Clinical practice method of evaluating pulmonary perfusion in children with pectus excavatum after surgical repair

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Objectives: We aimed to investigate the effects of surgical correction of left mediastinal displacement in children with pectus excavatum (PE) on pulmonary perfusion, using easily performed and minimally invasive methods, which minimize radiation exposure.

Methods: Consecutive patients with PE who underwent the Nuss procedure at Gunma Children’s Medical Center from July 2003 to December 2009 were evaluated. Two of 42 patients with insufficient data were excluded. The remaining 40 patients were prospectively studied pre- and post-operatively (just prior to pectus bar removal). A chest CT scan, radiography, echocardiography, and pulmonary perfusion scintigraphy were performed before surgery and at medium-term follow-up (3.0±0.2 years). The chest CT and radiograph were used to calculate the funnel index (FI) and left displacement index (LDI). LDI was defined as the ratio between the distance from the left border of the mediastinum to that of the thorax and the transverse thoracic dimension on a posteroanterior chest radiograph. Pulmonary perfusion scintigraphy was visually interpreted and the left-to-right count ratio for lung scintigraphy (Ls/Rs) was measured. Pre-ejection period (PEP), acceleration time (AcT), and ejection time (ET) of the right pulmonary artery (RPA) and left pulmonary artery (LPA) were measured by pulse Doppler echocardiography.

Results: Preoperatively, left pulmonary perfusion was significantly impaired compared with right pulmonary perfusion. Postoperatively, sternal depression expressed by FI and mediastinal displacement expressed by LDI were improved (P<0.001). Postoperatively, Ls/Rs was significantly increased (0.85±0.16 vs. 0.96±0.17, P<0.001) and AcT/ET was significantly altered (LPA: 0.29±0.05 vs. 0.33±0.05, P<0.001; RPA: 0.42±0.06 vs. 0.37±0.07, P=0.003). Echocardiography didn’t show pulmonary hypertension in any patients. To investigate the useful method, we examined the relationships of FI and LDI with Ls/Rs and AcT/ETLPA. LDI was correlated with Ls/Rs (R=0.371, P=0.001) and AcT/ETLPA (R=0.546, P<0.001). FI wasn’t correlated with Ls/Rs and poorly correlated with AcT/ETLPA (R=0.324, P=0.003). There was a significant correlation between ATILPA and Ls/Rs (R=0.338, P=0.003).

Conclusions: Imbalance of pulmonary perfusion in children with PE is improved after the Nuss procedure. There is a clear relationship between the degree of leftward displacement of the mediastinum and decreased left pulmonary perfusion. Children with PE can be followed up with minimal invasiveness.