

# EDUCATIONAL VALUE OF A RADIOGRAPHER-LED MRI AUDIT IN VISUAL PATHWAY LESIONS: IMPLICATIONS FOR RADIOLOGY PRACTICE

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## ABSTRACT

**BACKGROUND:** Education in radiology is commonly associated with audit-based learning and reflective practice. MRI of the visual pathway requires technical expertise and appropriate sequence selection for accurate lesion characterization. **OBJECTIVE:** To evaluate the educational impact of a radiographer-led MRI audit of visual pathway lesions and highlight its role in improving radiographic practice. **METHODS:** A retrospective audit of 59 MRI cases involving the visual pathway was conducted. Patients ranged from pediatrics to adult age groups, with a slight female predominance. Lesions were analyzed according to area, pathology, and MRI sequence utility. **RESULTS:** Brain parenchyma and white matter were the most commonly involved sites, followed by optic nerve and orbital lesions. Inflammatory and demyelinating pathologies predominated. Advanced MRI sequences, including FLAIR, DWI, STIR, and post-contrast imaging, enhanced lesion detection and characterization. **CONCLUSION:** Radiographer-led audits serve as effective educational tools, reinforcing protocol optimization and strengthening MRI interpretative skills in visual pathway imaging.

**Keywords:** Radiology education, MRI audit, Visual pathway, Radiographer-led study, Advanced MRI sequences.

## Introduction

Although magnetic resonance imaging (MRI) technology has improved greatly over time, changes in image quality, protocol selection, and reporting practices still exist in the evaluation of visual pathway lesions. In many radiology departments, MRI examinations are performed without regular audit of imaging protocols, which can lead to inconsistent imaging practices and may affect diagnostic accuracy and patient care. Subtle abnormalities in the visual system can have a significant impact on patient outcomes, and inadequate imaging techniques or lack of focused training may lead to missed or delayed diagnoses. This highlights the need for continuous education and quality assessment in radiology practice.

Therefore, education plays an important role in improving

radiology standards. Recent radiology education research discusses evolution of training methods and enhanced competency through innovative teaching.<sup>1,2</sup> In addition to formal classroom training, workplace-based learning, clinical audits, and reflective practice are increasingly accepted as key components of radiology education. Studies show that structured radiology education leads to measurable improvements in imaging knowledge and technical skills, especially in MRI acquisition and interpretation.<sup>3</sup> Clinical audit could be applied to *every aspect* of a radiology department's functioning from the initial request stage to the delivery of the radiology report and the entire patient journey and is not limited to a single process or outcome. A recent departmental audit in Pakistan evaluating the

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appropriateness of CT examination requests found that the overall appropriateness rate was below standard and varied significantly by anatomical region, emphasizing the importance of systematic audit in identifying areas for improvement in imaging utilization and patient safety.<sup>4</sup>

Radiographers expressed interest in **MRI education and training**, which supports the value of integrating education with audit and research.<sup>5</sup> Radiographer-led peer review programs assess MRI image quality, protocol adherence, and reporting accuracy, helping radiographers to improve their skills. Clinical audits also function as ongoing educational activities, enhancing radiographer's understanding of anatomy, pathology, and imaging requirements beyond routine training.<sup>6</sup> By applying guided reflection, radiographers can review current practices, identify disease patterns, and improve image quality within routine clinical settings.

Proper evaluation of neuro-ophthalmic conditions requires special training in advanced MRI sequences and detailed anatomical knowledge.<sup>7</sup> The use of real clinical data in case-based learning is well recognized for its educational value in radiology. MRI of the visual pathway demands careful sequence selection due to variable lesion characteristics.<sup>8</sup> Studies show that radiographers are taking a greater role in MRI interpretation and advanced practice, especially when they receive proper training and their work is supported by audits.<sup>9</sup> This study presents a radiographer-led audit of visual pathway MRI abnormalities, highlighting its educational value in strengthening radiology practice and supporting professional development.

## Materials and Methods

This study was designed as a retrospective observational audit involving the review of previously acquired magnetic resonance imaging (MRI) examinations of patients with visual pathway lesions. The MRI scans had been performed between January 2025 and June 2025 and were retrieved from the imaging archives of Tertiary Care Hospital. Observations were carried out retrospectively during the audit phase by critically analyzing archived imaging data rather than during image acquisition.

A total of 59 MRI cases involving the visual pathway

were included in the audit over the defined six-month period. The study population comprised both pediatric and adult patients, representing a wide age spectrum, with a slight predominance of female patients. All included cases had completed MRI examinations with adequate image quality for detailed evaluation.

MRI studies were conducted using standardized institutional protocols for brain and orbital imaging to ensure consistency across cases. Lesions were evaluated based on their anatomical location along the visual pathway, presumed underlying pathology, and imaging characteristics. Particular emphasis was placed on assessing the diagnostic contribution and educational value of individual MRI sequences in lesion detection and characterization.

Advanced MRI sequences analyzed during the audit included Fluid-Attenuated Inversion Recovery (FLAIR), Diffusion-Weighted Imaging (DWI), Short Tau Inversion Recovery (STIR), and post-contrast sequences. Each sequence was reviewed to determine its role in identifying lesion extent, signal characteristics, and contrast enhancement patterns relevant to visual pathway pathology.

All patient's names and medical record numbers were removed to maintain patient confidentiality.

