Original Article

Access this article online
Website: www.afrjpaedsurg.org
DOI: 10.4103/0189-6725.93298
Quick Response Code:

Feasibility of a simple drainage system in Cameroonian children after thoracotomy and decortication for empyema thoracis

Bernadette Ngo Nonga, Bonaventure Jemea[1], Faustin Mouafo Tambo[2], Nelly Kamgaing[3], Jean Bahebeck[2], Maurice A. Sosso[2]

ABSTRACT

Background: To analyse the outcome of children with empyema thoracis treated by decortication followed by a simple drainage system. **Patients and Methods:** Retrospective chart review from July 2001 to June 2010 of all cases of children who had a thoracotomy for empyema. We used an endotracheal tube as chest drain and a urinary bag as a collector. Statistical analyses were done using EXCEL and SPSS 9.0. **Results:** Forty one children underwent thoracotomy and decortication for empyema, there were 23 boys and 18 girls with a sex ratio of 1, 21. The mean age was 2½ years with a minimum of 1 month and a maximum of 15 years of age; 27 children were below two years of age. All the patients have received antibiotic for a long period before surgery. The culture was negative, except in two cases where we found *Klebsiella pneumonia* and *Staphylococcus aureus*. In five cases, the empyema was due to *Mycobacterium tuberculosis*. Three children presented a complication: One child had a persistent purulent drainage for 2 weeks; another one was re-operated upon because of necrotic lung abscess and one child died of sepsis. In most cases, the chest tube was removed between day 4 and day 6 post-operatively. The average length of hospital stay after the surgery was 10 days. **Conclusion:** Thoracotomy and decortication in children with empyema can be safely done in Cameroon using a simple drainage system with good results compared to those in the literature.

Key words: Children, decortications, drainage, empyema thoracis, thoracotomy

Service of Surgery, [1]Anesthesiology and Intensive Care Unit and [3]Pediatric Service of the University Teaching Hospital of Yaoundé, [2]Department of Surgery, Faculty of Medicine and Biomedical Sciences, University of Yaounde, Cameroon

Address for correspondence:
Dr. Ngo Nonga Bernadette,
Surgical Service, University Teaching Hospital of Yaoundé, Cameroon.
E-mail: ngonongab@yahoo.com

INTRODUCTION

Pleural sepsis is common in Sub-Saharan Africa and respiratory tract infection is one of the most common causes of death; some of these children below 5 years died because of inadequate treatment of the empyema.[1-3] In Cameroon, Surgeons are confronted to many difficulties in treating thoracic empyema: Lack of proper equipment and infrastructure, poverty due to very low income and the absence of health insurance coverage for the majority of the population. In this study, we are reporting our experience of surgical treatment in the management of life-threatening empyema in children using a simple drainage system.

PATIENTS AND METHODS

We retrospectively reviewed all cases of empyema thoracis in children less than 15 years of age who underwent thoracotomy and decortication between July 2001 and June 2010. Exclusion criteria were incomplete chart or an empyema treated non-operatively. The indication for surgery was a failed thoracocentesis or chest tube thoracostomy, persistent loculated pleural fluid despite insertion of chest drain with fever and sepsis. The standard equipment for efficient thoracic drainage was not available; for instances, we did not have an underseal type chest tube drainage, we created a drainage system using a recycled endotracheal tube [Figure 1] as a chest tube connected to a simple urinary bag placed on gravity or connected to an open bottle filled with water if air leak was present [Figures 2 and 3]. The size of the chosen endotracheal tube depended on the age of the child and ranged from size 2, 5 to size 6. We cut the cuff off the endotracheal tube when necessary; the smaller tubes were uncuffed. Under general anaesthesia and simple orotracheal intubation (double lumen ventilation was not available), the patient was placed in a lateral decubitus position with the affected side up, an axillary roll was necessary and immobilisation

