Efforts to Reduce Headache in Grade II Tuberculosis Meningitis Patients: A Case Study

Ryzka Fridelia Suhendar, Sri Hartati, Maria Komariah
Fakultas Keperawatan, Universitas Padjadjaran
Email: ryzkafridelias@gmail.com

Abstract

Tuberculous meningitis is a life-threatening disease and can cause severe manifestations and neurological disorders. Headache is one of the symptoms that occurs in patients with tuberculous meningitis. An 18-year-old woman was admitted with complaints of unilateral headache in the holocranial region with a description of throbbing pain on a scale of 6 (0-10), which decreases when she closes her eyes and sleeps. The pain is felt continuously and slightly interferes with activities. This case study aim to describe intervention that can reduce headache in Grade II Tuburculosis Meningitis. Nursing actions are given to minimize the pain experienced by patients with tuberculous meningitis, namely carrying out pharmacological and non-pharmacological pain management by collaborating in giving paracetamol 500 mg and teaching non-pharmacological pain management by facilitating patient rest, teaching deep breathing relaxation. In addition, immediate treatment is needed by administering anti-tuberculosis drugs (OAT) and corticosteroids. Corticosteroids are given to minimize complications and death rates by suppressing the inflammatory response in the subarachnoid space. After being given care, the problem of acute pain is partially resolved so that further treatment is needed with participation of the patient and family for the success of nursing care. It is necessary to improve pain management in treating patients with TB meningitis headaches.

Keywords: Tuberculosis Meningitis, Pain Management, Headache

Introduction

Meningitis, which is commonly called inflammation of the lining of the brain, is an infection that occurs in the cerebrospinal fluid (CSS) accompanied by inflammation of the arachnoid, pia mater and spinal cord, which are called the meninges. Tuberculosis is an infectious disease caused by mycobacterium tuberculosis (Brunner & Suddarth 2009). Tuberculosis meningitis occurs in the meninges covering the brain and spinal cord caused by the bacterium Mycobacterium tuberculosis and is characterized by inflammation of the membranes (meninges) around the brain or spinal cord. This disease generally occurs in individuals who experience reactivation of tuberculosis. Individuals with immunocompromised conditions such as HIV, chronic steroid use, diabetes mellitus, and individuals who are chronic alcohol addicts are at risk of experiencing tuberculous meningitis (Chin 2014; Seddon et al. 2020). Mortality rate due to tuberculosis meningitis is high in adult patients (50%) and children (20%) (Chiang et al. 2014; Wilkinson et al. 2017).

The global report on tuberculosis incidence in 2014 showed that there were 5.4 million new cases including 4.6 million cases of pulmonary tuberculosis and 0.8 million cases of extrapulmonary tuberculosis (World Health Organization, 2014). The World Health Organization states that tuberculosis is one of the infectious diseases that causes death in children and adults (Kartasasmita 2016). This disease is reported to be the cause of death for almost 2 million people per year, especially in developing countries, one of which is Indonesia. The prevalence of tuberculosis in 2019 was 845,000 cases with an average of 316 cases per 100,000 population (World Health Organization 2019).

Headache is one of the symptoms often experienced by patients with meningitis, which is a component of the meningitis triad (fever, headache, and neck stiffness). The incidence of headache is found in most patients with tuberculous meningitis, which ranges from 50-100% (Kumar et al. 2016). Inflammation of the meninges caused by infection with the mycobacterium tuberculosis bacteria is a source of headaches during the disease process, and can occur even after the infection has healed (post meningitic headache) (Kumar et al. 2016). Each patient who has tuberculous meningitis experiences the characteristics of a headache which is felt differently, including pain felt like being stabbed, throbbing or like being tied or like there is pressure. (Kumar et al. 2016).

Pain that is felt continuously can interfere with the activities of tuberculous meningitis patients and needs to be given comprehensive treatment to minimize complaints and improve the quality of patient health. Nurses as caregivers play a role in providing optimal care for tuberculosis meningitis patients in the form of treatment for the physical and psychological needs of patients during the treatment period, such as pain management both pharmacologically and non-pharmacologically. This case study aim to describe intervention that can reduce headache in Grade II Tuburculosis Meningitis. Nurses can monitor the patient's condition to prevent complications such as increased intracranial pressure, help patients to be able to return to pre-hospitalization conditions that are active independently, minimize anxiety experienced by patients, provide support to increase patient motivation in treatment programs, and collaborate on pharmacological therapy.

