ORIGINAL ARTICLE

A retrospective review comparing treatment outcomes of adjuvant lung resection for drug-resistant tuberculosis in patients with and without human immunodeficiency virus co-infection

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Abstract

OBJECTIVES: This review was undertaken to compare treatment outcomes in human immunodeficiency virus (HIV) negative versus HIV-positive patients following adjuvant lung resection for drug-resistant tuberculosis (DR-TB) in patients deemed feasible for surgery. Despite appropriate medical therapy, mortality remains extremely high and cure rates poor in patients with DR-TB and HIV co-infection. Therefore, adjuvant lung resection may warrant a more prominent role in the treatment of these patients.

METHODS: A retrospective review of all case records from 1 January 2012 to 31 March 2013 of all patients admitted to the Department of Cardiothoracic Surgery King Dinuzulu Hospital with DR-TB and treated with adjuvant lung resection was undertaken. Prior to surgery, all patients were treated for at least 3 months with appropriate drug therapy for DR-TB. This was continued for the recommended period following lung resection.

RESULTS: Fourteen patients with extensively drug-resistant tuberculosis (XDR-TB) were deemed suitable for lung resection. Of these patients, 10 patients were HIV-positive and 4 were HIV-negative. In the XDR-TB/HIV-positive group, 7 patients were cured, 2 converted and 2 patients developed a post-pneumonectomy broncho-pleural fistula. One patient was lost to follow-up. In the XDR-TB/HIV-negative group, 1 patient was cured, 3 converted and 1 patient developed a post-thoracotomy superficial wound infection. There was no in-hospital mortality in both groups. Thirty-six patients with multi-drug-resistant tuberculosis (MDR-TB) were deemed suitable for lung resection. Of these patients, 19 were HIV-positive and 17 HIV-negative. In the MDR-TB/HIV-positive group, 12 patients were cured and 6 converted. One patient developed a post-thoracotomy superficial wound infection and another patient who developed a post-pneumonectomy empyema thoracis was also regarded as a treatment failure. In the MDR-TB/HIV-negative group, 15 patients were cured, 2 converted and 1 patient developed a post-pneumonectomy lower respiratory tract infection which necessitated a short period of mechanical ventilation. There was no in-hospital mortality in both groups.

CONCLUSIONS: Lung resection for DR-TB may be safely undertaken in selected patients who are HIV-positive with cure rates equivalent to that of HIV-negative patients. More importantly, these patients also have significantly higher cure rates than those patients treated with medical therapy alone.

Keywords: Lobectomy • Lung pathology • Tuberculosis

INTRODUCTION

Mycobacterium tuberculosis infection (MTB) is virtually endemic in KwaZulu Natal, South Africa where about 80% of patients with active TB are coinfected with the human immunodeficiency virus (HIV). HIV-positive patients have a more than five times increased risk of being infected with TB than HIV-negative patients.

Directly observed treatment, short-course has only a 67% success rate with less than 20% of patients with extensively drug-resistant tuberculosis (XDR-TB) culture converting within the first 6 months following commencement of appropriate drug therapy [1, 2]. This is independent of their HIV status which, if positive, impacts negatively on these patients [3]. In 2009, the World Health Organization (WHO) reported that only 48% of the estimated half a million multi-drug-resistant tuberculosis (MDR-TB) patients worldwide were successfully treated with medical therapy [3, 4].

There is 40% mortality per annum in coinfected patients receiving treatment for drug susceptible tuberculosis (DS-TB) but who are not on antiretroviral therapy (ART) [3].

At best, 75% of patients with MDR-TB and about 40% of those with XDR-TB may be cured with appropriate medical therapy alone. These figures are far worse in developing countries. Newer

drugs like delaminid and bedaquiline have recently been included in the medical armamentarium for drug-resistant tuberculosis (DR-TB). Both drugs were shown to reduce the time to culture conversion as well as increase the rate of culture conversion when added to background MDR-TB. However, cure rates were still less than 50% [5, 6].

