INTRAINCISIONAL VERSUS INTRAVENOUS CEFOTAXIME IN OPEN APPENDICECTOMIES FOR PREVENTION OF SURGICAL SITE INFECTIONS: A RANDOMISED CONTROLLED TRIAL

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ABSTRACT

Introduction

Surgical site infection is one of the most common postoperative complications following abdominal surgeries. Whilst the use of prophylactic antibiotics has been shown to reduce postoperative wound infection, controversy remains as to the optimum route of administration and the duration of treatment.

Objective

To compare the efficacy of preoperative single dose of cefotaxime intraincisionally versus intravenously in preventing postoperative surgical site infections following open appendicectomies.

Methodology

Sixty cases diagnosed as uncomplicated appendicitis who consented for open appendicectomy in Jawaharlal Nehru Medical College and KLES Dr. Prabhakar Kore Hospital and MRC, Belgaum during the year 2012 were included in the study. Cases were randomized to 2 comparable groups of 30 patients each. Group A was given a single dose of Inj. Cefotaxime 1g intraincisionally and Group B was given a single dose of the same intravenously 30 minutes before the incision was made. Patients of both the groups were inspected on day 3, day 5 and day 7 following open appendicectomy and signs of surgical site infection if any, were recorded. Outcomes were tested for significance.

Results

All but one patient in Group A (96.7%) had an uneventful recovery 7 days following surgery whereas 4 out of 30 patients in Group B (13.3%) and a patient in Group A (3.3%) showed signs of postoperative surgical site infection ($p > 0.05$) in the follow up period of seven days which prolonged their hospital stay.

Conclusion

The use of preoperative intraincisional single dose cefotaxime has a clinically considerable reduced risk of postoperative surgical site infection when compared to the conventional intravenous antibiotic prophylaxis in clean and clean contaminated abdominal surgeries like open appendicectomy.

Keywords

Appendicitis; open appendicectomy; surgical site infection; antibiotic prophylaxis; cefotaxime; intraincisional; intravenous

LIST OF ABBREVIATIONS USED

ADP	-	Adenosine diphosphate
BP	-	Blood pressure
CVS	-	Cardiovascular system
CDC	-	Centre for Disease Control
cm	-	Centimeter
CNS	-	Central nervous system
DM	-	Diabetes mellitus
F	-	Female
HIV	-	Human immunodeficiency virus
HBsAg	-	Hepatitis B virus surface antigen
IP	-	In-patient
IM	-	Intramuscular
Inj	-	Injection
Intra-op	-	Intra-operative
IV	-	Intravenous
M	-	Male
mg/dl	-	Milligram per deciliter
MIC	-	Minimum Inhibitory Concentration
mL	-	Millilitre
mm	-	Millimeter
MRSA	-	Methicillin-resistant Staphylococcus aureus
n	-	Number of patients
NNIS	-	National nosocomial infection surveillance
PDGF	-	Platelet-derived growth factor

PMN	-	Polymorphonuclear neutrophils
POD	-	Post-operative Day
Pre-op	-	Pre operative
RS	-	Respiratory system
SSI	-	Surgical Site Infection
Temp	-	Temperature
USG	-	Ultrasonography
WBC	-	White blood cell
x^2	-	Chi square

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INTRODUCTION

Since the evolution of medicine, great strides have been taken in the field of advanced and minimal access surgeries. The focus is gradually shifting to day-care surgeries and surgeries with more cosmetically acceptable scars. However, despite the recent advances, one of the most commonly observed postoperative complication is surgical site infection (SSI).

According to the National Nosocomial Infection Surveillance (NNIS) report of the Centre for Disease Control (CDC), the prevalence rate of SSI, though preventable, is high.

Surgical site infections are one of the most common nosocomial infections and constitute 38% of all infections in surgical patients.[1] SSIs are infections present in any location along the surgical tract after a surgical procedure which may involve superficial tissues or deeper tissues or organ or intraabdominal spaces. Superficial incisional infections are the most common; they account for 60% to 80% of all SSIs and have a better prognosis than organ or space-related SSIs do.

Understandably, the Incidence of SSI is least in clean cases and highest in the contaminated wounds. However, majority of the general surgical procedures fall under the category of either clean or clean-contaminated. The incidence of SSI can be significantly reduced in the latter by proper use of antiseptic techniques and optimal antibiotic prophylaxis.

Postoperative wound infection causes morbidity like pain, anxiety, loss of function, scar contractions, increased incidence of incisional hernias and mortality secondary to sepsis. It also leads to increased hospital stay which further adds to the worry of both patient and the treating surgeon.

Adequate and optimal antibiotic prophylaxis, therefore, forms an important aspect in preventing SSI.

With the fear of a patient developing wound infection, surgeons usually burden the patient with higher antibiotics, even in clean and uncontaminated surgeries which is certainly not justifiable especially in the wake of new drug resistant microorganisms. Prolonged use of antibiotics also adds to the cost incurred by the patient and various side effects such as nausea, vomiting, metallic taste, loose stools, etc.

Hence, the timing, route and duration of antibiotic prophylaxis in surgery assume significant importance in that they should ensure that as high a concentration as possible reaches the wound before contamination as the most important factor in the pathogenesis of wound sepsis is the presence of bacteria in the incision at the time of closure.

Local intraincisional administration of antibiotics is sensible, practical, and in this era of cost containment and increasing drug resistance, it is responsible.

Acute appendicitis is one of the commonest causes of an abdominal emergency and accounts for approximately 1% of all surgical operations and

remains one of the most common surgical emergencies encountered in day-to-day practice.[2]

Conservative treatment with antibiotics and surgery are available options for appendicitis. Despite few studies supporting antibiotics as the primary treatment, appendicectomy remains the treatment of choice in uncomplicated appendicitis in view of the complications and accompanying morbidity of untreated or inadequately treated case of appendicitis. Perforative peritonitis leading to sepsis is a grave complication of inadequately treated acute episode of appendicitis with a high mortality rate.

The most common method of appendicectomy is to crush and ligate the stump and then invaginate into caecal wall by means of purse string suture. However some surgeons prefer to omit the step of invagination.[3]

Postoperative complications in appendicitis occur in about 5% of patients with an uncomplicated appendix but in more than 30% of patients with a gangrenous or perforated appendix, accounting for an average morbidity of around 10%. The most common complication following appendicectomy for uncomplicated appendicitis is surgical site infection (SSI) with an incidence of about 5 – 10%. The organisms most frequently cultured are anaerobic Bacteroides species and the aerobes Klebsiella, Enterobacter, and Escherichia coli.[4]

In view of the above context, the present study was undertaken to compare and evaluate the efficacy of single dose of preoperative intraincisional administration of cefotaxime with intravenous administration in preventing postoperative surgical site infections after open appendicectomies.

OBJECTIVE

The objective of the present study is:

To compare the efficacy of single dose of preoperative intraincisional administration of cefotaxime with intravenous administration in preventing postoperative surgical site infections after open appendicectomies.

REVIEW OF LITERATURE

HISTORICAL REVIEW

Although treatment of infection has been an integral part of the surgeon's practice since ages, the knowledge that led to the present field of surgical infectious disease was derived from the evolution of germ theory and antisepsis, along with the development of anesthesia. In many respects, the recognition of antisepsis and asepsis was a more important event in the evolution of surgical history than the advent of inhalational anesthesia was. It can be argued that even if anesthesia had never been conceived, a surgical procedure could still be performed, albeit with much difficulty. Without antisepsis and asepsis, major surgical operations more than likely ended in death rather than just pain. In fact, until recently, the occurrence of infection related to the surgical wound was the rule rather than the exception.

In the long evolution of world surgery, the contributions of several individuals stand out as being prominent.

In 1846, Ignaz Semmelweis, a Magyar physician, took a post at the Allgemein Krankenhaus in Vienna. He noticed that the mortality from puerperal ("childbed") fever was much higher in the teaching ward than in the ward where patients were delivered by midwives. He introduced a practice of rinsing hands thoroughly in chlorine water before entering. This simple intervention reduced mortality drastically. Unfortunately, Semmelweis' ideas were not well accepted by the authorities of the time. Despondent, he committed suicide in 1865 by

intentionally cutting his finger during the autopsy of a woman who died of puerperal fever, presumably as the ultimate proof of his tenets.[5]

Louis Pasteur worked during the latter part of the nineteenth century and provided what was at the time known as germ theory. He was able to elucidate the principle that contagious diseases are caused by specific microbes and that these microbes are foreign to the infected organism. Using this principle, he developed techniques of sterilization and also identified several bacteria responsible for human illnesses, including Staphylococcus, Streptococcus, and pneumococcus.

Joseph Lister is placed at the top because of his monumental efforts to introduce systematic, scientifically based antisepsis in the treatment of wounds and the performance of surgical operations. He pragmatically applied others' research into fermentation and microorganisms to the world of surgery by devising a means of preventing surgical infection and securing its adoption by a skeptical profession.

It was evident to Lister that a method of destroying bacteria by excessive heat could not be applied to a surgical patient. By 1865, Lister was instilling pure carbolic acid into wounds and onto dressings. Eventually he made various modifications. Although the carbolic acid spray remains the best remembered of his many contributions, it was eventually abandoned in favor of other germicidal substances.

A second important advance by Lister was the development of sterile absorbable sutures. He believed that contaminated silk ligatures caused much of

the deep suppuration found in wounds. Lister evolved a carbolized catgut suture that was better than any previously produced.

From 1878 until 1880, Robert Koch was the District Medical Officer for Wollstein, which was an area in which anthrax was endemic. Performing experiments in his home, without the benefit of scientific equipment and academic contact, Koch developed techniques for culture of Bacillus anthracis and proved the ability of this organism to cause anthrax in healthy animals.

He developed the following four postulates to identify the association of organisms with specific diseases:

(a) the suspected pathogenic organism should be present in all cases of the disease and absent from healthy animals,

(b) the suspected pathogen should be isolated from a diseased host and grown in a pure culture in vitro,

(c) cells from a pure culture of the suspected organism should cause disease in a healthy animal, and

(d) the organism should be reisolated from the newly diseased animal and shown to be the same as the original.

These postulates came to be known as Koch's postulates and became critical to our understanding of surgical infections and remain so today.[6]

During the twentieth century, the discovery of effective antimicrobials added another tool to the armamentarium of modern surgeons. Sir Alexander Fleming, worked on the natural antibacterial action of the blood and antiseptics. Penicillin, his first effective antibacterial agent, subsequently led to the

development of hundreds of potent antimicrobials which became a critical component of the armamentarium to treat aggressive, lethal surgical infections.

William Osler, a prolific writer and one of the fathers of American medicine, made an observation in 1904 in his treatise The Evolution of Modern Medicine. "Except on few occasions, the patient appears to die from the body's response to infection rather than from it".[7] The discovery of the first cytokines began to allow insight into the organism's response to infection, and led to an explosion in our understanding of the host inflammatory response. Preventing and treating this process of multiple organ failure during infection is one of the major challenges of modern critical care and surgical infectious disease.

Along with the development of numerous antimicrobial agents, advances in the field of clinical microbiology were also ongoing. Many new microbes were identified, including numerous anaerobes; the microflora of the skin, GI tract, and other parts of the body that the surgeon encountered in the process of an operation were described in great detail. However, whether these organisms were commensals or pathogens remained unclear. Subsequently, the initial clinical observations of surgeons such as Frank Meleney, William Altemeier, and others provided the key, when they observed that aerobes and anaerobes could synergize to cause serious soft tissue and severe intra-abdominal infection.[8,9] Thus, the concepts that resident microbes were nonpathogenic until they entered a sterile body cavity at the time of surgery, and that many, if not most, surgical infections were polymicrobial in nature, became critical ideas and were promulgated by a number of clinician-scientists over the last several decades.[10,11] These tenets became firmly established after microbiology laboratories demonstrated the

invariable presence of aerobes and anaerobes in peritoneal cultures obtained at the time of surgery for intra-abdominal infection due to a perforated viscus or gangrenous appendicitis. Clinical trials provided evidence that optimal therapy for these infections required effective source control, plus the administration of antimicrobial agents directed against both types of pathogens.

The first intra-abdominal operation to treat infection via "source control" (i.e., surgical intervention to eliminate the source of infection) was, in fact, appendectomy. This operation was pioneered by Charles McBurney at the New York College of Physicians and Surgeons, among others.[12] McBurney's classic report on early operative intervention for appendicitis was presented before the New York Surgical Society in 1889. Appendectomy for the treatment of appendicitis, previously an often fatal disease, was popularized only after 1902.

CLASSIFICATION OF SURGICAL WOUNDS

Surgical wounds are classified into four main categories depending on the degree of contamination that a wound is subjected to.[13]

Table 1: Classification Of Surgical Wounds

Classification	Criteria
Clean	Elective, not emergency, non-traumatic, primarily closed; no acute inflammation; no break in technique; respiratory, gastrointestinal, biliary and genitourinary tracts not entered.
Clean-contaminated	Urgent or emergency case that is otherwise clean; elective opening of respiratory, gastrointestinal, biliary or genitourinary tract with minimal spillage (appendicectomy) not encountering infected urine or bile; minor technique break.
Contaminated	Non-purulent inflammation; gross spillage from gastrointestinal tract; entry into biliary or genitourinary tract in the presence of infected bile or urine; major break in technique; penetrating trauma <4 hours old; chronic open wounds to be grafted or covered.
Dirty	Purulent inflammation (abscess); preoperative perforation of respiratory, gastrointestinal, biliary or genitourinary tract; penetrating trauma >4 hours old.

Before the routine use of prophylactic antibiotics infection rates were 1-2% or less for clean wounds, 6-9% for clean-contaminated wounds, 13-20% for contaminated wounds and about 40% for dirty wounds.[14,15] Since the introduction of routine prophylactic antibiotic use, infection rates in the contaminated groups have reduced drastically. Infection rates in United States National Nosocomial Infection Surveillance (NNIS) system hospitals were reported to be: clean 2.1%, clean-contaminated 3.3%, contaminated 6.4% and dirty 7.1%.[16] There is, however, considerable variation in each class according to the type of surgery being performed.[17]

Understandably, the Incidence of SSI is least in clean cases and highest in the contaminated group. However, majority of the general surgical procedures fall under the category of either clean or clean-contaminated. The incidence of SSI can be significantly reduced in the latter by proper use of antiseptic techniques and optimal antibiotic prophylaxis.

SURGICAL SITE INFECTION

Postoperative surgical site infection (SSI) is an important complication and is a major source of illness to a patient undergoing surgery.[18] Infections result in longer hospitalization and higher costs of treatment. Studies have shown that the average hospital stays doubled and that the cost of hospitalization was correspondingly increased when postoperative surgical wound infection developed.[19] Complicated surgical procedures have a grave impact, increasing the duration of hospitalization as much as twentyfold and the cost of hospitalization five-fold.[20] The fear of sepsis in wounds continues to haunt surgeons, particularly in operations of the gastrointestinal tract. The presence of bacteria in the incision at the time of wound closure is the most important factor in wound sepsis.[21-23] The prophylaxis of primary wound sepsis hence depends on minimizing operative exogenous and endogenous wound contamination and on the use of a potent antibiotic in the wound either before closure or parenterally.

The incidence of postoperative surgical site infection ranges anywhere from 4% (in developed countries and in clean cases) to 45% (in developing countries and in contaminated surgeries). An Indian study showed an incidence of 12% after a retrospective analysis of 1125 abdominal surgeries.[24] A large systematic review of 147 clinical trials showed an overall incidence of 11% following colorectal surgeries.[25]

An Indian study was conducted at Himalayan Institute of Medical Sciences, Dehradun, India from November 2008 to October 2009 to determine the incidence of SSI in elective abdominal surgeries; to correlate the SSI with the

nature of elective surgical procedure; to study the profile of bacterial isolates obtained from cases of SSI.[26] The incidence of SSI in elective surgeries was found to be 5%. E. coli was the most common organism isolated followed by Staphylococcus aureus. Risk factors like diabetes mellitus, smoking and duration of surgery play a significant role in causing SSI. The study concluded that, an effective surveillance programme for SSIs should be a critical component of any hospital infection control programme to reduce the rate of infection.

