ORIGINAL ARTICLE ASIAN JOURNAL OF MEDICAL SCIENCES

# Evaluation of diabetic foot ulcer with reference to demography, clinical presentation, and imaging modalities for diagnosis: An observational study

**Sanjay Maitra[1], Kaushik Biswas[2], Sangita Mandal[3], Aditya Chowdhury[4], Mohanchandra Mandal[5]**

*[1]Associate Professor, [2]Senior Resident, Department of Surgery, [4]Junior Resident, Department of Anaesthesiology, N.R.S. Medical College and Hospital, [3]Assistant Professor, [5]Professor, Department of Anaesthesiology, Institute of Post Graduate Medical Education and Research/S.S.K.M. Hospital, Kolkata, West Bengal, India*

Submission: 27-08-2022 Revision: 06-09-2022 Publication: 01-10-2022

## ABSTRACT

**Background:** Demography and clinical presentation of diabetic foot ulcer varies across geographical location. Multiple imaging modalities such as plain radiography and magnetic resonance imaging (MRI) are used to evaluate osteomyelitis or neuroarthropathy in diabetic foot. Plain radiography is a low cost and easily available test while MRI is reported to be of higher sensitivity and specificity for delineating the extent of soft tissue and bone involvement. **Aims and Objectives:** The study was designed to determine the spectrum of demographic and clinical findings and to find the utility of different diagnostic modalities such as clinical, plain radiography, and MRI that were used to differentiate between osteomyelitis and neuroarthropathy. **Materials and Methods:** After obtaining permission of Institute's Ethics Committee's permission, this observational study was carried out among patients, males and females aged 13 years and above, who presented with diabetic foot ulcer for treatment. The study spanned from March 2020 to August 2021 to reach a sample of 50 patients following non-random purposive sampling. A pro forma (containing history, physical examination findings, and laboratory investigations) was used to explore patient data. Besides clinical diagnosis, plain radiography and MRI were used to evaluate the clinical findings. **Results:** In the study, most of the subjects were between 51 and 70 years of age having diabetes for a duration of 5–15 years. The basis of complications observed is infections, ischemia, and neuroarthropathy. Among the diagnostic modalities used to reach a diagnosis of osteomyelitis or neuroarthropathy, MRI was able to pick up the diagnosis in a greater number of patients for above two entities. Osteomyelitis was identified in 24 (48%) patients and neuroarthropathy was identified in 22 (44%) patients. Use of plain radiography helped in reaching diagnosis in 30% of patients for each category. Clinical diagnosis about osteomyelitis or neuroarthropathy was made in 22% and 26% of patients, respectively. However, on analysis, it was not significant. **Conclusion:** The present study showed a male preponderance. Moreover, MRI was able to categorically diagnose different pathological parameters of osteomyelitis and neuroarthropathy. Marrow edema was detected in a larger proportion of patients among the MRI-diagnosed cases of osteomyelitis and neuroarthropathy. MRI appears to be more useful than plain radiography for clinical diagnosis.

**Key words:** Diabetic foot ulcer; Neuroarthropathy; Magnetic resonance imaging; Plain radiograph; Accuracy

**Access this article online**

**Website:** http://nepjol.info/index.php/AJMS

**DOI:** 10.3126/ajms.v13i10.47843

**E-ISSN:** 2091-0576

**P-ISSN:** 2467-9100



## INTRODUCTION

Diabetes mellitus (DM) is a growing and a major health problem worldwide. The global prevalence of diabetes in 2019 is estimated to be 9.3% (463 million) adults (20–79 years) and this will rise to 10.9% (700 million) by 2045.[1] The prevalence of diabetic foot varies demographically and associated with many comorbidities.[2]

**Address for Correspondence:**
Dr. Mohanchandra Mandal, Professor, Department of Anaesthesiology, Institute of Post Graduate Medical Education and Research/ S.S.K.M. Hospital, Kolkata, West Bengal, India. **Mobile:** +91-9433072820. **E-mail:** drmcmandal@gmail.com

Depending on the severity of disease, bone infection may be present in about 20–60% of these foot infections.[3,4] Soft tissue and bone infection involving the foot lead to serious impairment in quality of life.[5] It is quite challenging task for the clinician to differentiate between diabetic foot osteomyelitis and neuroarthropathy (i.e., Charcot neuropathic osteoarthropathy), especially at initial presentation.[6] As the approach to treatment is different, it is important for clinicians to know how to diagnose each of these entities to yield better outcome.[6] Thus, the importance of correct diagnosis cannot be understated.

