INTRODUCTION AND AIM OF WORK

Wound infection is defined as the presence of purulent discharge in or exuding from the wound or spreading erythema indicative of cellutitis around the wound. It results from microbial contamination during or after surgical procedure *(Mac Lean et al., 1989)*.

The organisms that cause post operative wound infection are either of exogenous or endogenous origin. The exogenous organisms are those transmitted to the patient from the environment or by contact from health care workers and those are the most important in clean wound infection. The endogenous organisms causing wound infections are endogenous to the patient and already exit in or on the individual and they may include bacteria that acquired in hospital prior to surgery *(Ako et al., 1992)*.

Post-operative bacterial wound infection delays recovery and often increases the length of stay; may produce long lasting sequels and require extra resources for investigations, management and nursing care. There is also a cost to the community service and to the patient who can't return to work and may have to be readmitted to hospital for further surgical intervention *(Reilly et al., 2001)*.

There are multiple reasons for post-operative wound infection which have been validated and documented as risk factors. These factors are any recognized contribution to an increase in post operative wound infection and they include significantly lengthened duration of hospital stay ,diabetes mellitus (D.M.), emergency operation, operations achieved by young inexpert surgeons and long operating time *(Karim et al., 2000)*.

The most common organisms involved in post operative wound infection include *Staphylococcus aureus* (*Staph. aureus*), *Streptococcus faecalis (Strept. faecalis), Escherichia coli (E.coli), Klebsiella, Pseudomonas, Proteus, Bacteroid fragilis and anaerobic Streptococci* (*anaerobic Strept.*). ***(Mashita et al., 2001).***

Tracing the source of infection by surveillance of patient's personnel and hospital environment is highly efficient in reducing nosocomial infections including surgical wound infection ***(Delgado et al., 2001).***

Aim of work:

The present study aims at identifying the bacterial etiology of postoperative wound infection in various surgical words in Benha University Hospital and to trace the possible sources of these infections.

Surgical wound infection

Definition:

Wounds are breaks in the continuity of the soft parts of the body structure. Surgical incised wounds are clean wounds with minimal tissue damage sustained as a result of cut with knives ***(Rains and Richie, 1981)***.

Surgical site infection is a feared complication of any surgical procedure, despite clear progresses during the last decades. Many patients still suffer from surgical site infection and it has a huge impact for patients and public health. Thus its prevention must constitute a priority of nosocomial infection control in hospitals. Surgical site infections are the third most frequently hospital acquired infection and remain a substantial cause of morbidity and mortality among surgical patients ***(Geffers et al., 2001)***.

CLASSIFICATION:

According to **Kaul and Jewett, (1981)**, operations have been traditionally classified into four categories which have been internationally recognized.

1-Clean wounds: in which:

- No inflammation is encountered.
- No hollow viscus is entered. (i.e., respiratory, gastrointestinal, genitourinary tracts are not opened).
- No breaks in aseptic technique, examples for clean operations are herniorraphy, thyroidectomy, mastectomy and removal of varicose

veins. Clean wounds are elective, primary, closed, undrained wounds and usually heal with low incidence of complications.

2-Clean-contaminated wounds: in which one of the following occurred:

- A hollow viscus is opened but minimal manipulation of contents occurred.
- Minor break in aseptic technique occurred.
- Wounds are mechanically drained, as none perforated appendectomy, operations in the biliary tract in absence of infected bile and operations in the urinary tract in absence of infected urine.

3-Contaminated wounds: in which one of the following occurred:

- Hollow viscus was opened with gross spillage.
- Fresh traumatic wounds less than 4 hours.
- Operation in which a major break in aseptic technique occurs (e.g., open cardiac massage).As operations in which entrance of biliary tract, genitourinary tract occurred in presence of infected bile or infected urine respectively.

4-Dirty wounds: in which one of the following occurred:

- Perforated viscus was found.
- Pus is encountered.
- A traumatic wound untreated for not less than 4 hours, as operation for purulent peritonitis. In dirty wounds, infection and other complication are expected to develop and steps are usually taken to provide adequate drainage and minimize risk of invasive infection.

