Correlation of Postoperative Wound Infection with Intraoperative Culture Results and Duration of Operation

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ABSTRACT:

OBJECTIVES:

To show the correlation of postoperative wound infection with intraoperative culture results and duration of operation.

METHODS:

Prospective studies of 168 randomized patients in which a wound swab was taken at wound closure and send for culture results, another swab taken if the wound become infected 5-7 days postoperative and send for culture to show the correlation of postoperative wound infection with intraoperative culture results in al-NAJAF teaching hospital from Jan.2003 to Jan.2004. Wounds are classified in to clean, contaminated and dirty surgery.

RESULTS:

In clean surgery the contamination rate was 7.4% and infection rate was 3.7 %, while in contaminated surgery the contamination rate was 27.7% and infection rate was 11%, while in dirty surgery the contamination rate was 35.9% and the infection rate was 25.6%. The results were compared with other studies of the world. Pseudomonas aeruginosa and S. aureus are the most common microorganisms to produce wound infection which are a serious microbe and are mostly hospital acquired and resistant to most of the commonly available antibiotics. As regards to relation of postoperative wound infection and duration of operation our results shows that long operations has a higher infection rate (more than 1 hour was 65.4% from the total cases) while the infection rate in surgical operations less than 1 hour was 34.6%,so infection rate is doubled by operations lasting more than one hour.

CONCLUSION:

The study showed a higher infection rate in clean surgery due to weak sterilization and poor preoperative preparation of the patients and the role of postoperative antibiotics in reduction of wound infection by about 38%.

KEY WORDS: Postoperative wound infection, Swab culture, Duration of operation.

INTRODUCTION:

Infection is a dynamic process involving invasion of the body by pathogenic microorganism and reaction of tissues to organisms and their toxins [1].

Infection stills a challenge for a large number of surgical procedures that not only increased morbidity but also a significant mortality. The cost of care postoperative wound infection alone in the United States is about several billion dollars a year and for any given type of operation , the development of wound infection will approximately double the cost of hospitalization, increases the need for antibiotics and re-operation[2].

Causes of Wound Infection [3]: It is a complex process but generally it depends on important factors that can be emphasized:

A) Bacterial factor such as the number microorganism in the wound and the toxins produced by these microorganisms and the organism's ability to resist phagocytosis and intracellular destruction e.g. the capsule of klebsiella and streptococcus pneumonia[3].

B) Local wound infection: Inhibition of local defenses mechanisms for cleaning bacteria is perhaps the most important cause of wound infection. Any thing that interferes with ability of phagocytic cells to contact directly and kill bacteria potentiates wound infection. the use of foreign bodies include sutures, drains, lack of accurate approximation of tissue, presence of dead tissue, heamatoma or seroma all increases the risk of infection. [3]

C) Patient factors: Wound infections are more common in the very young and the very old, perhaps because of immature or senescent resistance mechanism. Any things that reduce blood flow systematically or locally increase the incidence of infection. Decreased tissue oxygen tension increases the incidence of and severity of infection. Conditions that reduce vascular reactivity as in uremia, old age, high dose steroids also increase rate of wound infection, diabetes mellitus, morbid obesity, cancer and infections at other sides also increase risk of wound infection. [3]

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Wound contamination:

When wounds are stratified on the basis of contamination, a differential infection rate is obvious, as shown in Table 1. This is due to the effect that the number of contaminating bacteria has on the development of infection, e.g. approximately six million Staphylococcus pyogenes must be injected intradermally to produce a pustule in healthy subjects. [4]Although overall wound infection rates vary considerably, the clean-wound infection rate is relatively stable, and provides a useful benchmark for determining the effects of infection control interventions. [4]

Table (1) Classification of surgical wounds according to the degree of wound contamination*

Type	Definition
Clean	Non traumatic, asepsis maintained respiratory or GIT not entered.
Contaminated	GIT or respiratory tract entered without Significant spillage oropharynx , vagina, or Non infected Genitourinary or biliary tract Entered .
Dirty or infected	Traumatic wounds, Gross spillage from GIT. Entrance into genitourinary or biliary tracts in presence of infected urine or bile.

