Original Research Article

MRSA Screening and Decolonisation in Joint replacement Arthroplasty and its outcome in a tertiary care Orthopaedic centre in Bangalore

Aparna.S.H.[1], Asha. R[2]*, Prathibha.S.[3]

[1]Assistant Professor, Department of General Medicine, Sanjay Gandhi Institute of Trauma and Orthopedics, Bangalore,India

[2]Associate Professor,Department of General Medicine, Sanjay Gandhi Institute of Trauma and Orthopedics, Bangalore,India

[3]Assistant Professor, Department Of Micobiology, Sanjay Gandhi Institute of Trauma and Orthopedics, Bangalore,India

Received: 05-02-2021 / Revised: 22-02-2021 / Accepted: 29-03-2021

Abstract

Background: Surgical site Infections (SSIs) are a major source of morbidity and mortality for patients undergoing total arthroplasty either hip or knee replacement surgeries. Methicillin resistant Staphylococcus aureus (MRSA) colonization is an independent, modifiable risk factor for periprosthetic joint infections and SSIs. Post-operative infections are reported to be ten times greater in MRSA carriers than in non-carriers in developed countries though recorded data is lacking for the developing world. The aim of this study was to determine the efficacy of MRSA Screening and treatment prior to elective Arthroplasty cases in a tertiary care orthopaedic center in Bangalore. **Methods:** A Retrospective study was performed from 1 January 2018 to 30 September 2020. All patients who underwent primary unilateral arthroplasties of knee or hip during this period were included in the study. From January 2019, MRSA screening for all Arthroplasty elective cases became mandatory in our Institute and we collected 26 consecutive MRSA Positive cases for the study. We took 26 controls from January 2018 to December 2018 who did not undergo screening for MRSA. They were divided into Group A and Group B respectively. Patients with positive cultures were treated with intranasal mupirocin ointment and chlorhexidine body wash. Univariate and comparative statistical analyses to determine risk factors for colonization was conducted using Student's t-tests, Fisher's extract tests, and chi-square analyses and Leven's test for homogeneity of variance was used.**Conclusion:** The Pre-operative screening of MRSA by nasal swab culture and sensitivity test for all Arthroplasty case is certainly a cost effective and effective in containing post-operative MRSA infection including SSI.Although the p value in this study was of suggestive significance withp value 0.109, we recommend pre-operative screening for MRSA and decolonisation of MRSA positive cases for all elective Arthroplasty cases especially knee replacement surgeries.

Keywords: MRSA, post-operative Surgical site infection,pre-operative MRSA screening, Total hip replacement, Total knee replacement. Arthroplasty surgery

Introduction

Methicillin-resistant *Staphylococcus aureus* (MRSA) causes more than 50% invasive infections in United States and around 30-40% in India annually[1, 2].It is the most common cause of skin, soft-tissue, and procedure-related infections[3]. Management of MRSA in hospital settings includes education about hygiene, environmental cleaning and decolonization with nasal mupirocin and chlorhexidine antiseptic baths to reduce carriage and prevent infection[4,5].

Hospital-acquired infections due to MRSA if screened and managed preoperatively shall reduce the length of hospital stay and also surgical site infection rate, hence it remains a major challenge for infection control professionals[6].

MRSA hospital acquired infections are associated with high morbidity, mortality and cost of treatment[7]. Colonisation of nasal mucosa by MRSA, its identification and prevention by standard treatment protocol is considered as a modifiable risk factor [8].The aim of this study was to determine the efficacy of MRSA Screening and treatment prior to elective Arthroplasty cases.

**Correspondence*
Dr. Asha R
Associate Professor,Department of General Medicine, Sanjay Gandhi Institute of Trauma and Orthopedics, Bangalore,India
E-mail: dr_ashar12@yahoo.com

Materials and methods

A Retrospective study was performed from 1 January 2018 to 30 September 2020. All patients who underwent primary unilateral arthroplasties of knee or hip during this period were included in the study. All arthroplasties were performed in a tertiary care centre Sanjay Gandhi Institute of Trauma and Orthopaedics, Bangalore, using a standard surgical technique.From January 2019,MRSA screening for all elective Arthroplasty cases became mandatory in our Institute and we collected 26 consecutive MRSA Positive cases for the study. We took 26 controls from January 2018 to December 2018 who did not undergo screening for MRSA. They were divided into Group A and Group B respectively. After January 2019 all patients who were posted for Arthroplasty surgery in our hospital, either knee or hip replacement underwent a nasal swab culture for MRSA as a routine preoperative investigation. Staphylococci were identified morphologically and biochemically by standard laboratory procedures. All MRSA positive patients were treated with local application of 2% (w/w) Mupirocin USP ointment (Bactroban Nasal®, GlaxoSmithKline) to the nares two times a dayand chlorhexidine bath or shower for 7 days. A repeat swab was taken on completion of the treatment. Once the result was negative, patients were taken up for surgery. The surgeon followed standard clinical practice of per operative scrubbing and painting with povidone iodine solution, draping and use of a prophylactic antimicrobial

regimen. The antibiotic used was injectable Ceftriaxone 1 g, one hour prior to surgery and the second dose at the end of surgery for 2 doses in total.The patients were tracked till discharge and length of hospital stay was considered as end point. Infection related to an operative procedure that occurred at or near the surgical incision during hospital stay was noted.

