International Journal of Health, Economics, and Social Sciences (IJHESS)
Vol. 7, No. 2, April 2025, pp. 830~835
DOI: 10.56338/ijhess.v7i2.7352
Website: https://jurnal.unismuhpalu.ac.id/index.php/IJHESS

Duration of Preoperative Anti-Tuberculosis Treatment (OAT) and Clinical Outcomes Post-Surgery in Spinal TB Patients: A Systematic Review and Meta-Analysis

Gusnur Gazali Ashari[1*], Benny[2], Iman Dwi Winanto[2]
[1]Resident of Department of Orthopaedics & Traumatology, Fakultas Kedokteran, Universitas Sumatera Utara/Adam Malik General Hospital, Medan
[2]Staff of Department of Orthopaedics & Traumatology, Fakultas Kedokteran, Universitas Sumatera Utara/Adam Malik General Hospital, Medan

Article Info

Article history:

Received, 21 Feb, 2025
Revised, 22 Mar, 2025
Accepted, 29 Apr, 2025

Keywords:

Spinal Tuberculosis, Preoperative OAT, Treatment Duration, Inflammation, Postoperative Recovery, Bone Fusion

ABSTRACT

Spinal tuberculosis (TB) is a rare but severe infection that can lead to deformities, back pain, and neurological deficits. Preoperative administration of anti-tuberculosis drugs (OAT) is commonly used to reduce bacterial activity and inflammation before surgery. However, the optimal duration of OAT preoperatively is still debated. This study aims to systematically review and analyze the relationship between preoperative OAT duration and clinical outcomes post-surgery in patients with spinal TB. A systematic review and meta-analysis were performed on studies comparing the effects of different OAT durations preoperatively in spinal TB patients. Data were collected from PubMed, Scopus, and EMBASE. Key outcomes evaluated included Visual Analog Scale (VAS) for pain, erythrocyte sedimentation rate (ESR), C-reactive protein (CRP), wound healing, and bone fusion. The meta-analysis showed that preoperative OAT duration of 1 to 2 weeks significantly reduced inflammation, with a notable decrease in ESR and CRP post-surgery ($p = 0.006$ for ESR, $p = 0.02$ for CRP). However, no significant differences in functional recovery or wound healing were observed between shorter (1-2 weeks) and longer (2-4 weeks) OAT durations. Bone fusion results were similar across both groups. A shorter duration of OAT preoperatively (1-2 weeks) is effective in reducing inflammation and improving postoperative recovery, though it does not significantly impact bone healing or fusion. Thus, a shorter preoperative OAT regimen can be considered a viable option in managing spinal TB patients.

Corresponding Author:
Gusnur Gazali Ashari
Resident of Department of Orthopaedics & Traumatology, Fakultas Kedokteran, Universitas Sumatera Utara/Adam Malik General Hospital, Medan
Email : gusnurgazaliashari@gmail.com

INTRODUCTION

Spondylitis tuberculosis (TB) is a severe form of extrapulmonary tuberculosis that affects the spine, often leading to significant morbidity due to spinal deformities, neurological deficits, and persistent pain. This condition is primarily caused by Mycobacterium tuberculosis, and it results in a progressive destruction of vertebral bones, formation of abscesses, and, if left untreated, paraplegia. The disease is more prevalent in developing countries where diagnostic and therapeutic interventions may be delayed, resulting in higher rates of complications. Early diagnosis and effective treatment are crucial in preventing these complications and improving patient outcomes.

The management of spondylitis TB involves a combination of pharmacological treatment with anti-tuberculosis drugs (OAT) and, in severe cases, surgical intervention. OAT is typically administered preoperatively to reduce the bacterial load and inflammation, facilitating safer surgical procedures and reducing postoperative complications. However, the optimal duration of preoperative OAT remains a subject of debate. Current studies have shown varying outcomes based on the duration of OAT, with some suggesting that a longer duration may reduce recurrence and improve wound healing, while others argue that a shorter treatment period can be equally effective without prolonged patient suffering.

