

G31 The Use of Magnetic Resonance Imaging (MRI) in Forensic Age Estimation of Living Children, Adolescents, and Subadults: Protocol for a Systematic Review and Preliminary Results

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After attending this presentation, attendees will understand the need for a systematic review of studies on the use of MRI for age estimation. A protocol for an adequate conduct of the review and its preliminary results will be presented.

This presentation will impact the forensic science community by elaborating on the emerging field of radiation-free age estimation by means of MRI. It will be demonstrated that numerous studies have been conducted, but that an overview is necessary to bring age estimation based on MRI of developing anatomical structures into practice.

Background: Established methods for age estimation mainly use radiographs to register and evaluate teeth, carpal bones, and long bones, which are still developing in children and subadults; however, young individuals especially are highly sensitive to radiation exposure. Moreover, radiographs may be misinterpreted because of superposition. MRI overcomes both of these drawbacks. Therefore, several research groups are studying the use of MRI to register the developmental status of the considered body part. In particular, diverse MRI protocols were established depending on the anatomical structures used for age estimation.

Purpose: To review the use of MRI for forensic age estimation in living children, adolescents, and subadults and to provide data on age distribution of the development of different anatomical structures as registered on MRI. The systematic review aims to comply with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement.^{1,2} The review protocol was drafted according to the Cochrane Guidelines for review protocols (<http://training.cochrane.org/>), and registered in Prospero, the international prospective register of systematic reviews (<http://www.crd.york.ac.uk/PROSPERO>).³

Research Questions: How does the development of different anatomical structures, as registered on MRI, relate to chronological age? What is the performance of age estimation based on development of different anatomical structures as registered on MRI?

Search Methods: The following databases were searched: MEDLINE, Embase, and Web of Science. Additionally, reference lists of included articles and study registers were searched. No restrictions were made based on the country of publication, language, or publication date.

Selection Criteria: Two reviewers independently selected articles based on titles and abstracts. Study populations including living subjects up to 30 years were considered. MRI of any field strength studying the development of anatomical structures related to age were included. Cross-sectional observational studies, pilot studies, cohort observational studies, and case reports were considered. Review articles and pilot studies of included main studies were excluded. After resolving conflicts by discussion, the full text papers were evaluated independently for eligibility. Again, in case of conflicts, a consensus decision was made.

Data Extraction and Analysis: Study characteristics tables and data extraction tables for the included articles were independently developed. A tool for the risk of bias and paper quality assessment was developed, based on the Effective Practice and Organization of Care (EPOC) overview and Quality Assessment of Diagnostic Accuracy Studies (QUADAS) -2.^{4,5} Authors were contacted for further details and data if these were unclear, not reported, or in a format unsuitable for the review analysis.

Preliminary results: The search through the databases produced 468 results: MEDLINE ($n=99$), Embase ($n=192$), and Web of Science ($n=177$). Additional records, identified through other sources, provided two results. After deduplication, 259 records were screened based on title and abstract, rendering 60 records to be assessed for eligibility by reading the full-text articles. Finally, 34 studies were included for qualitative synthesis and data extraction.

Reference(s):

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5. Whiting P.F., Rutjes A.W., Westwood M.E., Mallett S., Deeks J.J., Reitsma J.B., Leeflang M.M., Sterne J.A., Bossuyt P.M. QUADAS-2: a revised tool for the quality assessment of diagnostic accuracy studies. *Ann Intern Med.* 2011;155(8):529-36.

Age Estimation, Magnetic Resonance Imaging, Subadults