News Release

Title

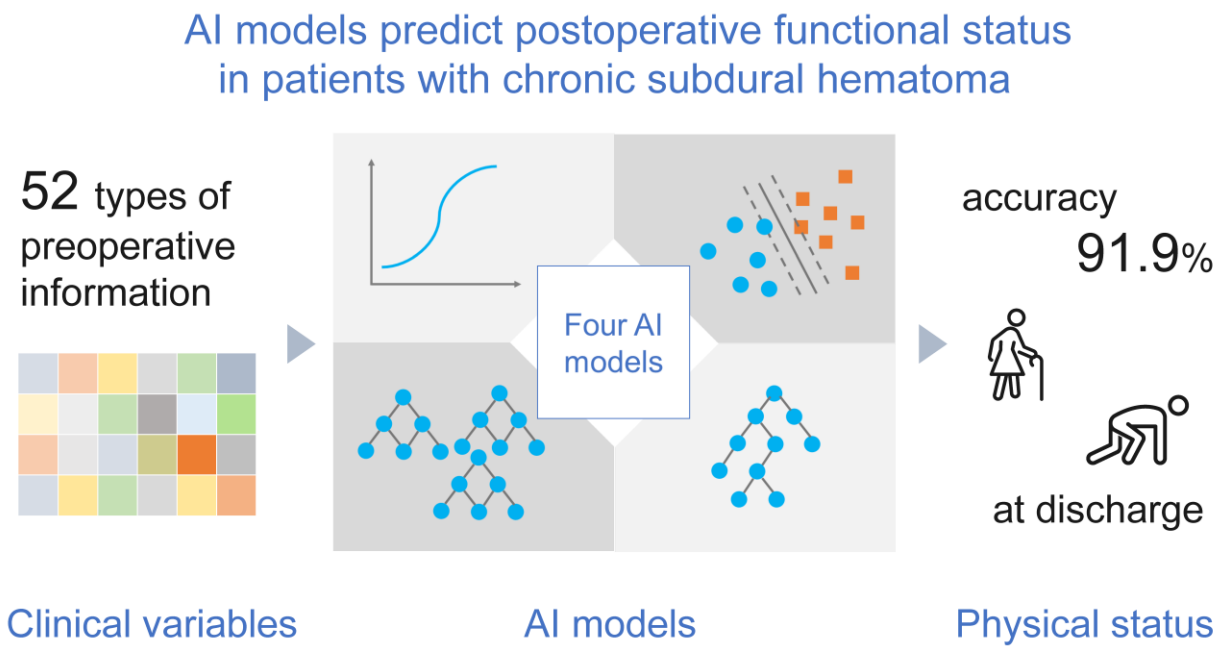
Development of machine learning models for predicting unfavorable functional outcomes from preoperative data in patients with chronic subdural hematomas

Key Points

•This research team's latest study sheds light on chronic subdural hematoma, an ailment linked to cognitive decline. As the global population ages, this condition is becoming notably prevalent, especially in countries like Japan.

•The team has developed an AI model that accurately predicts post-surgery physical capabilities of patients. This is achieved by leveraging pre-surgery blood tests and clinical observations.

•This predictive AI model is not just about diagnostics – it's about enhancing lives. With its insights, patients can expect optimized rehabilitation, informed discharge decisions, and tailored care planning.



Summary

A collaborated team from Nagoya University Graduate School of Medicine, led by Professor Ryuta Saito, Assistant Professor Yoshitaka Nagashima and PhD

Student Yutaro Fuse of the Department of Neurosurgery, and Professor Kinji Ohno and Assistant Professor Hiroshi Nishiwaki of the Division of Neurogenetics, has unveiled a state-of-the-art AI model. This breakthrough model predicts with an impressive 91.9% accuracy the post-surgery physical function of patients with chronic subdural hematomas using preoperative data.

With the greying of our global population, the number of chronic subdural hematoma patients—a condition stemming from head injuries and linked to cognitive decline—is on the rise. While surgery remains the primary treatment, ensuring post-operative recovery and life quality is paramount for both patients and their families. Traditional methods have struggled to precisely foresee post-surgery physical outcomes, making this development all the more significant.

