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RESEARCHARTICLE

ANALYSIS OF VARIOUS RISK FACTORS FOR THE DEVELOPMENT OF CULTURE POSITIVE SURGICAL SITE INFECTION FOLLOWING ORTHOPEDIC SURGERY

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ABSTRACT

Introduction: Surgical site infection following orthopedic surgeries is a dreaded complication. So prior knowledge, its identification and stratification of factors of surgical site infection is vital in application of measures to avoid surgical site infection.
Materials and Methods: This study was done in JIPMER Pondicherry between January 2013 and August 2014. We aimed at identifying the factors associated with a higher risk for the development of culture positive SSI. We studied 249 patients, who had undergone orthopedic surgical procedure and collected their data according to our proforma and as per our protocol .Out of 29 patients with surgical site infection only 10 patient showed growth of infective organism. At the end of the study various parameters were compared among patients (patients with culture positive SSI vs others).
Results: It was found that the duration of closed suction drain and use of implants are risk factors for the development of culture positive surgical infection.
Conclusion: The present study shows that, out of various factors evaluated use of implant, increased duration of closed suction drain are important risk factors for the development of culture positive surgical site infection.

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INTRODUCTION

Surgical site infection is disastrous in patients after surgical procedure as it leads, to increased hospital stay and complications (Merle *et al*., 2000). Hospital acquired infections are very common especially in surgical wards (Mangram *et al*.,1999) and it poses a burden to the patient (Mangram *et al*.,1999; Prokuski, 2008) in view of mortality, morbidity, increased duration of hospital admission and also in terms money expenditure for the treatment (Broex *et al*., 2009). Surgical site infections are found to be one of the most common causes of hospital acquired infection (Pittet *et al*., 1999). It has been well revealed that SSI rate is higher with open fractures, poor diabetic control, amount and drainage duration, increased number of persons in theatre and other co morbidities (Jadranka Maksimovic *et al*., 2008). As we know that the diagnosis and management of surgical site infection is a challenge for an orthopedic surgeon, the identification of its risk factors which most often leads to post operative complication is extremely important. In this perspective this research work was done in JIPMER pondicherry between January 2013 and August 2014. We aimed to find out the factors which most likely to have higher risk for SSI in our 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

2. To assess the risk factors for the development of culture positive surgical site infection

MATERIALS AND METHODS

This study was done in JIPMER (Jawaharlal institute of post-graduate medical education and research), Pondicherry, a tertiary care hospital.

Table 1. Demographic parameters and culture positive SSI

		Surgical site infection					χ^2	Df	P	OR	95% CI	
		Present		Absent								
		N	%	N	%	N					Lower	Upper
Age	≤45	6	10.4	139	89.6	145	.502	1	.479			
	>45	4	13.3	100	86.7	104						
Sex	Male	8	4.8	159	95.2	167	0.789	1	.374			
	Female	2	2.4	80	97.6	82						

Table 2. Comorbidities and culture positive SSI

		Culture positive wound discharge		Others		Total	%	$\chi 2$	p
		N	%	N	%	N			
DM	Absent	8	4.1	189	95.9	197	100	.005	0.944
	Present	2	3.8	50	96.2	52	100		
HTN	Absent	9	4.4	195	95.6	204	100	.459	0.498
	Present	1	2.2	44	97.8	45	100		
CD	Absent	10	4.2	228	95.8	238	100	.482	0.488
	Present	0	0	11	100	11	100		
KD	Absent	10	4.1	233	95.9	243	100	.257	0.612
	Present	0	0	6	100	6	100		

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 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 forantibiotic 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. AII statistical analysis was carried out at 5% level of significance and a p value < 0.05 was considered significant and results were drawn.

Observation

Infection	Frequency	Percent
Culture positive surgical site infection	10	4
others(control group)	239	96
Total	249	100.0

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

RESULTS

Increased duration of suction drain and use of implant are found to be important risk factors for the development of culture positive surgical site infection.

DISCUSSION

Surgical site infection (SSI) is a complication causing morbidity to the patient,high rate of re-surgery, side effects of prolonged antibiotic usage and increased burden to the patient as well as health care system (Merle *et al*., 2000). Most of these infections are acquired during surgical procedure itself (Ayliffe, 1991). So most of the health care departments are clinging to infection prevention strategies and measures during the surgical procedure itself than post surgery to prevent occurance of SSI and it has given us good outcome with decreased rate of surgical site infection and its complications.

