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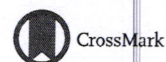

Research Article

Diagnosis of a Spectrum of Pulmonary Tuberculosis at Islam Hospital Sukapura, Jakarta, Indonesia: A Retrospective Study of 317 Cases

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Abstract

Background and Objective: In 2015, Indonesia ranked as the second highest tuberculosis-infected country in the world, after India. The accuracy of diagnosis determines the success of treatment and control and reduction of incidence of tuberculosis. Therefore, this study aimed to describe the diagnosis spectrum of pulmonary tuberculosis. **Materials and Methods:** This was a retrospective study with a cross-sectional design. The study subjects were 317 patients diagnosed with tuberculosis from 1st January, 2015 to 30th June, 2017 at Islam Hospital Sukapura Jakarta, Indonesia. **Results:** Most tuberculosis patients were 18-49 years old (55.5%) and male (63.4%), at senior high school (56.2%) and worked as seller/farmer/fisher/labor/entrepreneur (36.6%). Most patients had a productive cough (96.2%) with duration of cough $\geq$2 weeks (70.3%), shortness of breath (80.1%), loss weight (85.8%), night sweating (77.6%) were smear-negative (68.8%) and had duplex pulmonary tuberculosis (54.6%). The most common diagnoses were category I spectrum tuberculosis, prescribed anti-tuberculosis drugs (91.8%), pulmonary tuberculosis (94.3%), smear-negative tuberculosis (68.8%) and new case tuberculosis (85.5%). Smear-negative new case tuberculosis was the most frequent diagnosis (71.6%). Association between tuberculosis recurrence and the result of sputum microscopy was statistically significant ($p = 0.009$). **Conclusion:** The accuracy of tuberculosis diagnosis greatly determines the success of treatment and control of tuberculosis infection. In this study, the most frequent diagnoses were spectrum pulmonary tuberculosis, pulmonary tuberculosis, smear-negative tuberculosis, new case tuberculosis and smear-negative new case tuberculosis.

Key word: Infection, smear-negative tuberculosis, pulmonary tuberculosis, diagnosis spectrum, anti-tuberculosis drugs

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Competing Interest: The authors have declared that no competing interest exists.

Data Availability: All relevant data are within the paper and its supporting information files.

INTRODUCTION

Tuberculosis (TB) infection is a leading cause of mortality. Over 95% of TB mortality cases occur in poor and developing countries[1]. The number of newly diagnosed pulmonary tuberculosis cases in Indonesia increased from 324,539 in 2014 to 330,910 in 2015. Indonesia is ranked as the second highest TB-infected country in the world, after India[2,3].

The fundamental issues for the diagnosis and management of TB are the accuracy of the diagnosis, appropriate and standardized treatment, monitoring and treatment evaluation and public health responsibility. An improved accuracy of diagnosis would increase the success of TB treatment and control and thus reduce the incidence of tuberculosis[4].

Indonesia has the opportunity to half the rates of morbidity and mortality due to TB infection recorder for 2015. The Millennium Development Goals (MDGs) indicator for TB control has achieved its target. Diagnosis of pulmonary tuberculosis in an adult should be mainly based on bacteriology examination, such as direct microscopy examination and rapid testing. Previous study revealed that AFB smear positive found more in adult pulmonary TB patients with type 2 DM compared to TB patient without type 2 DM. It also found statistically significant between type 2 DM with the AFB smear results on adult pulmonary TB patient[5].

If the bacteriology examination result is negative, the diagnosis of pulmonary tuberculosis could be based on appropriate clinical findings and supportive examinations (at least chest X-ray) conducted by a trained doctor. Extrapulmonary tuberculosis is diagnosed based on clinical findings and the affected organ(s). The definite diagnosis of extra pulmonary tuberculosis is based on the clinical findings, bacteriology examination and histopathology examination from the sample of the affected organ[6].

Based on the above, this study aimed to describe the diagnosis spectrum of pulmonary tuberculosis based on clinical findings, bacteriology, laboratory and radiology examination at Islam Hospital Sukapura Jakarta, Indonesia from 2015 to the first semester of 2017.

MATERIALS AND METHODS

Study design: This was a retrospective study with a cross-sectional design. The study subject was all patients diagnosed was tuberculosis at Islam Hospital Sukapura Jakarta, Indonesia, from 1st January, 2015 to 30th June, 2017. This study used the secondary data from patient medical records and had been approved by the Research Ethics Committee of Islam Hospital Sukapura Jakarta, Indonesia. The sample was collected consecutively. The inclusion criteria were: (1) Patients who had been diagnosed as tuberculosis, (2) Adult tuberculosis patients >18 years old, (3) Having bacteriology examination, laboratory examination, radiology examination, the status of TB drug and the type of TB data available. The exclusion criterion was that the suspected tuberculosis patient had not yet been treated as a TB patient.

Study data: The data collected from medical records included patient profile (name, number of medical record, age, weight, birth date, gender, address, marital status, educational background), clinical findings, physical examination results, radiology examination results, bacteriology examination results (Spot/Morning/Spot sputum examination or GeneXpert), TB diagnosis and TB drug status.

Diagnosis of tuberculosis: Tuberculosis diagnosis was classified based on anatomy, history of TB drug and sputum microscopic examination. Based on the anatomy, TB diagnosis was classified as pulmonary or extra pulmonary tuberculosis. Pulmonary tuberculosis is a TB infection involving the lung parenchyma or tracheobronchial and extra pulmonary tuberculosis involving the organs outside of the lung parenchyma, such as the pleura, lymph node, abdomen, genitourinary tract, skin, joint, bone and meninges. Based on the history of TB drugs, TB diagnosis was classified as new or relapse cases. New case TB includes TB patients with no prior history of TB treatment or history of anti-tuberculosis drugs treatment in the past 1 month and relapse-case TB includes TB patients with a history of TB treatment and declared to have been cured or completed the treatment and recently diagnosed as recurrent TB. Based on sputum microscopy examination, TB diagnosis was classified as smear-positive TB or smear-negative TB.

Statistical analysis: Data were expressed as the percentage of the group for categorical and continuous variables. Appropriate descriptive statistics, such as proportion and percentage were used to analyze the findings and to draw the inferences. A database was created in Microsoft Excel and after appropriate cleaning, statistical analyses were performed using SPSS software (version 20.0 SPSS, Inc., Chicago, IL, USA). The Chi-square test was used to detect an association between the recurrence and sputum AFB results. A p-value of less than 0.05 was considered statistically significant.

RESULTS

Based on the TB patient medical record at Islam Hospital Sukapura Jakarta, Indonesia, from 2015 to June 2017, 317 TB patients were included in the study.