The game-changing factor of this AI model lies in its comprehensive analysis approach. Drawing from pre-surgery data like blood tests, imaging results, and clinical findings, the model boasts a precision hitherto unseen. By efficiently selecting and integrating diverse factors—going beyond what previous studies considered—and utilizing a meticulous pre-processing technique, the model stands out. Its potency was determined by juxtaposing various AI models, and it has been rigorously validated across multiple medical institutions, underscoring its reliability.

The future looks bright with this innovative AI model. Patients and their families can anticipate more tailored care plans, rehabilitation, and post-discharge life preparations. This pioneering research has earned its spotlight in the esteemed UK-based journal, Scientific Reports, in its electronic edition dated October 9, 2023.

Research Background

In our rapidly ageing society, the spotlight is increasingly on chronic subdural hematoma, a condition more prevalent among the elderly. It is characterized by a slow accumulation of blood on the brain's surface, often resulting from head trauma. The consequences can be severe, ranging from cognitive impairments and paralysis to an alarming decline in consciousness.

Surgery stands as the primary treatment for this condition, offering the hope of better cognitive and motor functions. The aim is clear: to preserve life and either maintain or enhance day-to-day quality of life. However, a concerning

reality emerges in Japan; nearly a third of those who undergo surgery don't witness a significant recovery in their physical abilities. This post-operative challenge often makes early home-based recovery difficult.

Given these circumstances, it's vital that patients and their families receive a realistic understanding of post-surgery prospects as soon as the diagnosis is made. Having a precise forecast of post-operative physical recovery can be a linchpin in making the best use of healthcare resources, providing clear information to patients and their kin, and fine-tuning support systems. All of which culminate in elevating the quality of healthcare services for the community at large.

While prior studies have pinpointed various factors influencing post-surgery physical recovery, current statistical models grounded in these findings remain wanting in prediction accuracy. The pressing call now is for the development of new models, ones that can succinctly and precisely predict post-operative physical outcomes.

Research Results

This study developed an AI model aimed at predicting post-operative physical function outcomes for patients with chronic subdural hematoma. The data was gathered from those treated at university-affiliated hospitals.

The AI model training utilized 52 distinct factors extracted from pre-surgery clinical information. This encompassed elements like blood tests, head imaging studies, background considerations, and physical observations. As a metric for assessing post-operative physical capability, the study employed the modified Rankin Scale (mRS), specifically focusing on the mRS scale range of 3-6.

The study utilized four AI algorisms, each demonstrating impressive predictive capacities with prediction indices ranging between 0.906 and 0.925. To ensure these models' adaptability and reliability across various contexts, they were validated using data from different medical facilities. The results remained commendable, with prediction indices consistently between 0.833 and 0.860. Notably, the top-performing AI model achieved an impressive accuracy rate of 91.9%, indicating its potential efficacy across diverse healthcare scenarios and locations.

A deeper dive into the clinical factors utilized to train the AI revealed that age,

consciousness state upon admission, and albumin levels from blood tests held particular sway over the predicted outcomes. By emphasizing these factors, there exists an opportunity to refine the model, ensuring its relevance and utility within the treatment milieu.

Research Summary and Future Perspective

Surgery, while crucial, isn't the sole solution for effectively treating chronic subdural hematomas. Ensuring comprehensive perioperative care, especially post-surgery rehabilitation, is of paramount importance. The predictive model from our study underscores the potential of AI in determining which patients most require tailored post-operative support and rehabilitation management.

By broadening the scope of this team's research across multiple centers, its aim to collate data from an extensive and diverse patient demographic. This holistic approach is set to pave the way for more individualized treatment strategies, tailored to a patient's unique circumstances and requirements. Ultimately, our goal is to enhance patient outcomes through such personalized interventions.

But this team isn't stopping at chronic subdural hematomas. It's poised to further refine our AI model's technical capacities. The underlying algorithms have applications beyond this specific condition. They hold promise for forecasting outcomes across a variety of diseases and surgical interventions. The team is optimistic that this pioneering approach will usher in a new era of personalized medicine, catering to an expansive spectrum of medical conditions.

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