

Laminar Flow Operation Theatre-Luxury or Necessity

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Abstract

Introduction

Infection is a dreaded complication in orthopaedic surgery. Post operative surgical site infection following orthopaedic implantation leads to need for resurgery, prolonged antibiotic usage and antibiotic resistance. It poses economic burden as well as prolonged morbidity to the patient. After the introduction of laminar flow ventilation it has widely become accepted as the standard during orthopaedic procedures such as joint arthroplasty¹. Laminar flow ventilation systems were pioneered by Sir John Charnley, when used in conjunction with other strategies to reduce sepsis, reported marked decline in post-operative wound infection. The practice became widely adopted in orthopaedic theatres after a series of trials that showed a significant decrease in infections from laminar flow theatres². Our study aims at comparing the post operative infection rate following orthopaedic surgery between laminar operation theatre and conventional operation theatre

Methodology

This is a prospective study conducted in department of orthopaedics, government general hospital, Guntur between September 2018 and September 2019 for a period of 1 year. All clean cases operated in laminar operation theatre and conventional operation theatre was included in the study. Post operative surgical site infection rate between laminar operation theatre and conventional operation theatre is studied.

Results

Of the total 185 cases included in the study. 7 cases had postoperative surgical site infection. Of the 7 cases that are infected 3 cases were done in laminar flow operation theatre and 4 cases were done in conventional flow operation theatre. The overall postoperative surgical site infection rate was 3.78%. The infected cases were 2 cases of proximal tibia fracture, 1 case of intertrochanteric fracture, 2 cases of distal tibia fracture, 1 distal femur fracture and 1 lateral malleolus fracture. The infection rate in laminar operation theatre was 3.26% and in conventional operation theatre was 4.3%. The results show that there is no significant difference between the infection rate between laminar flow OT and conventional OT.

Conclusion

Laminar flow operation theatre has no added advantage in the prevention of post operative surgical site infection compared to conventional operation theatre

Keywords: Laminar flow operation theatre, postoperative surgical site infection, conventional operation theatre, infection rate

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I. Introduction

Infection is a dreaded complication in orthopaedic surgery. Post operative surgical site infection following orthopaedic implantation leads to need for resurgery, prolonged antibiotic usage, and antibiotic resistance. It poses economic burden as well as prolonged morbidity to the patient. After the introduction of laminar flow ventilation it has widely become accepted as the standard during orthopaedic procedures such as joint arthroplasty¹. Laminar flow ventilation systems were pioneered by Sir John Charnley, when used in conjunction with other strategies to reduce sepsis, reported marked decline in post-operative wound infection. The practice became widely adopted in orthopaedic theatres after a series of trials that showed a significant decrease in infections from laminar flow theatres². But the efficacy of laminar flow ventilation in operation theatres is still questionable. The question arises whether the decrease in post operative infection rate is because of laminar flow ventilation or because of antiseptic techniques and prophylactic antibiotics. Our study aims at comparing the post operative infection rate following orthopaedic surgery between laminar operation theatre and conventional operation theatre

II. Materials & Methods

This is a prospective study conducted in department of orthopaedics, government general hospital, Guntur between September 2018 and September 2019 for a period of 1 year. Post operative surgical site infection rate between laminar operation theatre and conventional operation theatre is studied. A total of 185 cases were included in the study. Equal numbers of cases done in laminar and conventional operation theatre were included in study so as to facilitate comparison. All clean cases with no external injuries which were done on elective basis were included in the study. Cases with compound wounds, poor skin condition and all emergency procedures were excluded from the study. Of the 185 cases 106 were male patients and 79 were female patients (57.3% being males). Of the 185 cases 92 cases were performed in laminar operation theatre and rest 93 cases were performed in conventional operation theatre. Age group included in the study ranged between 5 to 82 years with mean age of 34.2 years. Duration of surgery ranged between 1-3 hours with the mean being 1.8 hours. All kinds of fractures both paediatric and adult cases were included in the study. Anaesthesia for the procedures is planned according to the fracture. It included spinal anaesthesia in 89 cases, brachial block in 72 cases and general anaesthesia in 24 cases. Closed surgical technique of fracture fixation was done in 82 cases and rest of the cases open techniques were done. Patients with co morbidities (diabetes, smoking, obesity) were taken in to consideration. Of the 185 cases, 22 cases were diabetic and were put on treatment and surgery was performed after the sugar levels were in normal range. 12 of the total cases were hypertensive and they were treated accordingly. 14 of the total cases were chronic smokers and 8 cases were obese. All the cases were evaluated thoroughly clinically and radiologically, routine surgical profile was done and co morbidities like diabetes and hypertension were treated accordingly. Pre anaesthetic checkup was done for all cases and all cases were posted on elective basis. Routine antibiotic prophylaxis was given prior to surgery and preparation of surgical site was done just before the surgical procedure. The surgical procedure and the technique whether closed or open reduction and the duration of surgery was taken in to consideration. Post operatively sterile techniques were followed. Dressing was changed on 2nd, 5th and 7th and 10th post operative day. Dressing was changed prior if soakage was observed or infection suspected. 7 cases out of the total study group had signs of post operative surgical site infection. 5 cases out of the 7 infected cases had redness around the surgical site and mild serous discharge for first 1 week following the surgery, which responded to change of antibiotic according to culture sensitivity and regular dressing. 2 of the infected cases (proximal tibial plating and lateral malleolus plating) had purulent discharge from the surgical site. Pus was sent for culture sensitivity wound irrigation was done and antibiotic started according to culture sensitivity report and dressing was changed daily for those cases. Post operative surgical site infection rate between laminar operation theatre and conventional operation theatre is studied. Results compared with other studies.