obtained as possible using soft material, all sensible points were protected to avoid pressure injury. A muscle sparing posterolateral thoracotomy was done entering the chest at the level of the fifth or sixth intercostal space. At surgery, we found either a thickened fibrotic pleura containing old pus, sometimes with pseudomembranes, or seropurulent fluid. The lung was collapsed in all cases. The pus was sent for culture. Decortication was done using a Kelly and a Kocher clamps to peel the fibrotic tissue from the visceral pleura. In many of our patients, the empyema was old and the collapsed underlying lung was trapped in a hard fibrotic tissue preventing the movement of the lung [Figure 4]. In few cases, we could not dissect the fibrotic tissue without injuring the lung. We have noticed that most of those lung lesions resolved quickly before the end of the procedure or just after the surgery and there is usually no significant residual pneumothorax; anyway in those cases, we used an open drainage system as described above. After we have obtained full expansion of the lung, the pleural cavity was thoroughly washed with 1 to 2l of warm saline and a single drain (an endotracheal tube) was placed posteriorly. It was then connected to a bag as described above. Since all the children were in shock before the procedure, they were admitted postoperatively, in the intensive care units for 24-48 hours. Chest therapy was begun as soon as possible. All children were treated as if it was the staphylococcal infection based on the literature with broad-spectrum antibiotic (Oxacillin, gentamicin and metronidazole; rarely ceftriaxone, ceftazidime or ciprofloxacin and imipenem associated with metronidazole). Children with tuberculosis received anti-tuberculosis drugs for a minimum of six months. In most of the cases, a chest X-ray was obtained before removal of the drain which was removed four to six days after surgery, even in cases where the lungs has been injured. It remained longer only in few cases as described below. A chest X-ray was obtained at one month, three months, then at one year. The charts were reviewed for demographics, the presenting symptoms and the laboratory results. Outcome measures were the disappearance of the major symptoms (fever and dyspnea), post-operative complications, the length of hospital stay and a good control chest radiograph.



Figure 1: An endotracheal tube inserted as a chest drain at the end of surgery



Figure 3: An open drainage with a plastic bottle filled with water in a child



Figure 2: A five-year-old girl on a second postoperative day in the intensive care unit



Figure 4: A large fibrotic peel removed during decortications

Statistical analyses were done using Microsoft Excel and SPSS 9.0. to analyse the data.

Informed consent was obtained from one of the parent and we have received approval of the committee of ethics of our institution.

RESULTS

During that period, 41 children aged from 27 days to 15 years met the criteria for selection. The mean age was 2½ years. Table 1 give the summary of the demographics. There were 23 (57%) boys and 18 (43%) girls with a sex ratio of 1, 21. Thirty two children (80%) were under 5 years with 27 (60%) below 2 years of age.

Table 2 gives a summary of the most common symptoms. They presented with signs of severe sepsis. All children have received broad-spectrum antibiotics for more than 10 days with no improvement.

Leucocytosis was the rule and ranged between 20200 to 50700/l with left shift. All children presented with mild anaemia; the haemoglobin range between 7.6 to 11 mg/dl. The platelet count was elevated between 504000 to 600,000 pl/ml. Even children with tuberculosis had neutrophilic leucocytosis. The chest X-ray was abnormal in all the cases and showed the empyema compressing the underlying lung and the mediastinum with a shift to the other side [Figure 5]. Sometimes, pyopneumothorax was present. A computerised tomography was done only in two cases because of poverty and the hemodynamic instability of most of the children on admission**.** The empyema was on the right side of the chest in 22 cases (15 boys and 7 girls). Nineteen children had it on the left side (8 boys and 11 girls).

All 41 children underwent thoracotomy and decortications. The children were seen late in their disease: two children only (4,9%) had a stage II empyema, 39 children (95,1%) were on stage III, There was no stage one in this serie. The longer the child has been sick, the more difficult was the decortication. In eight children (19.5%), it was really difficult to re-expand the lung when the empyema has been there for more than 6 weeks, while 31 children were operated between 3 and 6 weeks (77.2%). Seven children were found to have associated lung abscess from which five underwent lobectomy because the lung was necrotic and two underwent segmentectomy for debridement. One child had diaphragmatic necrosis due to gangrene on the right side; this was debrided and repaired by U stitches using a non-absorbable suture.

