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Original Research Article

Frequency of Recurrence and Associated Factors in Patients with Chronic Osteomyelitis: A Cross-Sectional Study

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Abstract: **Objective:** Chronic osteomyelitis remains a difficult bone infection with frequent recurrence despite prolonged antibiotic therapy and surgical management. Recurrence increase the burden of repeated hospital admissions, prolonged treatment and functional disability. This study was conducted to determine the frequency of recurrence and the factors associated with recurrence among patients with chronic osteomyelitis. **Study Design:** Cross-sectional study. **Place and Duration of Study:** Department of Orthopaedics, Rehman Medical Institute, Peshawar from 3rd July 2025 to 3rd November 2025. **Methodology:** A total of 104 patients with chronic osteomyelitis aged 18 to 65 years were included using non-probability consecutive sampling. Clinical assessment and previous treatment records were reviewed to identify recurrence and associated factors. Data were analysed using Statistical Package for the Social Sciences version 27. Categorical variables were presented as frequency and percentage, while quantitative variables were expressed as mean ± standard deviation. Chi-square test or Fisher's exact test was applied after stratification and a p-value of ≤0.05 was considered statistically significant. **Results:** The mean age was 39.35 ± 13.93 years and 74 (71.2%) patients were male. Recurrence was observed in 25 (24.0%) patients. Among recurrent cases, bone exposure was present in 19 (76.0%), immunosuppression in 13 (52.0%), absence of surgery in 18 (72.0%) and peripheral vascular involvement in 6 (24.0%) patients. Previous treatment history showed a statistically significant association with recurrence ($p<0.001$), with recurrence being higher after medical treatment alone 18 (60.0%) than surgical treatment 7 (13.7%). **Conclusion:** Recurrence was common among patients with chronic osteomyelitis. Previous treatment history was significantly associated with recurrence, while bone exposure, immunosuppression and absence of surgery were frequent contributing factors. Early surgical management with appropriate treatment may help reduce recurrence and improve patient outcome.

Keywords: Bone exposure; Chronic osteomyelitis; Immunosuppression; Peripheral vascular disease; Recurrence; Surgery

INTRODUCTION

Chronic osteomyelitis is an infectious process that involves the bone, and it usually follows an injury or surgical operation, or an open fracture, or a spread of infection into the bone from nearby tissue or bloodstream [1]. It is accompanied by pain, swelling, fever, discharge from the sinus, and reduced movement of the affected limb. In many instances, the patient suffers from symptoms for months or even years before the condition is diagnosed [2]. The

disease has been shown to have a greater occurrence in people with diabetes mellitus, peripheral vascular diseases, malnutrition, and a weak immune system [3]. Management of chronic osteomyelitis generally involves the administration of long-term antibiotics along with surgery [4]. Selection of appropriate antibiotics depends on culture sensitivity, and they may be administered for up to several weeks to eliminate infection completely. In cases where surgery becomes essential, the procedure includes debridement, drainage of abscesses, excision of necrotic bone, and removal of implants since antibiotic therapy alone cannot penetrate the affected avascular bone tissue [5]. However, despite advancements in antimicrobial drugs and surgical procedures, treatment failure and disease recurrence are major problems faced by many patients suffering from chronic osteomyelitis [6]. Factors leading to failure include inadequate debridement, microbial resistance, late detection of the disease, and poor adherence to prescribed antibiotics [7]. On the other hand, the possibility of disease recurrence occurs when bacteria persist in necrotic bone tissues or around implants. Generally, patients who suffer from recurring osteomyelitis often have symptoms of pain, swelling, and sinus discharge [8].

There are several contributing factors that lead to treatment failure and recurrence in chronic osteomyelitis. The prolonged period for which symptoms are experienced before seeking medical care is identified as one of the most important contributing factors, as it results in infection on a larger scale and makes its eradication very difficult [9]. One of the main contributing factors that significantly increase chances of recurrence due to immunosuppression is diabetes mellitus, steroid use, cancer, HIV infection, or malnutrition [10]. This increases the difficulty in treatment of infection due to reduced immune response of body to fight the infection. Failure of proper surgery also plays an important role, because if debridement of infected dead bone is not done properly, it may result in recurrence [11]. Other contributing factors include smoking, peripheral vascular disease, elderly age group, resistant bacteria, and poor compliance with antibiotics [12]. Chronic osteomyelitis is known to have a high incidence of treatment failures, which consequently leads to long-term suffering, repeated hospitalization, and impairment among patients. Identification of certain risk factors, such as prolonged history of illness, immunosuppressive states, and non-surgical treatment, may be vital for successful prevention and treatment of chronic osteomyelitis. Therefore, this study is needed to determine the factors associated with treatment failure and recurrence in patients with chronic osteomyelitis.

