Incidence Of Periprosthetic Joint Infection In Arthroplasty Cases In Rural Ot Setup At Pravara Rural Hospital, Loni – A Retrospective Study

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Abstract: Total joint arthroplasty improves the quality of life and functional outcomes in most of the patients suffering from any form of joint pathology which cannot be treated by any other treatment modality. However, infection is a feared complication and usually leads to delayed recovery, lengthier hospitalization, removal of prosthesis and revision of surgery. Periprosthetic joint infection (PJI) is still a great challenge to the orthopaedic community even after such advancements in treatment. Not only is the diagnosis of PJI very challenging, its management is also very difficult. It requires multiple procedures, antibiotic therapy and prolonged rehabilitation. Operation theatres with laminar airflow and antibiotic prophylaxis lead to reduction in incidence of periprosthetic joint infections. In India, where most of the population still lives in rural area and is non-affording, the use of disposable OT drapes and equipment is practically not possible. We are practicing in a medical college situated in a rural area, and our operating conditions are far from ideal. In spite of that, we have a surprisingly low infection rate. Our OT is just an ordinary room with no laminar flow, no special flooring and poor ventilation. Reusable water-impermeable autoclaved cotton wrap-around gowns and sheets are used. In this condition also we only have around 1% infection rate in patients that underwent arthroplasty. Our operating conditions and protocols are the highlights of this paper, being far from ideal and yet having such low infection rates.

1. INTRODUCTION:

Total joint arthroplasty is one of the most performed surgeries all around the world. It improves the quality of life and functional outcomes in most of the patients suffering from any form of joint pathology which cannot be treated by any other treatment modality (1). However, infection is a feared complication and usually leads to delayed recovery, lengthier hospitalization, removal of prosthesis and revision of surgery.

Periprosthetic joint infection (PJI) is still a great challenge to the orthopaedic community even after such advancements in treatment. Not only is the diagnosis of PJI very challenging, its management is also very difficult. It requires multiple procedures, antibiotic therapy and prolonged rehabilitation. Its impact on the medical health system is probably greater than many other diseases.

Since there is an increase in the number of total and hemi hip and knee arthroplasties all around the world each year, the number of revision knee and hip procedures will also increase correspondingly.

Operation theatres with laminar airflow and antibiotic prophylaxis lead to reduction in incidence of periprosthetic joint infections. (16, 28) Nevertheless, we must continue to identify contributing factors in regard to the increased incidence of infection after replacement, which will decrease the load of PJI on health care system. Common factors include age, gender, BMI and medical co-morbidities. (18)

Multinational companies tend to impress upon studies suggesting that disposable instrument sets, disposable helmet system and modular OTs are essential to good results in arthroplasty. However, some studies also show higher intraoperative contamination compared to standard surgical gown. Though these are all very good practices to be continued, but in India where most of the population still lives in rural area it is practically not possible.

We are practicing in a medical college situated in a rural area, and our operating conditions are far from ideal. In spite of that, we have a surprisingly low infection rate. Our OT is just an ordinary room with no laminar flow, no special flooring and poor ventilation. Reusable water-impermeable autoclaved cotton wrap-around gowns and sheets are used. In this condition also we only have around 1% infection rate in patients that underwent arthroplasty. Our operating conditions and protocols are the highlights of this paper, being far from ideal and yet having such low infection rates.
2. MATERIAL AND METHOD:

Inclusion and Exclusion criteria

This study was conducted at Dr Balasaheb Vikhe Patil Rural Medical College Loni, Maharashtra.

Inclusion Criteria:

1. Patient aged 18 years or older
2. Patients consenting to participate in this study
3. Patients who were admitted to our department and treated by joint arthroplasty.
4. Patients with at least 9 months follow up.

Exclusion Criteria:

1. Patients who were diagnosed with postoperative SSI and/or periprosthetic joint infection but did not undergo initial joint arthroplasty in our hospital
2. Patients who had undergone total knee arthroplasty or total hip arthroplasty due to tuberculosis
3. Patients with incomplete medical data
4. Patients lost follow up or dead after discharged from hospital

3. DATA COLLECTION AND DEFINITION OF VARIABLES:

Baseline information, surgery-related variables, laboratory index, medications and additional co-morbidities for each patient were collected from their medical records.

Variables of interest included 4 aspects:

1. Baseline characteristics: age, gender, body mass index (BMI), living places (rural or urban), profession, preoperative and total hospital stay;
2. Co-morbidities and lifestyle habits: smoking, diabetes mellitus, hypertension, heart disease
3. Surgery-related characteristics: ASA status, anaesthesia type, operative time, intraoperative blood loss (ml) and transfusion, intraoperative and postoperative use of antibiotics, postoperative use of drain; screening of infective foci including clearance from dermatology, ENT, ophthalmology, OMFS departments, and culture reports of urine and blood preoperatively
4. Preoperative laboratory indexes: Haemoglobin (Hb), white blood cell (WBC). BMI was grouped according to the WHO reference criteria: Underweight, <18.5; normal, 18.5–24.9; Pre obesity, 25–29.9; obesity class-I; 30–34.9; obesity class-II; 35-39.9 and obesity class-III; Above 40.