On the other hand, cure rates following adjuvant lung resection for patients with MDR-TB are about 90% [7–10]. It is well established that drug penetration into tuberculous pulmonary cavities and nodules is inadequate. Therefore, it seems a reasonable deduction that when feasible, it is only through surgical resection of these cavities and nodules that a 'true' cure may be achieved [7, 8]. The indications for surgery for DR-TB includes: high risk of treatment failure/relapse, two or more relapses/one or more relapses whilst on treatment, persistent sputum positivity after 3–6 months of therapy within 2 months of surgery, persistent cavitatory disease, intolerance to medical therapy, localized pulmonary disease, haemoptysis and bronchiectasis [7, 8].

Until now, there have been no reports in the literature comparing outcomes for adjuvant lung resection for DR-TB in patients with and without HIV co-infection. Patients with acquired immune deficiency syndrome requiring major surgery pose a significant challenge to the surgeon. Due to immunosuppression, these patients have poor wound healing and are susceptible to wound infection. Meticulous surgical selection is necessary to minimize complications [11].

A lack of adequate infrastructure to timeously and accurately diagnose DR-TB, prolonged inpatient and outpatient care (monitoring of drug side effects or treating adverse drug reactions), discomfort from daily intramuscular injections (approximately of 8 months duration) which further exacerbates substandard treatment compliance, inadequate drug penetration into lung cavities/nodules and problems of malabsorption in a large proportion of patients coinfected with HIV, are the multifaceted problems that have resulted in an overwhelming failure to control this epidemic in KwaZulu Natal.

Aim

To compare the primary outcome of treatment cure rates between HIV-positive and HIV-negative patients following lung resection for DR-TB.

Secondary outcomes between these groups were also compared and included the following:

(i) Conversion rates,
(ii) Treatment failed,
(iii) Procedural morbidity,
(iv) In-hospital mortality.

MATERIALS AND METHODS

A retrospective review of all lung resections for DR-TB from 1 January 2012 to 31 March 2013 was undertaken. Patients were admitted to the Department of Cardiothoracic Surgery King Dinuzulu Hospital. All patients were referred from the DR-TB unit within the King Dinuzulu Hospital complex once DR-TB was confirmed and treatment commenced. The timing and selection of patients referred to our unit was at the discretion of the treating physician. All patients were followed up for at least 12 months after lung resection. Whilst awaiting surgery, all patients continued

with their existing DR-TB and ART treatment regimens, were provided with nutritional supplementation and assessed for lung resection as per the inclusion criteria (Table 1).

The indications for surgery included: a high risk of treatment failure/relapse, two or more relapses/one or more relapses whilst on treatment, persistent sputum positivity after 3–6 months of therapy within 2 months of surgery, persistent cavitatory disease, intolerance to medical therapy, localized disease (absolute criteria): disease equivalent to one lung, haemoptysis and bronchiectasis.

MDR-TB was defined as resistance to isoniazid and rifampicin. XDR-TB was defined as resistance to isoniazid, rifampicin, any fluoroquinolone and at least one of three second-line injectable drugs (capreomycin, kanamycin and amikacin).

Inclusion criteria

(i) Confirmed DR-TB with appropriate medical therapy for a period of at least 3 months.
(ii) Arterial blood gas:
A PaO2 > 60 mmHg and PaCO2 < 45 mmHg were usually the lower limits for lung resection.
(iii) Full blood count:
A haemoglobin >10 g/dl was usually necessary. Preoperative blood transfusions were undertaken if required.
(iv) A normal clotting profile.
(v) Liver function and renal function:
Patients suitable for surgery usually had an albumin>30 g/dl (this was suggestive of adequate nutrition). Patients should ideally have normal or near-normal renal function.
(vi) HIV:
HIV-positive patients with a cluster of differentiation 4 (CD4) count >200 cells/µl if not prescribed ART or an undetectable viral load in patients treated with antiretroviral therapy. This was only considered in elective surgery.
(vii) Pulmonary function tests:
Lung resection was usually undertaken when the ppoFEV1 > 40% and, if necessary, a ppoDLCO > 40% (ppo: predicted postoperative; FEV1: forced expiratory volume in the first second; DLCO: diffusing capacity for carbon monoxide).
(viii) Radiology:
Localized cavitatory disease elucidated following routine chest radiograph and high-resolution computerized tomographic scan of the chest. Localized cavitatory disease was regarded as cavitatory lung disease less than or equivalent to one lung.

