Alternatives to Titanium Implants for Pectus Excavatum Repair

To the Editor:

The Annals published two articles reporting the disruption of titanium implants after chest wall resection or repair of pectus deformities [1, 2], concerning both the STRATOS system (MedXpert, Eschbach, FRG) and the MatrixRib Fixation System (Dupuy-Synthes, West Chester, Penn). Implant fracture occurred with a median follow-up time of 6.6 months to 2 years [1, 2]. The number of implants did not alter the risk of disruption. Anterior chest wall reconstruction was a risk because implants are challenged by combined tensile, bending, and rotational stress [2, 3].

These studies contain a couple of important messages. Titanium implants offer satisfactory mechanical resistance for lateral chest wall reconstruction. They are still a privileged option for anterior chest wall reconstruction, offering initial stability in combination with a soft tissue patch; we may assume that periprosthetic fibrosis occurring during the first postoperative months will lead to a stable chest wall even if the implant is disrupted.

Stabilization after correction of pectus excavatum differs from chest wall resection by the younger age and increased exercise abilities of the patients. The chest wall should be stable enough 6 months after a Ravitch repair to enable planning for early removal of titanium implants before fatigue rupture [2].

However, compliance of the relatively soft titanium to the sternal elastic recoil results in anteroposterior bending stress, which may affect the final cosmetic result. We recently started to use a novel approach for pectus repair as described by Rudakov and colleagues [4], which represents a double innovation. First, staged subperiosteal resections of all deformed cartilages are performed through two short incisions in the submammary fold. Second, the sternum is lifted up and stabilized with an original nitinol implant (KRI bar, KIMPP, Moscow, Russia). The shape of this implant mimics a seagull spreading its wings: the wing-parts lie down laterally onto the ribs, and stabilizers may be added to neutralize rotational stress; the body part presents a slight depression hosting the sternum. Nitinol offers two fundamental properties: thermomodulation and elasticity with memory of shape. The implant softens when cooled down and may be bent for easy insertion into a retrosternal tunnel created by blunt finger dissection; it pops back to its initially customized shape when heated above 27°C. Elasticity with memory of shape offers dynamic osteosynthesis with reduced pain [4].

simulate the complex stresses encountered in vivo. Use of a completely new system [3] is not a guarantee that clinical failures can be completely avoided, certainly not in the absence of well-documented test results.

Interestingly, the researchers from the clinic where the STRATOS system was developed did not contest our findings as published. In addition to the metallurgical arguments, this particular system was never designed to be removed, a feature that surgically poses quite a challenge when attempting to do so. Therefore, the entire design must be deemed to be flawed for pectus repair. The other important question is why we should not revert to Ulrich’s excellent and cheap Rehbein stainless steel material that was perfectly suited for repair of pectus deformities unsuitable for the now standard Nuss bar procedure [4]. The advantage of nitinol for this purpose is not immediately clear, and we should adhere to rigorous preclinical and clinical testing before introducing yet another expensive and unproven design.

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