

A Comparative Study to Find the Utility of Bone Marrow Culture and Blood Culture in the Diagnosis of Osteomyelitis

N Brahmananda Reddy¹, Pathuri Venkata Rama Chowdary², T Jaya Chandra³

¹Associate Professor, Department of Orthopedics, GSL Medical College, Rajahmundry.

²Associate Professor, Department of Orthopedics, GSL Medical College, Rajahmundry.

³Professor, Department of Microbiology, GSL Medical College, Rajahmundry.

Received: 02-12-2022 / Revised: 28-12-2022 / Accepted: 12-01-2023

Corresponding Author: Dr. Pathuri Venkata Rama Chowdary

Conflict of interest: Nil

Abstract

Introduction: Bone marrow culture (BMC) is a key tool in the diagnosis of osteomyelitis (OM), performed along with blood culture (BC). But the literature is limited from this area. With this a study was conducted to compare the BMC and BC techniques in the diagnosis of OM.

Methods: It was a prospective research conducted in the department of Microbiology, GSL Medical College between January to May 2022. Study protocol was approved by the Institutional ethical committee. Individuals of both gender, aged ≥ 18 years, with OM were considered in this research. Non cooperative individuals were not considered. Clinical findings were recorded in the study proforma. BM was collected as per the guidelines. Blood was collected for culture test under sterile precautions. Utmost care was taken to avoid contamination. After successful collection of the clinical specimen, cultured as per the standard guidelines. Identification of the bacteria and antibiotic susceptibility test (AST) were also carried as per the guidelines. Chisqaure test for the culture positive (CP) and culture negative (CN) results; $P < 0.05$ was considered to be statistically significant.

Results: Total 23 specimen were collected for BM and BC, 39. 2 years was the mean age. Maximum (10) study members were in 30 – 40 years group. The male female ratio was 1.08. In BMC 15 (65.2%) were CP whereas it was just 43.5% (10) in the BC test; statistically there was no significant difference.

Conclusion: BMC is a better tool for the diagnosis of OM. gram negative rods are the common pathogens. The infection rate is high in 30 – 40 years group.

Keywords: Bone marrow, culture, study.

This is an Open Access article that uses a funding model which does not charge readers or their institutions for access and distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>) and the Budapest Open Access Initiative (<http://www.budapestopenaccessinitiative.org/read>), which permit unrestricted use, distribution, and reproduction in any medium, provided original work is properly credited.

Introduction

Bone marrow (BM) analysis gives us a key element in the routine investigation of patient present with a clinical picture with a suspicious of underlying malignant or benign blood pathology. It is a key tool in the diagnosis of osteomyelitis (OM). To some extent this is also useful to confirm fever of unknown origin (FUO) among the immunosuppressed individuals. [1] But the

bone marrow culture (BMC) and its clinical necessity is questionable. [2]

Based on the clinical condition of the patient, usually, BMC is performed along with blood culture (BC) and culture of the other body fluids. [3] Here the cost of the diagnostic parameter, technical skill should be considered. It was clear in the literature

that BMC is useful in the diagnosis of Kala azar, typhoid fever, brucellosis. [1] *Mycobacterium avium* complex is an acid fast bacteria also can be isolated in BMC.

Currently there is availability of rapid culture the preliminary reports are delivered in few hours. In spite of these in developing countries such as India, the literature is limited especially on BMC and BC in the diagnosis of OM. However reports are available from the developed world on BMC and BC. With this a study was conducted to compare the BM and BC techniques in the diagnosis of OM from a tertiary health care setup.

Methods:

It was a prospective research conducted in the department of Microbiology, GSL Medical College. Study was conducted between January to May 2022. Study protocol was approved by the Institutional ethical committee. Informed consent was taken from the study participants. Individuals of both gender, aged ≥ 18 years, with OM were considered in this research. Non cooperative individuals were not considered in this research.

Various demographic parameters of the study participants along with the clinical findings were recorded in the study proforma. BM was collected from the required individuals as per the guidelines. Initially the skin was shaved to remove hairs and thoroughly cleaned. Sterile area was preferred for collecting BM, by aspiration. Needle was inserted into the bone through the skin using twisting motion. BM was aspirated with the syringe, and another needle was used to collect tissue.

Simultaneously 5 – 10 ml blood sample was collected for BC. Blood was collected for culture test under sterile precautions. Utmost care was taken by the phlebotomist so that there won't be any contamination.

After successful collection of the clinical specimen, both were cultured as per the standard guidelines. After incubation at 37°C, if bacterial growth was observed, identified by gram stain, biochemical reactions. Identification was followed by antibiotic susceptibility test (AST). Identification of the bacteria and AST were also carried as per the guidelines. [4]

Statistical Analysis:

The data were analysed using SPSS version 21. The data were presented in mean, median and percentage. Statistical analysis was carried by Chi-square test for the culture positive (CP) and culture negative (CN) results; $P < 0.05$ was considered to be statistically significant.