Table 1: Characteristics of adult TB patient at Islam Hospital Sukapura Jakarta, Indonesia, from January, 2015-June, 2017

Characteristics	Frequency (Hz)	Percentage
Age		
18-49 years old	176	55.5
50-79 years old	141	44.5
>80 years old	0	0
Gender		
Male	201	63.4
Female	116	36.6
Bloody cough		
Yes	76	24
No	241	76
Shortness of breath		
Yes	254	80.1
No	63	19.9
Productive cough		
Yes	305	96.2
No	12	3.8
Cough duration		
≥2 weeks	223	70.3
<2 weeks	94	29.7
Loss weight		
Yes	272	85.8
No	45	14.2
Fever		
Yes	272	85.8
No	45	14.2
Night sweating		
Yes	246	77.6
No	71	22.4
AFB		
Negative	218	68.8
1+	40	12.6
2+	37	11.7
3+	22	6.9
Chest X-ray		
Duplex pulmonary TB	173	54.6
Sinistra pulmonary TB	35	11
Dextra pulmonary TB	63	19.9
Pleuritis TB	17	5.4
Other	29	9.1
Level of education		
No educational background	3	0.9
Primary school	63	19.9
Junior high school	57	18.0
Senior high school	178	56.2
D3/S1/S2/S3	16	5.0
Working status		
Unemployed/retired	42	13.2
Housewife	83	26.2
Government employee/police/military	5	1.6
Private employee	70	22.1
Seller/farmer/fisher/labor/entrepreneur	116	36.6
Professional worker	1	0.3
Anti-tuberculosis drugs		
Category I	291	91.8
Category II	26	8.2

AFB: Acid fast bacilli

Most TB patients are 18-49 years old (55.5%) and male (63.4%) (Table 1). Based on clinical symptoms, most of the patients have a productive cough (96.2%) with duration of cough ≥2 weeks (70.3%), shortness of breath (80.1%), weight loss (85.8%) and night sweating (77.6%). Based on chest X-ray, most of the patients had duplex pulmonary TB (54.6%). Based on the level of education, most of the patients were in senior high school (56.2%), with the most frequent working status being seller/farmer/fisher/labor/entrepreneur group (36.6%). Based on anti-tuberculosis drugs category, most of the patients were receiving category I anti-tuberculosis drugs (91.8%).

Table 2: Diagnosis Spectrum Pulmonary Tuberculosis Patient at Islam Hospital Sukapura Jakarta, Indonesia from 2015-2017

Diagnosis spectrum	Number	Percentage
Based on anatomy		
Pulmonary TB	299	94.3
Extra pulmonary TB	18	5.7
Based on AFB		
Smear-positive TB	99	31.2
Smear-negative TB	218	68.8
Based on history of TB drugs		
New case TB	271	85.5
Relapse case TB	46	14.5
Based on history of TB drugs and microscopy examination		
Smear-positive new case TB	77	28.4
Smear-negative new case TB	194	71.6
Smear-positive relapse case TB	22	47.8
Smear-negative relapse case TB	24	52.2

AFB: Acid fast bacilli

The classifications of the diagnosis spectrum of pulmonary tuberculosis at Islam Hospital Sukapura Jakarta, Indonesia, from 2015-2017 are shown in Table 2. Based on anatomy, most of the subjects were diagnosed with pulmonary tuberculosis (94.3%). Based on AFB, most of the TB case were smear-negative TB (68.8%) and based on TB drug history, new case TB (85.5%) was more frequent than cases of relapse TB. Overall, smear-negative new case TB was the most frequent classification (71.6%).

The result of bivariate analysis based on the classification of TB diagnosis and the result of sputum microscopy from Table 3 showed that there is a significant association between TB recurrence and the result of sputum microscopy ($p = 0.009$).

DISCUSSION

In this study, most TB patients were male. The higher rate of TB in males might be attributed to their high-risk behaviors, such as alcohol, substance and tobacco abuse and also their typical work type. Smoking habit, type of job, lifestyle, environmental interactions and working outdoor might put people at higher risk of *Mycobacterium tuberculosis* infection[7,8]. Compared with females, earlier studies also reported a direct association between male gender and risk of

Table 3: Comparisons between TB recurrence and the results of microscopy examinations of pulmonary tuberculosis patients at Islam Hospital Sukapura, Indonesia, from 2015-2017

		Microscopy examination				
	Chi-Square test	Smear-negative (%)	Smear-positive (%)	p-value	OR	CI 95%
Classification	New case	194 (71.6%)	77 (28.4%)	0.009	0.011	0.009-0.013
	Relapse case	24 (52.2%)	22 (47.8%)			

TB infection, as well as unsuccessful TB treatment outcome. A clear association between TB incidence and gender has also been reported[8]. Similar to previous studies conducted by Riello *et al.*[7], Atif *et al.*[8], Lin *et al.*[9], Marais *et al.*[10], Sunnetcioglu *et al.*[11] and WHO[12], pulmonary TB patients were more likely to be males than females. The Indonesia Health profile, in 2013, 2014 and 2015, released by the Health Government Indonesian Republic, also reported that pulmonary TB was more frequent in males than females (prevalence = 0.4%)[3,4].

Most of the patients were 18-49 years old. The higher rate of TB in those of productive age might be attributed to the high risk of TB droplet transmission in their environment or workplace. Similar results were reported by Lin *et al.*[9] and Marais *et al.*[10], where TB mostly occurred in those of productive age. Based on the WHO Tuberculosis Report 2017 in the Asian Region, TB cases were more frequent in those of productive age (ranged 25-48 years old)[12]. A similar result was reported by Riello *et al.*[7],where the mean age of TB patients was 46 years. A previous study including 310 TB patients who under went sputum microscopy examination found that 58.7% of patients were 16-40 years old[13]. In Indonesia, it is estimated that 75% of pulmonary TB patients are 15-50 years old[14]. Similar results have shown that showed tuberculosis cases in Southeast Asia are mostly found in those of productive age (15-44 years old)[12].

Most of the patients were in senior high school (56.2%). A possible justification for this finding is that poorly educated patients fail to protect and prevent themselves from airborne infection and might have lower compliance to TB treatments. A Malaysian study found a positive relationship between TB-related knowledge and education level of the patients[8]. In a study conducted by Esmael *et al.*[15] and Javed *et al.*[16], the majority of pulmonary TB patients were illiterate and uneducated (58.1 and 51.7%). Similarly, Jethani *et al.*[17] also reported that 95% of patients had a family history of the disease and were uneducated. Most patients were members of the seller/farmer/fisher/labor/entrepreneur group (36.6%).This could be explained by working outdoors, which might put people at a higher risk of TB droplet transmission. Similarly, Gupta *et al.*[18] also reported a higher prevalence of TB infection among laborers (44%).

Most of the patients had pulmonary TB infection (94.3%). Lung parenchyma was the main predilection of aerobic bacteria, including *Mycobacterium tuberculosis*. Also, TB infection was easier to transmit via droplet than other transmission routes[12]. Another possible justification for this finding is the limited availability of diagnostic tools for extra pulmonary TB relative to pulmonary TB. Similar results were reported in the studies by Gomes *et al.* [19] in Brazil and Memish *et al.*[20] in Saudi Arabia. The WHO[12] Tuberculosis Report also stated that pulmonary TB was more frequent (85%) than extra pulmonary TB.

