Piezoelectric-assisted aortic valve repair

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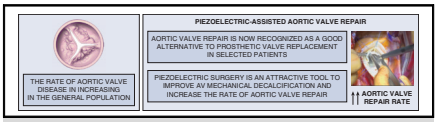

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CENTRAL MESSAGE

Aortic valve repair and shaving of calcifications to mobilize adequately pliable cups are increasing. A piezoelectric scalpel may enhance precision by reducing hazards of fragile tissue damage.

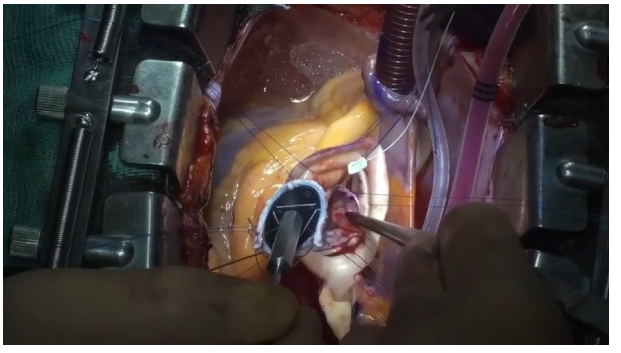
Video clip is available online.

Indications for aortic valve repair are steadily increasing.[1] Shaving of calcifications is often necessary to mobilize adequately pliable cusps, especially in bicuspid anatomy, which most commonly comprises a calcified raphe. Eccentric aortic insufficiency–derived turbulence also produces free edge thickening, typically of the nonfused cusp.

A piezoelectric scalpel may enhance precision by reducing hazards of damage to the fragile tissues. So-called piezosurgery is based on technology exploiting the piezoelectric effect to generate ultrasonic frequency vibrations of specific ceramics and crystals that deform applying alternating current. Mineralized tissue can be debrided at 24 to 29 kHz, whereas frequencies more than 30 kHz are necessary to cut hard tissues. Conversely, neurovascular tissues require frequencies more than 45 to 50 kHz. Thus, the energy range for calcium debridement is unlikely to compromise soft tissues, which renders this approach attractive in cardiovascular surgery.

This technology is commonly used in oral, craniofacial, orthopedic, and neurological surgery (Mectron SpA).[2-4] The transcatheter approach for lithotripsy of calcified aortic stenosis has been attempted anecdotally.[5] We used the piezoelectric scalpel uneventfully in 5 aortic valve repairs (3/5, bicuspid; 2/5, tricuspid; Video 1). Geometric subannular ring implantation (HAART, Biostable) and cusp plication completed the repairs, which remained stable at control echocardiograms. The device allowed smooth and precise removal of fibrosclerotic, calcified material avoiding undue traction and damage to delicate adjacent tissues. Micro-debris was aspirated on the operative field conventionally, although an integrated device would be helpful. No leaflet perforation or tear occurred, despite implantation of a rigid ring. Whether this technology could be helpful in other pathology or conditions in cardiac surgical candidates remains to be evaluated.

This technological approach is an attractive improvement to mechanical decalcification, particularly in relation to cusp fragility during aortic valve repair. Further experience is warranted to validate indications for piezoelectric devices in cardiac surgery.



VIDEO 1. A case of aortic valve repair with the use of the piezoelectric scalpel. Video available at: https://www.jtcvs.org/article/S2666-2507(24)00258-X/fulltext.

Conflict of Interest Statement

The authors reported no conflicts of interest.

The *Journal* policy requires editors and reviewers to disclose conflicts of interest and to decline handling or reviewing manuscripts for which they may have a conflict of interest. The editors and reviewers of this article have no conflicts of interest.

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