Results:

During the study period total 23 specimens were collected for BM and BC investigations. The mean age of the study participants was 39.2 years, maximum (10) study members were in 30 – 40 years age group. Gender wise 12 were male, 11 were female participants and the male female ratio was 1.08. In the BMC test 15 (65.2%) were CP whereas it was just 43.5% (10) in the BC test; statistically there was no significant difference (Table 1). Among the bacterial isolates gram negative rods (GNRs) are common pathogens followed by gram positive cocci.

Table 1: Comparison of BMC and BC results among the study members; n (%)

BMC results	BC results		
	CP	CN	Total
CP	7 (30.4)	8 (34.7)	15 (65.2)
CN	3 (13)	5 (21.7)	8 (34.7)
Total	10 (43.5)	13 (56.5)	23 (100)
Statistical analysis	χ^2 value = 0.1784; P value = 0.672754.		
	Statistically there was no significant difference		

Discussion

OM is one of the complex clinical condition. Maximum number of study participants in this research were between 30 – 40 years group. This age group is commonly involved in outdoor activity such as employment and also to procure things to home. Hence high infection rate is detected in this age group. The mean age of the study participants in this research was 39.2 years. The mean age was reported to be 46.4 years. [5] In another report on OM the mean age was reported to be 52.5 years. [6] In this research most of the study members depend in daily wages. Hence around 40 years is the ideal age group for the activity. Whereas it was not clearly mentioned in the other reports.

Gender wise, in this research more number of OM cases were observed in the male. For this also there was no clear reasons. However usually men involve more in the outdoor activity. [6] Though in the current world there was no gender difference in the employment there is some difference in this study. Because this study is conducted in a tertiary health care setup, most of the study members were from villages. Usually in villages men involve more in the outdoor activity especially for earning. Similar view was reported in the literature. [5]

Various techniques such as raise in erythrocyte sedimentation rate, CRP and so on are available in the diagnosis of OM. [7] But the specificity is limited. CT / MRI may be the key techniques but high cost is the major limitation. The advantage with the current research is the pathogen can be detected along with AST report. So that there is minimal chances of spreading drug resistance. In this study more number of OM cases were detected in BMC compared to BC; statistically also there was no significant difference (Table 1). BM may be correct specimen for the diagnosis of OM rather than blood. Similar to our study findings, more number of cases were detected using BMC, but it was in the diagnosis of FUO. [8, 9] In the current

report, GNRs are the common pathogens. Out of the 23 specimen, 16 were GNRs and the rest were gram positive cocci. Among the GNRs, Pseudomonas is the common pathogen. In the literature also more number of GNRs were identified to be the cause for the OM. [10] The exact reason for this is not clear. No significant drug resistance was identified, strains were susceptible to the commonly used antibiotics. Small sample size and short duration are the limitations of this research. However studies on large sample is recommended.

Conclusion

BMC is a better tool for the diagnosis of OM. GNRs are the common pathogens. The infection rate is high in 30 – 40 years group.

References

1. Sharvit G, Schwartz D, Heering G, Shulman A, Avigdor A, Rahav G, Toren A, Nagler A, Canaani J. Evaluation of the clinical impact of bone marrow cultures in current medical practice. *Sci Rep.* 2022; 12(1):9664.
2. Chramiec A, Vunjak-Novakovic G. Tissue engineered models of healthy and malignant human bone marrow. *Adv Drug Deliv Rev.* 20 19; 140: 78 – 92.
3. Ben-Baruch S, Canaani J, Braunstein R, Perry C, Ben-Ezra J, Polliack A, Naparstek E, Herishanu Y. Predictive parameters for a diagnostic bone marrow biopsy specimen in the work-up of fever of unknown origin. *Mayo Clin Proc.* 2012; 87(2): 136 – 42.
4. Chandra TJ, Lakshmi Prasanna, AV Rao. A study on isolation and identification of nosocomial infections causing bacteria on mobile phones of health care workers. *Calicut Med J.* 2011; 9(1):e2.
5. P. Sunil Kumar, T. Jaya Chandra. A study to isolate various bacteria causing osteomyelitis in a tertiary health care

- setup.Surgical Update: Int J Surg Orthopedics. 2020; 6(1):40 – 4.
6. Sadaksharam J, Murugesan M. Osteomyelitis of Maxilla: A Rare Finding from a Radiologist Point of View. Contemp Clin Dent. 2019; 10(2): 394 – 6.
 7. Jha Y, Chaudhary K. Diagnosis and Treatment Modalities for Osteomyelitis. Cureus. 2022; 14(10):e30713.
 8. Gavilán MG, López JB, Artola BS. Peculiarities of osteoarticular infections in children. Best Pract Res Clin Rheumatol. 1999; 13(1): 77 – 94.
 9. Pineda C, Espinosa R, Pena A. Radiographic imaging in osteomyelitis: the role of plain radiography, computed tomography, ultrasonography, magnetic resonance imaging, and scintigraphy. Semin Plast Surg. 2009; 23(2): 80 – 9.
 10. Raina D, Husain U, Kumar P, Pandita AK, Negi N. Bacterial Isolates and Their Antimicrobial Susceptibility Profile in Osteomyelitis Patients: An Experience From a Tertiary Care Center in a Hilly Area of Uttarakhand. Cureus. 2023; 15(8): e44263.