A DISSERTATION ON

SURGICAL SITE INFECTIONS– PREDISPOSING FACTORS, PREVENTION OF SSIs IN CLEAN AND CLEAN CONTAMINATED SURGERIES BY COMPARING EFFICACY OF PROPHYLACTIC ANTIBIOTICS VERSUS CLOSED SUCTION DRAINAGE OF SUBCUTANEOUS DEAD SPACE – A RANDOMIZED CONTROLLED TRIAL

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DECLARATION

I, **Dr. ANAND KURIYAN MATHEW**, solemnly declare that this dissertation - **"A DISSERTATION ON SURGICAL SITE INFECTIONS – PREDISPOSING FACTORS, PREVENTION OF SSIs IN CLEAN AND CLEAN CONTAMINATED SURGERIES BY COMPARING EFFICACY OF PROPHYLACTIC ANTIBIOTICS VERSUS CLOSED SUCTION DRAINAGE OF SUBCUTANEOUS DEAD SPACE – A RANDOMIZED CONTROLLED TRIAL"** is a bonafide work done by me in the Department of General Surgery, Government Stanley Medical College and Hospital, Chennai under the guidance of **Prof. P. Darwin, M.S.,** unit chief and **Prof. Dr. DEIVANAYAGAM,M.S.**, Head of the Department, Department of General Surgery, Government Stanley Medical College and Hospital, Chennai – 600001.

This dissertation is submitted to the Tamil Nadu Dr. M.G.R Medical University, Chennai in partial fulfilment of the university regulations for the award of M.S Degree (General Surgery) Branch – I, General Surgery examination to be held in April, 2011.

Place: Chennai

Date: 16th December, 2010 (Dr. Anand Kuriyan Mathew)

CERTIFICATE

This is to certify that **"A DISSERTATION ON SURGICAL SITE INFECTIONS – PREDISPOSING FACTORS, PREVENTION OF SSIs IN CLEAN AND CLEAN CONTAMINATED SURGERIES BY COMPARING EFFICACY OF PROPHYLACTIC ANTIBIOTICS VERSUS CLOSED SUCTION DRAINAGE OF SUBCUTANEOUS DEAD SPACE – A RANDOMIZED CONTROLLED TRIAL"** is a bonafide work done by Dr. Anand Kuriyan Mathew, post graduate in the Department of General Surgery, Stanley Medical College, Chennai, under my guidance and supervision, in partial fulfillment of regulation of The Tamil Nadu Dr. M. G. R. Medical University for award of M.S. Degree Branch I, Part II (General Surgery) during academic period from May 2008 to May 2011.

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This dissertation on **"SURGICAL SITE INFECTIONS – PREDISPOSING FACTORS, PREVENTION OF SSIs IN CLEAN AND CLEAN CONTAMINATED SURGERIES BY COMPARING EFFICACY OF PROPHYLACTIC ANTIBIOTICS VERSUS CLOSED SUCTION DRAINAGE OF SUBCUTANEOUS DEAD SPACE – A RANDOMIZED CONTROLLED TRIAL"** has been undertaken in the General Surgery Department – Government Stanley Hospital, under the expert guidance of my unit chief – **Prof P. Darwin**. I would like to thank the Professor for his guidance and encouragement throughout the course of the trial.

I would also like to thank my Assistant Professors **– Dr. Rajenderan, Dr. Senghuttuvan, Dr. Uthirakumar, Dr. Kumaran, Dr. Arun Babu and Dr. Vijaylakshmi** for their valuable input and support.

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Finally my fellow colleagues for their support and the patients for unconditionally and freely consenting to be part of this trial aimed to achieve better post surgical outcomes.

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AIM OF THE STUDY:

Surgical Site Infections constitute a major portion of post operative morbidity to surgical patients and also burden the hospital with significant but avoidable expenditure.

The use of antibiotics in the management of surgical wounds and prevention of Surgical Site Infections is well documented, however literature is varied in its opinion regarding their use in clean and clean contaminated cases. Most suggest the use of only prophylactic (pre-op) antibiotics but some even go as far as recommending usage of no antibiotics in especially clean wounds. Usage into post op period is not advised. Unmonitored, empirical and prolonged therapy is fraught with disadvantages like toxicities and antibiotic resistance. Hence,

AIM 1.To ascertain if Class I and Class II procedures require any active intervention for the prevention of Surgical Site Infections

AIM 2.To find out whether the use of cost-effective interventions like prophylactic antibiotics alone reduce the incidence of Surgical Site Infections in Class I and Class II procedures.

The creation of surgical wounds include a formation of a neo potential dead space in the subcutaneous plane causing possible acute fluid collections which subsequently acts as a nidus for infection. The obliteration of this dead space has been proved to decrease the incidence of Surgical Site Infections. Many methods have been described, the most commonly employed being either absorbable non-irritant suture obliteration or use of suction drains. Previous literature has shown drainage under suction to be more efficacious hence,

AIM 3.To find out whether the use of suction drains reduce the incidence of Surgical Site Infections in Class I and Class II procedures.

OBJECTIVES :

To study -

1. Risk factors for SSIs
2. Prophylactic antibiotics vs. No treatment
3. Closed suction drainage vs. No treatment

These aforementioned objectives if fulfilled by scientific means like a RCT, would enumerate risk factors for Surgical Site Infections, and find the most efficacious and cost effective intervention for prevention of Surgical Site Infections.

KEY TO EVIDENCE STATEMENTS AND GRADES OF RECOMMENDATIONS

The definitions of the types of evidence and the grading of recommendations used in this guideline originates from the US Agency for Health Care Policy and Research [1] and are set out in the following tables.

STATEMENTS OF EVIDENCE

Ia Evidence obtained from meta-analysis of randomised controlled trials.

Ib Evidence obtained from at least one randomised controlled trial.

IIa Evidence obtained from at least one well-designed controlled study without randomisation.

IIb Evidence obtained from at least one other type of well-designed quasi-experimental study.

III Evidence obtained from well-designed non-experimental descriptive studies, such as comparative studies, correlation studies and case studies.

IV Evidence obtained from expert committee reports or opinions and/or clinical experiences of respected authorities.

GRADES OF RECOMMENDATIONS

A Requires at least one randomised controlled trial as part of a body of literature of overall good quality and consistency addressing the specific recommendation.
(Evidence levels Ia, Ib)

B Requires the availability of well conducted clinical studies but no randomised clinical trials on the topic of recommendation.
(Evidence levels IIa, IIb, III)

C Requires evidence obtained from expert committee reports or opinions and/or clinical experiences of respected authorities. Indicates an absence of directly applicable clinical studies of good quality.
(Evidence level IV)

Therefore as the chosen form of analytical study is a Randomized Controlled Trial – this study is a *CLASS I evidence study* and its resultant *recommendations are Level 1*.

INTRODUCTION:

Surgical site infections (SSIs) are a real risk associated with any surgical procedure and represent a significant burden in terms of patient morbidity and mortality, and cost to health services around the world. Surgical wound infection is a common postoperative complication and causes significant postoperative morbidity and mortality, prolongs hospital stay, and adds between 10% and 20% to hospital costs.

Surgical site infections are the 3rd most common post op infection in surgical patients after urinary tract and respiratory tract infections. [2]

In cases of deep or extensive infection this resulted in a mortality rate of 70-80% [3].

Most SSIs are superficial, but even so they contribute greatly to the morbidity and mortality associated with surgery [4] [5]. Surgical site infections are usually secondary to inoculation of bacteria from patients own endoflora (eg. Anterior nares, mouth, rectum) and less often from the environment.

