



Stanford
Children's Health

Lucile Packard
Children's Hospital
Stanford



Chest Wall Program

chestwall.stanfordchildrens.org



Overview

The chest wall program at Stanford Children's Health is designed to evaluate and treat children and adolescents with chest wall deformities, including pectus excavatum, pectus carinatum and other chest wall anomalies. Many of these deformities are frequently noticed during puberty but may present much earlier in childhood. Our multidisciplinary team of pediatric surgeons, nurse practitioners, and staff will provide your child with a complete evaluation and treatment, as well as follow-up plans. Our goal is to help your child achieve the optimal function and cosmetic outcome for his or her chest wall abnormality. We recognize that each patient's needs are unique and we work with every child and his/her family to establish a customized treatment plan.

Our Care Team

Our care team includes an expert team of surgical professionals who take a compassionate, family-centered approach to care. Our team cares for each child in collaboration with other health care professionals, the child and the family. We believe this team approach leads to the best outcomes for the children we treat.

Pectus Carinatum

Also called “pigeon chest,” is a deformity of the chest characterized by a protrusion of the sternum and ribs. It occurs more often in boys and typically becomes more pronounced during early adolescence.



Pectus Carinatum

Evaluation

Your child will meet with our team at the Stanford Chest Wall Clinic, where we will obtain a complete medical history and perform a physical exam. We will also perform 3D mapping of your child's chest wall during the clinic appointment and may recommend additional diagnostic testing.

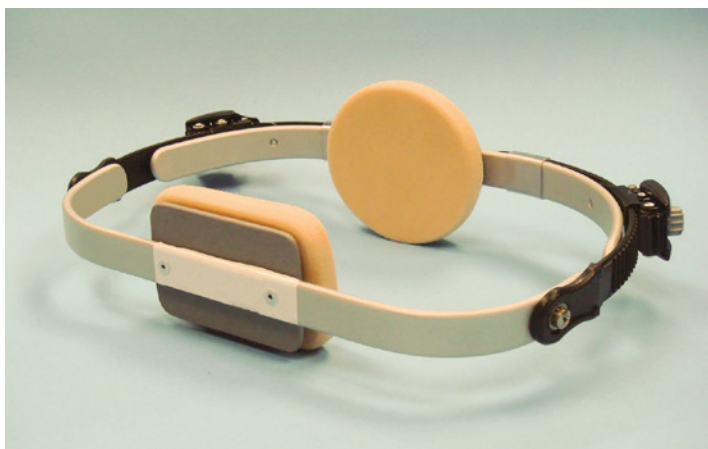
Treatment

One of the most common techniques used to address pectus carinatum is a nonsurgical bracing system that gradually decreases the degree of bony protrusion on the chest. This is accomplished with a specially fitted compression brace, which fits around the circumference of the chest and applies gentle pressure to reshape the chest over time.

The success of bracing is directly related to the amount of time your child wears the brace. In the initial period, we recommend he or she wear it for 16 to 20 hours a day. We will regularly evaluate your child in the clinic to follow his or her progress and adjust the bracing regimen as necessary.

Your child will be provided with a prescription for his or her custom-designed brace. A list of orthotics agencies we partner with has been provided for you.

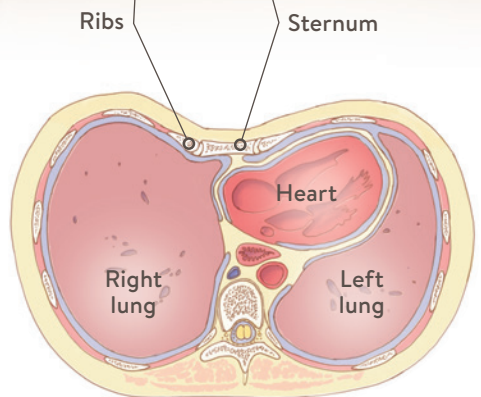
Surgical correction is an option for severe cases or for cases where bracing has failed.



Pectus Carinatum brace

Pectus Excavatum

Also referred to as “sunken chest,” is a depression in the chest wall. The depression may be in the center of the chest, or it may be more pronounced on one side. A child can be born with pectus excavatum, or he or she may develop the condition during the pubertal growth spurt. The condition may become more severe or apparent during periods of rapid growth. Early evaluation by a pediatric surgeon during the pre-pubertal period can help families gain an understanding of what to expect as their child matures and provide guidance as to whether intervention is optimal.



