ORIGINAL RESEARCH PAPER

Orthopaedics

ROLE OF LOCAL LINCOMYCIN INSTILLATION IN PREVENTING WOUND INFECTION OF HIP REGION FRACTURE SURGERIES

KEY WORDS: Infection in hip surgery,Antibiotic wound instillation,Lincomycin lavage

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ABSTRACT

OBJECTIVE: To study the effect of intra wound instillation of Lincomycin in 117 patients with closed fractures around hip region who were treated surgically by various methods during the period of 01/07/2015 to 30/06/2018 at a secondary level trauma care centre in north Kerala.

METHODS AND RESULTS: The patients were reviewed at frequent intervals for a minimum of six weeks to look for any signs of wound infection.We observed no signs of infection in any of the patient treated by this method.

CONCLUSIONS: We concluded that Lincomycin instillation is a reliable and effective method to prevent wound infection in hip region fracture surgeries.

INTRODUCTION

Hip fracture is increasing worldwide due to aging population.Intertrochanteric and neck fractures of femur together account for more than two thirds of hip region fractures.Postoperative surgical site infection (SSI) is uncommon in orthopedic surgery; but if it occurs it can lead to devastating complications affecting the functional outcome of the surgery(01).Most common bacteria responsible for infection of orthopaedic implants is Staphylococcus aureus.In United States alone about 35,000 surgical site infections are estimated to occur every year after orthopaedic surgeries(02).

Prophylactic measures like preoperative antibiotics,exhaust suits,laminar airflow rooms,ultraviolet lighting and minimum number of personals in the operating room has reduced the infection rate in hip region surgeries to a great extent(03,04).Older patients are more prone for infections in hip region surgeries due to impaired immune response to infectious agents,poor perineal hygiene,inferior nutritional status and associated co-morbidities especially diabetes(05).Along with other complications such as myocardial infarction, pulmonary embolism and urinary tract infections,higher rates of SSI have been observed in patients with diabetes mellitus(DM).In such patients if diabetes is poorly controlled, it negatively impacts bone, soft tissue, ligament and tendon healing.Complications of diabetes such as poor glycemic control, neuropathy, end stage renal disease and peripheral arterial disease are often responsible for increase in the risk of infection(06).

Surgical site infection (SSI) is multifactorial, involving patient, surgical and environmental factors(07,08).Systemic approach to co-morbid conditions of patient,proper antibiotic prophylaxis and hygienic orthopaedic surgeries help in preventing infections after orthopaedic surgeries(Fig.1).The main source of contamination in clean surgical procedures are patient's skin and airborne particles from the operating room personnel(09).Though direct contamination of surgical incision is thought to be the primary pathogenetic mechanism,especially in staphylococcus epidermidis infections, bacteria due to remote site infections also forms considerable percentage of patients(05).Hospital and surgeon related factors are also cause for wound infections which can be minimised to a great extent by following proper prophylactic and sterilization protocols.Decreasing the length of hospital stay alone is not a valuable method to decrease the risk of wound site infection(10).Shaving the incision area pre operatively increases the risk of infection and if absolutely necessary must be done immediately before the operation and preferably with electric clippers(04).

Scrubbing the incision area pre-operatively with chlorhexidine gluconate or iodophors reduces the risk of infection in orthopaedic surgeries(11,04).Chlorhexidine gluconate based solutions are superior to iodophors in surgical site preparations because of its long acting characteristic.Also iodophors gets easily inactivated by serum proteins and should be allowed to dry for its maximal effect(12).Use of adhesive draping over incision site helps to prevent infection due to skin flora and can provide additional antimicrobial benefits if impregnated with iodine(02).

Use of preoperative systemic antibiotics is the only consensus internationally acceptable to prevent infections in orthopaedic surgeries and the evidence for its use has been growing (13).Wound irrigation method has been widely practiced by joint replacement surgeons worldwide.Though many solutions like normal saline,caustic soap,antibiotic solutions and antiseptics like povidone iodine have been proposed,no convincing evidence is currently available to prove the efficacy of these products.Inspite of evidence with low certainty,a lower incidence of SSI is reported in participants treated with antibacterial irrigation compared with non antibacterial irrigation(14).Closed incision negative pressure therapy after periprosthetic fracture surgery around hip region has proved to be a reliable method to decrease surgical site infection and thus re-operation(01,15).Staples when used have three fold chance of surgical site infection compared to sutures (16,17).Relation between surgical wound care and SSI prevention(especially the proportion of SSI acquired postoperatively on the ward by direct inoculation) still remain obscure(18).