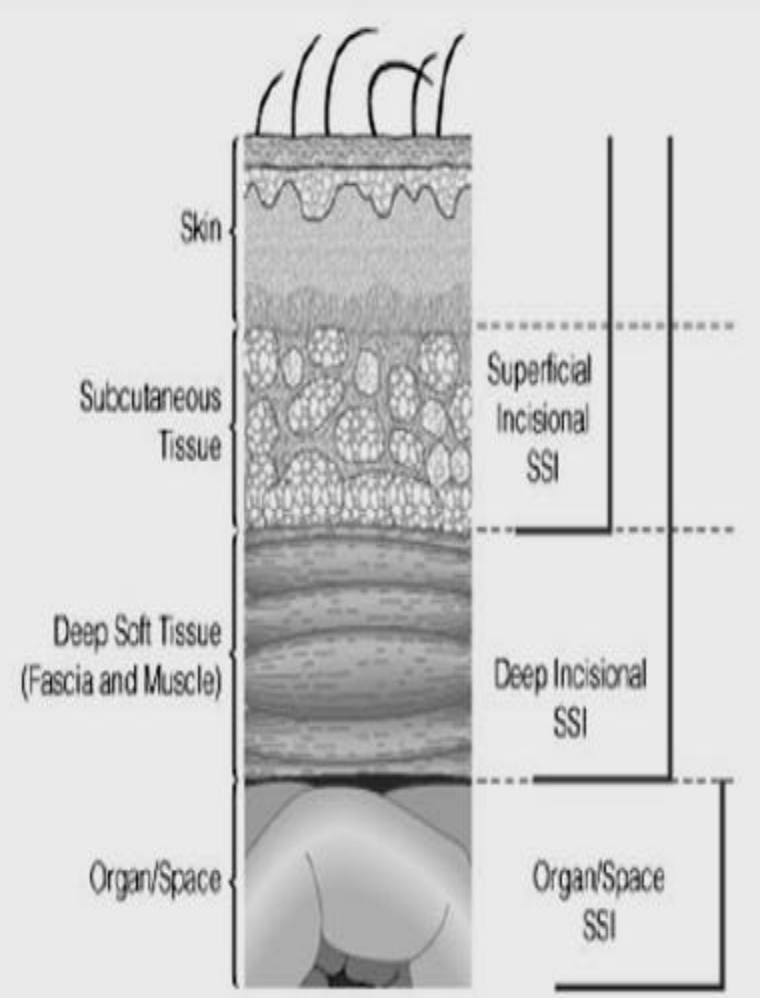
Definition of SSI: Any purulent discharge from a closed surgical incision, together with signs of inflammation of the surrounding tissue should be considered as wound infection, irrespective of whether micro-organisms can be cultured. Infection can occur at an incision site within 30 days of an operation, but if an implant is placed (eg. Arthroplasty, mesh) the definition is extended upto 1 year.

There are intermediate categories of wounds that may or may not be infected—namely, wounds that have a small amount of clear discharge. These wounds maybe considered as

'possibly' or 'probably' infected. In 1992, the Surgical Wound Infection Task Force replaced the term 'surgical wound infection' with ‘surgical site infection', to include infections of organs or spaces deep in the skin and soft tissues, such as peritoneum and bone. Surgical site infection is classified into superficial site infection and organ or space infection.

Types of SSI :

- **Superficial Incisional SSI**
- **Deep Incisional SSI**
- **Organ / Space SSI**



CRITERIA FOR TYPES OF SSI [6]

Superficial incisional SSI

Infection occurs within 30 days after the operation *and* infection involves only skin of subcutaneous tissue of the incision *and* at least *one* of the following:

1. purulent drainage, with or without laboratory confirmation, from the superficial incision
2. organisms isolated from an aseptically obtained culture of fluid or tissue from the superficial incision
3. at least one of the following signs or symptoms of infection:
   - pain or tenderness
   - localised swelling
   - redness
   - heat

   and superficial incision is deliberately opened by a surgeon, *unless* incision is culture-negative
4. diagnosis of superficial incisional SSI by the surgeon or attending physician

Do *not* report the following conditions as SSI:

1. stitch abscess (minimal inflammation and discharge confined to the points of suture penetration)
2. infection of an episiotomy or newborn circumcision site
3. infected burn wound
4. incisional SSI that extends into the fascial and muscle layers (see deep incisional SSI).

Note: specific criteria are used for identifying infected episiotomy and circumcision sites and burn wounds.

Deep incisional SSI

Infection occurs within 30 days after the operation if no implant is left in place or within one year if implant is in place and the infection appears to be related to the operation *and* infection involves deep soft tissues (e.g. fascial and muscle layers) of the incision *and* at least *one* of the following:

1. purulent drainage from the deep incision but not from the organ/space component of the surgical site
2. a deep incision spontaneously dehisces or is deliberately opened by a surgeon when the patient has at least one of the following signs or symptoms:
   - fever (> 38 °C)
   - localised pain
   - tenderness

   unless site is culture-negative
3. an abscess or other evidence of infection involving the deep incision is found on direct examination, during reoperation, or by histopathologic or radiologic examination
4. diagnosis of deep incisional SSI by a surgeon or attending physician.

Notes:

1. *Report infection that involves both superficial and deep incision sites as deep incisional SSI.*
2. *Report an organ/space SSI that drains through the incision as deep incisional SSI.*

Organ/space SSI

Infection occurs within 30 days after the operation if no implant is left in place or within one year if implant is in place and the infection appears to be related to the operation *and* infection involves any part of the anatomy (e.g. organs or spaces), other than the incision, which was opened or manipulated during an operation *and* at least *one* of the following:

1. purulent discharge from a drain that is placed through a stab wound into the organ/space
2. organisms isolated from an aseptically obtained culture of fluid or tissue in the organ/space
3. 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
4. diagnosis of an organ/space SSI by a surgeon or attending physician.

CDC Classification of Surgical Wounds[7]

Classification of operative wounds based on degree of microbial contamination	
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 (e.g. appendectomy) 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 (e.g. abscess); preoperative perforation of respiratory, gastrointestinal, biliary or genitourinary tract; penetrating trauma >4 hours old.

Infection rates in the four surgical classifications (clean, clean-contaminated, contaminated and dirty wounds) have been published in many studies but most literature refers to the work of Cruse and Ford as a benchmark for infection rates [8][9]. 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[8][9]. Since the introduction of routine prophylactic antibiotic use, infection rates in the most contaminated groups have reduced drastically. Infection rates in US 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% [10]. There is, however, considerable variation in each class according to the type of surgery being performed [11]

Systematic review of Indian literature suggests a wide average reported range of incidence of SSIs 2.5 to 41.9% in Class I and II wounds. (4.04 to 30% in class I and 10.06 to 45% in class II) [12 – 18]

RISK FACTORS FOR SSIs[19-20]

Risk or predisposing factors for the development of SSIs can be broadly classified into 3 groups –

- Host
- Environment
- Procedural

1. **Host**

   Pre existing illnesses like diabetes, renal failure, jaundice, anaemia and other co-morbidities –

   The American Society of Anaesthesiologists (ASA) has devised a preoperative risk score based on the presence of co-morbidities at the time of surgery. An ASA score >2 is associated with increased risk of wound infection and this risk is additional to that of classification of operation and duration of surgery

The American Society of Anaesthesiologists (ASA) preoperative assessment score, was validated in a large study involving 44 hospitals from 1987 to 1990.

The wound infection rate among patients in ASA class I or II was 1.9%, whereas among patients in class III to V was 4.3%. *Garibaldi et al* have since confirmed the independent predictive power of the ASA score in a prospective study of 1852 surgical patients in which the odds ratio of having a wound infection for ASA class III to V patients compared with Class I or II patients was 4.2.[21,6]

ASA CLASSIFICATION OF PHYSICAL STATUS

ASA score	Physical status
1	A normal healthy patient
2	A patient with a mild systemic disease
3	A patient with a severe systemic disease that limits activity, but is not incapacitating
4	A patient with an incapacitating systemic disease that is a constant threat to life
5	A moribund patient not expected to survive 24 hours with or without operation

Extremes of age

Obesity (>20% of ideal body weight)

Smoking or alcohol consumption

Bacterial colonization of anterior nares with S.aureus

Remote site infection

Duration of preoperative hospital stay (significant if more than 14 days) – *Kowli et al* found stay <1 week risk is 17.4% and if >3 weeks it is almost 71.4%. Similarly *Anvikar et al* found for stay less than 1 day risk was ~1.7% but for >1 week it was almost 5%

Immunosuppressed status

2. **Environment**

Theatre environs incl. cleanliness, sterilization, ventilation

Previous case operated on the same table (if contaminated or dirty the risk of SSI in subsequent cases increase)

Microbe related – common pathogens, its virulence and resistance patterns

3. **Procedural or operation based**

Pre op preparation(skin – scrub and method used; hair removal – best recommended is electroepilation; sterile techniques like hand washing, painting and draping, gloving)

Meticulous **surgical technique** like tissue handling with minimal devitalization, surgeon expertise, strict haemostasis, use of excessive electro cautery in the subcutaneous plane

Length of surgery–Duration of surgery is positively associated with risk of wound infection and this risk is additional to that of the classification of operation.[10] In this study by *Culver et al*, operations that lasted longer than the 75th percentile for the procedure were classified as prolonged. The 75th percentile is based on data

from the USA. These times have not been evaluated or confirmed by studies in the UK.

