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RESEARCH ARTICLE

A PROSPECTIVE ANALYSIS OF RISK FACTORS FOR POST OPERATIVE SURGICAL SITE INFECTION FOLLOWING IMPLANT SURGERY IN CLOSED FRACTURES

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Abstract

Aims And Objectives: To assess the incidence of postoperative surgical site infection following implant surgery in closed fractures. • To determine whether various risk factors & lab investigations are associated with the development of postoperative surgical site infection following implant surgery in closed fractures. • To quantify the contribution of risk factors to the probability of postoperative surgical site infection following implant surgery in closed fractures.

Materials And Methods: This study entitled " A Prospective Analysis of Risk Factors for Post-operative Surgical Site Infection following Implant Surgery in Closed Fractures" was performed in accordance with the ethical standards approved by the Ethical Committee of the institution in the Department of Orthopaedics, N.S.C.B. Medical College, Jabalpur (M.P.).

Conclusion: In our study, we conclude that Staphylococcus aureus remains the most important organism responsible for Post-operative surgical site infections in Orthopaedic Implants.

Introduction:-

Open reduction and internal fixation of fractures with implants and prosthesis has become the first line in the management of fractures in most trauma centres. This is not only because of the better understanding of the biomechanics of implantable materials but more importantly because of the better functional outcome in these patients.1 The operative fixation of skeletal fractures can be highly complex due to the unpredictable nature of the bone damage, the multitude of concomitant injuries that may need to be considered, and the frequency of life-threatening situations in emergency care. Infection after fracture fixation (IAFF) in orthopaedic surgery is the most challenging complication, resulting in non-union, permanent functional loss, or even amputation of the affected limb. It is not only a reason for postoperative morbidity and mortality but also a significant socio-economic burden. The incidence of IAFF may range from as low as 1 to 2 % for closed fractures, to 30% for open fractures. Over the past decades, it appears that there has been a steady reduction in the overall incidence of infection. The problem of implant-related bone infections has garnered increasing attention both in the clinical as well as preclinical arenas; however current literature has primarily been concentrated more onthe prosthetic joint infection (PJI), rather than on IAFF.

Although IAFF shares many similarities with PJI, there are numerous critical differences in many facets including infection susceptibility, prevention strategies, diagnostic modalities and management options. Most of the currently applied concepts in the surgical and medical treatment of IAFF are adaptations of algorithms found in prosthetic joint infection management. However, it is important to notice that those two identities must be distinguished.

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Compared to patients presenting for elective arthroplasty surgery, traumatic patients have generally more soft tissue damage, with even direct contamination in case of open fractures. Those delicate cases often need multiple surgeries going from delayed definitive fixation to cutaneous coverage by plastic surgeons. The infection rate between a patient scheduled for elective surgery and a fracture patient is thus not equivalent. On the other hand, mechanical stability is required in order to prevent infection and gain definitive bone healing. Clinical guidelines highlight the fact that construct stability is important not only for prevention but also for the treatment of IAFF. While the ultimate goal in the treatment of infected total joints is the eradication of the infection and a sterile implant, the goal of the treatment of an IAFF is the healing of the fracture and the avoiding of chronic osteomyelitis. Furthermore, after the consolidation of the bone, the implant can be extricated, contrary to the prosthesis. This allows for a more permissive attitude, with the use of 4 suppressive antibiotics until retrieval of the implant. Diagnostics in IAFF can be complicated because identification of the germ is often only possible after intraoperative sampling, in contrast to prosthetic infections where joint aspiration can help preoperatively with diagnostics and the establishment of a treatment plan. Preclinical research studies looking into the risk and progression of bone infection specifically in trauma-relevant models are also scarce9-11, and few specific innovations have been translated from the academic arena and made available to the musculoskeletal trauma surgeon12-14. The scarcity of specific data tailored towards the risk factors of postoperative surgical site infection following implant surgery in closed fractures compelled me to undertake this prospective analysis as a research topic for my thesis.