Cruse and Foord, (1987) reported that surgical staff readily agreed to this classification and it was widely accepted as standard classification of operative wounds. However, this classification has not proved to be useful in predicting the occurrence of wound infection which is the key to effective prevention *(Greif et al., 2000)*.

Risk factors of surgical wound infection

There are many factors which affect the ability of the patient to resist bacterial contamination occurring during surgery. Extreme of age, obesity, malnutrition, D.M., cirrhosis, malignancy, steroid or cancer therapy, leucopenia or immunocompromising diseases as human immunodeficiency virus (HIV) infection, all reduce the patient ability to resist infection. ***(Yong et al., 2001)***.

Other factors known to affect adversely the incidence of infection include the length of operation, the use of blood supply and splenectomy ***(Scott et al., 2001)***.

The risk of infection was quantified further with the use of the National Nosocomial Infection Surveillance System (NNISS), a scoring system in which the patient's risk of infection was predicted on the basis of, the type of surgery, duration of surgery and the patient physical status rating on scale developed by The American Society of Anesthesiologists. For both scales higher scores indicate a greater risk of infection. ***(Knight et al., 2001).***

I-Preoperative risk factors:

A-Factors related to the patient:

Extremes of age carry higher risk for developing surgical wound infection i.e., neonates and elderly. The increased risk in neonate is due to the inadequate development of their immune system and elderly due to progressive decline in immunocomptence ***(Nicolle et al., 1992; Geffers et al., 2001)***

Obesity is associated with increase risk of postoperative infection and is considered to be an important risk factor due to poor blood supply of large reservoir of subcutaneous adipose tissue *(Rios, 2001)*.

Karim et al.,(2000) reported that patients with chronic debilitating diseases such as D.M have higher incidence of wound infection than non diabetic .Other medical disorders include malignancy, chronic liver disease, chronic obstructive lung disease, cardiovascular disease, hypogammaglobulineamia, deficient cellular or humoral immunity or local skin infection are also associated with higher incidence of wound infection .

Patients with chronic renal failure and uremia have impaired host defense and delayed wound healing that can lead to an increased risk of infection in addition to a frequent need for surgical procedures with synthetic grafts and catheters *(Cheung and Wong, 2001)*.

There is increase in post operative wound infection in patients taking corticosteroids, the explanation is that corticosteroids impair the host defense mechanism due to depression of antibody formation and diminished phagocytic capacity of leucocytes and suppression of capillary formation and fibrogenesis (***Karim et al., 2000)***.

Inadequacy of tissue blood supply plays an important role in the development of post operative wound infection .So the parts of the body which have rich blood supply are the least vulnerable to develop

surgical wound infection i.e., the facial wounds are less prone to infection than the upper extremity wounds which in turn are less prone to infection than the lower extremity wounds. The inadequacy of blood supply leads to devaflalization of tissue which serves as an ideal medium for bacterial growth ***(Kurz et al., 1996)***.

Smoking has been associated with a lower production of collagen and a higher incidence of post operative complication including wound infection ***(Jorgensen et al., 1998)***.

Karim et al., (2000) reported that emergency operation were associated with a significantly higher incidence of infection.

B-Preoperative inadequacy of medical care: It includes improper treatment of skin infections which lead to increase the risk of surgical wound infection and improper timing of shaving. If shaving occurs at the night of the operation it will lead to bruises at this site and give chance for bacterial colonization .So proper shaving must occur in the operating theatre ***(McCray et al., 1986)***

The indiscriminate use of antibiotic leads to the emergence of drug resistant strains of bacteria and increases the risk of post operative infection ***(Scott et al., 2001)***.

C-Preoperative environmental conditions:

The preoperative environmental conditions is due to prolonged preoperative hospitalization which is associated with increase risk of surgical wound infection due to colonization of the patient by more virulent antibiotic resistant hospital strains of bacteria, ***(Benett et al.,1999)***.