Cruse and Foord found that the rate of wound infection increased for longer procedures, roughly doubling with every hour of the procedure. Operations lasting 1 hour or less had a wound infection rate of 1.3%, whereas those lasting3 hours or more had a rate close to 4.0%. *Haley et al* showed by using multivariate analysis that an operative time of more than 2 hours is the second greatest independent predictor of risk (wound contamination being the first)[22]

Antibiotic prophylaxis regimen

Foreign material in surgical wound inclusive of Drains - Insertion of any prosthetic implant increases the risk of infection of the wound and surgical site. The implant has a detrimental effect on the patient's host defences. As a result, a lower bacterial inoculum is needed to cause infection of a prosthetic implant than of viable tissue. Thus the chance of infection is increased [23]

Post operative **hypothermia and hypotension** [24]

PROBABILITY OF SSIs

Previous guidelines have referred to patients who are at high risk of SSI but have not provided clear information about prediction of risk. This section is intended to illustrate how co-morbidity and duration of operation add to the risk defined by type of operative wound.

Duration of surgery and co-morbidities have as great an impact on the risk of wound

infection as the operation classification.

The presence of the two risk factors co-morbidity (as indicated by an ASA score >2) and duration of operation (>75th percentile) can be used to calculate a "risk index", where:

Risk index 0 = when neither risk factor is present

Risk index 1 = when either one of the risk factors is present

Risk index 2 = when both risk factors are present.

For example, below illustrated Table was derived from a large epidemiological study of hospital acquired infection in which a risk score from a previous study was validated and refined. In this study, the risk of wound infection with a clean wound plus both additional risk factors was greater than the risk for a contaminated wound with no additional risk factors (5.4% versus 3.4%).

PROBABILITY OF WOUND INFECTION BY TYPE OF WOUND AND RISK INDEX

Operation classification	Risk Index		
	0	1	2
Clean	1.0%	2.3%	5.4%
Clean-contaminated	2.1%	4.0%	9.5%
Contaminated	3.4%	6.8%	13.2%

(or)

NNIS SCORING SYSTEM (*Culver et al*, 1991)

- Procedure time > 75th percentile / for convenience > 2 hours
- Contaminated / dirty wounds
- ASA III – V

No. of risk factors	Risk
0	1-2%
1	2-4%
2	5-10%
3	10-15%

ANTIBIOTIC PROPHYLAXIS – An overview

Introduction

Burke[25] demonstrated the importance of the timely use of prophylactic antibiotics in surgery. Antibiotic prophylaxis can decrease postoperative morbidity, shorten hospital stay, and reduce overall costs attributable to infection.

Limiting the use of antibiotic prophylaxis to the intra-operative period is one of the most significant changes in preventing infection and is dramatically different from the previously recommended 24 to 48hour coverage. Single-dose prophylaxis is effective in most surgical procedures. Additional, prolonged antibiotic prophylaxis while lines, tubes, and catheters are in situ is not necessary. The use of antibiotic prophylaxis is not a substitute for good infection control practices, proper patient preparation, good judgement, good technique, or an adequate operating environment. Inappropriate and indiscriminate use of prophylactic

antibiotics may increase costs through unnecessary drug use, requisite laboratory monitoring, and the emergence of resistant organisms. The potential toxicity of antibiotics is also an important risk of antibiotic prophylaxis.[26]

The goals of prophylactic administration of antibiotics to surgical patients are to:

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

It is important to recognize the difference between *prophylactic* and *empiric* therapy. *Prophylaxis* is indicated for procedures associated with high infection rates, those involving implantation of prosthetic material, and those in which the consequences of infection are serious. The antibiotic should cover the most likely contaminating organisms and be present in the tissues when the initial incision is made. Therapeutic concentrations should be maintained throughout the procedure. *Empiric* therapy is the continued use of antibiotics after the operative procedure based upon the intra-operative findings. Empiric antibiotic therapy is addressed in a separate guideline. Inappropriate prophylaxis is characterized by unnecessary use of broad-spectrum agents and continuation of therapy beyond the recommended time period. These practices increase the risk of adverse effects and promote the emergence of resistant organisms.

For most surgical procedures, a single bolus of intravenous antibiotic at the time of induction of anaesthesia or within 1 hour of skin incisions considered adequate. This dose enables a high plasma and tissue concentration to be attained rapidly. The rate of infection increases if prophylactic antibiotics are given more than 2 hours preoperatively, or postoperatively. Oral and intramuscular routes of administration produce a lower peak plasma level. [27-28]

The least toxic and most effective antibiotic regimen should be chosen. Choice should also based on local and current trends on prevalent pathogens and their sensitivity patterns.

The dose of prophylactic antibiotics should not be smaller than the standard therapeutic dose of the drug. A single prophylactic dose is effective and preferred to multiple doses. The single dose approach has the advantage of low cost, less toxicity, and less chance of developing antibiotic resistance.[29]

What is the "Decisive period" and why does the antibiotic have to be given within one hour of skin incision?

After skin incision there is breakdown of the normal epithelial and immune barrier and hence inoculation of pathogenic bacteria into the wound depths is an imminent possibility. Therefore at the time of skin incision maximum blood concentration of the antibiotic should be present. The time taken for an antibiotic to reach an effective concentration in any particular tissue reflects its pharmacokinetic profile and the route of administration.[30]

After incision the immune system takes about 4 hours to mobilize an acute inflammatory response of cells and proinflammatory substances at the site of injury thereby being able to

combat any infection seeded in the wound. Hence, antibiotics given preoperatively must be chosen and given appropriately so as to protect the wound in those first 4 hours of apparent risk.

Antibiotic chosen must have a half life that is almost 4 hours, does not have excessive first pass metabolism and must be given intravenously as it provides more consistent and maximal blood concentrations.

Risks of prophylaxis[31-37]

One of the aims of rationalising surgical antibiotic prophylaxis is to reduce the inappropriate use of antibiotics thus minimising the consequences of misuse. Rates of antibiotic resistance are increasing in all hospitals. The prevalence of antibiotic resistance in any population is related to the proportion of the population that receives antibiotics, and also the total antibiotic exposure.

An additional problem is the dramatic increase in the number of cases of colitis caused by Clostridium difficile. The prevalence of C. difficile infection is related to total antibiotic usage and, in particular, to the use of third generation cephalosporins. In epidemiological studies of C. difficile colitis, surgical antibiotic prophylaxis is the single most common indication for use of antibiotics. Although even single dose prophylaxis increases the risk of carriage of C. difficile, in a case control study of patients all of whom received surgical prophylaxis C. difficile was more common in patients who received prophylaxis for >24 hours (56% vs. 17%).

Choice of antibiotic

The antibiotics chosen for prophylaxis can be those used for active treatment of infection.

However, the chosen antibiotics must reflect local, disease-specific information about the common pathogens and their antimicrobial susceptibility.

A past history of a serious adverse event should preclude administration of a particular antibiotic.

