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Original Article

Proportion of Extrapulmonary MDR-TB Confirmed by GeneXpert® in Dr. Hasan Sadikin General Hospital, West Java, Indonesia Year 2012–2021

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ABSTRACT

As the third-highest country with tuberculosis (TB) incidence worldwide in 2020, Indonesia has increasing TB cases resistant to various anti-TB therapy or multidrug-resistant (MDR)-TB, and ranked fifth for its high incidence reported in Global Tuberculosis Report 2020. Moreover, extrapulmonary TB (EPTB) is rising, and data studies on EPTB with MDR-TB in Indonesia are scarce. This study aimed to explore the proportion of extrapulmonary MDR-TB among TB cases in Dr. Hasan Sadikin General Hospital Bandung, West Java, Indonesia. A descriptive retrospective and cross-sectional study design were conducted, retrieving medical records from all suspect MDR-TB adult patients examined by GeneXpert®, at Dr. Hasan Sadikin General Hospital Bandung, West Java period 2012–2021. Those with EPTB were further analyzed, and the demographic data was collected as well as clinical history, behavioral history, sites of extrapulmonary MDR-TB, and drug resistance. Of a total 7,013 TB cases, 1,900 (27.1%) were MDR-TB cases, of whom 0.08% (n6) were extrapulmonary MDR-TB cases and 0.16% (n11) were combined with PTB. The main characteristics of cases with extrapulmonary MDR-TB were median age 27-year-old (range 25–34), male gender (64.7%), underweight BMI (84.6%), and predominantly were primary cases (35.3%). The anti-TB drug resistance in MDR-TB were pre-XDR-TB (11.7%), XDR-TB (5.6%), MDR-TB (42%), and RR-TB (40.7%). Although the proportion of extrapulmonary MDR-TB among all TB cases is small (0.2%), this disease can't be ignored and has a great potential to be explored. Most of them are rifampicin-resistant. Further studies need to include a larger population to have more overview of MDR-TB with EPTB.

Keywords: *extrapulmonary; Indonesia; multidrug-resistant; rifampicin; tuberculosis;*

ABSTRAK

Sebagai negara ke-3 dengan kejadian tuberkulosis (TB) terbanyak di seluruh dunia pada tahun 2020, Indonesia juga mempunyai angka kejadian TB resisten obat ganda (MDR) yang meningkat, dan diketahui sebagai negara ke-5 terbanyak untuk kejadian MDR-TB di dunia berdasarkan Global Tuberculosis Report 2020. Ditambah dengan adanya kejadian TB ekstra paru yang meningkat, namun penelitian terkait MDR-TB ekstra paru di Indonesia masih sangat jarang. Penelitian ini bertujuan untuk mencari proporsi kasus MDR-TB ekstra paru dibandingkan dengan keseluruhan kasus di RSUP Dr. Hasan Sadikin Bandung, Jawa Barat. Deskriptif retrospektif dan desain potong lintang, dengan pengambilan data rekam medis pasien dewasa yang merupakan suspek MDR-TB dan diperiksa dengan TCM GeneXpert® di RSUP Dr. Hasan Sadikin Bandung, Jawa Barat pada tahun 2012 sampai tahun 2021. Proporsi MDR-TB ekstraparu kemudian dianalisis lebih lanjut, berserta dengan data demografi dan riwayat klinis, kebiasaan perilaku, lokasi infeksi MDR-TB ekstra

