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Deep learning model for grading metastatic Epidural Spinal Cord Compression on staging CT

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Statement of the Problem: Metastatic epidural spinal cord compression (MESCC), a common complication of malignancy, occur when cancer metastasizes to the spine or epidural space and causes compression of the spinal cord. Early diagnosis is vital to initiate appropriate therapy and prevent permanent neurological dysfunction. MRI is the most accurate imaging modality for the diagnosis of MESCC. But it is expensive and not feasible for routine screening of asymptomatic patients. Staging CT is performed routinely in cancer patients and presents an opportunity for earlier diagnosis. Hence, we aim to develop a deep learning (DL) model for epidural spinal cord compression (ESCC) on CT, which will aid earlier ESCC diagnosis for less experienced clinicians.

Methodology & Theoretical Orientation: Retrospective collection of 420 staging CT scans and corresponding MRI spines from 225 patients with suspected MESCC was conducted from September 2007 to September 2020. MESCC was classified using a modified Bilsky MESCC scale. Training and test datasets were labelled in consensus by two subspecialised radiologists (6 and 11-years-experience) using the MRI studies as the reference standard. For evaluation of the DL model performance, test sets were independently reviewed by 4 senior readers (3 senior radiologists and 1 consultant spine surgeon) and 4 orthopaedic medical officers of 1 year experience).

Conclusion & Significance: DL model for the diagnosis of ESCC on CT had comparable or superior performance to radiologists and spine surgeons. DL model has the capacity to earlier diagnose ESCC on CT. This could potentially reduce treatment delays, improving outcomes, reducing costs, and improving survival. Moving forward, prospective studies are required to assess the accuracy of this model on a more extensive range of oncological patients to better assess the real-world clinical performance and generalizability across a greater range of scanners and patients.

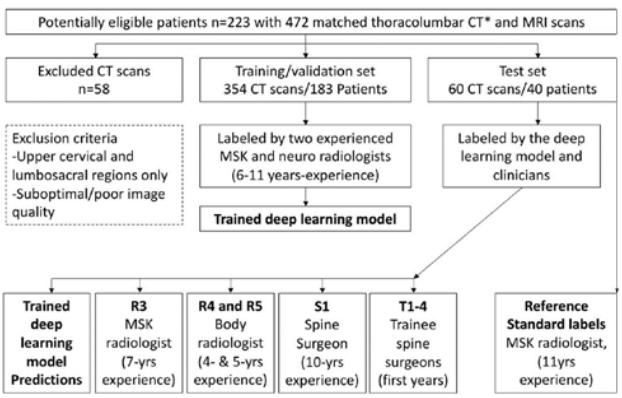

Figure 1: Flowchart of the study design

Recent Publications

1. van Tol, Floris R et al. "The importance of timely treatment for quality of life and survival in patients with symptomatic spinal metastases." European spine journal: official publication of the European Spine Society, the European Spinal Deformity Society, and the European Section of the Cervical Spine Research Society vol. 29,12 (2020): 3170-3178. doi:10.1007/s00586-020-06599-x
2. van Tol, Floris R et al. "Delayed presentation to a spine surgeon is the strongest predictor of poor postoperative outcome in patients surgically treated for symptomatic spinal metastases." The spine journal : official journal of the North American Spine Society vol. 19,9 (2019): 1540-1547. doi:10.1016/j.spinee.2019.04.011
3. Hallinan, James Thomas Patrick Decourcy et al. "Diagnostic Accuracy of CT for Metastatic Epidural Spinal Cord Compression." Cancers vol. 14,17 4231. 31 Aug. 2022, doi:10.3390/cancers14174231.

Biography

Sin Qinxiang Shant is currently a final year student from Yong Loo Lin School of Medicine, Singapore and has an interest and passion in the field of Orthopaedics. In collaboration with the other co-authors, it is hoped that the deep learning model could open avenues for improving healthcare. The concept behind this deep learning model is to establish a stronger integration between the use of CT scans as a convenient diagnostic tool and artificial intelligence to create a more efficacious and effective evaluation of our target group. In so doing, we can strive to push the boundaries of healthcare and serve our community better.

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