Patients with a history of anaphylaxis or urticaria or rash occurring immediately after penicillin therapy are at increased risk of immediate hypersensitivity to penicillins and should not receive prophylaxis with a beta-lactam antibiotic.

Timing of administration

As aforementioned the best time for is within 30-60 minutes before skin incision. (for protocol purposes literature does mention it to be at induction) [38-39]

Duration of prophylaxis and additional dosages

As mentioned before based on the decisive period concept the prophylactic effect must last atleast 4 hours.

Many of the drugs used in prophylaxis have relatively short half lives (1-2 hours in studies of normal volunteers). In such situations it may therefore seem logical to give an additional dose of prophylaxis during operations that last for more than 2-4 hours. However, in comparison with normal volunteers, patients undergoing surgery have slower clearance of drugs from their blood. This is probably due to a combination of factors. For example, in comparison with normal volunteers, surgical patients are older(and therefore have poorer renal function) and have more co-morbidities. The limited data available show that drugs

such as cefuroxime, which has a half life of 1-2 hours in normal volunteers have a half life of 2-4 hours in patients at the time of surgery, and that effective concentrations are maintained for at least five hours after the start of surgery.[40-41]

In all operations the administration of additional doses after the end of surgery does not provide any additional prophylactic benefit. Individual studies claiming to support additional postoperative doses are methodologically flawed. For example, not blinding observers to treatment allocation and including culture of bacteria from a wound swab as an indication of wound infection. This is specifically excluded from most definitions of wound infection, as the test does not distinguish between colonisation and infection. Moreover, patients who are continuing to receive antibiotics are clearly less likely to have bacteria grown from swabs than patients who are not receiving antibiotics.[7,42-46] Prophylaxis should be confined therefore to the perioperative period (i.e. administration immediately before or during the procedure). Postoperative doses of antibiotic for prophylaxis should not be given for any operation. Any decision to prolong prophylaxis beyond a single dose should be explicit and supported by an evidence base.

Route of administration

Intravenous administration of antibiotic prophylaxis immediately before induction of anaesthesia is the most reliable method for ensuring effective serum antibiotic concentrations at the time of surgery.

Serum concentrations after oral or intramuscular administration are determined in part by the rate of absorption, which varies between individuals. There is relatively little evidence about the effectiveness of orally or intramuscularly administered antibiotic

prophylaxis. A further problem is that often the correct time of administration is difficult to guarantee in practice, because, for example, it occurs without the theatre environment.

Dosage

The single dose of antibiotic for prophylactic use is, in most circumstances, the same as would be used therapeutically.

Blood loss, fluid replacement and antibiotic prophylaxis[47-50]

Serum antibiotic concentrations are reduced by blood loss and fluid replacement, especially in the first hour of surgery when drug levels are high.

The precise effects of blood loss and fluid replacement are difficult to predict, depending on the timing and rate of loss and replacement. However, in adults the impact of intraoperative bleeding and fluid replacement on serum drug concentrations is usually negligible.

An additional dose of prophylactic agent is not indicated in adults, unless there is blood loss of up to 1500 ml during surgery or haemodilution of up to 15 ml/kg.

In the event of major intraoperative blood loss (>1500 ml), additional doses of prophylactic antibiotic should be given after fluid replacement.

Fluid replacement bags should not be primed with prophylactic antibiotics because of the potential risk of contamination and calculation errors.

These guideline **does not cover** the following types of surgery:

- prevention of urinary tract or respiratory tract infections after elective surgery, with the exception of urinary tract infection after transurethral resection of the prostate

- use of antiseptics or topical antibiotics (e.g. tetracycline peritoneal lavage, subconjunctival injections for cataract surgery) for the prevention of wound infection after elective surgery
- treatment of anticipated infection in patients undergoing emergency surgery for contaminated or dirty operations
- administration of oral antibiotics for bowel preparation or to achieve selective decontamination of the gut

CLOSED SUCTION DRAINAGE – An overview

The dead space created during surgery in the subcutaneous plane can result in the formation of an acute fluid collection or seroma from minimal oozing from blood vessels or lymphatics or from fat lysis secondary to usage of excess diathermy to control small calibre bleeders during skin incision and deepening. This acute fluid collection when secondarily infected can result in a surgical site infection.

Therefore obliteration of this dead space would benefit in two ways –

a. Reduction of potential space into which any fluid could collect

b. Apposition of the walls of this space can act as a tamponade effect which could curtail further ooze from minor vessels.

Many methods have been suggested to decrease dead space such as, decreased dissection in this plane, use of absorbable non braided suture and insertion of drains either under suction or free open type.

A limited amount of literature has been published regarding the latter 2 methods.

Studies on mastectomy, axillary dissection and caesarean section (Pfannensteil) incisions are available which state emphatically the superiority of firstly drainage of space when compared with suture closure – probably because of impregnation of bacterial inoculum in the fibre and the lack of removal of the "foreign body" suture in the long run. Secondly suction drainage is better than free open drains (eg. Penrose) as the suction apparatus would prevent retrograde flow inoculation via the tubing and also provide a faster and more sustained evacuation of any resultant post operative fluid collection.[51-55]

HYPOTHESES :

1. To reduce SSIs - use of any of the 2 interventions (antibiotic, closed suction drain) is superior to no intervention at all.

2. To ascertain which of the above 2 interventions is the most effective at reducing the incidence of SSIs.

MATERIALS AND METHODS:

PLACE OF STUDY:

This study was conducted at the Dept. Of General Surgery at Stanley Medical College, Chennai. All cases admitted in the surgical unit headed by Prof. Darwin if fitting the stringent inclusion criteria were added.

STUDY PERIOD:

The study undertaken was for a period of one year- from November 2009 to November 2010.

STUDY DESIGN:

A Randomized prospective controlled trial to compare each intervention.

Patients will be randomly allocated into the 3 above mentioned study groups (no. 1 to 3) using a computer generated random number table.

Using available literature, the incidence of SSIs without the use of any intervention was found to be 30%, while the use of prophylactic antibiotics was found to decrease the SSIs to 15%. Similarly, the use of closed suction drain reduced the incidence of SSIs to 10%. Using these values and the formula given below the sample size was found to be 118 and 59 for each arm and total sample size was calculated to be 295.

The formulas used to calculate sample size was

$n = \frac{\{Z_{(1-\alpha/2)} + Z_{1-\beta}\}^2 [\pi_1(1-\pi_1) + \pi_2(1-\pi_2)]}{(\pi_1 - \pi_2)^2}$

which is a formula used when dealing with discrete data, to calculate the difference between proportions.

Statistical analysis will be done by- Fischer's Exact test or the Chi-square test.

INCLUSION CRITERIA :

1. All Class I and II (emergency/elective) operative procedures
2. Age >=15 years
3. Subjects who have given their informed consent
4. Subjects willing to follow up on Day 7,30 or earlier as indicated
5. Incision length >=6 cms

EXCLUSION CRITERIA :

1. All Class III and IV operative wounds
2. ASA III - V
3. More than 3 co-morbidities predisposing to SSIs
4. Attrition due to no follow up or to death
5. Antecedent planned operative site infection
6. Allergy to antibiotics used in study

METHODOLOGY:

Patients of class I and II were randomly allocated into the 3 study groups

(1=Control/No treatment; 2= prophylactic Antibiotics; 3= Suction drain).

Risk of developing SSI were calculated using NNIS System

All subject details were tabulated using the after mentioned pre tested proforma which includes demographic data, operative details, study group, clinical examination, radiological investigations, appropriate cultures, treatment of SSI if any.

In the case of group 1 subjects-no antibiotic was given preoperatively and no obliteration of dead space done, thus allowing natural history of wound healing to take its course.

In the case of Group 2 subjects the following prophylactic antibiotics were administered within one hour of skin incision (best protocol is : at induction)

Antibiotic used in **GI cases – Cefotaxime plus metronidazole**

Antibiotic used in **General cases (eg. Breast, thyroid, soft tissue)–Cefotaxime plus Gentamycin.**

In the subjects belonging to Group 3- For obliteration of dead space, closed suction drain [infant feeding tube / standard suction catheter (12 – 14F) connected to 10ml syringe or other appropriate suction devices] was inserted in the intra-operative period after wound irrigation with normal saline. Overlying skin was closed with standard skin suturing techniques.

