

Surgical Site Infection: Impacts and Challenges of Antibiotic Rationalism

Chowdhury *, Navim Kabir

Emergency Medical Officer, Islami Bank Central Hospital, Kakrail, Dhaka, Bangladesh.

***Corresponding Author:** Chowdhury, Emergency Medical Officer, Islami Bank Central Hospital, Kakrail, Dhaka, Bangladesh.

Received date: October 06, 2022; Accepted date: October 10, 2022; Published date: October 21, 2022

Citation: Chowdhury, Navim Kabir. (2022). Surgical Site Infection: Impacts and Challenges of Antibiotic Rationalism. *Clinics In Radiology*. 1(1); DOI:10.31579/cir-2022/005

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Abstract:

Surgical site infection (SSI) is one of the most common hospital acquired infections, and according to recent studies its incidence is estimated to approximate 10% for all surgical interventions. SSIs are associated with increased antimicrobials resistance, treatment costs, prolonged hospital stay and increased mortality. They can also cause disfiguring scars, which can be problematic, particularly for young adults. Comorbidities along with inappropriate debridement procedure, unhealthy hospital environment, habitual activity, immune suppression, nutritional deficiency, hypersensitivity causes prolong wound healing. Here the scenario of post operative surgical site infection with challenges and management has been highlighted in 107 patients who come in emergency department in post surgical procedure dressing purpose and those who admit in indoor patient department after operative procedure.

Key words: nosocomial; contaminated; mrsa; who; antimicrobial resistance

1. Introduction:

Surgical procedures are one of the most sensitive and vital part of treatment management. Different diseases which are not enough responsive to conservative treatment due to bad prognosis. For patient's life safety and proper treatment surgeons take the responsibility upon their shoulder. Though surgical procedure for the sake of patient's purpose, in some cases postoperative infection specially in surgical site becomes a burning issue for patient's management. Nosocomial infection along with other factors create the barrier in the management.

2. Classification of Surgical Wound:

According to Centre for Disease Control and Prevention (CDC) surgical wound classified into following group:

Class I/ Clean: No evidence of infection and inflammation may be found. Respiratory, genital, alimentary tracts are not involved. Primary closure is applicable and according to the need drain tube may be inserted. If blunt trauma is not followed, operative incisional wound may be included after meeting the criteria. [1] [2]



Figure 1: from left multiple clean cut wound and right after primary closure (Courtesy: Dr Nurul Islam MBBS,DLO, Emergency Medical Officer, Islami Bank Central Hospital).



Figure 2: Clean contaminated wound after closure

Class II/Clean-Contaminated: Here respiratory, genital, urinary tract may be involved and contamination is unusual. Biliary tract, oropharynx, vagina, appendix are involved where no evidence of infection or breach of sterility is found [3] .



Figure 3 : Contaminated wound

Class III/Contaminated: Open, fresh wound where breach of sterility occurs with gross spillage from Gastro Intestinal tract (GIT).No evidence of purulent discharge is found. [4][5]



Figure 4 : Dirty wound

Class IV/ Dirty wound: Presence of devitalized tissue that is involved with clinical infection and visceral perforation. Existence of infection can be found in operation table before operation. [6]

3.Prevalance:

This manuscript, the skin infection of the patients who come to the emergency department for dressing purpose and indoor patients wound condition after surgery has been highlighted.60 patients who come towards emergency department for wound dressing purpose who willingly participate to study with their health related info. [7] [8] Besides 47 patients from indoor (having postoperative status) participated. They

are asked about their comorbidities, lifestyle, habitual activity, dietary habit, drug history, previous operative history. [9,10,11]

In emergency patients about 60% wound are clean cut types due to RTA or other mechanical injury. About 80% were male and 20% were female. Some were wounded due to physical assault. Female were predominant in physical assault.In some cases due to fearness or unawareness they did not come towards the hospital. That made clean wound to contaminated, in some cases dirty.10% cases we found contaminated/dirty wound which probably clean in initial stage. About 20% cases wound was clean – contaminated. [12-16]

Types of wound/associated cause	Number of patients	Percentage
Clean	36	60%
Clean-Contaminated	12	20%
Contaminated	06	10%
Dirty	06	10%

