Effectiveness of intravascular lithotripsy for calcified coronary artery disease: A systematic review

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ABSTRACT

Introduction: Coronary artery calcification (CAC) is commonly encountered in patients with coronary artery disease (CAD) and poses significant challenges during percutaneous coronary interventions (PCI). Heavily calcified lesions are associated with complications such as vessel perforation, restenosis, and stent thrombosis. Intravascular lithotripsy (IVL) is a newer modality that uses pulsatile acoustic pressure waves to fracture calcified plaque, improving vessel compliance and enabling optimal stent deployment. This systematic review was conducted to evaluate the clinical effectiveness, safety, and cost-effectiveness of IVL for the treatment of calcified CAD. **Materials and Methods:** A systematic search was conducted using MEDLINE® (via Ovid), EBM Reviews, PubMed, US FDA, and INAHTA databases. Bibliographies of relevant articles were also manually searched. Only studies involving human subjects were included, with no language restrictions. The most recent search was performed on August 26, 2024. Eighteen studies meeting the inclusion criteria were included and assessed for study quality and critically appraised. **Results:** IVL demonstrated high clinical success rates in treating calcified coronary lesions, with two meta-analyses reporting success between 93% and 94.4%, defined as residual stenosis <50% post-stent and absence of in-hospital major adverse cardiovascular events (MACE). Procedural success ranged from 78.2% to 100%, and device success from 93.7% to 100%, with consistent definitions across studies involving residual stenosis <30% and TIMI III flow. Safety outcomes were favourable, with MACE rates reported between 2% and 8% at 30 days, and up to 12.6% in extended follow-up. Myocardial infarction (MI) rates were low (1%–5%), and overall mortality was reported at approximately 2%. No significant differences were observed between IVL and rotational atherectomy (RA) in terms of adverse outcomes. Complications such as coronary dissection, stent thrombosis, or perforation were rare. IVL received regulatory approval from the US FDA, CE mark in Europe, and registration with the Malaysian Medical Device Authority. Economically, one study indicated potential cost savings of £398 per PCI when using IVL compared to RA, due to reduced use of consumables. **Conclusion:** There is robust evidence supporting the effectiveness and safety of IVL in treating calcified CAD. The procedure shows high success rates, a favourable safety profile, and potential long-term cost benefits. IVL represents a promising and practical option for complex coronary interventions, particularly in heavily calcified lesions.

Keywords: Intravascular Lithotripsy, coronary artery disease, coronary calcification