Conclusion: Revisiting the neuroanatomy of the MMA shifts the cSDH treatment paradigm, offering a highly effective method to devascularize pathological neo-membranes. This established anatomical framework not only solidifies minimally invasive cSDH management but also opens promising therapeutic avenues for treating refractory migraines.

Keywords: MMA; SDH; Embolization

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Reassessing the Stifle Joint Stabilization System in Southern White Rhinoceros (Ceratotherium simum)

Fikru Niguissie [1,3], Brion Benninger [1,2,3,*,#]

[1] *Medical Anatomy Center, Western University of Health Sciences, HCOM-Heatherington College of Osteopathic Medicine, Lebanon, OR. USA*
[2] *Faculty General Surgery, Radiology Dept, Samaritan Health Services, Lebanon, OR. USA*
[3] *Gary R. Carlson MD College of Veterinary School Medicine Anatomy Lab, Oregon State University, Corvallis, OR. USA*
[*] *Corresponding author at: Medical Anatomy Center, Western University of Health Sciences, HCOM-Heatherington College of Osteopathic Medicine, Lebanon, OR. USA*
[#] *brionbenninger@gmail.com*

Objective: This study aimed to define ligamentous architecture and functional organisation of stifle joint in the southern white rhinoceros-Ceratotherium simum(CS) and evaluate potential structural adaptations associated with large body mass and limb alignment. Stifle joint in most ungulates is stabilized by well-defined system of three-patellar ligaments and collateral ligaments collectively providing passive support and guide joint motion. Ligamentous architecture of this system in large perissodactyls as the CS remains entirely uncharacterised.

Methods and Materials: Literature search was conducted regarding stifle morphology with contrast CT/MRI imaging of rhinoceroses. Macro anatomy dissection of stifle joint of adult specimen was performed, with systematic analysis of patellar and collateral ligaments, attachment sites, spatial relationships, and overall limb alignment. Nomenclature follows Nomina Anatomica Veterinaria.

Results: Literature search revealed no known rhinoceroses' studies regarding stifle morphology with imaging. Previously undescribed fourth patellar ligament was identified, situated lateral to lateral patellar ligament, constituting significant departure from conventional three-ligament arrangement. Medial collateral ligament extended distally beyond typical ungulate limits, reaching medial malleolus of tibia, while medial patellar ligament continued along medial tibial surface distal to tibial tuberosity, markedly expanding medial support envelope. Joint exhibited lateral stifle abduction with corresponding distal crus adduction, indicating altered mediolateral force distribution across limb axis.

Conclusion: This pilot study revealed substantial adaptation of the stifle stabilization system, characterised by supernumerary lateral reinforcement and an expanded medial ligamentous complex. This suggests adaptation to exceptional mediolateral mechanical demands imposed by large body mass, enhancing joint stability and optimising load transmission in this graviportal perissodactyl.

Keywords: rhinoceros, stifle-joint, patellar/collateral-ligaments.

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1. Etienne C, Houssaye A, Hutchinson JR. Limb myology and muscle architecture of the Indian rhinoceros *Rhinoceros unicornis* and the white rhinoceros *Ceratotherium simum* (Mammalia: Rhinocerotidae). PeerJ. 2021 May 11;9:e11314. doi: 10.7717/peerj.11314. PMID: 34026351; PMCID: PMC8121076.

More on request.

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Foundation Model Embeddings for Automated Bone Tumor Subtype Classification and Phenotypic Clustering

Mert Ocak [1,*,#], Cumali Çatak [2,3]

[1] *Assoc. Prof. Dr., Department of Anatomy, Faculty of Dentistry, Ankara University, Ankara, Türkiye*
[2] *MSc, Department of Forensic Anthropology, Graduate School of Health Sciences, Ankara University, Ankara, Türkiye*
[3] *MSc, Department of Forensic Anthropology, Institute of Forensic Sciences, Ankara University, Ankara, Türkiye*
[*] *Corresponding author.*
[#] *mocak@ankara.edu.tr*

Objective: Bone tumors present diverse radiographic morphologies that challenge accurate subtype classification. Traditional approaches rely on subjective manual assessment. This study aimed to develop a foundation model-based deep phenotyping pipeline for automated nine-subtype bone tumor classification and unsupervised phenotypic clustering using multi-center radiographic data.

Methods and Materials: We analyzed 4,642 regions of interest extracted from 1,867 annotated radiographs in the BTXRD dataset, spanning nine bone tumor subtypes including osteochondroma, osteosarcoma, giant cell tumor, and simple bone cyst. Image embeddings were obtained from two frozen foundation models: BiomedCLIP (512-d; 15M medical image-text pairs) and DINOv2 (768-d; self-supervised). Combined embeddings with clinical metadata underwent mutual information-based feature selection, followed by supervised classification via an optimized stacking ensemble (XGBoost, LightGBM, CatBoost) with patient-level stratified 5-fold cross-validation ensuring no data leakage. Unsupervised analysis employed UMAP dimensionality reduction, HDBSCAN, and spectral clustering.

Results: Binary classification (benign vs. malignant) achieved 92.8% accuracy (95% CI: 92.5–93.3%), F1-score of 0.851, and AUC of 0.939. Nine-class subtype classification reached 70.3% accuracy with AUC of 0.907. Spectral clustering ($k = 2$) yielded a silhouette score of 0.539 and Cramér's V of 0.532 ($p < 0.001$), confirming significant concordance between data-driven clusters and the benign/malignant distinction.

Conclusion: Foundation model embeddings combined with classical machine learning provide an effective, interpretable framework for bone tumor phenotyping without task-specific fine-tuning. Unsupervised clustering confirmed the biological distinction between benign and malignant groups, supporting clinical and anatomical decision-making.

Keywords: bone tumor classification, foundation model embeddings, deep phenotyping.

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