Letter to the Editor

A biological model for biomechanical testing of median sternotomy closure

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We read with interest the recent article by Casha et al. [1] on fatigue testing median sternotomy closures. Their model is based on 2.5-cm cut samples of sheep sternal bones, wired in the standard trans-sternal, figure-eight, and peristernal fashion; additionally, no. 5 gauge polyester and stainless steel bands were used. The authors conclude that use of polyester and figure-eight closures requires caution because they cut through bone faster than the wire closure [1]. Casha et al. illuminated a largely unresolved issue—superiority of one sternotomy closure technique over the other. The adequacy of their model is an open question, however. The human sternum’s anatomy is complex; thickness varies considerably from the manubrium to the structure’s most distal part. Strength consequently varies at different points, with direct effect on closure stability. Casha’s model investigated the closure properties of single sternal fragments, but not the complex properties of the entire sternotomy closure, which consists of several loops of closing material placed at variable distances from one another, and overlying bone of varying thickness and strength.

Casha’s group tried to avoid bias in applying complex statistics, including measurement of bone thickness and cortex/medulla ratio [1], but their study did not include analysis of the specimens’ bone quality, which is important for successful osteosynthesis. Published studies indicate that, as in humans, sheep suffer from osteoporosis and osteodystrophy. These can be diagnosed reliably using X-ray densitometry [2]. Did Casha’s group note the possibility of error in their results associated with the sheep’s osteodensitometry status variability?

The authors comment that polyester produces a less rigid closure than stainless steel, a major limitation. Other clinical research articles have reported improved closure and reduced tissue damage associated with polyester tapes [3]. Literature from experimental [4] and clinical [5] settings confirm that less rigid sternotomy closure, using resorbable synthetic materials such as polydioxanone, (PDS, Ethicon) are most successful. It remains for Casha’s modeling techniques to be compared with overlapping figure-eight and combined parasternal–peristernal (Robicsek) wiring methods, augmented closures claiming optimal sternal stability and reliability.

Despite some questions about study design and its relationship to earlier reports, Casha’s study represents an important step that should be followed by comparison with analogous experiments utilizing whole human cadaveric sternae.

References


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