METHODOLOGY

This cross-sectional study was carried out at the Orthopedic Department, Rehman Medical Institute (RMI), Peshawar from 3 July 2025 to 3 November 2025. Ethical approval was obtained from the Institutional Ethical Committee of Rehman Medical Institute (RMI), Peshawar under approval certificate REC-PG-RMI/Ethical Approval/PG-Synopsis/127, dated 2 June 2025 before commencement of the study. A total of 104 patients were enrolled. The sample size was calculated by using the WHO sample size calculator with 95% confidence level, 8% margin of error and an anticipated recurrence of chronic osteomyelitis of 22.4%.13 A non-probability consecutive sampling technique was used for recruitment of the participants.

Patients of both gender, aged 18 to 65 years with previously treated and cured chronic osteomyelitis documented in the medical record and presenting with clinical features including pain (VAS>4), swelling, sinus discharge, bone exposure, fever or restricted limb movement were included in the study. Patients with acute osteomyelitis of less than 6 weeks duration, history or evidence of tuberculous, fungal, or parasitic osteomyelitis, infected prosthetic joints or isolated prosthetic implant infections, malignant bone tumours or metastatic bone disease, severe uncontrolled systemic illness including advanced liver failure or terminal malignancy, incomplete medical records regarding previous treatment or recurrence status and congenital bone disorders or metabolic bone diseases were excluded from the study.

Written informed consent was obtained from all patients after explaining the objectives and benefits of the study. Demographic information including age, gender, affected bone, previous treatment history, socioeconomic status and comorbidities was recorded.

A detailed clinical history was taken and complete physical examination was performed in all patients. Previous medical records, operative notes, discharge summaries, and radiological reports were reviewed to confirm the diagnosis of chronic osteomyelitis and previous treatment history. Patients were evaluated for recurrence and the associated factors. Symptoms duration >3 months was assessed from the patient's history and available medical records. Bone exposure was identified during physical examination and review of radiological reports. Peripheral vascular involvement was assessed by examination of peripheral pulses, capillary refill time, ischaemic skin changes, ankle-brachial index, and Doppler ultrasound findings where available. Immunosuppression was determined from clinical history, documented comorbidities, medical records, and use of immunosuppressive medications. Absence of surgery was confirmed from treatment records showing management with medical therapy only

without any operative intervention including surgical debridement, sequestrectomy, incision and drainage, flap coverage, bone grafting, or reconstructive procedures. All information was entered by the researcher on a specially designed proforma.

Recurrence in chronic osteomyelitis was considered when infection reappeared after an initial period of clinical improvement or cure. It was identified by reappearance of pain, swelling, sinus discharge, local tenderness, fever, or bone exposure after completion of treatment together with supportive laboratory, radiological, or microbiological findings. The diagnosis was confirmed by erythrocyte sedimentation rate (ESR >20 mm/hour), C-reactive protein (CRP >10 mg/L), positive bacterial culture from bone or sinus tract specimen, and radiological evidence of sequestrum, involucrum, sinus tract, or bone destruction on X-ray, CT scan, or MRI. Symptoms duration >3 months was considered when clinical symptoms including pain, swelling, sinus discharge, local tenderness, fever, restricted limb movement, or difficulty in weight bearing had remained for more than 3 months before presentation according to the patient's history and medical records. Bone exposure was considered when exposed bone was visible through the skin or soft tissue defect during clinical examination with or without purulent discharge, sinus tract formation, wound breakdown, or radiological evidence of cortical bone destruction on CT scan or MRI. Peripheral vascular involvement was considered when impaired arterial blood supply to the affected limb was present as evidenced by diminished or absent peripheral pulses, capillary refill time >2 seconds, ankle-brachial index (ABI <0.9), ischaemic skin changes, lower limb ulceration, or Doppler ultrasound findings suggestive of peripheral arterial disease. Immunosuppression was considered when impaired immune status was present due to diabetes mellitus (HbA1c ≥6.5%), HIV infection, malignancy, chronic kidney disease, chronic liver disease, long-term corticosteroid therapy (>10 mg/day prednisolone for >2 weeks), chemotherapy, immunosuppressive drugs, or organ transplantation as documented in the clinical records. Absence of surgery was considered when chronic osteomyelitis had been managed only with medical treatment including antibiotic and wound care without any operative interventions throughout the complete treatment courses.

