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Causes and Management of Wound Infection

Ahmad Mohammad Kashha[1], Ayat Hassan Zailai[2], Waad Suliman Alsaadi[3], Rahaf Yaseen Almutawa[3], Moath Hassan Albarakati[3], Amir Hamoud Almhmadi[3], Wafa Saleh Alkhuzaie[4], Abdullah Hussain alZahrani[5], Shahad Khalid Ali balbaid[1]

Battarjee Medical College[1], Cairo University[2], Umm Alqura University[3], Ibn Sina National College[4], King Abdulaziz University[5]

Corresponding author: **Ahmad Mohammad Kashha** , email: A-1k1@hotmail.com

ABSTRACT

Aim of the work: the care of patients with a wound infection may seem conflicting, various diverse antibiotic preparations may be utilized after some time with an end goal to control the causative organism and a kwide range of treatment procedures might be utilized by various healthcare experts. With the approach of Independent (Supplementary) Nurse Prescribing Courses and the future potential for medical caretakers with reasonable capabilities to recommend antibiotics for patients with wound infections, there is a requirement for attendants and different specialists to review and update their insight into this vital subject.

Keywords: Wound Infection, Treatment, Antibiotic, Antiseptics.

INTRODUCTION

The advancement of a wound infection relies upon the intricate interaction of many components. In the event that the honesty and defensive capacity of the skin is broken, expansive amounts of various cell sorts will enter the injury and start a fiery reaction. This might be described by the exemplary indications of redness, torment, swelling, raised temperature and fever. This procedure eventually plans to reestablish homeostasis [1]. The potential for infection relies upon various patient factors, for example, the condition of hydration, diet and existing medical conditions and in addition extraneous variables, for instance identified with pre-operative, intra-operative and post-operative care if the patient has experienced surgery. This frequently makes it hard to foresee which wounds will become infected. Subsequently the avoidance of wound infection ought to be an essential administration objective for all medicinal services specialists [2]. The 2002 overview report by the Nosocomial Infection National Surveillance Service (NINSS), which covers the period between October 1997 and September 2001, showed that the frequency of hospital acquired infection identified with surgical injuries was as high as 10%. These infections muddle ailment, cause tension, increment tolerant distress and can prompt passing. The cost to the NHS is nearly £1 billion pounds for every annum [3]. Gathered data on the frequency of wound infections possibly underestimate the true incidence as most wound infections arise when the patient is discharged and these infections can be treated in the community without hospital notice. Infections of the surgical wound are a standout

amongst the most widely recognized HAIs and are a vital reason for horribleness and mortality. All surgical wounds are infected by microbes, nonetheless in most cases; infection does not improve as innate host defenses are quite efficient in the removal of contaminants.

A complex interplay between host, microbial and surgical features eventually determines the avoidance or creation of a wound infection. The postponement in recuperation and ensuing expanded length of doctor's facility stay additionally has financial outcomes. It has been assessed that every patient with a surgical site infection will require an extra 6.5 days in the hospital, which brings about the multiplying of healing center expenses related with that patient [4]. Surgical site infections are allied not only with increased morbidity, but also with substantial mortality. In a study, 77% of the deaths of surgical patients were related to surgical wound infection [5]. **Kirkland *et al.*** [6] calculated a relative risk of death of 2.2 attributable to surgical site infections, in comparison with matched surgical patients without infection.

The study was approved by the Ethics Board of Umm Alqura University.

Symptoms of Wound infection

The clinical presentation of wound infection contains fever, induration, erythema, edema, pain and a change in drainage to an infected nature. On the other hand, symptoms of infection in chronic wounds or drained patients might be more difficult to extricate. In these cases, diagnosis might depend on non-specific symptoms, for example, anxiety, disorder, or decrease in glycemic control in the diabetics. Most wound infections are caused by bacterial colonization, initiating either from the normal flora on the skin, or bacteria from other parts of the body or the outside environment. The

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most common infection-causing bacteria are *Staphylococcus aureus* and other types of staphylococci. Complications of wound infection may change in extend from nearby to foundational [7]. The most extreme nearby difficulty of a contaminated injury is slowed down injury recuperating, bringing about a non-mending wound. This frequently brings about huge torment, uneasiness and mental disservice for the patient. Foundational entanglements can incorporate cellulitis (bacterial disease of the dermal or subcutaneous layers of skin), osteomyelitis (bacterial contamination of the bone or bone marrow) or septicemia (bacterial nearness in the blood that can prompt an entire body incendiary state).