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paru, dan pola resistan pada MDR-TB. Dari 7,013 kasus TB, terdapat 1,900 kasus (27.1%) MDR-TB, yang terdiri dari 0.08% (n6) MDR-TB ekstra paru dan 0.16% (n11) MDR-TB kombinasi paru dan ekstra paru. Proporsi karakteristik yang terbesar pada penelitian ini ditandai dengan median pada umur 27 tahun, dengan kelompok umur 25 – 34 tahun, jenis kelamin laki-laki (64.7%), IMT <18.5kg/m2 (84.6%), dan kasus primer (35.3%). Proporsi pola resisten obat terbanyak yang ditemukan adalah pre-XDR-TB (11.7%), XDR-TB (5.6%), MDR-TB (42%), dan RR-TB (40.7%). Meskipun proporsi MDR-TB ekstra paru pada seluruh kasus TB hanya sedikit (0.2%), penyakit ini tidak bisa diabaikan dan masih mempunyai potensi yang besar untuk diteliti. Proporsi terbesar merupakan resistan terhadap rifampicin. Studi lebih lanjut memerlukan populasi yang lebih besar untuk mengetahui secara keseluruhan mengenai MDR-TB ekstra paru.

Kata kunci: *ekstra paru; Indonesia; resisten obat ganda; rifampicin; tuberkulosis*

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INTRODUCTION

Tuberculosis (TB) is well-known for its highly contagious transmission of *Mycobacterium tuberculosis (Mtb)* by airborne through coughing, sneezing, talking, or doing other things.[1] Although it has been identified for many years, the incidence of TB is still thriving from time to time.[2] Comparing the incidences between the year 2015 and 2019 in Indonesia, there were rises around 69%, which caused Indonesia to become the third country, coming up after India, with the highest TB incidences in the world in 2020.[3]

Inappropriate anti-TB drugs administration would lead to failed eradication of *Mtb* and risk leading to *Mtb* mutation, resulting in resistance to 1st category of anti-TB drugs, which could be confirmed as multidrug-resistant TB (MDR-TB) with GeneXpert®.[4] In Global Tuberculosis Report 2020, Indonesia was the fifth country with the highest MDR-TB incidence globally.[5] The MDR-TB incidence in Indonesia reached 8.8 cases in 100,000 populations, with 2.4% primary cases and 13% have treated with anti-TB drugs in 2019, which unknown for its incidence in 2020 although Indonesia was in the 30 high MDR-TB burden countries.[3,5] From inappropriate anti-TB drugs administrations, there are several risk categories defined in the National Guideline for Tuberculosis by the Ministry of Health Republic of Indonesia.[6–9]

Confirmed MDR-TB patients are those whose samples have been examined and proved that there were anti-TB drug-resistant *Mtb*, especially against isoniazid and rifampicin, can be together with or without other anti-TB drugs. MDR-TB could be grouped by its sites of infection, such as exclusively pulmonary TB (PTB), extrapulmonary TB (EPTB), and EPTB with PTB.[10] The extrapulmonary MDR-TB proportion in China is 2.5% among all TB patients and 9.3% among MDR-TB patients in 2008 – 2017; and 5.1% among all TB patients and 12.6% among MDR-TB patients in India period 2012 – 2014.[11,12]

The location of extrapulmonary TB could differ in every patient, mainly manifested in lymph nodes and pleura, consecutively causing TB lymphadenitis and TB pleurisy due to their sites being the nearest from the lungs.[13] Apart from them, TB infections may take place in the skeletal, abdomen, pericardium, central nervous system, and other locations.[11]

Although extrapulmonary MDR-TB cases are not rare, there have not been many studies reported, especially in Indonesia. Therefore, this study aimed to measure the proportion of extrapulmonary MDR-TB among TB cases and explore characteristics related to the MDR-TB cases at Dr. Hasan Sadikin General Hospital Bandung, West Java, Indonesia in 2012-2021.

MATERIALS AND METHODS

Study Site and Period

This study used a retrospective cross-sectional study design. Secondary data were collected using total sampling method, retrieved from the medical record in MDR clinic Dr. Hasan Sadikin General Hospital Bandung, cross-checked with data from e-TB manager, SITB (*Sistem Informasi Tuberkulosis*), and Lab TB 04 at Dr. Hasan Sadikin General Hospital Bandung, West Java, Indonesia, in the period between April 2012 – August 2021.