Drains were monitored for daily output and character of fluid, drains were retained till output was less than 2 ml per day or if infection precluded opening of the wound and resultant loss of closed space vacuum action.

All cases followed up in post operative period during hospital stay (note : dressings not removed till 48 hours unless indicated), day 7, day 30

Wound surveillance done using AEPSIS scoring system. Assessment of healing and infective complications was made using the asepsis wound scoring system[56] as recommended by the Surgical Infection Study Group. [57] This describes the appearance of the wound and the necessity for further treatment, such as the administration of antibiotics. The maximum score is 70. It is very sensitive and allows objective appraisal of infection, and its severity. For the purpose of our study, a score of 0 to 10was considered to represent normal wound healing, and a score of more than 10 an infection. This confers a sensitive, if arbitrary, definition of infection. A single neutral observer (CPL) recorded the scores at 5 days and 30 days after operation. The highest score for each patient was adopted.

ASEPSIS SCORING SYSTEM

	% wound involved					
	0	**<20**	**20 to 39**	**40 to 59**	**60 to 79**	**≥80**	
Appearance of wound							
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	
Additional treatments							
Antibiotics							10
Drainage of pus (LA*)							5
Debridement of wound (GA†)							10
Isolation of bacteria							10
Inpatient stay >14 days							5
Maximum score							70

* LA, local or no anaesthetic
† GA, general or regional anaesthetic

RESULTS AND OBSERVATIONS

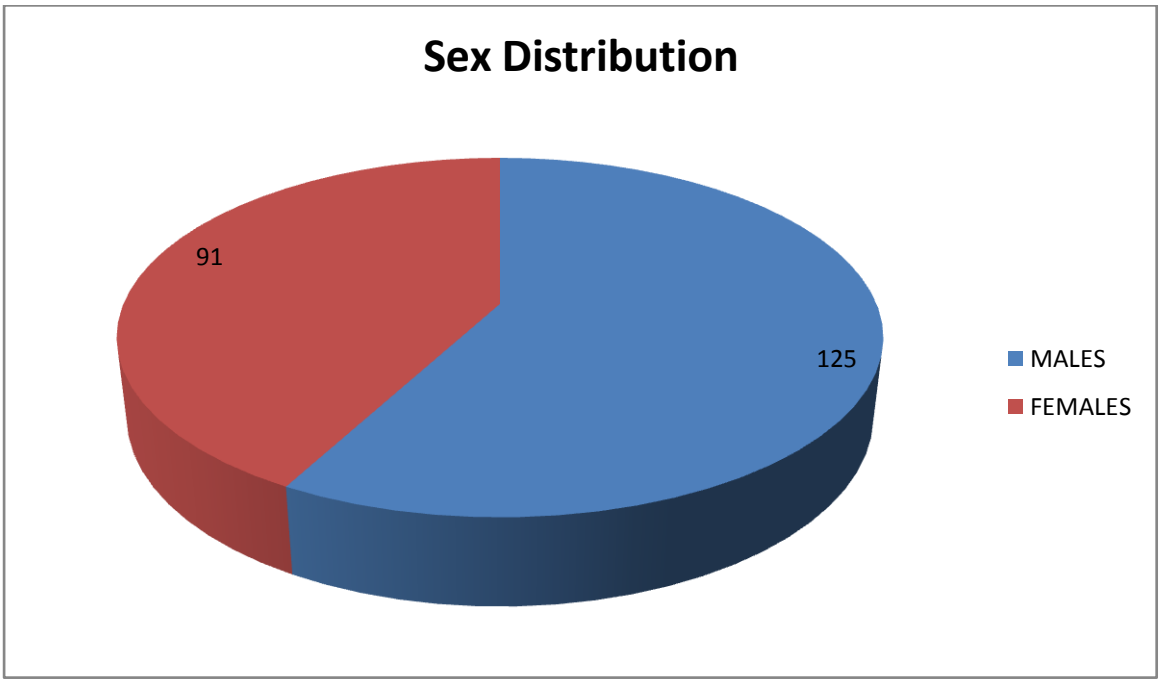
The trial was conducted for a period of one year during which 235 subjects were included.(adhering to strict inclusion and exclusion criteria) However 19 subjects were lost to follow up and hence the final number after attrition is 216.

The subjects were randomly included in the 3 study groups using a random number table.

Sex distribution :

The number of male subjects :**125**

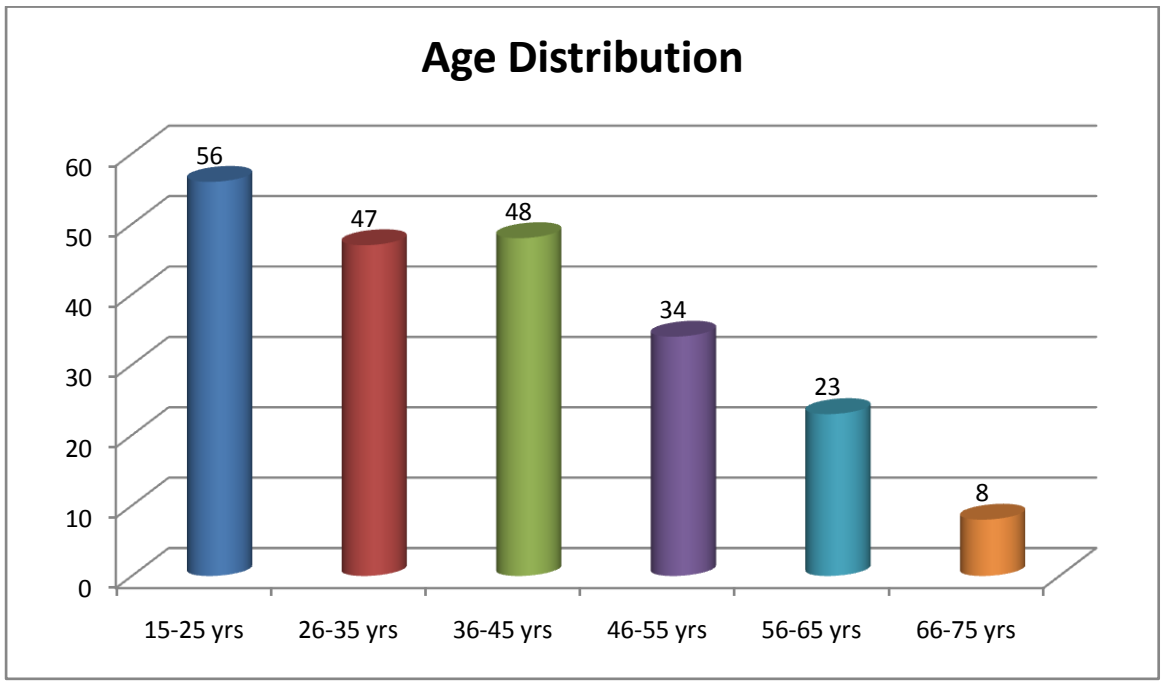
The number of female subjects :**91**



Age Distribution:

The age wise distribution of subjects is depicted in the graph below.

Maximum number was seen in the **15 – 25 years** age group, followed by **36 – 45 years**.



To test whether age independently influences the outcome viz. SSI – the study population was divided into less and more than 45 years.

Subjects <45years :**151** No. of subjects with SSI:**44** No. of subjects without SSI:**107**

Subjects > 45 years: **65** No. of subjects with SSI:**26** No. of subjects without SSI:**39**

The Chi-Square and Fischer's test was applied to the above discrete data and the two-tailed P value equals **0.1533**, the p value obtained was not statistically significant , hence according to this trial the age factor did not influence the occurrence of a SSI in subjects, and the

difference in incidence of SSIs in the 2 age distributions was due to chance or due to spurious sampling.

Class of operation:

The total number of **54** class I surgeries performed was and class II was **162**.