Multiple imaging modalities can be used to evaluate for suspected osteomyelitis or neuroarthropathy. Plain radiography is usually the first diagnostic test when evaluating for bone involvement in the diabetic foot.[7] It is one of the most common choices for radiological imaging due to its lower cost and wide availability.[8] Plain radiography is mainly used for the evaluation of major structural changes as it can provide information on arthropathic changes, osteomyelitis. However, the presence of soft-tissue gas, infected tissue, cellulitis, fasciitis, sinus tracts, and abscess formation is difficult to detect with plain radiography.[8] The accuracy of plain radiography for early diagnosis is only about 50–60%, with a reported sensitivity of 60% and a specificity of 80%, approximately.[7,9] For the assessment of soft-tissue infection and osteomyelitis involving the foot, magnetic resonance imaging (MRI) is the modality of choice, with sensitivity and specificity of 90% and 83%, respectively.[10,11] MRI, in combination with plain radiography, remains to be the most accurate in detecting diabetic foot osteomyelitis and differentiating it from neuroarthropathy.[12] MRI has distinct advantages over other modalities given its ability to detect early changes related to osteomyelitis, evaluate the true extent of disease, depict extra-osseous spread of infection, and help guide surgical management.[8] Hence, MRI is increasingly being used to evaluate potential bone infection.

### Aims and objectives

The present study was designed to perform a comprehensive study of diabetic foot ulcer, its clinical findings, and to find the utility of different diagnostic modality to differentiate between osteomyelitis and neuroarthropathy. Specific objectives were:

1. To determine the demographic pattern, the clinical presentation, and complications of diabetic foot ulcer patients in the present cohort.
2. To determine the pattern of clinical entities (osteomyelitis and neuroarthropathy) that were identified by different diagnostic modalities (clinical, radiological, and MRI).
3. To determine the distribution pattern of MRI-diagnosed cases of osteomyelitis and neuroarthropathy.

## MATERIALS AND METHODS

This prospective, observational (clinical analytical) study was conducted in the general surgery ward of a tertiary care center (Government Medical College) in the East India. The study was carried out after Institute's Ethics Committee's approval (No. NMC/798, dated February 14, 2020). The patients admitted with diabetic foot ulcer, males and females aged 13 years and above, were included in the study after obtaining proper consent. The followings were the exclusion criteria.

### Exclusion criteria

1. Patients aged 12 years and less
2. Patients on follow-up found to be suffering from such infectious diseases requiring isolation.
3. Patients who have left hospital against medical advices.

From hospital records, it was assessed that only 46 patients with diabetic foot ulcer were admitted in general surgery wards in the previous year. Considering this case load and characteristics of a population, we intended to have non-probability sample by recruiting 50 patients with diabetic foot ulcer for the present study. It was a non-random purposive sampling to match the objective of the present study. The study spanned from March 2020 to August 2021, till the sample size of 50 is reached. Thus, the total sample size was 50. It was an observational study and no control was required.

Patients undergoing follow-up and found to be suffering from such other infectious diseases requiring isolation were also excluded from the study. Patients who have left hospital against medical advices were not included in the study. Informed consent form was built up for taking consent from every participant in their respective understandable language. A pro forma (containing history, physical examination findings, and laboratory investigations) was used to explore patient data. Besides clinical diagnosis, plain radiography and MRI were used to evaluate the clinical findings.

Laboratory investigations consisted of complete hemogram, serum urea and creatinine, serum sodium and potassium, fasting and postprandial blood glucose, serum glycosylated hemoglobin (HbA1c), plain radiograph (X-ray), and MRI of the affected foot.

### Statistical analysis

For statistical analysis, data were entered into a Microsoft Excel spreadsheet and then analyzed by SPSS (version 27.0; SPSS Inc., Chicago, IL, USA) and GraphPad Prism version 5. Data had been summarized as count and proportions for categorical variables and mean±standard

deviation for numerical variables. Unpaired proportions were compared by Chi-square test or Fisher's exact test, as appropriate. Z-test was used to test the significant difference of proportions. For this study, P≤0.05 was considered for statistically significant.

## RESULTS

There was a considerable difference in gender which was noted when age range distribution was analyzed (Table 1). Furthermore, a male preponderance was noted (Chi-square value 3.2. P= 0.001). Out of total 50 patients, majority of the female patients were 61–70 years old and most of the male patients were 51–70 years old (Z=0.207. P=0.833). In our study, most of the patients were 61–70 years old and the mean age of patients was 58.8 years irrespective of gender.