Pectus Excavatum cross section

Evaluation

We will obtain a complete medical history and perform a physical exam when your child meets our team at the Stanford Chest Wall Clinic. We may then recommend additional diagnostic testing to best prepare your child for the most appropriate intervention that fits his or her individual needs. These diagnostic tests may include the following:

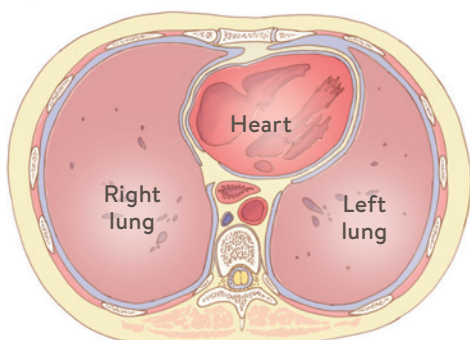
- X-ray, MRI or CT scan of the chest
- In-office 3D imaging of the chest wall
- Echocardiogram
- Pulmonary function testing
- Allergy patch testing

Once the work-up is complete, we will review with you the best options for your child. These may include the options discussed below.

Treatments

Vacuum bell

Mild to moderate pectus excavatum may be improved by a focused exercise regimen, a vacuum bell treatment or both. The vacuum bell is a nonsurgical treatment option for patients with mild to moderate pectus excavatum. While this procedure is nonsurgical, it should be used under the supervision of our care team. The vacuum bell is fitted to each patient so it sits comfortably on the chest. A bulb attached to the device generates negative pressure to create a vacuum, which raises the sternum over time. The vacuum bell must be



Normal cross section

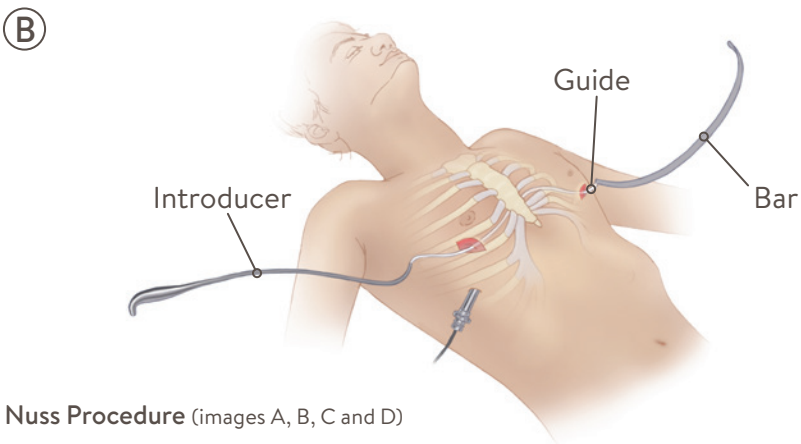
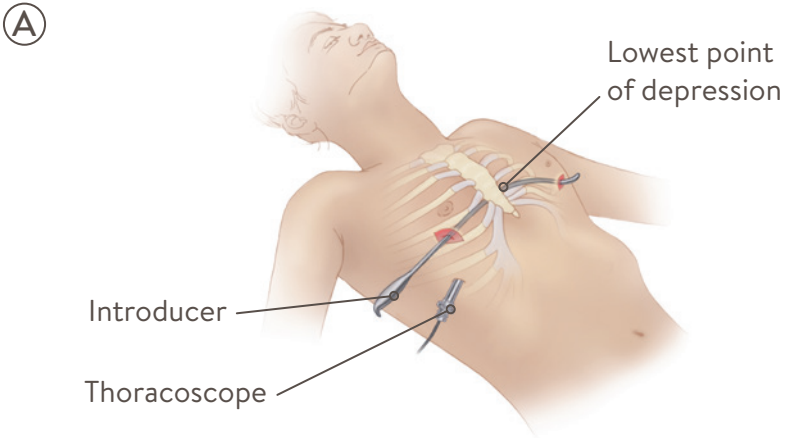


Vacuum bell

applied at regular intervals, ideally for up to two hours each session twice daily. The vacuum slowly pulls up the depressed area of cartilage. It may take several months of use to reach the maximum correction, and it may require up to two years of regular use to ensure a durable correction.

Nuss procedure

The most commonly performed surgical treatment for pectus excavatum is the Nuss procedure. During this minimally invasive surgical procedure, small incisions are made on each side of the chest so the surgeon can insert a metal support bar underneath the sternum to reverse the depression in the chest. Minimally invasive surgical techniques strive to minimize blood loss and operating times and can lead to a smoother, faster recovery.