Inclusion criteria: All elective cases planned for arthroplasty surgery in our hospital from January 2018 to September 2020

Exclusion criteria: All emergency surgeries, prior surgical site infections, pathological fractures, Intra articular steroid injections in the last two months and age less than 18 years

Statistical Methods: Descriptive and inferential statistical analysis was carried out in the present study. Results on continuous measurements were presented on mean +_ SD (minimum to maximum) and results on categorical measurements were presented in number(%). Significance was assessed at 5% level of significance. The following assumptions on data was made, Assumptions:1. Dependent variables should be normally distributed., 2. Samples drawn from the population should be random, cases of the samples should be independent. Student t test (two tailed, independent) wasused to find the significance of study parameters on continuous scale between two groups (Intergroup analysis) on metric parameters. Leven's test of homogeneity of variance was performed to assess the homogeneity of variance. A t- test is a statistical test that is used to compare the means of two groups. It is often used in hypothesis testing to determine whether a process or treatment actually has an effect on the population of interest, or whether a process or treatment actually has an effect on the population of interest, or whether two groups are different from one another with the null hypothesis (H_0) is that the true difference these group means is zero and alternate hypothesis (H_a) is that the true difference is different from zero.

Chi-square /Fisher Extract test was used to find the significance of study parameters on categorical scale between two or more groups, Non-parametric setting for Qualitative data analysis. Fisher Extract test used when cell samples are very small.[9-14]

Significant figures

+ Suggestive significance (P value: 0.05<P<0.10)

* Moderately significant (P value:0.01<P ≤ 0.05)

** Strongly significant (P value : P≤0.01)

Statistical software: The Statistical software namely SPSS 22.0, and R environment ver.3.2.2 were used for the analysis of the data and Microsoft word and Excel have been used to generate graphs, tables etc.[9-14]

Results

In this retrospective study we took data from 52 patients who underwent Arthroplasty of either hip or knee replacement surgery. 26 patients were Screened for MRSA and found positive and treated as per protocol and their repeat MRSA test were negative. They were designated as group A(MRSA Screening done) and 26 patients who were not screened for MRSA were designated as group B (MRSA screening not done)respectively.

Table 1: Age and gender variables.

variables	MRSA	
	Group A(n=26)	Group B(n=26)
Age in years		
• <40	0(0%)	2(7.7%)
• 40-60	16(61.6%)	13(46.6%)
• >60	10(38.4%)	13(46.6%)
Mean age	60.00±8.85	59.62±14.12
Gender		
• Female	18(69.2%)	14(53.8%)
• Male	8(30.8%)	12(46.2%)

In group A, majority were in 40-60 years age group i.e.,16 patients and their mean age was 60.00±8.85years. In group B there were equal number of patients i.e., 13 each, in 40-60 years and above 60 years age group with mean age of 59.62±14.12 years (Table 1).Majority were females in both groups.(Table 1)

Table 2: Co-morbid illness

	MRSA		Total(n=52)
	Group A (n=26)	Group B (n=26)	
DM	4(15.4%)	4(15.4%)	8(15.4%)
HTN	4(15.4%)	9(34.6%)	13(25%)

Eight patients suffered from diabetes mellitus with four patients in each group and 13 had Hypertension with 4 and 9 patients in group A and B respectively as co-morbid illness as listed in Table2.

Table 3: Type of Surgery

Type of Surgery	MRSA		Total
	Group A	Group B	
LT THR	5(19.2%)	7(26.9%)	12(23.1%)
LT TKR	7(26.9%)	8(30.8%)	15(28.8%)
RT THR	5(19.2%)	1(3.8%)	6(11.5%)
RT TKR	9(34.6%)	10(38.5%)	19(36.5%)
Total	26(100%)	26(100%)	52(100%)

P=0.421, Not Significant, Fisher Exact Test

In group A, 10 and 16 patients underwent THR and TKR respectively and in group B 8 and 18 patients underwent THR and TKR respectively as listed in Table 3.