III. Results

Of the total 185 cases included in the study, 7 cases had postoperative surgical site infection. Of the 7 cases that are infected 3 cases were done in laminar flow operation theatre and 4 cases were done in conventional flow operation theatre. The overall postoperative surgical site infection rate was 3.78%. The infected cases were 2 cases of proximal tibia fracture, 1 case of intertrochanteric fracture, 2 cases of distal tibia fracture, 1 distal femur fracture and 1 lateral malleolus fracture. The infection rate in laminar operation theatre was 3.26% and in conventional operation theatre was 4.3%. The results show that there is no significant difference between the infection rate between laminar flow operation theatre and conventional operational theatre.

IV. Discussion

Post operative surgical site infection is dreaded complication in orthopaedic surgery because it is very difficult to treat bone and joint infection. Post operative infection leads to increases morbidity ,mortality, extended hospital stay and causes socio-economic burden to the patient. Many preventable causes of surgical site infection have been identified, and if proper measures are implemented, the incidence could be reduced. Patients, surgeons, and nurses, as well as operative room atmosphere and instrumentation are prime areas of concern³. Various methods have been established to reduce infections in orthopaedic surgery, but infection does occur. Sterilisation techniques have evolved over period of time. The main idea behind every sterilisation technique is to prevent the contamination entering the operation theatre. There are several sources of infection like surgical instruments, linen, and operating room staff, performing surgeon, assistants and operating room air. Various studies have shown that laminar flow theatres have greatly reduced levels of particles and bacteria in theatre air compared to turbulent systems⁴. There surely exists a relationship between theatre air quality and post-op infection but it may be the case as Holton & Ridgeway have argued that once a certain level of air quality is achieved any further reductions in infection rates will be due to quality of aseptic technique⁵. It is therefore important that we look to assess the value of laminar airflow ventilation in terms of patient benefit post procedure rather than purely in terms of air quality. Our study compared the post operative surgical site infection rate between laminar operation theatre and conventional operation theatre. Our results showed when similar aseptic precautions and antibiotic prophylaxis was followed there is no significant difference between laminar and conventional operation theatre. The results were comparable with other similar studies.

In a paper examining the move of the Canisius Wilhelmina Ziekenhuis teaching hospital from its old site built in 1926 to a new facility built in 1992, the impact on post-operative infection rates that resulted from the move into modern laminar flow theatres was documented⁶. The authors found no change in the number of deep infections in joint replacement surgery after the move to modern facilities. Results for other forms of surgery were also included but again showed no difference in infection rates.

There are studies showing the contrasting results of increased infection rates in laminar operating rooms compared to conventional operating rooms.

A study using retrospective data from New Zealand joint registry the joint registry collects information on all revisions performed as well as the reasons they were undertaken. It also documents whether the initial procedure was undertaken in a laminar flow theatre as well as if space suits were used. The study provided more evidence that laminar flow theatres may indeed have a detrimental effect on post-operative infection rates. The study found statistically significant increased rates of required revision needed in the laminar flow cases⁷.

So laminar flow ventilation alone can't be regarded as the criteria to reduce the post operative infection rate. The sterile techniques of washing of hands and maintaining basic hygiene⁸, prophylactic antibiotics given at the proper time and at the correct strength⁹, surgical clothing¹⁰, and reducing the flow of staff in the operating room¹¹⁻¹³ all contribute to lowering the incidence of infection.

V. Conclusion:

Laminar flow operation theatre has no added advantage in the prevention of post operative surgical site infection compared to conventional operation theatre. Laminar flow in orthopaedic surgery is ESSENTIAL IF YOU CAN AFFORD IT ,BUT NOT A NECESSITY. We have to definitely walk an extra mile in preventing the post operative infection by not just relying on the laminar flow ventilation but by following the basic sterile techniques

LIMITATIONS:

The study has its limitations of the study group being small size and performed in single hospital the results cannot be generalised. Individual risk factors that can cause infection were not evaluated.

Table 1: CASES IN THE STUDY

TYPE OF FRACTURE	NUMBER OF CASES
INTERTROCHANTERIC FRACTURE	32
FEMORAL SHAFT FRACTURES	16
DISTAL FEMUR FRACTURES	8
PROXIMAL TIBIA FRACTURES	9
TIBIAL SHAFT FRACTURES	12
ANKLE FRACTURES	6
PROXIMAL HUMERUS FRACTURES	16
HUMERAL SHAFT FRACTURES	10
FOREARM FRACTURES	18
DISTAL RADIUS FRACTURES	28
PATELLA FRACTURES	6
OTHER SMALL BONE FRACTURES (PHALANX,METACARPAL,METATARSALS)	24

Table 2. CASES DONE IN LAMINAR VS CONVENTIONAL OT

CASES DONE IN LAMINAR OT	92	49.7%
CASES DONE IN CONVENTIONAL OT	93	50.2%

Table 3: SEX DISTRIBUTION

MALES	106	57.3%
FEMALES	79	42.7%

Table 4: AGE DISTRIBUTION

<50YEARS	112	60.5%
>50 YEARS	73	39.5%

Table 5: TECHNIQUE OF SURGERY

CLOSED TECHNIQUE	82	44.3%
OPEN TECHNIQUE	103	55.7%

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