Another Indian study by Lilani and colleagues done at Mumbai evaluated surgical site infections in 190 consecutive patients undergoing clean and clean-contaminated surgeries.[27] It was found that 8.95% of all cases developed postoperative surgical site infection in comparison to as many as 22.41% of clean-contaminated cases. This perhaps reflects the higher rate of surgical site infection when compared to most western studies.

Previous Indian studies also concur with similar rates of infection ranging from 10.06% to 45% in clean-contaminated cases.[28-30]

SCORING SYSTEMS

ASEPSIS scoring system[31]

Table 2:

	Proportion of wound affected					
Wound characteristic	0	<20	20-39	40-59	60-79	>80
Serous exudate	0	1	2	3	4	5
Erythema	0	1	2	3	4	5
Purulent exudate	0	2	4	6	8	10
Separation of deep tissues	0	2	4	6	8	10
Points are scored for daily wound inspection.						
Criterion				**Points**		
Additional treatment:						
Antibiotics				10		
Drainage of pus under local anaesthesia				5		
Debridement of wound (general anaesthesia)				10		
Serous discharge				Daily 0-5		
Erythema				Daily 0-5		
Purulent exudate				Daily 0-10		
Separation of deep tissues				Daily 0-10		
Isolation of bacteria				10		
Stay as inpatient prolonged over 14 days				5		
*Given score only on five of seven days. Highest weekly score used.						
Category of infection: total score 0-10 = satisfactory healing 11-20 = disturbance of healing 20-30 = minor wound infection 31-40 = moderate wound infection >40 = severe wound infection						

SOUTHAMPTON SCORING SYSTEM[32]

Table 3:

Grade	**Appearance**
0	Normal healing
I Normal healing with mild bruising or erythema:	
A	Some bruising
B	Considerable bruising
C	Mild erythema
II Erythema plus other signs of inflammation:	
A	At one point
B	Around sutures
C	Along wound
D	Around wound
III Clear or haemoserous discharge:	
A	At one point only (<2 mm)
B	Along wound (>2 cm)
C	Large volume
D	Prolonged (>3 days)
Major complication IV Pus:	
A	At one point only (< 2cm)
B	Along wound (>2 cm)
V Deep or severe wound infection with or without tissue breakdown; haematoma requiring aspiration	

The wound grading system used was simplified for the use of analysis.
By using the worst wound score recorded and information about any treatment instituted either in hospital or the community, wounds were regarded in four categories:

(A) normal healing;
(B) minor complication;
(C) wound infection – wounds graded IV or V or wounds treated with antibiotics after discharge from hospital, irrespective of the wound grading given to them by the nurse; and major haematoma – wound or scrotal hematomas requiring aspiration or evacuation.

CLASSIFICATION OF SURGICAL SITE INFECTION BASED ON CDC GUIDELINES

Based on CDC guidelines, surgical site infections have been classified into three types which are as follows:[33]

1. Superficial incisional SSI

Must meet the following criterion:

- Infection occurs within 30 days after the operative procedure, and
- involves only skin and subcutaneous tissue of the incision, and
- patient has at least 1 of the following:

  a. purulent drainage from the superficial incision

  b. organisms isolated from an aseptically obtained culture of fluid or tissue from the superficial ncision

  c. presence at least 1 of the following signs or symptoms of infection: pain or tenderness, localized swelling, redness, or heat, and superficial incision is deliberately opened by surgeon and is culture positive or not cultured. (A culture-negative finding does not meet this criterion.)

  d. diagnosis of superficial incisional SSI by the surgeon or attending physician.

2. Deep incisional SSI

Must meet the following criterion:

- Infection occurs within 30 days after the operative procedure if no implant is left in place or within 1 year if implant is in place and the infection appears to be related to the operative procedure, and

- involves deep soft tissues (eg, fascial and muscle layers) of the incision, and

- patient has at least 1 of the following:

  a. purulent drainage from the deep incision but not from the organ/space component of the surgical site

  b. a deep incision spontaneously dehisces or is deliberately opened by a surgeon and is culture-positive or not cultured when the patient has at least 1 of the following signs or symptoms: fever, or localized pain or tenderness. A culture-negative finding does not meet this criterion.

  c. an abscess or other evidence of infection involving the deep incision is found on direct examination, during reoperation, or by histopathologic or radiologic examination

  d. diagnosis of a deep incisional SSI by a surgeon or attending physician.

3. *Organ/space SSI*

An organ/space SSI involves any part of the body, excluding the skin incision, fascia, or muscle layers, that is opened or manipulated during the operative procedure. An organ/space SSI must meet the following criterion:

- Infection occurs within 30 days after the operative procedure if no implant is left in place or within 1 year if implant is in place and the infection appears to be related to the operative procedure, and

- infection involves any part of the body, excluding the skin incision, fascia, or muscle layers, that is opened or manipulated during the operative procedure, and

- patient has at least 1 of the following:

  a. purulent drainage from a drain that is placed through a stab wound into the organ/space

  b. organisms isolated from an aseptically obtained culture of fluid or tissue in the organ/space

  c. an abscess or other evidence of infection involving the organ/space that is found on direct examination, during reoperation, or by histopathologic or radiologic examination

  d. diagnosis of an organ/space SSI by a surgeon or attending physician.

Risk factors

Multiple risk factors for SSI have been identified over time and can all be compiled within one or more of the three major determinants of SSI: bacterial factors, local wound factors, and patient factors[34]

Table 4: Risk Factors Associated With Wound Healing

MICROORGANISM	LOCAL WOUND	PATIENT
Remote site infection	Surgical technique:	Age
Long-term care facility	Hematoma/seroma	Immunosuppression
Recent hospitalization	Necrosis	Steroids
Duration of the procedure	Sutures	Malignancy
Wound class	Drains	Obesity
Intensive care unit patient	Foreign bodies	Diabetes
Previous antibiotic therapy		Malnutrition
Preoperative shaving		Multiple comorbid conditions
Bacterial number, virulence, and antimicrobial resistance		Transfusions
		Cigarette smoking
		Oxygen
		Temperature
		Glucose control

The interaction between these three is what determines the risk for SSI as a complication of surgery. Most of these factors have been shown to be associated with SSI; however, it is difficult to prove an independent association between every specific risk factor and SSI, particularly when looking at different groups of surgical patients (i.e., different patient population, different procedures).

CUTANEOUS WOUND HEALING:

Cutaneous wound healing can occur in either of the following 3 ways:[35-37]

1. By primary intention (also known as healing by first intention)

It is the simplest type of cutaneous wound repair which is generally seen when a clean, uninfected surgical incision is approximated by surgical sutures. Because of minimal surrounding tissue trauma, it causes the least inflammation and leaves the best scar. The incision causes death of a limited number of epithelial and connective tissue cells and disruption of epithelial basement membrane continuity. Re-epithelialization to close the wound occurs with formation of a relatively thin scar.

2. By delayed primary intention (also known as healing by tertiary intention)

Delayed primary intention healing occurs when the wound edges are not opposed immediately, which may be necessary in contaminated or untidy wounds. The inflammatory and proliferative phases of healing have become well advanced when closure of the wound is carried out. This is also called healing by tertiary intention in some texts and will result in a less satisfactory scar than after healing by primary intention.

3. By secondary intention

The repair process is more complicated in excisional wounds that create large defects on the skin surface, causing extensive loss of cells and tissue. The healing of these wounds involves a more intense inflammatory reaction, the formation of abundant granulation tissue (described below), and extensive collagen deposition, leading to the formation of a substantial scar, which generally contracts.

However, despite these differences, the basic mechanisms of healing remain the same.

BASIC MECHANISMS OF WOUND HEALING

This is variously described as taking place in three or four phases.[38] These phases overlap, and their separation is somewhat arbitrary, but they help to understand the sequence of events that take place in the healing of skin wounds. the most commonly agreed being:

1. The inflammatory phase

2. The proliferative phase

3. The remodelling phase (maturation phase).

Occasionally, a haemostatic phase is referred to as occurring before the inflammatory phase, or a destructive phase following inflammation consisting of the cellular cleansing of the wound by macrophages.

The inflammatory phase:

The inflammatory phase begins immediately after wounding and lasts 2–3 days. Bleeding is followed by vasoconstriction and thrombus formation to limit blood loss. Platelets stick to the damaged endothelial lining of vessels, releasing adenosine diphosphate (ADP), which causes thrombocytic aggregates to fill the wound. Several cytokines (plateletderived growth factor (PDGF), platelet factor IV and transforming growth factor beta) are released which attract inflammatory cells such as polymorphonuclear lymphocytes (PMN) and macrophages. Platelets and the local injured tissue release vasoactive amines such as histamine, serotonin and prostaglandins, which increase vascular permeability, thereby aiding infiltration of these inflammatory cells. Macrophages remove devitalised tissue and micro-organisms while regulating fibroblast activity in the proliferative phase of healing. The initial framework for structural support of cells is provided by fibrin produced by fibrinogen.

The proliferative phase:

The proliferative phase lasts from the 3rd day to 3rd week consisting mainly of fibroblast activity with the production of collagen and ground substance (glycosaminoglycans and proteoglycans), the growth of new blood vessels as capillary loops (angioneogenesis) and the re-epithelialisation of the wound surface. The wound tissue formed in the early part of this phase is called granulation tissue. In the latter part of this phase, there is an increase in the tensile strength of the wound due to increased collagen.

The remodelling phase:

The remodelling phase is characterised by maturation of collagen (type I replacing type III until a ratio of 4:1 is achieved). There is a realignment of collagen fibres along the lines of tension, decreased wound vascularity and wound contraction due to fibroblast and myofibroblast activity.

FACTORS AFFECTING WOUND HEALING[35]

Systemic factors:

- Advanced age is linked with delayed healing.
- Malnutrition has profound effects on wound healing.
- Protein deficiency, and Vitamin (particularly vitamin C and vitamin A) deficiency, inhibit collagen synthesis and retard healing.
- Mineral deficiencies like Zinc and Iron also delay wound healing
- Metabolic status can change wound healing. Diabetes mellitus, for example, is associated with delayed healing, as a consequence of the microangiopathy that is a frequent consequence of this disease.
- Circulatory status can modulate wound healing. Inadequate blood supply, usually caused by arteriosclerosis or venous abnormalities (e.g., varicose veins) that retard venous drainage, also impairs healing.
- Hormones such as glucocorticoids have well-documented anti-inflammatory effects that influence various components of inflammation.
- Exogenous drugs like Doxorubicin (Adriamycin) and Glucocorticosteroids inhibit wound healing

Local factors:

- Size, location, and type of wound. Wounds in richly vascularized areas, such as the face, heal faster than those in poorly vascularized ones, such as the foot.
- Infection is the single most important cause of delay in healing, because it results in persistent tissue injury and inflammation.
- Mechanical factors, such as local tension and early motion of wounds, can delay healing, by compressing blood vessels and separating the edges of the wound.
- Foreign bodies, such as unnecessary sutures or fragments of steel, glass, or even bone, constitute impediments to healing.
- Ionizing radiation

APPENDICITIS

Introduction:

Acute appendicitis is one of the most common causes of an abdominal emergency and accounts for approximately 1% of all surgical operations.[39] Although rare in infants, appendicitis becomes increasingly common throughout childhood and reaches its maximal incidence between the ages of 10 and 30 years. After 30 years of age, the incidence declines, but appendicitis can occur in individuals of any age.

Pathophysiology:

The most commonly accepted theory of the pathogenesis of appendicitis is that it results from obstruction followed by infection.[40]

Obstruction of the lumen of the appendix by lymphoid hyperplasia, a fecolith, tumor, etc. is the initiating factor. Mucus then accumulates within the lumen of the appendix, and pressure within the lumen increases. Virulent bacteria convert the accumulated mucus into pus. Continued secretion combined with the relative inelasticity of the serosa leads to a further rise in pressure within the lumen and the appearance of mucosal ulcers. Continued secretion and increasing edema bring about a further rise in intraluminal and tissue pressure, resulting in venous obstruction and ischemia of the appendix. Bacteria spread into and through the wall of the appendix, and acute suppurative appendicitis ensues.

If this pathologic process is allowed to continue, venous and arterial thromboses occur in the wall of the appendix, resulting in gangrenous appendicitis.

Symptoms:

- Pain - The typical pain of acute appendicitis initially consists of diffuse, central, minimally severe visceral pain, which is followed by somatic pain that is more severe and usually well localized to the right lower quadrant

- Anorexia, Nausea, and Vomiting

Signs:

- Tenderness and Muscle Guarding - an area of maximal tenderness often is elicited in the area of McBurney's point, which is located two thirds of the distance along a line from the umbilicus to the right anterior superior iliac spine.

- Rebound tenderness is elicited by the sudden release of abdominal palpation pressure

- Rovsing's sign—pain elicited in the right lower quadrant with palpation pressure in the left lower quadrant

- Psoas Sign - The right hip is often kept in slight flexion to keep the iliopsoas muscle relaxed. Stretching the muscle by extension of the hip or further flexion against resistance can initiate a positive psoas sign, indicating irritation of the muscle by an inflamed appendix.

- Abdominal Mass - may be caused by an abscess or adherence of the omentum and loops of intestine to an inflamed appendix.

Investigations:

- Raised WBC count and a shift-to-left are classically described in appendicitis.

- Plain radiographs and barium enemas were previously used, but hold little clinical value at present.

- Currently, ultrasonography and Computerized Tomography are reported to have the highest sensitivity in diagnosing appendicitis.

MICROBIOLOGY

According to data from the NNIS system, the distribution of pathogens isolated from SSIs has not changed markedly during the last decade.[41,42] Staphylococcus aureus, coagulase-negative staphylococci, Enterococcus spp., and Escherichia coli remain the most frequently isolated pathogens. An increasing proportion of SSIs are caused by antimicrobial-resistant pathogens, such as methicillin-resistant S. aureus (MRSA), or by Candida albicans.[43-45] From 1991 to 1995, the incidence of fungal SSIs among patients at NNIS hospitals increased from 0.1 to 0.3 per 1,000 discharges.[42] The increased proportion of SSIs caused by resistant pathogens and Candida spp. may reflect increasing numbers of severely ill and immunocompromised surgical patients and the impact of widespread use of broad-spectrum antimicrobial agents.

Outbreaks or clusters of SSIs have also been caused by unusual pathogens, such as Rhizopus oryzae, Clostridium perfringens, Rhodococcus bronchialis, Nocardia farcinica, Legionella pneumophila and Legionella dumoffii, and Pseudomonas multivorans. These rare outbreaks have been traced to contaminated adhesive dressings, elastic bandages, colonized surgical personnel or contaminated disinfectant solutions.[46-50] When a cluster of SSIs involves an unusual organism, a formal epidemiologic investigation should be conducted.

ANTIBIOTIC PROPHYLAXIS IN SURGERY

It is now well recognized that antibiotics are required when a patient undergoes abdominal surgeries to reduce the risk of postoperative surgical site infection. This is especially important in clean-contaminated or contaminated cases, which constitute a majority of all the abdominal surgeries. It is also widely accepted that when prophylactic antibiotics are used in abdominal surgery, the first dose should be given preoperatively and this view is based from the experimental work of Burke who studied the effective period of preventive antibiotic action in experimental incisions and dermal lesions.[51-53] Stone and his colleagues have confirmed that postoperative antibiotics are ineffective as prophylaxis in gastric, biliary and colonic surgery.[54] In a critical review of the literature on prophylactic systemic antibiotics, Chodak and PIaut concluded that any study in which therapy was not begun preoperatively was inadequate.[55]

After it was concluded that postoperative antibiotics do not achieve significant prophylaxis in reducing surgical site infection, there arose a new question. And that was the 'timing' of antibiotic administration – whether prior to the incision, during the surgery or after the conclusion of surgery before closing the abdomen. Numerous studies were then undertaken to compare the results of these.