Based on the WHO and The International Union Against Tuberculosis and Lung Disease (IUATLD) guidelines, sputum microscopy examination should be conducted at least three times[21]. The majority of the patients in our study had smear-negative TB (68.8%). A possible explanation for this finding was the low sensitivity value of sputum microscopy examination. This could be due to the limitation of Ziehl-Neelsen staining ability in detecting AFB<10^4-10^5 basil per mL under optimal conditions. It has been shown that the sensitivity of AFB microscopy examination[22,23] is 22-43%. Ziehl-Neelsen staining could only reach its maximum sensitivity of up to 60% under optimal conditions[24]. Similarly, the WHO[12] Report also showed that smear-negative TB is more frequent than smear-positive Tb in the Philippines (63 vs. 37%). Geleta *et al.*[25] also found that the sensitivity value of the sputum microscopy examination is lower than other diagnostic tools, such as GeneXpert MTB/RIF (9.3 vs. 16.7%) in high prevalence TB infection. Reechaipichitkul *et al.*[26] also showed that the sensitivity and specificity of sputum AFB smears are lower than the GeneXpert MTB/RIF assay test (48 vs. 94% and 84 vs. 92%). Therefore, the low sensitivity and high specificity value of the sputum microscopy examination could explain the higher incidence of smear-negative TB in this study.

In this study, new cases of TB were more frequent than relapse cases. However, there were a greater proportion of smear-positive cases among the relapse TB cases (from 28.4-47.8%). This was supported by our finding of a significant association between sputum microscopy examination and TB recurrence (p = 0.009). High defaulter rate and the irrational use of second-line drugs by some public and private providers

might contribute to the increase of relapse-cases[27]. Also, low levels of TB-related knowledge might contribute to low compliance with TB treatment[8]. Therefore, it could be assumed that this subgroup of people might stop taking anti-TB drugs and then develop relapses. A similar result was also reported by Cross *et al.*[28].

Relapse cases were defined as patients who had a history of TB drugs and were declared as cured or had completed treatment and then recently diagnosed as having suffered a recurrent TB episode[6]. Resistance would develop if patients had a poor response to adequate therapy[27]. Rohmawaty *et al.*[29] stated that inadequate exposure to anti-tuberculosis drugs could be a reasonable factor of suboptimal response to therapy. This is supported by the findings of Burhan *et al.*[30], which showed an association between low concentration of anti-tuberculosis drugs and poor response to therapy. Rohmawaty *et al.*[29] also showed a significant difference in *Mycobacterium tuberculosis* load between the conversion group and non-conversion group after first-line TB drug treatment ($p = 0.04$). This could explain the significant association between TB recurrence and the result of sputum microscopy examination in this study.

This study describes the spectrum of pulmonary tuberculosis and emphasizes its importance in establishing the diagnosis of tuberculosis infection. Establishing proper diagnosis by general practitioners is crucial in determining appropriate therapy selection and preventing recurrence of tuberculosis.

CONCLUSION

The accuracy of TB diagnosis will greatly determine the success of treatment and control of tuberculosis infection. Classification of TB diagnosis also varied depending on the anatomy, the result of microscopy examination, history of treatment and both history of treatment and result of microscopy examination. In this study, the diagnosis spectrum of pulmonary tuberculosis is most frequent in pulmonary tuberculosis, smear-negative tuberculosis, new case tuberculosis and smear-negative new case TB.

SIGNIFICANCE STATEMENT

Although, there has been considerable previous research on tuberculosis, the novelty of this research was to describe the spectrum of diagnosis of pulmonary tuberculosis based on anatomy, microscopic examination, medical history and the combination of medical history and microscopic examination. This study also addressed the relationship between microscopic examination and relapse case, which had been only briefly discussed in previous studies.

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REFERENCES

1. Falzon, D., H.J. Schunemann, E. Harausz, L. Gonzalez-Angulo, C. Lienhardt, E. Jaramillo and K. Weyer, 2017. World Health Organization treatment guidelines for drug-resistant tuberculosis, 2016 update. Eur. Respir. J., Vol. 49. 10.1183/13993003.02308-2016.
2. Reviono, R., W. Setianingsih, K.E. Damayanti and R. Ekasari, 2017. The dynamic of Tuberculosis case finding in the era of the public-private mix strategy for Tuberculosis control in Central Java, Indonesia. Global Health Action, Vol. 10. 10.1080/16549716.2017.1353777.
3. Kementerian Kesehatan Republik Indonesia, 2015. Profil kesehatan Indonesia 2015. Kementerian Kesehatan Republik Indonesia.
4. PerhimpunanDokterParu Indonesia, 2011. Tuberkulosis pedoman diagnosis dan penatalaksanaan di Indonesia. http://klikpdpi.com/konsensus/Xsip/tb.pdf.
5. Fachri, M., M. Hatta, S. Abadi, S.S. Santoso and T.A. Wikanningtyas *et al.*, 2018. Comparison of Acid Fast Bacilli (AFB) smear for *Mycobacterium tuberculosis* on adult Pulmonary tuberculosis (TB) patients with type 2 Diabetes Mellitus (DM) and without type 2 DM. Respir. Med. Case Rep., 23: 158-162.
6. Kementrian Kesehatan Republik Indonesia, 2014. Pedoman nasional pengendalian tuberkulosis. Direktorat Jendral Pengendalian Penyakit Dan Penyehatan Lingkungan. http://www.tbindonesia.or.id/opendir/Buku/bpn_p-tb_2014.pdf
7. Riello, F.N., R.T.S. Brigido, S. Araujo, T.A. Moreira, L.R. Goulart and I.M.B. Goulart, 2016. Diagnosis of mycobacterial infections based on acid-fast bacilli test and bacterial growth time and implications on treatment and disease outcome. BMC Infect. Dis., Vol. 16. 10.1186/s12879-016-1474-6.
8. Atif, M., S.A.S. Sulaiman, A.A. Shafie, I. Ali, M. Asif and Z.U. Babar, 2014. Treatment outcome of new smear positive pulmonary tuberculosis patients in Penang, Malaysia. BMC Infecti. Dis., Vol. 14. 10.1186/1471-2334-14-399.