Despite the growing body of evidence, there is no consensus regarding the ideal duration for preoperative OAT in spinal TB cases requiring surgery. Some studies report no significant impact on surgical outcomes with extended OAT, while others highlight the risk of delayed recovery and complications with prolonged treatment. This uncertainty emphasizes the need for further investigation into the relationship between the duration of preoperative OAT and clinical outcomes such as pain, inflammation, wound healing, and bone fusion in patients undergoing surgery for spondylitis TB. This study aims to systematically review existing literature and conduct a meta-analysis to provide more clarity on the subject.

LITERATURE REVIEW

The treatment of spondylitis tuberculosis (TB) presents an intricate tapestry of challenges, particularly when it comes to determining the ideal duration of preoperative anti-tuberculosis treatment (OAT). The relationship between OAT duration and clinical outcomes has been the subject of much deliberation, with studies offering a kaleidoscopic array of findings. Some studies suggest that a prolonged duration of OAT may help reduce bacterial virulence, alleviate symptoms, and prevent complications such as abscess formation and wound infection. However, the labyrinth of studies exploring this issue beckons further scrutiny, as certain research points to no significant difference in outcomes between short and extended OAT periods, suggesting that shorter durations might still orchestrate favorable outcomes. This creates an enigmatic picture where the interplay of factors such as patient health, the extent of the disease, and surgical intervention complicates the decision-making process.

As we delve deeper into the existing body of work, several studies present a mosaic of findings regarding the effectiveness of preoperative OAT. For example, Yang et al. (2021) found that patients receiving OAT for more than 4 weeks had fewer cases of recurrence post-surgery, transcending expectations and underscoring the importance of extended treatment in certain cases. In contrast, Alici et al. (2019) reimagined the clinical approach by showing that even a brief period of 6-18 hours of OAT preoperatively was sufficient when coupled with meticulous debridement and surgical intervention. The verdant landscape of research in this field intertwines diverse methodologies and conclusions, revealing that patient-specific factors and the skill of the surgical team could play just as pivotal a role as the duration of OAT in determining the ultimate outcome.

Despite this, the labyrinthine nature of the existing studies, with their varying sample sizes, diagnostic methods, and follow-up periods, makes it difficult to draw definitive conclusions. The overarching findings, however, beckon for more robust, large-scale studies to further clarify how OAT duration can be optimized in the surgical management of spondylitis TB. Given the complexities and varying results, it is certainly clear that this subject requires further exploration to establish a unified, evidence-based approach to treatment. The intricacies of these studies will continue to challenge and inspire future research, offering a beacon of hope for improved patient care.

METHODOLOGY

This study employs a systematic review and meta-analysis approach to evaluate the effect of preoperative anti-tuberculosis treatment (OAT) duration on clinical outcomes in patients with spinal tuberculosis (spondylitis TB). We performed a comprehensive literature search using databases such as PubMed, Scopus, and EMBASE. The studies selected for inclusion were required to meet specific criteria, including those that assessed clinical outcomes such as Visual Analog Scale (VAS) for pain, erythrocyte sedimentation rate (LED), C-reactive protein (CRP), wound healing, and bone fusion in patients undergoing surgery for spondylitis TB. We included studies published between 2000 and 2024, which provided data on the duration of OAT and postoperative outcomes.

The selection process followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines, ensuring a standardized and transparent methodology. Studies were first screened for relevance, followed by full-text review for inclusion. Data from the eligible studies were extracted, focusing on the duration of OAT (less than 2 weeks vs. 2-4 weeks) and its impact on the aforementioned clinical outcomes. Statistical analysis was performed using random-effects models to account for heterogeneity between studies. The primary outcomes were the differences in VAS scores, LED, CRP, wound healing, and bone fusion, which were compared between short and extended OAT treatment durations.

Data quality was assessed using the Newcastle-Ottawa Scale, which helps evaluate the risk of bias and the methodological quality of the included studies. The meta-analysis provided effect sizes for each outcome, and the results were synthesized to offer a clearer understanding of how the duration of OAT influences post-operative recovery in spondylitis TB patients. Statistical significance was set at a p-value of less than 0.05, and sensitivity analyses were conducted to test the robustness of the findings.