Exclusion criteria

(i) No laboratory confirmation of DR-TB.
According to the WHO, cure, conversion and treatment failed were defined as follows [12]:

Cure was treatment completed and at least five consecutive negative sputum cultures during the last year of treatment.

Conversion was two consecutive negative sputum cultures taken at least 30 days apart.

Treatment failed was treatment terminated or the need for permanent regimen change of at least two anti-TB drugs due to either a lack of conversion by the end of the intensive phase or bacteriological reversion in the continuation phase following successful conversion or evidence of additional acquired resistance to fluoroquinolones or second-line injectables or adverse drug reactions.

Table 1: Demographics

	XDR-TB		MDR-TB	
	HIV-positive (*n* = 10)	HIV-negative (*n* = 4)	HIV-positive (*n* = 19)	HIV-negative (*n* = 17)
Age				
Mean (SD)	36.6 (9.6)	29.8 (5.4)	32.7 (13.8)	32.3 (8.9)
Male	3	1	4	8
Preoperative sputum culture positive	6	4	4	3
CD4 >200	1	0	1	0
ART	9	0	18	0
Duration preoperative medical therapy (months)				
6–12	2	0	3	2
12–18	3	1	6	2
18–24	2	3	4	3
>24	3	0	6	10

HIV: human immunodeficiency virus; CD4: cluster of differentiation 4; ART: antiretroviral therapy; SD: standard deviation; XDR-TB: extensively drug-resistant tuberculosis; MDR-TB: multi-drug-resistant tuberculosis.

A comparison of the outcomes (cure, treatment failure, reversion, conversion, procedural morbidity and mortality) of adjuvant lung resection undertaken for DR-TB in HIV-positive and HIV-negative patients were analysed. Univariate analysis of all categorical data using descriptive statistics and either Fisher's exact test or Pearson's χ^2 test where appropriate was undertaken. All continuous data were analysed using descriptive statistics and compared using an independent samples *t*-test or Mann–Whitney *U*-test where appropriate. A *P*-value of <0.05 was considered significant for all comparisons.

RESULTS

An analysis comparing (i) cure rates, (ii) conversion rates, (iii) treatment failed, (iv) procedural morbidity and (iv) in-hospital mortality between HIV-positive and HIV-negative patients who underwent adjuvant lung resection for DR-TB using Fisher's exact test showed the following association between the two groups (Tables 2 and 3).

Multi-drug-resistant tuberculosis

Of the 36 patients who underwent lung resection, 19 were HIV-positive and 17 were HIV-negative. There was no mortality in both groups.

Multi-drug-resistant tuberculosis/human immunodeficiency virus positive

Of the 19 patients who were HIV-positive, 18 were on ART, 4 were still sputum culture positive prior to lung resection and 16 patients were treated with medical therapy for more than a year.

Multi-drug-resistant tuberculosis/human immunodeficiency virus negative

Seventeen patients underwent lung resection of which 3 were still sputum culture positive prior to lung resection; 15 patients were treated with medical therapy for more than a year.

Table 2: Treatment outcomes

	DR-TB		
	HIV-positive (*n* = 28)	HIV-negative (*n* = 21)	*P*-value
Cure	19 (67.9%)	16 (76.2%)	0.7502
Conversion	8 (28.6%)	5 (23.8%)	0.7553
Treatment failed	1 (3.6%0	0	1.0000
Protocol morbidity	3 (10.7%)	2 (9.5%)	1.0000
Mortality	0	0	

XDR-TB/HIV-positive: 1 patient lost to follow-up.
DR-TB: drug-resistant tuberculosis; HIV: human immunodeficiency virus; XDR-TB: extensively drug-resistant tuberculosis.