Samples and Data Collection

The inclusion criteria were all data of adult MDR-TB and TB patients (≥18 years) registered in SITB and e-TB Manager as TB03 and TB06, and GeneXpert® Lab as TB04 in Dr. Hasan Sadikin General Hospital Bandung (Figure 1). The incomplete data, which were completely missing from the medical record, were excluded from this study.

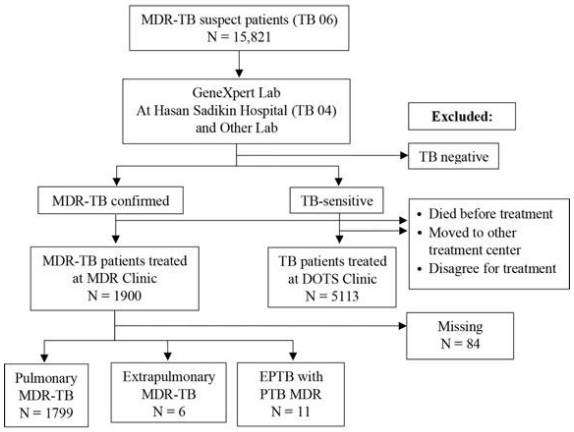

Figure 1. Flowchart of MDR-TB Suspect Cases at Dr. Hasan Sadikin General Hospital Bandung, West Java

The total number of cases of MDR-TB and TB sensitive were collected. The site location of MDR-TB, drugs resistances, and the extrapulmonary sites in MDR-TB was also collected and analyzed for their distribution proportion, along with the following data from the medical records, such as age, gender, body mass index, comorbid diseases (Diabetes Mellitus, HIV Status, Systemic Lupus Erythematosus, and others), smoking history, alcohol consumption history, and risk category for MDR-TB, were also analyzed for their proportions.

The gold standard for extrapulmonary MDR-TB diagnostics in Dr. Hasan Sadikin General Hospital Bandung preceded by rapid molecular test using GeneXpert®. The samples or tissue samples are collected from the suspected extrapulmonary TB locations. If the result appeared resistant, certified culture methods and drug susceptibility test (DST) would be performed with another collected tissue samples from the previous location. However, if the location of the samples is considered hard to reach, rapid molecular test is enough to diagnose extrapulmonary MDR-TB.

Data Definition and Analysis

The risk category for MDR-TB patients according to the national guideline for TB consisted of 12 categories, which number 10 – 12 were applied since 2020:[6–8]

1. Chronic TB patients, who are still sputum smear-positive at the end of the first line TB re-treatment (Category 2);
2. TB patients with 2nd category treatment which not converted in 3 months of treatment;
3. TB patients who have a non-standard TB treatment history using quinolone and 2nd line anti-TB drug injection for at least 1 month, who received any TB treatments outside of the national program, for example, non-DOTS and private clinic;
4. TB patients who failed 1st category treatment;
5. TB patients with 1st category treatment who remain positive after 3 months of treatment; Relapse TB patients, categories 1 and 2, whose most recent treatment outcome was ‘cured’ or ‘treatment completed’ yet return with TB symptoms;
6. Returning TB patients after loss to follow-up (negligent treatment/default), who

interrupted any TB treatments for two or more consecutive months and returned with TB symptoms;
7. Suspected TB patients with a history of close contact with MDR-TB patients, who live in the same household or spending many hours a day in the same indoor living space with an MDR-TB patient and show TB symptoms;
8. TB-HIV co-infection patients who do not respond to anti-TB drug administration;
9. MDR-TB patients who failed treatment;
10. Relapse MDR-TB patients;
11. Returning MDR-TB patients after loss to follow-up (negligent treatment/default).

