Journal of Pediatric Surgery 52 (2017) 1800–1805

Contents lists available at ScienceDirect

Journal of Pediatric Surgery

journal homepage: www.elsevier.com/locate/jpedsurg

Fast track pediatric thoracic surgery: Toward day-case surgery?

Pauline Clermidi [a], Myriam Bellon [b], Alia Skhiri [c], Olivier Jaby [d], Christine Vitoux [e], Michel Peuchmaur [f], Arnaud Bonnard [g,*]

[a] Department of Pediatric Surgery, Robert Debré Hospital, AP-HP 48 boulevard Sérurier, 75019 Paris, France
[b] Department of Pediatric Anesthesiology, Robert Debré Hospital, AP-HP 48 boulevard Sérurier, 75019 Paris, France
[c] Department of Pediatric Anesthesiology, Robert Debré Hospital, AP-HP 48 boulevard Sérurier, 75019 Paris, France
[d] Department of Pediatric Surgery, Creteil Intercommunal Hospital, Créteil 40 avenue de Verdun, 94000 Créteil, France
[e] Pediatric Intensive Care Unit, Robert Debré Hospital, AP-HP 48 boulevard Sérurier, 75019 Paris, France
[f] Department of Anatomopathology, Robert Debré Hospital, AP-HP 48 boulevard Sérurier, 75019 Paris, France
[g] Department of Pediatric Surgery, Robert Debré Hospital, AP-HP 48 boulevard Sérurier, 75019 Paris, France

ARTICLE INFO

Article history:
Received 11 November 2016
Received in revised form 16 January 2017
Accepted 1 February 2017

Key words:
Fast-track surgery
Congenital pulmonary airway malformation
Thoracoscopy
Fasttack protocol
Children

ABSTRACT

Purpose: Thoracoscopic lung resection for congenital pulmonary airway malformation (CPAM) is a safe technique for children. Our purpose was to evaluate the feasibility of a fast-track protocol in such cases.
Methods: From September 2007 to May 2016, 101 patients underwent a thoracoscopic pulmonary resection of which 83 for CPAM (lobectomy, wedge resection or sequestrectomy). We retrospectively reviewed the characteristics of surgical procedure, postoperative management and complications through three time periods (September 2007–December 2009: n = 14, January 2010–March 2013: n = 30, April 2013–May 2016: n = 39) corresponding to management protocols modifications introducing fast-track pathways.
Results: Through the 3 time periods, median postoperative hospital stay decreases (4, 3, 2 days successively, P = 0.02). In the third time period, 4 patients underwent surgery in day-case surgery.
The overall and surgical complication rates, mainly related to air leakage, remain stable through the 3 time periods (14%, P = 0.41 and 10%, P = 0.52 respectively). Among the 13 patients without postoperative pleural drainage, one required secondary drainage after a partial resection of an emphysema.
Conclusion: Fast-track protocol for children undergoing uncomplicated thoracic surgery for CPAM seems feasible without extra morbidity.
Selected patient undergoing thoracoscopic resection of the lung may benefit from the absence of pleural drainage and can be operated on in day-case surgery.
Level of evidence: Level III.

Congenital pulmonary airway malformations are rare lung malformations diagnosed on antenatal ultrasound or when symptomatic. Treatment is surgical resection: lobectomy, wedge resection of the involved lobe or resection of an isolated extralobar sequestration. Most cases are now detected by prenatal ultrasound allowing to schedule an elective resection before infectious complications.

Recognition of the morbidity associated with thoracotomy, especially in infants and children, including scoliosis, muscle girdle weakness, and chest wall deformity led to propose thoracoscopic approach for thoracic lesions even in infants. This allows successful reduction of the pain, faster recovery, and reduction of long-term morbidity of the thoracic surgery [1–4]. Early experience in thoracoscopic lobectomy in children was described in 2003 and thoracoscopic lung resection is now known as a safe technic associated with decreased postoperative pain [5,6].

Current reported studies in the literature support the feasibility and safety of fast-track management for thoracic surgery in adult practice [7–10]. Recently, efforts have been made to develop fast-track management in the field of pediatric surgery [11–13]. We aimed to introduce and establish standards of a fast-track protocol for pulmonary resection in pediatric practice. Our purpose was to evaluate the feasibility and safety of fast-track thoracic surgery for pediatric patients undergoing pulmonary resection for a congenital pulmonary airway malformation.

1. Patients and methods

1.1. Theory

Medical record of all patients managed for congenital pulmonary airway malformation requiring pulmonary resection between September 2007 and May 2016 in our institution were reviewed. Ethical

Abbreviations: CPAM, Congenital pulmonary airway malformation; FLACC scale, Face Legs Activity Cry Consolability scale.

* Corresponding author at: General Pediatric Surgery, Robert Debre Children University Hospital, 48 boulevard Sérurier, 75019 Paris, France. Tel.: +33 1 40 03 20 00; fax: +33 1 40 03 41 62.
E-mail addresses: pclermidi@gmail.com (P. Clermidi), myriam.bellon@aphp.fr (M. Bellon), alia.skhiri@aphp.fr (A. Skhiri), Olivier.Jaby@chicreteil.fr (O. Jaby), christine.vitoux@aphp.fr (C. Vitoux), michel.peuchmaur@aphp.fr (M. Peuchmaur), arnaud.bonnard@aphp.fr (A. Bonnard).

http://dx.doi.org/10.1016/j.jpedsurg.2017.02.005
0022-3468/

committee approval was obtained. Since September 2007, all patients were considered for thoracoscopic approach resection.

