The quest for ideal sternal closure: Not as simple as it sounds

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Sternal instability due to suboptimal sternal closure is problematic, causing pain, infection, disability, and increased costs. The determinants of sternal instability are so inextricably intertwined that it is difficult to single out what led to the sternal instability in the first place. These determinants could be related to the patient, procedure, surgical technique, or hardware.

Because patient- and procedure-related factors cannot easily be controlled, emphasis has been placed on optimizing surgical technique and developing a plethora of novel sternal closure platforms. The ideal sternal closure system would be simple, fast, reproducible, radio-opaque, durable, easily removable in an emergency or redo operation, free of infection risks, cost-effective, and able to provide rigid stable fixation.

Over the years, the literature has been deluged with studies comparing different sternal closure platforms and techniques. To make matters worse, there is no consensus on what constitutes the ideal standard wire closure because myriad wiring configurations are used in practice.1 A study by Schimmer and colleagues2 pointed out great variability among not only the sternal closure systems being used, but also surgeons’ perceptions regarding risk factors.

Marasco and colleagues3 compared standard wire closure with closure by tie bands (ZipFix; DePuy Synthes Inc, West Chester, Pa). The primary end points were sternal pain and analgesic use; the secondary end point was sternal movement assessed by ultrasonography. Not surprisingly, the authors found no significant advantage of closure with ZipFix ties over simple wire closure. Furthermore, at 4 weeks, patients in the ZipFix study arm had significantly more sternal instability.

The study also has some notable limitations. The study was underpowered to examine crucial secondary end points such as deep sternal wound infections and malunion. Computed tomography to test for sternal malunion was not routinely performed, and ultrasonography to test for sternal instability at 4 weeks was performed in only 29 patients in the ZipFix-tie arm and in 28 patients in the standard wire closure arm. High-risk patients were excluded. Only a few patients with osteoporosis were included; theoretically, ZipFix ties may have an advantage in such patients by not cutting through bone. Furthermore, the authors did not mention whether their technique was modified for any technical misadventures such as sternal fracture or off-midline sternotomy.

When used in actual patients, ZipFix ties appear to have critical shortcomings because they do not adequately compress and stabilize the sternum to protect against the myriad forces that act on it from different directions. According to the orthopedic literature, the most critical part of bone healing is stable, rigid fracture reduction,4,5 which cannot be attained with simple wiring configurations or ZipFix ties. Both methods address only unidirectional distraction forces on the sternum. On the contrary, recent clinical trials have shown better results for rigid plate fixation than for wire closure.6-8

The results of the current study do not show sternal closure with ZipFix ties to be a promising solution. However, further studies that are powered to examine sternal wound infections and malunion and have longer follow-up are needed.
References