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4 Title: High rates of treatment success in pulmonary multidrug-resistant tuberculosis

5 by individually tailored treatment regimens

6 Running title: Optimal multidrug-resistant tuberculosis treatment outcomes

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48

Abstract

Rationale

We evaluated whether treatment outcomes for patients with multidrug-resistant and extensively drug-resistant tuberculosis can be substantially improved, when sufficient resources for personalizing medical care are available.

Objectives

To describe the characteristics and outcomes of patients with pulmonary multidrug-resistant tuberculosis from the Otto Wagner Hospital in Vienna, Austria.

Methods

Retrospective single-centre study at the Otto-Wagner-Hospital, Vienna, Austria. The records of patients with multidrug-resistant tuberculosis were reviewed for epidemiological, clinical, laboratory, treatment and outcome data.

Results

Ninety patients with pulmonary multidrug-resistant tuberculosis were identified. Median age was 30 years (interquartile range 26-37). All patients were of non-Austrian origin and 70 (78%) came from the former Soviet Union States. Thirty-nine (43%) patients had multidrug-resistant tuberculosis, 28 (31%) had additional bacillary resistance to at least one second-line injectable drug, 9 (10%) to a fluoroquinolone, 14 (16%) patients had extensively drug-resistant tuberculosis. In 97.8% (n=88) of patients different drug combinations were used for treatment. Sixty-five (72.2%) patients had a successful treatment outcome, 8 (8.9%) defaulted, 3 (3.3%) died, 8 (8.9%) continued treatment in another country and their outcome was unknown, and 6 (6.7%) were still on therapy. None of the patients experienced treatment failure. Treatment outcome for extensively drug-resistant tuberculosis was similar to that of multidrug-resistant tuberculosis.

78   Conclusions

79   High rates of treatment success can be achieved in patients with multidrug-resistant

80   and extensively drug-resistant tuberculosis when individualized tailored treatment

81   regimen can be provided.

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85   Key words: drug resistance, MDR-TB, outcome, treatment, tuberculosis

Introduction

Despite Global efforts, tuberculosis (TB) remains a leading cause of morbidity and mortality representing the tenth most common cause of death worldwide (1). Although the incidence of TB has registered a descending trend in recent years, the emergence and increase in multidrug- resistant (MDR) TB incidence is a cause of great concern. According to the World Health Organization (WHO), an estimated 480,000 cases of MDR-TB have occurred in 2013 resulting in 210,000 deaths (2). MDR-TB is defined as bacillary resistance to isoniazid and rifampicin, while extensively drug-resistant (XDR)-TB is defined by additional resistance to at least one second-line injectable drug (amikacin, kanamycin, capreomycin) and at least one fluoroquinolone (3). The WHO recommends that patients with MDR-TB receive prolonged antimicrobial treatment of at least 20 months (4), including a minimum of 4 second-line drugs that are likely to be effective in the therapy plus pyrazinamide. MDR-TB treatment is frequently associated with adverse drug events (5), with high costs (6), and high rates of loss to follow-up and failure (7-11). Additionally, owing to limited possibilities to test for drug-resistance and to optimise regimens in many settings where the global burden of MDR-TB is highest, treatment for MDR-TB is often standardized irrespective of the severity of disease and the resistance pattern of the associated strain.

Poor treatment outcomes were reported in a meta-analysis of over 6700 patients, where MDR-TB treatment success ranged from 64% in patients with MDR-TB and no additional resistance to injectable drugs or fluoroquinolones to 40% in patients with XDR-TB (8). Additionally, according to data from the European Centre for Disease Prevention and Control (ECDC) analysing treatment outcomes, treatment success was registered in only 46% of MDR-TB and only 23.2% of XDR-TB cases

111   (10). Furthermore, access to MDR-TB treatment is often difficult with only a third of

112   the estimated cases being enrolled on treatment in 2013 (2).

113   While the European Region of the WHO has the highest proportion of all patients

114   with MDR-TB identified world-wide, the vast majority of these patients live in eastern

115   part of the European Region, especially in countries from the former Soviet Union.

116   Compared to the European Union/ European Economic Area countries, where a total

117   of only 1255 patients with laboratory-confirmed MDR-TB were identified in 2013,

118   there were 33,679 patients with MDR-TB identified in Eastern Europe during the

119   same time period (10). Furthermore, an estimated 100,000 MDR-TB cases occurred

120   in India in China (2).