Method

This study uses a case study approach that aims to describe efforts to reduce pain in patients with grade II tuberculous meningitis. The information obtained regarding cases of tuberculous meningitis experienced by patients, researchers collected data both through interviews, observation, physical assessment, study of documents, and evaluating every action taken during the treatment period. In addition, follow-up was carried out via the WhatsApp application regarding the patient's condition after the patient returned from the hospital. Nursing care given to patients with acute pain nursing problems is adjusted to the Indonesian Nursing Intervention Standards (SIKI) and World Health Organization guidelines

regarding the treatment of tuberculosis meningitis. The goals and outcomes of nursing are that after 72 hours (3x24 hours) nursing care is carried out, the patient shows a decrease in pain levels with the following criteria: decreased pain complaints, pain scale, decreased anxiety and grimacing, and improved sleep patterns (PPNI 2018b). Nursing implementation has been carried out in accordance with the interventions that have been planned according to the Indonesian Nursing Intervention Standards (PPNI 2018a). Formative evaluation is carried out in each intervention, and summative evaluation is carried out at the end of each task shift. The participant in the study was a patient suffering from grade II tuberculous meningitis who was undergoing treatment at a hospital in Bandung City.

Results

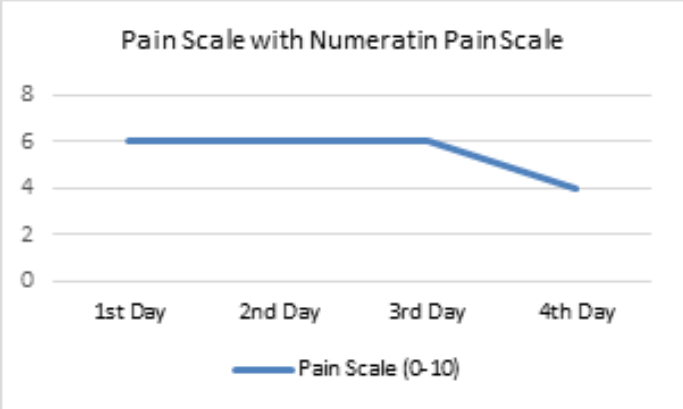
An 18-year-old woman was treated in a neurosurgery room at a hospital in the city of Bandung with a Glasgow Coma Scale (GCS) score of E4M6V4 = 14 (compos mentis). The patient is conscious and has a history of weight loss of 5 kg in the 3 weeks prior to hospital admission. Headaches and nausea but not vomiting are often experienced by patients. Previously, the patient had no history of trauma. The patient's family has a history of TB lymphadenitis and has been on treatment for 1.5 years. The patient has no history of comorbid diseases such as hypertension and diabetes mellitus.

At the time of assessment, the patient complained of holocranial headaches, with unilateral lateralization, moderate pain intensity on a scale of 6 (0-10) using a numeric rating scale, which is described as throbbing. The pain is felt to be worse when opening the eye and decreases when the patient closes the left eye and falls asleep. The results of the physical examination revealed that the patient looked weak and occasionally winced. The patient's vital signs were blood pressure 110/70 mm Hg, pulse 80 x/min, respiratory rate 20 x/min, temperature 36.6 oC. The patient's left eye looks inward (esotropia). Good swallowing reflex, positive neck stiffness, positive Kernig and Brudzinski signs, when lifting the patient's leg needs assistance. On examination of the chest, the patient did not complain of shortness of breath, no use of accessory breathing muscles, right-left vesicular breath sounds, and no enlarged heart (cardiomegaly). Extremities feel warm, CRT < 2 seconds. IV therapy was attached to the left extremity with 0.9% NaCl solution.

The results of laboratory tests showed an increase in leukocytes 14,020/µL, decreased hemoglobin levels 11.3 g/dL, hematocrit 33.8%, erythrocytes 3.91 million/µL, and platelets 303,000/µL, decreased sodium levels 133 mmol/L, decreased ionized calcium 4.14 mg/dL. Chest X-ray showed no active pulmonary TB and no heart enlargement (cardiomegaly). On CT scan of the head without contrast, it showed that there were currently no ischemic lesions, bleeding, SOL/mass, vascular malformations in the cerebrum, cerebellum or brain stem.

