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The Role of Prophylactic and Extended Antibiotic in Patient with Inguinal Hernia Treated with Mesh Repair or Non Mesh Repair

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Abstract: **OBJECTIVE :** We have conduct a prospective study to evaluate the use of antibiotic prophylaxis or extended in preventing or reducing post-operative wound infection in patients with open inguinal hernia surgery repaired with mesh or without mesh. **PATIENT AND METHODS**: A prospective study on 92 patients with inguinal hernia surgery collected in the department of general surgery at AL-Mousl and AL- Yarmouk Teaching Hospitals during the Period January 2009_ January 2011, where they divided into two groups: The first group (47 patients): were treated with mesh repair and 24 given a prophylactic antibiotic in the form of single dose of Ampicolx 500 mg intravenously at the time of induction of anaesthesia, and 23 treated with extended antibiotic for 7 days. The second group (45 patients): were treated with non mesh repair and 23 given a prophylactic antibiotic in the form of single dose of Ampiclox 500mg at time of induction of anesthesia, and 22 treated with extended antibiotic for 7 days. Follow up of the patients for 30 days postoperatively was carried Out. Swabs for culture and sensitivity were taken from the wound when signs of wound infection appear. **RESULTS:** The result was that the incidence of wound infection with the use of prophylactic antibiotic is less than the extended regime although there is no big difference (2.2% versus 4.4), while the incidence of wound infection with mesh or non mesh repair is (4.2% versus 2.2%). **CONCLUSION:** we can conclude that the use of extended antibiotic in inguinal hernia surgery has very little if any influence on the wound infection.

Keywords: Prophylactic, Extended Antibiotic, Inguinal Hernia.

INTRODUCTION

Hernia repair is one of the most common elective general surgical procedures performed worldwide. In the United States and Europe alone, more than a million inguinal hernia repairs are performed annually (Rutkow, I.M, 2003).

Since the classic paper by Bassini in 1890, which described the re-approximation of the internal oblique, transversus abdominis muscles and transversalis fascia to the shelving portion of Poupart,s ligament, more than 80 operative techniques have been described for inguinal herniorrhaphy (Millikan, K.W. *et al*., 1996).

Each of these techniques can be performed under general, regional or local anaesthesia. The outcome of hernia surgery is to a large extent a surgeon dependent one (Eubanks, S, 1997).

Lichtenstein "American Surgeon, from California institute" introduced the concept of tension free hernioplasty in repair of groin hernias. He used prolene monofilament and operation was done under local anesthesia (Lichtenstein, I.L. *et al*., 1989).

The material that has emerged as suitable for routine use in hernia surgery that have classic ideal characteristic include polypropylene (monofilament prolene or poly filament) Dacron and polytetrafluoroethylene (PTFE). Absorbable prosthesis such as those made of polyglactin are not durable and have no place in inguinal hernia surgery.(Brunicardi, F. *et al*., 2005) The classic ideal characteristic of prosthesis are; (Irving, L, 1986) :

1 - It is not modified physically by tissue fluid.
2 - It is chemically inert.
3 - It dose not cause inflammation or foreign body reaction.
4 - It is not carcinogenic.
5 - It dose not cause an allergic or hypersensitivity response.
6 - It is resistant to mechanical strain.
7 - It is easily sterilized.

The newer biological prosthesis made of human Cadaver skin, porcine, cross-linked dermal collagen, or porcine small intestinal submucosa are more expensive and have no advantage over synthetic material for an uncomplicated hernia repair. (Cappozi, J.A. *et al*., 1998).

Wound infection is the most common problem that occurs postoperatively as it becomes apparent from 3-7 days following surgery but sometimes up to 30 days postoperatively (Richard, J, 1999). Although open inguinal hernia repair is regarded as ‘’clean’’ surgery some surgeons tend to give antibiotics to their patients with such operation postoperatively for the following reasons (Salam M, M; Richard, J, 1999):

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1. The presence of carriers in the theatre and the ward that are not identified and this may increase the rate of infection.
2. Fear from cross infection from other patients with septic conditions.
3. Operation upon patient who had multiple risk factors such as obesity, diabetes mellitus, renal failure or skin infection in the groin region (Salam M, M, 1994).

Other surgeons consider hernia surgery as clean one and the Presence of risk factors doesn't greatly influence the rate of postoperative wound infection and so they don't give any antibiotic to their patients (Salam M, M, 1994).