Prophylactic administration of antibiotic can reduce postoperative morbidity, shorten hospitalization, and reduce the overall costs attributable to infections. A review article by Page et al give guidelines for antibiotic prophylaxis in surgery.[56] The article concludes that preoperative prophylactic

antibiotcs are helpful even in certain clean cases and selection should be based on specific contraindications, local infection control surveillance data, and the results of clinical trials.

Bates et al compared preoperative and intraoperative first dose with respect to wound outcome and pharmacokinetics.[57] It was found that overall wound infection rates were similar in both groups (16.7% vs 15.4% respectively). Overall length of stay was also similar. Concentrations of metronidazole were significantly higher in intraoperative group at 1, 2 and 3 h after induction of anaesthesia whilst cephazolin levels were higher at 1 and 2 h ($P < 0.05$). However, concentrations of the two antibiotics remained well within the therapeutic range (4 times the mean inhibitory capacity) for the expected organisms in both groups throughout the 3-h period. The study concluded that giving antibiotics with the premedication does not confer any advantage and it seems likely that a high plasma and tissue concentration at the time of operation is the most important factor.

Classen et al prospectively analysed 2847 patients undergoing clean or clean-contaminated surgeries with regard to timing of antibiotic administration and wound infection.[58] Timing of antibiotic administration was divided into 4 groups: 'early' – 2 to 24 h before incision; 'preoperative' – within 2 h of placing the incision; 'perioperative' – within 3 h after placing incision; 'postoperative' – 3 to 24 h after placing incision. The rates of surgical site infection were 14%, 0.6%, 1.4% and 3.3% respectively. Thus, the conclusion was that preoperative antibiotic administration was the most beneficial in preventing postoperative wound infection.

Meijer and his colleagues concluded that one dose of a short-acting antibiotic (half-life < 1.5 h) is as effective as a three-dose regimen in preventing major wound infection after biliary tract operation.[59] There was no difference in wound infection rates, but statistically significant differences were found between the groups in mean hospital stay and development of wound dehiscence.

An Australian study in 1998 systematically reviewed 28 clinical trials with 9478 patients which compared a single dose versus a multiple dose antibiotic prophylaxis.[60] The study concluded that there is no clear advantage of either single or multiple-dose regimens in preventing SSI. Subgroup analysis showed no statistically significant differences associated with type of antimicrobial used, blinded wound assessment, length of the multiple-dose arm or type of surgery.

A review article reviewed the use of irrigation of wound with antibiotic solution in various contexts apart from the surgical site e.g. trauma.[61] A critical review by the author does not provide supportive evidence for the use of this technique and also concludes that this mode of administration of antimicrobial agents may be not justified, except for patients with empyema following lobectomy or pneumonectomy and pyocystis.

A systematic review of 147 clinical trials was published which concluded that single-dose regimens are as effective and may be associated with less toxicity, fewer adverse effects and less risk of developing bacterial resistance.[62] However, combination of 2 different classes of antibiotics afforded greater protection against postoperative infection.

Badia et al published a study conducted in Spain in which he studied the mean concentrations of metronidazole in the plasma, fat and muscle at the operated site.[63] One group received intravenous metronidazole 2 hours before the incision while the other group received the same at induction. It was concluded that there was no significant differences in the concentration of the antibiotic at the time of closure in both groups. However, the authors observed that the drug failed to achieve therapeutic levels in subcutaneous fat which is the site of most postoperative infections. Hence, they suggested use of topical or intraincisional antibiotics or irrigation of the wound with antibiotics which may be an answer to the question posed.

CEPHALOSPORINS

Cephalosporium acremonium, the first source of the cephalosporins, was isolated in 1948 by Brotzu from the sea near a sewer outlet off the Sardinian coast. Culture fluids in which the Sardinian fungus was cultivated were found to contain three distinct antibiotics, which were named cephalosporin P, N, and C. After manipulation of the chemical structure, it became possible to produce semisynthetic compounds with antibacterial activity very much greater than that of the parent substance. These group of antibiotic were collectively named 'Cephalosporins'.[64]

Cephalosporins and cephamycins inhibit bacterial cell wall synthesis in a manner similar to that of penicillin.

Although cephalosporins may be classified by their chemical structure, clinical pharmacology, resistance to b-lactamase, or antimicrobial spectrum, the well-accepted system of classification by "generations" is very useful. Classification by generations is based on general features of antimicrobial activity.

First-generation cephalosporins - have good activity against gram-positive bacteria and relatively modest activity against gram-negative microorganisms

Second-generation cephalosporins - have somewhat increased activity against gram-negative microorganisms but are much less active than the third-generation agents.

Third-generation cephalosporins - generally are less active than first-generation agents against gram-positive cocci, but they are much more active against the Enterobacteriaceae, including b-lactamase-producing strains.

Fourth-generation cephalosporins - have an extended spectrum of activity compared with third generation and have increased stability from hydrolysis by plasmid and chromosomally mediated β-lactamases.

CEFOTAXIME

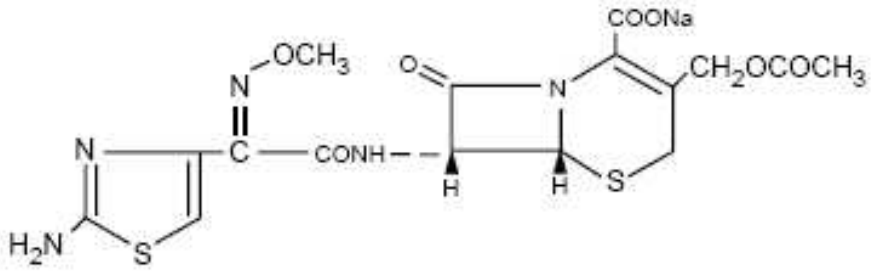


Figure 1: Molecular structure of Cefotaxime

Cefotaxime is a third-generation cephalosporin antibiotic.[64]

It has broad spectrum activity against Gram positive and expanded gram-negative compared to the first two generations of cephalosporins. Cefotaxime is highly resistant to many of the bacterial b-lactamases.

Cefotaxime has a half-life in plasma of about 1 hour and should be administered every 4 to 8 hours for serious infections. The drug is metabolized in vivo to desacetylcefotaxime, which is less active against most microorganisms than is the parent compound. However, the metabolite acts synergistically with the parent compound against certain microbes. Cefotaxime has been used effectively for meningitis caused by H. influenzae, penicillin-sensitive S. pneumoniae, and N. meningitides. Cefotaxime can be given intravenously in a dose of 1–2 g q6–12h.

Cefotaxime is similar to all other cephalosporins which are sensitizing and may elicit a variety of hypersensitivity reactions that are identical to those of penicillins, including anaphylaxis, fever, skin rashes, nephritis, granulocytopenia, and hemolytic anemia. Renal toxicity occurs rarely at high doses.

LOCAL ACTION OF ANTIBIOTICS

The goal of surgical prophylaxis is to achieve and maintain a satisfactory tissue concentration of a drug with a reasonable spectrum of activity against expected organisms during the period of potential bacterial contamination of the wound, so that organisms introduced into the wound during the operation would be immediately destroyed. Failure to maintain adequate serum and tissue levels throughout the surgical procedure increases the likelihood of infection. It needs to be emphasized that wound levels, not blood or serum levels, appear to determine the efficacy of agents for prophylaxis of operative wound infection. These very high tissue levels can only be achieved by a preoperative intraincisional injection.[65]

The benefits of intraincisional antibiotic had been proven by many studies. However, little was known about whether topically injected antibiotics remain primarily in the surgical wound or are systematically absorbed. Hence, studies were then performed to elucidate in better detail the pharmokinetics and dynamics of a locally infiltrated antibiotic and it's fate.

Petrakis et al in 1999 demonstrated for the first time the pharmacokinetics of a preincisional intraparietal (intraincisional) inection of antibiotic.[66] This study involved the use of ceftriaxone in diabetic patients undergoing various clean-contaminated abdominal surgeries. They concluded that mean plasma concentrations of ceftriaxone given intraincisionally are comparable with those of previous studies when the antibiotic was given intravenously or intramuscularly and the concentrations of free drug at 6-12 h were above the known minimum

inhibitory concentrations of organisms commonly encountered in surgical site infections.

The local action of antibiotics was also experimentally studied in rats where they concluded that more effectively reduces the bacterial count in graft segments.[67] Though this study predominantly focused on preventing infection in cases of prosthetic implantation, the utility of local action of antibiotics is highlighted.

Much higher concentrations of antibiotic (amoxycillin plus clavulanic acid) were found in tissue taken from the site of incision in the intraincisional than in the intravenous group in a study.[68]

EXPERIENCE WITH INTRAINCISIONAL ADMINISTRATION OF ANTIBIOTICS

Numerous studies have proven that preoperative administration of antibiotic (orally, intravenously or intramuscularly) reduce the incidence of postoperative infection. However, the results are far from satisfactory. Hence, alternative methods of antibiotic delivery have been studied by various authors in a quest to achieve as low an incidence as possible.

Shubing et al studied preoperative intraincisional metronidazole in preventing postoperative surgical site infection in patients undergoing appendicectomies compared to a control group in which no antibiotic was administered.[69] There was a single case of infection in the study group compared to 14 in the control group with a significant statistical difference ($p<0.001$).

Taylor et al demonstrated a statistically significant difference in the incidence of postoperative surgical site infection as well as in the duration of hospital stay when Cefamandole was used intraincisionally in the study group versus the control group which did not receive any antibiotics.[70]

Pollock et al showed a similar trend when they compared intraincisional administration of Amoxycillin plus clavulanic acid to intravenous administration of the same in patients undergoing abdominal surgeries.[71] In this study, however, metronidazole was added to select group of patients depending on anticipated complications.

Griego et al studied the effect of intraincisional nafcillin in 790 patients with 908 wounds undergoing clean surgeries viz reconstruction following Moh's micrographic surgery.[72] The control group did not receive any antibiotic. The study concluded that nafcillin was statistically significant in preventing postoperative infection (0.2%) versus 2.5% in control group.

In 2002, the same authors along with their colleagues performed another study to compare effect of intraincisional clindamycin versus placebo in preventing postoperative infection.[73] The result was yet again overwhelmingly in favour of intraincisional antibiotic with just 6 (1%) patients having wound score of >4 as against 23 (4%) in the control group. This was highly significant (p=0.001).

Pollock et al compared intraincisional cephaloridine with ampicillin in preventing postoperative SSI. 14% patients receiving cephaloridine developed SSI compared to 36% patients receiving ampicillin, thus concluding that cephaloridine proved to be significantly better compared to ampicillin.[74]

Taylor et al studied the effect of intraincisional cefoxitin in 181 consecutive abdominal surgeries after randomization.[75] There was no significant differences noted between the types of surgery or demographics in both groups. However, a significant difference (p=0.02) was noted with only 4.4% patients in the Cefoxitin group developing surgical site infection compared to 16.7% in the control group.

Petrakis et al undertook a study with 3 objectives - to determine the actual levels of ceftriaxone in patients with high risk of infection (diabetic, oncologic,

immunocompromised and obese); to compare found values with the already reported pharmacokinetic data of intravenous (IV) and intramuscular (IM) injections of ceftriaxone in healthy volunteers; and to evaluate the effectiveness of the intraparietal administration, in a prospective controlled study including 50 patients.[76] The author concluded that tissue concentrations measured at the end of the operation were higher than the corresponding plasma concentrations and these high tissue levels of ceftriaxone were maintained for the length of the operation and were constantly higher than the highest plasma concentration. No cases of wound infection were noted in the study.

Chalkiadakis et al studied effects and pharmacokinetics of intraincisional ceftriaxone in 20 consecutive patients.[77] Serial plasma concentration measurements revealed highest concentrations at 1.5 hours after administration and higher than MIC levels for at least 24 hours following administration. Also the tissue levels of ceftriaxone were considerably higher than corresponding plasma levels.

METHODOLOGY

Study design:

Randomized Controlled Trial.

Study period and duration:

The present one year study was conducted during the period of 1st January 2012 to 31st December 2012.

Site of study:

Department of General Surgery, KLES Dr. Prabhakar Kore Hospital and Medical Research Centre, Belgaum.

Source of Data:

Clinically diagnosed cases of appendicitis admitted for elective/emergency open appendicectomy under the department of General Surgery, KLES Prabhakar Kore Hospital and MRC, Belgaum.

Sample size:

The sample size was 60 patients.

Ethical Consideration:

The study was approved by the Ethical and Research Committee, Jawaharlal Nehru Medical College, Belgaum.

Selection criteria

Inclusion Criteria:

- Both sexes aged 18 – 65 years
- Clinically diagnosed cases of appendicitis (acute/ chronic / recurrent)
- Patients undergoing open appendicectomy
- Patients consenting for the study.

Exclusion Criteria:

- Age less than 18 years.
- Patients undergoing laparoscopic surgery
- Diabetes mellitus or immunodeficiency
- History of receiving systemic antibiotics within 2 weeks of proposed surgery
- History of ongoing/ recent systemic corticosteroid therapy
- Presence of pre-existing systemic/ local infection
- Presence of associated complications - appendicular abscess/ gangrenous appendicitis/ appendicular mass, gastrointestinal perforation, peritonitis and/or other apparent foci of active abdominal infection.
- Patients not consenting for the study.

METHOD OF COLLECTION OF DATA AND SAMPLING PROCEDURE:

- All patients attending General Surgery OPD who are clinically diagnosed to have appendicitis and getting admitted to KLES Prabhakar Kore Hospital and MRC, Belgaum for elective/emergency open appendicectomy were eligible for the study.
- After excluding patients based on the criteria mentioned above, the first consecutive sixty patients who fulfilled the inclusion criteria were included in the study.
- A written informed consent after briefing the nature of surgery, required investigations and possible untoward outcomes was obtained from each patient enrolled in the study (Annexure I).
- Data concerning demography, history of the illness and details of thorough clinical examination were recorded onto a predesigned proforma (Annexure II).
- Routine investigations such as complete blood count, blood urea, serum creatinine and special investigations such as ultrasound of abdomen were done as required.

Randomization:

Study patients were randomized into two groups by opaque envelope method. Sixty opaque envelopes were made containing a card inside. Thirty of these envelopes contained a card mentioning Group A and the remaining thirty had a card mentioning Group B. Patients were asked to randomly pick up an envelope and depending on the group mentioned in the envelope they were allocated into either one of the two groups.

GROUP A: To receive single dose of preoperative intraincisional cefotaxime (1 g diluted in 10 ml distilled water) 10 minutes before the incision is made.

GROUP B: To receive single dose of preoperative intravenous cefotaxime (1 g diluted in 10 ml distilled water) 10 minutes before the incision is made.

- **Preoperatively:**
  - Written informed consent for surgery was obtained
  - Concerned consultant was intimated regarding the inclusion of case in the study and regarding the procedure.
  - Shaving of the abdomen from nipple to mid-thigh, a day prior to surgery.
  - No antibiotic was given by any route other than that followed in study protocol.

- **Intraoperatively:**

  - All patients were given spinal anesthesia

  - All patients in both groups underwent painting of the abdomen with 10% povidone iodine and recleaning with spirit.

  - The surgical field was then draped appropriately. Routine aseptic precautions were taken.

  - **Group A:** Received a single dose of injection cefotaxime (1 g diluted in 10 ml distilled water) infiltrated at the proposed site of incision in the subcutaneous tissue and intramuscular plane after induction of anesthesia and 10 minutes prior to the incision. The dose of antibiotic was approximately 1 ml per cm of incision (which corresponded to 100 mg of antibiotic per cm). A 22G spinal needle was used to inject the antibiotic with a single entry point.

  - **Group B:** Received a single dose of conventional intravenous injection cefotaxime (1 g diluted in 10 ml distilled water) 10 minutes prior to the incision.

  - Cases in both groups underwent open appendicectomy as per the standard procedures.

  - Similar instruments and suture materials (stump ligation by Silk 2-0, closure of external oblique muscle by absorbable Vicryl suture 2-0, skin

closure by mattress sutures with Ethilon 2-0 or 3-0) were used in both the groups.

- Basic principles of surgery like adequate hemostasis, no undue extra traction on the tissues were followed in both the groups.

