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Hounsfield Unit Utilization in Cervical Spine for Bone Quality Assessment- a scoping review protocol

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ADMINISTRATIVE INFORMATION

Support - None.

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 29 October 2024 and was last updated on 31 October 2024.

INTRODUCTION

Review question / Objective to explore the current literature on cervical spine HU measurements as a reliable metric for BMD as well as the use of cervical HU in predicting postoperative subsidence following an ACDF in order to improve clinical and surgical outcomes.

Background Bone mineral density (BMD) remains a key indicator of skeletal strength and has significant implications for the planning and management of various spinal pathologies. Particularly, the use of hounsfield units (HU) calculated from computed tomography (CT) scans has become increasingly popular in its use as a reliable and non-invasive method to quantify bone density in the cervical spine when compared to the gold standard, a dual-energy X-ray absorptiometry (DEXA) scan for assessing trabecular bone density. Additionally, calculating and understanding BMD lends itself to prudent surgical planning especially in the cervical spine. One complication associated with an extremely common procedure, Anterior Cervical Discectomy and Fusion (ACDF), is postoperative cage subsidence, which can greatly affect expected alignment of the cervical spine and possibly necessitate further unwanted surgical intervention. Bone quality is also important for posterior instrumentation integrity and may affect decisions on the length of the construct. Recent studies have explored the reliability and utility of HU obtained from CT scans as not just a tool for calculating BMD, but also as an accurate predictor of cage subsidence. This scoping review aims at exploring the current literature on the use of cervical spine HU measurements as both a reliable metric for BMD and as a predictor of postoperative subsidence following ACDF with the goal of improving clinical and surgical outcomes.

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Rationale This scoping review aims at exploring the current literature on the use of cervical spine HU measurements as both a reliable metric for BMD and as a predictor of postoperative subsidence following ACDF with the goal of improving clinical and surgical outcomes.

METHODS

Strategy of data synthesis A Scoping review was performed using the PRISMA-ScR checklist as outlined by Arksey and O'Malley (2005). This review was performed by including all studies that reported on cervical Hounsfield units derived from computed tomography (CT) imaging. Eligible studies consisted of original research articles, reviews, and clinical guidelines published in peer-reviewed journals. A comprehensive literature search was conducted in several electronic databases, including PubMed, Web of Science, and Medline. The search strategy combined keywords and MeSH terms related to "Hounsfield units," "cervical spine," "computed tomography," and "clinical applications." The most recent search was executed on 10/21/2024. References of included studies were also screened to identify additional relevant literature. We considered studies involving adult populations only with cervical spine conditions, as well as studies that discussed the methodology of measuring HU in the cervical region. Excluded were non-English publications, case reports, and studies focused solely on non-cervical regions.

Eligibility criteria Eligible studies consisted of original research articles, reviews, and clinical guidelines published in peer-reviewed journals. Excluded were non-English publications, case reports, and studies focused solely on non-cervical regions.

Source of evidence screening and selection Two independent reviewers (R.F. and R.L.) screened the titles and abstracts of the identified articles. Full-text articles were obtained for all potentially relevant studies. The final selection was made based on the eligibility criteria, with discrepancies resolved through discussion or consultation with a third reviewer.

Data management Data were extracted using a standardized extraction form that included the following variables: authors, year of publication, study design, sample size, methods of HU measurement, clinical applications discussed, and key findings. This process was performed independently by both reviewers, with consensus reached on all extracted data.

Reporting results / Analysis of the evidence The data was then organized thematically to highlight key areas of focus, such as the role of cervical Hounsfield units in diagnosing specific conditions, prognostic significance, and methodological approaches to measuring HU. A narrative synthesis was employed to present the findings, with particular attention to gaps in the literature and areas for future research. While scoping reviews typically do not conduct formal quality assessments, we noted the study designs and methodologies of the included studies to provide context for the findings. Limitations of the studies were also discussed in relation to the reliability and validity of Hounsfield unit measurements in clinical practice.

Presentation of the results PRISMA flow diagram.

Language restriction English publications only.

Country(ies) involved United States.

Keywords Hounsfield units; cervical spine; computed tomography; and clinical applications.

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