Patients who don't belong to these categories and tested positive for resistance to at least rifampicin and isoniazid without any history of consuming 1st line TB treatment are considered to be primary MDR-TB.[9]

This study still used the old definitions of pre-XDR-TB is MDR-TB with resistance to any fluoroquinolone or at least one of three second-line injectable drugs (capreomycin, kanamycin, and amikacin), and XDR-TB is TB that is resistant to any fluoroquinolone and at least one of three second-line injectable drugs (capreomycin, kanamycin, and amikacin). However, there are new definitions by WHO in 2021 because this study used the data from the year 2012-2021, which used the old definitions for patients grouping.[14]

Data retrieved was further presented in the proportion of MDR-TB, characteristics, EPTB sites, and anti-TB drug resistance, using a descriptive method with SPSS IBM® SPSS® ver. 22.

Ethical Issues

Ethical permission for this study had been granted from the Ethics Committee of Universitas Padjadjaran with number 494/UN6.KEP/EC/2021 and the Research Permit were given from the Health Research Ethics Committee of Dr. Hasan Sadikin General Hospital Bandung with number LB.02.01/X.2.2.1/16836/2021.

RESULTS AND DISCUSSION

The data we collected was 7013 TB cases, consisting of 1900 MDR-TB cases (27.1%) and 5113 TB sensitive cases (72.9%). As we collected the data from 1900 registered MDR-TB patients, we found 97 patients that came repetitively, hence re-registered into the database, of whom came five times (n1), thrice (n6), and twice (n90), thus resulting in the same name counted as different cases in this study. Nevertheless, this study still included all of these data because the cases were considered different from those who lost to follow-up, relapsed, and failed conversion after treatment.

Of a total of 1900 adults, 1799 had pulmonary TB (PTB), 6 had extrapulmonary TB (EPTB), 11 combined had EPTB with PTB, and 84 with no data found, which excluded in other variables analyzed in Table 1–3. Table 1 shows the proportion of MDR-TB characteristics and exclusively shows the proportion of PTB MDR, EPTB MDR, and their combination. Most of the MDR-TB patients were in the age group 35 – 44 years old and 25 – 34 years old among EPTB MDR patients. The majority of the MDR-TB patients were male (58%). Underweight was found the most in MDR-TB patients (46.3%), pulmonary MDR-TB patients (61.2%), and extrapulmonary MDR-TB patients (84.6%).

There were 275 pulmonary MDR-TB patients with diabetes mellitus as their comorbid disease and 80 MDR-TB patients with hypertension. Interestingly, there were two MDR-TB patients with systemic lupus erythematosus (SLE) and 25 MDR-TB patients with HIV co-infection, consisting of 17 pulmonary MDR-TB patients, one combined EPTB with PTB MDR patient, and the rest were unknown. There were 43% of MDR-TB patients who had never smoked and 74.2% of MDR-TB patients who had never consumed alcohol. Category 6 from the risk category of MDR-TB, defined as relapse TB patients (category 1 and 2), was the most frequent in this study (36.8%) and among extrapulmonary MDR-TB was primary MDR-TB (35.3%), defined as acquired MDR-TB patients who don't belong to the 12 categories.

