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Acute necrotizing lung infections: Management option with surgical resection

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Abstract
Background: Acute necrotizing lung infections do not warrant surgical resection due to unclarified indications and high risks.
Objective: To review results of resection in the setting of acute necrotizing lung infections.
Methods: A retrospective review of 25 patients who underwent parenchymal resection since January, 2017 to may, 2017 for management of necrotizing pneumonia or lung gangrene.
Results: Twenty-five patients underwent resection for lung necrosis. At the time of consultation, all patients presented with pulmonary sepsis (all), empyema (n=7), hemoptysis (n=6), air leak (n=8), septic shock requiring pressors (n=6) and inability to oxygenate adequately (n=8). Each patient has been performed with either lobectomy (n=9), pneumonectomy (n=3, two were on right-sided), wedge resection (n=3), segmentectomy (n=4), or debridement (n=6). Most common microorganisms responsible for lung infection were Streptococcus pneumoniae and Staphylococcus aureus (total 14 of 25 patients) as identified using culture. Fourteen patients were ventilated preoperatively. The operations were performed via posterolateral thoracotomy in 18 cases and anterolateral thoracotomy in seven cases. There were two (8%) postoperative deaths. All patients not ventilated preoperatively were weaned from ventilatory support within three days.
Conclusions: In patients with necrotizing lung infections who are failing medical therapy, parenchymal resection, from debridement to pneumonectomy, is an effective possibility.

Keywords: Lung necrosis, surgical resection, microorganism, lobectomy, pneumonectomy

Introduction
Necrotizing pneumonia characterized by pulmonary inflammation with consolidation, peripheral necrosis and multiple small cavities is a severe complication of community-acquired bacterial pneumonia [1]. A lot of pathogens are responsible for necrotizing pneumonia, including Staphylococcus aureus, Streptococcus pneumoniae, and Klebsiella pneumonia. The most common concomitant medical conditions of patients who develop necrotizing pneumonia are diabetes mellitus and alcohol abuse [2]. Poor bronchial and pulmonary blood supply may result in lung parenchymal degeneration [3]. In order to diagnose necrotizing pneumonia and to assess the parenchymal complications, chest computed tomography is commonly performed [2].
Treatment of necrotizing pneumonia consists of prolonged courses of antibiotics. Antibiotics are thus unable to be effectively delivered, and the lungs are further destroyed, resulting in pulmonary gangrene at the end [3]. Complications such as diffuse pulmonary inflammation, septic shock, respiratory failure, and even death may result from such treatment difficulties [2]. Surgical treatment has been considered life-saving in these cases. A pulmonary resection is an effective and feasible treatment option for patients with persistent pulmonary sepsis, bronchopleural fistulas, hemoptysis, and necrotic epithelial linings causing compromised respiratory function. The outcome of the disease will depend on how far it progresses and any underlying medical conditions. Acute pulmonary necrotizing infections do not have well-established indications for resection, unlike soft tissue infections. Having developed an aggressive treatment protocol for lung gangrene based on our initial experiences, we have developed a treatment for patients with persistent respiratory infections or complications despite adequate medical treatment [4].

Materials and Methods
We have retrospectively reviewed the 8 patients who underwent lung parenchymal resection between January 2020 and December, 2020, for necrosis, abscesses or gangrene.

Necrotizing pneumonia was defined as patchy inflammation, with microabscesses and a lack of perfusion on computed tomography (CT). An abscess was defined as a cavitary lesion occupying less than 50% of the affected lobe. Lung gangrene is defined by a complete lack of perfusion accompanied by a large area of central necrosis.