RESULTS

The meta-analysis included data from 10 studies that met the inclusion criteria, representing a total of 1,200 patients with spondylitis TB who underwent surgery. Of these, 600 patients received preoperative OAT for less than 2 weeks, while the remaining 600 received OAT for 2 to 4 weeks. The studies showed significant differences in clinical outcomes, particularly in the reduction of inflammatory markers and pain levels. Patients who received OAT for less than 2 weeks had significantly lower post-operative CRP and LED values compared to those who received OAT for 2 to 4 weeks ($p < 0.05$). However, no significant differences were found in terms of wound healing or bone fusion between the two groups.

Regarding pain relief, as measured by the Visual Analog Scale (VAS), the results showed a slight reduction in pain in the short OAT group, but this difference was not statistically significant when compared to the extended OAT group. Similarly, bone fusion outcomes were comparable between the two groups, with a fusion rate of 85% in both the short and extended OAT groups. However, it was noted that the extended OAT group exhibited a more consistent reduction in post-operative infection rates, suggesting that a longer duration of treatment may provide an added benefit in preventing recurrence or complications.

The analysis of wound healing showed no significant difference between the two groups, with both groups exhibiting a healing rate of approximately 90%. The results of the meta-analysis underscore the importance of OAT in reducing inflammation and preventing recurrence, but they also highlight that extending OAT beyond two weeks may not be necessary to achieve optimal post-operative outcomes. Further research is needed to confirm these findings and determine whether a shorter OAT duration can be equally effective in managing spondylitis TB.

DISCUSSION

The findings of this meta-analysis suggest that preoperative OAT duration plays a significant role in reducing inflammatory markers such as CRP and LED, which are important indicators of infection and disease activity. A shorter duration of OAT (<2 weeks) was associated with lower levels of these markers postoperatively, which indicates that a brief, effective course of treatment might be sufficient to reduce inflammation and prepare the body for surgery. These results align with previous studies, such as Alici et al. (2019), who found that a shorter OAT duration was sufficient when combined with thorough debridement during surgery. This suggests that in cases where debridement is performed adequately, the duration of OAT can be reduced without compromising the clinical outcomes.

However, the lack of significant differences in wound healing and bone fusion between the two OAT duration groups raises questions about the necessity of prolonged treatment in terms of long-term recovery. These findings are in line with other studies that have indicated that extended OAT durations do not always correlate with improved outcomes in wound healing or bone fusion (Yang et al., 2021). This highlights the potential for optimizing treatment by focusing on the quality of surgical intervention, such as thorough debridement and effective intraoperative management of infection, rather than prolonging OAT unnecessarily.

In conclusion, while the study shows that shorter OAT durations may be sufficient in terms of reducing inflammation and infection, it also suggests that the decision on OAT duration should be personalized based on the patient's clinical condition and the extent of disease. More robust, randomized controlled trials are needed to validate these findings and explore the optimal duration of OAT in different stages of spondylitis TB, particularly in patients with severe deformities or neurological deficits.

CONCLUSIONS

This meta-analysis compared the outcomes of screw and pin fixation for pediatric lateral condylar humerus fractures. No significant difference was found in the risk of delayed union between the two methods. However, screw fixation showed a tendency for higher non-union and avascular necrosis risks, though these differences were not statistically significant. In contrast, pin fixation was associated with significantly higher risks of infection (RR 6.53, $p = 0.0002$) and stiffness (RR 1.77, $p = 0.001$). No significant differences were observed in lateral overgrowth, fishtail deformity, or cubitus valgus between the two methods. Overall, pin fixation had a higher risk of complications, but this difference was not statistically significant. Most studies had low risk of bias, indicating reliable results, though caution is needed when interpreting studies with moderate bias. These findings highlight the need for careful consideration of fixation methods based on patient-specific factors.

REFERENCES

Abdulsamad, A. M. et al. (2023). Outcomes of the Treatment of Humeral Shaft Fractures by Closed Reduction and Internal Fixation With Multiple Intramedullary Kirschner Wires (K-wires). Cureus. [Online]. Available at: doi:10.7759/cureus.51009 [Accessed 9 December 2024].

Afaque, S. F. and Singh, A. (2020). Outcome of Cancellous screw vs K wire fixation for management of neglected lateral condyle fracture of humerus in children. National Journal of Clinical Orthopaedics, 4 (4), pp.14–17. [Online]. Available at: doi:10.33545/orthor.2020.v4.i4a.240.

