

# Application of AI methods in predicting the likelihood of intracranial aneurysm rupture

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Our study aims to go beyond the common conviction that assessing the likelihood of intracranial aneurysms rupture risk can be done only through the investigations of medical images [1]. We claim that preliminary estimations of the probability of intracranial aneurysm rupture risk are possible based on laboratory data and textual information from medical records [2]. In this study, we focus on feature extraction from medical records to improve models of rupture predictability. Machine learning and explainable AI methods are used to build classification models, offering insights into decision-making processes and enhancing the understanding of diagnoses. The ultimate goal is to develop a diagnostic tool to reduce mortality, hospitalisation costs, and neurological complications in patients with intracranial aneurysms. Assessing rupture risk is challenging, emphasising the need for early detection and prevention. Clinical data were collected from 2095 patients hospitalised with ruptured or unruptured aneurysms between 2006 and 2021 at the Neurosurgery Clinic of the University Clinical Center in Gdańsk. The dataset includes 997 unique laboratory tests and 83875 medical notes. Statistical and comparative analyses identified factors differentiating patients' groups with ruptured and unruptured aneurysms. Models built supported by features from laboratory tests and medical notes improved accuracy to 0.65, a 0.12 increase over models based only on laboratory tests. This shows how to improve the ML models by potentially using large language models for extracting valuable predictors from medical documents.

[1] Zhou Z et al. Classification, detection, and segmentation performance of image-based AI in intracranial aneurysm: a systematic review. *BMC Med Imaging*. **24** (2024) 164.

[2] Fercho J, et al. Application of artificial intelligence methods in predicting the likelihood of intracranial aneurysm rupture to support clinical decision-making. Submitted to *Computers in Biology and Medicine* (2025).