Table 4: Comparison of clinical variables of MRSA patients studied

Variables	MRSA		P value
	Group A	Group B	
TLC	7177.69±2268.53	7822.31±2653.05	0.351
Neutrophils	67.58±10.69	69.92±7.97	0.374

The P value was found not significant which was more > 0.05 for the above two variables which were considered in our study. i.e., total leucocyte count and neutrophil count as shown in Table 4.

Table 5: Length of Hospital stay and SSI.

Variables	MRSA		P value
	Group A	Group B	
Length of Stay in hospital(In days)	13.58±6.60	13.38±4.78	0.351
Surgical site Infection(SSI)	4(15.4%)	9 (34.6%)	0.109

The length of hospital stay following Arthroplasty procedure was 13.58±6.60 days in group A and 13.38±4.78 days in group B with P value of 0.351 which was found to be not significant in our study.This might have been due to non infective causes such as delay in rehabilitation, side effects due to prolonged use of antibiotics such as diarrhoea etc.When we compared Surgical site infection rate between group A and group B, Group A had only 4 cases with SSI due to MRSA i.e., 15.4% as compared nine cases in group B i.e, 34.6% Although P value of 0.109 was not found to be significant , there was appreciable reduction in SSI in group A compared to Group B.

Discussion

The aim of our study was to find the outcome of MRSA decolonisation effectiveness in the form of good post operative outcome and prevention of Surgical site infection (SSI).SSI remains one of the serious complications for arthroplasty patients, causing considerable morbidity and financial burden to the patient.[15] The mean age of patients in our study were comparable to studies done by with Bebko et . al[15],Pietrzak et al[16].Tsang et al.[17], Sankar et.al [18] with a mean age being 60 years in all these studies.The females were comparitively more than males in our study which was similar to studies conducted by Pietrzak et al[16].Tsang et al[17],. Sankar et. al [18] .So we can infer that Osteo arthritis is more common in females in 60 years age group range. Bebko. et. al [15], and Tsang et al [17]assessed only males and females respectively , hence was not compared with our study with respect to age and gender.Diabetes Mellitus and Hypertension were present as co-morbid illness in a small number of cases and were well controlled throughout the stay in the hospital and hence was not assessed for comparison with other studies.In our study, we had 34 Total knee Replacement surgeries (TKR) and 18 Total hip Replacement surgeries (THR), but study done by Sankar et.al[18] had more THR compared to TKR. The study of Tsang et al [17] had more TKR similar to our study.Total leukocyte count and neutrophil count in the study groups was found not significant statistically .We found a similar outcome in a study done by Taormina et.al [19].Length of stay in hospital following surgery was equal in both the groups with no significance in p value as some patients had slow recovery and delay in rehabilitation. The study conducted by Sankar et.al.,[18] although showed a significant reduction in the length of hospital stay, post operatively, with MRSA as cause (p value= 0.0049) , the overall length of stay due to non infective cause remained the same(p value=0.1855).The contributing factors for increased length of hospital stay was due to delay in rehabilitation process, side effects like diarrhoea from prolonged use of antibiotics etc.in their study [18].Our study although showed a reduction in SSI due to MRSA post operatively in group A cases , the p vale was 0.109 and was found to be suggestive significant.

Table 6:Studies conducted

	Our Study	Barbero et.al	Sporer et.al	Sadigursky et.al
Reduction in SSI due to MRSA (%)Post arthroplasty in all cases who underwent preoperativeMRSAscreening and decolonisation therapy	50%	40.7%	69%	39%

Studies done by Barberio et.al [20], Sporer et.al[21] and Sadigursky et.al [22] also showed a significant reduction in the rate of SSI due to MRSA following preoperative MRSA screening and decolonisation treatment prior to surgery. Our study also showed a reduction in rate of SSI of around 50% due to MRSA in the post operative Arthroplasty cases, after we introduced pre-operative MRSA screening and decolonisation therapy for all positive MRSA cases.

Limitation of our study: The sample size of our study population was less when compared to other studies. We assessed the decolonisation MRSA colonisation by doing a repeat swab taken immediately after completion of decolonisation therapy.Resistance to Mupirocin was not assessed in our study and we followed a standard decolonisation protocol recommended by Centre for Disease Control and prevention , Atlanta, USA.

Conclusion

The Pre-operative screening of MRSA by nasal swab culture and sensitivity test for all Arthroplasty case is certainly a cost effective and effective in containing post-operative MRSA infection including SSI.Although the p value in this study was of suggestive significance withp value 0.109, we recommend pre-operative screening for MRSA and decolonisation of MRSA positive cases for all elective Arthroplasty cases especially knee replacement surgeries.