Tuberculosis was found in five children, three boys and two girls; three of them were older than 10 years. The other two children were 22 months and 7 years old. The pus was sent for culture. This was negative in all the cases, except in two children whose culture showed a multiresistant *Klebsiella pneumoni*a in one and *Staphylococcus auréus* in the other. Tuberculosis was diagnosed by the pathological analysis of the lung biopsy or pleural specimen.

The presenting symptoms subsided two to three days after surgery. The chest drain was removed in many cases between day 4 and 6. The average length of hospital stay was 10 days with a minimal of 6 days and a maximum of 3 weeks. There were three complications. One 9-month-old baby boy remained febrile a week after surgery because of persistent purulent drainage, the chest drain was replaced on day 8 and removed finally on day 16, he was discharged home on day 21. Another 9-month-old

Table 1: Demographics

Age	Male	Female	Total (%)
<1 year	7	2	9 (22)
>1 year <2 years	9	9	18 (44)
<5 years	3	3	6 (15)
>5 <10 years	1	2	3 (8)
>10 <15 years	3	2	5 (11)
Total (%)	23 (57)	18 (43)	42 (100)

Table 2: Most common symptoms

Sx in children below 5 years	Sx in older children
High fever, cough	High fever, cough
Dyspnea, polypnea	Dyspnea
Tachycardia, nasal flaring,	Polypnea
respiratory distress	Tachycardia

Sx = Symptoms

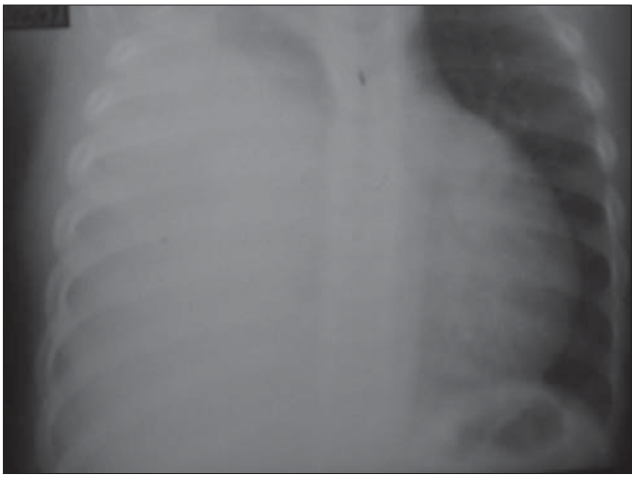


Figure 5: Chest X-ray of a seven-year-old girl which shows a massive right-sided empyema

baby girl had to be taken back to the operating room one week after surgery because of persistent fever, severe sepsis and development of an abscess on the left lower lobe [Figure 6]. The culture was positive to *Klebsiella pneumonia*. She underwent a lobectomy, recovered very well and was discharged on day 19. There was one mortality (2.4%): This was a four-month-old baby boy with severe sepsis and shock. He had an abscess of the lower segment of the lingula, he underwent a segmentectomy. The chest tube was removed on day 5, the control radiograph showed no signs of residual pneumothorax or empyema. The child remained febrile despite broad-spectrum antibiotics including imipenem. Despite all these measures, he died 3 weeks after surgery.

The follow-up chest radiograph was clear after one month with no residual empyema and normally expanded lungs in all the children. At one year, it was difficult to tell which side was operated upon [Figure 7].

