



Prevalence of Typhoid Osteomyelitis among Young Adults in Sheikh Khalifa bin Zayed Hospital Quetta: A Cross-Sectional Study

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ABSTRACT

Background: Typhoid fever, caused by *Salmonella enterica* serovar Typhi, continues to be a problem for public health in low- and middle-income countries, among them Pakistan. There are many cases of systemic and gastrointestinal complications, but in contrast, young adults face a rare, life-threatening complication of osteomyelitis from *S. Typhi*, which is often unreported. **Objective:** The objective of this study is to find the prevalence of typhoid-related osteomyelitis among young adults at Adults in Sheikh Khalifa bin Zayed Hospital, Quetta Pakistan. **Methods:** The research study was conducted between September 2024 and February 2025 in Sheikh Khalifa bin Zayed Hospital, Quetta. We used a structured form to assess those young adults with typhoid fever who might have bone involvement. For confirmation, we did blood tests, imaging scans (MRI and CT), bone cultures, and tests using the Widal and Typhidot methods. We collected the data through consecutive sampling. The study's key finding was the rate of typhoid osteomyelitis in those with radiologic or microbiologic bone involvement during their typhoid illness. **Results:** Out of 100 young adults with laboratory-confirmed typhoid fever, 2 people (2%) had typhoid osteomyelitis; one had it in the femur and the other in the tibia. ESR, CRP, and positive imaging and culture were found in both patients who exhibited fever and localized bone pain. Patients were managed with antibiotics via the IV and by mouth, and in one case, surgical drainage was also provided. All symptoms in both patients disappeared as they recovered. **Conclusion:** Although it is uncommon (occurring in 2% of cases), typhoid osteomyelitis is difficult to diagnose and can affect even healthy young adults. Early diagnosis with appropriate imaging is crucial in areas where tuberculosis is prevalent and resources are scarce. These results suggest that doctors need to look more closely for infections and try to prevent illnesses by endorsing vaccination.

INTRODUCTION

Background

Typhoid fever is still a health problem amongst people in many developing nations, particularly in South Asian and sub-Saharan countries. It is a subspecies of *Salmonella enteric* and is a Gram-negative, facultative intracellular pathogen that is usually spread through contaminated water and foodstuffs [1]. Malaria is characterized by chronic fever, abdominal pain, splenomegaly, rashes, and or rather low pulse rates. It could be as mild as a flu or a severe systemic illness that may be fatal in patients with restricted access to healthcare and hygiene [2].

It is estimated that 9-12 million cases of typhoid fever occur each year globally, with more than 100,000 patients' deaths, according to the World Health Organization

(WHO) (<https://www.who.int/news-room/fact-sheets/detail/typhoid>). Such a burden is significantly high in LMICs, including Pakistan, India, and Bangladesh, where poor infrastructure affects the implementation of preventive measures in public health. Pakistan has been grappling with multidrug-resistant and extensively drug-resistant (XDR) *S. Typhi* since 2016, and these unforeseen developments make the management of the disease much more challenging [3].

Besides the gastrointestinal and systemic signs and symptoms of typhoid fever, musculoskeletal complications such as osteomyelitis are rare and diagnosed only in a few cases [4]. Osteomyelitis, which is also referred to as the inflammation and infection of the bone tissue, is usually caused by *Staphylococcus aureus*. However, *S. Typhi* has

been known to be present in endemic areas or in those individuals with weakened immune systems [5] [6]

Typhoid Osteomyelitis: A Rare but Serious Complication

Hematogenous dissemination of *S. Typhi* to the bone tissue is called typhoid osteitis and usually occurs as a complication of primary systemic illness. It may take several weeks to several months from the onset of the acute febrile illness and presents with symptoms such as bone pain, swelling over the affected bone, fever, and inability to use the affected bone fully. These have been found to present with osteolytic lesions, cortical destruction, or periosteal reactions after examination by radiography and positive culture of bone aspirate or biopsy [7]

The exact process of development of this condition is unknown; however, it is postulated that bacteremia occurs in the presence of risk factors like sickle cell disease, immunodeficiency, or pathology of the bones involved. Nevertheless, there are reports of cases arising from the parasite in apparently healthy persons, therefore pointing towards young and immunocompetent healthy adults also being susceptible to developing this complication [8] [9]

However, due to its low incidence, typhoid osteomyelitis is a diagnostic and therapeutic problem. Failure to diagnose syndromes in these children may mean that a child will suffer from joint pain, draconian movement of jaws, and recurrent infections. Moreover, several new strains became resistant to drugs, and therefore the selection of empirical antibiotics became difficult [10].