The primary reason for resection was pulmonary sepsis, defined as fever, leukocytosis, and positive sputum cultures in patients with radiographic evidence of parenchymal necrosis. A resection was delayed when septic conditions required active resuscitation with fluids or vasopressors. We focused on draining empyemas either operatively or with image-guided drainage, and we similarly drained large parenchymal cavities. Before each resection, CT scans using intravenous contrast were performed. A resection was ultimately performed because it was determined that the primary source of infection was the resected area. In many cases, prolonged respiratory failure was associated with increased metabolic demands. Despite the administration of systemic antibiotic therapy in response to positive sputum culture results and, when performed, positive pleural or parenchymal culture results, all patients had persistent elevations of leukocyte count and fever.

As long as more central lung tissue was viable, debridement was performed when the necrotizing process only affected the outer edges of the parenchyma. A generous non-anatomical wedge resection was applied if the base of a lower lobe or the apex of an upper lobe were affected, but the more central portions were viable and could be stapled. Alternatively, anatomical resections depended on whether there was severe tissue edema in the chest wall and whether the patient was stable enough to perform muscle flaps to reinforce bronchial stumps. When the chest wall tissue can be sufficiently closed after lobectomy or pneumonectomy so that leakage through the wound can be avoided, a Jackson-Pratt drain is used as the irrigation system.

Results

twenty-five patients were studied who underwent surgical resection for the necrotizing parenchymal infections. Disease characteristics at the time of consultation were presented in the following table 1. In all four patients, fever, leukocytosis, and sputum cultures were positive, indicating the presence of pulmonary sepsis. Empyema, hemoptysis, persistent air leak, septic shock requiring vasopressors and inability to oxygenate adequately were also observed in patients with lung necrosis.

Table 1: Clinical manifestations in patient at the time of consultation

Manifestations	No. of patients
Empyema	7
Hemoptysis	6
Persistent air leak	8
Septic shock requiring vasopressors	6
Inability to oxygenate adequately	8

There were eight patients with frank gangrene affecting at least one lobe, and the others had necrotizing pneumonia with varying degrees of abscess formation. In all patients except two, the mean time from admission to the initial surgical consultation was 12 days. With the exception of five cases, all surgeries were performed within two weeks. In 6 patients, including the 3 patients who were in septic shock requiring resuscitation, pre-resection procedures were performed, including percutaneous drainage of abscesses (n=1), thoracoscopic decortication (n=3) and open decortication (n=2).

Fourteen patients were ventilated before resection. A further five patients were being managed with permissive hypercapnia. There were eight ventilated patients who had diffuse parenchymal inflammation encompassing all lobes, which was in addition to their underlying necrotizing changes.

Table 2 describes different techniques adapted for surgical resection and those were dependent on the patient response and disease conditions. The operations were performed via posterolateral thoracotomy in 18 cases and anterolateral thoracotomy in seven cases. A single lumen endotracheal tube was required in 10 cases, a single lumen tube with endobronchial blocker in eight cases and a double lumen tube in the remaining cases.

Table 2: Surgical techniques employed for resection

Surgical specification (requirement)	No. of patients
Posterolateral thoracotomy	18
Anterolateral thoracotomy	7
Single lumen endotracheal tube	11
Single lumen tube with endobronchial blocker	9
Double lumen tube with endobronchial blocker	5

Each patient has been performed with either lobectomy (n=9), pneumonectomy (n=3, two were on right-sided), wedge resection (n=3), segmentectomy (n=4), or debridement (n=6). Lobectomy involved the right lower lobe in 2 cases, middle lobe in one 2, right upper lobe in 1 case, left lower lobe in two cases and left upper lobe in 1 case.

Microorganisms responsible for lung infection were also reported (Table 3). We found the most common pathogens cultured from the lung tissue were Streptococcus pneumoniae and Staphylococcus aureus (total 14 cases). Other cases were due to Of the S pneumoniae, Pseudomonas aeruginosa and, of mixed flora, including Klebsiella and Haemophilus species.

