Experience using a flexible reinforced fiber suture for sternal closure in bilateral lung transplantation recipients undergoing bilateral transverse thoracosternotomy

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Bilateral transverse thoracosternotomy for sequential bilateral lung transplantation (BLTx) offers improved exposure of the hilum, mediastinum, and pleural spaces, but sternal complications are a common consequence of this approach. Complications such as dehiscence, sternal instability, infection, and chronic pain can require operative intervention. Common risk factors for sternal complications in transplant recipients include immunosuppression, malnutrition, and chronic corticosteroid use. Several techniques using stainless-steel wires have been promoted to reduce the risk of sternal complications,1,2 and sternal plating has also been recommended in high-risk or redo situations.3

Because of complications from sternal wire (SW) closure, our institution started using the Arthrex FiberTape Sternal Closure System4 as an alternative to a reinforced SW closure.1 We present our early outcomes using this technique of transverse thoracosternotomy closure in BLTx recipients.

MATERIALS AND METHODS

We performed a retrospective review of BLTx recipients from the University of Pittsburgh Medical Center from January 2021 to January 2022 who underwent bilateral transverse thoracosternotomy with traditional reinforced SW closure or with FiberTape. Patients were reviewed for early postoperative sternal complications including infection, chronic pain, instability, and dehiscence that required operative intervention. Our lung transplant surgery group transitioned completely to FiberTape closure in July 2021. BLTx, including closure, is completed by a single group and the technique is standardized. Demographics including age at time of transplant, sex, body mass index, and diagnosis were obtained for the 2 groups.

RESULTS

Fifty patients underwent BLTx with a clamshell incision requiring sternal approximation. Twenty-eight recipients had SW closure, and in 22 recipients FiberTape was used. There was no difference between the demographics of the 2 groups (Table 1). In the traditional stainless-
steel SW cohort, 28.6% of patients (8/28) had sternal complications requiring operative intervention (Table 2). There were no sternal complications when FiberTape was used for sternal closure ($P = .006$). Figure 1 demonstrates postoperative images with this sternal closure system.

**Technique**

The ribs are approximated in standard fashion. We use 4 figure-of-8 #5 Ti-cron (Medtronic) bilaterally. Two FiberTape sutures are passed through the superior and inferior sternum. The needle is cut from the flexible fiber suture, and the suture is passed through the pretied knot on the loading device. Intercostal and sternum are approximated. The FiberTape is passed into the tensioning device, and the sternal edges are brought together with appropriate tension. One half-hitch knot is tied down on each FiberTape, and then the intercostal sutures are tied. The tension process is repeated on the sternal closure. After appropriate tension is obtained, 5 knots are thrown, and suture tails are cut (Video 1). Muscle and subcutaneous tissues are closed in layers with absorbable suture, and skin is approximated with staples. If urgent reentry is required, FiberTape is easily cut with Mayo scissors.

**Adjunct Technique**

The flexibility of the reinforced suture allows for the combination closure technique with plating. Instead of using the plating screws, the FiberTape can be passed through the plates, and tension can be distributed with the Arthrex tension device. This is used in recipients at high risk of sternal dehiscence due to bone fragility, delayed closure, and short-telomere syndrome. A picture of this adjunct technique is included within the Video 1. This plating + FiberTape was not included in the comparison of cohorts.

**DISCUSSION**

Sternal complications are common after BLTx with transverse thoracosternotomy. Our institution used a reinforced wire technique described by Oto and colleagues, yet there was still a high incidence of SW pull-through.

### TABLE 1. Demographics

|                      | SW closure (n = 28) | FiberTape (Arthrex) closure (n = 22) | $P$ value |
|----------------------|--------------------|-------------------------------------|-----------|
| Age, y, median (IQR) | 64 (57-67)         | 63 (59-69)                          | .70       |
| Male sex, n (%)      | 18 (64)            | 16 (73)                             | .53       |
| Diagnosis, n (%)     |                    |                                     | .93       |
| COPD                 | 11 (39)            | 7 (32)                              |           |
| IPF                  | 11 (39)            | 10 (45)                             |           |
| Other                | 6 (21)             | 5 (23)                              |           |
| BMI, median (IQR)    | 24.8 (22.2-27.4)   | 26.0 (22.0-29.3)                    | .74       |
| Induction regimen    |                    |                                     | .42       |
| Alemtuzumab, n (%)   | 12 (43)            | 7 (32)                              |           |
| Basiliximab, n (%)   | 16 (57)            | 15 (38)                             |           |

SW, Sternal wire; IQR, interquartile range; COPD, chronic obstructive pulmonary disease; IPF, idiopathic pulmonary fibrosis; BMI, body mass index.

### TABLE 2. Description of sternal complications in the sternal wire cohort

| Complication                                      | Days after transplant | Operative intervention                                      |
|---------------------------------------------------|-----------------------|-------------------------------------------------------------|
| 1 Sternal dehiscence, deep surgical site infection, wires pulled through bone | 40                    | Multiple washouts; wound vac; eventual closure and pectoral muscle flap with plastic surgery |
| 2 Increased anterior chest wall pain, instability from sternal dehiscence | 29                    | Washout, wire removal, sternal plating system |
| 3 Sternal override, wires visible in superficial incision | 12                    | Washout, wire removal, sternal plating system |
| 4 Delayed deep wound infection, infected hematoma | 237                   | Washout, wire removal, wound vac |
| 5 Superficial sternal wound developed after proning | 12                    | Wound vac, delayed primary closure, musculocutaneous flaps with plastic surgery |
| 6 Sternal dehiscence, instability, wires pulled through bone | 12                    | Sternal ZIPFIX (DePuy Synthes) closure |
| 7 Deep surgical wound infection                    | 225                   | Debridement, wound vac |
| 8 Sternal instability, clicking                     | 15                    | Rewiring of sternum and primary closure |
The incidence of sternal complications in the literature ranges from 8% to 46%, and our outcomes using stainless-steel wires are within that range. Given a high occurrence that requires operative intervention, other methods of sternal closure were evaluated.

CONCLUSION

Although these are just early outcomes in a single institution, we are satisfied with the results using FiberTape. The FiberTape system allows sternal approximation the same as SW, but the fabric reinforced tape does not pull through fragile bone. The tension device engages and sets the appropriate amount of compression. This method is just as efficient as SW and is easy to remove in need for reexploration. We have demonstrated no short-term complications with its use. It is a reasonable alternative to standard stainless-steel wire closure.

References

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FIGURE 1. Sagittal computed tomography images of the sternum at (A) 12 days and (B) 6 weeks, and (C) lateral chest radiograph 6 months after transplant.

VIDEO 1. Detailing the steps of bilateral transverse thoracosternotomy closure using the Arthrex FiberTape Sternal Closure System. Video available at: https://www.jtcvs.org/article/S2666-2507(22)00284-X/fulltext.