It was found that the majority of patients had disease duration of 5–15 years (Table 2).

Regarding the days of suffering with diabetic foot problem, it was found that majority of patients presented after 2 weeks of sufferings (Table 3).

Most of the patients had presented with features of ulcer and neuropathic ulcer (Table 4). Other important presentations were with cellulitis and gangrene. The distribution was not significant on analysis (P=0.075).

**Table 1: Distribution of age**

| Age groups (years) | Male | Female | Total (irrespective of gender) |
|---|---|---|---|
| <50 | 7 | 0 | 7 (14%) |
| 51–60 | 10 | 8 | 18 (36%) |
| 61–70 | 10 | 9 | 19 38%) |
| 71–80 | 6 | 0 | 6 (12%) |
| Total | 33 (66%) | 17 (34%) | |

**Table 2: Duration of diabetes**

| Duration of disease | Number of patients (proportion) |
|---|---|
| <5 years | 9 (18%) |
| 5–10 years | 14 (28%) |
| 11–15 years | 13 (26%) |
| 16–20 years | 8 (16%) |
| >20 years | 6 (12%) |

Z=0.225, P=0.818

**Table 3: Distribution of days of sufferings**

| Duration | Number of patients (proportion) |
|---|---|
| <15 days | 15 (30%) |
| 15–30 days | 18 (36%) |
| 30–90 days | 10 (20%) |
| >90 days | 7 (14%) |

Z=0.638, P=0.522

About one-third (32%) of patients had lesion in dorsum of foot. Other frequent sites of involvement were fore foot and toes (Table 5).

Among the diagnostic modalities used, MRI was able to pick up the diagnosis in a greater number of patients; osteomyelitis was identified in 24 (48%) patients and neuroarthropathy was identified in 22 (44%) patients who had MRI diagnosis. However, on analysis, it was not significant (Table 6).

Among these MRI-diagnosed cases of osteomyelitis and neuroarthropathy, MRI was able to delineate different abnormalities. Among these pathologies, bone marrow edema was found to be the major entity (Table 7).

The majority of patients received wound debridement and excision of slough with regular dressing. Disarticulation and amputation were required in 13 patients (Table 8).

## DISCUSSION

Diabetic foot complications are considered as a significant public health hazard.[13] In DM, the foot is affected mainly due to neuropathic arthropathy and/or osteomyelitis.[14] About 12–25% of diabetic patients suffer from foot problems and foot ulceration remains to be the most common entity that often leads to complications.[15,16] When patients seek medical advice, clinical evidence of infection is present in more than 50% of diabetic foot ulcer cases. The incidence of diabetic foot complications such as foot ulcer, infection, and gangrene increases with age and duration of the disease.[17] Foot ulceration is a prominent cause of morbidity and mortality in patients of DM in the developing countries.[18]

Management for these patients needs repeated hospitalization and surgical management besides extensive medical

**Table 4: Distribution of clinical presentation**

| Clinical presentation | Number of patients (proportion) |
|---|---|
| Abscess | 4 (8%) |
| Cellulitis | 9 (18%) |
| Gangrene | 9 (18%) |
| Neuropathic ulcer | 10 (20%) |
| Ulcer | 18 (36%) |

Z=1.781, P=0.075

**Table 5: Site of the lesion**

| Site of the lesion | Number of patients (proportion) |
|---|---|
| Dorsum of foot | 16 (32%) |
| Fore foot | 12 (24%) |
| Toes | 11 (22%) |
| Planter foot | 09 (18%) |
| Heal | 02 (4%) |

Z=0.89, P=0.373

**Table 6: Diagnosis modalities of osteomyelitis and neuroarthropathy**

| Diagnostic modalities | Osteomyelitis | Neuroarthropathy | P-value |
|---|---|---|---|
| Clinical diagnosis | 11 (22%) | 13 (26%) | The Chi-square statistic is 0.2536. P=0.8809. |
| X-ray diagnosis | 15 (30%) | 15 (30%) | The result is not significant at P<0.05. |
| MRI diagnosis | 24 (48%) | 22 (44%) | |

Data are presented as number of patients (proportion), MRI: Magnetic resonance imaging