Among Class I surgeries **12** developed SSI (**22.22 %**) while in Class II surgeries **57** developed SSI (**35.19 %**)

Study group wise –

- Control group :

  Class I surgeries – **19** SSI developed in - **7** SSI not developed in -**12**

  Class II surgeries – **66** SSI developed in-**34** SSI not developed in -**32**

- Prophylactic antibiotic group :

  Class I surgeries **–22** SSI developed in - **4** SSI not developed in -**18**

  Class II surgeries-**62** SSI developed in-**7** SSI not developed in -**45**

- Closed suction drain group :

  Class I surgeries **–13** SSI developed in - **1** SSI not developed in -**12**

Class II surgeries – **34** SSI developed in-**6** SSI not developed in -**28**

Types of surgeries done and their respective class of surgery as per CDC classification:

Sl. No.	Type of Surgery	Number Performed	CDC Classification of Surgery and wound
1	Adhesiolysis	2	II
2	Anatomical + Mesh repair of ventral hernia	7	II
3	Anatomical Repair	5	I
4	Appendicectomy	68	II
5	Hernioplasty	62	II
6	Herniotomy	6	I
7	Herniorraphy	3	I
8	Trendelenburg operation	3	I
9	Cystogastrostomy for pseudocyst	1	II
10	Cholecystectomy	7	II
11	Thyroidectomy (Hemi, Near Total, Total)	6, 1, 1 = 8	I
12	Distal Pancreatectomy + Splenectomy	2	II
13	Soft Tissue Excisions	16	I
14	Orchidectomy	2	I

15	Laparotomy and Biopsy	1	II
16	Mayo Repair	1	I
17	Mesh repair for ventral hernia	2	II
18	Palliative Ant. GJ	2	II
19	Bowel reanastomosis	1	II
20	Total parotidectomy + MRND	1	I
21	Ilio – inguinal block dissection	1	I
22	Salpingo-oopherectomy	3	II
23	Subtotal excision of hydrocele sac	3	I
24	Sistrunk procedure	2	I
25	Truncal Vagotomy + GJ	3	II
26	Total Abdominal Hysterectomy	2	II
27	Splenectomy	1	I
38	High Femoral hernia repair	1	I

Predisposing Factors :

A number of predisposing factors were studied during this trial.

Environmental and procedural factors were relatively constant in all subjects hence did not contribute to the final outcome viz. SSI.

Cases were operated (on emergency and elective basis) on a table always following theatre washing and scrubbing between cases.

Pre op preparation was with bathing the night to prior to elective surgery and immediately preceding emergency surgery. Hair removal was done by shaving with sterile razor blades.

Standard hand washing techniques were employed with iodine based scrubs and Sterilium© disinfection. Standard operative field painting done with iodine based solution, thrice. Draping done with sterile linen. Meticulous technique in handling of tissue followed at all times. Use of diathermy in the parietal layers limited to control of bleeding vessels only and not used indiscriminately for opening tissue planes by electro-cutting or coagulation modes. Strict haemostasis was ensured at the end of surgery before closing parietal layers.

Tobacco and alcohol consumption was almost a universal factor among the male subjects and hence not considered a factor in this trial. Besides all patients were abstinent from tobacco and alcohol consumption for a minimum of 2 weeks prior to elective surgery as per anaesthetic orders, thereby alleviating the acute deleterious effects of the same. Only in emergency cases such abstinence could not be ensured.

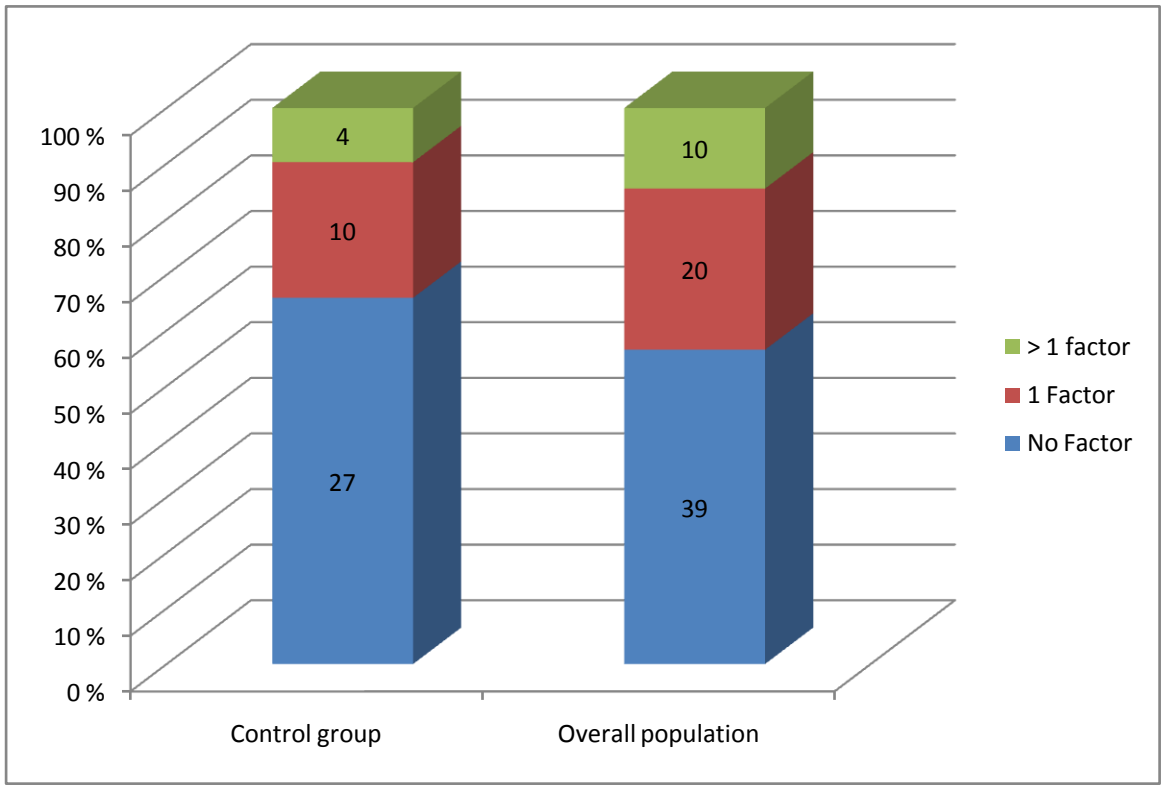
The predisposing factors encountered which could have a direct bearing on the outcome by affecting wound healing were – comorbidites like obesity/malnutrition, anaemia, diabetes(maximum) , hypertension, immunosuppression and increased (more than 14 days) of preoperative hospital stay.

Among the subjects who developed SSIs –

20 had a predisposing factor, **10** had more than 1 predisposing factor and **39** had none, in the overall trial population.

10 had a predisposing factor, **4** had more than 1 predisposing factor and **28** had none, in the control group respectively.

Most commonly encountered was **Diabetes mellitus**, the rest included – hypertension, obesity, malignancy, old age, anaemia, prolonged preoperative hospital stay, long duration of surgery and immunosuppression (due to HIV infection and previous radiotherapy to a different anatomical site).



Tests of statistical significance was performed and the result was –

- Control group

	FACTOR PRESENT	**NO FACTOR**
SSI DEVELOPED	14	27
SSI NOT DEVELOPED	6	38

Fischer's test was performed and the two-tailed P value obtained was **0.0396** – hence considered to be statistically significant.

- Overall population

	FACTOR PRESENT	**NO FACTOR**
SSI DEVELOPED	30	39
SSI NOT DEVELOPED	26	147

Fischer's test was performed and the two-tailed P value obtained was **0.0001** – hence considered to be extremely statistically significant.

Hence the conclusion that can be drawn is that the presence of predisposing factors does predispose the subject to develop a SSI in the post op period.

