ORIGINAL ARTICLE

Role of Sputum Induction in Suspected Cases of Pleural Tuberculosis

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ABSTRACT

Objective: To determine the role of sputum induction in suspected cases of pleural TB in tertiary care facility.

Study Design: Descriptive Cross sectional

Place and Duration of Study: Department of Thoracic Medicine, Fatima Jinnah Chest and general Hospital Quetta from 21st September 2019 to 20th March 2020.

Methodology: One hundred and eighteen suspected patients of pleural TB who failed to produce sputum spontaneously were studied. Sputum was induced in semi recumbent position after 15-20 minutes of nebulization with 15 mL of 3% hypertonic saline solution. The sputum of suspects was sent to well-equipped medical laboratory for culture of mycobacterium on Lowenstein Jensen medium at 37^0C and were examined for the presence of AFB on culture. Frequency and percentages was calculated for yield of sputum induction.

Results: Mean age of the patients was 38.33±9.87 years. Seventy (59.30%) patients were male and 48 (40.70%) were females. Poor socioeconomic status was presented in 73 (61.90%) and 45 (38.10%) patients were presented with middle economical status. There were 64 (54.20%) patients with illiterate educational status, 40 (33.90%) with ≤matric and 14 (11.90%) with ≥Intermediate educational status. Diagnostic yield of sputum induction founds positive in 63 (53.40%) patients.

Conclusion: Sputum Induction is a safe procedure with a high diagnostic yield for mycobacterium TB (53.40%) in suspected patients of pleural tuberculosis.

Keywords: Sputum induction; Pleural TB; Diagnostic yield of culture

INTRODUCTION

The pleural tuberculosis (TB) is disease caused by mycobacterium tuberculosis (MTB) and presents as pleuritic and pleural effusion.[1] The pleuritic is an inflammation of pleura and is also known as pleurisy.[2] The pleural effusion due to TB is called tuberculous pleuraleffusion.[2,3] The TB is categorized into pulmonary and extra-pulmonary TB.[4] The TPE occurs in 30% TB patients. Its incidence and prevalence is increasing in both developed and developing countries due to human immunodeficiency virus (HIV) pandemic.[1-4]

The diagnosis of TPE is a challenge and is mostly diagnosed by analysis of pleural fluid.[3] In this test mostly there is supportive evidences are present, such as raised protein and decreased glucose level on biochemistry, while cells microscopy shows an increase in white blood count more than 1500 cm^2 and differential leukocyte count shows predominance of lymphocytes.[4] Regarding microbiology Ziehl-Neelsen (ZN) stain is mostly negative, which is specific for TB.[5] The pleural fluid is very important specimen for other phenotyping and genotyping investigations of TB.[6] Other than ZN staining of acid fast bacilli (AFB) culture and drug susceptibility test are very important, which consist of Levinson Johnson (LJ) medium, Bactec and Bactec Magit 900. The LJ medium is solid medium, while the Bactec and Bactec Magit 900 are liquid medium. They are very useful investigations in the diagnosis of TB.[7] The genotyping investigations of TB consist of Gene Xpert and Line Probe Assay (LPA).[8]

The other supportive investigations are radiological examination, such chest X-ray postero-anterior view, computerized tomography (ct) scan and Magnetic resonance imaging (MRI) scan. The radiological findings are mostly obliteration of costo-phrenic angle, which is feature of pleural effusion.[9]

Another important specimen for the diagnosis of Pleural TB is pleural biopsies for histological examination, which shows non-caseating granulomas.[10]

Hence in addition to pleural fluid and biopsy investigation by various methods in suspected cases of Pleural TB, the sputum induction (SI) for various laboratory investigation is an additional specimen.[8,9]

AFB load varies in various specimens. The Ziehl-Neelsen staining requires bacillary densities of 10, 000/ml. The Gene Xpert can detect AFB load, when it more than 500/ml. The Line Probe Assay (LPA) can detect AFB load, when it more than 100/ml. the AFB culture detect AFB load, when it 10-100/ml, so AFB culture is still very important investigation, especially in those patients in which AFB load is very low. So sputum induction and AFB culture are needed in every suspected patients of pleural TB, because SI is non-invasive method and produce very useful specimen.[7-10]

Pleural tuberculosis is primarily associated with very small numbers of animals which makes the diagnosis very difficult11. Invasive procedures, for example pleural biopsy, are also necessary12. In many areas of the world, the capacity is limited to do pleural biopsy14. SI can be very helpful in these cases. The SI is a really healthy procedure for TPE patients.[10-13]

METHODOLOGY

This Descriptive Cross Sectional Study was conducted at Department of Thoracic Medicine, Fatima Jinnah Chest

and general Hospital Quetta from 21st September 2019 to 20th March 2020.