A combination of pharmacological and non-pharmacological therapy is given to patients comprehensively. Administration of pharmacological therapy includes administration of intravenous fluids 0.9% NaCl 1500 cc/24 hours, intravenous corticosteroid dexamethasone 1x14 mg, anti-tuberculosis drug (OAT) which is a combination of rifampin, isoniazid, pyrazinamide, and ethambutol, paracetamol 3x500 mg, omeprazole 40 mg and vitamin B6 50 mg. The non-pharmacological therapy is carried out according to the Indonesian Nursing Intervention Standards (SIKI), namely pain management (I.08238), including observing vital signs; identify location, characteristics, duration, frequency, quality and intensity of pain; pain scale monitoring; conduct studies related to the effect of pain on the patient's quality of life; facilitate rest and sleep; encourage patients to monitor pain independently; motivating patients to comply with the treatment program (PPNI, 2018a); and pain management with deep breathing relaxation therapy (Aritonang, 2020).

After being given nursing care, there was a clinical improvement in the patient, namely GCS 15 (E4M6V5) and complaints of reduced pain, reduced anxiety, the patient occasionally seemed to close his left eye. The patient's pain scale during the provision of nursing care is as follows:



Graph 1. Patient Pain Scale

Pain monitoring was carried out for 4 days as long as nursing care was given. Initially, the patient complained of pain on a scale of 6 (0-10), when evaluated with a numeric rating scale the patient said that the pain decreased on the fourth day, which was on a scale of 4 (0-10). The pain that is felt can be controlled by doing deep breathing relaxation techniques which make the patient feel more comfortable so that he can rest during the day and night. In an effort to deal with the pain felt by the patient, paracetamol 500 mg was given, deep breathing relaxation therapy, and other pharmacological therapies to overcome the causes of inflammation in the meninges.

Discussion

Tuberculous Meningitis

Tuberculous meningitis is the most serious form of tuberculosis which has a high mortality rate (Jullien et al. 2016), and 20%-30% of patients who survive have persistent central nervous system sequelae (Li et al. 2019). Clinical manifestations experienced by patients with tuberculous meningitis are fever, headache, neck stiffness, and if not treated promptly can cause loss of consciousness and even coma. Therefore, immediate treatment is needed in the treatment of tuberculous meningitis. Without treatment, the death rate from tuberculosis is quite high (Davis et al. 2019). As for the currently recommended treatment (anti-TB drugs for 4-6 months), about 85% of people can be cured (World Health Organization 2022).

Tuberculous meningitis is first transmitted to the host via inhalation droplets that infect alveolar macrophages. Primary infection localized in the lungs with spread to lymph nodes. In the process of infection, high levels of bacteremia can spread throughout the body hematogenously through the bloodstream, therefore a cellular immune response is formed by stimulating T lymphocytes to form lymphokines, these lymphokines activate mononuclear phagocyte cells in the bloodstream. Within these activated macrophages, organisms and macrophages can die and form tubercles. The tubercle focus adjacent to the subarachnoid space and located sub-ependymal is called the "Rich focus". This rich focus can rupture or rupture and cause tuberculosis bacilli to enter the subarachnoid or ventricular system and cause an intense inflammatory response that causes symptoms of tuberculous meningitis, one of which is headache.

Headache experienced by tuberculous meningitis patients is caused by rupture of a rich focus in the subarachnoid space which causes the formation of exudate that spreads along the meningeal coverings of the cranial nerves which can wrap around the cranial nerves causing nerve paralysis. This situation can damage blood vessels to cause vasculitis, and obstruction to the flow of cerebrospinal fluid resulting in hydrocephalus and increased intracranial pressure. Increased intracranial pressure causes stretching of the meninges (innervated by the trigeminal nerve), and thus causes headaches (Kumar et al. 2016). The buildup of cerebrospinal fluid (CSF), the fluid that cushions the spinal cord and brain causes an increase in intracranial pressure which is

one of the signs of intracranial hypertension syndrome.

Meningeal irritation with direct stimulation of sensory nerve endings in the meningeal vessels causes headache. Meningeal irritation is indicated by positive neck stiffness, positive Kernig's sign and Brudzinski's sign. An atypical headache for 2 to 8 weeks is experienced by most meningitis patients before symptoms of meningeal irritation appear. These non-specific symptoms include fever, weakness, myalgia malaise, anorexia and headache. In this case, the patient experienced unilateral headache in the holocranial region with moderate intensity, on a scale of 6 (0-10) and was described as throbbing. This is in line with the results of the study by Kumar et al. (2016) which stated that the majority of tuberculous meningitis patients experienced moderate intensity pain in the holocranial region which was described as throbbing. In mild intensity pain, the pain will disappear after 6 months.

