Radiography xxx (2018) 1–4

Contents lists available at ScienceDirect

Radiography

journal homepage: www.elsevier.com/locate/radi

Radiographer reporting of neurological magnetic resonance imaging examinations of the head and cervical spine: Findings of an accredited postgraduate programme

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ARTICLE INFO

Article history:
Received 20 February 2018
Received in revised form
25 April 2018
Accepted 19 May 2018
Available online xxx

Keywords:
Radiographer reporting
Advanced practice
Magnetic resonance imaging
Neurological imaging
Observer performance

ABSTRACT

Introduction: To analyse the objective structured examination (OSE) results of the first cohorts of radiographers (n = 13) who successfully completed an accredited postgraduate programme in clinical reporting of neurological magnetic resonance imaging (MRI) examinations of the head and cervical spine.
Methods: Forty MRI examinations were used in the OSE which included a range of abnormal cases (prevalence of abnormal examinations approximated 50%) and included: haemorrhage, infarction, demyelination disease, abscess, mass lesions (metastatic deposits, meningioma, glioma, astrocytoma); and disc disease, cord compression, stenosis, ligament rupture, syringomyelia appearances on patients referred from a range of referral sources. Normal variants and incidental findings were also included. True/false positive and negative fractions were used to mark the responses which were also scored for agreement with the previously agreed expected answers based on agreement between three consultant radiologists' reports.
Results: The mean sensitivity, specificity and agreement rates for all head and cervical spine investigations (n = 520) combined were 98.86%, 98.08% and 88.37%, respectively. The highest scoring cases were cases which included astrocytoma, disc protrusion with cord compression and glioma. The most common errors were related to syringomyelia, ligament rupture and vertebral fracture.
Conclusions: These OSE results suggest that in an academic setting, and following an accredited postgraduate education programme, this group of radiographers has the ability to correctly identify normal MRI examinations of the head/cervical spine and are able to provide a report on the abnormal appearances to a high standard. Further work is required to confirm the clinical application of these findings.

Introduction

Workload continues to rise in diagnostic imaging departments in the United Kingdom (UK), and in England the total number of plain imaging (X-ray), computed tomography (CT) and magnetic resonance imaging (MRI) investigations increased by 12% between 2012–13 and 2015–16, to over 30 million.[1] In the same period the number of MRI scans increased by 31%,[1] and as a result many departments face significant challenges to meet the escalating demands associated with the timely reporting of these examinations. Sustained increase in MRI examinations means additional reporting capacity is required and new models of care are required to meet the growing diagnostic capacity gap.

Radiographers, appropriately educated and trained, have been providing definitive clinical reports on a variety of imaging examinations since the 1990s; and the role of radiographer reporting, which is now well established within the UK,[2] continues to have an increasing impact on service and cost-effectiveness for imaging services in the UK.[3,4]

Studies which have investigated the interpretation of plain skeletal examinations by radiographers have demonstrated encouraging findings.[5] More recent research, related to radiographers' diagnostic performance in the reporting of other more complex investigations, is also emerging. In particular, this includes research related to the reporting of chest examinations,[6–8] and

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https://doi.org/10.1016/j.radi.2018.05.006
1078-8174/

cross-sectional imaging studies; MRI examinations of the lumbar/thoracic spine and knee[9,10] and computed tomography (CT) examinations of the head.[11,12]

Over 120 radiographers have completed the postgraduate certificate (PgC) Clinical Reporting (MRI- General Investigations) programme which aims to prepare radiographers to provide definitive clinical reports on lumbar/thoracic spine and knee investigations, and a growing number (>10%) of diagnostic imaging departments have confirmed that radiographers contribute to the delivery of MRI reporting services in this way.[9,13]

As radiographers can report different MRI body areas and given the significant challenges in meeting the growing diagnostic imaging reporting demands, the progression to prepare radiographers to report other neurological examinations (cervical spine and head) seems a logical extension.