Aims And Objectives:-

1. To assess the incidence of postoperative surgical site infection following implant surgery in closed fractures.
2. To determine whether various risk factors & lab investigations are associated with the development of postoperative surgical site infection following implant surgery in closed fractures.
3. To quantify the contribution of risk factors to the probability of postoperative surgical site infection following implant surgery in closed fractures.

Materials And Methods:-

This study entitled “A Prospective Analysis of Risk Factors for Post-operative Surgical Site Infection following Implant Surgery in Closed Fractures” was performed in accordance with the ethical standards approved by the Ethical Committee of the institution in the Department of Orthopaedics, N.S.C.B. Medical College, Jabalpur (M.P.).

Inclusion Criteria:-

a. Patients age 18 years and above. • Underwent Implant surgery for closed fracture.
b. At least 6 months of Clinical and radiographic follow-up

Exclusion Criteria:-

a. Known case of sepsis or HIV infection.
b. Any infection within the past 30 days.
c. Patient who underwent initialsurgery at an outside hospital.
d. Pathological fractures.

Methodology:-

A total of 1849 patients of both genders and closed fractures, who were operated on for fracture fixation were included in the study. Out of these patients, 50 patients who showed the clinical feature of post-operative surgical site infection were further evaluated according to the protocol.The diagnosis was established on the basis of history, examination and radiological findings. Patients were informed aboutfractures and our study.

Pre-operatively patients were assessed for their comorbid conditions like diabetes mellitus, obesity, hypertension, thyroid disease etc. and were categorized according to ASA class.. Blood sugar was monitored preoperatively with periodic check-ups and controlled for strict glycaemia level during surgery and post-operative period.

Relevant information obtained included the patient's age, gender, duration of pre-operative hospitalization, antibiotics, duration of surgery, an implant used, use of wound drains, and the number of people present in the theatre suite during thesurgery. A standard pre-operative preparation and instituted antibiotic protocol were followed for all patients. For each patient, 3rd generation cephalosporin was given 60 minutes prior to surgical incision. If the procedure lasted for more than two hours, the antibiotic dose was repeated. Strict sterilization

measures, scrubbing, and draping techniques were followed before surgery. Hairs were removed with the razor on the OT table just prior to the incision. Povidone iodine was used as an antiseptic for patients and for surgeons hand scrubbing.

Post-surgery, patients were continued on intravenous antibiotics for 120 hours and stopped. Post-operatively, if any wound was found to be infected, discharge was collected in a sterile container and immediately sent for bacteriological culture and antibiotic sensitivity. Meanwhile, the patients were started on empirical antibiotics and daily dressing till the C/S report was available. Afterwards, the patients were started on antibiotics according to the culture report for a duration of 3 weeks or till there was no discharge from the wound.

All patients were followed up to 6months after surgery for evaluation of post-operative wounds and any evidence of infection. Follow-up was done at one month, three months and at six months. The criteria for the diagnosis of postoperative wound infection were those used by the National Research Council, which defined POWI as "the presence of pus in a wound which has either discharged spontaneously or has to be released by theremoval of sutures or re-opening the incisions. "Swabs taken from clinically infected wounds were subjected to microscopy and culture using standard laboratory methods by the microbiology lab of the hospital.