Type of surgery and culture positive SSI

		N	%	N	%	N	%	X^2	p
Trauma	Absent	6	5.3	108	94.7	114	100	.848	0.357
	Present	4	3	131	97	135	100		
Spine	Absent	9	4	218	96	227	100	.018	0.895
	Present	1	4.5	21	95.5	22	100		
Arthroplasty	Absent	9	4	214	96	223	100	.002	0.963
	Present	1	3.8	25	96.2	26	100		
Deformity	Absent	9	4	217	96	226	100		
	Present	1	4.3	22	95.7	23	100		
Malignancy&Others	Absent	7	3.4	200	96.6	207	100	1.281	0.258

Intra operative risk factors and SSI

		Culture positive -SSI		Others		Total			
		N	%	N	%	N	%	χ^2	p
Use of implant / prosthesis	No implant used	0	0	67	100	67	100	3.835	0.045
	Implant used	10	5.5	172	94.5	182	100		
Use of C-Arm	No	3	2.5	118	97.5	121	100	1.442	0.23
	Yes	7	5.5	121	94.5	128	100		
Use of fracture table	Absent	7	3.3	207	96.7	214	100	2.192	0.139
	Present	3	8.6	32	91.4	35	100		

Unpaired t test to analyze the quantitative date between two groups of patients (culture positive SSI vs. others)

		N	Mean	Sd	t	p
BMI	Culture positive wound discharge	10	23.00	3.97	1.766	.079
	Others	239	21.43	2.70		
Serum albumin level (g/dl)	Culture positive wound discharge	10	4.23	.30	-.009	.993
	Others	239	4.24	2.40		
FBS Pre op (mg/dl)	Culture positive wound discharge	10	114.90	14.05	.553	.581
	Others	239	111.70	18.05		
FBS Post op (mg/dl)	Culture positive wound discharge	10	95.80	8.08	-.566	.572
	Others	239	97.54	9.57		
Preop hospital stay (days)	Culture positive wound discharge	10	16.30	8.14	.271	.786
	Others	238	15.47	9.51		
Duration of surgery (hrs)	Culture positive wound discharge	10	3.65	1.33	1.920	.056
	Others	239	2.84	1.31		
Amount of collection	Culture positive wound discharge	10	77.00	56.97	.492	.623
	Others	239	64.73	77.95		
No. of days	Culture positive wound discharge	10	2.1	1.10	2.031	.043
	Others	239	1.12	1.19		
Post op duration of stay (days)	Culture positive wound discharge	10	23.20	4.52	6.247	.000
	Others	239	12.37	5.40		

However, multicentric studies are still lacking to explain infection rate during surgical procedure versus after surgical procedure (Ilker *et al*., 2010). As per CDC definition and guidelines of prevention of SSI 1999, there are two types of SSI-incisional and organ/space. Incisional infections are again divided into superficial and deep Infection in any part of the body other than incisional site is called as organ/space infection.We looked at various factors which could be a cause for occurrence of surgical site infections. We analyzed the data and compared these characteristics between patients who developed culture positive SSI vs those with no culture positive wound discharge and normal wound healing. At the end of the study we had a total of 29 surgical site infection based on clinical judgement by our infection committee experts but only 10 of them showed growth of infective agent It was found in our study that use of implant and increased duration of suction drain are two very important risk factors for the development of culture positive surgical site infection. It is obvious from various studies that BMI, use of C arm, increased duration of surgical procedure, duration of closed suction drain and increased collection of drain, are risk factors of surgical site infection infection (Ridgeway *et al*., 2005; Peters *et al*., 2012; Kaska, 2010).

Another risk factor for the development of SSI is allogeneic blood transfusion (Heiss *et al*., 1993; Jensen *et al*., 1992) but there are studies with contradictory result on this matter (Talbot *et al*., 2004; Vamvakas *et al*., 1995).In our routine practice we keep suction drain at surgical site in order to prevent blood collection at operative site (hematoma) and SSI. In our study we have found that there is increased chance of culture positive surgical site infection with increased drain duration. But this practice is also a matter of debates and arguments as studied by various researchers (Broex *et al*., 2009; Clifton *et al*., 2008; Martyn J. Parker, 2007; Qi-dong Zhang *et al*., 2011; Margaret *et al*., 2008; Lilani *et al*., 2005). As per Association for Professionals in Infection Control and Epidemiology (APIC) elimination guide it has been summarised that orthopedic surgery usually involves the placement of foreign material in the form of metallic implants which causes SSI by direct contamination or invasion by blood stream and also has pointed out that infection which occur at the time of surgical procedure is by direct invasion but those infection which occur in post-operative period is usually caused by bacteraemia (Greene, 2012).

Another important cause of infection associated with use of implants, is the ability of microorganism to produce biofilm which leads resistance to antibiotics. So health care professionals should have the knowledge of risk factors especially surgical staff in the operation theatre to eliminate factor which are most likely a cause for the development of surgical site infection. There are many proven strategies which can prevent surgical site infection proper skin, appropriate pre-operative shaving, adequate hand wash and scrubbing, laminar airflow in operation theatre, proper draping, adequate sterilization of surgical instruments. By adoption of appropriate strategies especially in developing countries like India with resource limited healthcare system. We can prevent these infections, and thus can increase the efficiency of our health department.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 out of various parameters studied it was found that, increased duration of closed suction drain and use of implant are significant risk factors for the development of post-operative culture positive surgical site infection. It has also to be noted that there is significant increase in the duration of post-operative hospital stay in patient with surgical site infection.

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