121   Poor treatment outcomes that have been reported for MDR-TB may not be

122   applicable when resources for diagnosis and treatment are readily available and

123   MDR-TB management can be optimized. Austria has a low incidence of TB, where

124   only 16 patients with M/XDR-TB were registered in 2013 (12), more than half (57%)

125   of the patients diagnosed with MDR-TB from Austria are treated at the Otto-Wagner

126   Hospital in Vienna. This hospital has a dedicated unit for the treatment of patients

127   with M/XDR-TB, where highly specialized care can be provided under optimal

128   circumstances. In addition to continuous and unrestricted drug-availability as well as

129   rigorous monitoring during the course of therapy (clinical, laboratory, microbiological

130   and radiological), the management of all patients includes regular physiotherapy and

131   psychological counselling sessions supporting treatment adherence and coping with

132   the adverse events of therapy. Considering the large number of patients originating

133   from outside Austria, interpreters are present when required, to assist patients with

134   communication issues. Furthermore social workers form the department of public

135   health as well as an on-site fully-dedicated social worker, provide assistance with the

136   administrative and insurance-related issues and organize further care after discharge

137   from hospital.

138   We evaluated treatment outcomes for patients with M/XDR-TB under personalized

139   medical care.

140   Some of the results of this study have been previously reported in the form of an

141   abstract (13).

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143

144   **Methods**

145   *Patient population*

146   Patients with microbiologically-confirmed pulmonary MDR-TB and positive cultures

147   for *M. tuberculosis* from respiratory samples, admitted at the Otto Wagner Hospital,

148   Vienna for treatment between January 2003 and December 2012 were included in

149   the study. Otto Wagner Hospital is a referral center with extensive expertise in the

150   treatment of patients with TB from Austria.

151   *Data collection*

152   Patients were identified using the department patient register which included all

153   patients with M/XDR-TB hospitalized at the site. Entries were cross-referenced with

154   the microbiological registries to identify *M. tuberculosis* strains with rifampicin and

155   isoniazid resistance. Patient records were reviewed for epidemiological, clinical,

156   laboratory, treatment and outcome data and information was recorded in an

157   anonymized database which was further analysed.

158

159   *Drug susceptibility testing*

160 Drug susceptibility testing was performed in a specialized laboratory at the Institute

161 for Medical Microbiology and Hygiene, Austrian Agency of Health and Food Safety

162 and confirmed at the National Reference Center for Mycobacteriology, Borstel,

163 Germany, one of the WHO supranational reference laboratory for tuberculosis. All

164 patients included in the study had a positive *Mycobacterium tuberculosis* culture

165 available for drug susceptibility testing.

166 Susceptibility testing was performed for the following drugs: isoniazid, rifampicin,

167 rifabutin, ethambutol, pyrazinamide, streptomycin, amikacin, capreomycin,

168 fluoroquinolones, prothionamide, cycloserine, *para*-aminosalicylic acid (PAS), and

169 linezolid.

170

171 *Treatment and outcome*

172 Patients were considered to receive an appropriate MDR-TB treatment-regimen

173 once they received at least 4 drugs in combination therapy that were thought to be

174 effective according to the results of drug susceptibility testing, including a second-

175 line injectable drug for the intensive phase of treatment (14). TB treatment was

176 directly observed during the whole course of therapy. To ascertain the

177 microbiological response to treatment, sputum cultures were collected on a monthly

178 basis during hospitalization and every 1-2 months onwards until the end of therapy.

179 Outcome was ascertained using the revised WHO definitions (3). Patients were

180 considered to have a favourable outcome if they were either cured or had completed

181 the treatment or an unfavourable outcome in the case of default, treatment failure or

182 death.

183

184 *Statistical analysis*

185 Data processing and analysis were performed using SPSS v17.0 (SPSS Inc.,

186 Chicago, IL, USA). Mann-Whitney U test was used to test for differences between

187 continuous variables and chi-square test or Fisher's exact test were used for

188 categorical variables. The level of significance was set at α=0.05. Multivariate

189 analysis using backward stepwise logistic regression was then used to predict

190 treatment outcome when the p-value from the univariate analysis was <0.20.

191

192 *Ethics*

193 The study was approved by the ethics committee of the city of Vienna

194 (Ethikkommission der Stadt Wien: EK 14-240-VK).