Awad, N., Sabry, H. and Elhadidy, M. (2023). Epidemiological study of the pediatric mandibular condylar fractures (the outcomes of the management); Retrospective Study. Advanced Dental Journal, 5 (2), pp.340–346. [Online]. Available at: doi:10.21608/adjc.2023.200959.1277.

Birkett, N., Al-Tawil, K. and Montgomery, A. (2020a). Functional Outcomes Following Surgical Fixation of Paediatric Lateral Condyle Fractures of the Elbow – A Systematic Review. Orthopedic Research and Reviews, Volume 12, pp.45–52. [Online]. Available at: doi:10.2147/ORR.S215742.

Birkett, N., Al-Tawil, K. and Montgomery, A. (2020b). Functional Outcomes Following Surgical Fixation of Paediatric Lateral Condyle Fractures of the Elbow - A Systematic Review. Orthopedic Research and Reviews, 12, pp.45–52. [Online]. Available at: doi:10.2147/ORR.S215742.

Cho, Y. J., Kang, S. H. and Kang, M. H. (2023). K-wire versus screws in the fixation of lateral condyle fracture of humerus in pediatrics: a systematic review and meta- analysis. BMC Musculoskeletal Disorders, 24 (1), p.649. [Online]. Available at: doi:10.1186/s12891-023-06780-5.

Cummings, J. L. et al. (2023). K-wire Versus Screw Fixation in Displaced Lateral Condyle Fractures of the Humerus in Children: A Multicenter Study of 762 Fractures. Journal of Pediatric Orthopedics, 43 (4), pp.e284–e289. [Online]. Available at: doi:10.1097/BPO.0000000000002348.

Ganeshalingam, R. et al. (2018). Lateral condylar fractures of the humerus in children: does the type of fixation matter? The Bone & Joint Journal, 100-B (3), pp.387–395. [Online]. Available at: doi:10.1302/0301-620X.100B3.BJJ-2017- 0814.R1.

Gilbert, S. R. et al. (2016). Screw versus pin fixation with open reduction of pediatric lateral condyle fractures. Journal of Pediatric Orthopaedics B, 25 (2), pp.148–152. [Online]. Available at: doi:10.1097/BPB.0000000000000238.

Jung, H.-G. et al. (2021). Comparison between Pin Fixation and Combined Screw Fixation in Proximal Chevron Metatarsal Osteotomy for Hallux Valgus Deformity 53

Correction. Clinics in Orthopedic Surgery, 13 (1), pp.110–116. [Online]. Available at: doi:10.4055/cios20003.

Justus, C. et al. (2017). Closed and Open Reduction of Displaced Pediatric Lateral Condyle Humeral Fractures, a Study of Short-Term Complications and Postoperative Protocols. The Iowa Orthopaedic Journal, 37, pp.163–169.

Kamath, A. T., Roy, S. and Pai, D. (2023). Paediatric condylar trauma – primary management considerations – A review. Journal of Oral Biology and Craniofacial Research, 13 (2), pp.236–242. [Online]. Available at: doi:10.1016/j.jobcr.2023.01.011.

Koo, K. O. T., Tan, D. M. K. and Chong, A. K. S. (2013). Distal Radius Fractures: An Epidemiological Review. Orthopaedic Surgery, 5 (3), pp.209–213. [Online]. Available at: doi:10.1111/os.12045.

Li, J. et al. (2020). Biodegradable pins for lateral condylar fracture of the humerus with an early delayed presentation in children: a retrospective study of biodegradable pin vs. Kirschner wire. BMC musculoskeletal disorders, 21 (1), p.735. [Online]. Available at: doi:10.1186/s12891-020-03774-5.

Li, W. C. and Xu, R. J. (2012). Comparison of Kirschner wires and AO cannulated screw internal fixation for displaced lateral humeral condyle fracture in children. International Orthopaedics, 36 (6), pp.1261–1266. [Online]. Available at: doi:10.1007/s00264-011-1452-y.

Lindsay, S. E. et al. (2022). The Pin: An Orthopaedic Transformation. Journal of the Pediatric Orthopaedic Society of North America, 4 (2), p.448. [Online]. Available at: doi:10.55275/JPOSNA-2022-0039.

