Commentary

Sternal instability and eventual disruption of the sternal closure is a significant factor in the postoperative morbidity and mortality for the prevention of which numerous new suture materials, fixation devices, and technical innovations have been proposed. It is evident, however, that the quest for the solution to sternal instability must begin with the understanding of the underlying causes.

The integrity of the reunited sternotomy depends on static and dynamic elements in apposition: the holding power of the sternal sutures and the compactness of the sternal body on one side and the strain exerted by the traction of the respiratory muscles and also the intrathoracic pressure fluctuation on the other. The outcome of this ongoing competition of forces will decide whether the sternotomy closure "will hold" or not.

The article of McGregor and associates is dedicated to one aspect of this physiologic struggle, that is, quantitative vectorial analysis of the traction forces in the

human cadaver model. The strength of these forces was measured by the degree of separation of the approximated sternum that occurred as a result of the wires cutting the bone.

The shortcoming of this otherwise very valuable study is the fact that these consecutive tests involving traction forces of increasing magnitude were performed on the same cadaver; thus the authors reused the sternum already weakened by one or two previous experiments. This detracts from the validity of the final postulates.

Comparing the effects of traction forces acting in different direction, they found that those with lateral orientation threatened most the integrity of the sternotomy suture line. This is not surprising, considering that the direction of the sternal wire sutures is horizontal, directed bilaterally; thus bilateral traction acting in the opposite direction placed the highest stress on the wire sutures. This not only puts the integrity of the sutures in jeopardy but also allows the force to act directly and undiminished at the bone over a small surface area, thus making the cutting into the sternum likely. Given the fact that the wires seldom cut into the sturdy manubrium, with the wires being broken below, the manubrium will act as a pivot on which the sternum may shift like a lever. Their findings, that the area that will be least resistant to pulling forces is indeed the point farthest from the pivot, in this case the xiphoid process, was also predictable. The article concludes that closure techniques designed to minimize wire migration into the sternum should be developed and that sternal stability should be achieved by mechanical reinforcement near the xiphoid. I postulate that there are already techniques available that prevent wire migration, such as the application of bands in lieu of wires or, more preferably, buttressing of the sternal edges by parasternal weaving. If the wires are prevented from cutting into the sternum, further reinforcement at the level of the xiphoid or anywhere else is no longer a necessity.

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