1.2. Calculation

We reviewed demographic and clinical characteristics of the patients including preoperative symptoms, characteristics of the surgical procedure, postoperative management and early and late complications.

Complications were categorized according to the Clavien–Dindo classification [14].

1.3. Operative technique

The procedure was performed with the patient in a lateral decubitus position and bilateral lung ventilation. Three to four 5-mm endoscopic ports were used. The chest was insufflated with a 5 mmHg pressure of CO_2.

A lobectomy was performed in case of pure CPAM, CPAM associated with intralobar sequestration or congenital lobar emhysema. A sequestrectomy was performed in case of extralobar sequestration. A wedge resection was performed in case of limited pure intralobar sequestration, or a well-circumscribed congenital lobar emphysema.

Vessel, bronchial ligations and aerostasis of lung parenchyma were achieved with absorbable ligatures and the LigaSure ® device (Valleylab; Boulder, CO).

The specimen was brought out in a 10-mm Inzii ® Retrieval system (Applied Medical) through the posterior trocar site slightly enlarged. A single chest tube was left according to current institutional protocol.

All patients were operated on by a single senior referral surgeon for thoracic surgery or by a fellow for the last 15 cases under the senior supervision.

1.4. Post-operative management

Criteria for discharge were stable cardiopulmonary status, fully conscious and comfortable patient with non-opioid analgesic treatment, good pulmonary ventilation, minimal pneumothorax and minimal pleural effusion on the chest radiograph performed after the chest tube removal.

Three time periods were defined according to modifications of institutional management protocol introducing fast-track management principles: the first time period between September 2007 and December 2009, the second time period between January 2010 and March 2013, and the third time period between April 2013 and May 2016.

1.5. Chest tube placement and postoperative hospital stay

During the first time period, pleural drainage was routine and a single chest tube was left in all cases. The chest radiograph was performed 24 h after the chest tube removal and the patient was discharged home.

During the second time period, pleural drainage remained routine except after extralobar sequestration resection. The chest radiograph was performed 4 h after the drainage removal and the patient was discharged home 2 h later.

During the third time period, pleural drainage was not routine. In case of minor edge section of pulmonary parenchyma and controlled aerostasis of the parenchymal section, no pleural drainage was left. The patients with extralobar sequestration resection had no pleural drainage as during the second time period. Post-operative surveillance remained the same.

Patients without pleural drainage were eligible for day-case surgery. According to institutional protocol, to be eligible, children have to be over 3 months of age and be otherwise healthy. Family environment habitat condition and geographical distance from the hospital were evaluated before acquainting the family on day-case surgery.

1.6. Pain control

Pain control was managed according to anesthetist's protocol during the three time periods. They were given intravenous or oral non-steroidal anti-inflammatory drug and paracetamol on a routine basis. Intravenous opioid was administered as a rescue medication. The effect of pain control and the necessity for a rescue drug was measured with the FLACC scale (Face Legs Activity Cry Consolability) [15–17].

For the last 9 patients, optimization of pain control was provided with multimodal post-operative analgesia thanks to the use of paravertebral block for regional analgesia in addition to intravenous or oral medications (non-steroidal anti-inflammatory and paracetamol) [18–21]. Intravenous nalbufin instead of opioid was administered as a rescue medication for patients with a paravertebral catheter.

The paravertebral catheter was inserted with a landmark percutaneous approach under thoracoscopic vision at the end of the surgical procedure (Tuohy epidural kit, Perifix ONE Paed set 20 ®). Paravertebral analgesia was maintained with a continuous infusion of levobupivacaine up to discharge with a 72 h maximum (Fig. 1). For day-case surgery, a single injection was performed with intravenous adjuncts drugs (clonidine or dexamethasone) in purpose of improving the quality and duration of the block before removal of the catheter and the endotracheal tube in the operating room.

1.7. Statistical analysis

Descriptive statistics are presented as median (min to max).

Chi^2 or Fisher exact test was used to compare proportions for categorical variables, depending on contingency.

Mann–Whitney test was used to compare quantitative variables.

P-values <0.05 are considered statistically significant.

2. Results

2.1. Population

101 thoracoscopic pulmonary resections were performed from September 2007 to March 2016 of which 83 patients aged 5.3 months (12 days to 15.8 years) underwent a resection (lobectomy, wedge resection or sequestrectomy) for CPAM: 14 between September 2007 and December 2009, 30 between January 2010 and March 2013, 39 between April 2013 and May 2016.

Median age at surgery was 12.6 months (2 months to 15.8 years) in the first period, 5.0 months (21 days to 8.5 years) in the second and 5.1 months (12 days to 2.4 years) in the third time period. The preoperative diagnoses were congenital lobar emphysema in 16 cases, congenital cystic adenomatoid malformation and/or intralobar sequestration in 57 cases, isolated extralobar sequestration in 10 cases.

2.2. Characteristics of surgical procedure (Table 1)

Median operation time was 161 (130 to 290) min during the first period (data missing for the first six patients), 101 (34 to 192) min during the second and 74 (25 to 134) min during the third period (Fig. 2). Decrease in operating time between each period is significant ($P < 0.01$). Type of pulmonary resection (lobectomy versus wedge resection or sequestrectomy) was not different between the three time periods ($P = 0.13$).

According to the modifications of protocol, presence of post-operative drainage significantly decreased from one time period to the next (100%, 93%, 72% successively, $P = 0.01$). When pleural drainage was used, duration of pleural drainage was not significantly different between periods 1 and 2 ($P = 0.52$) but significantly decreased between periods 2 and 3 ($P < 0.01$).