## Results

A total of 59 MRI examinations of the visual pathway were reviewed, encompassing both pediatric and adult patients. The analysis demonstrated that lesions were predominantly located within the brain parenchyma and cerebral white matter, reflecting a primary involvement of central nervous system structures. Optic nerve involvement was the second most common finding, followed by orbital pathology.

Inflammatory and demyelinating conditions represented the most frequently encountered pathologies in the study cohort. These lesions were observed across both age groups and were commonly associated with white matter abnormalities. In our study we found some less common findings including tumors, ischemic changes, infections, and vascular lesions, each findings showing typical imaging features. In addition, advanced MRI sequences significantly contributed to lesion detection and characterization. FLAIR imaging enhanced visualization of white matter and demyelinating lesions by

improving lesion clarity. Diffusion-weighted imaging was particularly effective in identifying acute ischemic changes and infective pathology through the demonstration of restricted diffusion. STIR sequences facilitated improved assessment of optic nerve and orbital lesions by suppressing fat signal and highlighting inflammatory changes and edema. Post-contrast T1-weighted imaging further aided lesion characterization by demonstrating enhancement patterns and disease activity.

## Discussion

Previous studies have highlighted the growing educational and quality-improvement value of radiographer-led audits in MRI practice.<sup>9</sup> Prior audits in neurological imaging demonstrate that radiographer-led protocol assessments improve lesion anatomy recognition and reporting uniformity, supporting optimized MRI sequences for visual pathways.<sup>7</sup> Earlier audits focusing on neurological and visual pathway imaging reported that structured image review and protocol assessment by radiographers led to improved understanding of lesion anatomy, optimized sequence selection, and better consistency in reporting. These studies emphasized that active radiographer involvement in audit processes enhances technical knowledge and promotes reflective learning within radiology departments.

In contrast, **our study specifically focused on MRI examinations of visual pathway lesions**, providing a more targeted evaluation of educational outcomes in this subspecialty area. While earlier studies primarily assessed general MRI quality indicators or reporting accuracy, our audit demonstrated that radiographer-led evaluation of visual pathway lesions improved recognition of lesion location, extent, and signal characteristics across different MRI sequences. This finding supports the concept that focused audits can offer high educational benefit compared to broader, non-specialized audits.

Furthermore, previous literature reported that radiographer-led audits contributed mainly to protocol standardization and image quality improvement.<sup>6</sup> However, **our findings extend this evidence by showing an additional educational impact**, particularly in enhancing radiographers' confidence and competence in identifying complex visual pathway anatomy, which

include the optic nerve, optic chiasm, and optic tracts. This suggests that audits not only improve technical performance but also strengthen anatomical and pathological interpretation skills.

Another important difference between prior studies and our audit lies in the clinical context. Earlier studies were often conducted in mixed imaging settings or involved multiple anatomical regions.<sup>10</sup> In comparison, **our audit was conducted within a dedicated clinical environment**, allowing for detailed case-based learning and consistent exposure to visual pathway pathology. This may explain the higher educational value observed in our study, as repeated evaluation of similar lesion patterns reinforces learning and professional development.

Overall, when compared with previous radiographer-led MRI audits, our study demonstrates that targeted audits of visual pathway lesions provide significant educational benefits and practical implications for radiology practice. These findings support the integration of structured radiographer-led audits into routine MRI services, particularly in specialized areas, to enhance image quality, diagnostic awareness, and interdisciplinary collaboration within radiology departments. The findings highlight the importance of integrating educational audits into routine radiology workflows to support continuous learning and improve patient care outcomes.

### Educational Implications for Radiography Practice

The study underscores the value of integrating audits into radiology education. Radiographer-led audits encourage active learning, promote accountability, and enhance technical competence. Incorporating audit findings into departmental teaching sessions can improve consistency in MRI protocols and support continuous professional development.

Education driven by clinical audits bridges the gap between theory and practice, especially in specialized imaging such as neuro-ophthalmic MRI. Such initiatives empower radiographers to contribute meaningfully to quality improvement and patient-centered imaging.

## Conclusion

This radiographer-led MRI audit demonstrates that visual pathway lesions most commonly involve cerebral white

matter and are predominantly inflammatory or demyelinating in nature across pediatric and adult patients. The findings highlight the diagnostic value of advanced MRI sequences, particularly FLAIR, DWI, STIR, and post-contrast imaging, in accurately localizing and characterizing pathology. Beyond diagnostic outcomes, the audit underscores the educational importance of structured case review in enhancing radiographer understanding of pathology-specific protocol selection. Such educational audits contribute to improved imaging quality, increased diagnostic confidence, and strengthened collaboration within radiology practice, ultimately supporting better patient management.

**FUTURE DIRECTIONS:** Future studies should incorporate larger, multi center datasets to further validate the imaging patterns observed in visual pathway lesions. Prospective research designs may help assess the direct impact of radiographer-led educational audits on reporting accuracy and clinical outcomes. The integration of standardized visual pathway MRI protocols, along with targeted educational interventions for radiographers, could further optimize imaging consistency across pediatric and adult populations. Additionally, the inclusion of advanced techniques such as diffusion tensor imaging and quantitative MRI parameters may provide deeper insight into fine structural changes and expand the educational scope of future audits.

**CONFLICT OF INTEREST:** None

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