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INPLASY

The Role of Deep Learning in Aortic Aneurysm Segmentation and Detection from CT Scans: A Systematic Review and Meta-analysis

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ADMINISTRATIVE INFORMATION

Support - Cheng Hsin General Hospital, CY11102 and CY11201.

Review Stage at time of this submission - Data analysis.

Conflicts of interest - None declared.

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Amendments - This protocol was registered with the International Platform of Registered Systematic Review and Meta-Analysis Protocols (INPLASY) on 28 March 2024 and was last updated on 28 March 2024.

INTRODUCTION

Review question / Objective To evaluate the effectiveness and accuracy of deep learning algorithms in the segmentation and detection of aortic aneurysms from CT scans compared to traditional diagnostic methods.

Rationale Aortic aneurysms, if undetected or untreated, can lead to catastrophic outcomes, including rupture and death. Early and accurate detection and segmentation of these aneurysms via CT scans are crucial for timely intervention and treatment planning. Deep learning, with its capacity for sophisticated image analysis, presents a promising advancement in enhancing diagnostic accuracy and reducing manual interpretation variability.

Condition being studied Aortic aneurysms are local dilations of the aorta that increase the risk of aorta rupture. They can occur in any part of the aorta but are most commonly found in the abdominal section.

METHODS

Participant or population Adult patients undergoing CT scans for the detection or evaluation of aortic aneurysms.

Intervention The use of deep learning algorithms for the segmentation and detection of aortic aneurysms in CT scans.

Comparator Traditional diagnostic methods, including manual segmentation and detection by radiologists or use of conventional computer-aided diagnosis systems.

Study designs to be included Randomized controlled trials, observational studies, and retrospective studies that have utilized deep learning for aortic aneurysm detection and segmentation from CT scans.

Eligibility criteria Studies must involve the application of deep learning algorithms on CT images for aortic aneurysm detection and segmentation. Studies without clear

methodological details, not involving human participants, or not reporting specific outcomes (e.g., accuracy, sensitivity, specificity) will be excluded.

Information sources PubMed, Embase, and Web ofScience.

Main outcome(s) Accuracy, sensitivity, specificity, and Dice scores for the segmentation and detection of aortic aneurysms from CT scans.

Quality assessment / Risk of bias analysis Use of CLAIM and QUADAS-2 tools to assess the methodological quality and risk of bias of the included studies.

Strategy of data synthesis Meta-analysis using random-effects models to aggregate data on the diagnostic performance of deep learning algorithms, with subgroup analyses based on algorithm type, CT imaging modality, and aneurysm location.

Subgroup analysis Based on the type of deep learning algorithm, location of the aneurysm (thoracic vs. abdominal), and imaging techniques (contrast vs. non-contrast CT).

Sensitivity analysis To assess the robustness of the findings, sensitivity analyses will be conducted by excluding studies with high risk of bias.

Country(ies) involved Taiwan.

Keywords Aortic aneurysm; Deep Learning; CT Scan; Segmentation; Detection; Artificial Intelligence.

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