9. Lin, C.H., C.J. Lin, Y.W. Kuo, J.Y. Wang and C.L. Hsu *et al.*, 2014. Tuberculosis mortality: Patient characteristics and causes. BMC Infect. Dis., Vol. 14. 10.1186/1471-2334-14-5
10. Marais, E., C.K. Mlambo, J J. Lewis, N. Rastogi and T. Zozio *et al.*, 2014. Treatment outcomes of multidrug-resistant tuberculosis patients in Gauteng, South Africa. Infection, 42: 405-413.
11. Sunnetcioglu, A., M. Sunnetcioglu, I. Binici, A.I. Baran, M.K. Karahocagil and M.R. Saydan, 2015. Comparative analysis of pulmonary and extrapulmonary tuberculosis of 411 cases. Ann. Clin. Microbiol. Antimicrob., Vol. 14. 10.1186/s12941-015-0092-2.
12. WHO., 2017. Global tuberculosis report, 2017. World Health Organization, Geneva, Switzerland. http://www.who.int/tb/publications/global_report/gtbr2017_main_text.pdf
13. Guernier, V., T. Diefenbach-Elstob, D. Pelowa, S. Pollard, G. Burgess, E.S. McBryde and J. Warner, 2018. Molecular diagnosis of suspected tuberculosis from archived smear slides from the Balimo region, Papua New Guinea. Int. J. Infect. Dis., 67: 77-81.
14. Hatta, M., A.R. Sultan, N. Tandirogang, Masjudi and Yadi, 2010. Detection and identification of mycobacteria in sputum from suspected tuberculosis patients. BMC Res. Notes, Vol. 3. 10.1186/1756-0500-3-72.
15. Esmael, A., I. Ali, M. Agonafir, A. Desale, Z. Yaregal and K. Desta, 2013. Assessment of patients' knowledge, attitude and practice regarding pulmonary tuberculosis in eastern Amhara regional state, Ethiopia: Cross-sectional study. Am. J. Trop. Med. Hyg., 88: 785-788.
16. Javed, I., M.T. Javed, Z. Mahmood, M. Riaz, R. Iqbal, N. Rafiq and S. Rafiq, 2017. Socio-demographic and co-morbidity study of TB patients from selected areas of Punjab Pakistan. Res. J. Life Sci. Bioinform. Pharm. Chem. Sci., 3: 109-121.
17. Jethani, S., J. Semwal, R. Kakkar and J. Rawat, 2012. Study of epidemiological correlates of tuberculosis. Indian J. Community Med., 24: 304-309.
18. Gupta, S., V. Shenoy, C. Mukhopadhyay, I. Bairy and S. Muralidharan, 2011. Role of risk factors and socio economic status in pulmonary tuberculosis: A search for the root cause in patients in a tertiary care hospital, South India. Trop. Med. Int. Health, 16: 74-78.
19. Gomes, T., B. Reis-Santos, A. Bertolde, J.L. Johnson, L.W. Riley and E.L. Maciel, 2014. Epidemiology of extra pulmonary tuberculosis in Brazil: A hierarchical model. BMC Infect. Dis., Vol. 14. 10.1186/1471-2334-14-9
20. Memish, Z.A., E.A. Bamgboye, N. Abuljadayel, H. Smadi, M.S. Abouzeid and R.F. Al Hakeem, 2014. Incidence of and risk factors associated with pulmonary and extra-pulmonary tuberculosis in Saudi Arabia (2010-2011). PLoS One, Vol. 9. 10.1371/journal.pone.0095654.
21. Tuberculosis Division International Union against Tuberculosis and Lung Disease, 2005. Tuberculosis bacteriology-priorities and indications in high prevalence countries: Position of the technical staff of the tuberculosis division of the international union against tuberculosis and lung disease. Int. J. Tuberc. Lung Dis., 9: 355-361.
22. Bansal, R., P.K. Sharma, S.C. Jaryal, P.K. Gupta and D. Kumar, 2017. Comparison of sensitivity and specificity of ZN and fluorescent stain microscopy with culture as gold standard. J. Tuberculosis Res., 5: 118-128.
23. Singhal, R. and P.M. Vithal, 2015. Microscopy as a diagnostic tool in pulmonary tuberculosis. Int. J. Mycobacteriol., 4: 1-6.
24. Agrawal, M., A. Bajaj, V. Bhatia and S. Dutt, 2016. Comparative study of GeneXpert with ZN stain and culture in samples of suspected pulmonary tuberculosis. J. Clin. Diagn. Res., 10: 9-11.
25. Geleta, D.A., Y.C. Megerssa, A.N. Gudeta, G.T. Akalu, M.T. Debela and K.D. Tulu, 2015. Xpert MTB/RIF assay for diagnosis of pulmonary tuberculosis in sputum specimens in remote health care facility. BMC Microbiol., Vol. 15. 10.1186/s12866-015-0566-6.
26. Reechaipichitkul, W., T. Suleesathira and T. Chaimanee, 2017. Comparison of GeneXpert MTB/RIF assay with conventional AFB smear for diagnosis of pulmonary tuberculosis in Northeastern Thailand. Southeast Asian J. Trop. Med. Public Health, 48: 313-321.
27. Collins, D., F. Hafidz and D. Mustikawati, 2017. The economic burden of tuberculosis in Indonesia. Int. J. Tuberculosis Lung Dis., 21: 1041-1048.
28. Cross, G.B., K. Coles, M. Nikpour, O.A. Moore and J. Denholm *et al.*, 2014. TB incidence and characteristics in the remote gulf province of Papua New Guinea: A prospective study. BMC Infect. Dis., Vol. 14. 10.1186/1471-2334-14-93.
29. Rohmawaty, E., H.S. Sastramihardja, R. Ruslami and M.N. Shahib, 2017. Mycobacterium Tuberculosis Load and Rifampicin Concentration as Risk Factors of Sputum Conversion Failure. In: Advances in Biomolecular Medicine, Hofstra, R., N. Koibuchi and S. Fucharoen (Eds.). CRC Press, London, ISBN: 9781351804189, pp: 75-78.
30. Burhan, E., C. Ruesen, R. Ruslami, A. Ginanjar and H. Mangunnegoro *et al.*, 2013. Isoniazid, rifampin and pyrazinamide plasma concentrations in relation to treatment response in Indonesian pulmonary tuberculosis patients. Antimicrob. Agents Chemother., 57: 3614-3619.

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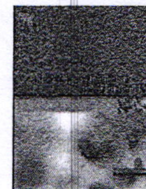

Case report

Comparison of acid fast bacilli (AFB) smear for *Mycobacterium tuberculosis* on adult pulmonary tuberculosis (TB) patients with type 2 diabetes mellitus (DM) and without type 2 DM

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Acid fast bacilli

ABSTRACT

Background: According to the Global Tuberculosis Report 2015, Indonesia ranked as second country in the world with the highest number of pulmonary tuberculosis cases. By 2015, the number of pulmonary TB new cases in Indonesia has increased to 330.910 cases of 2014 where 324.539 cases. DM is one of the most important factors that influence the occurrence worsening TB. Now is known that DM patients have body's immune response disorder thereby facilitating *M. tuberculosis* infection and causing TB.

Method: This research is cross sectional design. The sample in this research are adult pulmonary TB patients at General Hospital Grade C period October 1, 2013–March 31, 2016 as much as 225 patients.