195

196

197 **Results**

198 *Patient characteristics*

199 A total of 94 patients with M/XDR-TB who were admitted during the study period

200 were identified. Four patients had extrapulmonary M/XDR-TB, and were excluded

201 from the analysis. Median patient age at diagnosis was 30 years (interquartile range

202 (IQR) 26-37). Male to female ratio was 1.5:1. All patients were of non-Austrian origin

203 and came from the Russian Federation (n=55, 61.1%), Georgia (n=11, 12.2%),

204 Romania (n=11, 12.2%) or other countries (13, 14.4%). Fifty of the patients from the

205 Russian Federation were from Chechnya. Seventeen patients were intravenous drug

206 users, and 52 (58%) were active smokers. All patients were tested for HIV infection,

207 but none were HIV-seropositive. The characteristics of the patients included in the

208 study are presented in Table 1.

209

Drug susceptibility testing

Thirty-nine (43%) patients had MDR-TB only, 28 (31%) had additional resistance to at least one second-line injectable drug, 9 (10%) to a fluoroquinolone, while 14 (16%) of patients had XDR-TB. The patients with XDR-TB were originally from Chechnya (n=9), Romania (n=3), Georgia (n=1) and China (n=1). Resistance to at all first-line drugs was recorded in 40 (44%) of patients. The results of the drug susceptibility testing are shown in Figure 1. Of note is that 8 (8.9%) *M. tuberculosis* strains were susceptible to rifabutin.

Management and treatment outcome

Median time from hospital admission to the start of an appropriate M/XDR-TB treatment was 23.5 days (IQR 0.8-45).

Eighty-eight different drug combinations were used for the treatment of the 90 patients (97.8%) treatment. The drug regimens according to their composition are represented in Figure 2. The intensive phase contained a median of 5 drugs (IQR 5-6), while in the continuation phase, a median of 3 drugs (IQR 3-4) were used.

Smear conversion occurred after a median 61 days (IQR 22-135) following the initiation of adequate treatment while culture conversion occurred after a median of 62 days (34-112.8 days). Only 3 (3.3%) patients did not experience a culture conversion. Figure 3 shows smear and culture conversion during anti-TB treatment.

Culture conversion occurred in 40 (46%) patients within the first 2 months of effective M/XDR-TB therapy, and in 72 (82.8%) patients within 6 months.

The median duration of the intensive phase was 123 days (IQR 82-228) and continuation phase was 494 days (IQR 388-599 days). The overall median duration of therapy was 21 months (IQR 18-24 months); in patients with a favourable

outcome, the median duration of therapy was 23 months (IQR 19-24 months) while

in patients who experienced an unfavourable outcome it was 4 months (IQR 3-18

months, p <0.001). One patient defaulted before therapy could be initiated.

The median duration of inpatient stay was 141 days (IQR 96.5-230.3 days) while the

median duration of treatment in the out-patient setting was of 15 months (IQR 12-23

months).. Patients with smear positive tuberculosis had a significantly longer hospital

stay with a median duration of 191 days (IQR 108.5-243) compared to smear

negative patients - median duration 102.5 days (IQR 67.5-134.8, p <0.001).

Additionally, the median length of hospital stay was longer in patients with XDR-TB

in comparison to patients with non-XDR-TB (335 vs. 128 days, p <0.001).

Surgery was performed in 10 (11.1%) of patients. Of the nine patients with a known

outcome, 6/9 (66.7%) had a favourable outcome. For facilitating the administration of

parenteral therapy, 48 (53.3%) of patients received a totally implantable central

venous access system (port-a-cath).

As shown in Table 2, 65 (72.2%) patients had a favourable treatment outcome (56

fulfilled the criteria for cure and 9 completed treatment), 8 (8.9%) defaulted, 3 (3.3%)

died, 8 (8.9%) continued the treatment in their home-country after hospital discharge

and their outcome was therefore unknown, and 6 (6.7%) were still on therapy. One

of the patients who died had concomitant central nervous system TB. If only the

cases with a known outcome are considered, then 85.5% of patients had a

successful outcome. Out of 14 patients with XDR-TB, nine (64%) were cured, one

(7%) died and four (29%) were still on treatment. None of the patients included in the

study experienced treatment failure. Of the seven patients who were treated with

bedaquiline, five were still on treatment when the data were analysed, one was

transferred to another treatment facility and one died. All patients treated with

260 bedaquiline, who had a prolonged culture positivity, achieved culture conversion. Of

261 the 14 patients who had received fusidic acid, 13 had a favourable outcome, while

262 one died (p=0.68). In the univariate analysis the duration of therapy (p <0.01),

263 treatment with cycloserine (p <0.01), not receiving treatment with pyrazinamide

264 (p=0.04) and a negative culture status at six months (p=0.04) were associated with a

265 favourable treatment outcome. In the multivariate analysis the duration of therapy

266 (OR 0.66, 95%CI 0.51-0.86; p=0.002) and culture status at 6 months (OR 0.04,

267 95%CI 0.02-0.70; p=0.03) were associated with a favourable outcome.