DISCUSSION

Pleural sepsis is common in Sub-Saharan Africa.[1-3] The incidence of empyema has also increased dramatically recently in children in the western world.[4] Respiratory tract infection complicated with empyema is one of the major causes of death in children below 2 years of age.[4] The sex ratio in our patients is the same as reported in the literature, there are usually more boys than girls.[1,5-7] Few studies have reported a predominance of girls.[8] As in many studies,[1,5,6,8] which have demonstrated that empyema is more common in children below two years of age, 27 (66%) of our patients were below two years. Based on the history and the symptoms, the commonest cause of empyema was pneumonia (36 children or 88%), only five patients had tuberculosis (12%). Although Anyanwu *et al*.[1] have found other risks factors (measles, anaemia, malnutrition, sickle cell disease) common in their children, we did not have the same in this study; for instances, none of our children had sickle cell disease, although it is endemic in our country. Only two children had a positive culture of the pleural fluid, we believe that this is because all the children were treated with broad-spectrum antibiotics for many days before the surgical referral. In western countries, new techniques (isolation of bacterial antigen using real-time Polymerase chain reaction (PCR) have shown that in many of this cases where the culture is negative, pleural empyema is due to *Streptococcus pneumonia*.[9] In many studies done in Africa,[1,5] in Nigerian children and in Ethiopia,[10] the most common germ isolated from the culture was *Staphylococcus aureus*, this is the reason why we choose to treat our patient with broad-spectrum antibiotics covering also *Staphylococcus auréus*. In western countries, the children are admitted to the hospital at the very first days of their disease and they are usually seen in the early stages,[7] this is not the case in our country where many patients are referred to the surgeon very late because of poverty, traditional medicine or prolonged medical treatment.

There are three stages for empyema thoracis: The acute exudative phase, the fibrinopurulent stage and the fibrotic stage. After three weeks, the pus of the empyema is organised and collected with a thickening fibrotic wall.[11] The underlying lung is totally collapsed and simple drainage does not re-expand it. Many authors[8,11-13] have demonstrated the superiority of surgery with either open thoracotomy or VATS in treating empyema in the fibrotic stages. Many of our patients (95%) had chronic empyema with fibrosis, this is managed better by decortication to restore lung

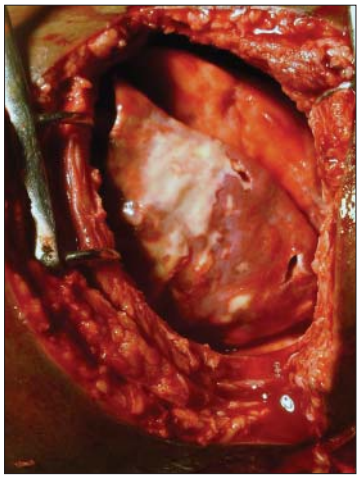


Figure 6: A left lower lobe abscess and perforation in a 9-month-old baby girl brought back to the operating room for the persistence of sepsis one week after decortications

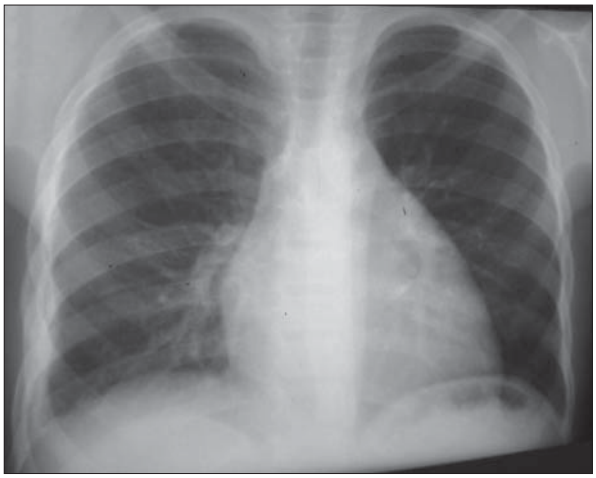


Figure 7: One year post-operative radiograph of the seven-year-old girl. It is difficult to tell which side was operated upon

function and avoid recurrence. Some people advocated that decortication must be done only on the parietal side. We have found it difficult to re-expand the lung without peeling the fibrosis on the visceral pleura.[14] We have noticed that with experience, the small pneumothorax resulting from injury to the lung always close very quickly, provided that the lung has fully expanded.