Elective vs. Emergency surgeries and its significance :

A total of **74** cases were operated on an emergency basis and a total of **146** cases were operated on elective basis respectively. The final outcome in these 4 sub groups was –

	Control gp with SSI	**Control gp without SSI**	**Total population with SSI**	**Total population without SSI**
ELECTIVE	31	29	50	94
EMERGENCY	11	14	18	54

Test of statistical significance applied on the control subset and total population to compare if performing a surgery as elective or emergency basis could alter the chance of developing SSI, the result was –

- Control group - The two-tailed P value equals **0.6354**, hence found to be not statistically significant.
- Overall population - The two-tailed P value equals **0.1641**, hence found to be not statistically significant.

Hence the conclusion that can be drawn is that performing a operation (either class I/II procedures) on elective or emergency basis does not influence the outcome of incidence of SSIs.

Surgical site infections – the outcome

Most SSIs were anatomically of the superficial incisional type (**95.65 %**), deep incisional type accounted for cases (**4.35 %**) and there were no tissue / organ space infections.

Most wound infections according to literature begin to occur from post operative day 4 onwards, with the rare entities of streptococcal/clostridial infection and wound dehiscence or contamination from gastro-intestinal or biliary/pancreatic anastomotic leaks occurring within the first 3 days of the post operative period.

In this trial – **68** patients developed SSI within 7 days(**98.55 %**) , no patients developed earlier than post op day 3.Mostcommonly infections began on **day 4 and 5**.

Only **2** patients developed late onset SSI (**2.89 %**) viz. Post 7 days in the post operative period but within 1 month of day of surgery. Both were cases of hernia repair with mesh placement.

Bacteriology of SSIs :

All exudation from the wound was swabbed using sterile techniques and sent for bacteriological analysis to obtain the nature, virulence and antibiotic sensitivity patterns of the inoculum. The empirically started antibiotic after noting the occurrence of a SSI (wound swab always preceded antibiotic initiation) can be hence changed to a more suitable antibiotic the organism is sensitive to.

It however must be noted that culture negative or positive wound is not considered a gold standard for the exclusion or presence of a SSI, but as recommended by the CDC in their definition of different SSI types - reiterate the need to correlate the same with "hard" clinical signs and symptoms.

Among the cases who developed SSI – **42** were culture positive while **27** were culture negative. Prevalent bacteria and their most sensitive antibiotic pattern cultured from the wound in the order of frequency is –

1st :Escherichia coli (Amikacin → Cefotaxime → Netilmycin)

2nd :Staphyloccus aures (Amikacin → Amoxycillin → Imipenam)

3rd :Klebsiella Sp., Pseudomonas Sp. and Proteus Sp. (maximum sensitivity to Amikacin),

Followed by Streptococcus sp. and CONS.

ASEPSIS score and its results :

The maximum ASEPSIS score was noted at the height of infection in each infected wound. Average scores in –

	Class I	**Class II**
CONTROL GROUP	26.75	27.35
PROPHYLACTIC ANTIBIOTIC GROUP	34.25	25.65
CLOSED SUCTION DRAINAGE GROUP	21	26.24

The above table when interpreted would allow the observer to state that –

- In class I wounds : Average ASEPSIS scores were least in the closed suction drainage group followed by the control and prophylactic antibiotic groups. Therefore class I wounds which develop SSIs are least extensive in the closed suction drainage group.
- In class II wounds : Average ASEPSIS scores were very clustered close together with least in the prophylactic antibiotic group followed by the closed suction drainage and control groups. Therefore class II wounds which develop SSIs are least extensive in the prophylactic antibiotic group.

Thus, the presence of either intervention should reduce the severity and extent of the SSI developing in a Class I and II wound.

Modalities of treatment :

The occurrence of seropurulent discharge, erythema and wound dehiscence with or without fever confirmed the presence of a wound infection. The wound sutures were removed in the area of discharge or bulge and fluid was let out. Wound swab was taken at this juncture. Wound wash with saline and hydrogen peroxide (if adherent slough present) given. Depth of the wound examined for involvement of deeper musculo-fascial planes. Appropriate debridement under local anaesthesia done.(note : no case in this trial required debridement under regional or general anaesthesia) If deep/organ space involvement was suspected, it was ruled out by appropriate radiological investigations like superficial ultrasonography or contrast study.

Empirical antibiotics were instituted based on prevalent bacterial and sensitivity patterns. The antibiotics were changed according to culture and sensitivity patterns when reports became available. Daily wound inspection with appropriate debridement and dressings continued till infection subsided. Wounds allowed to heal by secondary intention if of the superficial incisional type, if failed secondary suture closure was done. Wounds of deep incisional type were all closed secondarily in layers. Concurrent strict glycemic and BP control, improvement of haemoglobin to more than 10 gms%, hydration and nutritional quality and quantity were ensured.

Best intervention for prevention of SSIs :

The null hypotheses was proposed – that no intervention is superior to either intervention viz. Prophylactic antibiotic or closed suction drainage in each class of surgery.

On gross examination (on comparing percentage incidences of SSIs) –

1. No intervention vs. Prophylactic antibiotic

   Class I - **36.84 % vs. 18.18 %**

   Class II -**51.51 % vs. 27.42 %**

2. No intervention vs. Closed suction drainage

   Class I - **36.84 % vs. 7.69 %**

   Class II – **51.51 % vs. 17.65 %**

The above percentages would clearly indicate that in both classes of operations (I and II) the use of either intervention would reduce the incidence of SSIs.

The data also suggests that the use of closed suction drainage is superior to the use of prophylactic antibiotics in the prevention of SSIs in both Class I and II surgeries. However these findings need to be tested using appropriate statistical tests of significance.

Tests of statistical significance (Fischer's test and chi square test) - for discrete data performed to test the hypotheses.

Results :

1. No intervention vs. Prophylactic antibiotic

Class I - The two-tailed P value equals **0.2900**, not statistically significant

Class II -The two-tailed P value equals **0.0068**, very statistically significant

2. No intervention vs. Closed suction drainage

Class I - The two-tailed P value equals **0.1006**, not statistically significant

Class II - The two-tailed P value equals **0.0012**, very statistically significant

Hence based on obtained p values, the Class I difference between incidence rates between no intervention and either intervention was purely because of chance or random sampling methodology. However the use of either intervention was superior to none in Class II.

The lower p value of the closed suction drainage comparison against the p value of the prophylactic antibiotic group suggests the superior effect of closed suction drainage in the prevention of SSIs in Class II operations.

CONCLUSIONS AND RECOMMENDATIONS

The study was conducted for a period of 1 year. All cases were randomly allocated into the 3 study groups. A large variety of Class I and II operations were included, the maximum being hernia repairs with the placement of synthetic meshes as reinforcement. According to the definition of SSI, if a prosthetic implant like a mesh is placed, the follow up period is extended to 1 year. However in this study the follow up of each patient was upto only 30 days hence this is a fallacy secondary to the limited period of this study.

The trial is a hospital based trial hence during inclusion and randomization of subjects, it was not preceded by matching and hence the resultant increase in confounding factors. This fallacy could be avoided by a population based sample, subsequently matched and then randomized.

The overall incidence of SSI was 31.94 % and the incidence in individual classes (Class I - 22.22 % and Class II – 35.19 %) paralleled previous Indian and international literature.[8, 9, 11-18] However this trials incidence percentages are grossly larger than international literature which probably reflects the lesser standard of peri-operative wound precautions, care and management.

The type of SSIs encountered were mostly Superficial incisional type which is also the most common type according to literature.[4-5]

Most SSIs developed between post op day 3 and 6, which parallels literature. Only 2 cases were noted beyond the first week and those too were in “hernia repair with meshes” subjects which parallels the need for extended period of follow up/surveillance in the definition of SSIs for surgeries with prosthetic implant placement.

The effect of age on the chance of developing SSIs was studied and was not found to a statistically significant to be an independent factor to influence the incidence of SSIs.

