Korean J Thorac Cardiovasc Surg 2012;45:418-420 □ Case Report □
ISSN: 2233-601X (Print) ISSN: 2093-6516 (Online) http://dx.doi.org/10.5090/kjtcs.2012.45.6.418

Silastic Molding Method for Pectus Excavatum Correction Using a Polyvinyl Alcohol (Ivalon) Sponge

Jun-Ho Lee, M.D., Sung-Jin Kim, M.D., Jeong-Ho Kang, M.D.,
Won-Sang Chung, M.D., Hyuck Kim, M.D., Soon-Ho Chon, M.D.

Pectus excavatum is rare, but it is the most common type of sternal congenital disorder. There are many surgical methods to correct pectus excavatum such as the Ravitch method, Wada method, Silastic mold method, and the Nuss operation. We report a case of minimal invasive surgery for pectus excavatum using a polyvinyl alcohol sponge.

Key words: 1. Minimally invasive surgery
2. Funnel chest
3. Polyvinyl alcohol sponge

CASE REPORT

A 15-year-old male had visited our outpatient clinic of Hanyang University Seoul Hospital due to pectus excavatum in 2007. He had no symptoms such as chest pain, dyspnea, or heart problems. However, he complained of cosmetic problems due to the appearance of his asymmetrical chest wall.

Echocardiography was performed to check for possible heart problems, and the results were normal. A pulmonary function test was performed to check for any lung problems, and the results presented a force vital capacity (FVC) of 4.06 L and a forced expired volume in 1 second (FEV1) of 3.68 L, showing a normal pattern of flow-volume. However, the patient wanted to undergo surgery to obtain a more symmetric chest wall. We recommended a follow-up visit because he was in rapid adolescent growth. Therefore, surgical treatment was delayed until his chest wall was fully developed.

In 2010, when he was 18 years old, he still wanted the operation for his pectus deformity. At that age, we assumed that he achieved full skeletal maturity. Therefore, we decided to perform surgical treatment for the pectus excavatum. Echocardiography and pulmonary function tests were performed. The results of the echocardiogram were an ejection fraction of 57%, normal valve function, normal wall motion, and no pericardial effusion. In addition, the results of the pulmonary function test were an FVC of 4.1 L and an FEV1 of 3.8 L; they were within normal range. A follow-up chest computed tomography showed no interval change of the pectus excavatum (Fig. 1). The laboratory findings showed a white blood cell count of 5,800/mm^3, hemoglobin at 15.1 g/dL, platelet count of 218,000/mm^3, bleeding time at 3 minutes, and prothrombin time of 10.9 seconds. The liver enzymes aspartate aminotransferase and alanine aminotransferase were 16 U/L and 11 U/L, respectively, and the levels of sodium, potassium, and chloride electrolytes were normal. All of the laboratory findings were within normal limits except the bilirubin

Department of Thoracic and Cardiovascular Surgery, Hanyang University Seoul Hospital, Hanyang University College of Medicine
Received: May 7, 2012, Revised: August 4, 2012, Accepted: August 16, 2012
Corresponding author: Jeong-Ho Kang, Department of Thoracic and Cardiovascular Surgery, Hanyang University Seoul Hospital, Hanyang University College of Medicine, 222 Wangsimni-ro, Seongdong-gu, Seoul 133-791, Korea
(Tel) 82-2-2290-8461 (Fax) 82-2-2290-8462 (E-mail) jhkang@hanyang.ac.kr

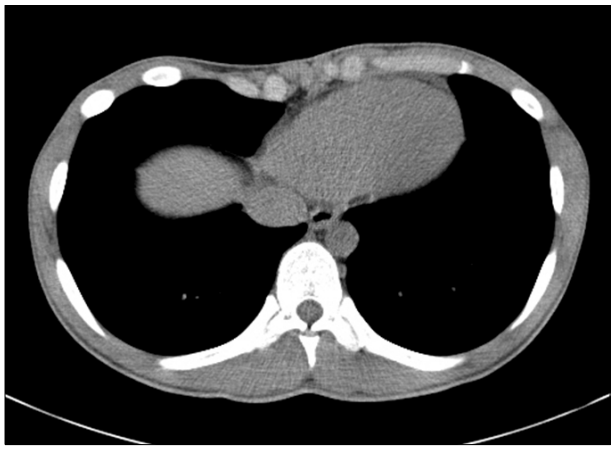

Fig. 1. Preoperative chest computed tomography scan shows that the right chest wall is concave compared to the left chest wall.