- **Postoperatively:-**

  - No antibiotic was given by any route other than that followed in study protocol.

  - Analgesics, intravenous fluids and other supportive treatments were given as per the surgeon's advice.

  - Surgical wound was inspected on postoperative day 3, day 5 and day 7.

  - The findings at each dressing were charted in a pre-formed table to assess wound infection.

  - Wound inspection was also done if specific complaints were present on any other day.

  - If, on any postoperative day, the surgical site showed clinical signs of infection, pus/discharge was sent for bacterial culture and sensitivity.

  - The wound was labelled as 'infected' if it fulfilled the CDC criteria.

  - Appropriate antibiotic was initiated following bacterial sensitivity report.

  - Sutures were removed on the 7th postoperative day, if there were no complications.

STATISTICAL ANALYSIS:

- The analysis of data was descriptive using SPSS version 13.0 (SPSS Inc, Chicago, IL)

- Statistical evaluation of the collected data were carried out using mean, frequency, percentage, chi square test and Fisher's exact test.

- The difference between wound infection rates in two groups was analysed using Fischer's exact test. Fischer's exact p value <0.01= highly significant, <0.05= significant, >0.05= not significant.

RESULTS

Table 5: Distribution of patients according to age

Age group (in years)	25 and below		26-50		51 and above		Total
	Frequency	%	Frequency	%	Frequency	%	
Group A	13	43.3	15	50	2	6.7	30
Group B	12	40	16	53.3	2	6.7	30
Total	25	41.7	31	51.7	4	6.6	60

χ 2=0.361 DF=1 p=0.818

A total of 60 patients (30 in each group) were enrolled in the study. Age ranged from 18 to 64 years. Mean age was 30.8 ± 12.62 years in Group A and 30.3 ± 10.29 years in Group B.

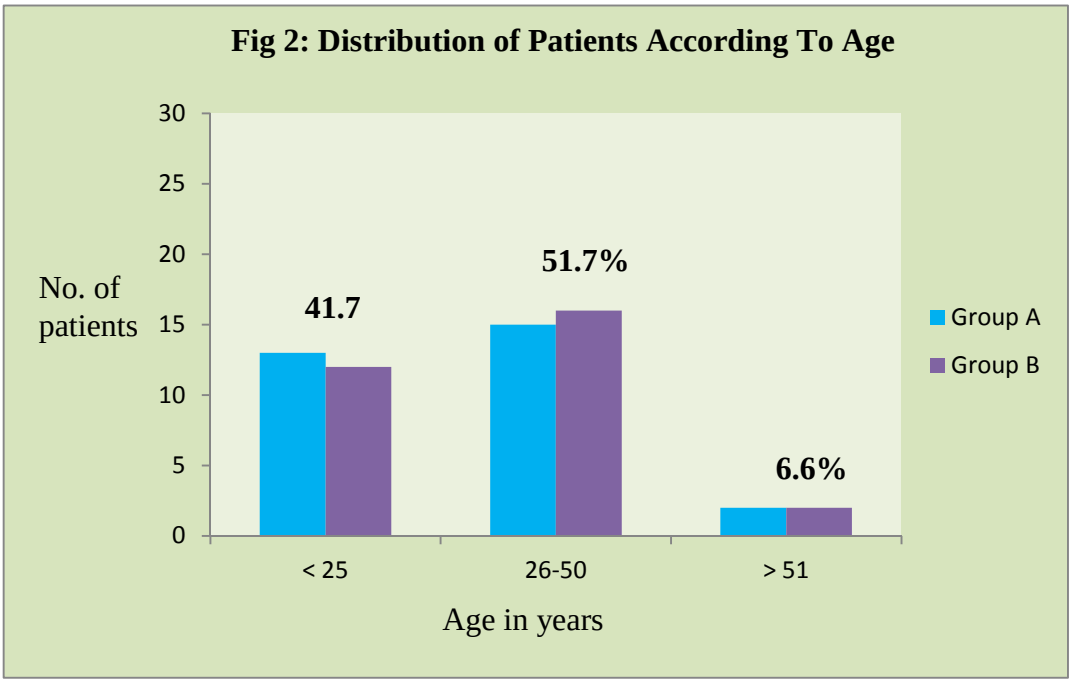


Table 6: Distribution of patients according to gender

Gender	Male		Female		Total
	Frequency	%	Frequency	%	
Group A	9	30	21	70	30
Group B	18	60	12	40	30
Total	33	55	27	45	60

χ 2=5.455 DF=1 p=0.02

A total of 33 (55%) male patients and 27 (45%) female patients participated in the study. Group A had 9 (30%) males and 21 (70%) females. Group B had 18 (60%) males and 12 (40%) females.

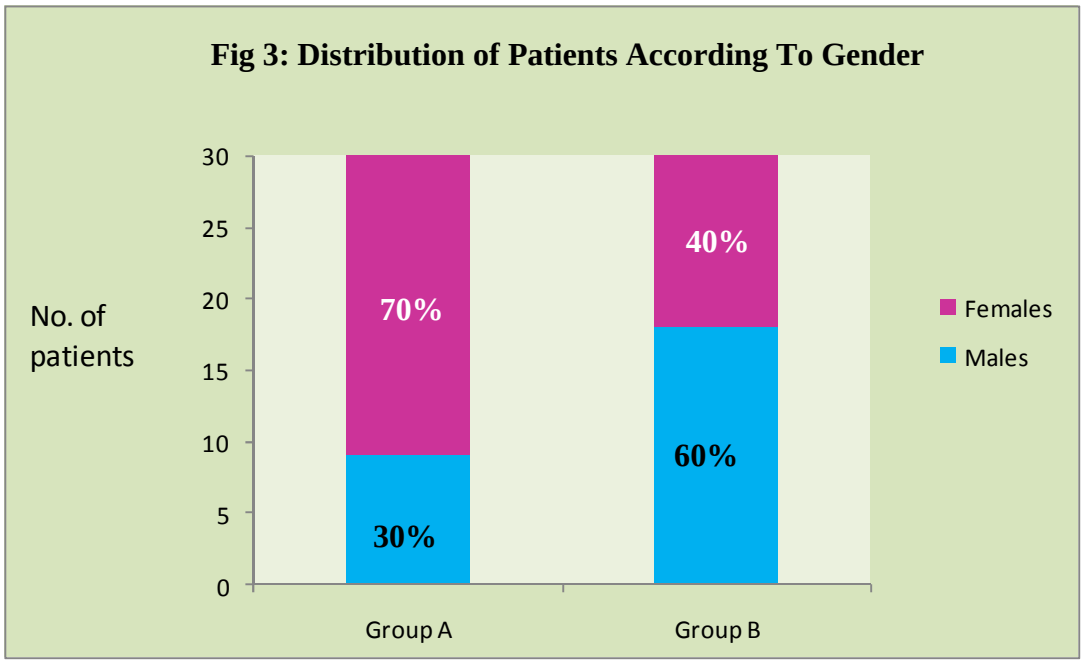


Table 7: Presenting symptoms of appendicitis

Symptom	Group A		Group B		Total	
	Frequency	**%**	**Frequency**	**%**	**Frequency**	**%**
Pain in RIF	30	100	30	100	60	100
Fever	30	100	30	100	60	100
Anorexia	10	33.3	9	30	19	31.7
Nausea	14	46.7	16	53.3	30	50
Vomiting	4	13.3	5	16.7	9	15

Patients suspected of appendicitis presented with multiple symptoms. History of pain in RIF and fever was present in all the patients (100%) of both the groups. Overall, nineteen patients (31.7%) had anorexia, 30 patients (50%) had nausea and 9 patients (15%) had vomiting at the time of presentation.

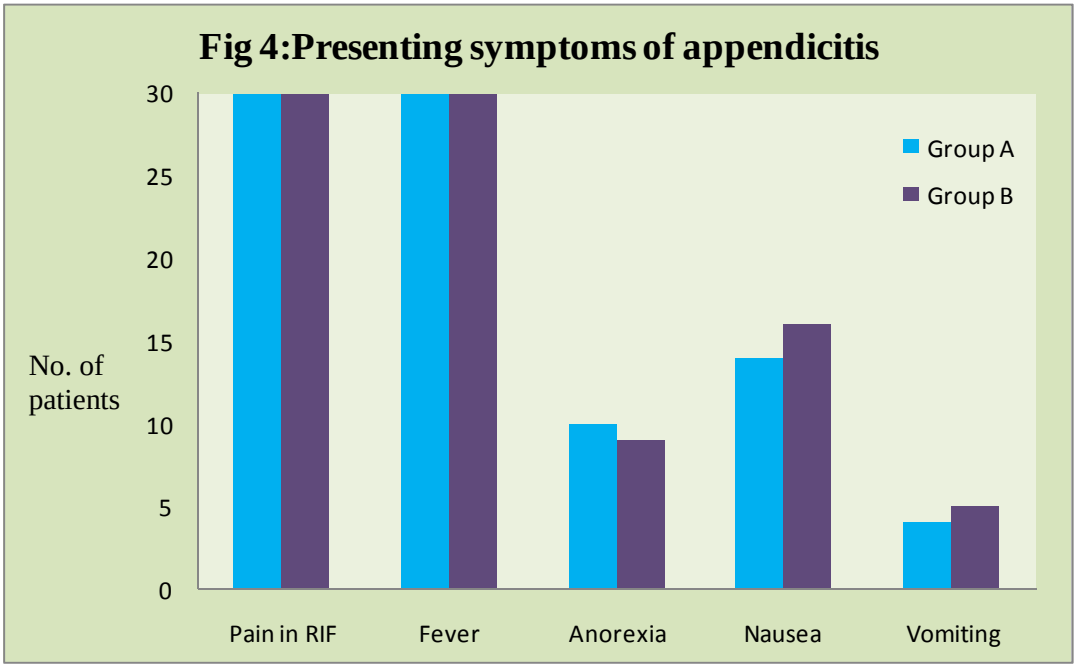


Table 8: Clinical signs of appendicitis

Symptom	Group A		Group B		Total	
	Frequency	**%**	**Frequency**	**%**	**Frequency**	**%**
RIF tenderness	30	100	30	100	60	100
Rebound tenderness	4	13.3	7	23.3	11	18.3
Elevated body temperature	19	63.3	23	76.7	42	70

All the study patients had tenderness in RIF on abdominal palpation. Rebound tenderness was elicited in 11 patients (18.3%). Elevated body temperature was recorded in 42 (70%) patients at the time of presentation.

Fig 5: Clinical signs of appendicitis

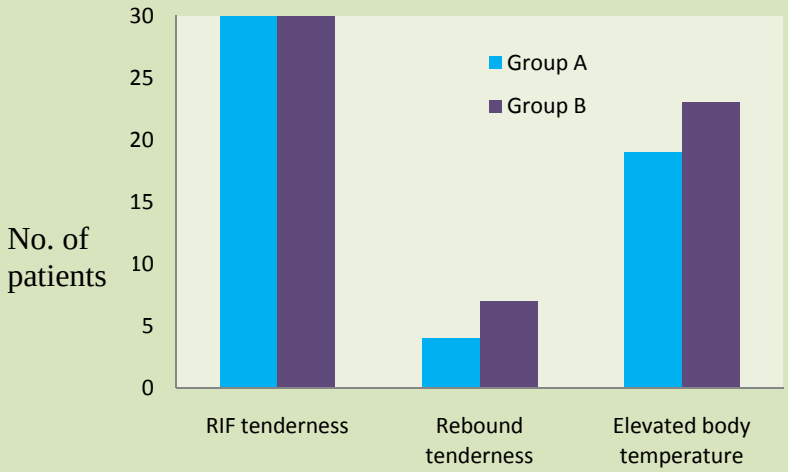


Table 9: Leucocytosis (>10,000 cells/cumm)

Leucocytosis	Present		Absent		Total
	Frequency	%	Frequency	%	
Group A	14	46.7	16	53.3	30
Group B	16	53.3	14	46.7	30
Total	30	50	30	50	60

Leucocytosis was noted in 14 patients (46.7%) in Group A while 16 patients (53.3%) in Group B showed the same finding.

Table 10: Type of appendicitis

Type appendicitis	Acute		Recurrent		Total
	Frequency	**%**	**Frequency**	**%**	
Group A	22	73.3	8	26.7	30
Group B	21	70	9	30	30
Total	43	71.7	17	28.3	60

$\chi 2 = 0.082$ DF = 1 p = 0.774

Out of the 60 study patients, 43 (71.7%) had features of acute appendicitis for the first time whereas 17 (28.3%) of them had past history suggestive of recurrent episodes of appendicitis. Group A had a higher number (22/30) of patients with acute appendicitis compared to Group B (21/30).

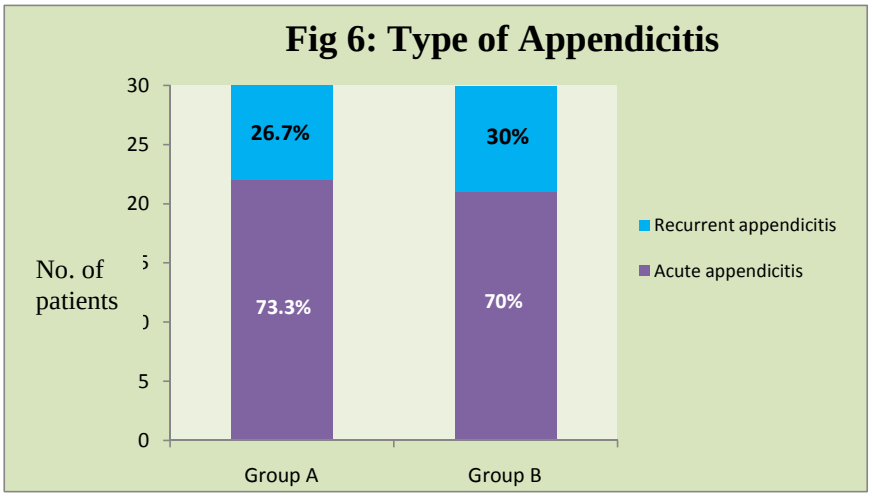


Table 11: Type of surgery

Type of surgery	Elective		Emergency		Total
	Frequency	%	Frequency	%	
Group A	24	80	6	20	30
Group B	20	66.7	10	33.3	30
Total	44	73.3	16	26.7	60

χ 2 = 1.634 DF = 1 p = 0.243

Overall, open appendicectomy was an elective surgery in 44 study patients (73.3%) and an emergency surgery in 16 patients (26.7%). Group A had 24 patients (80%) who underwent elective appendicectomy and 6 patients (20%) who underwent emergency appendicectomy, whereas Group B had 20 (66.7%) patients with elective surgery and 10 patients (33.3%) with emergency surgery.

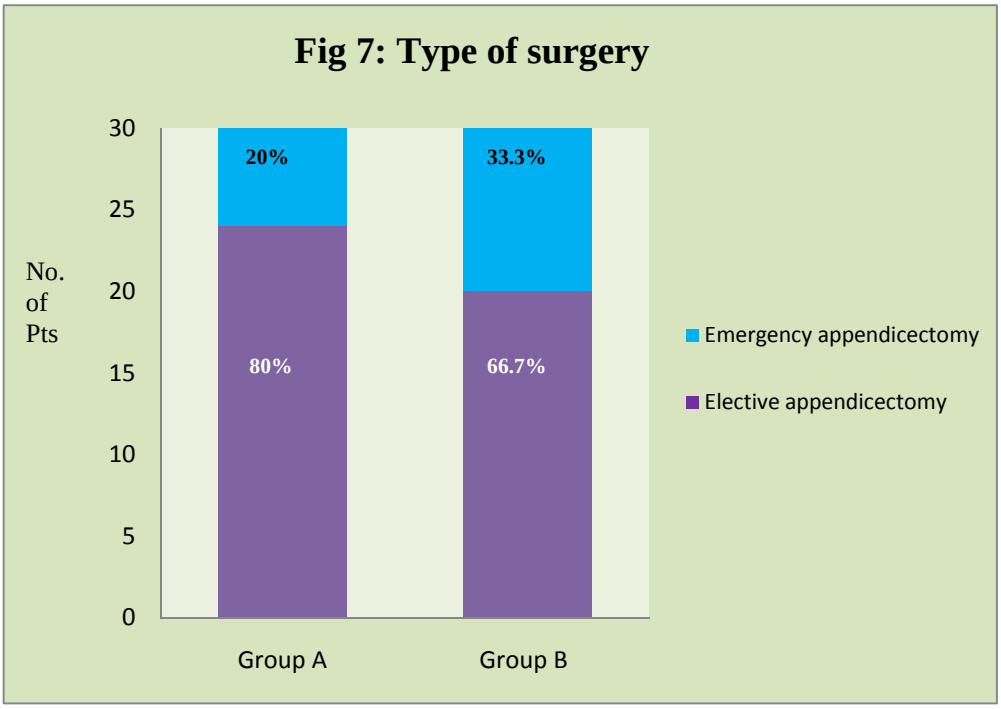


Table 12:Post-operative surgical wound assessment on day 3 of surgery

Infection	Absent		Present		Total
	Frequency	%	Frequency	%	
Group A	30	100	0	0	30
Group B	28	93.3	2	6.7	30
Total	58	96.7	2	3.3	60

Fisher Exact Test *p = 0.492

No patients from Group A developed infection on postoperative day 3 whereas 2 (6.7%) patients from Group B were documented as having developed superficial surgical site infection.