268

269 *Adverse events*

270 Gastrointestinal adverse events occurred in 74 (82.2%) patients, polyneuropathy in

271 48 (53.3%), ototoxicity in 31 (34.4%), psychiatric adverse effects in 44 (48.9%), and

272 liver enzymes were elevated during therapy in 44 (48.9%) of patients. Treatment with

273 linezolid was more frequently associated with polyneuropathy (62.3% versus 34.5%,

274 p=0.023), while ototoxicity was associated with amikacin therapy (52.2% versus

275 28.4%, p=0.046). Ototoxicity was present in 25% of patients who had received

276 capreomycin versus 42% of patients without capreomycin treatment, p=0.92.

277

278

279 **Discussion**

280 While treatment outcome for patients with M/XDR-TB in Europe are frequently

281 reported to be poor (15), we are able to show that treatment outcomes for pulmonary

282 M/XDR-TB can be substantially improved in a setting where patient management is

283 individualized. By using tailored drug regimen, treatment success rates close to the

284 target proposed by the WHO (13) can be achieved. In this study from a single

285 referral centre in Austria treatment success rates were over 72%, (and over 85% in

286 patients with a definite outcome) which contrasts with the ECDC data which reports

287 a successful treatment outcome in only 46% of patients from Europe (10). One

288 explanation for this large difference might be the incomplete reporting of treatment

289 outcomes to the ECDC and a larger proportion of lost to follow-up due to migration,

290 as well as an offsetting contribution by countries with a large number of MDR-TB

291 patients and low treatment success rates such as Romania and Lithuania (10).

292 Furthermore, individualized therapy is also likely to have played an important

293 contribution to achieving high rates of treatment success, considering that in this

294 study 88 different drug-combinations were used.

295 With the advent of two new drugs for the treatment of MDR-TB and XDR-TB,

296 treatment outcomes may improve substantially. As 6 of the 7 patients receiving a

297 bedaquiline based treatment regimen experienced sustained culture conversion it is

298 hoped that treatment outcomes may improve in general in the European region,

299 when these drugs will become universally available. Recently it has been reported,

300 that 28 of 29 (97%) patients with culture-positive pulmonary M/XDR-TB who were

301 treated with a bedaquiline containing regimen, experienced culture conversion at 6

302 months of treatment (16). Furthermore, the 6 months culture status is a very good

303 approximation for achieving a successful treatment outcome in patients treated for

304 MDR-TB (17).

305 While analyses of large patient cohorts describe unfavourable outcomes in more

306 than half of patients with MDR-TB, studies from individual countries or specialized

307 centres report significantly higher rates of treatment success. For example, studies

308 on selected patient cohorts from other European countries, describe treatment

309 success rates of 59% in Germany (18), 68% in Belgium (19), 71% in the United

310   Kingdom (20), 76% in Switzerland (21), and 79% in the Netherlands (22).

311   Interestingly, the overall and MDR-TB treatment success rates in Austria were lower

312   than the ones from this study, of 66% and 65%, respectively, emphasizing the

313   importance of highly- specialized management (10).

314   All patients with M/XDR-TB in this study are not of Austrian origin. The ECDC TB

315   report also suggests that over half of patients with TB in a lot of the countries of

316   Western Europe are of foreign origin (10). This underscores the importance of

317   migration in the epidemiology of MDR-TB. While in the countries of Western Europe

318   most patients with MDR-TB have access to appropriate treatment, in other countries

319   such as Russia less than half of the estimated 44,000 patients with MDR-TB were

320   enrolled on treatment in 2011 (23), while in Ukraine, a country with a high-burden of

321   MDR-TB due to conflict and population displacement many patients have difficulties

322   in accessing treatment (24). More than half of the patients with M/XDR-TB in this

323   study were from Chechnya. This might be because Austria has the second largest

324   Chechen diaspora in Europe with a large proportion of refugees (25) and in

325   Chechnya about a half of TB cases are MDR (26).

326   Another factor that contributes to treatment accessibility and success is the cost of

327   MDR-TB therapy. While a full course of MDR-TB treatment costs 70 times more than

328   for pan-susceptible TB, costs for XDR-TB might be as 280-fold higher making it a

329   considerable burden on countries where M/XDR-TB are prevalent (6).