Table (a) : Percentage of wounds in different patients of emergency

During observation and taking history, we find some reasons for contaminated and dirty wound. One of the cause is unawareness of dressing. But some other causes also effect delayed wound healing make contaminated.[17-20] Different co-morbidities like Diabetes mellitus, hypoxic factor, Ischemic Heart Disease, cancer overall immunosuppression, steroid intake, vitamin-c deficiency results delayed wound healing. Diabetes is one of the most devastating factor for

processing dirty wound. Smoking also a factor for making Peripheral Vascular Disease like Burger’s disease.[21,22] But the shocking cause was use of antibiotics irrationally or incomplete dosage. This two points were affecting healing and infection as diabetes did. During asking some told about overlooking the dosage schedule and some told about taking multiple types of antibiotic for management of delayed healing process. [23-27]

Factors	Number of Patients	Percentage
Diabetes Mellitus	20	33%
Irrational use of antibiotics/ incomplete dosage schedule	17	29%
Smoking	12	21.5%
Dietary Deficiency (mostly Vitamin-c)	07	11%
Steroid	03	5.5%
Immunosuppressive condition (post cancer chemotherapy)	01	01%

Table(b): Factors Responsible for Delayed Wound Healing

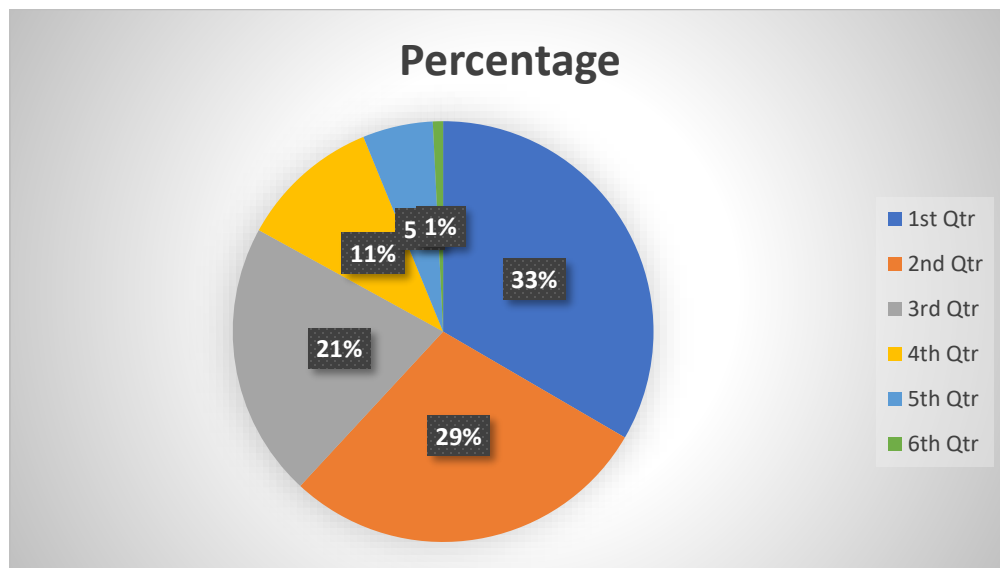


Figure 5 : Distribution of the percentage of delayed wound healing factors by pie chart

From above discussion Diabetes and irrational anti microbial usage are two vital factor for surgical site infection. From the history of 60 patients approximately 70% take Flucloxacillin, 20% patients use cefixime and rest of the patients use cefuroxime or in some cases cefuroxime and clavulonic acid combination. Production of Beta Lactamase is one of the reason for drug resistance and in that perspective combination may be effective though its efficacy evidence is not sufficient yet. [28]

47 patients of indoor (in postoperative stage) who participated to the survey. About 35% from abdominal surgery and 30% from orthopedic case. In this 65%, about 46% were facing post surgical site infection who hadn't taken the sufficient dose initially. Rest of the 19% affected from

nosocomial infection. From the culture sensitivity report causative organisms are *Staphylococcus aureus* 39%, *E.coli* 35.5%, *Klebsiella* 20% and 5.5% others species. Rest of the 20% affected from nosocomial infection. In this 46% patients a satisfactory percentage recovered after proper wound dressing and broad spectrum antibiotics chiefly Ceftriaxone, Cefuroxime, aminoglycosides. But in complicated cases most of the drugs are resistant to bacteria that demanded combination of drugs for the overall management. Without antimicrobial in time management in some cases septicemia formed and ICU management needed. In case of visceral postoperative procedure, some in vivo factor creates delayed wound healing. Like emergency patients comorbidities specially Diabetes is an obstacle for healing. [29,30,31]