It is generally recommend using low wall suction to be able to drain blood from the pleural cavity; this study has shown that simple gravity was enough to provide good drainage with the same results. There was one mortality (2.4%) in this study and only two complications (4.8%). Before the introduction of the surgical treatment in our hospital, more than two children out of three with life-threatening empyema thoracis were dying.Anyanwu reported a mortality of 36.4% in children treated only with antibiotics and 21.7% in children who received antibiotics associated with tube thoracostomy.[1]

Many of these children would have died if they were not operated upon. We started using this drainage system when we decided to help a child who was dying because of a life-threatening thoracic emergency, since then, this has become common practice. The major problems encountered in our daily practice are lack of infrastructure with proper equipment and poverty; the large majority of families do not have health insurance and they must pay the surgical intervention fees, the medications and hospitalisation fees. It is usually very difficult for them, especially when the majority have a very low income. This is the reason why we came up with this drainage system which is very cheap, it cost less than 8 dollars US; hence, it is very useful. Our results can be compared to those in the literature.

CONCLUSION

Although this is a retrospective study, it has shown that blood and air can be drained from the pleural cavity using simple gravity. Working in poor countries is not always easy but lives can be saved using simple materials with the same good results as in western countries. We believe that one need not too much to help a child. We are aware that further prospective studies are needed, and we hope that we will get the proper equipment for chest drainage which will enable us to improve our results.

REFERENCES

1. Anyanwu CH, Egbue M. Management of pleural sepsis in Nigerian children. Thorax 1981;36(4):282-5.
2. Hassan I, Mabogunje O. Paediatric empyema thoracis in Zaria, Nigeria. Ann Trop Paediatr 1992;12:265-71.
3. Sinzobahamvya N, Ikeogu MO, Zaal DA. Empyema thoracis in childhood in the tropics. Trans R Soc Trop Med Hyg 1988;82:160-3.
4. Doski JJ, Lou D, Hicks BA, Megison SM, Sanchez P, Contidor M, *et al*. Management of parapneumonic collections in infants and children. J Pediatr Surg 2000;35:265-8
5. Mangete ED, Kombo BB, Legg-Jack TE. Thoracic empyema: A study of 56 patients. Arch Dis Child 1993;69:587-8.
6. Rodriguez ML, Catalan GT. Outcome of pediatric empyema thoracis managed by tube thoracostomy. Asian Cardiovasc Thorac ANN 2006;14:98-101.
7. Pierrepoint MJ, Evans A, Morris SJ, Harrisson SK, Doull IJ. Pigtail catheter drain in the treatment of empyema thoracis. Arch Dis Child 2002;87:331-2.
8. Gun F, Salman T, Abbaso lu L, Salman N, Celik A. Early decortications in childwood empyema thoracis. Acta Chir Belg 2007;107:225-7.
9. Eltringham G, Spencer D, Leeming J. Culture-negative childhood empyema is usually due to penicillin-sensitive *Streptococcus pneumonia* capsular serotype I. J Clin Microbiol 2003;3:521-2.
10. Hailu S. Paediatric thoracic empyema in an Ethiopian referral hospital. East Afr Med J 2000;77:618-21.
11. D'Abreu AL. The treatment of Empyema Thoracis. Proceedings of the Royal Society of Medecine 1954;47(5):366-8.
12. Huang FL, Chen PY, Ma JS, Yu HW, LU KC, Chi CS, *et al*. Clinical experience in managing empyema thoracic in children. J Microbil Immunol Infect 2002;35:115-20.
13. Shah AA, Shah AV, Shah RC, Shah PR. Thoracocospy in the management of empyema in children. Indian Pediatr 2002;39:957-61.
14. Leinwand MJ, Tolan RW. Infections of the lung, pleura, and mediastinum, surgical treatment. Emedecine Medscape 2010.

Cite this article as: Nonga BN, Jemea B, Mouafo Tambo F, Kamgaing N, Bahebeck J, Sosso MA. Feasibility of a simple drainage system in Cameroonian children after thoracotomy and decortication for empyema thoracis. Afr J Paediatr Surg 2012;9:27-31.

Source of Support: Nil. **Conflict of Interest:** None declared.