Result: AFB smear results in patients with type 2 DM with smear 3 + was 14 (17.28%), 2 + was 15 (18.52%), 1 + was 15 (18.52%) and negative (−) was 37 (45.68%). AFB smear results in patients without type 2 DM with smear 3 + was 3 (2.08%), 2 + was 6 (4.17%), 1 + was 19 (13.19%), negative (−) was 112 (77.78%) and have no sputum was 4 (2.78%). Number of adult pulmonary TB patients were 225 patients. Of the 225 patients, found 81 patients with type 2 DM and 144 patients without type 2 DM.

Conclusion: AFB smear positive found more in adult pulmonary TB patients with type 2 DM compared to TB patient without type 2 DM. It also found statistically significant between type 2 DM with the AFB smear results on adult pulmonary TB patients.

1. Introduction

Mycobacterium tuberculosis infection particularly attacks the lungs (pulmonary TB) is a disease that is still a public health problem the world today. In 1993, the World Health Organization (WHO) has declared tuberculosis (TB) as a Global Health Emergency [1]. According to the Global Tuberculosis Report 2015, found 9.6 million new cases of pulmonary tuberculosis in 2014 with the number of cases occurs in Southeast Asia (58%), the Western Pacific (58%) and Africa (28%) [2]. Also reported that the prevalence and incidence of pulmonary tuberculosis in 2014 increased to 647/100.000 and 399/100.000 population from the previous year of 272/100.000 and 183/100.000 population, as well as the mortality rate from tuberculosis in 2014 that had increased to 41/100,000 population from the previous year, namely 25/100.000 from population [3].

Based on data from the Global Tuberculosis Report 2014, Indonesia entered the top six countries in the world with the number of cases of pulmonary tuberculosis highs along with India, China, Nigeria, Pakistan and South Africa, 4 whereas according to data from the Global Tuberculosis Report 2015, Indonesia has increased keperingk at riding position with both countries in the world with the highest number of cases of pulmonary TB after India, with the number of cases of pulmonary tuberculosis by 10% of the total number of cases of pulmonary tuberculosis in the world [4].

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By 2015, the number of new cases of pulmonary TB in Indonesia increased to 330 910 cases of pulmonary TB in new cases in 2014, namely 324 539 cases. The highest number of cases of pulmonary TB were reported in the province of West Java, East Java and Central Java (three provinces, has a number of cases by 38% of the total number of new cases of pulmonary TB in Indonesia). By age group, new cases of pulmonary tuberculosis in 2015 found most frequently in the age group of 25–34 years with a percentage of 18.65%, followed by the age group 45–54 years (17.33%), 35–44 years (17,18%), 15–24 years (15.89%), 55–64 years (13.82%), 0–14 years (8.59%) and ≥65 years (8.54%) [5].

In 2014 discovered new cases of pulmonary tuberculosis with AFB is positive in Indonesia as many as 176 677 cases, decreased when compared with the new cases with smear-positive pulmonary TB were discovered in 2013, namely 196 310 cases. The highest number of cases reported in the province of West Java, East Java and Central Java. New cases with smear positive pulmonary TB in these three provinces for 40% of the total number of new cases with smear-positive pulmonary TB in Indonesia [6].

Diabetes mellitus (DM) is one of the most important risk factor in the deterioration of TB. Since the beginning of the 20th century, clinicians have observed an association between diabetes and TB, although it is still difficult to determine whether the DM that precede TB or TB that cause the clinical manifestations DM. People with diabetes mellitus have a disorder of the body's immune response so as to facilitate the infection of *M. tuberculosis* and cause TB disease so that people with diabetes have a risk of 2–3 times higher for pulmonary tuberculosis disease than patients without DM [7].

The frequency of diabetes in TB patients reported to be around 10–15% and the prevalence of TB 2–5 times higher in patients with diabetes compared with non-Diabetes [8]. DM patients who were diagnosed with TB have a higher risk of death during TB treatment and risk of relapse after completion of treatment [9]. Research Dobler et al. in Australia found people with diabetes who use insulin as a treatment have a higher risk of suffering from pulmonary tuberculosis [10], while research in Indonesia in the year 2001–2005 found 60 cases of DM among 454 patients TB [11–13]. The research also stated that 40% of patients with pulmonary tuberculosis discount risk history of diabetes and diabetic patient to undergo pulmonary tuberculosis by 4.7 times. Aim of this study is to compare the results of smear examination of *Mycobacterium tuberculosis* in patients with pulmonary TB disease adults with type 2 diabetes with the results of smear examination of *Mycobacterium tuberculosis* in adult pulmonary TB patients who are not accompanied by disease type 2 diabetes. Interest is learning the description of the basic characteristics (gender, age, patient type, category ATA, the results of treatment), conversion rate and clinical symptoms in adult pulmonary TB patients with type 2 diabetes who accompanied and not accompanied by type 2 diabetes. The hypothesis of this study is AFB smear positive found more in adult pulmonary TB patients with type 2 DM compared to TB patient without type 2 DM.

2. Materials and method

This research is a comparative cross-sectional study design. This research was conducted at the General Hospital of class C Jakarta in November 2016. On 56 Permenkes RI 2014 describes Hospital grade C is composed of medical personnel (at least 9 general practitioners, two general dentist, 2 basic medical specialists, 1 specialist support, and 1 dentist specialist), power pharmacy (at least one pharmacist head of pharmacy, two pharmacists who served in inpatient assisted by 4 technical personnel pharmacy, four pharmacists in inpatient assisted eight people power pharmaceutical technical, 1 pharmacist as coordinator reception, distribution and production), nursing staff (at least 2 nurses for every three beds), as well as having space Emergency room (ER) which is open 24 hours, outpatient, inpatient, ambulatory intensive, ambulatory surgery, childbirth, radiology, clinical laboratory, blood services, medical rehabilitation, pharmacy, nutrition and room installations of body [14].

Diagnosis of pulmonary TB in adults in this study was established first with bacteriological examination. Bacteriological examination is a direct microscopic examination of acid fast bacilli (AFB) smear with interpretation of results according to International Union Agains Tuberculosis and Lung Disease (IUALTD). If bacteriologic examination results are negative, then the diagnosis of pulmonary TB may be clinically performed using clinical examination and investigation (at least appropriate chest radiographic examination and established by trained physicians interpreting TB lesions) [15,16]. The criteria for the diagnosis of type 2 DM in this study were fasting blood glucose (FBG) level ≥ 126 mg/dl, blood glucose (BG) level ≥ 200 mg/dl with classic DM complaints, plasma glucose level ≥ 200 mg/dl 2 hours after Oral glucose tolerance test (OGTT), or HbA1c ≥ 6.5% examination using standardized methods by the National Glycohemoglobin Standardization Program (NGSP) [17–19].