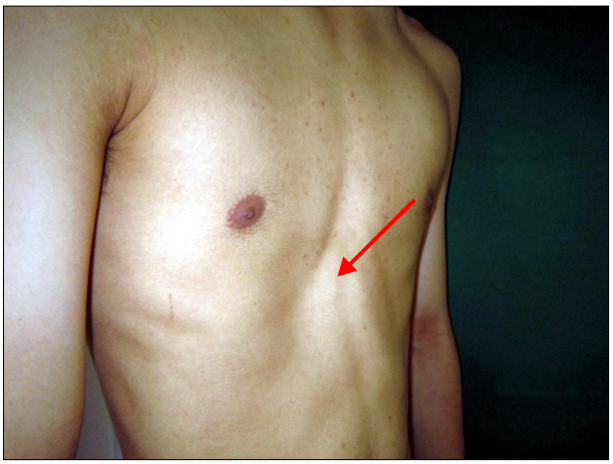

Fig. 2. Preoperative picture.

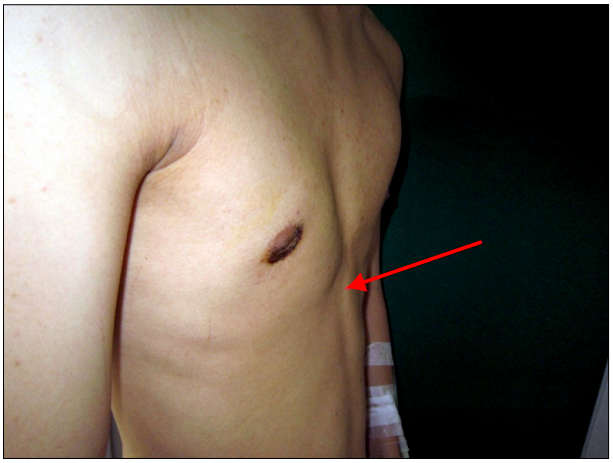

Fig. 3. Postoperative picture.

level. The total bilirubin and direct bilirubin were elevated to 2.2 mg/dL and 0.9 mg/dL, respectively. Thus, abdominal ultrasonography and a consultation with the department of gastrointestinal medicine were performed. The abdominal ultrasonography showed normal findings except for dilatation of the common bile duct, and Gilbert's syndrome was suspected based on the results from the consultation with the Department of Gastrointestinal Medicine. The operation was proceeded as planned (Fig. 2).

Under general anesthesia, the patient was placed in the supine position. Right periareolar incision was performed. Subcutaneous dissection was performed to reach to the concave area of the pectus excavatum. The space of that area was filled with a polyvinyl alcohol sponge soaked in antibiotics mixed with warm saline. The patient was discharged on postoperative day 8 (Fig. 3).

DISCUSSION

Pectus excavatum is rare, but it is also the most common disorder among the congenital conditions of the sternum [1]. It has an incidence of 1 in every 250 children born [2]. Very few patients with this deformity have congenital heart or lung problems [2]. If it is severe, it may cause secondary mechanical effects on the respiratory and cardiovascular systems. However, these are generally mild, and most patients are free from organic symptoms. Complicated cases of pectus excavatum require surgical treatment due to a decrease in respiratory and cardiovascular function. Most cases of uncomplicated pectus excavatum need surgical treatment for cosmetic reasons.

There are many surgical methods for treating pectus excavatum such as the Ravitch method, Wada method, Silastic mold method, and the Nuss operation [3,4]. In addition, many techniques have been reported such as subcutaneous insertion of molded Silastic implants, Cronin prosthesis, silicone implants, 2 mm Gore-Tex DualMesh, and autologous fat transplantation.

In our case, the patient did not have any complications due to pectus excavatum such as dyspnea or chest pain, but he

wanted to undergo surgery because of the asymmetrical appearance of his chest wall. Therefore, we decided to perform minimally invasive surgery because of the cosmetic effects. The method we chose was Silastic molding using a polyvinyl alcohol sponge.

Many implantable materials have been used for granulation tissue formation such as steel mesh, polyvinyl alcohol, polytetrafluoroethylene, polyurethane, and viscose cellulose sponges. The side effects of these materials on granulation tissue formation are considerable. Ideal materials must not interfere with the normal wound-healing process, and the implant materials must satisfy several conditions such as flexibility, ease of manufacture, long-term durability, non-carcinogenic, non-allergenic, and ease of sterilization [5]. A polyvinyl alcohol sponge satisfies most of these conditions as an ideal implant material.

The polyvinyl alcohol sponge has been used in many surgical procedures such as a rectopexy material for prolapsed rectum and embolization plug material for vascular intervention for patent ductus arteriosus, hepatic tumor embolization, intracranial meningioma, and so on. The results of most polyvinyl alcohol sponge implants has been safe and feasible [6-8].

A polyvinyl alcohol sponge can be the first choice for satisfactory cosmetic results, only in patients whose skeletal maturity is full and who do not have any cardiogenic or respiratory symptoms, using filling material for the concave area of the pectus excavatum. The operation performed in this case is simpler and easier than a Nuss operation; there were few complications. Other advantages are that this method can be completed in one procedure, and it is more economical. The best advantage is the cosmetic results because a simple periareolar incision is performed without significant scarring. Our patient was satisfied with the cosmetic results. This method is an excellent choice for correction of pectus excavatum.

CONFLICT OF INTEREST

No potential conflict of interest relevant to this article was reported.

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