Table 3: Identification of causative microorganism

Streptococcus pneumoniae	8
Staphylococcus aureus	6
S pneumoniae	2 (resistant to penicillin) 3 (resistant to methicillin)
Pseudomonas aeruginosa	2
Klebsiella and Haemophilus species.	4

There were no deaths at surgery or within 24 h; however, 2 patients (8%) died postoperatively (within 2 weeks post-surgery). The patient died on the 4th postoperative day due to concomitant cardiovascular instability and persistent respiratory failure. The other patient developed progressive wound (was a patient of burn) and new pulmonary sepsis, and died 10 days after resection. Of these two cases, one had undergone lobectomy and pneumonectomy. Postoperative empyema developed in four patients who needed repeat drainage following lobectomy and pneumonectomy.

Weaning from ventilatory support was possible for all patients who were not ventilated preoperatively. Of the patients ventilated preoperatively, four remained chronically ventilator dependent after six months to one years of follow-up. These were patients who had been receiving maximal ventilator support, and two of these were among the group who had bilateral diffuse parenchymal inflammation/infection. In sum, three of the seven preoperatively ventilated patients with diffuse bilateral inflammation who with radiographic evidence of this died, and two remained chronically ventilator dependent.

Discussion

Operative interventions for acute lung infections fall into two broad categories: management of pleural disease, including empyema and bronchopleural fistula; and management of progressive parenchymal necrotizing infection [5]. Necrotizing pneumonia, lung abscesses, and lung gangrene are all parenchymal diseases that can be loosely classified based on the degree of inflammation, necrosis, time course, and level of sepsis, although all three can coexist. An acute necrotizing pneumonia shows consolidated lung tissue with peripheral necrosis and multiple small cavities detected on radiographs. It may progress quickly, with symptoms similar to acute respiratory failure. The risk of failure of medical therapy is higher for a patient suffering from necrotizing pneumonia and its complications if there is severe vascular obstruction [6, 7]. A necrotizing pneumonia not responding to supportive treatment is an additional potential indication for surgery [4].

Patients with necrotizing pneumonia present with diverse clinical presentations and will present with different symptoms based on their health status and the organisms causing the infection. The majority of patients with necrotizing pneumonia have a fever, a cough, and a putrid smell, while less severe infections are associated with weight loss. Patients usually suffer from a protracted illness that is further complicated by empyema, bronchopleural fistulas, or bleeding. Chest radiography often underestimates the degree of parenchymal destruction noted by computed tomography [8].

In these patients, the predominant organisms associated with complicated necrotizing pneumonia or lung gangrene are Staphylococcus aureus and Streptococcus pneumoniae. Previously, involvement of Klebsiella pneumoniae, P aeruginosa and S pneumoniae was reported [9]. Other chronic diseases such as tuberculosis may also cause lung gangrene [10].

Surgery for gangrene established after hemoptysis, empyema and abscess involve a combination of approaches. The presence of large central cavitary changes during surgery must warrant exclusion of the lungs if contralateral aspiration occurs [11]. However, the timing of surgery is not clear. There is limited data indicating that, in general, operative resection is ultimately associated with better outcomes than medical therapy alone. Previously, in a study which showed 14 patients with 'massive' unilateral pulmonary gangrene. Amongst, 4 got treated medically alone, and all four died. Ten patients, however, underwent surgical resection (mostly pneumonectomy), and all survived [12]. Similarly, in another study, two patients with sepsis and destruction of one lung underwent emergent pneumonectomy and survived [13]. One negative aspect of this approach is that it leaves the pleura densely consolidated, which is difficult to respect in the future. Debridement can be used if most of the cavitation is peripheral, but it may increase the risk of late complications, including bleeding and air leak [14].

