

# A study of incidence and risk factors of Surgical site infection following orthopedic surgical procedure in a tertiary care hospital in south India

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## Abstract

**Introduction:** Surgical site infection following orthopaedic surgeries is a particularly catastrophic complication. So identification and stratification of risk factors of surgical site infection is utmost important in implementation of measures to prevent surgical site infection. **Materials and Methods:** This study was done in JIPMER Puducherry between January 2013 and August 2014. We aimed at identifying the incidence of surgical site infection and also tried to find out the factors associated with a higher risk for SSI. We studied a total of 249 patients, and collected their demographic data as per our proforma and at the end of the study data was compared among two groups of patients (patients with SSI vs Patients without SSI). **Results:** We found in our study that the incidence of patients developing surgical site infection as 11.6% (29 patients). BMI (>25), use of C arm, duration of surgery (>3 hours), duration of closed suction drain (>2 days) and amount of collection of drain (>170 ml) are risk factors of post-operative wound discharge and infection. **Conclusion:** The present study shows that incidence of surgical site infection in our patient population is 11.6%, and out of various parameters studied we found that, BMI, use of C-arm, blood transfusion, duration of closed suction drain and amount of collection in suction drain to be important risk factors for the development of surgical site infection

**Key words:** Surgical site infection, risk factors, orthopedic surgeries

## Introduction

Surgical site infection can be catastrophic in patients after orthopedic surgery as infection leads, to prolonged hospital stay and other complications [1]. Healthcare associated infections are very common in hospital ward especially surgical wards [2] and it imparts a high burden on health care system and on patients [2,3] in view of mortality, morbidity, increased duration of hospital admission and also in terms of extra cost of treatment [4]. Surgical site infections are found to be second most common hospital acquired infection after asymptomatic bacteriuria [5].

Jadranka Maksimovic et al concluded that surgical site infection is associated with hyperglycemia, compound

fracture, increased number of persons in theatre, amount and drainage duration, contaminated wounds, and co morbidities [6]. As we know that surgical site infection is a nightmare for an orthopedic surgeon, the identification of factors which most often leads to post operative complication is extremely important. In this context this study was done in JIPMER Puducherry between January 2013 and August 2014. We aimed at identifying the incidence of surgical site infection and also tried to find out the factors associated with a higher risk for SSI in a group of patients who had undergone clean elective orthopedic surgical procedure We also aim to create awareness among health professionals about risk factors of SSI, so that they can implement methods to prevent occurrence of SSI.

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## Aims & Objectives

1. To determine the incidence of surgical site infection following orthopaedic surgery in our patient population.
2. To assess the risk factors for the development of surgical site infection following orthopedic surgery

## Materials & Methods

This study was done in JIPMER (Jawaharlal institute of post-graduate medical education and research), Pondicherry, a tertiary care hospital. Those patients who had undergone clean elective orthopedic surgical procedure were included in this study. It was a prospective study and was carried out from September 2012 to June 2014. Study approval was obtained from the institute PG thesis review meeting and ethical clearance was obtained from the Institute Ethics Committee of JIPMER. The purpose and details of the study protocol was explained to the subjects and informed consent was obtained.

The study comprised of a single study group of two hundred and forty nine patients. Subjects were enrolled into the study based on the following inclusion and exclusion criteria.

### (i) Inclusion criteria

1. All patients undergoing any clean elective orthopedic surgical procedure were included in the study.

### (ii) Exclusion criteria

1. Those patients who failed to consent for inclusion in study,
2. Those patients who had some other known source of infection (respiratory or urinary infection) or any other septic foci.
3. Those patients who deviated from our study

## Observation

Infection	Frequency	Percent
Surgical site infection	29	11.6
No wound discharge and normal wound healing(control group)	220	88.4
<b>Total</b>	<b>249</b>	<b>100.0</b>

Statistical Analysis: Various parameters were compared among patients using chi square test as given below.

protocol.

4. Known immune deficiency state.
5. Proven pre-op infection.

All patients who satisfy our inclusion criteria were followed up during study period according to the existing departmental protocol for antibiotic prophylaxis, pre operative preparation and post operative wound care. Pre operative patient preparation was started by scrubbing with chlorhexidine followed by application of a sterile towel two days prior to surgery and the day of surgery.