Table1. Diagnostic studies and risk factors of surgical wound infection

Diagnostic Studies	Risk Factors
Blood culture	Diabetes
Antimicrobial susceptibility	Malnutrition
Bacterial culture	Poor hygiene
Gram stain	Compromised or suppressed immune system
Fungal culture	Decreased mobility or immobility
	Obesity
	Poor circulation

Possible wound infection pathogens

The majority of micro-organisms is under than 0.1mm in distance across and can accordingly just be seen under a microscope. They can be arranged into various groups, such as bacteria, fungi, protozoa and viruses, depending on their structure and metabolic capabilities [8].

Protozoa

These are single celled organisms inside a fragile membrane and without a cell wall. They are most essentially connected with infected skin ulcers.

Fungi

These are made out of bigger more intricate cells than bacteria. They are either single-celled yeasts or multi- cellular organisms with a cores contained inside a cell tissue. Fungi can be in charge of shallow infections of the skin, nails and hair [9].

Bacteria

These are generally basic cells that can be additionally sorted by contrasts in their shape and cell wall. Cocci (round formed cells), bacilli (poles) and sprirochaetes (spirals) can be organized separately; however cocci and bacilli can likewise be found in sets, chains and unpredictable groups. They can be imagined utilizing a bacteriological recoloring process called Gram recoloring; after Gram recoloring, Gram-positive microscopic organisms are purple and Gram-negative microorganisms are red. Species that neglect to recolor with the Gram response, for example, Clostridia, require specific stains. The development and survival of all microorganisms are needy upon natural components, for instance strict aerobes require oxygen, while anaerobes are quickly executed by oxygen. It is imperative to note, notwithstanding, that the two aerobes and anaerobes can make due in closeness to each other and that some can get by in the two conditions by developing vigorously and afterward changing to anaerobic digestion without oxygen; these are known as facultative anaerobes [10].

Viruses

These are made out of genetic material (nucleic corrosive) encased inside a protein coat or a membranous envelope. In spite of the fact that infections don't for the most part cause wound contaminations, microscopic organisms can taint skin injuries framed throughout certain viral ailments. It is critical to recollect that distinctive micro-organisms can exist in polymicrobial groups and this is regularly the case inside the edges of a wound [11].

Table2. Models of possible wound infection pathogens

Gram-positive cocci	Beta Haemolytic Streptococci (Streptococcus pyogenes)* Enterococci (Enterococcus faecalis) Staphylococci (Staphylococcus aureus/MRSA)*
Fungi	Aspergillus Yeasts (Candida)
Gram-negative facultative rods	Enterobacter species Escherichia coli Klebsiella species Proteus species
Anaerobes	Bacteroides Clostridium
Gram-negative aerobic rods	Pseudomonas aeruginosa*

* Most common causative organisms associated with wound infections

Methicillin-resistant *Staphylococcus aureus*

Methicillin-resistant *Staphylococcus aureus* was first announced in the UK in the 1980s and

remains a reason for worry for all human services professionals. There are presently a wide range of strains of Methicillin-resistant *Staphylococcus aureus* influencing an expansive number of people in a wide range of medicinal services settings. How much individuals are influenced runs in seriousness from basic injury colonization, which should not be dealt with forcefully, to foundational disease, for example, bronchopneumonia, which may turn out to be lethal. Narrative confirmation recommends that methicillin-resistant *Staphylococcus aureus* is not any more pathogenic in an injury than the non-safe variant; notwithstanding, it is acknowledged that if an injury is tainted with methicillin-resistant *Staphylococcus aureus* it is hard to make do with antibiotics. When in doubt, professionals ought to take after the neighborhood convention for the administration of a wound colonized with methicillin-resistant *Staphylococcus aureus*, with continuous treatment in view of clinical signs.

Wound infection and improvement of infection

There are a number of ways in which micro-organisms can gain access to a wound:

- **Direct contact**: transfer from equipment or the hands of carers
- **Airborne dispersal**: micro-organisms deposited from the surrounding air
- **Self-contamination**: physical migration from the patient's skin or gastrointestinal tract