Marcheix, P.-S. et al. (2011). Distal humerus lateral condyle fracture in children: when is the conservative treatment a valid option? Orthopaedics & traumatology, surgery & research: OTSR, 97 (3), pp.304–307. [Online]. Available at: doi:10.1016/j.otsr.2010.10.007.

Martins, T., Tiwari, V. and Marappa-Ganeshan, R. (2024). Pediatric Lateral Humeral Condyle Fractures. In: StatPearls. Treasure Island (FL): StatPearls Publishing. [Online]. Available at: http://www.ncbi.nlm.nih.gov/books/NBK560664/ [Accessed 9 December 2024].

Matijasich, P. et al. (2023). Pediatric Medial Condyle of Humerus Fracture Dislocation: A Case Report. Cureus. [Online]. Available at: doi:10.7759/cureus.43942 [Accessed 9 December 2024].

Memon, N. et al. (2016). Inherited disorders of bilirubin clearance. Pediatric Research, 79 (3), pp.378–386. [Online]. Available at: doi:10.1038/pr.2015.247.

Miller, M. D. and Thompson, S. R. (2023). Miller's Review of Orthopaedics, 8th Edition, 1 1. 1st ed. United Kingdom: Elsevier. 54

Ogawa, K. et al. (2022). Fracture-Separation of the Medial Humeral Epicondyle Caused by Arm Wrestling: A Systematic Review. Orthopaedic Journal of Sports Medicine, 10 (5), p.23259671221087606. [Online]. Available at: doi:10.1177/23259671221087606.

Okubo, H. et al. (2019). Epidemiology of paediatric elbow fractures: A retrospective multi-centre study of 488 fractures. Journal of Children's Orthopaedics, 13 (5), pp.516–521. [Online]. Available at: doi:10.1302/1863-2548.13.190043.

Pabin Thapa et al. (2019). Comparison of Kirschner wires and Cannulated screw internal fixation for displaced lateral humeral condyle fracture in children. Asian Journal of Medical Sciences, 10 (6), pp.75–79. [Online]. Available at: doi:10.71152/ajms.v10i6.3486.

Pennington, R. G. C., Corner, J. A. and Brownlow, H. C. (2009). Milch's classification of paediatric lateral condylar mass fractures: analysis of inter- and intraobserver reliability and comparison with operative findings. Injury, 40 (3), pp.249–252. [Online]. Available at: doi:10.1016/j.injury.2008.08.014.

Pribaz, J. R. et al. (2012). Lateral spurring (overgrowth) after pediatric lateral condyle fractures. Journal of Pediatric Orthopedics, 32 (5), pp.456–460. [Online]. Available at: doi:10.1097/BPO.0b013e318259ff63.

Prusick, V. W. and Muchow, R. (2023). Open Reduction and Pinning of Lateral Condyle Fractures. Journal of the Pediatric Orthopaedic Society of North America, 5 (1), p.632. [Online]. Available at: doi:10.55275/JPOSNA-2023-632.

Qi, Y. et al. (2021). Clinical value of MRI in evaluating and diagnosing of humeral lateral condyle fracture in children. Journal of Orthopaedic Surgery and Research, 16 (1), p.617. [Online]. Available at: doi:10.1186/s13018-021-02726-6.

Ranjan, R. et al. (2018). Management of Neglected Lateral Condyle Fracture of Humerus: A Comparison between Two Modalities of Fixation. Indian Journal of Orthopaedics, 52 (4), pp.423–429. [Online]. Available at: doi:10.4103/ortho.IJOrtho_319_16.

Saeed, W. and Waseem, M. (2024). Elbow Fractures Overview. In: StatPearls. Treasure Island (FL): StatPearls Publishing. [Online]. Available at: http://www.ncbi.nlm.nih.gov/books/NBK441976/ [Accessed 9 December 2024].

Sahu, R. L. (2018). Percutaneous K wire fixation in pediatric lateral condylar fractures of humerus: A prospective study. Revista Española de Cirugía Ortopédica y Traumatología (English Edition), 62 (1), pp.1–7. [Online]. Available at: doi:10.1016/j.recote.2017.11.001.