Tuberculosis meningitis is categorized by the British Medical Research Council into three degrees, including grade 1 which is characterized by a Glasgow Coma Scale (GCS) score of 15 without focal neurological disorders, grade 2 is characterized by a GCS score of 15 accompanied by focal neurological deficits, or GCS 11-14, while degree 3 is marked with GCS ≤10. This categorization aims to group and determine the patient's prognosis (Pemula et al. 2016). Patients in this study included grade 2 tuberculous meningitis which was characterized by a GCS score of 15 accompanied by neurological deficits as evidenced by slow contact.

Efforts to Reduce Headache in Tuberculosis Meningitis Patients

Pharmacological Therapy

The management of tuberculous meningitis consists of anti-tuberculosis drugs given in the first two months, then two drugs are given, namely rifampin and isoniazid according to the patient's condition. Administration of drug therapy to patients is consistent with the antituberculosis treatment regimen recommended by the World Health Organization (WHO). The patient received oral rifampicin (10 mg/kilogram) for 2 months, isoniazid (5 mg/kilogram), pyrazinamide (25 mg/kilogram), and ethambutol (15 mg/kilogram), followed by 7 months of rifampin and isoniazid at different daily doses. The same. The choice of the currently recommended rifampicin dose (10 mg/kg) is not based on optimal efficacy, but due to the high cost of rifampicin and concerns over toxic effects (Charlie et al. 2021; Dian et al. 2018).

In dealing with inflammation that can cause headaches in patients with tuberculous meningitis, dexamethasone therapy is given for 8 weeks with an intravenous dexamethasone dose of 0.4 mg/kg body weight per day, and then reduced by 0.1 mg/kg every week. This was followed by oral medication for 4 weeks, starting at a total of 4 mg/day and decreasing by one mg weekly. Administration of corticosteroids (dexamethasone or prednisolone) is carried out in all tuberculous meningitis patients regardless of degree (Kemenkes RI 2013). Oral pyridoxine 20-40 mg/day was given to all patients. Administration of 20% mannitol (1 gm/kg body weight/day in 4 to 6 doses) is given to patients showing increased intracranial pressure. Antiepileptic drugs are used in patients who have seizures (Kumar et al. 2016). Administration of corticosteroids can suppress the inflammatory response which minimizes the risk of increased intracranial pressure so as to reduce headache (Pemula et al. 2016). In addition to giving corticosteroids and anti-tuberculosis drugs, given paracetamol which is an antipyretic and analgesic used in individuals who experience headaches or migraines (Sheena and Moore 2013). Paracetamol 500 mg therapy is given to minimize moderate intensity pain experienced by patients.

Provision of anti-tuberculosis therapy (OAT) consisting of rifampin and pyrazinamide often results in symptoms of increased stomach acid such as pain in the pit of the stomach, nausea, and even vomiting (Abbas 2017). Patients in this study experienced nausea but did not vomit every time they took OAT in the morning, therefore they were given omeprazole 40 mg to treat gastric disorders in the form of nausea and vomiting. Consumption of vitamin B6 supplements can reduce the risk of side

effects of the antituberculosis drug, namely isoniazid. Isoniazid can cause disorders of the nerves or peripheral neuropathy, impaired liver function, allergic reactions, and headaches. Therefore, vitamin B6 therapy is given which functions to maintain the health of the nervous system and prevent risks caused by one of the anti-tuberculosis drug ingredients, namely isoniazid.

In an effort to deal with inflammation that occurs in the meninges, corticosteroid dexamethasone 14 mg was given intravenously. Intravenous administration of corticosteroids has been shown to play an effective role in reducing mortality in tuberculosis meningitis patients due to suppression of the inflammatory response in the subarachnoid space which minimizes the risk of cerebral edema, obstruction of cerebral blood flow, increased intracranial pressure and vasculitis. Dexamethasone was administered intravenously for 4 weeks and continued with oral administration according to the patient's clinical condition (Pemula et al. 2016).

Non-Pharmacological Therapy

In patients given non-pharmacological therapy deep breathing relaxation techniques. Deep and slow breathing techniques activate the endogenous opioid system, one of which is endorphins. Endorphin is an endogenous opioid peptide which functions as a neurotransmitterEndorphin structure has similarities with morphine to reduce pain signals. On the third day after doing the breathing relaxation technique independently, the patient said he felt more relaxed and was able to control the pain he was experiencing. In several studies, breathing relaxation techniques have been shown to be effective in minimizing and controlling pain (Aritonang 2020; Gopichandran et al. 2021). Deep breathing techniques can help patients with acute pain (Joseph et al. 2022). Aritonang's research (2020) states that deep breathing techniques can reduce headache scales because they can lower blood pressure, relax tense muscles around the neck and head so that patients can relax and have less headaches.