The epidemiological factors for all the patients were noted as per the attached proforma. Any patient who developed a serous discharge from the wound site or presented with signs of inflammation like warmth, redness, induration at the operative site was further evaluated for the presence of surgical site infection. Wound swab was taken and sent for Gram stain along with pyogenic cultures, All the routine clinical and hematological work up were done to look for signs of infection including 4 hourly temperature chart, pulse charting, complete hemogram with peripheral smear, ESR and CRP levels. Other potential sites of infection such as respiratory and urinary tract infections were ruled out by appropriate clinical examination and lab investigations. All the patients were followed up till surgical wound healing and all the patients with wound complication and surgical site infection were noted.

**Statistical Analysis:** It was a prospective study. Chi square or fisher's exact test for comparing the categorical variables and logistic regression analysis was used to identify the independent factors associated with surgical site infection. All statistical analysis was carried out at 5% level of significance and a p value < 0.05 was considered significant and results were drawn.

**Table No 1: Demographic parameters and SSI**

		Surgical site infection				N	$\chi^2$	Df	P	OR	95% CI	
		Present		Absent							Lower	Upper
		N	%	N	%							
Age	≤45	15	10.4	129	89.6	144	.502	1	.479			
	>45	14	13.3	91	86.7	105						
Sex	Male	17	10.2	150	89.8	167	1.060	1	.303			
	Female	12	14.6	70	85.4	82						

There is no significant difference in two groups of patients with/without surgical site infection in terms of age and sex.

**Table No 2: Preoperative risk factors & SSI**

		Surgical site infection				N	X <sup>2</sup>	Df	P	OR	95%CI	
		present		absent							Lower	Upper
		N	%	N	%							
BMI	≥25	9	45	11	55	20	23.510	1	.000	8.550	3.167	23.084
	<25	20	8.7	209	91.3	229						
ASA2	Grade 2 or 3	8	14.8	46	85.2	54	.673	1	.412			
	Grade 1	21	10.8	174	89.2	195						
Trauma	Present	14	10.4	121	89.6	135	.467	1	.495			
	Absent	15	13.2	99	86.8	114						
Arthroplasty	Absent	23	10.1	204	89.9	227	.093	1	.760			
	Present	4	15.4	22	84.6	26						
Deformity	Absent	25	11.2	198	88.8	223	0.647	1	.421			
	Present	1	4.3	22	95.7	23						
Malignancy&Others	Absent	28	12.4	198	87.6	226	.043	1	.836			
	Present	4	9.5	38	90.5	42						
	Absent	25	12.1	182	87.9	207						

BMI >25 is found to be significant pre-operative risk factor for the development of SSI.

**Table No 3: Risk factors during surgery and SSI**

		Surgical site infection				N	X <sup>2</sup>	Df	P	OR	95%CI	
		present		absent							Lower	Upper
		N	%	N	%							
Method of hair removal	PSRW	25	13.2	165	86.8	190	1.780	1	.182			
	Not done or Shaving on the table	4	6.8	55	93.2	59						
No of assistants	≥3	27	12.2	195	87.8	222	.590	1	.443			
	<3	2	7.4	25	92.6	27						
Use of C-Arm	Present	20	15.6	108	84.4	128	4.052	1	.044	2.305	1.005	5.285
	Absent	9	7.4	112	92.6	121						
Use of fracture table	Present	7	20	28	80	35	2.762	1	.097			
	Absent	22	10.3	192	89.7	214						
Indwelling	Present	14	16.5	71	83.5	85	2.919	1	.088			

urinary catheter	Absent	15	9.1	149	90.9	164						
Blood transfusion	Yes	8	30.8	18	69.2	26	10.317	1	.001	4.275	1.659	11.014
	No	21	9.4	202	90.6	223						
Site	Upper limb	4	6.8	55	93.2	59	6.597	2	.037			
	Lower limb	19	11.3	149	88.7	168						
	Spine	6	27.3	16	72.7	22						

**Result:** Use of C arm, blood transfusions are found to be post-operative risk factors of SSI.

**Table No 4: Post operative risk factors and SSI**

		Surgical site infection				N	X <sup>2</sup>	Df	P	OR	95%CI	
		present		absent							Lower	Upper
		N	%	N	%							
Post op FBS (mg/dL)	>110	4	2	13	76.5	17	2.504	1	.114			
	<110	25	10.8	207	89.2	232						
Amount collection drain	≥170	8	29.6	19	70.4	27	9.517	1	.002	4.030	1.574	10.321
	<170	21	9.5	201	90.5	222						
No days ( drain)	>2	9	30.0	21	70.0	30	11.166	1	.001	4.264	1.723	10.553
	<2	20	9.1	199	90.9	219						
Post op duration of stay in days	>18	20	55.6	16	44.4	36	78.851	1	.000	28.333	11.102	72.310
	<18	9	4.2	204	95.8	213						
Duration of surgery in hours	>3	20	17.4	95	82.6	115	6.853	1	.009	2.924	1.274	6.710
	<3	9	6.7	125	93.3	134						

Large amount collection drain, No days( drain),Post op duration of stay in days, Duration of surgery in hours are found to be risk factors of SSI.