Data were analysed using IBM SPSS version 27. Categorical variables including gender, recurrence, affected bone, socioeconomic status, comorbidities, symptoms duration >3 months, bone exposure, peripheral vascular involvement, immunosuppression and absence of surgery were presented as frequencies and percentages. Quantitative variables including age and duration of disease were expressed as mean ± standard deviation. Recurrence was stratified with respect to age, gender, affected bone, socioeconomic status and comorbidities. Post-stratification Chi-square test or Fisher's exact test was applied where appropriate. A p-value ≤0.05 was considered statistically significant.

RESULTS

The mean age of patients was 39.35±13.93 years and the duration of osteomyelitis was 10.42±4.89 months. Majority of the patients were male 74 (71.2%) as compared to female 30 (28.8%). Regarding the affected bone, tibia was most commonly involved 50 (48.1%), followed by femur 24 (23.1%), radius 8 (7.7%), others 8 (7.7%), fibula 6 (5.8%), humerus 5 (4.8%) and ulna 3 (2.9%). With respect to previous treatment history, surgical treatment was received by 51 (49.0%) patients, medical treatment by 30 (28.8%) and both by 23 (22.1%). Socioeconomic status was low in majority 57 (54.8%), middle in 34 (32.7%) and high in 13 (12.5%) patients. Comorbidities noted were diabetes in 42 (40.4%), hypertension in 35 (33.7%) and others in 27 (26.0%) patients (Table 1).

Table 1. Patient Demographics

Demographics	Mean ± SD / n (%)
Age (years)	39.35±13.93
Duration of Osteomyelitis (months)	10.42±4.89
Gender	
Male n (%)	74 (71.2%)
Female n (%)	30 (28.8%)
Affected Bone	
Tibia n (%)	50 (48.1%)
Femur n (%)	24 (23.1%)

Fibula n (%)	6 (5.8%)
Humerus n (%)	5 (4.8%)
Radius n (%)	8 (7.7%)
Ulna n (%)	3 (2.9%)
Others n (%)	8 (7.7%)
Previous Treatment History	
Medical n (%)	30 (28.8%)
Surgical n (%)	51 (49.0%)
Both n (%)	23 (22.1%)
Socioeconomic Status	
Low n (%)	57 (54.8%)
Middle n (%)	34 (32.7%)
High n (%)	13 (12.5%)
Comorbidities	
Diabetes n (%)	42 (40.4%)
Hypertension n (%)	35 (33.7%)
Others n (%)	27 (26.0%)

Out of the total 104 patients, recurrence was observed in 25 (24.00%) patients while 79 (76.00%) patients did not show any recurrence. Among the factors associated with recurrence, bone exposure was noted in 19 (76.00%) patients, peripheral vascular involvement in 6 (24.00%) patients, immunosuppression in 13 (52.00%) patients and absence of surgery in 18 (72.00%) patients (Table 2).

Table 2. Frequency of Recurrence and Associated Factors in Patients with Chronic Osteomyelitis

Recurrence	Frequency	% age
Yes	25	24.00%
No	79	76.00%
Total	104	100%
Associated Factors		
Bone Exposure	19	76.00%
Peripheral Vascular Involvement	6	24.00%
Immunosuppression	13	52.00%
Absence of Surgery	18	72.00%

Association of recurrence with previous treatment history came out to be statistically significant ($p<0.001$), with recurrence noted in 18 (60.0%) patients who received medical treatment as compared to only 7 (13.7%) patients who received surgical treatment and none of the 23 patients who received both. No other factor showed a statistically significant association with recurrence, including age (≤40 years 13 (22.4%) vs >40 years 12 (26.1%), $p=0.663$), gender (male 21 (28.4%) vs female 4 (13.3%), $p=0.132$), affected bone ($p=0.803$), duration of osteomyelitis (≤3 months 0 (0.0%) vs >3 months 25 (26.6%), $p=0.113$), socioeconomic status ($p=0.377$) and comorbidities ($p=0.366$) (Table 3).