Prolonged ICU stay, extended duration of surgery and unnecessary blood transfusion has found to increase the incidence of infection in fixation of hip fractures(19).Surgical site infection occurs when micro organisms multiply in a wound causing local signs and symptoms which finally leads to a systemic inflammatory response(07).More the operative time, higher is the chance for surgical site infection in hip region surgeries(01,20).Probable parameters that can impact operating time include pre-operative planning, surgeon experience, surgeon fatigue, operating room staff experience, and access to equipment. Exact mechanisms by which SSI incidence is increased because of prolonged operative time is not fully understood.Intra wound application of vancomycin powder has proved to reduce infection rate in instrumentation surgeries of spine(21,22).Powdered antibiotics if administered locally have proved to provide remarkably high intra-wound concentrations without risk for systemic toxicity.Lack of high quality evidence in the orthopaedic literature has prevented widespread adoption of this technique. Available clinical studies on local intra-wound antibiotics have evaluated the use of topical powdered vancomycin only and that too in spinal surgery(02,08).Although vancomycin powder appears to be effective at decreasing postoperative infections in spine surgery, literature regarding use of vancomycin in other orthopaedic

subspecialties is lacking as of today.

Lincomycin is a product of lincolnemsis and possesses certain unique properties which includes good in-vitro activity against many strains of hospital staphylococci resistant to most other antibiotics.By virtue of its apparent low toxicity, even in high dosage (where such is necessary), lincomycin possesses some advantages overother antibiotics in infection prevention especially in organ dysfunction patients where vancomycin is contraindicated(03).

OBJECTIVE

To assess the effects of intra wound instillation with Lincomycin in the prevention of surgical site infection(SSI) of hip region orthopaedic trauma surgeries.Through this paper we attempt to introduce a novel practice to reduce wound infection in fracture treatment surgeries around hip region.

MATERIALS AND METHOD

117 patients with closed fractures around hip region who underwent surgical treatment during the period 01/07/2015 to 30/06/2018 at a secondary level trauma care centre in Kerala,India were included in this study.Age of the patients varied from 39 to 98 years(average=68.5yrs).Patients were categorised depending on the diagnosis and age(Table.1) and were assessed for postoperative signs of wound infection for a period of upto 6 weeks.No exclusion criteria were included in the study because most of the patients had one or more associated co-morbid conditions.All surgeries were done under spinal anaesthesia unless otherwise indicated.No additional prophylactic measures like exhaust suits,laminar airflow rooms and ultraviolet lighting were available.Skin preparation was done using 5% povidone iodine and later with 70% isopropyl alcohol just before putting incision.Average duration of surgery was between 30 minutes to one hour.All patients underwent intraoperative irrigation with 4 ml Lincomycin(300 mg/ml) just before wound closure.All wounds were closed with no.1 vicryl to the muscle,fascia and subcutaneous tissue followed by surgical staples to the skin.None of the patients were given negative suction drainage.Preoperative antibiotic injection was administered intravenously within 1 hour of the skin incision using a single dose of 1.5 g of Ceftriaxone + Sulbactum combination(in 2:1 ratio) followed by 3-5 doses of same antibiotic in 12 hourly intervals.All patients underwent change in wound dressing after 48 hours and were discharged after 72 hours of surgery with or without oral antibiotics (for a maximum of 3 days) depending on wound status.Suture removal was done after 10 postoperative days in all patients and thereafter incision site left open.Patients were reassessed after four weeks for any signs of delayed infection and signs of radiological union.They were told to report at emergency care immediately if any signs of infection noticed.

Table.1 Showing age wise distribution of patients

Fracture (n=117)	Below 60 years	61-70 years	71-80 years	Above 80 years
Neck of femur fracture (n=43)	9	13	08	13
Intertrochanteric fracture (n= 67)	1	18	17	31
Subtrochanteric fracture (n=7)	1	0	2	4

RESULTS AND DISCUSSION

More than 40% of patients in this study were above 80 years and out of them more than 50% had one or more associated co-morbidities like diabetes.Only one patient was aged below 50 years and that too intertrochanteric fracture following fall from height.None of the 117 patients in our study,with hip region fractures, who underwent surgical treatment and local lincomycin instillation before wound closure developed surgical site infection.

