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Video-assisted thoracoscopic versus open surgery for persistent ductus arteriosus

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Abstract

Background/Purpose: The aim of this study is to compare the experience with video-assisted thoracoscopic surgery (VATS) for patent ductus arteriosus (PDA) since 1995 with the results of conventional open surgery from the preceding 10 years.

Methods: The records of 60 children who underwent standard posterolateral muscle splitting thoracotomy and ligation of PDA in 1986-1995 were reviewed for the study. The data on 50 children who underwent VATS PDA ligation since 1995 were collected prospectively.

Results: All patients survived. Ductal bleeding requiring sutures with patches occurred once in the open surgery group. Two patients in the VATS group underwent immediate rethoracoscopy and clipping because of residual ductal flow in the postoperative echocardiography. Complications in the VATS group included 6 (12%) recurrent laryngeal nerve injuries (3 transient) and 2 chylothoraces. One patient in each group underwent open reoperation because of residual ductal flow 1 year after the initial operation. The operative time, duration of recovery room/neonatal intensive care unit care, duration of pleural drainage, and length of hospital stay were significantly shorter in the VATS group.

Conclusions: VATS PDA ligation gave results equal to traditional open surgery with a shorter operative time, faster recovery, and shorter hospital stay. More complications, especially recurrent laryngeal nerve injuries, occurred in the VATS group.

The application of video-assisted thoracoscopic surgery (VATS) for the management of patent ductus arteriosus (PDA) was first described by Laborde et al [1] in 1993. VATS PDA ligation is now performed in many centers. Potential advantages of VATS compared with open thoracotomy include decreased postoperative pain, shorter hospital stay, decreased incidence of chest wall deformity (including scoliosis and breast deformity), lower incidence of postthoracotomy pain syndrome, and better cosmesis. These advantages are, however, largely undocumented, and very few series have actually compared VATS with open surgical ligation [2]. Ligation by VATS has been the primary therapy for PDA in our institution since 1995 [3]. This report compares our experience of VATS since 1995 with that of open surgery from the preceding 10 years.

1. Material and methods

Sixty children underwent open ligation of PDA between 1986 and 1995. Their records were reviewed for

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the study. The data on the patients undergoing VATS were collected prospectively. Fifty children underwent VATS PDA ligation from November 1995 until the end of 2004. Statistical analysis was by Minitab software (Minitab Inc, State College, Pa, USA). *P* values less than .05 were considered significant.

2. Surgical technique

2.1. Open thoracotomy

Open procedures were done via a standard left posterolateral muscle splitting thoracotomy in the fourth intercostal space. The parietal pleura was incised along the aorta, the hemiazygos vein was ligated and divided, and the medial pleural leaf was retracted to expose the aortic arch, the descending aorta, the left subclavian artery, and the ductus itself. Special attention was paid to identify and protect the vagus and phrenic nerves. The ductus was dissected free, circumvented with a right-angled clamp, and closed with a minimum of 2 nonabsorbable ligatures. The pleural incision was closed with a running absorbable suture, and the chest was drained and closed in layers.

All children underwent chest radiography postoperatively in the recovery room. Depending on their age, the children stayed in the recovery room or in the neonatal intensive care unit (NICU) until they have recovered from the anesthesia. The attending surgeon decided upon the removal of the pleural drain, discharge of the patient, and a follow-up evaluation on an individual basis.

2.2. Video-assisted thoracoscopic surgery

The original technique, adopted from Laborde et al [1], has been described previously [3]. The patient was placed in the right lateral decubitus position under general anesthesia with single-lumen endotracheal intubation. A one-handed technique was used. Two 5-mm-diameter ports were inserted in the left hemithorax: one through the third intercostal space behind the scapula for the camera, and the other through the fourth intercostal space below the inferior angle of the scapula for the instruments. A third entry was a short incision 5 to 7 mm long made under thoracoscopic control anterior to the scapula at the level of the interlobar fissure. Two cotton swabs and nerve hooks were introduced through this incision to retract the lung and expose the operative field through the interlobar fissure.

The pleura overlying the aorta was opened with an L-shaped cautery dissector, and the hemiazygos vein was cauterized and divided. The anterior pleural flap was retracted by an assistant with 2 nerve hooks introduced through the anterior incision, taking care to protect the vagus and recurrent laryngeal nerves. The upper and lower borders of the ductus were dissected free, but no attempt was made to circumvent the ductus. One or 2 vascular clips (12 mm) were placed around the ductus with an endoscopic clip applier (Ethicon EL 414 Large, Ethicon Endo-Surgery, Cincinnati, Ohio) inserted through the incision below the scapula. The operative field was checked for chylous leaks and bleeding. The pleural incision was left open. A drain was tunneled into the chest through the existing incisions, the instruments were removed, the lung was reexpanded, and the incisions were closed with absorbable sutures.

Echocardiography was performed before the patient left the operation theater to confirm the absence of ductal flow. Patients were normally extubated in the operating room. The drain was removed when one could ascertain the absence of a chylous leak. Chest radiography was performed immediately postoperatively, after removal of the chest drain, and in the next morning. The patient was usually discharged on the second postoperative day, with an appointment for follow-up echocardiography by a pediatric cardiologist 3 months later.

3. Results

The demographics of the 2 groups are presented in Table 1. The VATS group had more signs of cardiac decompensation and pulmonary hypertension. The mean

Table 1 Patient characteristics

	Open ligation	VATS	*P*
Patients (% males)	60 (37)	50 (36)	
Median age at operation (range), mo	12 (0-204)	15 (0.75-213)	NS
Median weight at operation (range), kg	10.4 (1.0-49)	10.5 (1.6-65)	NS
No. of patients with symptoms (%)	7 (12)	7 (14)	NS
No. of patient with signs of cardiac decompensation or pulmonary hypertension (%)	13 (22)	23 (46)	<.05[a]
Maximum diameter of the ductus, mean (range), mm	5.0 (1.3-10.0)	2.9 (1.0-7.0)	<.05[b]
Aortopulmonary gradient, mean (range), mm Hg	63 (42-85)	74 (45-92)	<.05[b]
No. of patients with associated cardiac anomalies (%)	9 (15)	13 (26)	NS
No. of patients with chromosomal anomalies (%)	8 (13)	5 (10)	NS
No. of patients with any comorbidity (%)	27 (45)	29 (58)	NS

NS indicates not significant.
[a] χ^2 test.
[b] Student's *t* test.