While there is no complete proof to recognize the most well-known course of section for a miniaturized scale creature into an injury, coordinate contact and poor hand-washing systems of social insurance experts amid pre-and operative periods of patient care are thought to be noteworthy components. The nearness of a miniaturized scale living being inside the edges of an injury does not show that injury contamination is inescapable [12]. Defensive colonization may have an influence whereby a few microorganisms create very particular proteins that murder or repress other, normally firmly related, bacterial species or where certain microbes deliver an assortment of metabolites and finished results that restrain the increase of other small scale life forms [13]. At last, improvement of a contamination will be affected to a great extent by the harmfulness of the life form and immunological status of the patient; for instance, patients considered most in danger are those being treated with long haul steroids and those getting chemotherapy. Harmfulness portrays both the pathogenicity (Table 3) and obtrusiveness of the significant small scale creature. Various particular components have likewise been distinguished in connection to disease rates in surgical injuries [14]. These include:

- Presence of an existing chronic infection
- Time interval between skin preparation and surgery
- Nature of the invasive procedure - especially if involving the bowel
- Extent of tissue loss and/or trauma to tissues during surgery
- Adequacy of wound drainage
- Appropriate use of wound management materials.

Specific wound-related factors that may predispose to the development of an infection include:

- Poor application of the principles of asepsis at the time of wound dressing changes
- Presence of devitalised tissue within the wound margin - necrotic tissue or slough, particularly if over 50%
- Nature and prolonged presence of exudate not managed by a closed wound drainage system.

Table3. Pathogenic effects of virulent micro-organisms

Toxin production	Vigorous stimulation of immune cells
Superantigen production	Some species of micro-organisms such as the exotoxins of Staphylococcus and Streptococcus produce superantigens
Presence of biofilms	A microbial colony enclosed in an adhesive polysaccharide matrix that is usually attached to a wound surface [8]. Biofilms present in the form of a transparent sticky film covering the wound surface. Cells in biofilms exhibit a decreased sensitivity to host immunological defence mechanisms, decreased susceptibility to antimicrobial agents and increased virulence. They have also been implicated in persistent infections [15]
Superantigen release within the blood stream that initiates an uncontrolled proliferation of T cells	Stimulation of T (thymus maturing) cell subsets allowing the release of cytokines that initiate cell and tissue damage

On the off chance that, after cautious appraisal, it is obvious that the injury is tainted, it is vital to affirm this and distinguish the causative organism(s) and conceivable sensitivities to anti-microbials. Wound swabbing is the most widely recognized testing technique utilized all through the UK in spite of the fact that its clinical esteem has been addressed by various creators [16]. It has been recommended that normal swabbing, for example, at week by week interims or at the season of incessant dressing changes, is neither useful nor savvy [17]. In simply money related terms, a negative injury swab costs from £15 to £25 per swab - subordinate upon the wellbeing setting in which it has been gotten - and each asked for anti-infection affectability will cost an extra £5 per set per life form. Promote examinations include:

Serum examinations, these include little measures of blood being gotten from the patient to recognize lifted white cell tallies and raised levels of serum C-receptive protein (CRP), a protein ordinarily not found in the serum, but rather display in numerous intense fiery conditions with corruption. In any case, it ought to be recollected that the last is not analytic of a constant injury contamination [18]. Quantitative investigation (through injury biopsies), this can help with the acknowledgment of an expanded bacterial weight; in any case, this is not frequently embraced in the UK and past investigations have demonstrated that injuries can mend regardless of high bacterial numbers [19].

Treatment

Once a conclusion of wound infection has been affirmed and anti-infection sensitivities recognized, proper administration regimens ought to be considered, with a high need given to reducing the danger of cross infection. It is critical to regard the patient all in all and not the contamination alone, so administration procedures must be founded on information got from an all-encompassing evaluation of the necessities of the individual [20]. The principle treatment target will be to decrease instead of kill the bacterial weight inside the injury edges. Notwithstanding anti-microbial treatment, there are two fundamental generic groups of wound administration items that can possibly decrease the bacterial weight in the injury; these are compounds containing silver or iodine [21].

Antibiotic treatment

Antibiotics are chemical substances created by a micro-organism that have the volume, in weaken arrangements, to specifically hinder the development of or to execute other micro-organisms [8]. While it is presently, for the most part, acknowledged that foundational antibiotics are essential for the management of clinically infected wounds, the choice of antibiotic to be used is not always apparent. Only after a comprehensive assessment process including consideration of patient characteristics, the results of microbiological investigations and the identification of both the nature and location of the wound, can the most proper antibiotic be distinguished. The standard utilization of topical antibiotics is not advocated for colonized or infected wounds. What's more, a current methodical survey of antimicrobial operators has presumed that foundational or topical antimicrobials are not by and large showed for the administration of chronic wound infections [22]. In any case, there might be some incentives in the prophylactic utilization of topical antimicrobials for the underlying administration of intense cellulitus, while anticipating elucidation of anti-infection affectability and the foundation of a helpful regimen. Resistance to antibiotics has turned into a difficult issue as of late especially with the ascent of pandemic strains of methicillin-resistant Staphylococcus aureus. The overuse of broad-spectrum antibiotics will only serve to exacerbate the situation. It could accordingly be contended that all antibiotic utilize ought to be founded on known sensitivities.