330   Interestingly, almost a tenth of the *M. tuberculosis* strains isolated were still

331   susceptible to rifabutin. This underscores the importance of drug susceptibility

332   testing for rifabutin, and if susceptible, including it in the therapy regimen which, due

333   to its effectiveness, could potentially lead to a shorter duration of therapy and

334   improved treatment outcomes.

335   A number of drugs of unclear efficacy against *M. tuberculosis* were used for the

336   treatment of MDR-TB. Fusidic acid, an antibiotic which works via protein synthesis

337   inhibition and active on gram-positive bacteria, was used as part of the drug regimen

338   in almost a fifth of patients in the study. There was a trend showing a higher rate of

339   favourable outcome in patients receiving fusidic acid, but the difference was not

340   significant. *In vitro* studies have shown that fusidic acid has an inhibitory effect on *M.*

341   *tuberculosis* growth (27, 28). As this drug has not been evaluated in early

342   bactericidal activity studies or in clinical trials fusidic acid should be explored as a

343   repurposed drug for the treatment of MDR-TB.

344   Over two thirds of patients in this study were treated with linezolid, which has been

345   shown to be effective in patients with M/XDR-TB (18, 29). A recently published meta-

346   analysis on linezolid-containing regimens reported favourable outcomes in 83% of

347   patients treated with linezolid (30), however most of the studies were retrospective

348   and had no control arm. Unfortunately, linezolid therapy is associated with frequent

349   and sometimes severe adverse events requiring treatment discontinuation (30, 31).

350   In the present study, linezolid therapy was also significantly associated with

351   polyneuropathy in over 60% of patients.

352   The multivariate analysis showed that a longer total duration of therapy, and the

353   status of sputum culture at 6 months were associated with a favourable outcome.

354   The *M. tuberculosis* strains from the patients included in the study had high rates of

355   additional resistance to anti-tuberculosis drugs other than rifampicin and isoniazid..

356   Over 44% of strains had resistance to all first-line drugs, 49% had resistance to

357   prothionamide, 46% had resistance to at least one second-line injectable drug and

358   over a quarter had resistance to fluoroquinolones. These findings are in line with

359   other recent observations on the level of bacillary drug resistance of MDR- *M.*

360 *tuberculosis* in the region (32, 33).This represents higher rates of resistance than

361 that reported in studies using standardized treatment regimens for MDR-TB (34) and

362 suggests that a standardized treatment approach should not be followed in the

363 European Region as patients may be treated with second line antituberculosis drugs

364 that are not effective. Standardized treatment could lead to further acceleration of

365 drug-resistance development. It is important to notice that with an individualize

366 treatment approach high treatment success rates could be achieved despite the

367 "MDR-TB plus" scenario in patients treated for M/XDR-TB in Vienna.

368 MDR-TB requires a prolonged duration of therapy and is associated with an

369 increased length of hospital stay, frequent and sometimes irreversible adverse

370 events and extremely high costs. Due to the physical and psychological difficulties

371 experienced by patients during the course of treatment, specialized support is of

372 great value. It is very likely that the regular psychological counselling and social

373 support given to the patients from this study, played an important contribution to

374 improve treatment adherence and attain high rates of treatment success in this

375 setting.

376 Although this study is retrospective and lacks a direct comparison to other

377 management strategies, it provides unique information on a large number of patients

378 with pulmonary M/XDR-TB from a single-centre from a Western European country of

379 a low tuberculosis-incidence.

380 In conclusion this study shows that high rates of successful treatment outcome can

381 be achieved in patients with M/XDR-TB in Europe when the drug regime is

382 individualized to the results of 2nd line drug susceptibility testing and 2nd line drugs

383 are available for the treatment without restrictions. Additionally, the adequate

384 funding to provide medications, appropriate testing and supportive care, treatment

385 adherence due to prolonged hospitalization and effective management of adverse

386 events also played an important role in the high rates of treatment success. The

387 results also underscore the importance of a multidisciplinary treatment approach

388 comprising individualized patient care, as well as psychological and social support to

389 improve adherence to therapy and for the early detection and management of

390 treatment-related adverse events (35). With these combined efforts, treatment

391 outcomes for patients with M/XDR-TB can be substantially improved.