Multi-drug-resistant tuberculosis

Sputum analysis. Of the 19 patients who were HIV-positive, 12 (63%) were cured, whilst 15 of the 17 (88%) HIV-negative patients, were cured. Six of the 19 (32%) HIV-positive patients converted, whilst 2 of the 17 (11%) HIV-negative patients converted. There was one treatment failure in the HIV-positive group, with none in the HIV-negative group.

The one treatment failure in the MDR-TB/HIV-positive group was a patient who, despite converting 1 month after surgery, developed XDR-TB whilst receiving treatment for a post-pneumonectomy empyema thoracis. This was probably due of a lack of basic in-hospital isolation facilities.

Procedural morbidity and mortality. Complications following lung resection in the HIV-positive group included 1 patient who developed a post-pneumonectomy empyema thoracis and one who developed a post-thoracotomy superficial wound infection (11% morbidity). Complications following lung resection in the HIV-negative group included 1 patient who developed a post-pneumonectomy nosocomial pneumonia necessitating a short period of mechanical ventilation and intravenous antibiotics (1%).

Table 3: Treatment outcomes

	XDR-TB			MDR-TB		
	HIV-positive (n = 9)	HIV-negative (n = 4)	P-value	HIV-positive (n = 19)	HIV-negative (n = 17)	P-value
Cure	7 (77.8%)	1 (25%)	0.2168	12 (63.2%)	15 (88.2%)	0.1279
Conversion	2 (22.2%)	3 (75%)	0.2168	6	2 (11.8%)	0.2357
Treatment failure	0	0		1	0	1.0000
Protocol morbidity	2 (22.2%)	1 (25%)	1.0000	1 (5.3%)	1 (5.9%)	1.0000
Mortality	0	0		0	0	

XDR-TB: extensively drug-resistant tuberculosis; MDR-TB: multi-drug-resistant tuberculosis; HIV: human immunodeficiency virus.

None of the comparisons in cure rates, conversions, treatments failures, morbidity and mortality between the HIV-positive and HIV-negative groups were statistically significant.

Extensively drug-resistant tuberculosis

Of the 14 patients who underwent lung resection, 10 patients were HIV-positive. There was no mortality in both groups. One patient in the HIV-positive group was lost to follow-up.

Extensively drug-resistant tuberculosis/human immunodeficiency virus positive

Of the 10 patients who underwent lung resection, 6 were sputum culture positive prior to surgery. Eight patients were treated with medical therapy for more than a year.

Extensively drug-resistant tuberculosis/human immunodeficiency virus negative

Of the 4 patients who underwent lung resection, all were sputum culture positive prior to surgery and all were treated with medical therapy for more than a year.

Extensively drug-resistant tuberculosis

Postoperative sputum analysis. Seven of the 9 (78%) patients who were HIV-positive were cured. One of the 4 (25%) HIV-negative patients was cured. Two of the 9 (22%) HIV-positive patients converted. Three of the 4 (75%) HIV-negative patients converted. There was no treatment failure in either group.

Procedural morbidity and mortality. Complications following lung resection in the HIV-positive group included 2 patients who developed a post-pneumonectomy broncho-pleural fistula (22% morbidity) which was treated with open drainage.

Complications following lung resection in the HIV-negative group included 1 patient who developed a post-thoracotomy superficial wound infection treated with topical dressings and oral antibiotics (25% morbidity).

None of the comparisons in cure rates, conversion rates, morbidity and mortality between the HIV-positive and HIV-negative groups were statistically significant.

One of the patients who developed a post-pneumonectomy broncho-pleural fistula had the bronchial stump covered with an intercostal muscle flap. Her postoperative convalescence was uneventful and she was discharged 10 days thereafter. After a fortnight there was a history of blunt thoracic trauma and what was a normal post-pneumonectomy chest radiograph was misinterpreted as a post-traumatic haemothorax at her rural hospital. Subsequently, an intercostal drain was inappropriately inserted on two occasions before specialist advice was sought.

The most likely aetiology of the second post-pneumonectomy broncho-pleural was due to devascularization of the bronchial stump after removal of large peribronchial lymph nodes. No muscle flap was used in this instance.