**Table 7: Distribution of clinical features in MRI-diagnosed cases of osteomyelitis and neuroarthropathy**

| Parameters | Osteomyelitis | Parameters | Neuroarthropathy |
|---|---|---|---|
| Marrow edema | 29% | Marrow edema | 36% |
| Sinus tract | 25% | Bone destruction | 27% |
| Sequestrum | 17% | Periarticular infection | 14% |
| Intraosseous abscess | 17% | Tarsometatarsal and metatarsopharyngeal joint involvement | 14% |
| Subperiosteal abscess | 12% | Periarticular bone marrow abnormality | 9% |

Data are presented as proportion of patients

**Table 8: Modalities of surgical treatments received**

| Modalities of surgical treatment | Number of patients (proportion) |
|---|---|
| Wound debridement | 18 (36%) |
| Excision of slough and regular dressing | 12 (24%) |
| Fasciotomy | 3 (6%) |
| Disarticulation | 9 (18%) |
| Below-knee amputation | 3 (6%) |
| Above-knee amputation | 1 (2%) |
| Incision and drainage | 2 (4%) |
| Split skin grafting | 2 (4%) |

Z=1.309 and P=0.19

treatment. Charcot neuroarthropathy is an infrequent but dreadful complication of diabetic peripheral neuropathy. Often, it culminates into lower limb amputation.[19] Neuroarthropathy is reported to affect 0.8–8% of the diabetic population[20] and the incidence appears to be increasing further. Moreover, a higher proportion of cases are being detected with the utilization of advanced imaging studies for diagnosing foot problems.[20,21]

Diagnostic imaging is a crucial factor not only in diagnosis but also helps in determining surgical decision and extent of surgical intervention. There may be difficulty in distinguishing osteomyelitis from neuroarthropathy, both clinically and on imaging.[22] Radiologist can contribute much to the patient management due to their familiarity with the particular technical requirements of MRI and the specific imaging features of these entities. By providing an accurate diagnosis based on imaging, the radiologist can play an important role in the multidisciplinary team for the management of patients with complications of diabetic foot.[22] In many cases, the osseous infection is evident on digital X-ray. MRI is not only a sensitive and specific diagnostic modality of osteomyelitis but also it helps in pre-operative planning of surgical resection of infected bone.[23] MRI is becoming increasingly available and currently the imaging modality of choice in the assessment of osteomyelitis and soft-tissue complications in the diabetic foot. Diagnosis through MRI can be challenging due to the myriad manifestations and at times overlapping features of these complications.[22] MRI, in combination with radiography, is the most accurate in the detection of diabetic pedal osteomyelitis and its differentiation from neuroarthropathy.[24]

The present study showed a male preponderance and elderly patients with Type 2 diabetes were more than young aged Type 1 DM. In a study in Western countries, male sex was found to be associated with a 1.6-fold increase in foot ulcer risk.[25] In a recent study[24] on Indian population, males are found to be more affected than females in case of soft-tissue infections and joint complications. High prevalence of DM in men compared with women and more trauma-prone occupations in males, especially in low-income groups, may attribute to this difference.[26] However, contrast reporting[2] does exist where a higher prevalence of females than male (about 22% vs. 13%, respectively, P=0.03) has been observed.

Foot ulceration is a common cause of morbidity and mortality due to DM in the developing countries. In an observational study (n=47),[18] involving consecutive DM patients with foot ulcers, majority (85%) of the patients were found to have Type-2 variety of the disease. About 25% of patients having Type-2 DM were diagnosed about their systemic disease only when they presented with foot ulceration.

The present study finds that ulcer (56%) and more specifically the neuropathic type (20%) are one of the most predominant complications of diabetic foot. Oyibo et al.,[2] found that most patients with diabetic foot complications had Type-2 diabetes and a majority (87%) of them presented with foot ulcers of which a considerable portion (52%) was neuroischemic origin.

The present study showed that MRI diagnosis was possible in a considerable proportion of patients in correctly diagnosing the neuroarthropathy and osteomyelitis compared with X-ray diagnosis and clinical diagnosis. Moreover, MRI was able to categorically diagnose different pathological parameters of osteomyelitis and neuroarthropathy. Among the MRI-diagnosed cases of osteomyelitis and neuropathy, the marrow edema was detected in a considerable proportion of patients. Based on the present study findings, it may be commented that MRI appears to be a better modality than plain radiograph with respect to accuracy of detecting complications.

### Limitations of the study

The present study has certain limitations. It was a single-center study and the observed population was small. Moreover, non-probability sampling was adopted in which the sampling technique was influenced by the subjective judgment of the researcher rather than random selection. Thus, a less stringent method was followed. Furthermore, the performance of nonrandom purposive sampling depends purely on the researcher's knowledge and experience. Future multicenter study involving a large sample may reveal important observations.