Co-morbidities were identified according to clinical diagnosis from the specialist during hospitalization.

4. OUR OT SETUP AND PROTOCOL

Modernization, especially on the infrastructure and instrumentation frontier, seems not to have caught up with several hospitals and our institute is no exception. However, due to the geographical location of our institute being rural, we have to compensate for the lack of resources and modern-most facilities by instating an iron-clad preoperative, intraoperative and postoperative protocol to ensure complete sterility and obtaining an infection-free outcome.

The operation theatre is fumigated overnight before every case. All the arthroplasty cases are taken as first case in the morning. All members used liquid bathing soap followed by povidone iodine scrub (7.5%) to scrub hands before dawnig for the surgery. Double gloves are used by all on-table surgeons and OT staff as per standard protocol. Water-impermeable autoclaved cloth gowns are used by all members of the surgical team. Neither a surgical helmet system nor a face shield is used for any of the cases, only a simple disposable cap and mask are used. The stainless-steel instruments are autoclaved as routine, while the actual prosthesis comes pre-sterilized and packed by the provider company. The cautery is reused after sterilization by ethylene oxide (ETO).

The operation theatre does not have laminar airflow and it has two working air conditioners. The average operating temperature at the table was around 35°C due to old overhead lights. There is separate door for dirty utility in each OT.

Screening of infective foci including clearance from dermatology, ENT, ophthalmology, OMFS departments, and culture reports of urine and blood are obtained preoperatively. In preoperative preparation, the night before surgery, scrubbing of the part with betadine scrub (7.5% iodine) followed by sterile dressing is done. Hair removal from the part
is not done at this stage. Autoclaved clothes are given to patient to wear on the day of surgery. On the day of surgery, in the morning, both limbs are painted with povidone iodine (10% iodine), covered with stockinet and kept on until the patient is shifted onto the OT table.

Intraoperatively, care is taken to include minimum number of members inside the OT, and any movement to and from the OT is maintained to the least. Dressing, drape and gown, and instrument trolley are prepared under standard sterile protocol. After taking patient on the OT table, foley’s catheterization is done after anaesthetic induction of the patient. After that, the stockinet is removed and hair removal is done using a hair trimmer. Scalpel blade or razors are not used to ensure that skin barrier is maintained and to avoid any accidental cuts on the skin. After induction, the door to the OT is kept closed throughout the surgery to minimize any contamination. Reusable autoclaved cotton drapes are used for draping the patient. Ioban is applied onto the part before surgical incision is taken. Strict sterility is maintained throughout the surgery.

A negative suction drain is placed in majority of the cases. For our sample size, 80 out of 94 cases underwent a negative suction drain application before closure. After surgical closure, a dry gauze and pad dressing is used, followed by the use of dynaplast strips to stick the dressing. Drain is removed after 2 days of surgery and suture/staple removal is done after 12-14 days of surgery as per standard protocol.

One dose of cefuroxime 1.5gm (preoperative antibiotic) is given 30 minutes before taking incision and repeated 3 hourly intraoperatively in the event of longer operating time. For postoperative antibiotics, parenteral cefuroxime (750 mg twice daily) and amikacin (500 mg twice daily) are administered for 5 days and then switched to oral cefuroxime (500 mg twice daily) for a week (till suture removal).

After surgery, most patients are transferred to special rooms that are fumigated overnight and postoperative contact with relatives was restricted to a minimum. There was no control over the patients' smoking or drinking habits after they were discharged.

There was control over the movement of personnel into the theatre as door was kept locked throughout the surgery. However, there was no control on the anaesthesia team using their face mask properly. The barrier between the trolley and instruments was one layers of cotton cloth above sterile plastic sheet.

5. RESULTS:

As per the study there was only around 1% infection noted, with only 1 case getting infected on its suture line in subcutaneous plane out of 94 cases included in this study. All of these cases were done using the described protocol in rural setup. We have used 8 variables to conclude our study, which are:

1. Age
2. Gender
3. BMI
4. Diabetic status
5. Hypertension
6. Haemoglobin
7. ASA status
8. Infection status

Table 1

<table>
<thead>
<tr>
<th>Age group</th>
<th>No. of cases</th>
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<tr>
<td>18-40</td>
<td>19</td>
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<tr>
<td>41-60</td>
<td>33</td>
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<tr>
<td>61-80</td>
<td>37</td>
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<tr>
<td>&gt;81</td>
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<tr>
<td>total</td>
<td>94</td>
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<td>Male</td>
<td>55</td>
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<tr>
<td>Female</td>
<td>39</td>
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<tr>
<td>Total</td>
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Table 3