Both patients who developed a broncho-pleural fistula were HIV-positive on ART.

DISCUSSION

To date, no studies have analysed the outcomes of adjuvant lung resection in HIV-positive patients with DR-TB. In view of the high prevalence of DR-TB and HIV co-infection in KwaZulu Natal, the increased susceptibility of HIV-positive patients to DR-TB and the alarmingly high mortality associated with co-infection, the importance of this study is self-explanatory. In addition, adjuvant lung resection for DR-TB and HIV co-infection comprises more than a third of all lung resections undertaken annually in our unit.

HIV predominantly affects the T-lymphocytes, reducing cellular immunity. Preoperative risk factors such as previous opportunistic lung infections, decreased effort tolerance, low CD4 cell count without ART, persistently elevated viral load despite ART and nutritional status in particular an albumin of less than 30 g/dl should be considered prior to major surgery. Once these risk factors are carefully considered and excluded, major surgery may be undertaken with the anticipation of good outcomes [13]. Other studies have also shown that the outcomes for emergency lung resection for massive haemoptysis in selected patients were independent of their HIV status [14].

Gandhi *et al.* showed that 98% (52 of 53) of XDR-TB patients died after a mean survival of 16 days from the time of specimen collection. Of the more than 50% of patients diagnosed with XDR-TB, none had ever been previously treated for TB. Another third of patients in this group had been cured or previously completed TB therapy. Two-thirds of XDR-TB patients were also noted to have a recent hospital admission, inferring a high likelihood of nosocomial spread especially considering inadequate isolation

facilities. Of the 44 patients with XDR-TB who consented to testing for HIV, all were found to be coinfected [2].

Adjuvant lung resection in selected patients with MDR-TB has proven higher cure rates of up to 90% with negligible complications [7]. Hence, the current approach is to adopt a more aggressive strategy for DR-TB in order to prevent further, more extensive, spread of the disease.

Despite the fact that patients with tuberculous pulmonary cavities may be sputum negative, it is well established that these cavities harbour 10^7 to 10^9 bacilli [7, 9]. This increases the risk of recurrence of DR-TB. Therefore, adjuvant lung resection for DR-TB in patients with localized cavitatory lung disease is primarily considered to prevent recurrence rather than to achieve cure, especially in patients with MDR-TB.

Xie et al. showed that with appropriate surgical selection and early adjuvant lung resection in MDR-TB patients presenting with localized cavitatory disease, a high rate of cure may be achieved. In that study, 40 of the 43 (90%) patients, all of whom were sputum positive preoperatively, converted after adjuvant lung resection [9]. In the review by Yaldiz et al. [10], it was stated that, despite a relatively high early postoperative morbidity, adjuvant lung resection in carefully selected patients with MDR-TB achieved higher cure rates than medical therapy alone.

The present review showed a cure rate of 75% and a conversion rate of 22% (possible potential cure rate of 99%) in the MDR-TB/HIV-positive group and a cure rate of 62% and conversion rate of 38% (possible potential cure rate of 100%) in the XDR-TB/HIV-positive group.

It is worthwhile reiterating that only 75% of patients with MDR-TB and about 40% of those with XDR-TB may be cured with appropriate medical therapy alone. This is even with the addition of newer drugs like delaminid and bedaquiline. In order for TB drug therapy to be effective and reach the intended target, appropriate drug concentrations have to enter the blood, move into non-vascularized pulmonary lesions, diffuse into necrotic foci and the caseum, permeate the lipid-rich MTB envelope and then reach their molecular target in adequate concentrations for the required time. It is therefore not surprising that even with combination therapies no single drug can reach and kill MTB bacilli.

Gler et al. studied the addition of delaminid to background MDR-TB therapy and showed that there was an increased sputum conversion of 45.4% at 2 months at a dose of 100 mg twice daily and 41.9% at a dose of 200 mg twice daily compared with 29% when only treated with background MDR-TB therapy. However, no HIV-positive patients were included in this trial. In addition, there was a 10% increase in adverse events when compared with background MDR-TB therapy only [5].

