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Impact of concomitant thoracic interventions on feasibility of Nuss procedure

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Abstract

Background: This study aimed to analyze the feasibility of subsequent minimally invasive pectus repair, particularly modified Nuss procedure, combined with simultaneous thoracic procedures for different underlying intrathoracic diseases and conditions.

Methods: A total of 110 patients, who underwent minimally invasive pectus repair in Nuss technique over a 5-year period, were retrospectively analyzed concerning complications, cosmetic results, and satisfaction. Six patients (5%) underwent the Nuss procedure with concomitant thoracic interventions. Patients with prior cardiac surgery or planned redo pectus repair were not examined and were excluded. The mean age of 6 patients (3 male and 3 female) was 11 years (range, 5.5-17.2). Two patients with former left-sided transabdominal diaphragmatic hernia repair and 1 with former lobectomy of the left lower lobe underwent thoracoscopic adhesiolysis. Two underwent thoracotomy: one for closure of a recurrent left-sided diaphragmatic hernia with fundoplication owing to a large hiatal hernia, another for lobectomy of the right middle lobe owing to recurrent infections and bronchodysplasia. One patient presented with anterior mediastinal mass, which was suspected to be benign, and underwent thoracoscopic complete resection. All patients underwent a 1-stage procedure with subsequent simultaneous Nuss procedure.

Results: Simultaneous Nuss procedure was feasible without intraoperative complications in all patients (100%). Thoracoscopic adhesiolysis did not affect the feasibility of the Nuss procedure in 3 patients with former diaphragmatic hernia repair, particularly former lobectomy in one. Thoracotomy with middle-lobe lobectomy, as well as repair of recurrent diaphragmatic hernia and fundoplication in 2, did not affect modified Nuss technique and dispensed thoracoscopic guidance. Histopathologic analysis in one patient with a removed anterior mediastinal mass revealed Hodgkin lymphoma (stage IA), and the patient received multiagent chemotherapy. The postoperative course was uneventful in 5 of 6 patients. One patient required intermittent drainage of pleural effusion after simultaneous lobectomy. At follow-up (6 months-5 years), 6 patients had excellent cosmetic results and good quality of life confirmed by a questionnaire. There was no evidence of recurrent malignancy in one patient after 6 months.

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Conclusions: Thoracic surgery and subsequent Nuss procedure can be performed simultaneously. Underlying conditions, such as prior repair of congenital diaphragmatic hernia or diaphragmatic eventration, as well as former lobectomy, had no impact on feasibility. Open thoracotomy can be combined with Nuss procedure dispensing thoracoscopy.

With various technical modifications of the original described Nuss procedure [1-4], minimally invasive pectus repair (MIRPE) has gained acceptance worldwide as a new standard for correcting pectus excavatum [5]. Most patients undergo the procedure for progression of chest deformity and for cosmetic reasons [6]. Nevertheless, possibly associated cardiorespiratory disease has to be verified [3], but the impact of MIRPE on cardiopulmonary effects remains to be evaluated in further studies [7]. Surgical corrections of cardiac anomalies and associated chest deformity were performed together [8,9]. Minimally invasive pectus repair as a redo procedure for failed pectus, irrespective of the type of former repair, was also reported [10]. Reports on pectus repair combined with other underlying diseases or simultaneous interventions are lacking. Therefore, we analyzed our patients concerning the feasibility of a combination of thoracoscopic, particularly open thoracic surgery, and subsequent MIRPE at a 1-stage procedure.

1. Patients and methods

From February 2000 to July 2006, 110 patients underwent MIRPE, particularly modified Nuss technique for pectus excavatum, and were retrospectively analyzed. Preoperative evaluation included computed tomography (CT) or magnetic resonance imaging (MRI), lung function tests (LFTs), and echocardiography (ECG). Indication for operation in our series was mainly cosmetic and owing to progression of the deformity and severe psychologic conditions. Patients planned for redo procedure and those with prior cardiac surgery were not a topic of our study and were excluded.

Of 110 patients, 6 (5%) had thoracoscopic (n = 4), particularly open thoracic (n = 2), procedures with subsequent simultaneous MIRPE, particularly modified Nuss procedure. All procedures were performed under single-lumen tube ventilation. Mean age was 11 years (range, 5.5-17.2); 3 were male and 3 female. At follow-up, clinical examination was performed and answers to a questionnaire concerning satisfaction were evaluated.

1.1. Operative technique

Minimally invasive pectus repair was performed as described elsewhere [1,11], and a 1-bar technique was used under thoracoscopic guidance in supine position. Deviations from above are described according to cases listed in Table 1.

1.2. Prior repair of congenital diaphragmatic hernia (case 1 and 2) and former lobectomy (case 3)

A 5-year-old girl (case 1) developed severe funnel chest after thoracic repair of right-sided congenital diaphragmatic eventration (CDE) and prior abdominal left-sided closure of congenital diaphragmatic hernia (CDH).

A 17-year-old adolescent boy presenting with asymmetric funnel chest underwent left-sided abdominal closure of CDH in the neonatal period and left-sided thoracic reconstruction of the diaphragm after developing CDE at 9 months of age. Both patients had normal LFT results, ECG, and CT, which showed no evidence of recurrent CDH.

A 7-year-old boy (case 3) presented with deep asymmetric funnel chest. He underwent a thoracotomy with left lower-lobe resection for a congenital cystic adenomatoid malformation (CCAM) at the age of 3 months. Lung function test results and ECG were normal.

All 3 patients underwent MIRPE for cosmetic reasons and because of psychosocial impairment in the older. In supine position, a left-sided thoracoscopy with adhesiolysis of pleural adhesions was performed, followed by subsequent MIRPE under videoscopic guidance from the left side. Follow-up after bar removal after 2 years and a questionnaire after 4 years, an another respectively at 5 years, confirmed a good satisfaction and excellent cosmetic results in 2 patients (case 1 and 2). The third patient (case 3) presented with a good cosmetic result and awaits bar removal in 2 years.

1.3. Recurrent diaphragmatic hernia (case 4)

A 10-year-old boy presented with asymmetric funnel chest. Preoperative CT revealed a left-sided recurrent diaphragmatic hernia with herniation of the stomach, which had developed after abdominal CDH repair in the neonatal period. He was clinically asymptomatic concerning recurrent CDH (medial part of the diaphragm including the hiatus) and related concomitant giant herniation of the stomach, which was diagnosed by chance at preoperative imaging (Fig. 1). The recurrent left-sided diaphragmatic hernia led us to perform a