The sample in this research was taken with total sampling technique totaling 225 patients that have met the criteria for inclusion and exclusion criteria. The inclusion criteria were adult patients with pulmonary TB age > 18 years, pulmonary TB patients with type 2 DM, and pulmonary TB who are not accompanied by disease type 2 diabetes. These patients have complete data in medical record. The exclusion criteria were patients with extrapulmonary TB, TB patients are accompanied with type 1 DM disease and pulmonary TB patients who do not have the results of the BG level content, FBG and HbA1c.

This study uses secondary data about the event or the diagnosis of adult pulmonary TB are taken from the book form of TB registers and the medical records of adult pulmonary TB patients pulmonary clinic General Hospital C Class the period October 1, 2013–Mar 31, 2016. Data collected included: patient characteristics adult pulmonary TB (age, gender, type of patient, category ATA, treatment results, the conversion of smear, clinical symptoms); BG levels, FBG and HbA1c adult pulmonary TB patients; *M. tuberculosis* sputum smear examination results in adult pulmonary TB patients accompanied by type 2 DM disease and the results of smear examination *M. tuberculosis* in adult pulmonary TB patients who are not accompanied by disease type 2 DM.

This research used Chi Square test to determine the relationship between BG levels, FBG, HbA1c and type 2 DM disease with the results of smear examination in adult pulmonary TB patients. IBM SPSS Statistics version 23 statistical tools were used in this study.

3. Results

Table 1 are data indicate that patients with male sex has a higher number ie 138 patients (61.33%) compared with patients who are female, amounting to 87 patients (38.67%). The above data also show that the age group 45–54 years had the highest number with 76 patients (33.78%) followed by the age group of 55–64 years with the number 41 (18.22%), aged ≥ 65 years with the number of 34 patients (15.11%), aged 25–34 years with 29 patients (12.89%), aged 35–44 years with 26 patients (11.56%) and aged 15–24 years with a number of 19 patients (8.44%). For the category of patient type, the majority of patients based on the above data is the number of new patients with 208 patients (92.44%), then the patient relapsed with a number of 6 patients (2.67%), patients default with 4 patients (1.78%), patients failed by the number 1 patient (0.44%), and the type of patient, etc. with the number 6 (2.67%). For the category of ATA, the majority of patients using ATA Category I with the number of 208 patients (92.44%), while category II ATA is used by 17 patients (7.56%). For the category of results of treatment, patients with complete treatment has the highest number with 145 patients (64.45%), then the patient recovered with a number of 57 patients (25.33%), default by the number of patients 12 patients (5.33%), patients died with a total of 7 patients (3.11%) and patients moved by the number of 4 patients (1.78%).

The results of patients who had a BG levels ≥200 mg/dl was 50 patients (10.92%), while patients with low BG levels 100–199 mg/dl

Table 1
Basic characteristics of study sample.

Basic Characteristic		Tipe 2 DM		Non- Tipe 2 DM	
		Amount	Percentage	Amount	Percentage
Gender	Male	48	21,3%	92	40,9%
	Female	33	14,6%	52	23,1%
Age	15–24	0	0	19	8,4%
	25–34	0	0	29	12,9%
	35–44	0	0	26	11,5%
	45–54	46	20,4%	31	13,8%
	55–64	25	11,1%	15	6,7%
	≥65	10	4,4%	24	10,7%
Type of TB Patient	New	76	33,8%	132	58,7%
	Relapse	3	1,3%	3	1,3%
	Default	1	0,4%	3	1,3%
	Failed	0	0	1	0,4%
	Move	0	0	0	0
	others	1	0,4%	5	2,2%
ATA Category	Category of I	76	33,8%	132	58,7%
	Category of II	5	2,2%	12	5,3%
Treatment Results	Recovery	38	16,9%	20	8,9%
	Treatment Completed	35	15,5%	108	48%
	Default	4	1,8%	9	4%
	Failed	0	0	0	0
	Move	1	0,4%	3	1,3%
	Dead	3	1,3%	4	1,8%

and < 100 mg/dl respectively amounted to 77 patients (16.81%) and 63 patients (13.76%). The above data also showed that the number of patients who had a fasting blood glucose level ≥126 mg/dl amounted to 64 (13.94%), while patients who had fasting blood glucose level 100–125 mg/dl and < 100 mg/dl respectively account for 10 patients (2.18%) and 13 patients (2.84%). For blood glucose postprandial (BGPP) levels, patients with examination results ≥ 200 mg/dl totaling 59 patients (12.88%), 140–199 mg/dl are 5 patients (1.09%), and < 140 mg/dl are 15 patients (3.27%). For A1C, patients who had ≥6.5% examination results were 18 patients (3.93%), 5.7–6.4% amounting to 1 patient (0.22%), and < 5.7 were 3 patients (0.66%).

The adult pulmonary TB patients with type 2 diabetes disease amounts to 81 patients (17.69%), whereas adult pulmonary TB patients who are not accompanied by disease totaled 144 type 2 diabetes patients (31.44%).

The number and percentage of clinical symptoms of pulmonary tuberculosis in patients with type 2 diabetes disease symptoms are most widely perceived is coughing ≥2 weeks were found in 77 patients (95.06%), then shortness of breath totaling 67 patients (82.72%), malaise totaling 66 patients (81.48%), body weight loss totaling 65 patients (80.25%), anorexia totaling 64 patients (79.01%), night sweats totaling 61 patients (75.30%), chest pain of 60 patients (74.07%), as well as coughing up blood and fever were each found in 58 patients (71.60%).

Clinical symptoms of TB in patients who are not accompanied by type 2 diabetes disease ≥2 weeks Cough is a symptom that is most felt by the number of 134 patients (93.06%), followed by shortness of breath were found in 118 patients (81, 94%), fever were found in 110 patients (76.39%), and anorexia with decrease of body weigh, each of which was found in 106 patients (73.61%), chest pain were found in 97 patients (67.36%), night sweats were found in 96 patients (66.67%), malaise found in 91 patients (63.19%), as well as coughing up blood were found in 81 patients (56.25%).

The majority of patients with pulmonary TB AFB (+) were accompanied with type 2 diabetes have a high conversion rate after the end of the intensive phase that is numbered 38 patients (86.76%). The above data also showed no adult pulmonary TB patients AFB (+) with type 2 diabetes who have not the result of the conversion by the end of the intensive phase.

Table 2
AFB Examination Results in Patients with pulmonary TB are accompanied with type 2 diabetes and with out type 2 diabetes.

Chi Square Test	AFB Examination Results				P value
	3+	2+	1+	–	
Pulmonary tuberculosis with diabetes mellitus type 2	14	15	15	37	p = 0.000
Pulmonary TB is not accompanied by type 2 diabetes mellitus	3	6	19	112	

The majority of adult patients with pulmonary TB AFB (+) were not accompanied with type 2 diabetes have a conversion result at the end of an intensive phase with a number of 20 patients (71.43%), while for the result of the conversion is not only found in 1 patient (3.57%).