II-Operative risk factors:

A-Factors related to the patients:

1-Allogenic blood transfusion:

Postoperative infections appear to be related to the transfusion of allogenic blood as opposed to autologous blood. ***(Trilizi et al., 1992; Vignali et al., 1996)***. Leukocytes are present in all blood components and they are unintentionally transfused along with intended product and the immune suppressive effect of transfusion is mediated by leukocytes as when leukocyte reduced blood was transfused, infection rates fall (***Jensen et al., 1996)***

2-Patient hypothermia:

Kunz et al., (1996) reported that, intraoperative hypothermia was shown to increase the incidence of surgical wound infection and prolong hospitalization as compared with normothermia. Hypothermia delays wound healing by triggering thermoregulatory vasoconstriction which decreases subcutaneous oxygen tension. Reduced levels of oxygen in tissue impair oxidative killing by neutrophils and decrease the strength of the wound healing by reducing the deposition of collagen.

B-Surgical procedure risk factors:

1-The duration of surgical procedure:

The duration of operative procedure did significantly affect the frequency of infection in surgical wounds (***Roth et al., 1986).***

Greif et al., (2000) reported that the duration of surgery is one of the factors that have a proven influence on the frequency of wound infection.

2-Length of surgical incision:

The longer the surgical incision, the more delayed wound healing and more liability to sepsis ***(Walter and Israel, 1984)***

3-Use of drains:

The use of drains had a significant negative impact on the clean wound infection rate as it is generally accepted that wound drains provide access for bacterial entry via colonization and hands. Drains should not be used as alternative to good hemostasis, but if essential the closed system of wound drains is preferred. Open wound drains are not considered appropriate and lead to an increase in wound infection. ***(Mead et al., 1986)***

4-Unexperienced surgeons:

Wurtz et al., (2001) stated that new experienced surgeons had higher surgical site infection rates than their experienced colleagues until they gain experience.

Etiology of surgical wound infections

1-The sources of surgical wound infections:

Ako et al., (1992) reported that organisms that cause postoperative wound infection are either of endogenous or exogenous sources.

1-Endogenous sources of infection:

Endogenous infections are often the results of surgical manipulation and improper chemotherapeutic treatment and diagnostic or therapeutic procedures. The highest frequency of wound infection reported in gastrointestinal tract surgeries are due to contamination from gut contents *(Nishith and Kosloske, 1990)*.

E.coli is a universal commensal of the bowel and present in about one third of all specimens of faeces. It is probable that a considerable frequency of wound infections caused by this organism as a result of true autoinfection. *(Johnson, 1991)*.

E.coli is considered as a non pathogenic or an opportunistic pathogen. However if *E.coli* is displaced into the genitourinary tract it finds itself in a new environment and therefore it becomes highly pathogenic depending on the site of infection and the immunological response of the patient *(Gabriel and Michael, 1997)*.

Endogenous infection is developed by organisms that already exit in or on the individual and may include bacteria acquired in hospital prior to surgery and these organisms are of low virulence and are recognized as members of ones own microbial flora as they are carried by the patient in his nose or distributed on his skin e.g., *Staph. aureus* or may be carried in his bowel *(Kluytmans, 1998)*.

2-Exogenous sources of infection:

Exogenous infections are those caused by organisms derived either from the environment or from other patients in the ward, medical staff nursing, workers and visitors as they may carry organisms in one or more of the following sites, the nose, the perineum, infected lesion and on the hands. So the patient in the ward can give organisms to the environment and also can acquire organisms from those present in the environment *(Sartor et al., 1995)*.

II-Mode of transmission of surgical wound infection:

Organisms causing surgical wound infection can be transmitted either directly or indirectly. (***Walter and Israel, 1984***) Direct transmission of infection occurs via direct physical contact with hospital personnel and patients that remain a major mode of transmission of infection. When a surgeon removes a dressing from contaminated wound it could accidentally contaminate his hands with infectious microorganisms and transfers them to other patients. Direct infection may also occur from bedding as bed sheets and blankets are usually heavily contaminated with *Staphylococci* due to friction between their surfaces and the bodies of the patients and lastly direct infection may occur via touching contaminated objects as towels, wound dressing or clothes ***(Kallen et al., 2000)***.

Indirect infection may occur during surgery as a result of using poorly sterilized instruments, sutures, sponges and irrigating solutions. Presence of foreign materials in a wound significantly enhances the susceptibility to infection. Also contaminated or improperly sterilized surgical cystoscopies and endoscopies are important modes of infection transmission ***(Pollack et al., 2000)***.