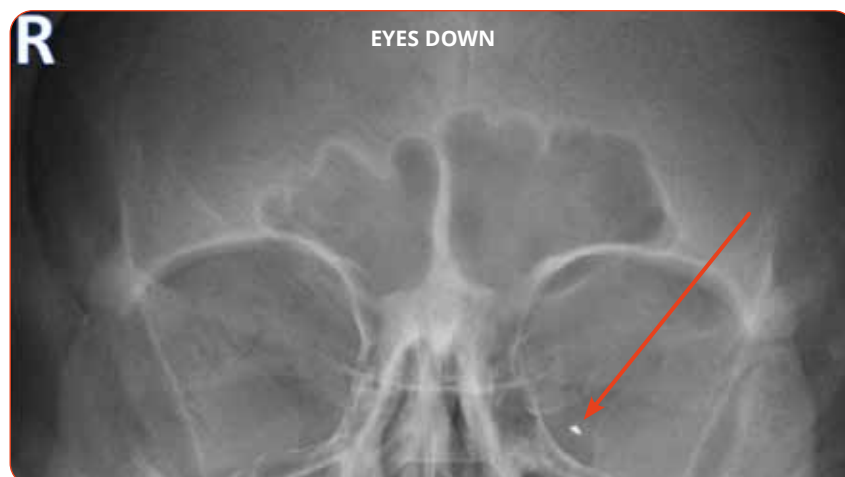


Figure 2. Image obtained with the patient looking down and the FB moved downwards.

the inferomedial quadrant of the left orbit and changes position at the second view confirming that it lies within the globe. The radiographic features are consistent with metallic intra-orbital foreign body (IOFB). It is risky to perform the requested MRI Brain examination". The report was sent to the referring clinician; the MRI examination was cancelled in line with the advice from the radiologist.

DISCUSSION

MRI is a useful imaging modality for the diagnosis and treatment planning of neurological disorders, diseases, and injuries for which the Zambian population has greatly benefited since the availability of the service. At the time of writing this case report, there were eight (8) medical facilities offering MRI services, three (3) public and five (5) private sector, respectively. Public MRI medical facilities include Levy Mwanawasa University Teaching Hospital (LMUTH), Cancer Diseases Hospital (CDH), and Maina Soko Medical Centre. The private MRI medical facilities include Medland Hospital, Fairview Hospital, St John Paul II Orthopaedic Mission Hospital (Former Italian Orthopaedic Hospital), Sinozam Friendship Hospital, and Sanket Sunsol Imaging Services. These medical facilities are in Lusaka and Copperbelt provinces, leaving the remaining eight provinces of Zambia without direct access to MRI services. The unavailability and uneven distribution of MRI services is due to the cost of buying and maintaining the equipment. The Zambian situation is similar to other developing countries such as Ghana,^[13] and Zimbabwe.^[14] This reduced availability and unequal distribution of medical imaging equipment is one of the challenges hindering the delivery of quality healthcare services in Zambia.^[15,16]

• MRI safety protocols to rule out metallic foreign bodies

In a MRI department, the safety of patients and clinical staff is paramount due to associated strong magnetic fields, time-varying magnetic fields, and radio-frequency pulses.^[2] Staffing levels and competence should be such that there is no compromise regarding patient safety in order to avoid serious injury or death.^[7] In Zambia, screening of patients for possible metallic IOFB is undertaken by clinicians during the consultation process. Radiographers also use an MRI safety checklist to screen patients before an examination. If there is any suspicion of a metallic IOFB, a patient undergoes plain-film projections of the orbits. This policy is in line with the literature. Conventional radiography is the modality of choice for screening patients with suspected metallic IOFB before a MRI examination.^[5,7,9] This is due to its availability and low radiation dose.^[5] In our case, two occipital-mental (Waters) projections were undertaken with radiographic images obtained with the patient looking up and down. This is the standard technique for undertaking orbital projections for suspected metallic IOFB. If the position of a fragment changes, this is a confirmation that it lies with the globe of the eye.^[5,12]

• Advantages of role extension for radiographers

Our hospital has no radiologist to report on radiographic images. Currently, radiographic images are interpreted by referring clinicians; specialised examinations such as MRI and computed tomography (CT) are sent to other medical facilities with radiologist services. Plain radiographic images are only sent for reporting upon special requests, like in this case discussed above. A shortage of radiologists affects most of the medical facilities in Zambia, with only twelve (12) under the Ministry of Health (MOH), servicing a population of over 19.5 million.^[17,18] To overcome this problem, there is a need to establish reporting radiographers in Zambia.^[19] UK radiographers, since the 1990s, and from 2010 those in Uganda, have extended their role to include image interpretation and reporting on radiographic images.^[5,20,21] This was due to a shortage of radiologists to give a timely written report. This initiative has worked well in these countries; there are minimal or no delays in having the radiographs reported on. Compared to the UK and Uganda the shortage of radiologists in Zambia is dire. The methods of healthcare delivery are not static; responding to patients' needs is important which requires new ways of delivering services without comprising the quality. One of the best initiatives is the establishment of reporting radiographers.^[19,20] This would allow the current (n=12) radiologists in the country to focus on specialised examinations such as CT and MRI, and for radiographers to report on general radiographic images. This can improve the delivery of imaging services in Zambia.

CONCLUSION

This case report highlights the importance of having, and adhering to, pre-MRI screening protocols to avoid injury to patients. An injury was prevented because of the knowledge MRI radiographers had, to ensure the safety of patients and others entering the MRI imaging room. This also involves offering periodical MRI safety awareness programmes to clinical staff. This case also highlights the negative impact that a shortage of radiologists has on the delivery of timely imaging services. There is a need to adopt new ways of offering our imaging services which are working well in other countries such as reporting radiographers. This should ensure that many patients have access to timely diagnostic imaging reports, both in urban and rural areas.

CONSENT FOR PUBLICATION

Written informed consent was obtained from the patient for the publication of this case report and accompanying radiographic images.

ACKNOWLEDGEMENTS

Special thanks go to Mr Eddie Mwansa Ng'andwe of the UK for reviewing this case report before being submitted for publication. The authors would also like to thank all radiographers who were involved in the imaging of our patient reported in this case report.

CONFLICT OF INTEREST

The authors have no conflict of interest to declare.

AUTHORS' CONTRIBUTIONS

OB, the main author conceptualised this case report and was responsible for the supervisory role. EC and NM identified the case. All authors assisted in the writing of the case report.

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