

05. Diagnostic Value of Pleural Fluid N-Terminal pro-Brain Natriuretic Peptide Levels in Patients with Cardiovascular Diseases

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Background: Pleural effusion is a prevalent complication of multiple pathologies leading to annual incidence of 3000 cases per million. The delay in diagnosing the cause of pleural effusion and treatment of the underlying cause is the major factor of mortality. **Objectives:** The study aims to analyse the accuracy of pleural pro-BNP in evaluating the cardiac causes of pleural effusion. **Methods:** A systematic review and meta-analysis was conducted according to PRISMA guidelines. A comprehensive literature search was performed across PubMed, Google Scholar, and ClinicalTrials.gov databases for studies published between 2016 and 2026. A total of 326 studies were identified using predefined search terms related to pleural effusion and N-terminal pro-brain natriuretic peptide (NT-proBNP/pro-BNP). Following duplicate removal and title and abstract screening using Zotero software, 48 studies underwent full-text review. Of these, 16 studies met the inclusion criteria and were included in the final systematic review and meta-analysis. Eligible studies included prospective and retrospective observational studies involving adult patients with both cardiac and non-cardiac causes of pleural effusion and retrievable outcome data. Studies involving pediatric populations, animal studies, review articles, editorials, duplicate publications, and conference abstracts without sufficient data were excluded. Data extraction was performed independently using Microsoft Excel sheets. Statistical analysis was conducted using Review Manager (RevMan) and R Studio software. A random-effects model was applied to calculate pooled diagnostic estimates. Heterogeneity was assessed using Cochran's Q test and I² statistics. Risk of bias assessment was performed using the Newcastle-Ottawa Scale and ROBINS-E tool. Forest plots and funnel plots were generated to evaluate pooled outcomes and publication bias respectively. **Results:** 16 studies involving patients with both cardiac and non-cardiac pleural effusions were included in the pooled analysis. Pleural fluid NT-proBNP/pro-BNP levels were significantly elevated in patients with cardiac pleural effusion compared to non-cardiac etiologies. The pooled diagnostic sensitivity of pleural NT-proBNP for identifying cardiac pleural effusion was 92% (95% CI: 88%–95%), while pooled specificity was 89% (95% CI: 84%–93%). The pooled positive predictive value was 90% (95% CI: 86%–94%) and the negative predictive value was 87% (95% CI: 82%–91%). Meta-analysis demonstrated significant diagnostic accuracy favoring pleural NT-proBNP

as a biomarker for differentiating cardiac from non-cardiac causes of pleural effusion. Moderate heterogeneity was observed among the included studies (I² = 46%; p = 0.03), likely attributable to variations in diagnostic cut-off values and assay techniques. Funnel plot analysis demonstrated minimal publication bias, and overall risk of bias assessment revealed low-to-moderate methodological bias among included studies. **Conclusion:** Pro BNP levels can aid in distinguishing cardiac from non cardiac causes of pleural effusion. Early detection of cause with accuracy.

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