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Local Intrawound Administration of Powdered Antibiotics in Cardiac Surgery

**Vipul Dogra¹, Subodh Satyarthi², Kuber Sharma¹, Sunita Chaudhary¹, Ankit Jain¹,
Muhammed Abid Geelani³**

¹Senior Resident, Department of CTVS, G B Pant Institute of Postgraduate Medical Education and Research, New Delhi

²Professor, Department of CTVS, G B Pant Institute of Postgraduate Medical Education and Research, New Delhi

³Director Professor and Head, Department of CTVS, G B Pant Institute of Postgraduate Medical Education and Research, New Delhi

Corresponding author : Dr Vipul Dogra , Senior Resident, Department of CTVS, G B Pant Institute of Postgraduate Medical Education and Research, New Delhi, India – 110002 , E-mail: vipul638@gmail.com



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Abstract

Surgical site infection (SSI) is a known complication seen after cardiac surgery and when it progress to deep sternal wound infection (DSWI) also known as mediastinitis, then it increases morbidity and mortality of patients. Despite strict preoperative antibiotic prophylaxis and aseptic techniques protocols, SSI have been observed frequently. Local intrawound powdered antibiotic has potential to provide high concentration of antibiotic at the local site with less systemic side effects. In this study we have compared two groups with and without the use of powdered antibiotic.

Keywords: Surgical Site Infection, Cardiac surgery, Local antibiotics

Introduction

Cardiac surgeries can have prolonged recovery period and serious complications and SSI added on to it becomes more serious condition. It increases the morbidity, mortality, length of hospital stay and financial burden on the patient and health care system. In spite of strict preoperative antibiotic protocols and aseptic techniques, SSI in cardiac surgeries are reported in 1.3% to 12.8% cases[1].The reported incidence of postoperative mediastinitis varies between 1 and 5% [2–4].

When systemic antibiotic prophylaxis was not defined during 1960s, topical antibiotics were used in abdominal surgeries[5]. They were also used in irrigation fluids and sponges[6]. This practice of topical use of antibiotics is still popular in many surgical branches as it provides high concentration of antibiotic in desired area without much systemic side effects. Studies regarding use of topical antibiotics have been done in many surgical branches but data in this regard with

respect to cardiac surgeries is very less. The present study was performed to evaluate the role of topical antibiotics in decreasing SSI in cardiac surgeries.

Materials and Methods

This study was performed as a retrospective comparative study at tertiary level super-specialty institute in India on total 400 patients who underwent cardiac surgeries from September 2018 to October 2019. The patients included were those who underwent elective or emergency cardiac surgeries and included both on-pump and off-pump surgeries. The patients excluded from the study were those having history of active skin infections in last 6 months prior to surgery, patients undergoing redo procedures with previous or ongoing SSI and patients having previous history of previous internal mammary artery harvesting.

Detailed history taking and examination was performed for all patients with routine workup as per institutional protocol. These 400 patients were comprised of two groups of 200 patients each randomly selected from all the patients who operated during study period. Group 'A' consisted of 200 patients who underwent application of local powdered Piperacillin and Tazobactam antibiotic just prior to sternal closure. Group 'B' consisted of 200 patients who did not undergo any topical intrawound antibiotic application. The postoperative records of the patients were reviewed to note the incidence of SSI, proportion of superficial and DSWI among these, and mortality due to SSI. Data was tabulated in Microsoft Excel. Categorical variables were expressed as percentages and analyzed using chi-square test while continuous variables were expressed as mean (\pm SD) and analyzed using student 't' test in SPSS version 20. Significant difference between the two groups was considered if p-value was found to be <0.05 .

Preoperative preparation of the patients

The preoperative preparation for elective or urgent patients followed a standardized protocol. The day before cardiac surgery, hair removal was performed with a clipper. Skin washing was performed the day before surgery with antimicrobial wash lotion. All patients received perioperative antibiotic prophylaxis with a third-generation cephalosporin (ceftriaxone). The dose was given in the OR 30–60 min before skin incision. Standard painting and draping method is used in OR. An additional adhesive plastic barrier on top of the skin was used.

Cardiac surgery

All patients underwent isolated elective or urgent cardiac surgery. The majority of patients were operated on with the use of cardiopulmonary bypass (CPB), whereas a most of coronary artery bypass grafting without CPB. Closure of sternotomy done by using steal wires, subcutaneous layer closed using polyglactin 2-0 (vicryl), skin closed using skin staplers. To ensure appropriate intraoperative glucose management, blood glucose levels were monitored frequently and insulin was administered if necessary to achieve blood glucose levels <200 mg/dl. Postoperatively, we monitored blood glucose levels every hour in the first 24 h on the intensive care unit and blood glucose level strictly maintained below 200 mg/dl.

Study end-point

The primary study end-point was to analyse the incidence of superficial and deep sternal SSI in patients undergoing cardiac procedures with median sternotomy in the two different groups (powdered antibiotic-group, without powdered antibiotic-group) during hospital stay and after 3 months postoperatively. The secondary study end-point was to determine independent risk factors for an increased SSI rate of the sternum.

Timing of local antibiotics

Topical antibiotics are applied just before the closure, there is evidence to suggest that there is a finite period during which prophylactic antibiotics may suppress an incisional infection.