Bedaquiline was also shown to reduce the time to culture conversion as well as increase the rate of culture conversion when added to background MDR-TB therapy. However, the addition of bedaquiline was associated with a higher mortality. Bedaquiline has been recommended for use only when there is a lack of four effective drugs or MDR-TB plus fluoroquinolone resistance. Once again, this study excluded patients on antiretroviral therapy.

Nevertheless, the time to conversion as well as conversion rate with the addition of either of these novel drugs was still lower when compared with that of adjuvant lung resection in patients with DR-TB.

Torun et al. showed that long-term treatment success and cumulative survival rates were significantly higher in MDR-TB patients treated with fluoroquinolones. This was especially so in the group of patients who underwent adjuvant lung resection.

Though long-term treatment success was higher in the group undergoing adjuvant lung resection, this as well as cumulative survival was not found to be significantly different. However, no HIV-positive patients were included in this study. Furthermore, those patients in whom surgery was planned but not undertaken had no significant difference in treatment responses and survival but did have a lower long-term treatment success rate when compared with those patients who underwent surgery [15]. Contrary to this, Chan et al. [16] demonstrated that adjuvant lung resection was associated with an improved outcome in MDR-TB patients when compared with medical therapy alone which included the addition of fluoroquinolones.

In the current study, 10 of 14 patients with XDR-TB (6 patients were HIV-positive) were sputum positive prior to surgery. All patients were treated for at least 12 months with medical therapy prior to surgery. Seven of the 36 patients with MDR-TB (4 patients were HIV-positive) were sputum positive prior to surgery. Once again, all patients were treated with medical therapy for at least 12 months prior to surgery. Within 3 months following surgery and with the continuation of appropriate drug therapy, all patients were found to be sputum negative.

Dravniece et al. [17] showed that, of the 17 patients with XDR-TB (no HIV-positive patients), 16 were still sputum positive despite more than 12 months of medical therapy prior to adjuvant lung resection. Eight of the 17 patients were regarded as cured following adjuvant lung resection. This lower cure rate may have been due to residual disease as only 1 of the 5 patients with bilateral cavitatory disease was cured. Bilateral cavitatory disease is a poor prognostic factor for achieving a cure. Shiraishi et al. [18] showed that following adjuvant lung resection in 5 patients with XDR-TB (no HIV-positive patients), all were deemed cured without any operative mortality.

XDR-TB which occurs in a large proportion of MDR-TB patients was an independent poor prognostic factor predictor even in HIV-negative patients [18, 19].

Studies have shown that patients with active tuberculosis who undergo lung resection are at an increased risk of surgical morbidity and mortality rates of up to 12.5 and 5.5%, respectively [20]. Other studies have shown that although some patients with MDR-TB were sputum positive at the time of lung resection, even after a minimum of 3 months of medical therapy, there was no evidence to suggest a significantly higher surgical complication rate [7, 8, 20, 21].

In this study, the probable cause of the treatment failure in 1 patient was due to vastly inadequate in-hospital isolation techniques. Unfortunately, this problem is not unique to this facility despite the fact that this unit manages the highest number of DR-TB patients with and without HIV co-infection in South Africa.

Two patients in the XDR-TB/HIV co-infection group developed a post-pneumonectomy broncho-pleural fistula. Though this complication accounted for about 14% of procedural complications within the particular group and 4% (2 out of 50 patients) of all lung resections undertaken, it was unequivocally similar to the expected surgical complications in HIV-negative patients with active TB, following lung resection. However, it is the opinion of the authors that this was easily avoidable if the chest radiographs were correctly interpreted and meticulous surgical techniques adhered to. This is despite the fact that these patients had positive sputum cultures prior to lung resection and were HIV-positive (on ART) with low body mass indices.

In this review, all bronchial stumps were closed with interrupted Vicryl® (Johnson and Johnson) absorbable sutures. Reinforcement

of the bronchial stump with a muscle flap was rarely used. Soiling of the pleural space from transgression of the cavity was not routinely recorded. Nevertheless, all cavities that were inadvertently opened were timeously sutured closed. The pleural space was also routinely washed with at least 2 l of betadiene solution following lung excision, which is standard practice.