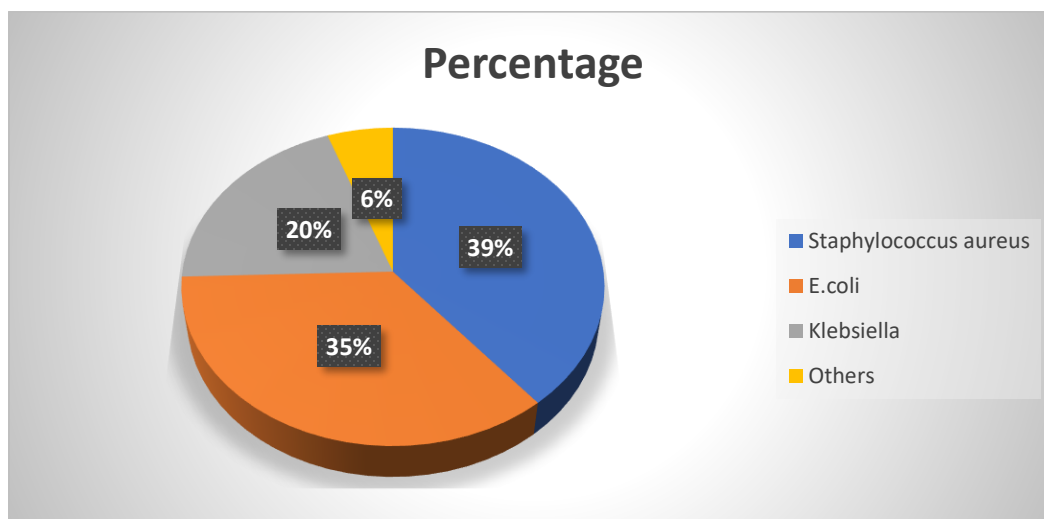


Figure 6: Pie Chart Showing Percentage of Different Species responsible for nosocomial infection.

4.Result:

Above discussion we see that postoperative surgical site infection and its management depends mostly on co morbidities and nosocomial infection. Nosocomial infection predominantly on indoor patient due to prolonged operative process, in situ instruments and different invasive procedure. *Staphylococci* are predominant in organisms and specially for gram

positive and *E.coli* in gram negative. We follow culture sensitivity for detecting the organism as well as proper anti microbial compound.

5.Discussion:

According to history and observation etiologies, management have been correlated for treatment purpose.

6.Etiologies:

Surgical risk factors include prolonged procedures and inadequacies in either the surgical scrub or the antiseptic preparation of the skin. Physiological states that increase the risk of SSI include

- Trauma
- Shock
- Blood transfusion
- Hypothermia
- Hypoxia
- Hyperglycemia.

But Nosocomial Infection associated irrational uses of antibiotics results antimicrobial resistance which becomes significant traits for SSI. [32-34]

7.Mechanism of Antimicrobial Resistance:

Activation of antimicrobial resistance induced by 4 methods:

- ✓ Limiting uptake of a drug
- ✓ Modifying a drug target
- ✓ Inactivation of a drug
- ✓ Active drug efflux.

Intrinsic resistance activate drug resistance all 4 except target site modification of a drug procedure. Due to structural differences activation process of drug resistance between gram positive and gram negative bacteria is different. Gram negative bacteria use above 4 mechanisms whereas gram positive bacteria hardly follow limiting uptake due to absence of Lipopolysaccharide (LPS) in cell membrane. Besides gram positives haven't specific mechanism for drug efflux process. [33-36]

8.Management of Anti Microbial Resistance (ABR):

The World Health Organization (WHO) endorsed a global action plan to tackle antimicrobial resistance. It sets out five strategic objectives:

Improving awareness and understanding of antimicrobial resistance.