Table 3. Association of Recurrence with Demographic and Clinical Factors

Factors	Categories	Recurrence — Yes n(%)	Recurrence — No n(%)	p-value
Age (years)	≤40	13 (22.4%)	45 (77.6%)	0.663
	>40	12 (26.1%)	34 (73.9%)	
Gender	Male	21 (28.4%)	53 (71.6%)	0.132
	Female	4 (13.3%)	26 (86.7%)	
Affected Bone	Tibia	13 (26.0%)	37 (74.0%)	0.803
	Femur	6 (25.0%)	18 (75.0%)	

	Fibula	2 (33.3%)	4 (66.7%)	
	Humerus	2 (40.0%)	3 (60.0%)	
	Radius	1 (12.5%)	7 (87.5%)	
	Ulna	0 (0.0%)	3 (100.0%)	
	Others	1 (12.5%)	7 (87.5%)	
Duration (months)	≤3	0 (0.0%)	10 (100.0%)	0.113
	>3	25 (26.6%)	69 (73.4%)	
Previous Treatment History	Medical	18 (60.0%)	12 (40.0%)	<0.001*
	Surgical	7 (13.7%)	44 (86.3%)	
	Both	0 (0.0%)	23 (100.0%)	
Socioeconomic Status	Low	15 (26.3%)	42 (73.7%)	0.377
	Middle	9 (26.5%)	25 (73.5%)	
	High	1 (7.7%)	12 (92.3%)	
Comorbidities	Diabetes	13 (31.0%)	29 (69.0%)	0.366
	Hypertension	6 (17.1%)	29 (82.9%)	
	Others	6 (22.2%)	21 (77.8%)	

*Statistically significant (p<0.05)

DISCUSSION

In present study recurrence was found in 25 (24.00%) of patients, which is showing that despite treatment, a considerable proportion of the patients remain at risk of relapse due to persistence of dormant bacteria within the sequestrum and biofilm formation over necrotic bone, which protects the organisms from antibiotic penetration and host immune response. Bone exposure was identified as an important factor, present in 19 (76.00%) of the patients with recurrence. This can be explained on the basis that exposed bone is having poor soft tissue coverage and vascularity, which is limiting the antibiotic delivery to the site of infection and is favouring the bacterial persistence and re-activation of disease. Absence of surgery was noted in 18 (72.00%) of the recurrent cases, and previous treatment history showed statistically significant association with recurrence (p<0.001), with recurrence being much higher among patients managed medically 18 (60.0%) as compared to those managed surgically 7 (13.7%). Such a result appears scientific from the perspective that treatment via medications alone is not sufficient for getting rid of infected and necrotic bones. In case there is no debridement, the site of infection will remain the same, thus increasing the risk of a re-infection. Debridement through surgery eliminates the site of infection and improves blood flow locally, thus enhancing the ability of the medication to reach the area of interest. Immunosuppression occurred in 13 (52.00%) cases of the re-infected patients.

The present study is showing recurrence in 25 (24.00%) of patients with chronic osteomyelitis, which is broadly comparable with the findings of Jorge et al. [14], where recurrence was seen in 38 (20%) patients, and with Su et al. [15], who reported recurrence in 25 (15.3%) patients, though slightly lower than the current study. However, higher recurrence rates were reported by Dell'Aquila et al. [16] in 34 (30.9%) patients and by Afanasyev et al. [17] in 41 patients out of 131, and Pande et al. [18] also mentioning recurrence of around 20–30% in reviewed literature, which is showing that recurrence rates are varying widely depending on treatment protocol, duration of follow-up, and patient population being studied. Such variation is also reflected in the scoping review by Arshad et al. [19], where remission without recurrence ranged from 67.7% to 100% across 40 included studies, indicating that heterogeneity in surgical technique and disease staging is a major contributor to differing outcomes across settings.