Table 1. Characteristics Proportion in MDR PTB, EPTB, and EPTB with PTB

Characteristic		MDR-TB Total	MDR-TB Locations		
			PTB	EPTB	EPTB with PTB
		n (%)	n (%)	n	n
		1816	**1799**	**6**	**11**
Gender	Male	1058 (58.3)	1047 (58)	4	7
	Female	758 (41.7)	752 (42)	2	4
Age (years) – Median (IQR)		38 (35–44)	38 (35–44)	28 (25–34)	27 (25–34)
Clinical History					
BMI (kg/m^2)*		**1432**	**1419**	**6**	**7**
	<18.5	879 (46.3)	868 (61.2)	5	6
	18.5-22.9	426 (22.4)	424 (29.9)	1	1
	23-24.9	62 (3.3)	62 (4.4)	-	-
	≥25	65 (3.4)	65 (4.6)	-	-
Comorbid Diseases	Diabetes Mellitus	275 (15.1)	275 (15.3)	-	-
	HIV/AIDS	25 (1.4)	18 (1)	-	1
	Hypertension	80 (4.4)	80 (4.5)	-	-
	SLE	2 (0.1)	2 (0.1)	-	-
Behavioral History					
Smoking		**1734**	**1722**	**5**	**7**
	Yes	101 (5.8)	99 (5.7)	1	1
	Ex-smoker	815 (47)	812 (47.2)	2	1
	Non-smoker	818 (47.1)	811 (47.1)	2	5
Consuming Alcohol		**1733**	**1721**	**5**	**7**
	Yes	8 (0.5)	8 (0.5)	-	-
	Ex-drinker	315 (18.2)	314 (18.2)	1	-
	Non-drinker	1410 (81.4)	1399 (81.3)	4	7
Risk Category for MDR-TB†		**1814**	**1797**	**6**	**11**
	1. Chronic TB patients	184 (10.2)	183 (10.2)	-	1
	2. TB patient with 2nd category treatment which not converted in 3 months of treatment	80 (4.3)	80 (4.5)	-	-
	3. TB patient who have a non-standard TB treatment history using quinolone and 2nd line anti-TB drug injection for at least 1 month	104 (6.1)	103 (5.7)	-	1
	4. TB patients who failed 1st category treatment	214 (11.7)	213 (11.9)	-	1
	5. TB patients with 1st category treatment who remain positive after 3 months of treatment	76 (4.2)	74 (4.1)	-	2
	6. Relapse TB patient, categories 1 and 2	672 (36.8)	667 (37.1)	3	2

7. Returning TB patients after loss to follow-up	201 (11.3)	201 (11.2)	-	-
8. Suspected TB patients with a history of close contact with MDR-TB patients	54 (2.9)	54 (3)	-	-
9. TB-HIV co-infection patients who do not respond to anti-TB drug administration	4 (0.3)	4 (0.2)	-	-
10. MDR-TB patients who failed treatment	6 (0.3)	6 (0.3)	-	-
11. Relapse MDR-TB patients	13 (0.7)	12 (0.7)	-	1
12. Returning MDR-TB patients after loss to follow-up	3 (0.2)	3 (0.2)	-	-
Primary MDR	208 (11)	197 (11)	3	3

Note: There were samples that weren't listed. *BMI classification based on Asia-Pacific guidelines; Underweight: <18.5 kg/m2. Normal: 18-22.9 kg/m2. Overweight: 23-24.9 kg/m2. Obese: >25 kg/m2
†Risk category number 10 – 12 applied since the year 2020. MDR: Multi drug Resistant, PTB: Pulmonary TB, EPTB: Extrapulmonary TB

Table 2 shows the site of infection in extrapulmonary MDR-TB, the most frequent was in the bone. The proportion of drug resistance was described in Table 3, which shows the most frequent resistance from this study was the MDR-TB (41.4%) and rifampicin-resistant TB (RR-TB) in extrapulmonary MDR-TB (76.8%).

Table 2. Distribution Proportion of EPTB by Site in MDR-TB Patients

Extrapulmonary MDR-TB Location	n (%)	EPTB, n (%)	EPTB with PTB, n (%)
TB Lymphadenitis	4 (23.5)	1	3
TB Meningits	3	1	2 (66.7)
Bone or Joint TB	6 (35.3)	3 (50)	3
TB Spondylitis	5 (29.4)	2 (40)	3
TB Colitis	3	1 (33.3)	2 (66.7)
TB Pleurisy	1	-	1 (100)
Total (n)	17	6	11

