See Article page 212.

Commentary: Funneling the funnel chest debates into appropriate management of adult pectus excavatum

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CENTRAL MESSAGE

Both Ravitch and Nuss procedures are comparable and successful. Type of surgery should depend on age, degree of deformity, and symptoms. Surgery should be considered only when benefit outweighs risk.

The funnel chest deformity, or pectus excavatum (PE), is a common chest wall anomaly, affecting up to 1 in 400 people.[1] It is not surprising, therefore, that artistic depictions of this deformity have been seen in imagery since ancient Egyptian and Renaissance times.[2,3] In 1594, Bauhinus described a patient with dyspnea and cough as a result of severe PE.[4] Despite the centuries' worth of professional interest in PE, however, this deformity continues to stimulate debate regarding its etiology and physiologic impact. Naturally, surgeons also debate the best corrective procedure, the best age to perform it, and even whether its effects can be resolved with surgical correction.

Apart from the visible deformity, patient symptoms may range from entirely asymptomatic to psychologically suffering from body image embarrassment to cardiopulmonary symptoms of dyspnea, fatigue, and chest pain.[5] When symptomatic, PE may cause significant decreased quality of life and even a shorter life expectancy than matched controls.[6]

Once intrathoracic surgery became possible in the 20th century, surgeons began attempting to correct PE. Numerous procedures have been described, but currently the most commonly performed are various modifications of either the open "Ravitch procedure" (RP), reported by Mark Ravitch in 1949, which involves bilateral resection of deformed costal cartilages with sternal osteotomy,[7] or the minimally invasive "Nuss procedure" (NP), first performed by Donald Nuss in 1987, where a substernal steel bar is placed through small incisions.[8] Other concepts in treating this deformity with silicone implants or external devices such as the magnetic mini-mover procedure and the vacuum bell suction cup are yet to be established in the standard of care.

Although some may assume that the minimally invasive NP is the current standard of care, the literature does not support this conclusion, as evidenced by numerous comparative studies. A recent systematic review based on procedure and age showed that adult patients who had undergone the NP experienced longer hospital stay, more hardware displacement, and more epidural analgesia (7.3 days, 6.1%, 3 days) than adult patients who had undergone the RP (2.9 days, 0%, 0 days). Patients who had undergone the NP also experienced greater complication rates (pediatric 38%; adult 21%) than patients who had undergone the RP (12.5%; 8%).[9] Another meta-analysis in 2010 comparing RP and NP showed no significant difference in overall complication rates, length of hospitalization, time to ambulation, or patient satisfaction between the 2 techniques. Conversely, the rates of reoperation, pneumothorax, and hemothorax were significantly greater in the NP group.[10] Another report comparing NP, RP, and the Leonard modification of RP in 92 patients from a single

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institution found significantly greater hospital duration, overall cost, analgesic needs, and complication rates within the Nuss group.[11]

One recent study in this *Journal*, by Sollie and colleagues,[12] describes 61 adult patients who underwent modified RP with permanent titanium plates of pectus deformities (54 excavatum, 6 carinatum, and 1 mixed) over an 8-year period. In their early experience, significant complications including a cardiac injury with tamponade caused the need for re-exploration. With experience, these complications became much less frequent. A quality-of-life questionnaire revealed improvement in health (75%), breathing (75%), exercise capacity (65%), chest pain (59%), and self-esteem (8.2/10 from 6.6/10).[12] This study adds to the body of literature on RP for adult patients with PE. It also underscores that this operation for a benign condition in a young healthy individual should be approached with utmost care. Severe complications such as injuries to the heart, major vessels, lung, liver, and diaphragm, although rare may be fatal. The true incidence of these major complications is unknown but may be 0.1% for NP with most occurring during the learning curve.[13]

It is clear that although we continue to debate the merits of our preferred procedure over the shortcomings of all others, the jury is still very much out. Perhaps the operation with shorter incisions is not always best for this condition. Ultimately, the main lessons we can glean from the study of PE are that this condition has a wide spectrum of presentation, that surgical approaches to this disease are quite successful, and that these operations can sometimes be associated with significant complications. Based on these facts, we should funnel our knowledge into formulating common-sense algorithms for the management of PE according to the degree and shape of deformity, associated psychologic or physiologic impairment, age at presentation, previous procedures, and comorbidities. Whether open or minimally invasive, it is important to emphasize that any repair should be considered only when the benefit outweighs the risk.

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