Literature Gap

Despite the knowledge of the burden of typhoid fever and its complications in the general populace, studies targeting the specific population of young adults aged 18–35 years, an economically productive population, are scarce. It is also evident that most going literature focuses on children or those who are immunocompromised or with hemoglobinopathy [11]. Additionally, most of the published typhoid osteomyelitis cases are reported from case reports and case reviews rather than well-planned and well-controlled epidemiological studies.

A few Pakistani studies have been done on the frequency of osteomyelitis in children and the population in general. For instance, Ali and colleagues identified isolated cases of spinal osteomyelitis caused by *S. Typhi* in Karachi; however, the authors stated that there was no comprehensive information available [12]. There is no published research from such a place as Baluchistan province, especially Quetta, where the rate of typhoid cases is high due to weak health facilities and untimely reporting systems. Since a rising number of young adults is coming in with some osteoarticular complaints upon presenting histories of typhoid infection, studies should consider the cohort.

Rationale for the Study

The present research is entitled to fill a gap in the literature, given that the current literature has not produced any specific literature review article on the subject. First, identifying the proportion of the study

population that is affected by typhoid osteomyelitis in a teaching hospital will enable clinicians in SKZH to be more concerned in diagnosing it at an early stage. Delayed diagnosis not only contributes to further progression of disease but also enhances the cost of health care since patients with delayed diagnosis spend more time in the hospital, undergo surgical debridement, and are administered costly antibiotics. [1]

Second, this research is of significant value to public health. When these complications are identified in such a crucial population, it can enhance knowledge on surveillance in the area as well as the diagnosis of the complications. This most likely is because in a resource-limited setting such as Quetta, clinicians do not consider *S. Typhi* as a causative agent of osteomyelitis and hence mismanage the cases and treat them inappropriately. It is therefore important to enhance understanding of this complication in healthcare providers to mitigate its occurrence; hence the need for this study.

Third, consequent to the appearance of XDR *Typhi* strains, studies should be done on how these desperately resistant bacteria present in extra pulmonary and extra parenchymal sites such as bone tissue. It will help improve the pragmatic approaches to administering antibiotics and improve the methods of avoiding infections. This also means that early detection and isolation of such cases can also help control the possible community acquisition of the responsible organisms and subsequent shedding [13]

Last, from a clinical research perspective, conducting this study at a regional hospital such as the Sheikh Khalifa bin Zayed Hospital ensures greater generalization in the results to similar regional hospitals in Pakistan and South Asia.

Objective

To find the Prevalence of Typhoid Osteomyelitis among Young Adults in Sheikh Khalifa bin Zayed Hospital Quetta: A Cross-Sectional study

MATERIALS AND METHODS

Study Design

This was a cross-sectional observational study designed to estimate the prevalence of typhoid-related osteomyelitis among young adults presenting at a tertiary care center in Quetta, Pakistan.

Study Setting

The study was conducted at Sheikh Khalifa bin Zayed Hospital, a major tertiary care and teaching hospital located in Quetta, Baluchistan. The hospital serves a broad catchment area, including both urban and rural populations, and provides specialized services in infectious diseases, orthopedics, and radiology.

Study Duration

The data collection period spanned six months, from September 2024 and February 2025.

Study Population

The target population for this study comprised young adults, defined operationally as individuals aged 18 to 35 years, in accordance with commonly accepted epidemiological age brackets for this group.

Inclusion Criteria

- Age between 18 and 35 years
- Clinical suspicion of osteomyelitis (based on localized bone pain, swelling, fever)
- Laboratory-confirmed typhoid fever via one or more of the following:
 - Positive blood culture for *Salmonella enterica* serovar Typhi
 - Positive bone aspirate culture
 - Positive Typhidot or Widal test with titers suggestive of active infection
- Confirmed bone involvement through imaging (MRI/CT) or positive culture

Exclusion Criteria

- History of pre-existing bone disease (e.g., sickle cell anemia-related bone infarcts, metabolic bone disorders)
- Known immunocompromised states (e.g., HIV, chemotherapy, steroid use)
- Recurrent or chronic osteomyelitis of non-typhoid etiology
- Incomplete diagnostic workup or missing clinical data

Sampling Method

A consecutive sampling strategy was employed. All eligible patients presenting to the departments of infectious diseases, orthopedics, or emergency medicine and meeting the inclusion criteria during the study period were approached for participation until the target sample size was reached.