MDR: Multidrug-resistant, PTB: Pulmonary TB, EPTB: Extrapulmonary TB

Table 3. Anti-TB Drug Resistance Proportion in MDR-TB Patients

Drug Resistance	n (%)	n = 1816		
		PTB, n (%)	EPTB, n	PTB + EPTB, n
Pre-XDR-TB	212 (11.7)	211 (11.7)	-	1
XDR-TB	102 (5.6)	101 (5.6)	-	1
MDR-TB, n	**757 (41.7)**	**755 (42)**	**1**	**1**
Rifampicin-isoniazid	350 (19.3)	349 (19.4)	-	1
Rifampicin-isoniazid-ethambutol	141 (7.8)	140 (7.8)	1	-
Rifampicin-isoniazid-streptomycin	98 (5.4)	98 (5.4)	-	-
Rifampicin-isoniazid-ethambutol-streptomycin	167 (9.2)	167 (9.3)	-	-
Rifampicin-isoniazid-ethambutol-streptomycin-pyrazinamide	1 (0.1)	1 (0.1)	-	-
Rifampicin-resistant Based	745 (41)	732 (40.7)	5	8
Total (n)	**1816**	**1799**	**6**	**11**

Pre-XDR: Pre-extensively drug resistant, XDR: Extensively drug resistant, MDR: Multidrug-resistant, PTB: Pulmonary TB, EPTB: Extrapulmonary TB.

This study has explored the characteristics proportion, location, infection site in extrapulmonary and anti-TB drugs resistance of MDR-TB. With the GeneXpert®, MDR TB suspects have been examined since 2012. In total, 15821 adults examined, MDR TB confirmed were 1900 adults, of whom 1799 pulmonary TB (PTB), including one miliary TB case, 6 exclusively extrapulmonary TB (EPTB), 11 combined EPTB with PTB, and 84 unknown data locations. The total extrapulmonary MDR-TB cases were 17 cases, 0.24% of total TB cases, and 0.9% of MDR-TB cases. These results show differences with the studies in China, which were 2.5% of total TB patients and 9.3% of MDR-TB patients, and in India, were 5.1% of total TB cases and 12.6% of MDR-TB cases.[11,12] However, in MDR cases, extrapulmonary TB always has shown less frequent than pulmonary TB, which suggested by Raveendran *et al*., that could be caused by fewer number of extrapulmonary TB that has been treated before.[15]

In this study, the median age of MDR-TB patients was 38-year-old in the age group 35 – 44 years old and in extrapulmonary was 27-year-old in the age group 25 – 34 years old, which is similar to previous studies where most patients belonged to the productive age group of 21 – 45 years old.[12,16,17] Most productive age people spend most of their time outside their home, meeting or passing by many people frequently, which increases the risk of TB or MDR-TB exposure, well-known for its high incidence in Indonesia.[5,12]

Among MDR-TB and EPTB MDR patients, males were found more commonly (58.3% and 64.7%), similar to previous studies in India and China, consecutively 59.5% and 69.1%.[12,17] This finding is probably due to the patriarchal culture in the related country, causing females to become more passive to independently go to healthcare to check themselves up, resulting in female patients being found less than male patients.[12,17,18] A different result showed from a study in Peru, with a more female proportion (60.6%).[19] This difference was presumptively caused by the ratio of male-to-female that defers in each country. In 2012 – 2020, the male population outnumbered the female population in Indonesia, with an average of 50.4%.[20]

Almost half of the MDR-TB patients (46.3%) in this study had a body mass index (BMI) <18.5 kg/m^2, which is categorized as underweight. PTB MDR patients (61.2%), EPTB MDR patients (67%), and combined EPTB with PTB patients showed a similar result. A higher underweight population in MDR-TB patients was probably resulting from a decreased immune system that existed in underweight, leading to an increased risk of getting community-acquired infection.[21]

