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Perspective

Accuracy and Role of Transthoracic Echocardiography in Suspected Acute Atraumatic Thoracic Aortic Syndrome

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INTRODUCTION

Thoracic Acute Syndrome (TAS) mainly represents Thoracic Aortic Dissection (TAD), Intramural Haematoma (IMH) and Penetrating Aortic Ulcer (PAU). TAD accounts for about 95% of the cases, with almost 2 in 3 due to type A and the rest to type B. TAD has a high mortality and morbidity, though the mean annual incidence is only 6-8 per 100,000 populations. The clinical presentations are usually chest, back and/or abdominal pain with or without features of mal-perfusion syndrome. About 25% of patient's experience delays in diagnosis within first 24 hours from presentation and misdiagnosis is estimated to be over 33% with obvious devastating consequences. This along with other factors has led to the recent call to improve diagnostic pathway in TAD.

Currently, Aortic Dissection Detection Risk Score (ADD-RS) that is the common clinical decision tools for TAD, has a low sensitivity and D-dimer as the only useful blood biomarker has a low specificity. Computer tomography imaging is the definitive diagnostic tool for TAD, though if performed unselectively it exposes patients to unnecessary anxiety, radiation and contrast media as well as a negative impact on health resources and economics. Bedside focused Transthoracic Echocardiography (TTE) has shown promising potentials in effective and efficient diagnosis of TAD.

DESCRIPTION

In a recent systematic reviews and meta-analysis, our group has shown that TTE has high specificity for type A and B TAD, a moderate to high sensitivity for type A but poor for type B TAD and unclear diagnostic accuracy for IMH and PAU. Our study also demonstrated that the misdiagnosis rate and time to the definitive TAD diagnosis was significantly reduced by utilizing TTE. However, there was a wide variation in selectiveness, timing, protocol and operators of TTE, amongst other heterogenicity and biases. Additionally, the role of TTE alongside ADD-RS and D-dimer in the overall diagnostic pathway of suspected TAD in acute settings needs more investigation.

Nazerian, et al., demonstrated that an approach that combines ADD-RS ≤ 1, negative TTE for direct sign of TAD (intraluminal intimal flap) and D-dimer <500 ng/mL had 100% (95% CI 82.8-93.6%) sensitivity, 58.7% (95% CI 55.0%-62.4%) specificity, 32.8% (95% CI 28.4%-37.3%) PPV and 100% (95% CI 99%-100%). Morello, et al., has illustrated that a suspected TAD diagnostic strategy TTE and age-adjusted D-dimer in ADD-RS ≤ 1 could safely rule out TAD and significantly reduced advanced aortic imaging with acceptable levels of missed cases to clinicians. The same group had previously shown that ADD-RS>1 combined with presence of TTE direct sign for type A TAD had 24% (95% CI 13%-38%) sensitivity, 98% (95% CI 96%-99%) specificity, 75% (95% CI 48%-93%) PPV (Positive Predictive Value) and 86% (95% CI 81%-90%) NPV (Negative Predictive Value).

On the other hand, Wang, et al., investigated the performance of a TTE indirect sign (thoracic aortic aneurysm) for type A TAD alongside AAD-RS. Ascending aorta diameter >40 mm and ADD-RS ≥ 1 had 84.6% sensitivity, 87.6% specificity, 76.7%, PPV and 92.2% NPV. Furthermore, patients with ADD-RS ≥ 2, aneurysm as diagnosed by TTE had 98.1% specificity, 24.4% sensitivity, 86.4% PPV and 72.8% NPV for type A TAD. Nazerian, et al., found that when TTE direct and indirect signs for TAD are absent and D-Dimer is negative ADD-RS ≤ 1 cohort, sensitivity is 100% (95% CI 97.3%-100%), specificity is 48.4% (95% CI 44.6-52.15), PPV is 18% (95% CI 24.2%-32.2%) and NPV 100% (95% CI 98.8%-100%).

Nevertheless, there are questions that remain largely unclear before proposed integrated algorithm could become widely implemented. Is ADD-RS the most optimal clinical decision tool for TAD? Are different D-dimer assays, including point-of-care, perform the same in the pathway? What is the exact timing and protocol for bedside focused TTE? There are also cautions that need to be exercised, as TTE has low sensitivity for type B TAD, IMH and PAU. The PPV and NPV needs closer attention as the

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prevalence of TAD could vary in different settings and hospitals. There is also a need to define minimum competencies, training and education required for performing and interpreting TTE by frontline clinicians along with the other ongoing governance and administration challenges. It is also paramount to analyses resource requirements, cost-effectiveness, equity, acceptability and/or feasibility of utilizing bedside focused TTE for suspected TAS. This may include qualitative studies to investigate the facilitators, barriers and perspectives of patients and clinicians.

CONCLUSION

Nevertheless, the evidence so far shows promises that in suspected Type A TAD, integrated pre-test probability using ADD-RS and focused bedside TTE could help stratify CT scan in low-risk cases. When TTE and D-dimer are negative in patients with ADD-RS ≤ 1, type A TAD could almost certainly be ruled out. However, in cases where the patient is unstable, type B TAD or IMH or PAU is suspected, ADD-RS>1 urgent advance aortic scanning should be performed without any delay.