A small number of radiographers (n = 13) have also completed a separate PgC programme (accredited by the College of Radiographers) which prepares radiographers to report magnetic resonance imaging (MRI) neurological investigations of the head and cervical spine.[14] The 12-month workplace based programme consists of short, two day, briefing blocks held at the university approximately every two months. Experienced MRI consultant radiologists are involved in the design, management, teaching and assessment aspects of the programme. The assessment schedule includes a case-study, an assignment which requires students to critically reflect on their developing competence in MRI reporting and 500 practice reports, 125 of which must be checked by a consultant radiologist mentor in the students' workplace. Consistent with other postgraduate programmes in clinical reporting at this university, one of the final summative assessments for the PgC is an Objective Structured Examination (OSE) which, for this pathway, consists of 40 MRI investigations.

Aim

To analyse the OSE results of the first cohorts of radiographers (n = 13) who successfully completed the PgC programme; and to determine radiographers competence to report magnetic resonance imaging (MRI) neurological investigations of the head and cervical spine.

Method

Compliance with the University's Research Ethics and Governance procedures was confirmed and all other relevant guidance followed.[15]

Obuchowski[16] acknowledged the importance of the diversity of observers' interpretations and in particular recognised the need to consider the performance of an 'average reader' when measuring observer performance. Accordingly the OSE was constructed using cases (n = 40) where there was good agreement between 3 experienced consultant radiologists.

To ensure that an adequate number of cases were available to be selected for the OSE and aware of the variation that exists, even between experienced observers,[16,17] approximately 100 MRI examinations of the head and cervical spine were randomly selected from archives at two diagnostic imaging departments in Southern England. To ensure compliance with the relevant data protection legislation all identifying information was removed from the images, request details and the initial radiological reports, which were then coded anonymously. Subsequent reports were provided independently by two consultants radiologists blinded to the original report. All the reports were provided by non-specialist consultant radiologists.

Although the specific agreement rates between the consultant radiologists was not calculated, the method adopted had been used previously[17] and the cases in good agreement were selected for inclusion in the OSE.

Based on the file report, and the two subsequent reports, the expected answer (including diagnosis), was then agreed by consensus by the programme team (KP and LP) and one of the consultant radiologist external examiners experienced in MRI reporting, for every examination (n = 40) selected for the OSE. The external examiner also confirmed that an appropriate selection of discriminatory cases were included.[17] A range of cases were included to adequately test the candidates' knowledge and to demonstrate competence at postgraduate level. The final prevalence of abnormal (Fig. 1) to normal (including normal variants) cases approximated 1:1. Mean age of the patients was 46.2 years, and the male to female ratio was 1:1 (20 males, 20 females).

All examinations were viewed on 42 cm monitors with native screen resolution of 1280 × 1084, ~1.3 megapixels, consistent with relevant guidance[18,19] in Digital Imaging and Communications in Medicine (DICOM) format using KPACS software[20] to enable manipulation.

Candidates were provided with the patient's details (age, gender, referral source and clinical history) and were asked to make a decision whether the appearances were normal (including normal variants) or abnormal, recording the decision on the pro forma. For the abnormal cases the student was expected to provide key details on the abnormal radiographic appearances and include suggested pathology/ies where applicable, in the form of a free text hand-written report. Credit was also given where candidates made appropriate recommendations related to further imaging.

The responses were compared to the expected answer by one of the programme team and second marked as required by university procedures (KP/LP). If the examination was correctly identified as normal or abnormal, a true negative/positive (TN/TP) fraction was allocated accordingly. If the case was marked as incorrectly normal or abnormal, a false negative/positive (FN/FP) was recorded. Overall sensitivity and specificity rates, and 95% confidence intervals (CI) were calculated, using the Wilson procedure.[21,22]

In terms of agreement, and as used previously to mark OSE answers, one mark for each normal and a maximum of five marks for each abnormal case was allocated and fractionated[9] where necessary to reflect the different key aspects that were required in

Head

Haemorrhage – various
Infarction – various
Demyelination disease
Mass lesions
- Metastatic deposit/s
- Meningioma
- Adenoma
- Astrocytoma
- Low grade glioma
- Dysembryoplastic neuroepithelial tumours (DNET)
- Abscess

Cervical spine

Degenerative disc disease, vertebral endplate (Modic) changes

Figure 1. Range of abnormalities included in the OSE.

Please cite this article in press as: Piper K, et al., Radiographer reporting of neurological magnetic resonance imaging examinations of the head and cervical spine: Findings of an accredited postgraduate programme, Radiography (2018), https://doi.org/10.1016/j.radi.2018.05.006