There are a few studies on combination of systemic antibiotic prophylaxis, consisting of first generation cephalosporins and local vancomycin application available in literature;but none on local application of lincomycin.It was ease of availability,cheaper cost and broad antimicrobial coverage which made us study about the role of lincomycin in SSI prevention. Even though a preventable complication,SSI often lead to poorer patient outcomes, increased mortality, morbidity and re-operation rates(23).Hip region surgeries are highly prone for postoperative infections,cause for which is often multimodal .Conscious efforts must be made to implement the most current evidence based preventive measures which include antibiotic prophylaxis, sterilization of operating room air, and antiseptic skin preparations.With reference to the available literature, it is natural to expect that some kind of "anti-biofilm" agent would perform better. We reviewed many study reports of treating subtrochanteric fractures by different surgeons.Some of the studies showed evidence of castile soap or benzalkonium chloride being more effective in disrupting biofilm from metal surfaces than saline alone.Acetic acid, commonly known as vinegar has been shown *in vitro* to be highly effective against both Gram positive and Gram negative biofilms (24). Hydrogen peroxide(3%) irrigation of orthopaedic wound has bactericidal effect as well as inhibition of biofilm formation by gram positive bacteria.Being a natural ingredient of host tis-sue it degrades into non toxic byproducts and has synergistic action with other antiseptic compounds(25).Povidone iodine being bactericidal at concentrations between 0.5% to 4% is proved to be effective in preventing SSI if irrigated before wound closure and it works by down regulating an operon necessary for biofilm formation(02).

Some surgeons have tried surgical debridement by delivering local antibiotics in extremely high concentrations that are able to help eradicate biofilm components. Relatively better way to deliver local antibiotics that has been explored, is to use some kind of antibiotic-impregnated carrier (PMMA beads,calcium sulphate pellets, collagen fleece, etc.).But both these methods were introduced mainly to eradicate microbes from an already infected wound.Literature does not support any evidence for their use in preventing infection of fracture fixation surgeries.

Recently use of fibrin Sealant and occlusive dressings with silver hydrogel is growing because of their antimicrobial, non adherent, and absorptive properties.Silver is proved to have broad antimicrobial coverage not only against all types of bacteria;but also against yeast and fungi.Cyanoacrylate glue provide good tensile strength when combined with a sub cuticular suture and has been shown to decrease wound drainage and thus SSI especially in arthroplasty surgeries(02).Hydrogen peroxide with antiseptic efficacy against most bacteria has demonstrated potential synergy with other irrigation solutions such as chlorhexidine and povidone iodine.It is cheap and widely available and also a naturally occurring molecule in the host tissue.It decomposes into nontoxic byproducts and its mechanism of action is highly effective in removing biofilm from implant surfaces(25).Since the available treatment modalities are becoming increasingly less effective with more virulent organisms and bacterial resistance,innovative biofilm-disrupting algorithms are at the forefront of medical research.These include use of anti-biofilm coatings (like polyethylene oxide,silver,calcium peroxide,etc.),bioactive enzymes like dispersin and cytotoxic agent like citric acid.Use of antimicrobial tethered implants has proved to decrease bacterial colonisation and biofilm formation (26). Recent innovations include electrical stimulation or pulsed electromagnetic field application or laser generated shockwave peg application of implant surfaces(27).

CONCLUSION

Surgical site infection continues to be one of the most devastating and debilitating complications after orthopaedic surgeries around the hip region. No consensus exists regarding the optimal method for its prevention.Though many studies have proved wound irrigation with antimicrobial products to be effective,none has shown to be promising.We were unable to discern a difference in infection rates between available antibiotic solutions.But none of our patients who underwent irrigation with lincomycin just before wound closure developed any form of wound infection.Previous studies suggests theoretical advantages, including antimicrobial benefits to sterilize the wound before closure, and may be regarded to be safe to remain in the wound upon closure.Further

research is needed to provide better insight into the utility of Lincomycin solution for intraoperative wound irrigation in the prevention of infection of hip region orthopaedic trauma surgeries.Since such prevention is multifactorial, a study to compare results of all measures is necessary to reach at a reasonable conclusion.

Recommendation	Description
MRSA screening	Institute a screening and decolonization protocol with either nasal swab or PCR testing before elective surgery. Decolonize with nasal mupirocin and utilization of chlorhexidine wipes before surgery.
Chlorhexidine bathing	Use chlorhexidine wipes both the night before and the morning of surgery, provide patients with written instructions, and institute a web-based alert for maximum compliance.
Adhesive draping	No current evidence supports its use.
Povidone-iodine irrigation	Limited evidence; mix 35 mL of sterile povidone-iodine into 1,000 mL of normal saline to generate a 3.5% solution and leave it in the wound for ≥3 min.
Vancomycin powder	Evidence is limited for orthopaedic subspecialties other than spine; no recommendations exist regarding the optimal dose or application layer.
Incisional negative-pressure wound therapy	Therapy is effective at decreasing wound drainage and infection, but there are no conclusions regarding duration of use or optimal pressure.
Fibrin sealant/occlusive dressings	Silver dressings are effective at decreasing infection among arthroplasty patients.

MRSA = methicillin-resistant *Staphylococcus aureus*, PCR = polymerase chain reaction

Fig.1 showing available methods for preventing surgical site infections

CONFLICT OF INTEREST

Both authors declare that there is no conflict of interest.

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