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Bridging the evidence gap: RAG-enabled LLMs in neuroimaging decision support

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Background: Large language models (LLMs) offer potential for clinical decision support but may not fully adhere to current guidelines. Retrieval-augmented generation (RAG) may address this gap by dynamically incorporating external knowledge. This study evaluated LLM adherence with and without RAG to Canadian neuroimaging guidelines. Methods: A novel RAG framework was developed that integrated Canadian Association of Radiologists (CAR) Diagnostic Imaging Referral Guidelines with GPT-4o and o1 models. Clinical scenarios were curated to represent various central nervous system conditions, such as acute stroke, subarachnoid hemorrhage, and multiple sclerosis. Models were prompted with the clinical scenarios, and responses were scored for adherence to the CAR imaging recommendations. Results: Overall, 300 clinical scenarios were used to prompt each model. Adherence rates were 83.8% for GPT-4o, 94.0% for GPT-4o+RAG, 85.5% for o1, and 93.2% for o1+RAG. A Kruskal-Wallis test ($H(3)=44.1$, $p<0.001$) identified significant differences among models. Post-hoc comparisons showed RAG-enabled LLMs significantly outperformed standalone models ($p<0.001$). No significant differences were observed between GPT-4o and o1 without RAG ($p=0.531$), or between GPT-4o +RAG and o1+RAG ($p=0.532$). Conclusions: RAG integration significantly improved LLM adherence to Canadian neuroimaging guidelines, even when baseline models demonstrated moderate performance. Future work should validate and explore broader applications of RAG-enabled tools to advance evidence-based care.

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Radiologico-pathologic heterogeneity and complexity of polymicrobial brain abscesses

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Background: Polymicrobial brain abscess (PBA) is a complex infection caused by two or more pathogens and a life-threatening condition with diagnostic and therapeutic challenges. Methods: We retrospectively identified PBAs in 31 patients (a median of 58 years; 24 male, and 7 female) then examined their clinical, radiological and pathological characteristics. These characteristics of PBAs were compared with those of monomicrobial BAs (MBAs) in the previously reported 113 patients. Results: PBAs and MBAs had a few similarities such as nonspecific clinical presentations and overall similar prognosis following surgical intervention with broad-spectrum antimicrobial therapy. However, PBAs were highly heterogeneous with more complexity on MRI/CT imaging and histopathology. While PBAs were typically rim-enhancing lesions at late-stages, 30/31 (97%) of PBAs showed the lobulation of enhancing rims/walls; on MRI, 14/26 (54%) of cases demonstrated marked difference in the thickness of enhancing rim, marked difference in the degree of DWI signal, and/or marked variation in intra-lesional MRI signal. PBA histopathology was characterized by alternating early-stage and late-stage features with a combinations of 2-4 pathogens. Conclusions: BPAs share some features with MBAs, but they are more heterogeneous with greater complexity on imaging and histopathology. Their diagnosis and disease staging require a clinico-radiologico-pathological approach.

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Decoding the brachial plexus : from fundamentals to advances - anatomy, imaging and pathologies

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Background: The brachial plexus provides motor and somatosensory innervation to the upper limb and upper chest. Evaluation of brachial plexus disease is based on history, physical examination etc but imaging plays an important role for lesion localization, characterization and its classification. Effective reporting of imaging findings requires that neuroradiologist should be familiar with the brachial plexus anatomy, relevant landmarks, the spectrum and categories of brachial plexopathies. All above objectives will be discussed in this oral presentation. Methods: Normal brachial plexus anatomy is assumed for five anatomic landmarks: neural foramen, interscalene triangle, lateral border of the first rib, medial border of the coracoid process, and lateral border of the pectoralis minor corresponding to level of roots, trunks, divisions, cords and terminal branches. Conventional radiography has role in evaluating bony injuries. CT has limited role. MR used for comprehensive evaluation of the brachial plexus. Causes of brachial plexopathy are divided into traumatic and nontraumatic with specific features of each. Results: Imaging of brachial plexus is important part of treatment planning and rehabilitation of brachial plexopathies. Confident reporting can be done by knowing basics and injury patterns. Conclusions: Neuroradiologist should have sound knowledge of brachial plexus imaging in order to better contribute to pateint care.

NEUROTRAUMA

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Value of CTneck angiography and expanded Denver Criteria in assessing blunt cerebrovascular injury (BCVI) in blunt cervical trauma, assaults, and strangulation

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Background: This study evaluates the utility of CT angiography (CTA) and the Expanded Denver Criteria (EDC) in detecting blunt cerebrovascular injuries (BCVI) in blunt cervical trauma, assaults, and strangulation. Methods: A retrospective review of

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