Table 13:Post-operative surgical wound assessment on day 5 of surgery

Wound infection	Absent		Present		Total
	Frequency	%	Frequency	%	
Group A	29	96.7	1	3.3	30
Group B	26	86.7	4	13.3	30
Total	55	91.7	5	8.3	60

χ^2 with Yate's correction = 0.873 *p = 0.350

One patient from Group A developed infection on postoperative day 5 whereas 2 (6.7%) additional patients from Group B were documented as having developed superficial surgical site infection.

Table 14:Post-operative surgical wound assessment on day 7 of surgery

Wound infection	**Absent**		**Present**		**Total**
	Frequency	**%**	**Frequency**	**%**	
Group A	29	96.7	1	3.3	30
Group B	26	86.7	4	13.3	30
Total	55	91.7	5	8.3	60

χ^2 with Yate's correction = 0.873 *p = 0.350

No additional patients from both groups developed infection on postoperative day 7.

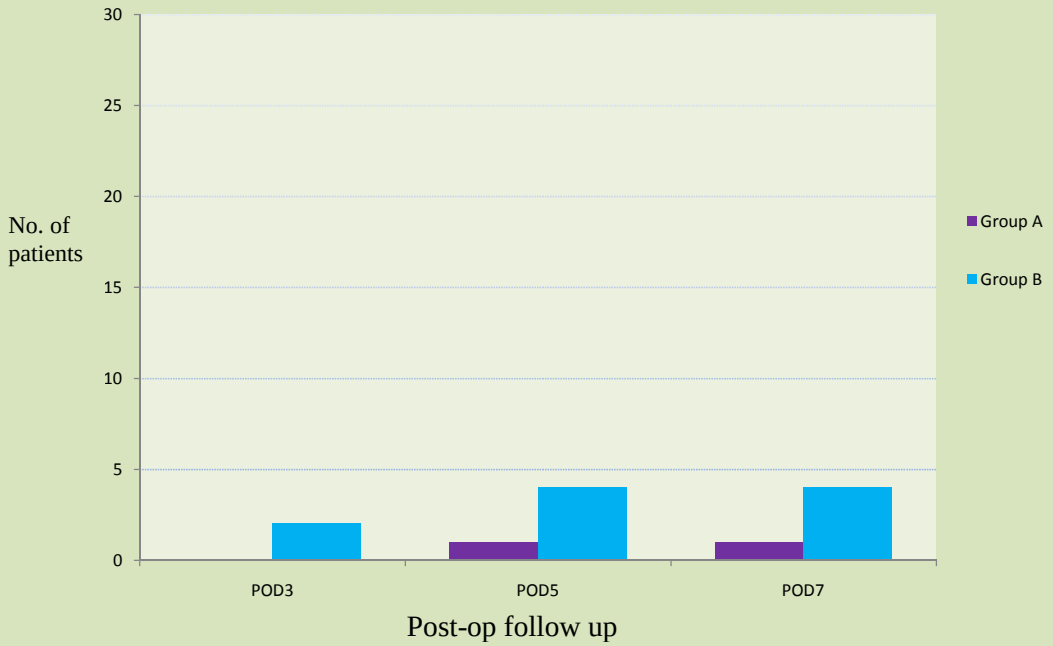
Table 15: Overall post-operative surgical wound assessment

Wound infection	Absent		Present		Total
	Frequency	%	Frequency	%	
Group A	29	96.7	1	3.3	30
Group B	26	86.7	4	13.3	30
Total	55	91.7	5	8.3	60

χ^2 with Yate's correction = 0.873 *p = 0.350

Overall, 1 patient from Group A developed infection postoperatively whereas 4 patients from Group B were documented as having developed superficial surgical site infection in the postoperative follow up period of 7 days.

Fig 8 : Post-Operative Surgical Site Infection



DISCUSSION

Wound infection remains an important postoperative complication with significant clinical and economic consequences.[78] Moylan estimated that in the United States, 7%-8% of all operations are complicated by wound infection.[79] From the study of 1000 general surgical operations, Davidson et al clearly showed that the most important factor in the pathogenesis of wound sepsis was the presence of bacteria at the time of wound closure.[80]

The goal of surgical prophylaxis is to achieve and maintain a satisfactory tissue concentration of a drug with a reasonable spectrum of activity against expected organisms during the period of potential bacterial contamination of the wound, so that organisms introduced into the wound during the operation would be immediately destroyed. Failure to maintain adequate serum and tissue levels throughout the surgical procedure increases the likelihood of infection.[81] It has also been emphasized that wound levels, not blood or serum levels, appear to determine the efficacy of agents for prophylaxis of operative wound infection. These very high tissue levels can only be achieved by a preoperative intraincisional injection. Prophylactic antibiotics are generally administered systemically prior to operation. The concentration of an appropriate antibiotic in the wound itself, rather than in the serum, is the critical factor in determining the efficacy of agents used for the prophylaxis of surgical wound infections. [82]

Appendicectomy is one of the most commonly performed surgical procedures with SSI complicating 1–5% of appendicectomy cases.[83-86] The lifetime rate of appendicetomy is 12% for men and 25% for women, with approximately 7% of all people undergoing appendicectomy for acute appendicitis during their life time. Over the past 10 years the rate of appendicectomy for appendicitis has remained constant at 10 per 10,000 per year.[87]

In 1999, CDC issued guidelines for reducing the risk of SSIs, based on existing scientific data, theoretical rationale and applicability. These guidelines include, handling of the tissues gently, maintain effective hemostasis, minimize devitalized tissue and foreign bodies (sutures, charred tissues, necrotic debris), and eradicate dead space at the surgical site.

The pathologic state of the appendix is the most important determinant of postoperative infection.[88,89] Wound infection after appendicectomy, for perforative or gangrenous appendicitis is four to five times higher than for early disease. Because the pathologic state of the appendix often cannot be determined before or during operation, a parenteral antibiotic agent is recommended as prophylaxis in all patients.

The present study was undertaken to compare and evaluate the efficacy of single dose of preoperative intraincisional administration of cefotaxime with intravenous administration in preventing postoperative surgical site infections after open appendicectomies.

This study was conducted in the Department of General Surgery, KLES Dr. Prabhakar Kore Hospital and Medical Research Centre, Belgaum over a period from January 2012 to December 2012 on 60 patients with non-perforated appendicitis. Based on the envelope method, patients were divided into two groups namely group A (single dose of preoperative intraincisional cefotaxime) and group B (single dose of preoperative intravenous cefotaxime).

In the present study, there was an overall male preponderance in patients who presented with appendicitis similar to a previous study.[90] However, females outnumbered males in Group A, who received intraincisional cefotaxime and males outnumbered females in Group B who received intravenous cefotaxime.

A total of 60 patients (30 in each group) were enrolled in the study. The age of participants ranged from 18 to 64 years. Mean age was 30.8 ± 12.62 years in Group A and 30.3 ± 10.29 years in Group B with a p value of 0.818 which suggests that they were comparable.

These findings were consistent with literature showing, appendicitis is most frequently seen in patients in their second through fourth decades of life with a mean age 31.3 years and a median age of 22 years.[90,91]

All patients with diabetes mellitus or immunodeficiency were excluded from the study. Similarly, patients who had a history of consumption of antibiotics and steroids were also excluded to reduce confounding bias. Patients who were diagnosed with complications of appendicitis such as perforated appendix, appendicular mass and gangrenous appendicitis were also excluded

from the study as the study was confined to assess wound infection in an uncomplicated clean-contaminated surgery viz appendicectomy.

All the patients presented with multiple symptoms. A history of pain in the right iliac fossa and fever was present in all the patients (100%) of both the groups. Nineteen patients (31.7%) had anorexia. Nausea as one of the presenting complaint was present in thirty (50%) patients, whereas 9 (15%) patients had vomiting at the time of presentation.

All the sixty patients had tenderness in right iliac fossa on abdominal palpation. Rebound tenderness was elicited in 11 patients (18.3%). Elevated body temperature was recorded in 42 (70%) patients at the time of presentation.

Leucocytosis (Total WBC count >10,000/cumm) was noted in 14 (46.7%) patients in Group A while 16 (53.3%) patients in Group B showed the same finding. Mild leukocytosis, ranging from 10,000 to 18,000 cells/mm3, usually is present in patients with acute, uncomplicated appendicitis and often is accompanied by a moderate polymorphonuclear predominance. White blood cell counts are variable, however.[92]

Out of the 60 study patients, 44 (73.3%) had features of acute appendicitis for the first time whereas 16 (26.7%) of them had past history suggestive of recurrent episodes of appendicitis.

Overall, open appendicectomy was an elective surgery in 44 study patients (73.3%) and an emergency surgery in 16 patients (26.7%). Group A had 24 (80%) patients who underwent elective appendicectomy and 6 (20%) patients

who underwent emergency appendicectomy, whereas Group B had 20 (66.7%) patients with elective surgery and 10 (33.3%) patients with emergency surgery.

No patients from Group A developed infection on postoperative day 3 whereas 2 (6.7%) patients from Group B were documented as having developed superficial surgical site infection.

1 patient from Group A developed infection on postoperative day 5 whereas 2 additional (6.7%) patients from Group B were documented as having developed superficial surgical site infection.

No additional patients from both groups developed infection on postoperative day 7.

Overall, 1 patient from Group A developed infection postoperatively whereas 4 patients from Group B were documented as having developed superficial surgical site infection postoperatively in a follow up period of 7 days.

Pus was sent for culture and antibiotic sensitivity in all the cases. Among the 5 cases, the culture in 3 cases was found to be E. coli, 1 was found to be Staphylococcus aureus and 1 was found to be Streptococcus species. Antibiotics were then initiated accordingly. All 5 cases however recovered by further non-operative management i.e. daily dressings and healing by secondary intention. No further surgical intervention was required.

Interestingly, one case in the intraincisional group developed subcutaneous emphysema around the operative site. However, no other signs of wound infection were noted. No further intervention was required and the

emphysema resolved by conservative management alone. Whether, this was as a result of the antibiotic injection is unclear.

Several similar studies have been done to establish the efficacy of intraincisional administration of antibiotic. The following is a summary of the various important studies that document the superiority of intraincisional antibiotic administration:

Sl No.	**Study**	**Type of Surgery**	**Drug used in intra-incisional group**	**Drug used in intra-venous control group**	**Sample size**	**Infection rate in intra-incisional group**	**Infection rate in control group**
1	Shubing et al	Appendi-cectomy	Metro-nidazole	Metro-nidazole	239	0.8%	11.6%
2	Taylor et al	Various clean-contaminated upper abdominal surgeries	Cefamandole	Placebo	250	0.79%	14.5%
3	Pollock et al	All types of abdominal surgeries	Amoxycillin + Clavulanate	Amoxycillin + Clavulanate	624	8.4%	15.9%
4	Taylor et al	All types of abdominal surgeries	Cefoxitin	Placebo	181	4.4%	16.7%
5	Chalkiadakis et al	All types of abdominal surgeries	Ceftriaxone	Placebo	36	0	10.65%
6	Present study	Appendi-cectomy	Cefotaxime	Cefotaxime	60	3.33%	13.33%

As evident from the above table, the results obtained in our study are comparable to the other studies.

All the above studies support the results of the present study indicationg that intraincisional administration of antibiotic is as effective as intravenous administration of the same.

However, despite the above conclusion, the importance of good surgical technique, maintenance of asepsis and good postoperative care cannot be undermined to reduce the incidence of postoperative surgical site infection and thereby reduce significant morbidity and mortality.

Overall, the results of this study suggest that, the use of single dose of intraincisional cefotaxime is as effective as intravenous administration of the same and resulted a clinically noticeable reduction in the rate of postoperative surgical site infection. However, the difference was not found to be statistically significant. This may be attributed to the smaller sample size of the study. Further studies on larger sample size could focus the beneficial effect of intraincisional antibiotics.

Limitations of the study

- Only one type of clean-contaminated surgery was included in the study. Further studies are required to extrapolate the same conclusion for other clean-contaminated surgeries.

- Patients with comorbidities like diabetes mellitus and immunosuppression were excluded to eliminate confounding bias. However, studies including such patients are required in future in order to apply the same conclusion for the general population.

CONCLUSION

The results of the present study show that a single dose preoperative intraincisional administration of cefotaxime is as effective as intravenous administration of cefotaxime for prevention of postoperative surgical site infection after open appendicectomies.

Clinically, there were lesser incidences of SSI in individuals who received intraincisional cefotaxime compared to intravenous cefotaxime. However, the difference was not statistically significant.

SUMMARY

Acute appendicitis is one of the commonest causes of an abdominal emergency and remains one of the most common surgical emergencies encountered in day-to-day practice. Open appendicectomy is considered as the standard of care for the treatment of appendicitis. Appendicectomy is classified as a clean-contaminated surgery. Postoperative surgical site infection is the most common complication following appendicectomy for uncomplicated appendicitis. Intraincisional administration has been studied as an alternative to intravenous administration of antibiotic and has been met with success in experimental settings.

The purpose of this study was to compare the efficacy of single dose preoperative intraincisional cefotaxime with intravenous cefotaxime in preventing postoperative surgical site infection following open appendicectomies.

This one year randomized clinical trial was conducted in the Department of General Surgery, KLES Dr. Prabhakar Kore Hospital and Medical Research Centre, Belgaum over a period from 1st January 2012 to 31st December 2012 on 60 patients diagnosed as acute or recurrent appendicitis. Based on the opaque envelope method, patients were randomly divided into two groups namely group A (intraincisional cefotaxime) and group B (intravenous cefotaxime).

In the present study, males outnumbered females overall (55% vs 45%). The age of participants ranged from 18 to 64 years with a mean age of 30.8 ± 12.62 years in Group A and 30.3 ± 10.29 years in Group B.

Overall, 1 patient (3.3%) from Group A developed superficial surgical site infection compared to 4 patients (13.3%) among Group B who were diagnosed with superficial surgical site infection.

Though a certain clinical difference was observed among patients in the study group, a statistically significant difference could not be demonstrated.

Thus, the present study shows that intraincisional administration of cefotaxime was as effective as intravenous administration of cefotaxime for prevention of postoperative surgical site infection after open appendicectomies. Clinically, there were lesser incidences of SSI in individuals who received intraincisional cefotaxime compared to intravenous cefotaxime. However, the difference was not statistically significant. Further studies need to be conducted with a larger sample size to establish a significant difference.

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ANNEXURE I

INFORMED CONSENT

Title of Research Study: Intraincisional versus intravenous cefotaxime in open appendicectomies for prevention of surgical site infections – a randomized controlled trial

Principal Investigator:-
Dr. _____
Professor & Head,
Department Of General Surgery,
J. N. Medical College, Belgaum.

