Magnetic resonance imaging signal artefacts from invisible metal debris following surgery to the elbow

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Abstract

We report a case of exuberant artefacts on the magnetic resonance imaging scan of the elbow produced by invisible metal debris secondary to previous surgery.

Keywords

metal artefacts, metal debris, MRI scan

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Introduction

The use of magnetic resonance imaging (MRI) has increased in musculoskeletal radiology. When surgery was previously performed on the area that is to be scanned, there are expected changes to be seen at the bone and soft tissue level and this depends on the time that elapsed since previous surgery.¹ If metal hardware is present, it often impedes obtaining optimal images, leading to misinterpretation of pathologies and the inability to conclude a diagnosis. Metal-related artefacts depend on the composition, size and orientation of the metallic object with regard to the direction of the external magnetic field.^{2,3} In this case report, we describe significant metal artefacts on MRI from metal debris that are completely invisible on radiographs.

Case report

A 42-year-old female patient underwent an Outerbridge and Kashiwagi (OK) procedure⁴ of the right elbow for post-traumatic pain and stiffness 3 years previously. The patient's operative notes revealed that the procedure had been performed openly using a high-speed burr. The patient presented later with persistent pain and stiffness. On clinical examination, the range of motion was 30° to 120°. The pain was localized at the tip of elbow and was elicited mainly on extending the elbow joint. The plain radiographs were unremarkable

Figure 1. Plain radiographs showing the previously performed Outerbridge and Kashiwagi procedure with no metal debris visible.

but showing bony spurring at the tip of olecranon as well as the previously undertaken OK procedure (Figure 1).

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Figure 2. Magnetic resonance imaging axial and sagittal images demonstrating significant metal artefacts.

Figure 3. Computed tomography scan sagittal and axial images revealing metal debris corresponding to the areas of artefacts seen on the magnetic resonance imaging scan.

An MRI scan was carried out and, as a result of significant artefacts, we could not conclude a diagnosis or highlight any intraarticular or ligament pathologies (Figure 2).

A computed tomography (CT) scan was performed to exclude any intraarticular loose body or impinging osteophytes. The CT scan revealed multiple metal debris around the previous surgical site, therefore explaining the artefact seen on the MRI scan (Figure 3).

The CT scan showed impingement of the tip of the olecranon and the posterior aspect of the distal humerus. The patient underwent surgical debridement and excision of the tip of olecranon.

Following surgery, the patient's symptoms improved and so did the range of motion of the elbow joint.

Discussion

Generally, when metal hardware such as implants, screws and metal anchors are present in the vicinity of the anatomical part that is to be scanned with MRI, certain measures are taken, such the use of a metal artefact reduction sequence scan (MARS). The main unusual findings in the case that we report are the

exuberant artefacts seen on the MRI arising from metal debris that remained completely invisible on the plain radiographs.

It is conventionally known that the type, size, number and orientation of metal hardware in relation to the magnetic field all correlate strongly with the amount of artefact seen on the MRI scan. Ferromagnetic implants, for example, produce more artefacts than the titanium ones. The observed artefact in the present case report arose from small metal shavings from the use of a burr on hard and sclerotic bone.

Alterations to the MRI protocol can help reduce artefacts, such as by reducing the magnetic field strength, the choice of pulse sequence and the direction of the magnetic field: for example, the artefact size increases proportionally with an increase in the angle between the long axis of the metal implant and the main magnetic field direction.⁵

However, in our case, none of the above measures in the MRI protocol would have been applicable to avoid or minimize the observed artefacts because the metallic debris remained completely invisible on the plain radiographs.

Declaration of Conflicting Interests

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