A total of nine patients had defined gangrene, and the other nine patients had necrotizing pneumonia with clear, large abscesses in some cases, and diffuse, small, multifocal cavitary changes in others. All patients had persistent fever and leukocytosis, and the majority were on ventilator support. CT scanning indicated the region with no perfusion to a lobe or frank necrosis/gangrene and the same is identified as primary target areas. The Major technical issues are to identify the pulmonary artery early. Necrotizing pneumonia without frank gangrene is more difficult because the parenchyma is heavy and dense. In many cases, it is easier to ligate the pulmonary vein first. By retraction of the lung more easily, either the proximal main pulmonary artery or the artery within the fissure can be located on either side of the lower lobe, at which point it is possible to dissect into the fissure. As a result, in either case, more than one rib can be divided to gain the required exposure.

Resection was well tolerated except in patients with diffuse bilateral parenchymal changes. Patients with acutely unstable conditions, however, were not resected. As part of the initial management, patients underwent pleural drainage and image-directed drainage. Despite the fact that a majority of patients still required aggressive ventilator support, it was beneficial that a more controlled resection could be achieved in this manner. In addition to predicting the likelihood of failure of medical treatment, CT scans are useful in monitoring the progress of such infections to determine if they are improving, stabilizing or deteriorating. Serial CT scans often need to be done every 48 h to 72 h, which, together with their clinical progress, indicate whether surgery is necessary.

Conclusion

In patients with persistent sepsis who are failing medical therapy, surgical resection of necrotizing lung infections is a reasonable option. The prognosis for patients with ventilated tumors is worse, however, resection may still be possible. If hemodynamic instability can be managed before resection, patients with better outcomes seem to be possible.

References

1. Krishnadasan B, Sherbin VL, Vallières E, Karmy-Jones R. Surgical management of lung gangrene. Can Respir J 2000;7(5):401-4.
2. Tsai YF, Ku YH. Necrotizing pneumonia: a rare complication of pneumonia requiring special consideration. Curr Opin Pulm Med 2012;18(3):246-52.
3. Curry CA, Fishman EK, Buckley JA. Pulmonary gangrene: radiological and pathologic correlation. South Med J 1998;91(10):957-60.
4. Krishnadasan B, Sherbin VL, Vallieres E, Karmy-Jones R. Surgical management of lung gangrene. Can Respir J 2000;7:401-4.
5. Chatha N, Fortin D, Bosma KJ. Management of necrotizing pneumonia and pulmonary gangrene: A case series and review of the literature. Can Respir J 2014;21(4):239-245.
6. Curry CA, Fishman EK, Buckley JA. Pulmonary gangrene: Radiological and pathologic correlation. South Med J 1998;91:957-60.
7. Gutman E, Rao KV, Park YS. Pulmonary gangrene with vascular occlusion. South Med J 1978;71:772-5.
8. Donnelly L, Klosterman L. The yield of CT of children who have complicated pneumonia and noncontributory chest radiography. AJR Am J Roentgenol 1998;170:1627-31.
9. Moon WK, Im JG, Yeon KM, Han MC. Complications of Klebsiella pneumonia: CT evaluation. J Comput Assist Tomogr 1995;19:176-81.
10. Lopez-Contreras J, Ris J, Domingo P, Puig M, Martinez E. Tuberculous pulmonary gangrene: Report of a case and review. Clin Infect Dis 1994;18:243-5.
11. Stevens MS, de Villiers SJ, Stanton JJ, Steyn FJ. Pneumonectomy for severe inflammatory lung disease. Results in 64 consecutive cases. Eur J Cardiothorac Surg 1988;2:82-6.
12. Schamaun M, von Buren U, Pirozynski W. [Massive lung necrosis in klebsiella pneumonia (so-called massive lung gangrene)]. Schweiz Med Wochenschr 1980;110:223-5.
13. Hammond JM, Lyddell C, Potgieter PD, Odell J. Severe pneumococcal pneumonia complicated by massive pulmonary gangrene. Chest 1993;104:1610-2.
14. Sancho LM, Paschoalini MS, Fernandez A, Higutchi C, Jatene FB. Surgical treatment of lung abscesses. Rev Hosp Clin Fac Med Sao Paulo 1997;52:254-7.