Various dimensions of headache such as severity, duration, and frequency can affect activities of daily living (ADL) and quality of life for individuals. Both pharmacological and non-pharmacological therapy are given to improve the quality of health.

The long period of treatment for tuberculous meningitis makes some people feel anxious, therefore active participation from the family is needed in the success of the treatment program provided. Patients are given information and education related to treatment programs so as to increase patient and family knowledge and it is hoped that patients and families can comply with the treatment program so as to minimize the risk of unwanted complications.

Conclusions

Management of pain in patients with tuberculosis meningitis with the main complaint felt by patients is unilateral holocranial headache which is characterized by the patient's grimace, left eye squint inward, decreased levels of hemoglobin, hematocrit, erythrocytes, sodium and calcium ions and increased leukocytes. In the patient's case, the actual diagnosis was acute pain associated with an inflammatory process in the meninges. Nursing interventions for patients are arranged based on the priority of acute pain diagnosis using pharmacological and non-pharmacological techniques, as well as administration of corticosteroids. Pain management is carried out, namely collaboration in giving paracetamol, deep breathing relaxation techniques which are effective in relaxing and comfortable during treatment at the hospital and controlling the pain experienced by patients. Administration of corticosteroids aims to minimize the occurrence of complications and the mortality rate by suppressing the inflammatory response in the subarachnoid space. Pharmacological management is carried out to deal with the causes of pain experienced by patients so that it is hoped that pain will decrease along with the patient's clinical improvement. It is necessary to improve pain management and improve another implementation in treating patients with TB meningitis headaches.

References

Abbas, Akhmadi. 2017. "Monitoring Efek Samping Obat Anti-Tuberkulosis (OAT) Pada Pengobatan Tahap Intensif Penderita TB Paru Di Kota Makassar." Journal of Agromedicine and Medical Sciences 3(1):19–24.

Aritonang, Yanti Anggraini. 2020. "The Effect of Slow Deep Breathing Exercise on Headache and Vital Sign in Hypertension Patients." Jurnal Keperawatan Padjadjaran 8(2):166–74. doi: 10.24198/jkp.v8i2.1320.

Brunner & Suddarth. 2009. Keperawatan Medikal Bedah. 1st ed. Jakarta: EGC.

Charlie, Loveness, Solomon Meuquante Abay, Abraham Tesfaye, Ronald Nachipo Miera, Samuel Mwango, and Mary Goretti. 2021. "Safety and Efficacy of High-Dose Rifampicin in the Management of Tuberculosis Meningitis: Systematic Review and Meta-Analysis." International Journal of Mycobacteriology 10(9):312. doi: 10.4103/ijmy.ijmy_135_21.

Chiang, Silvia S., Faiz Ahmad Khan, Meredith B. Milstein, Arielle W. Tolman, Andrea Benedetti, Jeffrey R. Starke, and Mercedes C. Becerra. 2014. "Treatment Outcomes of Childhood Tuberculous Meningitis: A Systematic Review and Meta-Analysis." The Lancet Infectious Diseases 14(10):947–57. doi: 10.1016/S1473-3099(14)70852-7.

Chin, Jerome H. 2014. "Tuberculous Meningitis: Diagnostic and Therapeutic Challenges." Neurology: Clinical Practice 4(3):199–205. doi: 10.1212/CPJ.0000000000000023.

Davis, Angharad Grace, Ursula Karin Rohlwink, Alize Proust, Anthony Figaji, and Robert J. Wilkinson. 2019. "The Pathogenesis of Tuberculous Meningitis." J Leukoc Biol. 105(2):267–80. doi: 10.1002/JLB.MR0318-102R.

Dian, S., V. Yunivita, A. R. Ganiem, T. Pramaesya, L. Chaidir, K. Wahyudi, T. H. Achmad, A. Colbers, L. Te Brake, R. Van Crevel, R. Ruslami, and R. Aarnoutse. 2018. "Double-Blind, Randomized, Placebo-Controlled Phase II Dose-Finding Study to Evaluate High-Dose Rifampin for Tuberculous Meningitis." Antimicrobial Agents and Chemotherapy 62(12):1–12. doi: 10.1128/AAC.01014-18.

