Refinements In Surgery For Chest Deformity

Since 1987, when a surgeon at Children's Hospital of The King's Daughters developed a minimally-invasive surgery to correct sunken chest, the procedure has been adopted world-wide as a standard of care and continually refined to increase its effectiveness and safety, according to a paper published in the December issue of the *Annals of Surgery*. Coming more than two decades after the procedure was developed by surgeon Donald Nuss, the article summarizes the cases of 1,215 patients who had the Nuss Procedure at Children's Hospital of The King's Daughters and focuses on technical modifications which have increased both the success rate and the safety of the surgery.

"Any time new surgical techniques are developed, it is essential to review outcomes and share refinements, so that others can benefit from our experience," says surgeon Robert Kelly, one of the authors. Often described as sunken or funnel chest, pectus excavatum appears as an indentation of the chest toward the spine. It is the most common deformity of the chest wall, occurs in one in every 1,000 children and can range from mild to severe.

In years past, pectus excavatum was considered to be primarily a cosmetic concern, but an increasing body of research performed at CHKD and elsewhere documents that patients with uncorrected pectus excavatum often suffer shortness of breath and exercise intolerance. Before the development of the Nuss procedure, correction of pectus excavatum required radical, open chest surgery. In the Nuss Procedure, surgeons insert a curved medal bar through the chest cavity and under the sternum, popping the depression out. The bar is anchored to the ribs and remains in place for 2-3 years while the chest hardens into the proper position.

Although the Nuss Procedure is performed around the world, CHKD has emerged as the world's primary site of surgical training, research and treatment of pectus excavatum and a related condition called pectus carinatum, or pigeon chest, in which the cartilage protrudes outward. In reviewing the pectus excavatum surgeries performed since 1987, authors determined that 95.8 percent of patients who had the surgery had a "good to excellent anatomic result." During that time, and especially in the last decade, new instruments were developed with input from CHKD surgeons, according to the article. These include a stronger and more streamlined bar; an instrument specially designed to improve substernal tunnel creation; a stabilizer to prevent bar displacement; and titanium bars for patients with metal allergies

New surgical techniques were also developed to minimize risk when dissecting between the heart and the sternum in an extremely deep defect. These include:

- Dissecting two tunnels, one higher than the deepest part of the depression, and using the first tunnel to elevate the lowest part of the defect before the bar is inserted.
- Use of a chest suction cup to elevate the sternum.
- Introduction of a high resolution thorascopic camera into the chest as the procedure is performed.

The paper details a radical revision of CHKD's post-operative pain management and post-operative therapies, such as deep breathing exercises that patients should perform. Dr. Kelly believes that it's important to include the full range of surgical modifications to benefit centers around the world whose surgeons routinely perform the Nuss procedure. "The minimally invasive repair of pectus excavatum has become a standard of care," he said. "What we're demonstrating in this paper is that the procedure can be performed both safely and effectively."

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