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Tables and figures

Figure 1. Spectrum of first- and second line anti-tuberculosis drug-resistance in 90 strains of *M. tuberculosis* from patients with M/XDR-TB at Otto-Wagner Hospital, Vienna (Austria) admitted between 2003 and 2012.

Figure 2. Drugs regimens for the treatment of M/XDR-TB.

Regimens are represented according to their composition. In the central square it is shown how many patients received fluoroquinolones, aminoglycosides, both or none. Drugs are added along the lines. The number in the circle represents the number of the patients who go through that particular node. The black point (•) represents the number of patients ending the regimen in that node. AMC amoxicillin clavulanic acid; BDQ bedaquiline; CFZ clofazimine; CLA clarithromycin; CS cycloserine; DDS dapsone; EMB ethambutol; FQ fluoroquinolones; FUS fusidc acid; IMP imipenem; INJ second-line injectable drugs; LZD linezolid; PAS para aminosalicylic acid; PTO prothionamide; PZA pyrazinamide; RFB rifabutin; SXT trimethoprim-sulfamethoxazole.

Figure 3. Smear (A) and culture (B) conversion during anti-tuberculosis treatment.

Smear conversion is shown only for patients with a positive smear at treatment initiation.

588 **Table 1**. Characteristics of 90 patients with M/XDR-TB admitted between 2003 and

589 2012 at the Otto-Wagner Hospital, Vienna (Austria)

Variable	MDR-TB N = 76	XDR-TB N = 14	p-value
Male gender, n (%)	45/76 (59.2)	9/14 (64.3)	0.722
Age (years), median (IQR)	30 (25.3-35.3)	33.5 (28.8-42.3)	0.101
Country of birth, n (%) Former Soviet Union Other	60/76 (78.9) 16/76 (21.1)	10/14 (71.4) 4/14 (28.6)	0.503
Previous TB treatment, n (%)	38/69 (55.1)	10/13 (76.9)	0.142
Cavitary disease, n (%)	50/76 (65.8)	12/14 (85.7)	0.211
Smear positive at diagnosis, n (%)	50/75 (66.7)	11/14 (78.6)	0.535
Resistance to all first-line drugs, n (%)	31/76 (40.8)	9/14 (64.3)	0.104
Resistance to fluoroquinolones, n (%)	9/75 (12)	14/14 (100)	NA
Resistance to second-line injectable drugs, n (%)	28/76 (36.8)	14/14 (100)	NA
Number of drugs in the intensive phase, median (IQR)	5 (5-6)	6 (6-6.3)	0.021

Number of drugs in the continuation phase, median (IQR)	3 (3-4)	4 (3-4)	0.051
Linezolid treatment, n (%)	49/76 (64.5)	12/14 (85.7)	0.177
Bedaquiline treatment, n (%)	3/76 (3.9)	4/14 (28.6)	0.010
Days in hospital, median (IQR)	128 (89.8-212.5)	335 (190.5-436.5)	<0.001
Duration of treatment (months), median (IQR)	19.5 (17.8-24)	24 (22.3-24.8)	0.012
Culture conversion, n (%)	71/65 (95.9)	14/14 (100)	1.00
Time to smear conversion (days), median (IQR)	56.5 (21-119.5)	128 (56-269.5)	0.024
Time to culture conversion (days), n (%)	61 (30.8-96)	110 (54.8-288.8)	0.010

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592   **Table 2.** Treatment outcomes in patients with M/XDR-TB

	MDR-TB N = 76	XDR-TB N = 14
Favourable outcome (cured + completed)	56 (73.7)	9 (64.3)
Cured	47 (61.8)	9 (64.3)
Completed	9 (11.8)	0 (0)
Unfavourable outcome (died + failure)	2 (2.6)	1 (7.1)
Died	2 (2.6)	1 (7.1)
Failure	0 (0)	0 (0)
Unknown outcome (default + transferred out)	16 (21)	0(0)
Default	8 (10.5)	0 (0)
Transferred out	8 (10.5)	0 (0)
Still on treatment	2 (2.6)	4 (28.6)

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