# Decompression of Enlarged Mediastinal Lymph Nodes Due to *Mycobacterium Tuberculosis* Causing Severe Airway Obstruction in Children

Pierre Goussard, MMed(Paed), Robert P. Gie, FC Paed, Jacques T. Janson, FC Cardio(SA), Pieter le Roux, FCA,† Sharon Kling, FC Paed, Savvas Andronikou, PhD, and Gawie J. Roussouw, FC Cardio(SA)

Departments of Pediatrics and Child Health, Cardiothoracic Surgery, and Anesthesiology and Critical Care, Faculty of Medicine and Health Sciences, Stellenbosch University and Tygerberg Children's Hospital, Cape Town; and Radiology Department, Faculty of Health Sciences, University of Witwatersrand, Johannesburg, South Africa

*Background.* **Large airway compression by enlarged tuberculosis (TB) lymph nodes results in life-threatening airway obstruction in a small proportion of children. The indications, safety, and efficacy of TB lymph node decompression are inadequately described. This study aims to describe the indications and efficacy of TB lymph node decompression in children with severe airway compression and investigate variables influencing outcome.**

*Methods.* **A prospective cohort of children (aged 3 months to 13 years) with life-threatening airway obstruction resulting from TB lymph node compression of the large airways were enrolled. The site and degree of airway obstruction were assessed by bronchoscopy and chest computed tomography scan.**

*Results.* **Of the 250 children enrolled, 34% (n = 86) required transthoracic lymph node decompression, 29% as an urgent procedure and 71% (n = 63) after failing 1 month of antituberculosis treatment that included glucosteroids. Compression (less than 75%) of the bronchus intermedius (odds ratio 2.28, 95% confidence interval: 1.29 to 4.02) and left main bronchus (odds ratio 3.34, 95% confidence interval: 1.73 to 6.83) were the best predictors for lymph node decompression. Human immunodeficiency virus status, drug resistance, and malnutrition were not associated with decompression. Few complications (self-limiting, 8%) or treatment failures (2%) resulted from the decompression. There were no deaths.**

*Conclusions.* **In one third of children with TB, severe airway obstruction caused by enlarged lymph nodes requires decompression. Transthoracic decompression can be safely performed with low complication, failure, and fatality rates.**

**(Ann Thorac Surg 2015;99:1157–63)**


Surgery for acute pulmonary tuberculosis (TB) is rarely performed in children. There is, however, a small group of children who present with life-threatening airway obstruction due to airway compression by enlarged lymph nodes caused by *Mycobacterium tuberculosis*. Transthoracic surgical decompression of the enlarged mediastinal lymph nodes is sometimes required to relieve the airway obstruction. A number of small studies have described the procedure and complications that arise from the surgery [1–7]. These studies did not evaluate the indications for decompression or the optimal timing of the intervention. A definite indication for decompression is children requiring assisted ventilation owing to critical airway obstruction. Relative indications include acute perforation of a lymph node into the airway with accompanying respiratory failure, obstruction of a major airway resulting in lung or lobar collapse, or a ball-valve effect. These indications have not been tested in a prospective clinical trial, and the degree of airway obstruction requiring surgery has not been determined. Surgical intervention to relieve airway obstruction is also thought to prevent damage to the underlying lung parenchyma, preventing bronchiectasis and recurrent lower respiratory tract infections [8–10].

The primary aim of this study is to describe the indications and the effectiveness of lymph node decompression in children presenting with clinical and radiologic features of severe airway obstruction caused by TB lymph node enlargement. The secondary aim is to compare the indications for glandular enucleation in children with human immunodeficiency virus (HIV) infection and children with drug-resistant *M tuberculosis* to those for children uninfected by HIV and children whose TB is caused by drug-susceptible mycobacterium.

## Patients and Methods

This prospective, cohort study was done from January 2004 to December 2011 at Tygerberg Children's Hospital, Western Cape, South Africa. The study population and

Accepted for publication Dec 16, 2014.

†Pieter le Roux died March 27, 2013.

Address correspondence to Dr Goussard, Department of Paediatrics and Child Health, Faculty of Medicine and Health Sciences, Stellenbosch University, PO Box 19063, Tygerberg 7505, South Africa; e-mail: pgouss@sun.ac.za.



