CONQUER CHIARI
From Knowledge, Strength. Through Research, Hope.

Machine Learning Identifies Surgical Outcome Predictors for CM with a Syrinx

A group from China has used machine learning (a type of artificial intelligence) to identify surgical outcome predictors for Chiari patients with a syrinx. Specifically, they found that a larger syrinx diameter before surgery, longer symptom duration before surgery, the presence of gait instability, and older age at time of surgery were associated with poorer outcomes, while a higher peak velocity of cerebrospinal fluid (CSF) at the foramen magnum (the opening at the bottom of the skull) was associated with better outcomes.

They determined this by looking at a large number of demographic, clinical, and imaging based parameters from 151 adults with CM/SM who were operated on between 2018-2023. Outcomes were based on the Chicago Chiari Outcome Scale (CCOS, 4-16) with scores of 11 and higher classified as High and scores of 4-10 classified as Low. The research team then trained seven different machine learning models on 121 of the participants (72% High. 38% Low) and tested the models' performance on the rest of the patients.

The best machine learning model as one called CatBoost, which was able to accurately predict whether a patient would have a High or Low CCOS score roughly 90% of the time. The model further identified the five factors listed previously as being significant predictors. Specifically, the average syrinx diameter in the Low group was 51% larger than the High group (7.1 vs 4.7 mm). Similarly, the average symptom duration in the Low group was 4 years compared to only 16 months in the High CCOS group. Meanwhile, 52% of the Low group experienced gait instability as a symptom compared to only 11% in the High group.

While the accuracy of the machine learning model is impressive, the specific factors it identified are not surprising. Syrinx diameter (or width) has long been recognized as an important indicator, since once the tissue of the spinal cord is stretched and put under too much stress it is difficult for its function to fully return. In addition, a Conquer Chiari study based on the Chiari1000 found that patients with a symptom duration greater than 2 years prior to surgery have significantly worse outcomes compared to those who get surgery sooner. While the authors don't provide an explanation for the finding that a higher CSF velocity at the foramen magnum was associated with better outcomes, it is likely that this is indicative of greater crowding by the herniated cerebellum which has been shown to be associated with better surgical outcomes.

It is unfortunate that the researchers did not repeat the analysis using different CCOS cut-off scores to group the outcomes into High vs Low. A CCOS score of 11 is not that great from a patient point of view, so it would be useful to see if the predictive parameters change if the cut-off was set at 13 or 14.

Source: Wang H, Lu L, Fan B, Xiao X. Phase-contrast magnetic resonance imaging-based predictive modelling for surgical outcomes in patients with Chiari malformation type 1 with syringomyelia: a machine learning study. *Clin Radiol*. Published online January 29, 2025. doi:10.1016/j.crad.2025.106829

Please consider a $10 donation as Conquer Chiari's educational material is free to read, but not free to produce:

https://www.conquerchiari.org/donate

Conquer Chiari's research updates highlight and summarize interesting publications from the medical literature while providing background and context. The summaries do contain some medical terminology and assume a general understanding of Chiari. Introductory information and many more research articles can be found in the Conquer Chiari Library.