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<th>BMI class</th>
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<td>Underweight (BMI &lt; 18.5)</td>
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<td>Normal (BMI 18.5–24.9)</td>
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<td>Pre-obesity (BMI 25-29.9)</td>
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<td>Obesity Class 1 (BMI 30-34.9)</td>
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<tr>
<td>Obesity Class 2 (BMI 35-39.9)</td>
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<td>Obesity Class 3 (BMI &gt; 40)</td>
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<td>Normal</td>
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<td>Elevated</td>
<td>16</td>
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<td>Hypertension stage 1</td>
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<tr>
<td>Hypertension stage 2</td>
<td>38</td>
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<tr>
<td>Total</td>
<td>94</td>
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Table 5

| Diabetic Status     | No. of cases |
Table 6

<table>
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<tr>
<th>Haemoglobin Status</th>
<th>No. of cases</th>
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<tr>
<td>Within normal range</td>
<td>38</td>
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<tr>
<td>Below normal range</td>
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<td>Total</td>
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Table 7

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<th>ASA status</th>
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<td>ASA 1</td>
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<td>ASA 2</td>
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<td>ASA 3</td>
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<td>Total</td>
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Table 8

<table>
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<tr>
<th>Infection status</th>
<th>No. of cases</th>
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<td>Infected</td>
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<tr>
<td>Not infected</td>
<td>93</td>
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<tr>
<td>Total</td>
<td>94</td>
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</table>

6. DISCUSSION AND CONCLUSION:

Periprosthetic joint infection (PJI) is a devastating complication of arthroplasty surgery and major cause of revision of surgery.

Early infection is presumed to be secondary to iatrogenic contamination and one study demonstrated that 98% of bacteria with the wound are due to airborne contamination. (10)

Improvement in preoperative skin preparation, antibiotic prophylaxis and wound management have led to substantial reduction in risk of infection.

There was a study conducted in New Zealand to compare infection rate in arthroplasty done in laminar flow OT & Conventional OT. Reports are comparable in terms of infection rate. (14)

Shedding of bacteria from the skin of surgical team has been implicated as major potential source of wound contamination. The large airflow from laminar system is commonly vertical & pushes air and debris from the ceiling to the floor. This flow passes from surgeons’ face & head and can potentially contaminate the wound from source. The ears are most common part from which bacteria are spread. The use of enclosed hoods & exhaust system combined with
occlusive gowns should decrease wound contamination from this source. However, it has been shown that disposable cap & mask are functionally as aseptic as a sterilized helmet aspirator system. (12)

Charnley reported the lowering of infection after THR from 10 % to 1% with use of laminar airflow (2) & full body exhaust suits. Study conducted in New Zealand show that there is no benefit in the use of laminar flow or space suits in reducing the rate of infection & revision for early deep joint infection in total joint replacement. (11)

In Australia the occurrence of PJI after TKA & THA was previously reported to be 1.7% over 2 years using a data from 4 hospitals. (15)

A Meta analysis of >11000 patients concluded that antibiotic prophylaxis reduced absolute risk of wound infection by 85% and relative risk by 8% compared to patients receiving no antibiotic prophylaxis.

Several factors in the pre, intra & post operative phases are involved that can predispose a patient to PJI. It is always better to focus on prevention rather than treatment.

Periprosthetic joint infection can occur any time after surgery episodic bacteraemia could be potential risk of PJI and certain medical procedure are most likely to cause bacteraemia. In 2012, the American academy of orthopaedic surgeons (AAOS) released new guideline on “The prevention of orthopaedic implant infection in patient undergoing dental procedure”, which outlines such medical procedures, and ways to prevent & manage the bacteraemia.

In two articles, mentioned that ASA > 3 as an independent risk factor for the development of SSI. (18,19) Application of drain system remains controversial in different studies.

Some reported studies report no additional benefit of using a drain (20-22) while other studies have confirmed that wound drain is associated with increased risk of Periprosthetic joint infection. (23-25)

In our study no adverse effects were associated with application of a negative pressure drain. Some significant variable like surgical sterility, treatment of alcohol consumption, infective foci from other parts (UTI, dental caries, ear infection) were not analysed in our study.

Co-morbidities like DM, RA, Obesity or previous fracture have also been suggested to be associated with an increased risk of infection in joint replacement. (26)

Antibiotic prophylaxis substantially reduces risk of infection in total joint arthroplasty.

This discussion serves to encourage smaller centres that do not have ideal conditions and laminar OTs, to adopt strict protocols before arthroplasty surgeries.

7. REFERENCES:
17. Gross L. AAOS , ADA release CPG for prophylactic antibiotics. AAOS website.