

Comparison between Figure of Eight Trans-Sternal and Figure of Eight Peri-Sternal Wiring In Median Sternotomy Closure

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Abstract: Midline sternotomy is established as the gold standard for variety of open heart operations. Sternal dehiscence after the operation is recognized devastating complication. The established closure technique uses steel wires in either figure 8 or simple interrupted suturing methods. In this typical technique, the steel wires are pushed across the each half of sternum. However peristernal and pericostal placement appears to reduce sternal damage, many surgeons use trans-sternal figure 8 wires for sternal fixation. In this study we have compare between peristernal and trans-sternal wiring. 50 cases selected prospectively. Fifty patients undergoing elective cardiac surgery via complete median sternotomy at a single institution were randomly assigned. The groups were well matched. In 25 cases sternal closer was done by three figure of eight trans-sternal wiring and in another 25 cases by three figure of eight peristernal wiring. Post operatively comparison was done for pain over sternum, peristernal collection/discharge, and sternal dehiscence, by examining patients at time of discharge, three month follow up and six month follow up. Our study suggest that peristernal wire technique provide better sternal stability than trans-sternal technique. Two patients in trans-sternal wiring group have complained of clicking and pain at sternum because of sternal instability

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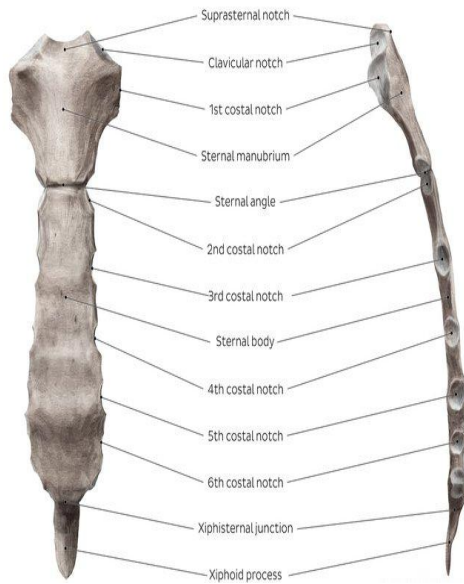
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I. Introduction

Since its very beginning in 1957 midline sternotomy is established as the gold standard for variety of open heart operations, however, not without adverse effects. Sternal dehiscence after the operation is recognized devastating complication, having incidence rates from 1%-25%. The risk of these complications is increased in those patients with obesity, diabetes, osteoporosis, COPD, and those who are over the age of 75. When not recognized during early postoperative period, it may result into complete sternal breakdown, infection, and thus into full blown mediastinitis, the later is linked with mortality ranging from 14% to 47%. More than three dozen varieties of sternal closure techniques have been known, all been claimed for superior postoperative stability of sternum. The established closure technique uses steel wires in either figure 8 or simple interrupted suturing methods. In this typical technique, the steel wires are pushed across the each half of sternum. However peristernal and pericostal placement appears to reduce sternal damage and weakening of sternal wire many surgeons use trans-sternal figure 8 wires for sternal fixation. Movement of sternum and its stability may be compromised within first few weeks postoperatively secondary to some unavoidable technical problems in bone, wire or surgical technique itself. Moreover, better results can be achieved when sternotomy closure results into marvelous rigidity with strength. Some researchers are strongly in favor of figure of 8 sternal wire closure technique, however is not adopted by many others, thus not falling into category of Gold standard approach.

While the cause of sternal events is multifactorial, research has shown that the most important factor in their prevention is a stable sternal approximation following median sternotomy. Inadequate sternal closure can lead to sternal instability and early, moderate and late surgical complications To this end, many have tried alternative closure systems to improve upon the standard method of steel wire cerclage used by the majority of cardiothoracic surgeons today. However these alternative closure systems which includes cables, plates, clamps, clips and merseline taps, have failed to gain wide spread adoption because of poor ergonomics and foreign techniques to expensive materials.

It is important to know anatomy of sternum and its mechanics for the cardiothoracic surgeons



.4 Sternal instability following first days after surgery can be associated with the density of bone and type of wire closure and other factors. . Chances of sternal wire cut through also depends on lateral distraction force over sternum, which depends on-

$$T = r l P.$$

here, T is the distraction force in Newtons, r is the average radial distance of the chest, l is the average length of the sternum, and P is the pressure applied to the chest walls. Lateral distraction occurs during breathing and coughing in a patient which cause the expansion of the thoracic cavity resulting in forces pulling the sternal halves away from each other.