*National Research Council Classification of Operative Wounds [2]

Normal skin flora

The skin carries several types of microbes, some of which are pathogenic. Hand microbes can be classified as either resident or transient.

Resident flora (also called colonizing flora) are those organisms which can be persistently isolated from the hands of most people. They are not readily removed by mechanical friction, and have adapted to life on the relatively inhospitable surface of the skin. They include:

- Coagulase-negative staphylococci
- Corynebacterium (diptheroids or coryneforms)
- Proprionibacterium
- Acinetobacter species

Transient flora (Also called contaminating or noncolonizing flora) can be isolated from the skin, but are not consistently present in the majority of people. These organisms can be readily transmitted unless removed by washing. They include many of the microbes encountered by health care workers, including methicillin-resistant Staphylococcus aureus (MRSA). They may be acquired by contact with contaminated objects, or the patient's skin or body substances. [4]

MATERIALS AND METHODS:

A randomized 168 patients were selected in our study from January 2003 to January 2004 with age range (10- years – 80 years) who underwent surgery for different pathologies in AL-Najaf teaching hospital excluding traumatic cases.

All patients have no medical diseases that increase the risk of wound infection like diabetes mellitus, patients on steroids, jaundice, uremia and cancer patients. In all those patients a wound swab was taken at the end of the operation (intraoperative) and sends for microscopical examination and culture and sensitive tests. Another swab from the same wound was taken 5-7 days post operatively for wound that shows signs of wound infection and sends again for microscopically examination and culture and sensitivity tests, the results were compared with the results of the previous test.

We categories our patients into 3 groups according to the well – known classification clean, contaminated and infected or dirty as shown in table 1. Our inquiry form include name, age ,sex, address , type of surgery, date of surgery, duration of operation and closure swab results and infected wound swab result post operatively .

All patients had been given postoperative antibiotics as a routine.

RESULTS:

From January 2003 to January 2004 , 168 randomized patients underwent different type of abdominal surgery were studied 100 male and 68 female with male to female ratio 1.47 : 1 aged between 10 year – 80 year as show in table 2.

Table 2: The distribution of patients according to the sex and disease.

Disease	Male	Female	Total
Clean	27	27	54
Contaminated	23	13	36
Dirty	58	20	78
Total	108	60	168

In our study form the 168 patients 54 patients underwent clean surgery with 50 patients had negative swab results and 4 positive results with wound contaminating rate 7.4%. Two patient had staphylococcus albus and the other 2 had coagulase positive staphylococcus aureus, 5-7 days later 2 has no infection and the other 2 has positive swab for staphylococcus aurous with an infection rate 3.7 % as shown in the table (3) .

Table (3): Shows the contamination and infection rates in clean surgery

	Intra operative swab Contaminated	Postoperative swab Infected
CLEAN SURGERY n=54	4 (7.4%)	2 (3.7%)

As regard to the contaminated surgery 36 patients was underwent abdominal surgery, 10 of them shows positive swab at the time of surgery with contamination rate of 27 % , form those patients 6 has no infection 5-7 days later while 4 patient show infection with streptococci and E.coli with infection rate of 11% as shown in table(4) .

Table (4): shows the contamination and infection rates in contaminated surgery

	Intra operative swab Contaminated	Postoperative swab Infected
CONTAMINATED SURGERY n=36	10 (27.7%)	4 (11%)

As regard to the dirty or infected surgery 78 patients underwent abdominal surgery from them 28 patients had positive culture intraoperatively with contamination rate of 35.9%, the second swab was taken 5-7 day later, 20 patients has positive culture result 7 patients was pseudomonas, 4 cases was proteus mirabilis, 4 was E.coli, 1 entercocci, 1 with staphylococcus aureus and 3 was mixed infection with klebsiella and proteus. The other 8 patients had negative culture; the infection rate was 25.6% as in table (5).