Table 2 data shows the results of smear examination in patients with pulmonary TB disease adult type 2 diabetes with a value + + + (3+) amounted to 14 patients (17.28%), the value + + (2+) total 15 patients (18, 52%), the value + (1+) amounted to 15 patients (18.52%) and a negative value (−) amounted to 37 patients (45.68%). The above data also shows the majority of adult pulmonary TB patients who are not accompanied by disease type 2 diabetes mellitus have a smear test results negative (−) by the number of 112 patients (77.78%), while the results of smear examination with a positive value (3+/2+/1+) only held by a minority of adult pulmonary TB patients were accompanied with type 2 diabetes (+ + + (3+) was found in 3 patients (2.08%), the value + + (2+) was found in 6 patients (4.17%), the value + (1+) was found in 19 patients (13.9%)).

Table 3 data indicate that patients with pulmonary tuberculosis grown with the results of smear-positive (1+/2+/3+) are more common in patients with pulmonary tuberculosis adults with higher levels of BG, FBG or BGPP increased (BG ≥ 200 mg/dl, FBG ≥ 126 mg/dl or BGPP ≥ 200 mg/dl). In addition, found an association statistically significant between levels of BG (p value = 0.000), FBG (p value = 0.009), BGPP (p value = 0.012) with the results of the AFB in patients with pulmonary tuberculosis adult because p value based on the results calculations using Chi Square test was < 0.05. The above data also showed that patients with high levels of BG ≥ 200 mg/dl (OR = 4.179), FBG ≥ 126 mg/dl (OR = 4.420), BGPP ≥ 200 mg/dl (OR = 4.696) had a risk four times higher to obtain the results of smear examination with positive scores than patients with BG levels < 200 mg/dl, FBG < 126 mg/dl, and BGPP < 200 mg/dl. HbA1c levels, which is one of the diagnostic criteria were included in the study variables can not be linked to the results of smear examination because very few adult pulmonary TB patients who have HbA1c test results, which can not be calculated using Chi Square test because the data are homogeneous.

The above data in Table 4 indicate that patients with pulmonary tuberculosis grown with the results of smear-positive (3+/2+/1+) are more common in patients with pulmonary TB adults with the disease of

Table 3
Relationship of BG, FBG and BGPP with AFB examination results.

Chi Square Test		AFB Examination Results		P value	CI 95%	OR
		(1+/2+/3+)	–			
BG (mg/dl)	≥200	26	24	p = 0.000	2.089–8.358	4.179
	< 200	28	108			
FBG (mg/dl)	≥126	39	25	p = 0.009	1.535–12.726	4.420
	< 126	6	17			
BGPP (mg/dl)	≥200	36	23	p = 0.012	1.503–14.673	4.696
	< 200	5	15			

Table 4
Relations of Type 2 diabetes with AFB Examination Results.

Chi Square Test	AFB Examination Results		P value	CI 95%	OR
	(3+/2+/1+)	-			
Pulmonary tuberculosis with diabetes mellitus type 2	44	37	p = 0.000	0.115–0.384	0.210
Pulmonary TB is not accompanied by type 2 diabetes mellitus	28	112			

type 2 diabetes than in patients with pulmonary TB adults who are not accompanied by type 2 diabetes. The above data also showed statistically significant association between type 2 diabetes disease with the results of smear examination in patients with adult pulmonary TB because p value $\leq$ 0,005.

4. Discussion

In the present research found cases of pulmonary TB is more common in patients with male sex compared with patients who are female. The results are consistent with research conducted by Alisjahbana et al., Park et al., Wang et al., Fengling et al., Syed Sulaiman et al., Dobler et al., Dooley et al., And Ruth Haryanti et al. [7–12,20,21] who discovered pulmonary TB patients with male gender higher compared to patients whose sex of female. These results are also consistent with the data from the Indonesia Health Profile 2013, 2014, 2015 issued by the Ministry of Health of Indonesia which states that cases of pulmonary TB is more common in males that compared to female [3,5]. Not only for sex, the subject/sample also found that cases of pulmonary TB is more common in the group age 45–54 years. This happens because the adult pulmonary TB patients who become research subjects are included in the category of Type 2 DM (BG $\geq$ 200 mg/dl, FBG $\geq$ 126 mg/dl or HbA1c $\geq$ 6.5%) were aged $>$ 45 years (according to one risk factors for type 2 diabetes are aged $>$ 45 years).

Distribution by type of patients showed the majority of patients were found in this study is a new patient. These results are consistent with research Fengling et al. and Ruth Haryanti Sihotang et al. [8,12] who also found the majority of patients who obtained is new patient. For treatment outcomes, the study found that the majority of patients received full treatment at the end of the treatment phase. These results are consistent with studies of Wang et al. [11] who also found the majority of patients received full treatment at the end of the treatment phase in the department of Friendship which found that the highest rate of treatment results in patients with MDR-TB is default. High rate of default on MDR TB cases might be due to the onset of depression, anxiety, and stress the socio-economic in TB treatment phase MDR. For ATA category, in this study, the majority of patients using the first category compared with the ATA category II. This is because the majority of the types of patients who are found in this study were new patients so that many categories of ATA given is ATA category I.

In this research, the clinical symptoms most commonly experienced are coughing $\geq$2 weeks. These results are consistent with research conducted Park et al. and Wang et al. [10,11] who found cough $\geq$ 2 weeks as clinical symptoms are most often perceived pasien. These results are also consistent with studies that find Indra Wijaya most clinical symptoms felt by the patient is coughing $\geq$2 weeks. In the present research found patients with pulmonary TB adults with DM type 2 have the results of AFB with a positive value (3+/2+/1+) is higher than the results of the AFB with a positive value in patients with pulmonary TB adults who are not accompanied DM type 2. These results are consistent with research conducted Park et al., Wang et al., Fengling et al. and Dooley et al. [10–12,20] who find adult pulmonary TB patients accompanied with DM had a smear test results with a positive value higher than the results of smear examination with a positive value in patients with pulmonary TB who are not accompanied DM. These results are also in accordance with Sukara research Safri Agung et al. and Vitello et al. [22] which found that DM patients with pulmonary TB disease have the results of smear examination with a positive value higher than the results of smear examination with grades negatif. Value positivity were found to be higher in patients with pulmonary tuberculosis DM likely due to a decline in system the body's defenses or immunocompromised in diabetic patients due to decreased function of alveolar macrophages to phagocytosis be disturbed.

AFB conversion rate at the end of the intensive phase of the subject/sample showed a high rate compared to the no conversion. These results are consistent with studies Fengling Mi et al. [12] who found AFB conversion results at the end of the intensive phase is higher than the figure does not konversi. These results are also consistent with studies Iis Kurniati and Ruth Haryanti Sihotang et al. [8,23] who found AFB conversion results in patients with pulmonary TB AFB (+) is higher than the figures do not konversi. However, AFB conversion rate in this study was not able to meet the national target of a minimum reach 80%. In this research to found an association statistically significant between levels of BG and FBG which is one of the criteria diagnostic.