Gopichandran, Lakshmanan, Achal Kumar Srivastsava, P. Vanamail, C. Kanniammal, G. Valli, Jaideep Mahendra, and Manju Dhandapani. 2021. "Effectiveness of Progressive Muscle Relaxation and Deep Breathing Exercise on Pain, Disability, and Sleep among Patients with Chronic Tension-Type Headache a Randomized Control Trial." Holistic Nursing Practice (May):1–12. doi: 10.1097/HNP.0000000000000460.

Joseph, Amira E., Rajat N. Moman, Ross A. Barman, Donald J. Kleppel, Nathan D. Eberhart, Danielle J. Gerberi, M. Hassan Murad, and W. Michael Hooten. 2022. "Effects of Slow Deep Breathing on Acute Clinical Pain in Adults: A Systematic Review and Meta-Analysis of Randomized Controlled Trials." Journal of Evidence-Based Integrative Medicine 27:1–10. doi: 10.1177/2515690X221078006.

Jullien, Sophie, Hannah Ryan, Manish Modi, and Rohit Bhatia. 2016. "Six Months Therapy for Tuberculous Meningitis." Cochrane Database of Systematic Reviews 2016(9). doi: 10.1002/14651858.CD012091.pub2.

Kartasasmita, Cissy B. 2016. "Epidemiologi Tuberkulosis." Sari Pediatri 11(2):124. doi: 10.14238/sp11.2.2009.124-9.

Kemenkes RI. 2013. Tata Laksana Tuberkulosis. Pedoman Nasional Pelayanan Kedokteran.

Kumar, Sanjeev, Rajesh Verma, Ravindra K. Garg, Hardeep S. Malhotra, and Praveen K. Sharma. 2016. "Prevalence and Outcome of Headache in Tuberculous Meningitis." Neurosciences 21(2):138–44. doi: 10.17712/nsj.2016.2.2015678.

Li, Xuelian, Liping Ma, L. Zhang, Xiaoguang Wu, Hongmei Chen, and Mengqiu Gao. 2019. "Clinical Characteristics of

Tuberculous Meningitis Combined with Cranial Nerve Palsy." Clinical Neurology and Neurosurgery 184(July):12–15. doi: 10.1016/j.clineuro.2019.105443.

Pemula, Giok, Roezwir Azhary, Ety Apriliana, and Paulus Dwi. 2016. "Penatalaksanaan Yang Tepat Pada Meningitis Tuberkulosis." Jurnal Medula Unila 6(1):50–55.

PPNI. 2018a. Standar Intervensi Keperawatan Indonesia: Definisi Dan Tindakan Keperawatan. 1st ed. Jakarta: DPP PPNI.

PPNI. 2018b. Standar Luaran Keperawatan Indonesia: Definisi Dan Kriteria Hasil Keperawatan. 1st ed. Jakarta: DPP PPNI.

Seddon, James A., Lillian Tugume, Regan Solomons, Kameshwar Prasad, Nathan C. Bahr, Infectious Diseases, and Imperial College London. 2020. "The Current Global Situation for Tuberculous Meningitis : Epidemiology , Diagnostics, Treatment and Outcomes." Wellcome Open Research 4:1–15.

Sheena, Derry, and Andrew Moore. 2013. "Paracetamol (Acetaminophen) with or without an Antiemetic for Acute Migraine Headaches in Adults." Cochrane Database of Systematic Reviews (4). doi: 10.1002/14651858.CD008040.pub3.

Wilkinson, Robert J., Ursula Rohlwink, Usha Kant Misra, Reinout Van Crevel, Nguyen Thi Hoang Mai, Kelly E. Dooley, Maxine Caws, Anthony Figaji, Rada Savic, Regan Solomons, and Guy E. Thwaites. 2017. "Tuberculous Meningitis." Nature Reviews Neurology 13(10):581–98. doi: 10.1038/nrneurol.2017.120.

World Health Organization (2015) Global Tuberculosis Report, WHO Press. Available at: https://apps.who.int/iris/bitstream/handle/10665/191102/9789241565059_eng.pdf?sequence=1&isAllowed=y (Accessed: 13 December 2022).

World Health Organization. 2019. WHO TB Report.

World Health Organization. 2022. Global Tuberculosis Report.

World Health Organization (WHO). 2014. Global Tuberculosis Report. Geneva, Switzerland.