Muscle flaps have been suggested in instances of preoperative sputum positivity, the presence of a broncho-pleural fistula prior to surgery, polymicrobial space contamination and anticipated space problems following lobectomy [7, 8]. Other studies suggest that this is debatable as there have been satisfactory results without its routine use [9, 10].

It has been shown that not using muscle flaps or the use of suture closure for the bronchial stump is not a risk factor for a broncho-pleural fistula, even in patients with active tuberculosis [14]. Though the use of muscle flaps are not standard practice in our unit, the authors do advocate its routine use with DR-TB and HIV co-infection.

No comparative trials have been undertaken to show the superiority of staple versus suture closure for the bronchial stump. Meticulous suture technique and preservation of the blood supply to the bronchial stump (avoiding skeletonization of the bronchial stump) help prevent a broncho-pleural fistula.

Post-resectional empyema thoracis is another concerning complication occurring in about 13–45% of cases (2% of all lung resections undertaken in this review).

This study showed that procedural morbidity is not statistically significant with regard to whether lung resection was undertaken at 3 months or later. It stands to reason that unnecessary delays when surgery is feasible may result in extensive spread of pulmonary disease beyond the realms of beneficial adjuvant lung resection. In addition, adjuvant lung resection should be considered at an earlier stage in cases where drug resistance is beyond XDR-TB.

DR-TB therapy should be continued for at least 12–24 months post-surgery depending on bacteriological and radiological findings to diminish the risk of further resistance and increased mycobacterial spread, which is also advocated by this study [7].

One of the most important reasons for failure to cure DR-TB is poor treatment compliance. Numerous factors may be attributed to this, especially in developing countries. Factors include poverty, the discomfort associated with intramuscular injections for a period of at least 6 months, long distances that need to be travelled in order to receive medical therapy and more importantly the duration of therapy (18–24 months). In order to improve compliance as well as to decrease the huge financial burden, there is now interest in shortening the duration of drug therapy especially with the introduction of novel antibiotics like bedaquiline and delaminid. Surgery may play a vital role in this aspect as numerous studies, including the study under review, have shown that adjuvant lung resection markedly reduces the time to sputum conversion. This may pave the path for shorter more effective drug therapies. When analysed from 2 weeks to 2 months, newer drug combination regimens like the moxifloxacin, nitroimidazole Pa-824 (pretomanid) and pyrazinamide regimen (M-Pa-Z) have shown to be safe, well tolerated and more active with greater bactericidal activity against DS-TB and DR-TB than isoniazid, rifampicin, pyrazinamide and ethambutol (HRZE) regimen [22].

In KwaZulu Natal, novel treatment strategies may also assist in effectively implementing cost-saving programmes like decentralized treatment programmes for patients, which may be reintroduced back into their communities with a reduced risk of spreading the disease. Due to higher cure rates and earlier conversion times, provided by adjuvant lung resection, this treatment strategy may be the catalyst for desperately needed economic and social relief.

Study limitations

Though this study cohort is small, the literature is extremely limited with regard to adjuvant lung resection for DR-TB/HIV co-infection. In addition, this is a single-centre observational study that needs to be tested prospectively. Furthermore, follow-up of these patients should be done for a period of at least 2 years.

CONCLUSION

Lung resection for DR-TB may be safely undertaken in selected patients who are HIV-positive with cure rates equivalent to HIV-negative patients. This is especially reassuring since there is a high mortality associated with XDR-TB and HIV co-infection in patients treated with medical therapy alone. Furthermore, the cure rates in this patient category treated with adjuvant lung resection remains significantly higher than those patients treated with medical therapy alone.

It is imperative that any form of therapy that improves cure rates with acceptable morbidity and mortality be meticulously explored. As such, adjuvant lung resection in selected patients with DR-TB both with, but more importantly without HIV co-infection justifiably warrants more urgent attention and utilization.

Conflict of interest: none declared.

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