Qualities of prophylactic antibiotics contain effectiveness against anticipated bacterial microorganisms most likely to cause infection (**Table 4),** good tissue penetration to reach wound involved, cost efficiency, and insignificant disturbance to intrinsic body flora (e.g. gut) [23].

Table4. References for Prophylactic Antibiotics as Specified by Probable Infective Microorganism Involved [24, 25].

Operation	Expected Pathogens	Recommended Antibiotic
Head and neck surgery	S aureus, streptococci, anaerobes and streptococci present in an oropharyngeal approach	Cefazolin 1-2 g
Appendectomy, biliary procedures	Gram-negative bacilli and anaerobes	Cefazolin 1-2 g
Obstetric and gynecological procedures	Gram-negative bacilli, enterococci, anaerobes, group B streptococci	Cefazolin 1-2 g
Gastroduodenal surgery	Gram-negative bacilli and streptococci	Cefazolin 1-2 g
Urology procedures	Gram-negative bacilli	Cefazolin 1-2 g
Colorectal surgery	Gram-negative bacilli and anaerobes	Cefotetan 1-2 g or cefoxitin 1-2 g plus oral neomycin 1 g and oral erythromycin 1 g (start 19 h preoperatively for 3 doses)
Orthopedic surgery (including prosthesis insertion), cardiac surgery, neurosurgery, breast surgery, noncardiac thoracic procedures	S aureus, coagulase-negative staphylococci	Cefazolin 1-2 g
Vascular surgery	S aureus, Staphylococcusepidermidis, gram-negative bacilli	Cefazolin 1-2 g

Surgical treatment

In spite of the fact that the objective of each specialist is to avert wound diseases, they will emerge. Treatment is individualized to the patient, the injury, and the idea of the contamination. The working specialist ought to be made mindful of the likelihood of contamination in the injury and decide the treatment for the injury. In a perfect world, surgical care should begin with fastidious detail to systems that keep the advancement of surgical site infections in any case. Preoperatively, consideration ought to be paid to factors like enhancement of patient status, appropriate asepsis, and surgical site planning. Intraoperatively, adherence to great essential surgical standards of negligible and fine tissue dismemberment, legitimate determination of suture materials, and appropriate injury conclusion is imperative. On the off chance that a surgical site infection sets in, the treatment frequently includes opening the injury, clearing discharge, and purging the injury. The more profound tissues are reviewed for trustworthiness and for a profound space disease or source. Dressing changes enable the tissues to pulverize, and the injury mends by auxiliary expectation more than half a month. Early/deferred conclusion of contaminated injuries is regularly connected with backslide of disease and wound dehiscence.

Recommendation for the avoidance of Surgical Site Infection (SSI)

•Accomplish intraoperative skin arrangement with a liquor based disinfectant specialist aside from this is contraindicated (solid proposal; great proof).

•The utilization of plastic cement wraps with or without antimicrobial properties is redundant for the counteractive action of SSI. (frail proposal; high-to direct quality proof).

•Implement perioperative glycemic control, and utilize blood glucose target levels lower than 200 mg/dL in patients with and without diabetes (solid proposal; high-to direct quality proof).

•Application of a microbial sealant instantly after intraoperative skin planning is a bit much for the counteractive action of SSI (powerless suggestion; low-quality proof).

•In perfect or clean-contaminted prosthetic joint arthroplasties, don't direct extra antimicrobial

prophylaxis measurements after the surgical entry point is shut in the OR, even within the sight of a drain (solid proposal; great proof).

CONCLUSION

Wound Infections are mutual and costly complications that increase morbidity and mortality in hospitalized patients, while not all surgical site infections may be avoided, investigation has established that a significant portion may be avoided by subsequent evidence-based infection control principles, for instance, tight glucose control in diabetic patients, timely prophylactic antibiotic administration, appropriate hair removal, and aseptic skin and surgical site preparation. Nonetheless, in order for avoidance strategies to be successful, a team approach within each facility is necessary to ensure that best practices are applied dependably.

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