It is also clear from the study that average duration of stay in hospital in patients with SSI is 23 days as compared to 12 days in patients without surgical site infection (with a p value of 0.00).

**Discussion**

Surgical site infection (SSI) is a complication causing excessive morbidity to the patient,high chance of re-operations, use of antibiotics for longer duration with its side effects, pain,and increased economic burden to the patient as well as health care system [1]. Majority of surgical site infections are said to be happened at the time of surgical procedure[7]. This fact was very well

reinforced by decreased rate of infection by execution of infection prevention strategies focussed towards practices during surgery inside operation theatre.However,there is no study which will depict actual infection rate acquired at the time of surgical procedure in the operating theatre versus during post-operative period in the ward [8].

In our study we found that the incidence of post-operative SSI after clean elective orthopedic surgical procedure was 11.6%, this is in contrast to incidence of surgical site infection of 2% in developed countries [9]. The higher incidence of surgical site infection in our study may be due to the lack of economic assets, obsolescent instruments and improper ventilation in our operating theater, as well as incomplete solicitation of infection prevention strategies.

We looked at various parameters which could be a cause for occurrence of surgical site infections. We analyzed the data and compared these characteristics between patients who developed wound discharge with evidence of infection and those which showed normal wound healing. It was found in our study that BMI, use of C arm, blood transfusion, duration and amount of collection of post-operative closed suction drain, duration of surgery were significant risk factors for the development of surgical site infection in the post-operative period.

Also On reviewing the literature we found comparable results in some of the previous studies. BMI (>25), use of C arm, duration of surgery (>3 hours), duration of closed suction drain (>2 days) and amount of collection of drain (>170 ml), are risk factors of post-operative wound discharge and infection [10,11,12].

BMI is found to be a significant risk factor for development of wound complication if BMI is >25 with a p value of 0.000 and OR of 8.55, this fact has also been proved by Ridgeway et al [10]. This is in contrast to BMI of >30 or >35 in western patient population. This lower value of BMI as a risk factor for SSI as compared to western population may be due to average low BMI of our patient population. The use of 'C arm' is found to be another potential risk factor leading to post-operative wound complications with a p value of 0.044 and OR of 2.305 [11,12]. This can be explained due to lack of frequent draping during surgical procedure with each rotation of C arm.

It is apparent in our study that peri-operative blood transfusion is a risk factor for the development of post-operative complications from those without blood transfusion with a P value of 0.001 and OR of 4.275. This fact also has been observed by various studies [13,14] revealing that allogenic blood transfusion will cause increased perioperative complications. However there are studies which shows conflicting result on this

matter [15,16].

In day to day practice we usually keep suction drain at surgical site in order to prevent haematoma and SSI but this practice is also a matter of debate as seen in various studies [4,17,18,19,20,21]. In our study we have found that there is increased chance of wound discharge if amount of collection is >170ml (p=0.002) and suction duration is >48 hours (p=0.001).

It is evident in our study that higher chance of infection is associated with Increased duration of surgery (>3 hours-P value of 0.009 and OR of 2.924). It can be attributed to exposure of operative site to environment for longer duration. This information has already been given by Mangran AJ et al [22].

This study illustrates that, not only patient specific elements are responsible, but procedure and post procedure related factors are also responsible for surgical site infection and complications

Our study has certain limitations as there is no clear cut protocol for surveillance and follows up of patients who are getting discharged from our institute. Because of this, patients developed SSI after discharge may not be included in our study. Secondly our study comprises a small sample size, so further randomized trials with larger sample size are recommended.

## Conclusion

This study had shown that incidence of surgical site infection in our patient population was 11.6%, and out of various demographic parameters studied it was found that BMI, use of C-arm, blood transfusion, duration of closed suction drain and amount of collection in suction drain were found to be risk factors for post-operative wound discharge and complications.

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**Permission of IRB:** Yes

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