Estimated pulse wave velocity

The estimated pulse wave velocity (ePWV) is a recently developed, simple and useful tool to measure arterial stiffness and to predict long-term cardiovascular mortality. However, the association of ePWV with mortality risk in patients with subarachnoid hemorrhage (SAH) is unclear.

A study aims to assess the potential prediction value of ePWV on short- and long-term mortality of SAH patients.

Methods: Data of adult patients with no traumatic SAH were extracted from the Medical Information Mart for Intensive Care (MIMIC) III and IV database in this retrospective cohort study. Weighted univariate and multivariable Cox regression analyses were used to explore the associations of ePWV levels with 30-day mortality and 1-year mortality in SAH patients. The evaluation indexes were hazard ratios (HRs) and 95% confidence intervals (CIs). In addition, subgroup analyses of age, the sequential organ failure assessment (SOFA) score, surgery, atrial fibrillation (AF), renal failure (RF), hepatic diseases, chronic obstructive pulmonary disease (COPD), sepsis, hypertension, and diabetes mellitus (DM) were also performed.

Results: Among 1,481 eligible patients, 339 died within 30 days and 435 died within 1 year. After adjusting for covariates, ePWV ≥ 12.10 was associated with higher risk of both 30-day mortality (HR = 1.77, 95%CI: 1.17-2.67) and 1-year mortality (HR = 1.97, 95%CI: 1.36-2.85), compared to ePWV < 10.12. The receiver operator characteristic (ROC) curves showed that compared to single SOFA score, ePWV combined with SOFA score had a relative superior predictive performance on both 30-day mortality and 1-year mortality, with the area under the curves (AUCs) of 0.740 vs. 0.664 and 0.754 vs. 0.658. This positive relationship between ePWV and mortality risk was also found in age ≥ 65 years old, SOFA score < 2, non-surgery, non-hepatic diseases, non-COPD, non-hypertension, non-DM, and sepsis subgroups.

Conclusion: Baseline ePWV level may have potential prediction value on short- and long-term mortality in SAH patients. However, the application of ePWV in subarachnoid hemorrhage prognosis needs further clarification [1)].

Critical review

The study published in *BMC Neurology* on October 22, 2024, titled *“Association between estimated pulse wave velocity and the risk of mortality in patients with subarachnoid hemorrhage: a retrospective cohort study based on the MIMIC database”* presents a commendable attempt to explore a novel predictor—estimated pulse wave velocity (ePWV)—in the prognosis of subarachnoid hemorrhage (SAH). While the intentions are clear, several aspects of the study raise significant concerns that demand attention.

1. **Methodological Weaknesses**

The study relies on data from the MIMIC III and IV databases, which, though extensive, are often subject to well-known limitations in retrospective cohort designs. Selection bias is a primary concern, especially given that the authors excluded traumatic SAH cases. The justification for this exclusion is not sufficiently explained, leaving open the question of whether their findings are truly generalizable to all SAH cases or merely a subset. Additionally, the lack of granularity in describing how the ePWV

values were measured and standardized is a glaring omission. Pulse wave velocity (PWV) can be influenced by numerous factors, and a single estimate may not accurately capture arterial stiffness variability across patients.

2. **Over-reliance on Statistical Associations**

While the authors present statistically significant associations between ePWV and both 30-day and 1-year mortality, the study suffers from an over-reliance on statistical significance without adequate exploration of clinical relevance. The hazard ratios (HRs) provided—1.77 for 30-day mortality and 1.97 for 1-year mortality—appear modest. In a clinical setting, these ratios, though statistically significant, may not translate into actionable information for treating SAH patients. The study could have benefited from a deeper discussion on the clinical impact of these findings and their utility in day-to-day medical decisions.

3. **Superficial Subgroup Analyses**

The subgroup analyses add some depth to the study but come across as superficial. The decision to stratify by conditions such as atrial fibrillation, renal failure, and chronic obstructive pulmonary disease appears arbitrary, without solid grounding in prior literature on SAH. Additionally, the authors fail to provide any meaningful interaction analysis to show whether these conditions truly modify the relationship between ePWV and mortality. Without this, the subgroup results seem more like fishing for significant p-values rather than deriving clinically useful insights.

4. **ROC Curves and Predictive Value**

The use of ROC curves to compare the predictive value of ePWV with the SOFA score raises additional questions. While the area under the curve (AUC) values suggest a slight improvement in prediction (0.740 vs. 0.664 for 30-day mortality), this marginal gain does not justify the additional complexity introduced by including ePWV as a predictor. Moreover, the paper does not explore the implications of this improvement in prediction—what does a 0.076 increase in AUC mean for clinical outcomes? How does this impact decision-making in intensive care settings? These are critical considerations that the paper overlooks entirely.

5. **Lack of Mechanistic Insight**

One of the most significant shortcomings of the paper is its failure to offer any mechanistic insight into the association between ePWV and mortality in SAH patients. The connection between arterial stiffness and SAH prognosis is hinted at but never fully explored. A discussion on potential biological pathways or interactions between arterial stiffness and cerebrovascular health in the context of hemorrhage would have elevated the study’s impact. Without this, the paper feels like a black-box statistical exercise devoid of clinical or biological insight.

6. **Conclusion: A Premature Endorsement**

The study concludes that ePWV may have predictive value for mortality in SAH patients but tempers this with the caveat that further research is needed. This hedging is appropriate, given the various limitations, but it also highlights a critical flaw—the premature endorsement of ePWV as a prognostic tool. Given the modest hazard ratios, the questionable generalizability of findings, and the limited clinical insight provided, the paper ultimately raises more questions than it answers.

Final Verdict:

This study, while interesting in its approach, ultimately falls short of providing compelling evidence for the use of ePWV as a prognostic tool in SAH patients. Its methodological weaknesses, lack of clinical applicability, and superficial analyses make it a paper that is unlikely to shift the paradigm in SAH prognosis. Further research, preferably with prospective data and mechanistic exploration, is needed before ePWV can be recommended for clinical use.

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Chen M, Fan H, Xie L, Zhou L, Chen Y. Association between estimated pulse wave velocity and the risk of mortality in patients with subarachnoid hemorrhage: a retrospective cohort study based on the MIMIC database. BMC Neurol. 2024 Oct 22;24(1):408. doi: 10.1186/s12883-024-03897-5. PMID: 39438839.