5. Conclusion

From these results it can be concluded as follows:

1. Patients who have adult pulmonary TB smear positive test results are more common in adult pulmonary TB patients with BG levels, FBG or BGPP increased.
2. Adult pulmonary TB patients with smear-positive test results are more common in adult pulmonary TB patients were accompanied diseases type 2 diabetes compared to adult pulmonary TB patients who are not accompanied by disease type 2 diabetes.
3. There is a statistically significant relationship between the level of BG, FBG, BGPP and type 2 diabetes disease with the results of smear examination in adult pulmonary TB patients.

Appendix A. Supplementary data

Supplementary data related to this article can be found at http://dx.doi.org/10.1016/j.rmcr.2018.02.008.

References

[1] World Health Organization, Global Tuberculosis Report 2015, WHO, Geneva, 2015, p. 2.
[2] Kementerian Kesehatan Republik Indonesia, Profil Kesehatan Indonesia 2015, Kemenkes RI, Jakarta, 2015, pp. 161–162 (in Indonesia).
[3] A. Cahyadi, Venty, Tuberkulosis paru pada pasien diabetes mellitus, J. Indon. Med. Assoc. 61 (4) (2011) 174.
[4] I. Wijaya, Tuberkulosis paru pada penderita diabetes mellitus, 42 (6) (2015) 412–414 CDK-229.
[5] S. Yamashiro, K. Kawakami, K. Uezu, T. Kinjo, K. Miyagi, K. Nakamura, et al., Lower expression of Th1-related cytokines and inducible nitric oxide synthase in mice with streptozotocin-induced diabetes mellitus infected with *Mycobacterium tuberculosis*, Clin. Exp. Immunol. 139 (2005) 57.
[6] A. Wijayanto, E. Burhan, A. Nawas, et al., Faktor terjadinya tuberkulosis paru pada pasien diabetes mellitus tipe 2, J. Respir. Indones. 35 (1) (2015) 2 (in Indonesia).
[7] B. Alisjahbana, R.V. Crevel, E. Sahiratmadja, M. Den Heijer, A. Maya, E. Istriana, et al., Diabetes mellitus is strongly associated with tuberculosis in Indonesia, Int. J. Tubercul. Lung Dis. 10 (6) (2006) 697–698.
[8] R.H. Sihotang, B. Lampus, A.J. Pandelaki, Gambaran Penderita Tuberkulosis Paru yang Berobat Menggunakan DOTS di Puskesmas Bahu Malalayang I Periode Januari – desember 2012, J. Kedokteran Komunitas dan Tropik 1 (1) (2013) 68 (in Indonesia).
[9] S.A.S. Sulaiman, A.H. Khan, A.R. Muttalif, M.A. Hassali, N. Ahmad, M.S. Iqubal, Impact of diabetes mellitus on treatment outcomes of tuberculosis patients in tertiary care setup, Am. J. Med. Sci. 345 (4) (2013) 322.
[10] S.W. Park, J.W. Shin, J.Y. Kim, I.W. Park, B.W. Choi, J.C. Choi, Y.S. Kim, The effect

of diabetic control status on the clinical features of pulmonary tuberculosis, Eur. J. Clin. Microbiol. Infect. Dis. 31 (2012) 1307–1308.

[11] C.S. Wang, C.J. Yang, H.C. Chen, S.H. Chuang, I.W. Chong, J.J. Hwang, M.S. Huang, Impact of type 2 diabetes on manifestations and treatment outcome of pulmonary tuberculosis, Epidemiol. Infect. 137 (2009) 206–207.

[12] F. Mi, S. Tan, L. Liang, A.D. Harries, S.G. Hinderaker, Y. Lin, W. Yue, X. Chen, B. Liang, F. Gong, J. Du, Diabetes mellitus and tuberculosis: pattern of tuberculosis, two-month smear conversion and treatment outcomes in Guangzhou, China, Trop. Med. Int. Health 18 (11) (2013) 1381–1382.

[13] M.J. Magee, R.R. Kempker, M. Kipiani, N.R. Gandhi, L. Darchia, N. Tukvadze, P.P. Howards, K.M.V. Narayan, H.M. Blumberg, Diabetes mellitus is associated with cavities, smear grade and multidrug-resistant tuberculosis in Georgia, Int. J. Tubercul. Lung Dis. 19 (6) (2015) 687.

[14] S.S. Antin, M. Kashinkunti, T.V. Sowmya, M. Dhananjaya, S. Alevoor, Comparative study of oral glucose tolerance test in sputum positive pulmonary tuberculosis category I and II RNTCP regimens, Scholars J. Appl. Med. Sci. 2 (2B) (2014) 581.

[15] Kementerian Kesehatan Republik Indonesia, Pedoman Nasional Pengendalian Tuberkulosis, Kemenkes RI, Jakarta, 2014 p.1-4,14-5,19-21,24-5,120–122.

[16] Perhimpunan Dokter Paru Indonesia, Tuberkulosis Pedoman Diagnosis dan Penatalaksanaan di Indonesia, PDPI, Jakarta, 2011 p.3-14,16-21,23-25,28–30.

[17] Berkumpulan Endokrinologi Indonesia, Konsensus Pengelolaan dan Pencegahan Diabetes Mellitus Tipe 2 di Indonesia, PERKENI, Jakarta, 2015 p.6-44,48-51,55-6,60–64.

[18] D. Purnamasari, Diagnosis dan Klasifikasi diabetes mellitus, in: S. Setiati, I. Alwi, A.W. Sudoyo, et al. (Eds.), Buku Ajar Ilmu Penyakit Dalam Jilid 2, sixth ed., Interna Publishing, Jakarta, 2014, pp. 2324–2325.

[19] S.R. Paputungan, H. Sanusi, Peranan pemeriksaan hemoglobin A1c pada pengelolaan diabetes melitus, 41 (9) (2014) 650–651 CDK-220.

[20] K.E. Dooley, T. Tang, J.E. Golub, S.E. Dorman, W. Cronin, Impact of diabetes mellitus on treatment outcomes of patiens with active tuberculosis, Am. J. Trop. Med. Hyg. 80 (4) (2009) 635.

[21] C.C. Dobler, J.R. Flack, G.B. Marks, Risk of tuberculosis among people with diabetes mellitus: an australian nationwide cohort study, BMJ Open 2 (2012) 4.

[22] S.S.K. Jaya, E. Burhan, Rochsismandoko, cahyarini. Uji banding pemeriksaan mikroskopis sputum basil tahan asam dengan Xpert MTB/rif pada pasien diabetes mellitus yang diduga tuberkulosis paru, J. Respir. Indones. 35 (3) (2015) 147.

[23] I. Kurniati, Angka Konversi Penderita Tuberkulosis Paru yang Diobati dengan Obat Anti Tuberkulosis (OAT) Paket Kategori I di BP4 Garut, MKB 42 (1) (2010) 35.