Table (5) shows the contamination and infection rates in dirty or infected surgery

	Intra operative swab Contaminated	Postoperative swab Infected
DIRTY OR INFECTED SURGERY n=78	28 (35.9%)	20 (25.6%)

In our study almost in all patients the skin was prepared by povidine iodine 10% and no preoperative antibiotics was used.

As regard to the duration of operation 70 cases were more than 1 hour duration with ratio of (41.6%), 51 cases between 30 minute and 1 hour (30.4 %) while 47 cases were less than 30 minute duration (28%).

From our 26 patients with postoperative wound infection 17 cases had more than one hour duration of operation with infection rate of 65.4%, 7 cases was between 30 minute and 1 hour with infection rate of 26.9%, 2 cases with operation time of less than 30 minute with infection rate of 7.7% as shown in table (6).

In our study the microorganisms isolated were as follow; In clean surgery the contaminating microorganisms was 2 staphylococcus albus and 2 staphylococcus aureus, in contaminated surgery the contaminating microorganism was E.coli in 6 cases, 2 case with streptococci and the other 2 with staphylococcus aureus. While in dirty surgery the contaminating microorganisms was 8 patients was pseudomonas ,5 cases with proteus mirabilis, 5 was

E. coli , 2 entercocci, 3 with staphylococcus aureus, 3 was mixed infection with klebsiella and proteus mirabilis and 2 with Enterobacter species as shown in table (7). As regard to the infecting microorganism isolated was the following:
In clean surgery the infecting microorganisms was staphylococcus aureus in 2 cases, in contaminated surgery the infecting microorganism was S. aureus (2 cases) and E.coli (2 cases), While in dirty surgery the infecting microorganisms was 7 patients was pseudomonas aeruginosa,4 cases with proteus mirabilis, 4 was E.coli, 1 entercocci, 2 with staphylococcus aureus, 2 was mixed infection with klebsiella and proteus mirabilis as shown in table (8).

Table (6) : Shows classification of wounds according to the duration of operation and their infection rates.

DURATION OF OPERATION	Total cases	Infected wounds	Infection rate %
More than 1 hour	70	17	65.4
30 minute-1 hour	51	7	26.9
Less than 30 minute	47	2	7.7

chi square =8.86 df=2 *P<0.05

Table (7): Shows the different types of microbes isolated at the end of surgical operations in different types of surgery.

Contaminating microorganism	Clean	Contaminated	Dirty or infected	TOTAL (%)
S. albus	2	0	0	2 (4.7%)
S. aureus	2	2	3	7 (16.6%)
E. coli	0	6	5	11 (26.2%)
Streplococci	0	2	0	2(4.7%)
P. aeruginosa	0	0	8	8 (19.2%)
Proteus mirabilis	0	0	5	5 (12%)
Enterococci	0	0	2	2(4.7%)
Enterobacter species	0	0	3	3 (7.2%)
Klebsiella and proteus mirabilis	0	0	2	2(4.7%)
Total cases	4	10	28	42 (100%)

*P<0.05

Table (8): shows the different types of microbes isolated from infected wounds in different types of surgery.

Infecting microorganism	Clean	Contaminated	Dirty or infected	Total
S.aureus	2	2	2	6 (23.1%)
E.coli	0	2	4	6 (23.1%)
P.aeruginosa	0	0	7	7 (27%)
proteus mirabilis	0	0	4	4 (15.4%)
Enterococci	0	0	1	1 (3.8%)
Klebsiella and proteus mirabilis	0	0	2	2 (7.6%)
Total cases	2	4	20	26 (100%)

*P<0.05

DISCUSSION:

Post-operative wound infection delays recovery and often increases length of hospital stay and may produce lasting sequelae and require extra resources for investigations, management and nursing care. Therefore, its prevention or reduction is relevant to quality patient care [5]. Our study concern with the relation of postoperative wound infection with intraoperative swab. In clean surgery our study showed contamination with one of the normal residents of skin (S .albus) which is cured by giving postoperative antibiotics and contamination with S. aureus which could be transient flora from the patient skin or transmitted from the operating staff in spite of antibiotics (+ve) culture was isolated 5 days later with infection rate of 3.7% which is higher than other studies of the world 1-2%. [6] Cruse et al record a clean-wound infection rate of 2.5%. [7] In contaminated surgery 10 patients shows contaminated wounds mostly with GIT microorganisms, 6 cases with E.coli, 2 with streptococci and 2 with S. aureus. with contamination rate of 27% after giving antibiotics 6 of them had (-ve) culture result while 4 had infection with E.coli and S. aureus with infection

rate 11% which is similar to other studies of the world 10-20 %.[8] Evans RS[9], shows infection rate of clean contaminated surgery between 7.7%-15.2% which is comparable to our study. In dirty or infected surgery 14 case had a contaminated wounds 8 of them was with P.aeruginosa,5 cases with proteus mirabilis, 5 with E.coli, 2 with Enterococci, 3 with S. aureus, 3 enterbacter species and 2 with klebsiella and proteus mirabilis with contamination rate of 35.9%, after treatment with broad spectrum antibiotics, 7 was infected with P.aeruginosa,4 cases with proteus mirabilis, 4 with E.coli, 1 with Enterococci, 2 with S. aureus and 2 with klebsiella and proteus mirabilis with infection rate of 25.6% which was less than infection rate of other studies of the world 40%[10]. Weiss CA et al 1999 [11] shows infection rate for dirty surgery between 10-40% which is comparable with our study.

Table (9) shows comparison between our study, Culver DH[12]and NNIS system[13]study .

Microorganism	Our study	Culver DH[12]	NNIS system[13]
S.aureus	23 %	17%	20%
P.aeruginosa	27%	8%	8%
E.coli	23%	10%	8%
proteus mirabilis	15.4%	4%	3%
klebsiella and proteus mirabilis	7.7%	7%	3%
Enterococci	3.8%	13%	12%
Candida species	0	2%	3%
Coagulase-negative staphylococci	0	12%	14%
Enterobacter species	0	8%	7%

From these results Pseudomonas aeruginosa and S. aureus are the most common microorganisms to produce wound infection which are a serious microbe and are mostly hospital acquired and resistant to most of the commonly available antibiotics. While in Culver DH, Horan TC and NNIS system (1996)[13] S. aureus and entercocci are the most common microbes probably due to the less common use of antibiotics routinely postoperatively table(9). From our study the contamination rate was 25% (42/168) while other studies done in king Saudi university [14] shows contamination rate of 17%, this is probably because of weak sterilization methods and poor preoperative preparation of our patients. The ratio of infection rate(26/168=15.5%) to contamination rate 15.5% /25% is 0.62 which means that postoperative antibiotics plays a very important role in reduction of wound infection. As regards to relation of postoperative wound infection and duration of operation our results shows that long operations has a higher infection rate (more than 1 hour was 65.4% from the total cases) while the infection rate in surgical operations less than 1 hour was 34.6%,so infection rate is doubled by operations lasting more than one hour**.**

CONCLUSION:

From studying the correlation between postoperative wound infection and intraoperative wound swab the following points can be concluded: **1-** The higher contamination rate in all kinds of surgery in the teaching hospital contributes largely to the weak sterilization and poor preoperative preparation of the patients.

2- The appearance of S. aureus as the most common microbe that affect clean and clean-contaminated surgery which is a transient skin microbe and mostly hospital acquired means that good skin preparation of the patient is mandatory and adequate hand washing facilities should be present for the medical staff.

3- Postoperative antibiotics play a very important role in reduction of wound infection by about 38%.

4- Decreasing operative time to less than 1 hour decrease infection rate by about the double.

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