Surgical wound are classified into the following (Russell, R.C.G. *et al*., 2010):
1- Clean wound (class 1): wounds with no entry into gastrointestinal, genitourinary, and respiratory system like hernia repair, thyroid and some types of breast surgery, and the infection rate at surgical site is 1- 2%.
2- Clean contaminated wounds (class 2): entry to gastrointestinal or respiratory tracts with no spillage of their contents as cholecystectomy and elective gastrointestinal surgery, and the infection rate is <10%.
3- Contaminated wounds (class 3): there is gross spillage from hollow viscus or acute inflammation (without pus formation) at time of operation like penetrating abdominal injury, enterotomy during bowel obstruction, and the infection rate is 15-20%.
4- Dirty wounds (class 4): gross pus is encountered at operation as in perforated appendicitis and diverticulitis with intraperitoneal abscess collection, and the infection rate is <40%.

The sources of wound infection are (Russell, R.C.G. *et al*., 2010):
1. Primary: acquired from a community or endogenous source such as that following a perforated peptic ulcer.
2. Secondary or exogenous: acquired from the operating theatre (such as inadequate air filtration) or the ward (such as poor hand washing compliance) or from contamination at or after surgery (such as an anastomotic leak).

Wound infections were categorized as superficial incisional surgical site infection and deep surgical site infection (DSSI), according to the latest definitions of the Centers for Disease Control (Richard, J. *et al*., 1999).

*Superficial incisional surgical site infection was defined as an infection occurring within 30 days after operation involving only the skin or subcutaneous tissue.
* Deep Surgical Site Infection (DSSI) was defined as an infection involving fascial and muscle layers and also the graft(Richard, J. *et al*., 1999).

Risk factors for surgical site infection(Richard, J. *et al*., 1999):
Patient related factors:

- Extremes of age
- Poor nutritional state
- Obesity
- Diabetes mellitus
- Smoking
- Coexisting infections at other sites
- Bacterial colonisation, e.g. nasal colonisation with *Staphylococcus aureus*
- Immunosuppression
- Prolonged post-operative stay

Operation related factors:

- Length of surgical scrub
- Length of operation
- Operating theatre ventilation
- Inadequate instrument sterilization
- Foreign material in surgical site
- Surgical drains
- Surgical technique including haemostasis, poor closure, tissue trauma
- Post-operative hypothermia

If empirical antibiotics are given, they should be used when local wound defences are not established (the decisive period, it is the time when the invading bacteria may become established in the tissues) (Russell, R.C.G. *et al*., 2010).

Ideally, maximum blood and local tissue levels should be present at the time at which the first incision is made and before contamination occur (Russell, R.C.G. *et al*., 2010). Intravenous administration of prophylactic antibiotics at induction of anesthesia is optimal (Russell, R.C.G. *et al*., 2010). In long operation, in insertion of prosthesis, when excessive blood loss, or when unexpected contamination occurs, antibiotics may be repeated 8 and 16 hours later. The choice of antibiotic depends on the expected spectrum of organisms likely to be encountered, the cost and local hospital policies. The use of the newer, broad spectrum antibiotics in prophylaxis should be avoided.(Russell, R.C.G. *et al*., 2010)

Goals of Antibiotic Prophylaxis

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The goals of prophylactic administration of antibiotics to surgical patients are to(AHFS, 2002):

- reduce the incidence of surgical site infection
- use antibiotics in a manner that is supported by evidence of effectiveness
- minimize the effect of antibiotics on the patient's normal bacterial flora
- minimize adverse effects
- cause minimal change to the patient's host defences.

An Appropriate Prophylactic Antibiotic Should (Hill, C. *et al*., 1981)**:**
(1) Effective against microorganisms anticipated to cause infection.
(2) Achieve adequate local tissue levels.
(3) Cause minimal side effects.
(4) Be relatively inexpensive.
(5) Not be likely to select virulent organisms.

The Aim of the Study:
To evaluate and compare between prophylactic and extended antibiotic regime in patient with inguinal hernia surgery for incidence of postoperative infection and cost effectiveness.