Observation

SSI observed within 3month period and described as superficial and DSWI

Following parameters studied

	Topical antibiotic	SSI	Without antibiotic	SSI
1) Congenital	1) 20	1) 1	4) 20	1) 2
2) Adult on Pump	2) 100	2) 3	5) 100	2) 7
3) Adult off pump	3) 80	3) 4	6) 80	3) 8
Sex		1) 5		1) 10
1) Male	1) 90	2) 3	3) 86	2) 7
2) Female	2) 110		4) 114	
Pre disposing factors		1) 5		1) 10
1) Diabetes	1) 28	2) 4	1) 23	2) 8
2) Low cardiac output	2) 21	3) 1	2) 19	3) 2
3) Use of steroids	3) 8		3) 11	
Type of procedure		1) 6		1) 14
1) Elective	1) 184	2) 2	1) 187	2) 3
2) Emergency	2) 16		2) 13	
Mortality	6	1	9	3

	SSI in group A	Mortality	SSI in group B	Mortality
1) Superficial	1) 6	1) 0	1) 10	1) 0
2) DSWI	2) 2	2) 1	2) 7	2) 3

Results

In our study overall 6.25% cases of SSI were seen out of which SSI in antibiotic group 4% which is less as in comparison to non antibiotic group 8.5%. In congenital group overall 7.5% cases of SSI were seen out of which 5% seen in antibiotic group and 10% in non antibiotic group. In on pump adult group overall 5% cases of SSI were seen out of which 3% in antibiotic group and 7% without antibiotic group. In off pump adult group overall 7.5% cases of SSI were seen out of which 5% in antibiotic group and 10% in without antibiotic group.

8.52% of overall male population was affected out of which 5.55% in antibiotic group vs 11.63% in non antibiotic group. In female group overall SSI rate was 4.46% out of which 2.73% in antibiotic group and 6.14% in non antibiotic group.

29.41% of diabetic patients developed SSI out of which 17.86% in antibiotic group and 43.48% in non antibiotic group.

30% of low cardiac output patients developed SSI out of which 19.05% in antibiotic group and 42.10% in non antibiotic group.

15.78% patients on steroids developed SSI out of which 12.5% in antibiotic group and 18.18% in non antibiotic group.

Overall 5.4% of cases developed SSI seen in elective cases out of which 3.3% in antibiotic group and 7.5% in non antibiotic group.

In emergency cases 17.24% patients developed SSI out of which 12.5% in antibiotic group and 23.08% in non antibiotic group.

Overall mortality in our study seen 4.75% out of which SSI related mortality were 1%. (antibiotic group 0.5% and non antibiotic group 1.5%)

It was observed that mortality in both the groups due to DSWI and lesser patients developed DSWI in antibiotic group

Patients who developed SSI managed by aseptic dressings and by giving antibiotics as per culture sensitivity reports.

Hospital stay was prolonged in patients who developed SSI and more in patients who developed DSWI.

But once patients developed SSI there were no significant difference in the hospital stay of antibiotic and without antibiotic group.

SSI more in off pump cases in both groups because mainly off pump cases were CABG in which LIMA harvested down and it affects sternal blood supply and more sternal fractures seen in CABG cases as well as this group of patient is old as compare to on pump cases.

Discussion

During surgical procedure all aseptic precautions are used and standard technique of preoperative antibiotic prophylaxis, skin preparation and painting and draping done which reduces the bacterial load from skin, but small breach in sterile technique or small inoculum during procedure leads to SSI. SSI in cardiac surgeries are reported in 1.3% to 12.8% cases [1]

Most of cardiac surgeries are performed via mid-line sternotomy. When SSI advance to become (DSWI) Mediastinitis which is a rare but life-threatening complication after cardiac surgery. It is associated with high morbidity, decreased long-term survival, prolonged length of hospital stay and increased costs of health care [7-8]

Most of CABG done off pump these days in which LIMA/BIMA is harvested hence blood supply to sternum decreases, sometime sternal fractures occur which increases the chances of mediastinitis [9-10] In cardiac surgeries most of the procedures done on cardiopulmonary bypass machine which transiently affects the immune system and also has effect on hepatorenal system hence systemic antibiotics are used cautiously. Furthermore duration of cardiac procedures, pump time, age, comorbidities causes increased chances of SSI. In our study use of powdered antibiotic showed less number of SSI in every group. As powdered antibiotic provide more concentration at local site for prolonged duration with less systemic toxicity. In our study we observed overall SSI 10.25% and we have included erythma, induration with slight gaping of suture line into superficial SSI, more number of SSI seen in group without use of powdered antibiotic but overall SSI rate was within the range of 1.3% to 12.8% [1]. We have observed that SSI less common in adult on pump group as mean age in this group were 43.44 years and procedure time was less and chronicity of disease was less as compare to adult off pump group. More number of SSI seen in adult off pump cases in both the groups but less in powdered antibiotic group, reason being that old age group of patients with mean age of 65.7 years were included and CABG procedure was done in which internal mammary artery was harvested that too decreases the sternal blood supply, moreover it was observed that sternal fractures were more in this age group and sternum was osteoporotic. Comorbidities were more in this age group like diabetes mellitus, hypertension, atherosclerosis and disease duration were of more time as compare to congenital and adult on pump group.

Males developed SSI more in comparison to females as more number of CABG done to male patients with more comorbidities. Patients with comorbidities and those who underwent emergency procedure developed significantly more SSI in both groups in comparison to overall rate of SSI in our study. Mortality due to SSI were more in group without use of powdered antibiotic as more patient developed DSWI in that group. There were no significant difference in both groups in hospital stay once patient developed SSI.

Conclusion

Prophylactic use of intravenous antibiotic for cardiac procedures is well established and there is fixed guidelines are there. Use of local antibiotics along with parenteral antibiotics is helpful in

preventing SSI. Future research should focus on large study population group with more study parameters which can help in establishing role of local intrawound antibiotic in cardiac surgery.

Limitation of study:

Smaller population group, because of nature of study (retrospective comparative) many parameters were not included which can be included in prospective study groups.

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