Longitudinal distraction occurs during banding on one side or putting body weight on one arm

This force which is applied over sternum, now after sternotomy same force is distributed over points where wire encircle the sternum. Chances of cut through of sternum proportionate to force at unit point of sternum and inversely proportionate to density of bone between sternotomy margin and wire encircle site. Thus distribution of force at wider area will reduce force at unit area of sternum at wire encircling site and thus chances of bone cut through. This can be done by either putting more wire or/and more broad wires. More sternal bone density and encircling wire more away from sternotomy margins also will reduce chances of bone cut through. Thus looking to this mechanic same number of figure of eight wires put trans sternally will have more chances of bone cut though than wires put peristernally. But whether peristernal wire have other draw backs like compromising blood supply, fixing sternocostal joint is the issue. Thus purpose of this study is to compare between these two techniques. Diabetic obese patients is susceptible to activation of inflammation and involvement of sternum after sternotomy.⁵ Previous studies have shown that utilization of more wires for closing of sternum can increase wound sternal infections, therefore, selection of optimal closure technique with less wires may reduce wound sternal infections. At same times as looking to mechanics less number of wires will increase chances of bone cut through and thus favours putting more wires.

AIMS AND OBJECTIVES- Comparision between trans-sternal figure of eight wiring and peristernal figure of eight wiring in view of post-operative pain, sternal infaction, and sternal dehiscense.

II. Material And Methods

In this study after ethical comity approval 50 patients divided in two groups were selected. In 25 cases sternal closer was done by three figure of eight trans-sternal wiring and in another 25 cases by three figure of eight peristernal wiring. The 2 groups of patients were comparable for sex, age, preoperative risk factors, and operative procedures The demographic data and preoperative risk factors such as COPD, hypertension, ejection fraction, blood sugar status and renal disease (creatinine level higher than normal range), risk factors during surgery (duration of cardiopulmonary bypass) were recorded for all patients. In all fifty cases three figures of 8 wires were used with equal spacing throughout sternotomy, first upper wire was put in manumbrium trans-sternally in figure of 8 configurations. In half cases second and third wire was put trans-sternally while in other half's it were put peristernally. Sternal fracture patients and re-exploration cases were excluded. According to the patient self-rated numeric pain intensity scale, the diagnosis and evaluation of pain were based on structured interview with the patient that was included the severity, location, quality, duration, course, and timing of the pain, as well as factors that make the pain better or worse. Post operatively comparison for pain, peristernal collection/discharge, and sternal

dehiscense was done by examining patients at time of discharge, three month follow up and six month follow up.

III. Results

50 cases were selected which were comparable for age, sex, disease and operative procedure. Diabetic and COPD patients were excluded. In peristernal group no single patient had sternal instability on examination at time of discharge, three month and six month follow up. While in trans-sternal group out of 25 cases two cases came in three month follow up found to have sternum was unstable. No difference was found in pain score at sternal area. But out of 25 patients five patients had low Blood gas parameter and prolong icu stay out of which one patient deteriorated and ultimately died of icu sepsis while in trans-sternal group two patient had low blood gas parameter and prolong recovery.

IV. Discussion

Most study have compaire b/w figure of eight and standard simple wire techniques but no study has compaired b/w figure eight trans- sternal and peristernal techniques. In this study we compaire Between trans-sternal figure eight wiring and peristernal figure eight wiring in veiw of post operative pain, sternal discharge, and sternal dehiscense¹

V. Conclusion

Our study suggest that peristernal wire technique provide better sternal stability than trans-sternal technique of figure 8 wire closure and no difference was found in pain in sternum/peristernum area in both groups. Two patients in trans-sternal wiring group have complained of clicking and pain at sternum because of sternal instability. But in peristernum group there was unexplained slow recovery and more icu stay and one patient ultimately died while in trans-sternal group there was better functional recovery and early mobilization. It is difficult to conclude superiority of one technique over other as fate of two patients in trans-sternal group has to be followed.

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