Previous treatment history was found to be significantly associated with recurrence in the present study (p<0.001), with recurrence being much higher among medically treated patients 18 (60.0%) as compared to surgically treated ones 7 (13.7%), and none among those receiving both modalities. This finding is in agreement with Su et al. [15], who identified open injury-related infection (OR 35.698; P<0.001) and combined flap surgery (OR 41.408; P<0.001) as significant independent risk factors of recurrence, and with Dell'Aquila et al. [16], who found prolonged operative duration as an independent predictor of recurrence (OR 1.3; P=0.015). Afanasyev et al. [17] also reported previous debridement (P=0.002) and bone defect volume (P=0.045) as significant predictors, and Aljadani et al. [20] showed patients not undergoing salvage surgery having considerably higher risk of treatment failure (HR 1.59) and amputation (HR 1.98), which is supporting the current finding that adequate surgical debridement, rather than medical management alone, is crucial for reducing recurrence. This is scientifically explainable, as medical treatment without removal of necrotic and infected bone is leaving the nidus of infection in situ, hence predisposing to relapse.

Comorbidities like diabetes 13 (31.0%) and hypertension 6 (17.1%) were not found significantly associated with recurrence in the present study (p=0.366), a finding which is similar to Pearson et al. [21], who also could not establish significant association between comorbidities like tobacco use, alcohol abuse and diabetes with recurrence, despite these being highly prevalent among the patients studied. This is suggesting that comorbid conditions alone may not be independently driving relapse, and other local factors like bone exposure, vascularity, and adequacy of surgical clearance may be having more influence on disease outcome than systemic comorbid burden.

Age was not significantly associated with recurrence in the present study (≤40 years 13 (22.4%) vs >40 years 12 (26.1%), p=0.663), which is in contrast with Jorge et al. [14], where advanced age was found to be a strong independent predictor of recurrence, with hazard ratios reaching 6.086 for age 61–80 years and 9.975 for age above 80 years. This difference is likely because of the smaller sample size and narrower age distribution in the present cohort as compared to the much larger and elderly-inclusive cohort studied by Jorge et al., where age-related decline in immune and healing capacity may be playing a bigger role.

Bone exposure was noted in 19 (76.00%) of the recurrent cases in the present study, a factor which is supported indirectly by Arshad et al. [19] and Yalikun et al. [22], both emphasising that adequate debridement and dead-space management are essential for infection control, since exposed and poorly vascularised bone is impeding antibiotic penetration and delaying healing, hence increasing chances of relapse. Similarly, immunosuppression was present in 13 (52.00%) of the recurrent patients in the present study, which is conceptually in line with the findings of Yue et al. [23] in paediatric chronic recurrent multifocal osteomyelitis, where markers of systemic inflammation such as C-reactive protein (P=0.013) and interleukin-6 (P=0.003) were significantly differing between clinical phenotypes, further supporting that host immune status is playing an important part in determining disease course and likelihood of recurrence.

The research has been carried out using a single center approach and this might restrict the applicability of results to a wider population with varied demographical and medical backgrounds. The number of subjects used in the research is relatively small, thus restricting the ability to show a relationship between recurrence and uncommon related factors. There is no uniform follow-up period for all the subjects included in the study and this might affect the true frequency of the recurrences. Long term effects have not been evaluated in the study.

CONCLUSION

According to our study, recurrence in chronic osteomyelitis is still a considerable problem among the patients despite the treatments they undergo. The previous history of treatment is found out to be one of the factors linked to recurrence, which is said to have better results when surgery is used than medication alone. Other factors include bone exposure, immunosuppression and lack of surgery.

Ethical Approval

Ethical permissions for this study was obtained from the Institutional Ethical Committee before beginning the research. The approval certificate number was REC-PG-RMI/Ethical Approval/PG-Synopsis/127 dated 2 June 2025.

Patients' Consent

Written informed consent was taken from all participant before enrolment in the study.

Competing Interests

The author declares that there was no conflict of interest related to this research.

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