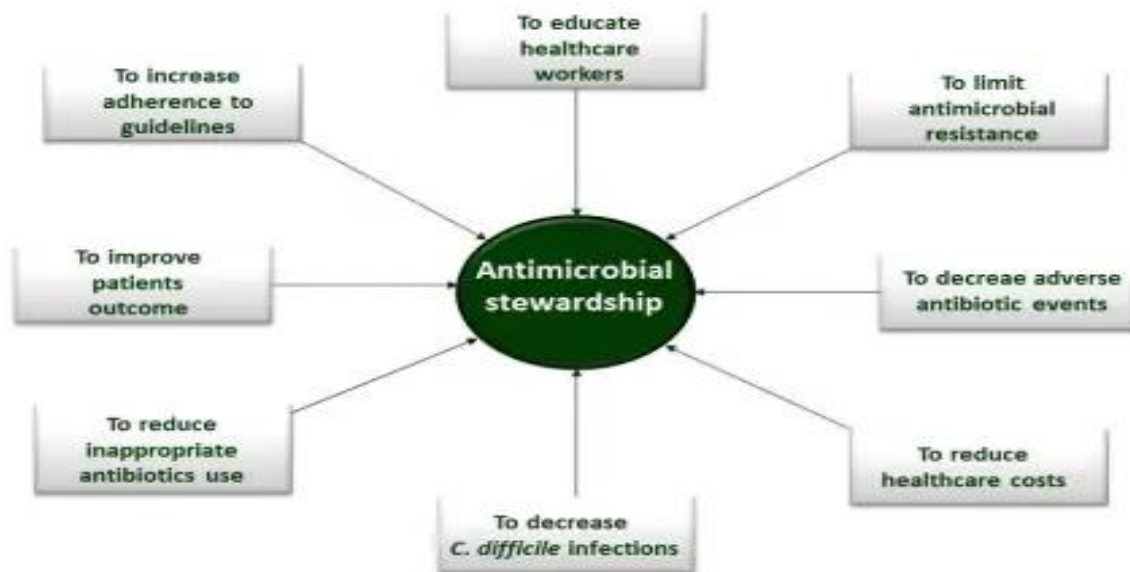
To strengthen knowledge through surveillance and research.

Reducing the incidence of infection

Optimal the use of antimicrobial agents; and

Developing the economic case for sustainable investment that takes account of the needs of all countries, and increase investment in new medicines, diagnostic tools, vaccines and other interventions. [37]

The 8 goals of the antimicrobial stewardship programs



Antimicrobial application is a vital point to manage surgical site infection management. Specially in a country like Bangladesh some additional preventive measures that can be great advantage to protect human life. Like-

- ✓ Create awareness about post/post procedural dressing. Proper wound debridement be a dynamic step for reducing recovery time.
- ✓ Antibiotic should not be sold without registered physician's written prescription. People unawefully buy antibiotics and it was about 15-20% that we know during taking drug history from the patients.
- ✓ In grass root level people are not enough solvent to buy costly drugs specially oral/ injectable antibiotics. Pharmaceuticals company should think how can improve and increase production process with thinking generalized cost effectiveness.
- ✓ Biotechnology sector should be emphasized.

- ✓ Governmental/ Non governmental logistics support should be widen for expanding pharma sector.
- ✓ Laboratory facilities like CBC, blood culture and other microbiological investigations should be practiced rationally. Cost effectiveness should be in priority basis. [38-39]

9.Conclusion:

Undoubtedly post operative management is an important traits for preventing infection. Lack of awareness, body mechanism and others associated circumstantial factors make it aggressive and turns to septicemia in advanced cases. Pharmacological specially antibiotic is an achievement rather it become resistant due to proper monitoring and irrational use. Making the goal of antibiotic extraordinary for the people, nonpharmacological actions, research could be more effective and make effective management protocol to form healthy infection free earth.

10. Acknowledgement:

Dr Nurul Islam MBBS,DLO Emergency Medical Officer, Islami Bank Central Hospital,Kakrail, Dhaka, Bangladesh.

11. Funding Information:

No funding assistance applicable to this manuscript.

12. Competing Interest:

The author have no competing interests to declare.

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