The 118 suspected patients of pleural TB who failed to produce sputum spontaneously were studied. The sputum was induced after 15-20 minutes of nebulization with 15 mL of 3% hypertonic saline solution. The sputum of suspects was sent to well-equipped medical laboratory for culture of mycobacterium on Lowenstein Jensen medium at 37^0C and were examined for the presence of AFB on culture.

Patients of aged between 18-50 years of either genders were included in this study. The other inclusion criteria were suspected cases of pleural TB as defined in the operational definition, patients fail to produce sputum spontaneously, duration of symptoms like persistent cough, fever ≥100^0F and weight loss (≥2 kg), presence of pleural effusion on chest radiograph ≥4 weeks. The exclusion criteria were, patients already taking anti-TB drugs, patients with Renal, cardiac and liver failure, patients with lung cancer and pregnancy.

Suspected cases admitted in a tertiary care facility were enrolled in the study. Informed consent was taken from the patient before inclusion. History was taken for duration of symptoms, economic status and educational status. All patients were briefed about the correct technique of SI. All patients were kept nil per oral for at least four hours. All the patients were advised to clean their mouth, teeth, gums and tongue before SI procedure.

These findings were entered in the proforma attached as annexure. All the statistical analysis was performed using SPSS 20 version. Effect modifiers like age, gender, yield-of-sputum-induction-, economic status and educational status was controlled through stratification to see the impact on outcome by using chi square test taken. The P <0.05 value was considered as significant.

RESULTS

Mean age of the patients was 38.33 with the standard deviation of 9.87years. Most of the patients were presented with age >30 years, i.e. 86 (72.90%). The mean duration of symptoms was 6.22 with the standard deviation of 1.84 weeks (Table 1).

The most of the patients were presented with ≤6weeks, 60 (50. 8%). There were 70 (59.30%) male and 48 (40.70%) females. The yield of sputum induction founds positive in 63 (53.40%) patients. The age stratification shows that yield of individual founds slightly higher in patients with age >30 years as compared to patients with ≤30 years, 47 (54.5%) and 16 (50%) respectively. Statistically relationship was significant {P<0.05) observed (Table 2). The stratification of gender shows that yield of individual founds higher in male patients as compared to female patients, 42 (60%) and 21 (43.8%) respectively. Statistically significant (P<0.05) relationship was observed (Table 3)

The stratification of economic status shows that yield of individual founds higher in middle economic status patients as compared to patients with poor economic status, 33 (73.3%) and 30 (41.1%) respectively. Statistically sufficient evidence of significant (P<0.05) relationship was observed (Table 4). The stratification of educational status shows that yield of individual founds higher in ≤ matric educational status patients as compared to patients with ≥ Intermediate and Illiterate, 25 (62.5%), 7 (50%) and 31 (48.4%) respectively. Statistically insufficient evidence of no significant (P>0.05) relationship was observed (Table 5)

Table 1: Descriptive statistics of the patients

Variable	Mean±SD
Age (years)	38.33±9.87
Duration of symptoms (weeks)	6.22±1.84

Table 2: Yield of sputum induction with respect to age (n= 118)

Age (years)	Yield of sputum Induction			P value
	+ve	-ve	Total	
≤30	16 (50)	16 (50)	32 (100)	0.653
31	47 (54.5)	39 (45.3)	86 (100)	
Total	63 (53.4)	55 (45.6)	118 (100)	

Table 3: Yield of sputum induction with respect to gender (n= 118)

Gender	Yield of sputum Induction			P value
	+ve	-ve	Total	
Male	42 (60)	28 (40)	70 (100)	0.082
Female	21 (43.8)	27 (56.2)	48 (100)	
Total	63 (53.4)	55 (45.6)	118 (100)	