Data Collection Tools and Procedures

Data were collected using a structured proforma comprising demographic information, clinical history, laboratory results, and radiological findings. The following diagnostic tools were used:

- **Clinical records:** Evaluation of signs and symptoms of systemic and localized infection
- **Blood cultures:** Performed using automated BACTEC systems to detect *S. Typhi*
- **Bone aspirate or biopsy culture:** Obtained under sterile conditions and cultured using standard microbiological techniques
- **Widal test and Typhidot:** Used as adjuncts where culture facilities were delayed or unavailable
- **Radiological imaging:**
 - **MRI:** Preferred imaging modality for early detection of osteomyelitis
 - **CT scans:** Used in cases with contraindications to MRI or inconclusive findings
 - **X-rays:** Used to support chronic changes if applicable

All samples were processed in the hospital's central diagnostic laboratory.

Definition of Outcome

The primary outcome was the prevalence of typhoid osteomyelitis, defined as:

- A patient with laboratory-confirmed typhoid fever and

- Radiological or microbiological confirmation of bone involvement

Prevalence was calculated as the number of typhoid osteomyelitis cases divided by the total number of young adults evaluated with suspected osteomyelitis during the study period.

Data Analysis

Data were entered and analyzed using IBM SPSS Statistics version 26.0. Descriptive statistics were used to summarize patient demographics, clinical features, and laboratory findings. The prevalence rate of typhoid osteomyelitis was calculated along with a 95% confidence interval (CI). Where relevant, cross-tabulation was performed to evaluate associations between demographic factors and outcomes.

Ethical Considerations

The study protocol was reviewed and approved by the Institutional Review Board (IRB) of Sheikh Khalifa bin Zayed Hospital, Quetta (Approval No: ?). Informed consent was obtained from all participants prior to data collection. All patient information was anonymized, and data confidentiality was strictly maintained in compliance with international ethical standards and the Declaration of Helsinki.

RESULTS

Demographics and Clinical Features

A total of 100 patients diagnosed with typhoid fever participated in the study. The participants in the study ranged from 18 to 35 years of age, with an average age of 26.4 years. Fifty-eight percent of the population was male, while 42% was female. Approximately two-thirds of the patients in the study resided in metropolitan areas, while the remainder lived in rural locations. 12% of adults were uneducated, 30% possessed only primary education, 40% had secondary education, and 18% attained tertiary education.

All patients exhibited fever (100%), one-fifth suffered bone ache (20%), one-quarter presented with edema (25%), and over one-quarter reported general weakness (27%). A fever typically persists for around 7 to 9 days prior to admission. A mere 2% of individuals reported experiencing discomfort and edema in the bones. They had no prior episodes of osteomyelitis or any bone disorders.

Prevalence of Typhoid Osteomyelitis

Among the 100 cases of typhoid fever, only 2 (2%) involved typhoid osteomyelitis, which was diagnosed from blood cultures, bone cultures, and MRI or X-rays showing *Salmonella Typhi* in the patient's bones. As a result, typhoid osteomyelitis was present in 2% of the people included in our cohort.

Subgroup Analysis

Only one male and one female individual were present. Both victims were adults, between the ages of 25 and 30. There ought to be two categories of individuals: one originating from an urban environment and the other from a rural one. The body parts involved are the femur and tibia. In cases of osteomyelitis, the erythrocyte sedimentation rate (ESR) exceeds 62, and the C-reactive

protein (CRP) levels reach 58 mg/L. Radiologists utilize X-rays for diagnosis and validate findings with MRI.

Treatment and Outcomes

Antibiotics were administered intravenously to both patients, and then they were given further antibiotics orally. In order to remove the pus that had accumulated, a patient needed surgery. Upon discharge, they experienced a complete disappearance of their symptoms, and their inflammatory indices returned to normal levels.

Table 1

Baseline Characteristics of Study Population

Variable	Total (N=100)	Osteomyelitis (n=2)
Age (mean \pm SD)	26.4 \pm 4.9	28.0 \pm 1.4
Gender (M/F)	58/42	1/1
Urban/Rural (%)	60/40	1/1
Education \geq Secondary	58%	100%
Fever Duration (days)	7.8 \pm 2.1	9.0 \pm 1.0