Co-investigator:-
Dr. _____
Post Graduate Student,
Department Of Gen Surgery,
J. N. Medical College, Bgm.

You are requested to participate in a study that is an attempt to find out the effectiveness of preoperative intraincisional injection of antibiotic as compared to intravenous injection of the same antibiotic.

Prophylactic preoperative antibiotics are routinely used to prevent development of wound infection after a surgical procedure. However, excessive and irrational use of antibiotics has serious consequences like increased cost for the patients, adverse effects of the drugs and also development of new species of microorganisms that are resistant to existing antibiotics.

In an effort to avoid the above mentioned problems, this study has been undertaken to evaluate the efficacy of a new, alternate technique of administration compared to the conventional intravenous route. In this study, an

'intraincisional' route of injecting the antibiotic will be compared to the standard procedure of injecting the antibiotic 'intravenously' (for eg. routinely through a vein in the upper limb. About 60 patients with appendicitis will be enrolled in this study.

This study will be conducted by Dr. _____, Post Graduate in Department of Surgery, under the direct supervision and guidance of Dr. _____ Professor and Head, Department of Surgery, J. N. Medical College, Belgaum.

You need to be eligible, meeting all the selection criteria to participate in this study. You should be willing to provide information about yourself. 60 subjects will be enrolled in this study who will then be randomised in either of 2 groups (details below).

If you agree to participate in this study, you will be randomly allotted into a group (A or B) and accordingly receive either the standard treatment (intravenous) or the newer treatment (intraincisional). Post operatively, your wound will be examined for any signs of infection and discharge, if any, will be sent for culture and sensitivity. The further treatment will then be initiated depending on the sensitivity report.

The benefits of the procedure under study (intraincisional route) are - lesser exposure to antibiotics and hence lesser side effects; more effective in controlling local wound infection (as proved by previous similar studies)

There is no additional risk compared to the standard method of administration.

Taking part in the study will not affect the cost of treatment i.e. it will be similar to the cost of standard procedure. In the event that you become injured as a result of taking part in this study, treatment will be offered to you or you will be given information about where to receive medical care: but you/your insurance company will be responsible for the costs. However, no reimbursement, compensation or free medical care will be given.

Every effort will be made to protect the confidentiality of the information you provide. This means that the researchers will not let anyone, not a part of the study, see the information you provide. Only Dr. _____ and Dr. _____ will have access to the information collected. Results of this study may be published but your name will not be revealed.

Taking part in this study is voluntary; you may choose not to enroll in this study. Your decision will not change the present or future health care services offered to you at KLES Dr. Prabhakar Hospital, Belgaum. The alternative that you have is to undergo the traditional procedure that is carried out in KLES Hospital.

If you have any queries about the study, you may contact Dr. _____ (Mobile No. _____); or Dr._____(Mobile No. _____). If you need any further information regarding your rights as a study participant, you may also contact Dr. _____, Chairman of Institutional Ethics Committee, JNMC, Belgaum (Mobile No. _____).

CONSENT TO PARTICIPATE IN THE STUDY

I Mr./Ms._____ have been explained about the research study, the need of the study, the intervention, their risks, benefits and alternatives available in my own vernacular language.

I voluntarily agree to participate in this study by signing up this form below. I understand that I may withdraw at any time from this study. I have been given adequate time to clarify my doubts about the study and my rights as a study participant.

My signature / thumb impression below indicates that I have read or information in the consent been read to me including the risks and benefits and have cleared my doubts.

Name of participant: Signature/LTI:

Name of legally authorized Representative (if applicable): Signature/LTI:

Relationship with participant:

Name of witness: Signature:

Name of investigator: Signature:

Date:

Place:

ANNEXURE II - PROFORMA

Title: Intraincisional versus intravenous cefotaxime in open appendicectomies for prevention of surgical site infections – an RCT

Name: Age: Sex:

Address:

IP No.: Unit:

Date of admission: Ward:

Education: Religion:

Marital Status: Occupation:

Socio-Economic Status:

HISTORY :

Pain abdomen: Yes / No Duration:

Details:

Associated complaints and duration:

Fever

Nausea/Vomiting

Anorexia

Other -

Previous history of use of antibiotics/steroids:

Past History (including Treatment history):

Personal History:

Family History:

GENERAL PHYSICAL EXAMINATION:

Built and Nourishment:

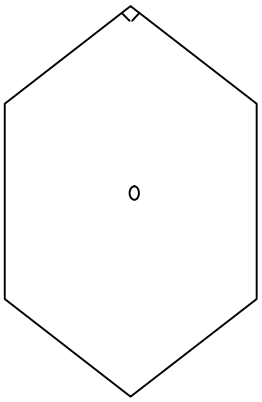
Weight:

Pallor / Icterus / Cyanosis / Clubbing / Edema / Lymphadenopathy

Vital Signs: PR: /min; BP: mmHg; RR: /min; Temp:

SYSTEMIC EXAMINATION:

Per Abdomen examination:



Respiratory System:

Central Nervous System:

Cardio-Vascular System:

PREOPERATIVE INVESTIGATIONS:

Hemoglobin: g/dl
TLC: /cu mm
DLC: N- L- M- E- B-
ESR: at end of 1st hour
PCV: %
Platelets: /cu mm
RBCs: /cu mm
Urea: mg/dl
Creatinine: mg/dl
Any other investigations:

Date of Surgery:

Name of procedure:

Group assigned by randomization**:** **A / B**

POSTOPERATIVE WOUND ASSESSMENT

	Postop Day 3	Postop Day 5	Postop Day 7
Discharge from surgical site (Present /Absent)			
If yes, - Site (Superficial / Deep) - Type of discharge - Whether sent for culture and sensitivity			
Pain			
Localised tenderness			
Fever (If present, temperature in ^{o}C)			
Redness			
Increased local temperature			
Whether deliberately opened by consultant			
Whether diagnosed as SSI by attending consultant			
Wound gaping/dehiscence (present/absent)			
Result of culture and sensitivity, if sent			
Evidence suggestive of infection during direct examination/ reoperation/ microbiology/ radiological examination (Present / Absent; If present, the details)			

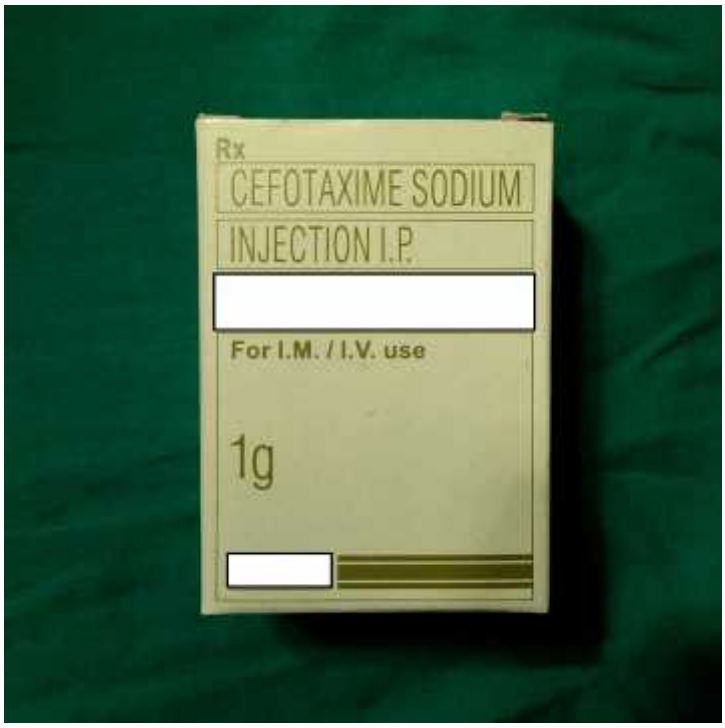
If any of the above findings observed/recorded on any other postoperative day, details are as follows:

If any other findings noted, details are as follows:

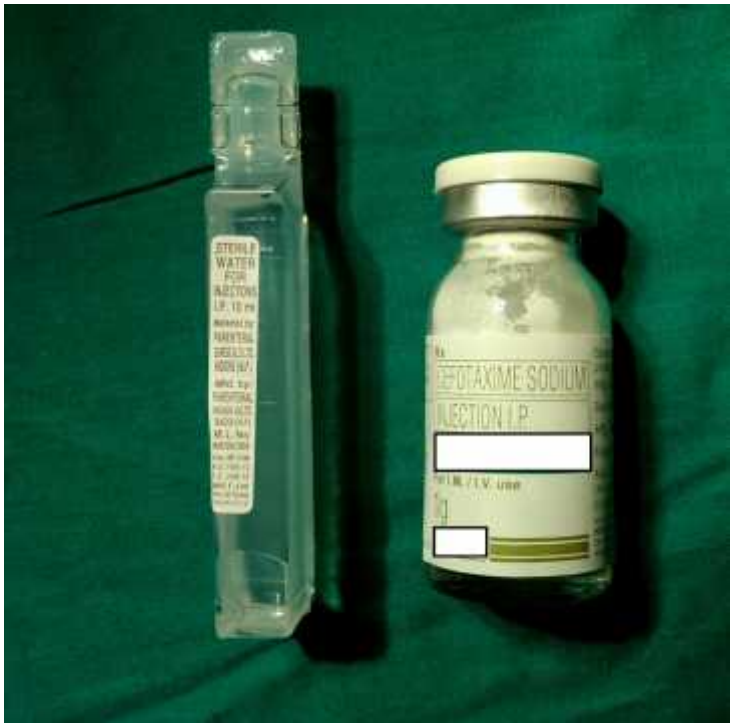
Based on above findings, as per CDC guidelines, postoperative wound infection is:

PRESENT / ABSENT

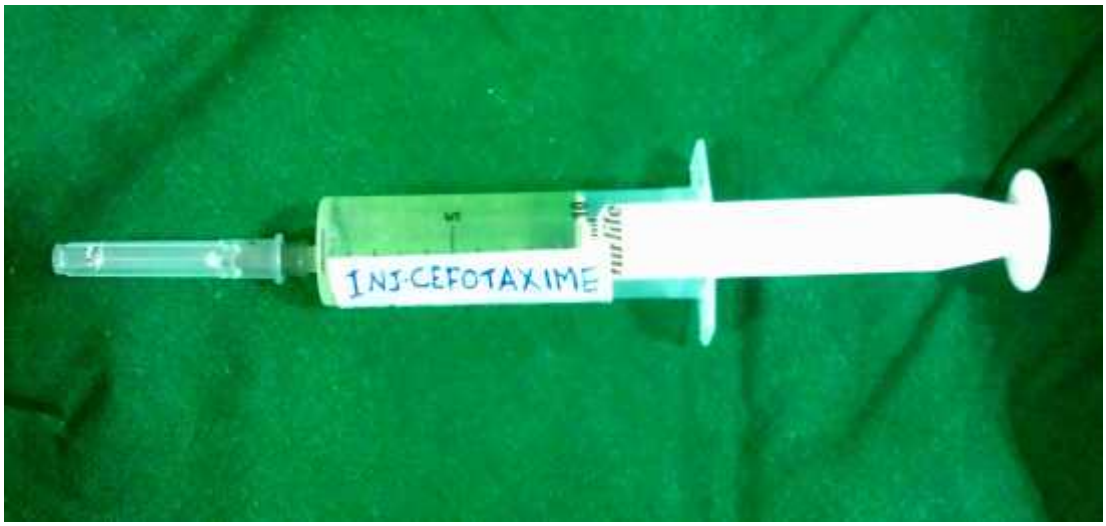
ANNEXURE III – PHOTOGRAPHS



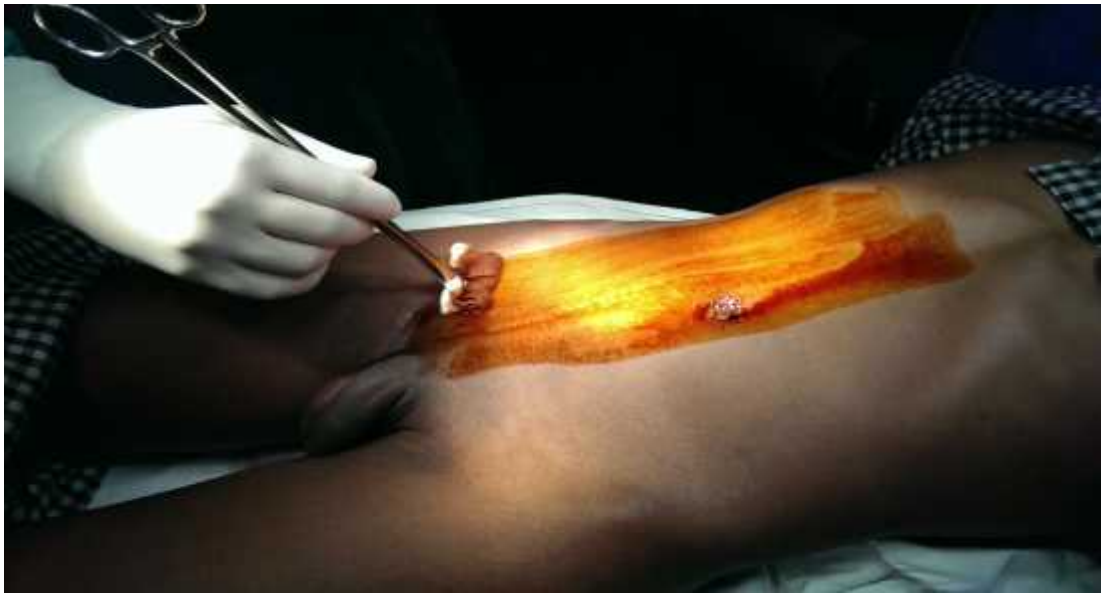
Photograph 1: Cefotaxime Injection - Box



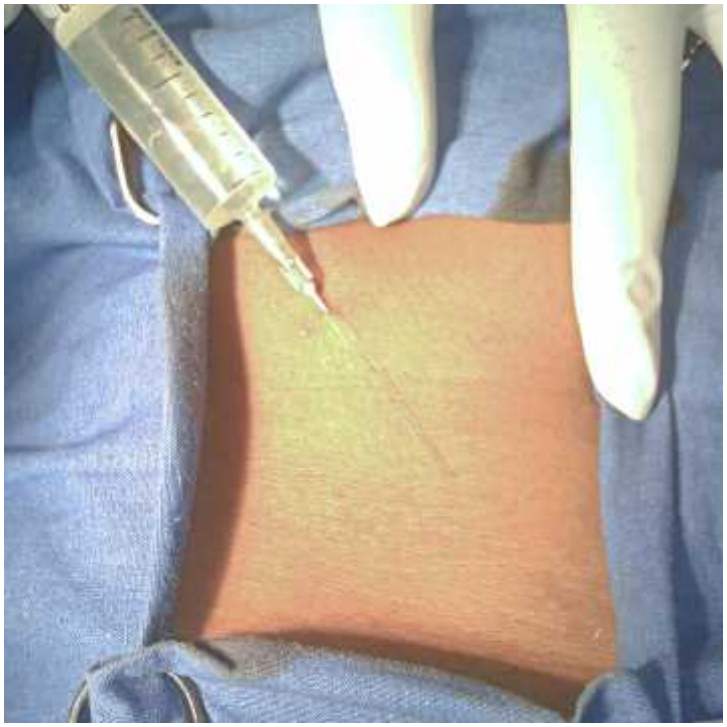
Photograph 2: Cefotaxime Injection - Contents