Table 4: Yield of sputum induction with respect to economical status (n= 118)

Economical status	Yield of sputum Induction			P value
	+ve	-ve	Total	
Poor	30 (41.1)	43 (58.9)	73 (100)	0.001
Middle	33 (73.3)	12 (26.7)	45 (100)	
Total	63 (53.4)	55 (45.6)	118 (100)	

Table 5: Yield of sputum induction with respect to educational status (n= 118)

Educational status	Yield of sputum Induction			P value
	+ve	-ve	Total	
Illiterate	31 (48.4)	33 (51.6)	64 (100)	0.363
≤ Matric	25 (62.5)	15 (37.5)	40 (100)	
≥ Intermediate	7 (50)	7 (50)	14 (100)	
Total	63 (53.4)	55 (45.6)	118 (100)	

DISCUSSION

The pleural TB occurs in up to 30% of TB patients.[3] Extrapulmonary TB constituted 20% of all nationally reported cases in 2003, compared with 16% in 1993..[5,6]In this study, the AFB culture was founding positive in 63 (53.40%) of patients, using SI in suspected patients of pleural TB.[14] The detection of MTB in suspected cases of pleural TB were augmented by the inclusion of sputum by SI procedure.[15] The sensitivity was ranging from 3.5 to 100% in patients suffering from pleural TB by AFB culture from sputum collected by SI has been reported.[12,16]

Early diagnosis and treatment are especially important in areas where pleural biopsy is difficult to perform. In these areas it is very difficult to diagnose cases of pleural TB. In these areas the rates of drugresistantTB are very high.[11,13] The presence of MTB load in the pleural fluid specimen is very low and it is not detectable by Zn staining, Gene Xpert and LPA.[17]The recurrent plural fluid paracentesis may cause superimposed acute pyogenic pleural infection. In these patient's sputum specimen may have key role, but often not available. Thesepatients are not able to produce sputum voluntarily.[18]The SI is a safe

method for the diagnosis of MTB in those patients suffering from pleural TB.[14-18]

The concentration of saline used for SI was ranged from 0.9–7% in different studies.[19] In most of the studies the concentration of saline was changed during the procedure, starting from normal saline (0.9%) to subsequently increasing to 7%.[20] In certain studies saline was modified during the procedure from 3 per cent and subsequently increased to 4 and 5 per cent.[21] According to some studies, the toleration, protection and success rate of the procedure and the cellular and biochemical characteristics of the sputum obtained by SI[19-21] can be influenced by saline concentration and nebulizer production.

The concentration of more than 4 percent and 5 percent hypertonic saline solution and nebulizing performance may affect the health, tolerability and success rate of the procedures as well as the cellular and biochemical features of the induced sputum. 3% more effective than normal saline for SI was recorded with hypertonic saline solutions.[16]

However, the SI with either isotonic or hypertonic saline cause no difference cellular composition e.g. red blood cell count, total and differential leukocyte count.[17] The hypertonic saline solution of more than 3% may cause bronchospasm in certain patients, due to this, it is advised to use mostly 3% saline solution for SI.[16-17]

A study conducted by Schoch et al shows that increasing saline solution concentration during SI has no advantage over using a single saline concentration.[18] This study suggests, that hypertonic saline solution of 3% is more effective, as compared to other saline concentrations.[19] Theeffect of different saline solution concentrations on levels of soluble mediators, which are present in SI are not known and they need further research.[20-21]

The sputum osmolarity varies from 70–360 mOsm, and sputum concentrations of magnesium, chloride and sodiumvaries from individual to individual, but they don't exceed the concentrations of these electrolytes in blood.[23]

The duration of nebulization is another very important factor in SI. When duration is reduced, there may be small amount of sputum and when duration is prolonged, there may be big amount of sputum. In certain studies, it is also reported, there may be change in sputum biochemical and cellular components, obtained by procedure of si.[22,23]

CONCLUSION

The SI in suspected patients of pleuralTB, who fails to produce sputum spontaneously is very useful specimen for sake of diagnosis. It is noninvasive method for the diagnosis of pleural TB and that can be done even in low resource and remote medical centers and to avoid invasive procedure like pleural biopsy.

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