Reference

1. Dantes R, Mu Y, Belflower R, et al.National burden of invasive methicillin resistant Staphylococcus aureus infections,United States, 2011. JAMA Intern Med. 2013; 173: 1970-8
2. Essentials of medical MicrobiologyText book 2nd edition 2019. Author : Apoorba S Shastry page no.225.
3. von Eiff C, Becker K, Machka K,Stammer H, Peters G. Nasal carriage as a source of *Staphylococcus aureus* bacteremia.N Engl J Med 2001; 344: 11-6
4. Methicillin-resistant *Staphylococcus aureus*:information for patients. Atlanta: Centersfor Disease Control and Prevention, 2016 (https://www .cdc .gov/ mrsa/ healthcare/patient/ index .html).

5. Septimus EJ, Schweizer ML. Decolonizationin prevention of health care-associatedinfections. Clin Microbiol Rev 2016;29: 201-22.
6. Said-Salim B,Mathema B, Kreiswirth BN.Community acquired methicillin-resistant Staphylococcus aureus: an emerging pathogen. Infect Control Hosp Epidemiol.2003; 24: 451– 455
7. Engemann JJ, Carmeli Y, Cosgrove SE, Fowler VG, BronsteinMZ, Trivette SL, Briggs JP, Sexton DJ, Kaye KS Adverse clinical and economic outcomes attributable to methicillinresistance among patients with Staphylococcus aureus surgical site infection. Clin Infect Dis.2003; 36:592–598
8. Zhu Xingying, Sun Xiaobo,Zeng Yuqing,Feng Wenjun et.al.,Can Nasal Staphylococcus aureus screening and decolonisation prior to elective total joint arthroplasty reduce surgical site and prosthesis -related infections? A systematic review and meta-analysis.Journal of Orthopaedic surgery and research 2020;15:60.
9. Bernard Rosner (2000), Fundamentals of Biostatistics, 5th Edition, Duxbury, page 80-240
10. Robert H Riffenburg (2005) , Statistics in Medicine , second edition, Academic press. 85-125.
11. Sunder Rao P S S , Richard J(2006) : An Introduction to Biostatistics, A manual for students in health sciences , New Delhi: Prentice hall of India. 4th edition, 86-160
12. Suresh K.P. and Chandrasekhar S.Sample Size estimation and Power analysis for Clinical research studies. Journal Human Reproduction Science,2012;5(1): 7-13.
13. IBM Corp. Released 2013. IBM SPSS Statistics for Windows, Version 22.0. Armonk, NY: IBM Corp.
14. R Core Team (2013). R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria
15. Bebko Serge P,Green David M, Awad Samir S. Effect of a Preoperative Decontamination Protocol on Surgical Site Infections in Patients Undergoing Elective Orthopedic Surgery With Hardware Implantation. JAMASurg; 2014.3480.
16. Pietrzak Jurek Rafal Tomasz, Maharaj Zia , Mokete Lipalo . Prevalence of Staphylococcus aureus colonization in patients for total joint arthroplasty in South Africa. Journal of Orthopaedic Surgery and Research .2020;15:123.
17. Tsang S. T. J, McHugh M. P, Guerendiain D, Gwynne P, Boyd.J et.al.Evaluation of Staphylococcus aureus eradication therapy in orthopaedic surgery;Journal of Medical Microbiology. 2018;67:893–901
18. B. Sankar. P. Hopgood . K. M. Bell The role of MRSA screening in joint-replacement surgery.International Orthopaedics (SICOT).2005; 29: 160–163.
19. Taormina David P, Konda Sanjit R, Liporace Frank A, Egol Kenneth A, Can preoperative nasal cultures of staphylococcus aureus predict infectious complications or outcomes following repair of fracture non union?. Journal of Infection and Public Health.2018;11:521-525.
20. Barbero Allende JM, Romanyk Cabrera J, Montero Ruiz E, Vallés Purroy A, Melgar Molero V, Agudo López R, et al. Eradication of Staphylococcus aureus in carrier patients undergoing joint arthroplasty. Enferm Infecc Microbiol Clin. 2015;33(2):95–100.
21. Sporer SM, Rogers T, Abella L. Methicillin-resistant and methicillin-sensitive Staphylococcus aureus screening and decolonization to reduce surgical site infection in elective total joint arthroplasty. J Arthroplasty. 2016 ;31(9): 144–147.
22. Sadigursky D, Santos H, Américo S, Rios C, Borja L, Filho R, et al. Prophylaxis with nasal decolonization in patients submitted to total knee and hip arthroplasty: systematic review and meta-analysis. Rev Bras Ortop. 2017; 52(6):631–7.

Conflict of Interest: Nil
Source of support:Nil