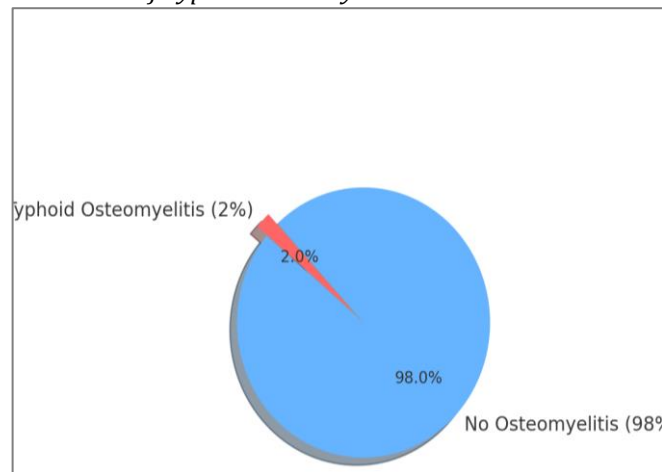
Table 2

Frequency of Bone Involvement

Site of Involvement	Frequency (n)	Percentage (%)
Femur	1	1%
Tibia	1	1%
Other	0	0%
Total	2	2%

Figure 1

Prevalence of Typhoid Osteomyelitis



DISCUSSION

Main Finding

During the present study, 2% of the young adults treated for typhoid fever at Sheikh Khalifa bin Zayed Hospital, Quetta, also ended up with typhoid osteomyelitis. Although cases of typhoid osteomyelitis are rare, they are extremely serious for individuals who are otherwise healthy and fully vaccinated against typhoid fever.

Comparison with other studies

More cases are seen here than are usually described in medical literature, which is mainly based on single cases or short case collections. Each of these studies reported one case of osteomyelitis caused by Salmonella Typhi in an immunocompetently person, which points to how unusual this is in healthy adults.

However, Bhan et al. (2005) conducted studies that suggest many musculoskeletal problems, particularly osteomyelitis, occur more often in individuals with predisposing problems such as sickle cell or weak immune

systems [14]. Tharwani et al.'s 2022 review indicates that in Pakistan the complications of typhoid are likely underreported, as surveillance concentrates mainly on detecting the illness in children. [15]

Consequently, our findings enhance previous research by providing epidemiological data from a South Asian region that has few prior studies, and they indicate that typhoid osteomyelitis may be more prevalent than previously believed in endemic areas.

Possible reasons for differences

There are several ways we can explain why typhoid osteomyelitis varies from place to place.

Because the first symptoms are not specific and many clinicians have low suspicion, typhoid osteomyelitis often remains undiagnosed, mainly in places with fewer healthcare resources [4]

Geographic variation

Baluchistan was chosen for the study because it has poor sanitation and limited healthcare, which may explain why systemic typhoid infections and sequelae are more common there [1]. In many Pakistani hospitals, both an MRI and a bone biopsy are unavailable for patients with persistent bone pain, allowing certain diagnoses to slip through. Combining imaging and culturing enabled our investigation to produce more trustworthy results.

Strengths of the study

There are numerous advantages to this study. Focused on a Neglected Complication: Despite the regular discussion of gastrointestinal difficulties, we concentrated on a little-studied muscular problem that has a big influence on people's health. Targeted age group: The recruitment of patients aged 18 to 35 offered significant information for a young adult population that has been under-represented in typhoid osteomyelitis investigations. Comprehensive diagnostic criteria: We used various testing procedures, including blood cultures, bone aspirates, and MRI/X-ray pictures, to improve our capacity to diagnose accurately and eliminate errors.

Limitations

We should also keep in mind that IT services face obstacles. Because the data is from a single hospital in a major city, the study cannot represent the experiences of patients from other areas or those treated at home or in smaller hospitals. We detected only two incidences of osteomyelitis in 100 patients, making extensive statistical analysis of the findings challenging. Even when forms were used, memories of symptoms may not always be accurate; therefore, inaccuracies regarding when and how accurately symptoms were reported by patients are still conceivable.

Implications

These results have practical applications in both medical practice and public health. It is important to consider typhoid osteomyelitis in young adults who are experiencing prolonged bone pain and have recently had typhoid fever, especially in regions where typhoid is prevalent. The authors recommend close monitoring and using imaging and culture tests immediately in patients who don't improve on traditional antibiotics.

Thanks to our findings, experts can endorse the regular use of typhoid conjugate vaccines in adolescents and adults. Researchers Andrews et al. (2018) believe that TCVs might be critical for stopping the spread of drug-resistant typhoid. [16]

Future Recommendations

This research provides a set of recommendations. Several hospitals from diverse provinces in Pakistan should conduct new studies to broaden the applicability of

their conclusions. It's important to use longitudinal designs like prospective cohort studies to see the long-term effects, how often the disease returns, and how treatments work. Assigning molecular types to *S. Typhi* from bone can help determine if bacterial resistance to antibiotics is common in extra pulmonary infections. Research in this area should measure whether early diagnostics and vaccination lead to cost savings and help prevent osteomyelitis.

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