## CONCLUSION

The present study showed a male preponderance for diabetic foot ulcer. MRI can be more useful modality to diagnose different pathological parameters of osteomyelitis and neuroarthropathy. MRI appears to be more useful than plain radiography for evaluation of diabetic foot ulcer. Bone marrow edema remains to be a dominant parameter in MRI-diagnosed cases of osteomyelitis as well as neuroarthropathy. In other words, MRI can be more helpful than plain radiography in detecting the extension of the disease, differentiating between osteomyelitis and neuroarthropathy, and thereby suggesting the diagnosis in diabetic foot ulcer.

## ACKNOWLEDGMENT

We wish to offer our thanks to Abhijit Mukherjee, Associate Professor, Department of Community Medicine, Nil Ratan Sircar Medical College and Hospital, Kolkata, West Bengal, India for his expert help in data analysis.

## REFERENCES

1. Saeedi P, Petersohn I, Salpea P, Malanda B, Karuranga S, Unwin N, et al. Global and regional diabetes prevalence estimates for 2019 and projections for 2030 and 2045: Results from the international diabetes federation diabetes atlas, 9th edition. Diabetes Res Clin Pract. 2019;157:107843. https://doi.org/10.1016/j.diabres.2019.107843
2. Oyibo SO, Jude EB, Voyatzoglou D and Boulton AJ. Clinical characteristics of patients with diabetic foot problems: Changing patterns of foot ulcer presentation. Pract Diabet Int. 2002;19(1):10-12.
3. Lipsky BA, Peters EJ, Senneville E, Berendt AR, Embil JM, Lavery LA, et al. Expert opinion on the management of infections in the diabetic foot. Diabetes Metab Res Rev. 2012;28(Suppl 1):163-178. https://doi.org/10.1002/dmrr.2248
4. Richard JL, Lavigne JP, Hartemann GI, Malgrange D, Tsirtsikolou D and Senneville AB. Management of patients hospitalized for diabetic foot infection: Results of the French OPIDIA study. Diabetes Metab. 2011;37(3):208-215. https://doi.org/10.1016/j.diabet.2010.10.003
5. Leone A, Cassar-Pullicino VN, Semprini A, Tonetti L, Magarelli N and Colosimo C. Neuropathic osteoarthropathy with and without superimposed osteomyelitis in patients with a diabetic foot. Skeletal Radiol. 2016;45(6):735-754. https://doi.org/10.1007/s00256-016-2339-1
6. Ertugrul BM, Lipsky BA and Savk O. Osteomyelitis or Charcot neuro-osteoarthropathy? Differentiating these disorders in diabetic patients with a foot problem. Diabet Foot Ankle. 2013;4. https://doi.org/10.3402/dfa.v4i0.21855
7. Lipsky BA, Berendt AR, Deery HG, Embil JM, Joseph WS, Karchmer AW, et al. Infectious diseases society of America. Diagnosis and treatment of diabetic foot infections. Plast Reconstr Surg. 2006;117(Suppl 7):212S-238S. https://doi.org/10.1097/01.prs.0000222737.09322.77
8. Zgonis T, Stapleton JJ, Girard-Powell VA and Hagino RT. Surgical management of diabetic foot infections and amputations. AORN J. 2008;87(5):935-946; quiz 947-50. https://doi.org/10.1016/j.aorn.2008.02.014
9. Shank CF and Feibel JB. Osteomyelitis in the diabetic foot: Diagnosis and management. Foot Ankle Clin. 2006;11(4):775-789. https://doi.org/10.1016/j.fcl.2006.06.008
10. Schweitzer ME and Morrison WB. MR imaging of the diabetic foot. Radiol Clin North Am. 2004;42(1):61-71, vi. https://doi.org/10.1016/S0033-8389(03)00163-5
11. Kapoor A, Page S, Lavalley M, Gale DR and Felson DT. Magnetic resonance imaging for diagnosing foot osteomyelitis: A meta-analysis. Arch Intern Med. 2007;167(2):125-132. https://doi.org/10.1001/archinte.167.2.125
12. Berendt AR and Lipsky B. Is this bone infected or not? Differentiating neuro-osteoarthropathy from osteomyelitis in the diabetic foot. Curr Diab Rep. 2004;4(6):424-429. https://doi.org/10.1007/s11892-004-0051-3
13. Mahendra M and Singh R. Diagnostic accuracy and surgical utility of MRI in complicated diabetic foot. J Clin Diagn Res. 2017;11(7):RC01-RC04. https://doi.org/10.7860/JCDR/2017/25902.10154
14. Nouh MR, Zidan M and Eid AF. Diabetic Foot: Spectrum of MR Imaging Findings. European Congress of Radiology-ECR;2016. https://doi.org/10.1594/ecr2016/C-1255
15. Cavanagh PR, Lipsky BA, Bradbury AW and Botek G. Treatment for diabetic foot ulcers. Lancet. 2005;366(9498):1725-1735. https://doi.org/10.1016/S0140-6736(05)67699-4
16. Singh N, Armstrong DG and Lipsky BA. Preventing foot ulcers in patients with diabetes. JAMA. 2005;293(2):217-28. https://doi.org/10.1001/jama.293.2.217