PATIENT AND METHODS

From January 2019- to January 2021, a prospective study of 92 Patients of different age groups with inguinal hernia were candidate for elective surgery in the surgical unit of Baladroz hospitals. All patients underwent inguinal hernia surgery in the form of herniotomy alone, or herniotomy plus repair of posterior wall. Diabetic, immunosuppressed patients, or patient with hypersensitivity to penicillin was excluded from the study. The patients were divided into two groups: The first group (47 patients) were treated with mesh repair and 24 given a prophylactic antibiotic in the form of single dose of Cefotaxim vial 1g intravenously at the time of induction of anaesthesia, and 23 treated with extended antibiotic of Cefotaxim for 7 days.

The second group (45 patients): were treated with non mesh repair and 23 given a prophylactic antibiotic in the form of single dose of Cefotaxim vial 1g at time of induction of anesthesia, and 22 treated with extended antibiotic of Cefotaxim for 7 days.
Five patients had recurrent inguinal hernia, all them treated with mesh repair using the anterior approach and four of them treated with extended antibiotic and the fifth patient treated with prophylactic antibiotic.

All patients were discharged from hospital after 8-24 hours postoperatively. All wound dressing were inspected before discharge, and all incisions were carefully reexamined during first follow up visit at 7 days after the operation, during the second follow up visit 2 weeks after discharged, and 4 weeks after discharged.

Patients were instructed to attend for examination if any sign of infection appears in the wound after the 4th week.

In our study wound infection was defined on clinical criteria as:
1- Pain and erythema.
2- Swelling
3- A purulent wound discharge or wound abscess.
4- Breakdown or dehiscence with clinical evidence of infection.

Wound swabs were taken from those patients with infected wounds and send to laboratory for culture and sensitivity to identify the causative microorganism and appropriate antibiotic required.

RESULT

Ninety two patients recruited in the study between January 2019- to January 2021. The first group (47 patients): were treated with mesh repair and 24 given a prophylactic antibiotic in the form of single dose of Cefotaxim vial 1g intravenously at the time of induction of anaesthesia, and 23 treated with extended antibiotic of Cefotaxim for 7 days.

The second group (45 patients): were treated with non mesh repair and 23 given a prophylactic antibiotic in the form of single dose of Cefotaxim vial 1g at time of induction of anesthesia, and 22 treated with extended antibiotic of Cefotaxim for 7 days.

The demographic data, incidence of age, weight, sex, type of hernia, and type of operation performed are shown in table (1).

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Talbe 1: Demographic data

Parameters	Prophylactic Antibiotic group	Extended Antibiotic group
Age mean (years)	32.5	34.2
Weight mean (kg)	65	60
Sex: Male Female	 47 4	 40 1
Inguinal hernia Direct Indirect	 5 42	 4 41
Surgery		
Herniorrhaphy with mesh Herniorrhaphy by Darn Herniatom	24 18 5	23 19 3
Recurrent hernia	1	4

Table 2: Types of repair with regime of antibiotic and percent of patients

Type of repair	Regime of antibiotic	Number of patients	%
Mesh repair	Prophylactic Antibiotic	24	26.1
	Extended Antibiotic	23	25
Non Mesh repair	Prophylactic Antibiotic	23	25
	Extended Antibiotic	22	23.9

Table 3: Age distribution

Age(yr)	Number	%
10-20	14	15.2
20-30	21	22.8
30-40	37	40.2
40-50	16	17.3
50-60	4	4.3

The overall 92 patients, 2 developed wound infection in the first group and 1 developed infection in the second group.

The number of patients with infection in each group is shown in table (4).

Table 4: Total and infected patients with percentages

Type of repair	NO. of patients	Regime of antibiotic	Infected patients	%
Mesh repair	47	Prophylactic Antibiotic	1	4.2
		Extended Antibiotic	1	
Non Mesh repair	45	Prophylactic Antibiotic	0	2.2
		Extended Antibiotic	1	
Total	92		3	6.4

The details of these wound infections are shown in table (5).

Table 5: Criteria of wound infection

Infection criteria	Prophylactic Antibiotic	Extended Antibiotic	
Erythema and pain	1	1	2
Purulent wound discharge	0	1	1

The major pathogenic organism isolated from swab Culture from the infected wound was Staphyllococcus aureus in 2 patients and streptococcus pyrogenes in one patient as shown in table (6).

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Table 6: Bacteria isolated from wound infection

Bacteria	Prophylactic Antibiotic	Extended Antibiotic	Total
Staph. Aureus	1	1	2
Strep. Pyrogenes	0	1	1

DISCUSSION

Inguinal hernia is one of the most common procedures performed in general surgical ward and surgical repair is advised because of the danger of obstruction and strangulation (Brunicardi, F. *et al*., 2005).