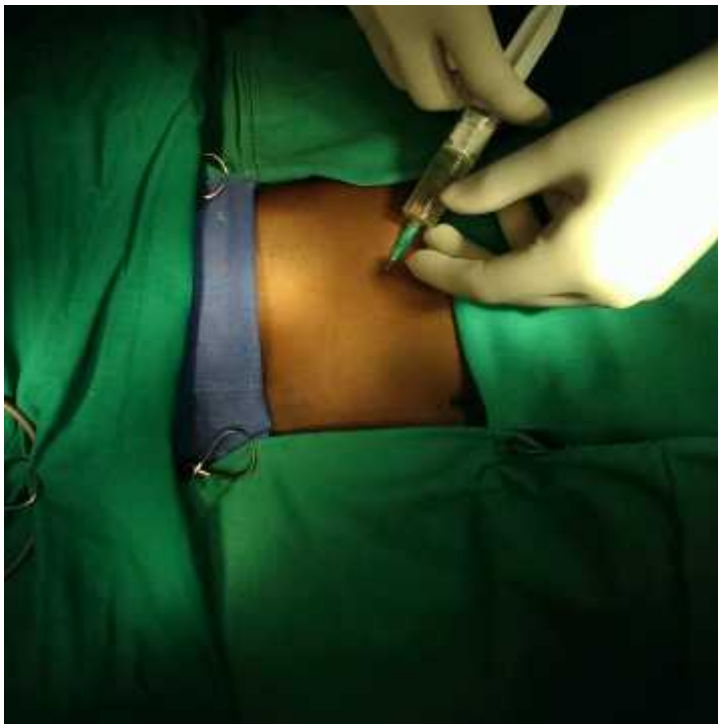
Photograph 3: Injection Cefotaxime after reconstitution



Photograph 4: Painting the abdomen before surgery

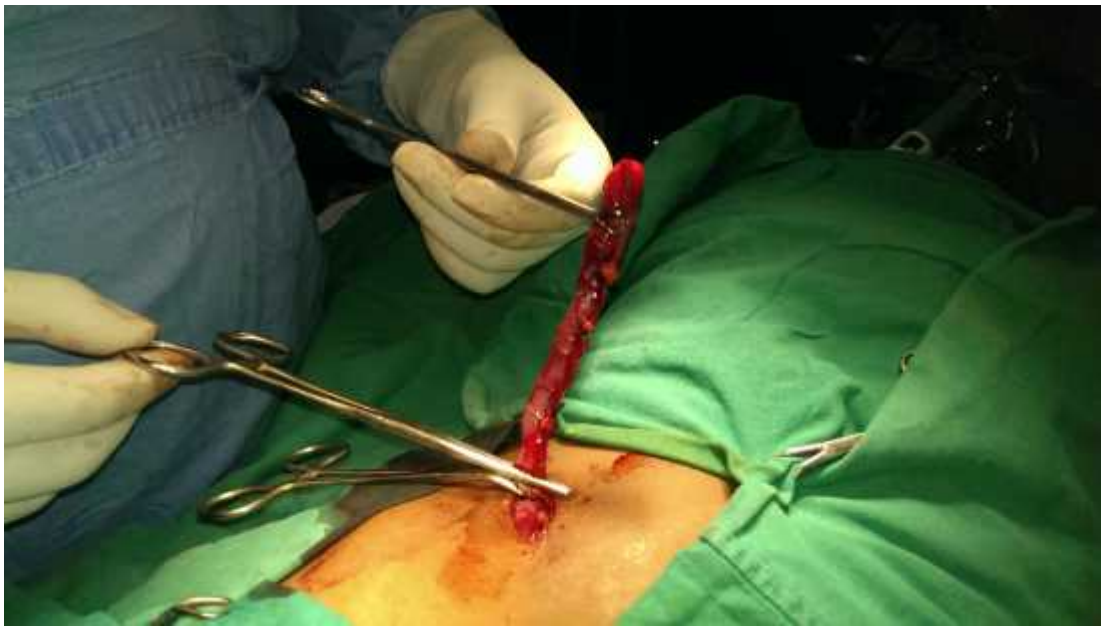


Photograph 5(a): Intraincisional injection of Cefotaxime

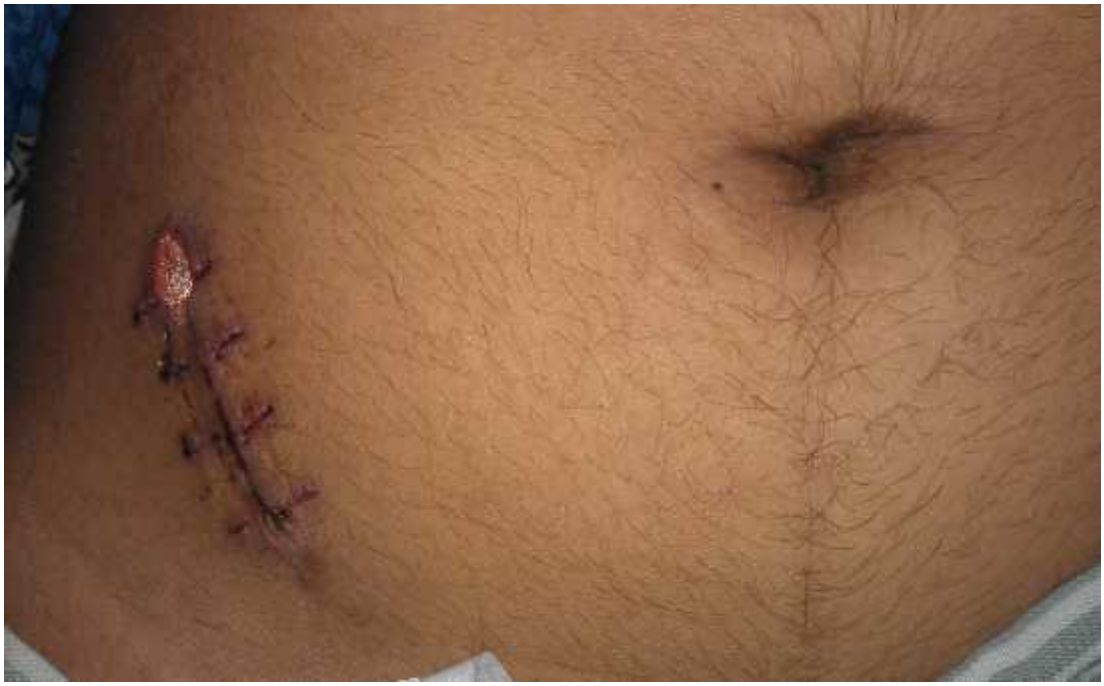


Photograph 5(b): Intraincisional injection of Cefotaxime

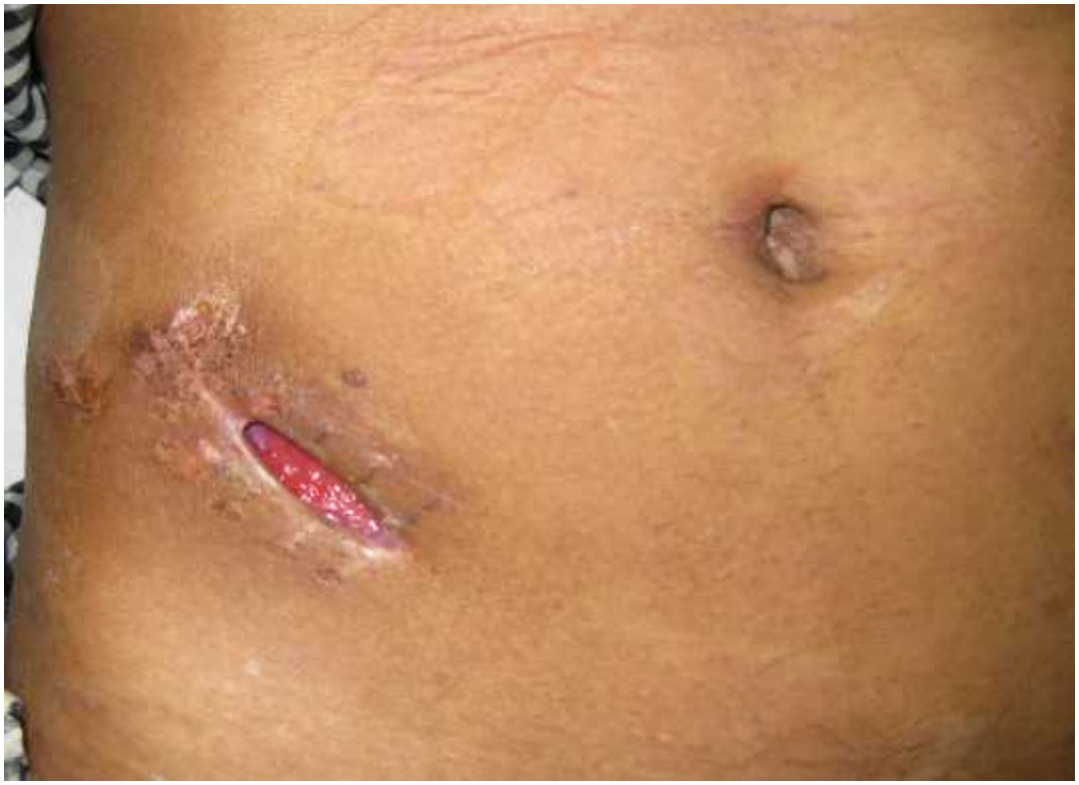
Photograph 6(a): Appendiicectomy in progress



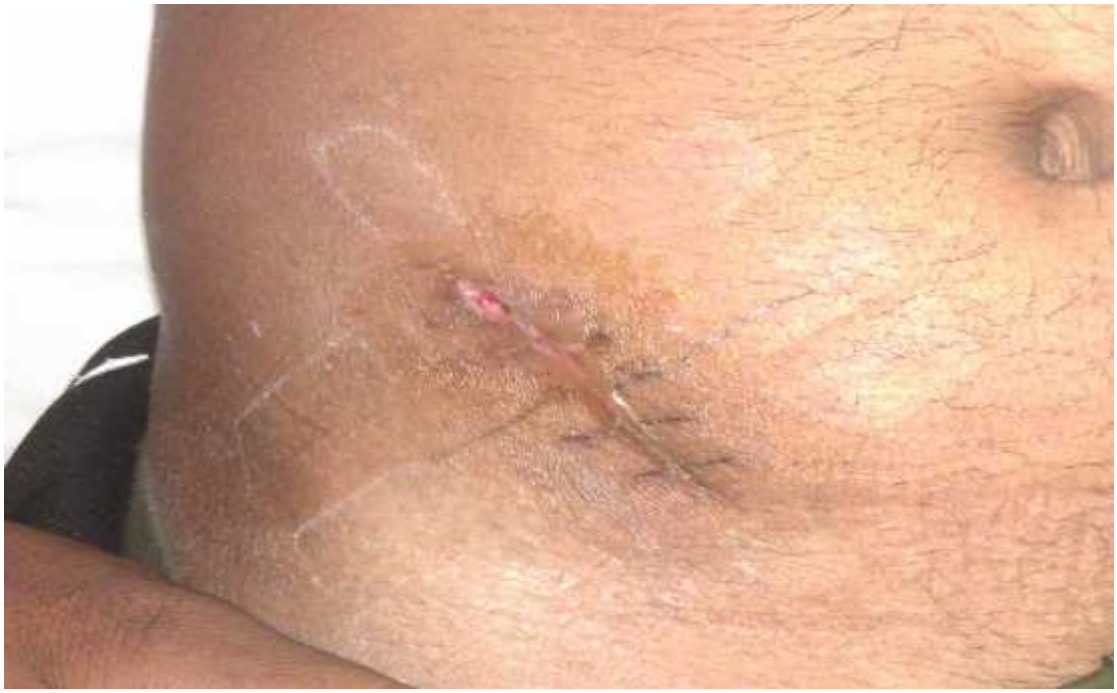
Photograph 6(b): Appendiicectomy in progress



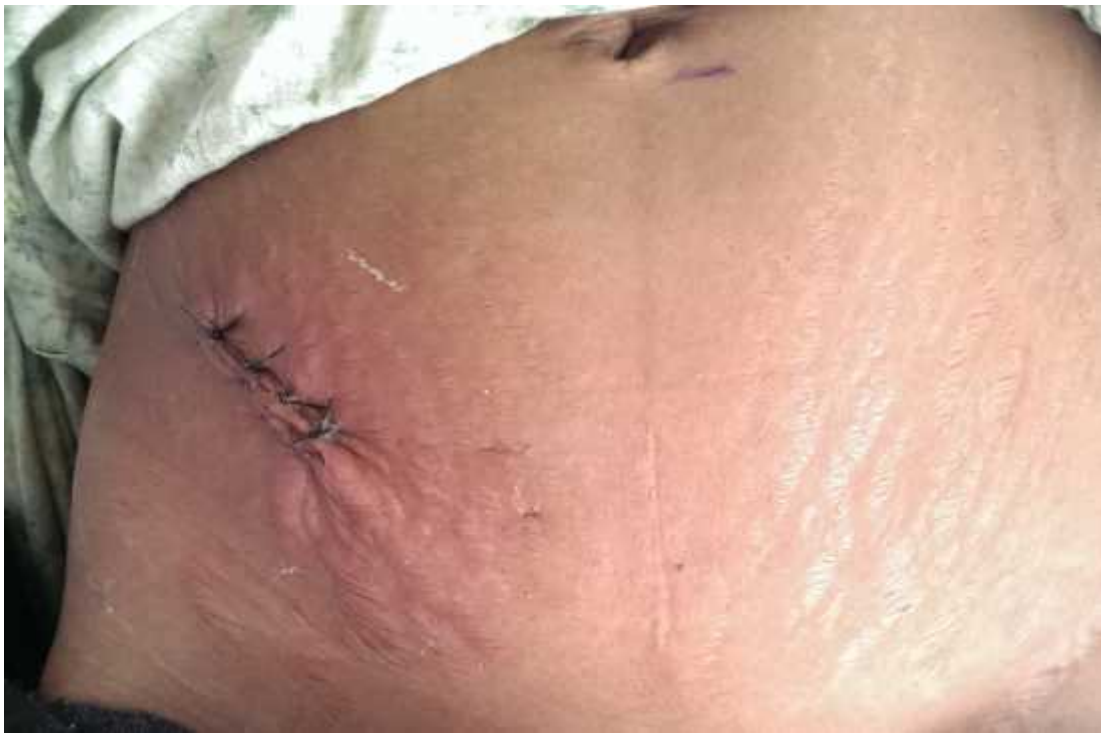
Photograph 7(a): Posoperative surgical site infection



Photograph 7(b): Posoperative surgical site infection



Photograph 7(c): Posoperative surgical site infection



Photograph 7(d): Posoperative surgical site infection

ANNEXURE IV – KEY TO MASTER CHART

A	-	Anorexia
AA	-	Acute appendicitis
DOA	-	Date of admission
DOS	-	Date of Surgery
EL	-	Elective
EM	-	Emergency
ET	-	Elevated temperature
F	-	Fever
Grp	-	Group
IP No.	-	In Patient Number
L	-	Leucocytosis
N (in 'History')	-	Nausea
N (in 'Wound infection')	-	No
No.	-	Number
P	-	Pain abdomen
POD	-	Post operative day
RA	-	Recurrent appendicitis
RT	-	Rebound tenderness
Sl No.	-	Serial number
T	-	Tenderness in Right iliac fossa
V	-	Vomiting
Y	-	Yes