Nuss Procedure (images A, B, C and D)

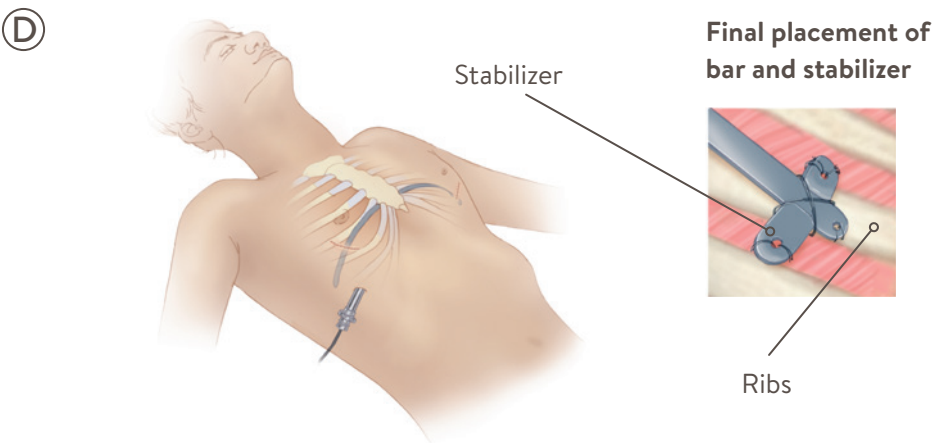
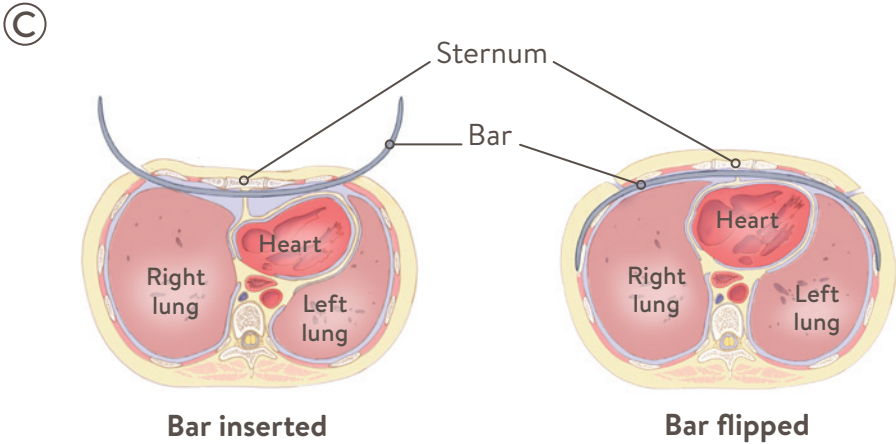
The bar is typically left in place for two to four years. Early bar removal can result in recurrence of the depression.

Bar removal

The procedure to remove the bar can be completed on an outpatient basis under general anesthesia.

Open procedure (Modified Ravitch procedure)

In certain rare cases, correction of pectus excavatum (and/or pectus carinatum) can be performed via a more invasive open surgical procedure. This technique involves an incision across the chest, excision of all deformed costal (rib) cartilages, and correction of the sternum. This option is available to patients with special circumstances.





Preparing for Surgery

Before surgery

Once your child's surgery is scheduled, you will be provided with specific information about when and where to arrive for surgery. Our anesthesia department will contact you to discuss your child's anesthetic plan and answer any questions you may have. Your child will be given an incentive spirometer (a device which is used to help keep the lungs healthy after surgery) to practice deep-breathing exercises prior to surgery. You will be given instructions for your child to start a gentle laxative regimen the day before his or her surgery to help prevent any discomfort he or she may experience due to post-operative constipation. You will also be given antiseptic wipes to clean your child's chest the night before and the morning of surgery to help reduce the risk of infection.

The hospital stay

For most pectus excavatum or pectus carinatum surgical repairs, patients should expect to stay in the hospital for four to seven days. Patients will be able to eat and move around immediately after surgery. During your child's hospital stay, our care goals will be to:

- Optimize pain control
- Work with physical therapy to develop strategies to transfer your child and help him or her move around comfortably
- Monitor the incisions to ensure proper healing
- Encourage your child to practice taking deep breaths using the incentive spirometer to help fully re-expand the lungs after surgery and prevent fluid or mucus build-up that could lead to the development of pneumonia

Returning home and follow-up

Your child will be discharged to your home once his or her pain is well controlled and he or she can move around independently. Your child will be provided with exercises to help aid in his or her recovery at home. There will be minimal care required for your child's incisions. We will typically ask to see your child for follow-up visits one month, three months, six months and one year after discharge. We will then arrange for a follow-up visit two years after surgery to evaluate your child's progress and discuss optimal timing for bar removal.

