Tara Korbal
L4
LSU Health Sciences Center, New Orleans, LA

Erich Rutz, MD, PhD, FRACS:
The University of Melbourne, Department of Orthopaedics, The Royal Children's Hospital Melbourne

"Three-dimensional ultrasound to evaluate muscle morphology and properties in children with cerebral palsy"

Background:
Cerebral palsy (CP) is the most common cause of childhood physical disability, associated with impaired muscle growth and abnormal architecture. Reliable, non-invasive assessment of muscle morphology is critical for monitoring disease progression and informing treatment. Three-dimensional ultrasound (3DUS) has emerged as a promising alternative to MRI, but reporting practices vary across studies.

Objective:
To systematically review studies applying 3DUS to evaluate skeletal muscle morphology in children with CP, with a focus on reported outcome parameters and measurement approaches

Methods:
A systematic search of MEDLINE, PubMed, and Embase identified original studies using 3DUS in children and young adults (≤30 years) with CP. Data were extracted in duplicate and assessed for risk of bias using the Cochrane RoB-1 tool and the Methodological Index for Non-Randomised Studies (MINORS). Given methodological heterogeneity, results were synthesized narratively.

Results:
A total of 39 studies were included in the review (n = 1,148 participants). The medial gastrocnemius was the most frequently studied muscle. Reported outcomes included muscle volume (reported in 74% of studies), cross-sectional area (31%), fascicle length (21%), and echo intensity (26%). Mean muscle volume across the studies ranged from 6.8 to 134ml, while mean normalized volume ranged from 1.1 ml/kg to 2.3 ml/kg. Normalization methods varied, most commonly adjusting for body mass.

Conclusions:
3DUS is increasingly used to quantify skeletal muscle morphology in CP. Substantial heterogeneity in measurement techniques and normalization approaches limits comparability across studies. Standardization of 3DUS protocols and outcome reporting is essential to strengthen reproducibility, enable meta-analysis, and enhance clinical translation in the management of children with CP.