This study shows 275 MDR-TB patients (15.1%)—all belonged to pulmonary MDR-TB, had diabetes mellitus (DM), as the similar results found in a study in Sudan (15.8%).[22] This is probably related to decreasing the immune system in patients with DM, increasing the infection risk, and decreasing anti-TB drugs effectivity, resulting in delayed conversion in TB patients, leading to the risk of *Mtb* strains resistance.[23,24] Unfortunately, Indonesia is TB and DM high burden country, so doctors and government should pay more attention to these diseases.[25] The following comorbid disease is hypertension (4.4%). Its reasons are still unknown, and some studies showed no evidence between hypertension and TB.[26] Still, presumably, it is related to high hypertension prevalence in Indonesia, resulting in its pretty high proportion in MDR-TB.[28] There were also 25 patients (1.4%) with HIV co-infection, which its cause was similar with patients with DM, people living with HIV/AIDS (PLWHA) also had a decreased immune system, which could increase the risk of getting infection and malabsorption of anti-TB drugs, especially isoniazid and rifampicin, resulting in a higher risk of getting MDR-TB.[28] This study showed two patients with SLE, with probable mechanism, were the administration of

corticosteroid as SLE therapy, which lower the patient's immune system, resulting in an increased risk of getting any infection.[29]

In this study, 101 MDR-TB patients (5.8%) smoked, which had a considerable far gap than studies in India and Sudan, consecutively 65.8% and 59.2%.[12,22] However, in this study, there were also found 815 patients (47%) who had a smoking history but had stopped. Eight patients (0.5%) also consumed alcohol, which had a considerable gap with other studies in India and Sudan, with 42.1% and 47.4%, consecutively.[12,22] Different results in Indonesia might result from their majority religion, Muslim, which alcohol is considered *haraam* or forbidden so that most of them choose not to drink alcohol.[30]

According to the risk category of MDR-TB, most patients came after a TB relapse, meaning that the patient had been treated with anti-TB drugs, which correspond with the study in India (56.2%).[12] Previous anti-TB drugs exposure might increase MDR-TB incidence globally by 18% and in Indonesia 13% from an MDR-TB incidence. Those numbers might differ from other studies in other countries.[5,31] Primary MDR-TB patients took over 11% of MDR-TB patients and were found in six out of 17 extrapulmonary MDR-TB patients, similar to the result in a study done in India (7.9%).[32] Yet, Indonesia and India also had similar estimated percentages in primary MDR-TB incidence, consecutively 2.4% and 2.8%.[5]

Among 17 cases of extrapulmonary infection, the most frequent sites were bone (35.3%) and lymph (23.5%), with a similar percentage compared to extrapulmonary MDR-TB and combined EPTB with PTB MDR. A study in China about extrapulmonary TB also shows skeletal TB as its predominant site (41.4%), but it doesn't exclusively show the results of extrapulmonary MDR-TB.[11] Meanwhile, a study in India showed that 51.3% of sites involved in extrapulmonary MDR-TB were in lymph nodes, which is reasonable due to TB pathogenesis resulting in *Mtb* travel to lymph nodes for antigen-presenting, shuttled to other lymph nodes, or continue to travel via lymph fluid.[32] This study found that the most frequent anti-TB drug resistance was rifampicin (41%), followed by RIF+INH-resistant (19.3%). Nevertheless, more resistances towards INH+RIF+EMB+SM (31.1%) were found in India, which shows different results against this study.[12]

CONCLUSIONS

The retrospective method limits this study to explore the proportion of extrapulmonary MDR-TB and its characteristics proportion due to missing and incomplete data. This study was conducted in a referral hospital resulting in more frequent MDR-TB cases. The extrapulmonary MDR-TB cases are scarce, not portraying the actual proportion, unlike the MDR-TB cases. Future studies are needed to include more cases in other centers to have more overview of MDR-TB with EPTB.

To conclude, the total extrapulmonary MDR-TB cases in Dr. Hasan Sadikin General Hospital Bandung period 2012 – 2021 take over 0.24% from all of TB cases and 0.9% from all MDR-TB cases, predominated by age group 25 – 34 years old with age median 27-year-old, male gender, underweight BMI, non-smoking behavior, non-alcohol consuming behavior, and previous history of TB. Most extrapulmonary MDR-TB cases are rifampicin-resistant, and the site of infection is located in bone.

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CONFLICT OF INTEREST

The author(s) declared no potential conflicts of interest concerning this article's research, authorship, and/or publication.

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