0003-4975/$36.00
http://dx.doi.org/10.1016/j.athoracsur.2014.12.042

methods have been described in detail in a recently published paper [11]. Briefly, all children (aged 1 month and 13 years) admitted to the hospital with clinical and radiologic signs of severe airway obstruction were investigated, and those with airway obstruction caused by TB lymph node compression of the airways were enrolled in the study. Children were excluded if the airway compression was asymptomatic, not caused by *M tuberculosis*, or if there was a contraindication to fiberoptic bronchoscopy or general anesthesia. All participants underwent HIV testing, with appropriate counseling before and after testing. Other tests routinely performed were a Mantoux skin test, chest radiography, and gastric aspirates for *M tuberculosis* culture, and drug susceptibility testing. Fiberoptic bronchoscopy under general anesthesia was performed in the bronchoscopy theater to determine the site, degree, and extent of the airway obstruction. During the fiberoptic bronchoscopy, the divisions of large airways were systematically examined, and the degree of airway narrowing for each site was estimated. Bronchoalveolar lavage samples were collected from the site of greatest involvement, and transbronchial needle aspiration samples were collected as indicated [12].

The children diagnosed with TB were treated according to internationally recognized protocols and drug dosages. During the intensive phase of 2 months, four antituberculosis drugs (isoniazid 10 mg/kg daily, rifampicin 10 mg/kg daily, pyrazinamide 25 mg/kg daily, and ethambutol 20 mg/kg daily) were given daily, followed by the consolidation phase of two drugs (isoniazid and rifampicin) for 4 months. If multidrug-resistant tuberculosis was either suspected or confirmed, treatment with five or six drugs was prescribed for 18 to 24 months according to World Health Organization recommendations [13].

All children with significant airways obstruction (greater than 50%), as estimated at bronchoscopy, were given prednisone (2 mg/kg daily) for 30 days and then weaned. After 1 month of treatment, the children were reevaluated. For children who had significantly improved, as assessed clinically and radiologically, medical treatment was continued. Children were seen after completion of the TB treatment and reevaluated if symptomatic. If a child remained symptomatic or the chest radiologic image showed no improvement, a second bronchoscopy was performed. Children with airway narrowing less than 75% of the airway caliber were continued on medical treatment, whereas decompression was considered for children with a greater degree of airway obstruction. Children requiring decompression had a chest computed tomography scan performed to determine which glands required decompression.

The indications for decompression used in this study were (1) severe life-threatening airway obstruction requiring ventilation; (2) critical airway obstruction, as assessed at the initial bronchoscopy, where the airway obstruction of both the main bronchi or trachea was greater than 90%; and (3) severe airway obstruction (75%), after 1 month of medical treatment, as assessed at bronchoscopy. The first two indications were considered as the indications for urgent decompression. Children with significant right upper lobe parenchymal disease were not considered for decompression as the right upper lobe needed to be collapsed to perform the procedure. These children were treated medically for an additional month and then reevaluated. After the additional month of treatment, the same indications for decompression were used. Left-sided upper lobe expansile pneumonia was treated as per normal protocol, because decompression with few exceptions occurred through a right-sided thoracotomy.

### *Mediastinal Node Decompression*

ANESTHETIC TECHNIQUE. After a gas induction with sevoflorane, endobronchial intubation of the nonoperative side was performed. Complete lung separation was seldom achieved. The exposed lung was compressed during the surgery. That resulted desaturation, particularly if the dependent lung was diseased. Increased fraction of inspired oxygen ($F_iO_2$), positive end-expiratory pressure (2 to 5 cm $H_2O$) and shortened surgical access time were used to manage the problem. The airway plugging was common, and was relieved by airway suctioning.

OPERATIVE TECHNIQUE. A right thoracotomy through the fourth or fifth intercostal space was the most common access used. The right upper lobe was compressed to expose the offending lymph nodes. The capsule of the node was carefully opened using cautery. A sucker or forceps were used to remove the nodal contents. The subcarinal nodes were drained separately. Lymph nodes were not removed to prevent injuring surrounding structures.

Air leaks were dealt by suturing the capsule of the lymph node. No additional measures were taken, and no sutures placed in the airways. The air leaks sealed within 1 or 2 days. Isolated left main bronchus obstruction was uncommon and was dealt with through a left thoracotomy. The mediastinal pleura was opened over the aortopulmonary window, and the aortopulmonary nodes and subcarinal nodes were decompressed. The lung was expanded before closure and an intercostal drain inserted. Early extubation and spontaneous ventilation was aimed for in all the patients. All children were admitted to the pediatric intensive care unit for respiratory support, monitoring, and analgesia. Pain management included epidural analgesia and intravenous paracetamol or morphine. The intercostal drain was removed after 24 hours if there was no sign of a persistent air leak. Surgical complications, together with need for ventilation and duration of ventilation, as well as durations of pediatric intensive care unit and hospital stay were recorded.

Data analysis was performed using SAS version 9.1 (SAS Institute, Cary, NC). Cross tabulations were done with the $\chi^2$ test for comparing categorical variables, and one-way analysis of variance was used for comparing means between groups.

Informed consent for the procedures was obtained from the parents or legal caregivers. The Human Research Ethics Committee of the Faculty of Health