Open inguinal hernia repair is regarded as clean surgery and it is not a normal practice in United Kingdom to administer prophylactic antibiotic in such operation (Brunicardi, F. *et al*., 2005; Kumur, S. *et al*., 1992).

It is well documented that prophylactic antibiotic coverage of most "clean-contaminated" surgical procedures (e.g., colorectal resection) can significantly prevent infectious complications, including wound infection, thereby affecting the overall rates of death and complications(AHFS, 2002).There is also no doubt that antibiotic prophylaxis is needed in selected "clean" surgical procedures where a prosthesis is implanted, because the consequences of a graft infection can be severe or even fatal(Hill, C. *et al*., 1981; Kaiser, A.B. *et al*., 1987).

However, the benefit of antibiotic prophylaxis in other "clean" surgical procedures, such as inguinal hernia surgery, has been considered questionable. The low rate of wound infections and the straightforward treatment if they occur at all are the main arguments against routine antibiotic coverage during inguinal hernia surgery (18).

A review of the experiences of institutions specifically studying infection rates in hernia operations showed figures ranging from 3.3% to 14%.(Lazorthes, F. *et al*., 1992; Santos, K.R. *et al*., 1997) Considering the frequency with which hernia operations are being performed, prevention of infection becomes important.

Platt and colleagues, reported wound infection rate dropped from 4.2% to 2.3% with use of prophylaxis.(Platt, R. *et al*., 1993)

Lazorthes and colleagues, documented a significant decrease from 4.5% to 0% (p _.03) in the wound infection rate with local antibiotic prophylaxis(Lazorthes, F. *et al*., 1992).

In our study, 92 patients contribute in the study and 3 patients developed wound infection, 2 patients who repaired with mesh and one of them treated with prophylactic antibiotic and the second treated with extended regime with incidence of wound infection of 4.2%, and 1patient who repaired without mesh and treated with extended antibiotic with incidence of wound infection of 2.2%.

To minimize wound infection we do the following:
1-Hair was removed by clipper
2- Skin sterilized by povidone iodin
3- Avoid excess cauterization.
4- Meticulous dissection.
5- Good handling of tissue.
6- Good haemostasis.

Our results show that the incidence of wound infection with the use of prophylactic antibiotic is less than the extended regime although there is no big difference (2.2% versus 4.4), while the incidence of wound infection with mesh or non mesh repair is (4.2% versus 2.2%), this may be because of the small sample in the study, so the use of prophylactic antibiotic is more benefit than the extended regime and at the same time, the cost effectiveness is significantly lower in comparing between single dose of antibiotic than multiple doses for a week, and also the use of mesh in the repair of inguinal hernia did not significantly increase the incidence of wound infection.

The choice of antibiotic should be broad spectrum and effective against contaminating or infecting microorganisms, and the timing of administration is important to achieve adequate concentration level at time of incision in blood and wound site and this level is maintained throughout the operation and should be available, least toxic and with reasonable price(AHFS, 2002).

The best time of administration of prophylactic antibiotic is at the time of induction of anesthesia and other one or two doses may be given per and post operatively depending on type and duration of operation and whether foreign body is used like in hernia repair with mesh to maintain adequate level of antibiotic in blood (Dole, W. *et al*., 2005).

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The use of Cefotaxim is an appropriate choice of antibiotic for this study, because it has good and appropriate pharmacokinetics and broad spectrum of activity against most Gram positive and Gram negative bacteria.

The use of antibiotic is associated with side effects like allergy, toxic reaction, overgrowth of resistant bacteria and the antibiotic when used for longer duration is less tolerable by the patients and its cost becomes more , for example : in United States , in excess of 20 billions $ is spend on antibiotic each year (Katzung, B.G, 2001).

The effectiveness of prophylactic antibiotic is largely reduced if given earlier than one hour before operation and wound infection is established during decisive period during which local wound defences are not yet activated (Dole, W. *et al*., 2005). Such type of infection may not disturb hospital bed occupancy or threaten the lives of the patients, but it ecessitate district nurse time, general practitioner consultation and considerable inconvenience for the patient who is unable to return to work (13).

CONCLUSION

1. Antibiotic prophylaxis is better than the extended regime in reducing wound infection.
2. Single dose of antibiotic reduce cost effectiveness than extended antibiotic.

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