Observation And Results:-

In our study, the majority of our patients (37; 74%) were in the age group of 41 to 60 years.
In our study, the majority of our patients were males (82%).
In our study, 27 patients (54%) were from a lower class, and 19 patients (38%) were from the upper lower class socioeconomic status.
In our study, the only risk factor identified was chronic smoking in 12 patients (24%).
In our study, only 13 patients (26%) had Raised ESR.
In our study, only 13 patients had raised C-RP (26%).
In our study, 50 patients (100%) were operated on by elective Surgery.
In our study, 19 patients (38%) were operated on with 4 medical personnel, & 31 Patients (62%) were operated on with 5 medical personnel.
In our study, 30 patients (60%) were operated on without the use of a tourniquet.
In our study, 38 patients (76%) were operated on without the use of a suction drain.
In our study, the Bone graft was used only in 6 patients (12%).
In our study, post-operatively 24 patients (48%) were kept insidethe room, 23 patients (46%) in the ward. Only 3 patients (6%) required ICU care.
In our study, the First check-up was done in ICU in 1 patient (2%), in OT with 32 patients (64%), in the Side room with 12 patients (24%) &inward 5 patients (10%).
In our study, Culture report sterile in 26 pts (52%), 15 pts (30%) had S. Aureus, 6 pts (12%) had Klebsiella & 3 pts (6%) had gram-negative cocci.

Discussion:-

Surgical site infection, especially in orthopaedics, is very debilitating to the patient, overburden at the health care infrastructure and burden over the economy of the patient and country. The morbidity associated with musculoskeletal trauma underscores the need for safe and effective orthopaedic care. Surgical site infections may be useful quality indicators for orthopaedic surgical services, although orthopaedic trauma patients may be at a higher risk for complications, including SSIs, than general orthopaedic patients. Surgical site infection rates may be influenced by a wide variety of parameters, from patient delays and mechanism of injury to the health care delivery system and the human and material resources available in the operating room. Surgical site infection after ORIF are of particular consequence, because infection may result in prolonged courses of oral or intravenous antibiotic agents, wound irrigation and debridement, failure of fixation, mal-union or non-union, and potential need for hardware removal. Surgical Site infections are mainly caused by direct contamination during surgery, but they can also be caused by haematogenous spread of bacteria from an infection site somewhere else in the human body. 71 Our study included 1849 patients with closed fractures who were operated for internal fixation. Out of these 1849 patients, 50 cases showed clinical features of Surgical Site Infection, although only 24 cases could be confirmed bacteriologically. In the rest 26 patients, the culture report was sterile. Our comprehensive research identified an SSI rate of 2.7 % infections following fracture fixation in closed fractures. Similar study by M Q Shah et al reported an incidence of 5.03% in closed fractures, 2.1% by Jain et al, and 5.8% by Salman et al at Khyber Teaching Hospital,

Peshawar. In our study, out of 50 patients with post-operative surgical site infection in closed fractures, 37 patients (74%) belonged to 40 to 60 years age group. 41 patients (82%) were males, 27 patients (54%) belonged to lower class and 19 patients (38%) to upper lower class. This may be attributed to the poor hygiene and illiteracy of the lower class. We could identify only one risk factor, viz. chronic smoking in 12 patients (24%). This is in contrast to other several studies, in which diabetes mellitus, hypertension, thyroid diseases, etc has been found to be the common comorbidities associated with infection. This factor may be attributed to the fact that most of the patients in our study belonged to the lower socio-economic status, in which diabetes and hypertension is not very prevalent. 72 ESR & C-reactive Protein was found to be elevated in only 26% of our cases in our study. Rest of the 74% cases had a normal range of these parameters. This may be attributed to the anti-inflammatory agents and antibiotics being administered to these patients. All of these 50 cases who acquired infection were operated in the elective set-up. Although this seems to be a surprising finding, as chances of infection usually are more in the emergency set-up. This happened mainly due to the fact that 95% of the operative cases were being done as an elective procedure, due to the COVID Pandemic. During this pandemic, the cases which were operated as an emergency procedure were bare minimum, mainly due to the unavailability of the anaesthetist. In our study, 19 patients (38%) were operated with 4 medical personnel, &31 Patients (62%) were operated with 5 medical personnel. The independent risk factor for the development of surgical site infections identified in the study was a greater number of scrubbed persons in the operating room during the operation. A greater number of persons in the operating room increases the rate of surgical site infections from 1.5 to 3.8. In our study, 30 patients (60%) were operated without use of tourniquet, 38 patients (76%) were operated without use of suction drain, bone graft was used 73 only in 6 patients (12%). All these factors were found to be insignificant with the development of infection. In our study, post-operatively 24 patients (48%) were kept in side room, 23 patients (46%) in ward. Only 3 patients (6%) required ICU care. First check-up was done in ICU in 1 patient (2%), in OT 32 patients (64%), in Side room 12 patients (24%) and in ward 5 patients(10%). In our study, Culture report sterile in 26 pts (52%), 15 pts (30%) had S. Aureus, 6 pts (12%) had Klebsiella &3 Pts (6%) had gram-negative cocci. The isolated bacteria in almost all studies, all around the world is Staphylococcus aureus, causing orthopaedic implant infections.