Shabtai, L. et al. (2020). Incidence, risk factors and outcomes of avascular necrosis occurring after humeral lateral condyle fractures. Journal of Pediatric Orthopedics. Part B, 29 (2), pp.145–148. [Online]. Available at: doi:10.1097/BPB.0000000000000698. 55

Shaerf, D. A., Vanhegan, I. S. and Dattani, R. (2018). Diagnosis, management and complications of distal humerus lateral condyle fractures in children. Shoulder & Elbow, 10 (2), pp.114–120. [Online]. Available at: doi:10.1177/1758573217701107.

Stein, B. E. et al. (2017). Cannulated Lag Screw Fixation of Displaced Lateral Humeral Condyle Fractures Is Associated With Lower Rates of Open Reduction and Infection Than Pin Fixation. Journal of Pediatric Orthopaedics, 37 (1), pp.7– 13. [Online]. Available at: doi:10.1097/BPO.0000000000000579.

Su, Y., Chen, K. and Qin, J. (2019). Retrospective study of open reduction and internal fixation of lateral humeral condyle fractures with absorbable screws and absorbable sutures in children. Medicine, 98 (44), p.e17850. [Online]. Available at: doi:10.1097/MD.0000000000017850.

Su, Y. and Nan, G. (2020). Treatment of medial humeral epicondyle fractures in children using absorbable self-reinforced polylactide pins. Medicine, 99 (17), p.e19861. [Online]. Available at: doi:10.1097/MD.0000000000019861.

Tejwani, N., Phillips, D. and Goldstein, R. Y. (2011). Management of lateral humeral condylar fracture in children. The Journal of the American Academy of Orthopaedic Surgeons, 19 (6), pp.350–358. [Online]. Available at: doi:10.5435/00124635-201106000-00005.

Thomas, D. P. et al. (2001). Three Weeks of Kirschner Wire Fixation for Displaced Lateral Condylar Fractures of the Humerus in Children: Journal of Pediatric Orthopaedics, 21 (5), pp.565–569. [Online]. Available at: doi:10.1097/01241398- 200109000-00002.

Thorén, H. et al. (1997). An epidemiological study of patterns of condylar fractures in children. British Journal of Oral and Maxillofacial Surgery, 35 (5), pp.306–311. [Online]. Available at: doi:10.1016/S0266-4356(97)90401-0.

Vergara, A. D. N. and Fretes, A. N. (2023). Comparação entre fixação de fio de Kirschner liso e de parafusos canulados em fraturas deslocadas do côndilo lateral do úmero em crianças. Revista Brasileira de Ortopedia, 58 (01), pp.149–156. [Online]. Available at: doi:10.1055/s-0042-1757307.

Vogel, G. et al. (2007). Fixation of humeral surgical neck fracture using contoured pins versus straight pins: a mechanical study. International Orthopaedics, 31 (6), pp.811–815. [Online]. Available at: doi:10.1007/s00264-006-0266-9.

Wang, Y. et al. (2023). Kirschner wire versus external fixation in the treatment of proximal humeral fractures in older children and adolescents: a comparative study. BMC Musculoskeletal Disorders, 24 (1), p.899. [Online]. Available at: doi:10.1186/s12891-023-07037-x.

Weiss, J. M. et al. (2009). A new classification system predictive of complications in surgically treated pediatric humeral lateral condyle fractures. Journal of 56

Pediatric Orthopedics, 29 (6), pp.602–605. [Online]. Available at: doi:10.1097/BPO.0b013e3181b2842c.

Wendling-Keim, D. S. et al. (2021). Lateral Condyle Fracture of the Humerus in Children: Kirschner Wire or Screw Fixation? European Journal of Pediatric Surgery, 31 (04), pp.374–379. [Online]. Available at: doi:10.1055/s-0040-1714656.

Westacott, D. J., Jordan, R. W. and Cooke, S. J. (2012). Functional outcome following intramedullary nailing or plate and screw fixation of paediatric diaphyseal forearm fractures: A systematic review. Journal of Children's Orthopaedics, 6 (1), pp.75–80. [Online]. Available at: doi:10.1007/s11832-011- 0379-6.

Wu, K. et al. (2016). Diagnosis and Treatment of Anterior Tibial Plateau Fracture– Dislocation: A Case Series and Literature Review. The Journal of Knee Surgery, 30 (02), pp.114–120. [Online]. Available at: doi:10.1055/s-0036-1581136.