Serial No.	Group assigned	Code No.	Name	IP No.	DOA	DOS	Unit
1	B	B1	VISHWANATH	452651	2/1/2012	4/1/2012	A
2	A	A1	REKHA	453537	6/1/2012	6/1/2012	C
3	A	A2	JAYASHREE	453958	9/1/2012	9/1/2012	C
4	B	B2	RENUKA	454702	14/1/2012	16/1/2012	C
5	A	A3	RESHMA	456059	24/1/2012	25/1/2012	C
6	A	A4	SHASHIKALA	457042	31/1/2012	2/2/2012	B
7	B	B3	RAJU	457434	3/2/2012	3/2/2012	C
8	B	B4	SHIVALEELA	458036	6/2/2012	10/2/2012	C
9	A	A5	DUNDAPPA	458985	12/2/2012	15/2/2012	A
10	B	B5	NAGAPPA	458746	10/2/2012	17/2/2012	A
11	B	B6	SINDU	461110	27/2/2012	27/2/2012	C
12	A	A6	ASHWINI	461565	29/2/2012	1/3/2012	C
13	B	B7	SANGEETA	462211	5/3/2012	5/3/2012	A
14	A	A7	NARAYAN	462720	9/3/2012	9/3/2012	C
15	A	A8	ANAND	462495	7/3/2012	12/3/2012	C
16	B	B8	BASAVRAJ	463148	12/3/2012	14/3/2012	A
17	B	B9	GUNDURAO	464583	21/3/2012	22/3/2012	C
18	B	B10	POOJA	466237	2/4/2012	2/4/2012	C
19	A	A9	RAHAMATBI	468517	17/4/2012	18/4/2012	A
20	A	A10	YASHODA	468694	18/4/2012	20/4/2012	C
21	A	A11	ARCHANA	470478	30/4/2012	1/5/2012	C
22	A	A12	ROOPA	470456	30/4/2012	2/5/2012	A
23	B	B11	FAKIRAPPA	470407	30/4/2012	2/5/2012	A
24	A	A13	MANJULA	471197	4/5/2012	7/5/2012	C
25	A	A14	RAVI	470715	2/5/2012	7/5/2012	C
26	B	B12	MAHADEV	471684	7/5/2012	9/5/2012	E
27	A	A15	UDDAWWA	472105	9/5/2012	11/5/2012	C
28	B	B13	SUJATA	472269	10/5/2012	13/5/2012	C
29	A	A16	IMTIYAZ	476943	7/6/2012	7/6/2012	C
30	A	A17	JYOTI	476893	6/6/2012	8/6/2012	C
31	A	A18	VARSHA	476681	5/6/2012	8/6/2012	C
32	B	B14	SURAYYA	477340	9/6/2012	12/6/2012	C
33	B	B15	MD ISHAQ	478035	13/6/2012	13/6/2012	C
34	A	A19	GANGU	478484	16/6/2012	16/6/2012	C
35	B	B16	REKHA	481090	3/7/2012	3/7/2012	C
36	B	B17	SIDDHALINGAPPA	481656	6/7/2012	6/7/2012	B
37	B	B18	MUKTA	482123	9/7/2012	9/7/2012	C
38	B	B19	SANTOSH	481889	7/7/2012	9/7/2012	C
39	A	A20	HARSHAL	483354	16/7/2012	16/7/2012	A
40	B	B20	PARVATI	484873	26/7/2012	28/7/2012	D
41	A	A21	LAXMI	486311	3/8/2012	4/8/2012	B
42	A	A22	MALLAPPA	486019	2/8/2012	4/8/2012	D
43	B	B21	KALMESH	486684	6/8/2012	8/8/2012	A
44	B	B22	SUMAYYA	489601	24/8/2012	24/8/2012	C
45	B	B23	MAHESH	489370	23/8/2012	25/8/2012	D

46	B	B24	NADEEM	491272	3/9/2012	3/9/2012	C
47	B	B25	SANTOSH	491862	6/9/2012	8/9/2012	D
48	A	A23	MUMTAZ	492844	12/9/2012	14/9/2012	C
49	A	A24	PRABHAVATI	494401	22/9/2012	26/9/2012	A
50	B	B26	HADIN	494572	24/9/2012	26/9/2012	E
51	A	A25	RADHA	494903	25/9/2012	1/10/2012	C
52	A	A26	CHANDRIKA	497927	14/10/2012	15/10/2012	B
53	B	B27	SAFWAN	498733	19/10/2012	19/10/2012	C
54	A	A27	BALVINDRAPPA	498830	20/10/2012	22/10/2012	C
55	B	B28	SANGEETA	499468	26/10/2012	29/10/2012	C
56	A	A28	MARUTHI	499922	29/10/2012	30/10/2012	C
57	A	A29	SAVITRI	500336	3/11/2012	3/11/2012	C
58	A	A30	KANCHAN	501726	15/11/2012	19/11/2012	C
59	B	B29	JAGADISH	503156	26/11/2012	28/11/2012	A
60	B	B30	ASHOK	505814	13/12/2012	13/12/2012	D

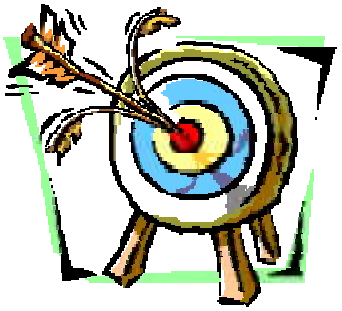
Age	Sex	Religion	Marital status	Occupation	Education
55	M				
19	F				
36	F				
30	F				
24	F				
18	F				
34	M				
23	F				
21	M				
21	M				
18	F				
19	F				
20	F				
35	M				
22	M				
26	M				
47	M				
20	F				
38	F				
64	F				
37	F				
18	F				
35	M				
28	F				
42	M				
48	M				
45	F				
24	F				
26	M				
18	F				
18	F				
55	F				
30	M				
38	F				
28	F				
41	M				
21	F				
28	M				
24	M				
37	F				
26	F				
50	M				
24	M				
24	F				
22	M				

28	M
27	M
26	F
18	F
18	M
27	F
22	F
28	M
58	M
25	F
40	M
45	F
22	F
36	M
35	M

Sl No	Grp	Code No.	Name	IP No.	DOA	DOS	Unit	Age	Sex	History	Exam-ination	Invest-igations	Diag-nosis	Nature of Surgery	Wound infection				Conc-lusion
															POD3	POD5	POD7	Other	
1	B	B1	VISHWANATH	452651	1/2/2012	1/4/2012	A	55	M	P,N,F	T,ET	L	RA	EL	N	N	N	-	N
2	A	A1	REKHA	453537	1/6/2012	1/6/2012	C	19	F	P,V,F	T,ET	-	AA	EM	N	N	N	-	N
3	A	A2	JAYASHREE	453958	1/9/2012	1/9/2012	C	36	F	P,F,A	T,ET,RT	-	AA	EM	N	N	N	-	N
4	B	B2	RENUKA	454702	1/14/2012	1/16/2012	C	30	F	P,N,F,A	T,ET	-	AA	EL	N	N	N	-	N
5	A	A3	RESHMA	456059	1/24/2012	1/25/2012	C	24	F	P,F,A	T	-	AA	EL	N	N	N	-	N
6	A	A4	SHASHIKALA	457042	1/31/2012	2/2/2012	B	18	F	P,F	T,ET	L	AA	EL	N	N	N	-	N
7	B	B3	RAJU	457434	2/3/2012	2/3/2012	C	34	M	P,V,F,A	T	L	RA	EL	N	N	N	-	N
8	B	B4	SHIVALEELA	458036	2/6/2012	2/10/2012	C	23	F	P,N,F,A	T,RT	-	AA	EL	N	N	N	-	N
9	A	A5	DUNDAPPA	458985	2/12/2012	2/15/2012	A	21	M	P,F	T	L	AA	EL	N	N	N	-	N
10	B	B5	NAGAPPA	458746	2/10/2012	2/17/2012	A	21	M	P,N,F	T	-	AA	EL	N	N	N	-	N
11	B	B6	SINDU	461110	2/27/2012	2/27/2012	C	18	F	P,F,A	T,ET,RT	-	RA	EM	N	N	N	-	N
12	A	A6	ASHWINI	461565	2/29/2012	3/1/2012	C	19	F	P,V,F	T,RT	-	RA	EL	N	N	N	-	N
13	B	B7	SANGEETA	462211	3/5/2012	3/5/2012	A	20	F	P,F	T,ET	L	RA	EM	N	N	N	-	N
14	A	A7	NARAYAN	462720	3/9/2012	3/9/2012	C	35	M	P,N,F	T,ET	-	AA	EM	N	N	N	-	N
15	A	A8	ANAND	462495	3/7/2012	3/12/2012	C	22	M	P,F,A	T	L	AA	EL	N	N	N	-	N
16	B	B8	BASAVRAJ	463148	3/12/2012	3/14/2012	A	26	M	P,V,F	T,ET	L	AA	EL	N	N	N	-	N
17	B	B9	GUNDURAO	464583	3/21/2012	3/22/2012	C	47	M	P,N,F	T,ET	L	AA	EL	N	N	N	-	N
18	B	B10	POOJA	466237	4/2/2012	4/2/2012	C	20	F	P,F	T,ET	L	AA	EM	N	N	N	-	N
19	A	A9	RAHAMATBI	468517	4/17/2012	4/18/2012	A	38	F	P,F,A	T,ET	-	RA	EL	N	N	N	-	N
20	A	A10	YASHODA	468694	4/18/2012	4/20/2012	C	64	F	P,N,F	T,ET	-	AA	EL	N	N	N	-	N
21	A	A11	ARCHANA	470478	4/30/2012	5/1/2012	C	37	F	P,F,A	T,ET	-	AA	EL	N	N	N	-	N
22	A	A12	ROOPA	470456	4/30/2012	5/2/2012	A	18	F	P,N,F	T	-	AA	EL	N	N	N	-	N
23	B	B11	FAKIRAPPA	470407	4/30/2012	5/2/2012	A	35	M	P,N,F,A	T,ET	-	AA	EL	N	N	N	-	N
24	A	A13	MANJULA	471197	5/4/2012	5/7/2012	C	28	F	P,F	T,ET	L	AA	EL	N	N	N	-	N
25	A	A14	RAVI	470715	5/2/2012	5/7/2012	C	42	M	P,F	T,ET	-	AA	EL	N	Y	Y	-	**Y**
26	B	B12	MAHADEV	471684	5/7/2012	5/9/2012	E	48	M	P,N,F,A	T,ET	L	RA	EL	N	N	N	-	N
27	A	A15	UDDAWWA	472105	5/9/2012	5/11/2012	C	45	F	P,N,F	T	-	AA	EL	N	N	N	-	N
28	B	B13	SUJATA	472269	5/10/2012	5/13/2012	C	24	F	P,N,F,A	T,ET	L	AA	EL	N	N	N	-	N
29	A	A16	IMTIYAZ	476943	6/7/2012	6/7/2012	C	26	M	P,N,F	T,RT	L	RA	EL	N	N	N	-	N
30	A	A17	JYOTI	476893	6/6/2012	6/8/2012	C	18	F	P,F,A	T,ET	-	AA	EL	N	N	N	-	N

31	A	A18	VARSHA	476681	6/5/2012	6/8/2012	C	18	F	P,N,F,A	T	-	AA	EL	N	N	N	-	N
32	B	B14	SURAYYA	477340	6/9/2012	6/12/2012	C	55	F	P,F,A	T,ET	L	AA	EL	N	Y	Y	-	**Y**
33	B	B15	MD ISHAQ	478035	6/13/2012	6/13/2012	C	30	M	P,V,F	T,ET	L	AA	EM	N	N	N	-	N
34	A	A19	GANGU	478484	6/16/2012	6/16/2012	C	38	F	P,N,F	T,ET	L	RA	EM	N	N	N	-	N
35	B	B16	REKHA	481090	7/3/2012	7/3/2012	C	28	F	P,F	T,ET,RT	-	AA	EM	N	N	N	-	N
36	B	B17	ODHALINGAP	481656	7/6/2012	7/6/2012	B	41	M	P,F,A	T,ET	L	AA	EM	N	N	N	-	N
37	B	B18	MUKTA	482123	7/9/2012	7/9/2012	C	21	F	P,F	T	-	AA	EM	N	N	N	-	N
38	B	B19	SANTOSH	481889	7/7/2012	7/9/2012	C	28	M	P,N,F	T,ET	-	RA	EL	Y	Y	Y	-	**Y**
39	A	A20	HARSHAL	483354	7/16/2012	7/16/2012	A	24	M	P,V,F	T,,RT	-	RA	EM	N	N	N	-	N
40	B	B20	PARVATI	484873	7/26/2012	7/28/2012	D	37	F	P,N,F	T,ET	L	RA	EL	N	N	N	-	N
41	A	A21	LAXMI	486311	8/3/2012	8/4/2012	B	26	F	P,N,F,A	T,ET	L	AA	EL	N	N	N	-	N
42	A	A22	MALLAPPA	486019	8/2/2012	8/4/2012	D	50	M	P,N,F	T	L	AA	EL	N	N	N	-	N
43	B	B21	KALMESH	486684	8/6/2012	8/8/2012	A	24	M	P,N,F	T,ET	-	AA	EL	N	N	N	-	N
44	B	B22	SUMAYYA	489601	8/24/2012	8/24/2012	C	24	F	P,N,F	T,ET,RT	L	AA	EM	N	N	N	-	N
45	B	B23	MAHESH	489370	8/23/2012	8/25/2012	D	22	M	P,V,F	T,ET,RT	-	RA	EL	N	N	N	-	N
46	B	B24	NADEEM	491272	9/3/2012	9/3/2012	C	28	M	P,N,F	T	L	AA	EL	N	Y	Y	-	**Y**
47	B	B25	SANTOSH	491862	9/6/2012	9/8/2012	D	27	M	P,N,F,A	T,ET	-	AA	EL	N	N	N	-	N
48	A	A23	MUMTAZ	492844	9/12/2012	9/14/2012	C	26	F	P,F	T,ET	-	RA	EL	N	N	N	-	N
49	A	A24	PRABHAVATI	494401	9/22/2012	9/26/2012	A	18	F	P,F,A	T,ET	L	AA	EL	N	N	N	-	N
50	B	B26	HADIN	494572	9/24/2012	9/26/2012	E	18	M	P,F	T	-	AA	EL	N	N	N	-	N
51	A	A25	RADHA	494903	9/25/2012	10/1/2012	C	27	F	P,N,F	T,ET	L	RA	EL	N	N	N	-	N
52	A	A26	CHANDRIKA	497927	10/14/2012	10/15/2012	B	22	F	P,N,F	T,ET	L	AA	EL	N	N	N	-	N
53	B	B27	SAFWAN	498733	10/19/2012	10/19/2012	C	28	M	P,N,F,A	T,ET,RT	-	AA	EM	N	N	N	-	N
54	A	A27	ALVINDRAPP	498830	10/20/2012	10/22/2012	C	58	M	P,V,F	T,ET	-	AA	EL	N	N	N	-	N
55	B	B28	SANGEETA	499468	10/26/2012	10/29/2012	C	25	F	P,N,F	T,ET	L	RA	EL	N	N	N	-	N
56	A	A28	MARUTHI	499922	10/29/2012	10/30/2012	C	40	M	P,N,F	T	L	RA	EL	N	N	N	-	N
57	A	A29	SAVITRI	500336	11/3/2012	11/3/2012	C	45	F	P,N,F	T,ET	L	AA	EM	N	N	N	-	N
58	A	A30	KANCHAN	501726	11/15/2012	11/19/2012	C	22	F	P,N,F,A	T,ET	L	AA	EL	N	N	N	-	N
59	B	B29	JAGADISH	503156	11/26/2012	11/28/2012	A	36	M	P,F	T	L	AA	EL	Y	Y	Y	-	**Y**
60	B	B30	ASHOK	505814	12/13/2012	12/13/2012	D	35	M	P,V,F	T,ET,RT	-	AA	EM	N	N	N	-	N

Introduction

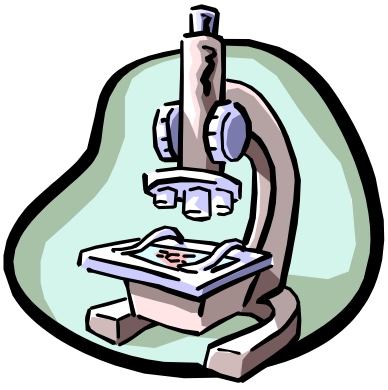


Objectives

Review of Literature

Methodology

Results

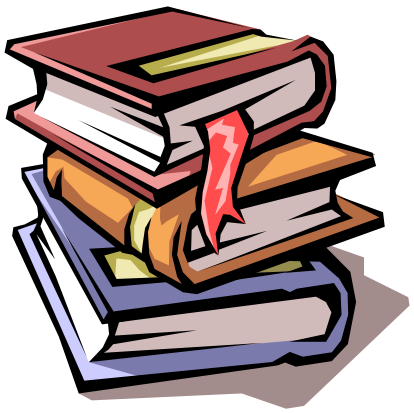


Discussion

Conclusion

Summary

Bibliography



Annexures