17. Meloni M, Izzo V, Giurato L and Uccioli L. Medical management of acute foot injury in diabetic patients. J Endocrinol Diab. 2016;3(3):1-8.
http://doi.org/10.15226/2374-6890/3/3/00153
18. Ogbera OA, Osa E, Edo A and Chukwum E. Common clinical features of diabetic foot ulcers: Perspectives from a developing nation. Int J Low Extrem Wounds. 2008;7(2):93-98.
https://doi.org/10.1177/1534734608318236
19. Ergen FB, Sanverdi SE and Oznur A. Charcot foot in diabetes and an update on imaging. Diabet Foot Ankle. 2013;4.
https://doi.org/10.3402/dfa.v4i0.21884
20. Rajbhandari SM, Jenkins RC, Davies C and Tesfaye S. Charcot neuroarthropathy in diabetes mellitus. Diabetologia. 2002;45(8):1085-1096.
https://doi.org/10.1007/s00125-002-0885-7
21. Gouveri E and Papanas N. Charcot osteoarthropathy in diabetes: A brief review with an emphasis on clinical practice. World J Diabetes. 2011;2(5):59-65.
https://doi.org/10.4239/wjd.v2.i5.59
22. Low KT and Peh WC. Magnetic resonance imaging of diabetic foot complications. Singapore Med J. 2015;56(1):23-33; quiz 34.
https://doi.org/10.11622/smedj.2015006
23. Ciotola N and Spielfogel WD. Reevaluating magnetic resonance imaging in radiographically suspected osteomyelitis of the toe. J Am Podiatr Med Assoc. 2018;108(6):472-477.
https://doi.org/10.7547/16-148
24. Kumar M, Chandra A and Gopal K. A comprehensive study of diabetic foot ulcer with special reference to magnetic resonance imaging. Int Surg J. 2022;9(1):133-136.
https://doi.org/10.18203/2349-2902.isj20215145
25. Abbott CA, Carrington AL, Ashe H, Bath S, Every LC, Griffiths J, et al. North-West diabetes foot care study. The North-West diabetes foot care study: Incidence of, and risk factors for, new diabetic foot ulceration in a community-based patient cohort. Diabet Med. 2002;19(5):377-384.
https://doi.org/10.1046/j.1464-5491.2002.00698.x
26. Sriyani KA, Wasalathanthri S, Hettiarachchi P and Prathapan S. Predictors of diabetic foot and leg ulcers in a developing country with a rapid increase in the prevalence of diabetes mellitus. PLoS One. 2013;8(11):e80856.
https://doi.org/10.1371/journal.pone.0080856

**Authors' Contributions:**
**SM-** concept of study design, daily guidance on conduct of study, data collection, and writing of first draft; **KB-** participated in and conduct of study, data collection, interpretation of result, and writing first draft; **SM-** helped in the concept of study, data analysis, review of literature, and revision of first draft; **AC-** conduct of study, data collection, and participated in first draft; and **MM-** concept of study, statistical analysis, logical conclusion, first draft, and revision.

**Work attributed to:**
Department of Surgery, N.R.S. Medical College and Hospital, Kolkata, West Bengal, India.

**Orcid ID:**
Sanjay Maitra - https://orcid.org/0000-0002-5446-480X
Kaushik Biswas - https://orcid.org/0000-0002-8618-559X
Sangita Mandal - https://orcid.org/0000-0002-3416-9344
Aditya Chowdhury - https://orcid.org/0000-0001-6774-8054
Mohanchandra Mandal - https://orcid.org/0000-0003-4183-993X

**Source of Support:** Nil, **Conflict of Interest:** None declared.