Frequently Asked Questions

1. What steps do I need to take to have my child evaluated in the Packard Children's Chest Wall Clinic?

Your primary care provider can make a referral to our clinic for evaluation. You can also call our surgery office directly and ask to speak with our staff to schedule an appointment. We recommend you bring the following with you to the appointment:

- New patient evaluation form
- HIPAA consent/acknowledgement form
- Copy of insurance card

2. How long does it take to complete any pre-operative testing?

Depending on the tests ordered, it may take one to two months.

3. Can any radiologic or allergy testing be done outside of Packard Children's?

Ideally, we would like our radiology service and allergists to be involved in the evaluation. However, we realize this is not always possible due to insurance or the family's distance from the hospital. We recommend all images and reports of studies be sent directly to our pediatric surgery office:

- Department of Pediatric Surgery
- 300 Pasteur Dr
- Alway Building, M116
- Stanford, CA 94305-5733

Remember that metal allergy testing may require certain panels that we can help clarify. Often, your child will undergo testing and then return to the allergist's office a few days later for interpretation.

3. What is the typical age for the Nuss procedure?

For optimal results, the Nuss procedure is typically offered during early adolescence, but it can even be performed with excellent results in adults. Each patient is evaluated on an individual basis to determine a treatment plan that best suits his or her needs.

4. Is surgery urgent?

Surgical correction with the Nuss procedure is never an emergency. This is a procedure that must be planned. Take your time, and prepare your family and your child for the procedure.

Other Rare Conditions of the Chest Wall

Chest wall anomalies include a broad spectrum of congenital conditions. All of these deformities should be evaluated by a pediatric surgeon. Some may require immediate repair while others may simply need to be observed over time. Examples of rare anomalies of the chest wall include:

Poland syndrome

This syndrome affects approximately 1 out of 30,000 births. It can include the following abnormalities:

- Absence of part or all of the muscles of the chest wall (pectoralis major, pectoralis minor, serratus anterior, rectus abdominus, latissimus dorsi)
- Absence of breast tissue or nipple deformities
- Fusion (syndactyly) or shortening (brachydactyly) of the fingers and toes
- Absence of axillary hair and a limited fat layer under the skin

Sternal cleft

This is a rare deformity that can be associated with congenital cardiac defects and abdominal wall defects. A sternal cleft is a gap in the sternum (breastbone) that can span part or the entire length of the bone. The gap in the sternum may impair breathing and can also result in decreased protection of the underlying organs, such as the heart and lungs.

Travel Information

We recognize that many of our patients must travel significant distances to reach us. If you need to make travel arrangements for your child’s hospital stay, Lucile Packard Children’s Hospital Stanford has a Housing Office that helps out-of-town families arrange accommodations near the hospital. The Housing Office works directly with each child’s family to ensure they have best possible accommodations. When families contact the Housing Office, they are provided with information about possible housing options, which may include:

Ronald McDonald House

Ronald McDonald House at Stanford provides a “home-away-from-home” and offers support for the families of children with life-threatening illnesses who are receiving treatment at Lucile Packard Children’s Hospital Stanford. Ronald McDonald House is a haven these families can call home, allowing them to give complete attention and support to their ill child.

Corporate Apartments

There are a few local corporate apartments that provide a discounted daily rate to families whose children are receiving treatment at Lucile Packard Children’s Hospital.

Lodging information and placement services are available whether your family needs a single night of lodging or many months. Please contact the **Housing Office at (650) 498-7971** for assistance.

Lucile Packard Children’s Hospital Stanford

Housing Office

700 Welch Rd, Ste 114-B
Palo Alto, CA 94304
Tel (650) 498-7971
Fax (650) 498-8007

Hours of Operation

Monday – Friday
9:00 a.m. – 6:30 p.m.



Locations

At Stanford Children's Health, we strive to provide world-class care in the neighborhood where you live. To better serve our patients, we have clinic locations throughout the San Francisco Bay Area.

Stanford Children's Health

– Los Gatos

Pediatric General Surgery
14601 S. Bascom Ave, Ste 200
Tel (650) 723-6439
Fax (650) 724-5344

California Pacific Medical Center

– California Campus

Pediatric General Surgery
3801 Sacramento St
San Francisco, CA 94118
Tel (415) 386-2749

Santa Clara Valley Medical Center

Pediatric General Surgery
751 S Bascom Ave
San Jose, CA 95128
Tel (408) 885-5940

Lucile Packard Children's Hospital Stanford

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730 Welch Rd, 2nd floor
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