Risk factors for surgical site infection:-

The most critical factors in the prevention of post-operative infections are the sound judgement and proper technique of the surgeon and surgical team, as well as the general health and disease state of the patient. The risk of infection in each patient can be evaluated by considering both patient-dependent factors and Surgeon-dependent factors.

Patient dependent factors:-

Various patient-related risk factors are inherent to the host and cannot be altered, whereas others may be reduced or eliminated by preoperative screening and appropriate preventive measures. 1. Malnutrition, 2. Secondary cell-mediated deficiencies due to steroid therapy, malnutrition, lymphoma, autoimmune deficiency syndrome predisposing to fungal and mycobacterial infections. 3. Smoking. 4. Obesity, 5. Diabetes mellitus, Surgeon related factors 1. Pre-operative factors Skin preparation: Preoperative skin preparation is an important factor in the prevention of infection, but it removes only up to 80% of skin flora. Selwyn S et al showed that the preparation bacterial counts among inpatients who received preoperative hexachlorophene showers were significantly lower than that of outpatients who did not receive preoperative showers. The standard surgical antisepsis involves scrubbing the skin with antiseptic solutions. Scrubbing with 75 clorhexidine significantly reduced hand bacterial counts compared with povidoneiodine. Preoperative hair preparation: Shaving immediately before the procedure decreased the infection rate compared with shaving within 24 hours, which is probably the result of microscopic abrasions that house bacteria. 2. Intraoperative factors Operating room: Infection rates have been shown to correlate with the number of airborne bacteria within 30 cm of the wound. The source of the environmental bacteria in the operating room has been shown to be the operating room personnel, and the quantity of environmental bacteria is related directly to the amount of bacteria the personnel shed and the number of people present: 30% of people are colonized by S. aureus, and people shed about 106 skin scalesloaded with bacteria per day. A cohort study by Knobben et al demonstrated that, compared with the use of conventional airflow systems, use of a laminar flow system significantly decreases the rates of bacterial wound contamination, prolonged wound discharge, and superficial surgical site infection. Duration of surgery: When operating room time for orthopedic procedures increases, the rate of infection also increases.

Conclusion:-

In our study, we conclude that Staphylococcus aureus remains the most important organism responsible for Post-operative surgical site infections in Orthopaedic Implants. Infection after Fracture Fixation is one of the most

challenging complications in orthopaedic trauma surgery. It implies severe consequences not only for patients but also for the health care system. Since the clinical diagnosis is not always obvious and there is no gold standard diagnostic test, a standardized interdisciplinary diagnostic approach is mandatory before initiating appropriate treatment. Awareness of this potential complication, early recognition, intensive debridement and a multidisciplinary approach are keys to a successful treatment. 1. The incidence of post operative surgical site infection following implant surgery in closed fractures was 2.7% in our study. 2. More people in the operating room is directly related to the risk of surgical site infection. Hence, movement of surgeons, anaesthetists and scrub nurses should be reduced. 3. Chronic smoking is an important risk factor for the development of surgical site infection.

Limitations Of The Study:-

The limitations of the study were:-

1. Small sample size.
2. Presence of COVID Pandemic affected the routine orthopaedic workings.
3. Short follow-up period, thus may not account for seasonal variations.

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