The risk factors predisposing to SSIs were studied.[19-20] As previously mentioned, since environmental and procedural factors were relatively constant, only the host related pre-existent co morbidities were analysed. Tobacco and alcohol consumption were also excluded and the final list was headed by diabetes mellitus. Others were hypertension, anaemia, old age, prolonged preoperative stay (>14 days), long duration surgery (> 4 hours) and different immunosuppressive states. Statistical testing of these factors against occurrence of SSIs was done – and found to be significant. Therefore the presence of even one or two co-existent illnesses could increase the risk of developing SSIs, as supported by previous literature.

Whether the risk of developing SSIs was different in elective or emergency procedures was examined statistically and the tests revealed that the risk of development of SSIs was not determined by these 2 factors atleast when applied to class I and II wounds.

The objective assessment of wounds after the development of SSIs was done and scored using the ASEPSIS scoring system. This was done to see if class of wound and intervention offered could influence the severity of the resultant infection. The data obtained was however not as expected –

In class I wounds : Average ASEPSIS scores were least in the closed suction drainage group followed by the control and prophylactic antibiotic groups. Therefore class I wounds which develop SSIs are least extensive in the closed suction drainage group.

In class II wounds : Average ASEPSIS scores were least in the prophylactic antibiotic group followed by the closed suction drainage and control groups. Therefore class II wounds which develop SSIs are least extensive in the prophylactic antibiotic group.

Therefore the control group was found to have lesser severity when compared to antibiotics in class I wounds. The expected outcome was that either intervention should not only reduce the incidence but also the severity of infection, in either class of surgery. Also of interest is that the aforementioned apparent statistical advantage (in reducing the incidence of SSI) of the drain over the prophylactic antibiotic does not seem to also translate to a less severe infection (in drains compared to antibiotics) among Class II wounds.

The expected increase in severity of infection, as evident by average respective class wise ASEPSIS scores in Class II (**26.41%**) when compared to Class I (**27.33%**) wounds was also not evident.

These unexpected results could be due to early intervention of the wound and not allowing the wound to course through its natural history and influence maximum ASEPSIS score.

However, the presence of either intervention should reduce the severity and extent of the SSI developing in a Class I and especially in Class II wound.

All resultant wound exudates were swabbed and sent for microbiological analysis. Approximately 60.87 % was found to be positive for an organism. This reiterates the fact that culture positivity is not the gold standard for labelling a wound as being infected but an adjunct to the diagnosis which is primarily clinical. The resultant pattern of organisms and their culture patterns could influence clinicians on the choice of empirical antibiotics once infection is noted. These empirical antibiotics are subsequently altered based on swab

culture sensitivity patterns. In this trial E.coli was the most prevalent inoculum with a predominant sensitivity to Amikacin.

Finally the null hypothesis was put to the test. Prophylactic antibiotics were given using standard dosing and administration protocols (as described in the Introduction – Antibiotic Prophylaxis section and the Methodology section). Repeat intraoperative dosing was given in a few subjects due to prolongation of procedure time beyond 4 hours. Closed suction drainage was achieved with standard 12 - 14F gauge suction tubes connected to syringes or appropriate suction devices.

The analysis of resultant incidence percentages revealed - that in both classes of operations (I and II) the use of either intervention would reduce the incidence of SSIs.

The data also suggests that the use of closed suction drainage is superior to the use of prophylactic antibiotics in the prevention of SSIs in both Class I and II surgeries. However these findings need to be tested using appropriate statistical tests of significance.

Based on comparing no intervention vs. Each intervention in each class of operation individually, the following conclusions were drawn –

1. In Class I wounds : neither intervention was found to reduce the SSI incidence when compared to no intervention at all

2. In Class II wounds : both interventions were found to have a statistically significant role in reduction of the occurrence of SSIs. The lower P value obtained with the closed drainage group compared with the prophylactic antibiotic group when individually tested against the control group would suggest a significant superiority of drainage to antibiotics in the prophylaxis Class II wounds.

These conclusions prevent the indiscriminate use of antibiotic prophylaxis and its resultant adverse effects like development of resistance, increased costs, antibiotic side effects in both Class I and II wounds. Class I wounds could be managed without any prophylaxis.

On comparison of the cost incurred during use of either intervention the cost of a simple suction catheter and syringe was found to lesser than even a single dose of the prophylactic antibiotic. Thus the most cost effective intervention for Class II wounds is the closed suction drainage of the subcutaneous space.

FINAL RECOMMENDATIONS :

- The Class of procedure is an important determinant of the occurrence of SSIs.

- **All Class I surgeries do not require any prophylaxis for the prevention of SSIs.**

- **The most cost effective and rationale prophylactic intervention for Class II surgeries is Closed suction drainage of the subcutaneous dead space** followed by Prophylactic antibiotic use, in the prevention of SSIs.

- The occurrence of SSIs in elective and emergency procedures does not differ and hence the prophylaxis would be dictated according to class of wound instead.

- The presence of predisposing factors would influence the possibility of developing a SSI and hence must be controlled/negated in the preoperative period and the patient must be cautiously followed in the post operative period.

- Standard antibiotic prophylaxis regimens must be followed [7, 25, 42-46, 38-39, 47-50] – as used in this trial → [form a protocol wherein appropriate antibiotic is used for the appropriate procedure and dictated by prevalent hospital and community culture sensitivity patterns; usual therapeutic dose used; IV route used, administered within 1 hour of incision or at induction; repeat intra op doses based on time elapsed since incision or fluid loss/dilution]

- Wound infection must be identified early by clinical and bacteriological methods. Appropriate management must be instituted determined by plane of affection and severity including letting out of exudate, debridement and empirical antibiotics. These empirical antibiotics must also be based on prevalent culture – sensitivity patterns and changed according to wound swab reports. Other supportive measures must be instituted to improve the wound healing environment.

- Regular wound and antibiotic audits must be conducted in the institution. These appraisals would allow the clinician to adapt to the constantly changing scenarios regarding SSIs.

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ANNEXURE I – PROFORMA

Name : Study group : 1-3

Age :

Sex :

IP No. :

Weight :

ASA class :

DOA : DOS : DOD:

Diagnosis :

Procedure done :

Findings :

Procedure time :

Elective / Emergency

Wound Class :

Antibiotic used and regimen :

DT used :

Daily DT output (vol./nature) :

DT removed on day _____

Signs and symptoms suggestive of SSI and POD of occurrence :

Cultures :

Radiological investigations (if any) :

ASEPSIS score :

Review of wound :

Treatment given (if any) :

Predisposing factors (tick as appropriate) :

1. Host : co-morbidities (like obesity, malnutrition, immunosuppression, anaemia, uraemia, jaundice, diabetes) , alcohol and tobacco use, duration of pre-operative hospital stay, remote site infection

2. Environmental : microbe related (viz. Pathogen, virulence and resistance profile), theatre environs (viz. Previous case operated)

3. Procedure : Pre-op preparation like shaving/bathing, sterile techniques such as hand washing/painting/draping/gloving, meticulous technique like handling and devitalization, use of diathermy, haemostasis

ANNEXURE II- MASTER CHART

Name	Study group	Wound class	Age	Sex	ASA	DOA-DOS	DOS-DOD	Diagnosis	Procedure	duration	Type of surgery (em/el)	Wound class	Antibiotic regimen	Daily DT output and nature	DT removal day	S/O SSI	SSI POD	Culture	Treatment	Asepsis score	R/w	Predisposing
thangaraj	1	1	1	1	I	<14	>14	lt congenital hernia	lt herniotomy	1	1	1	no	no	no	erythema, ser exudate(<20%)	4	no	1&3	17	POD5-as noted and POD30-WNL	
Samsudin	1	2	4	1	I	<14	<14	LIIH	hernioplasty	1	1	2	no	no	no	erythema+ pus(40%)	4	Staph aureus - amikacin	1	37	POD5-as noted and POD30-WNL	
vasanthi	1	2	3	2	II	<14	>14	benign GOO	TV+GJ	1	1	2	no	no	no	erythema+ ser exudate (40%)	4	no	1&3	21	POD5-as noted and POD30-WNL	1(obesity)
mathu	1	2	5	1	II	<14	<14	RDIH	hernioplasty	1	1	2	no	no	no	erythema+s/p exudate(<25%)	4	no	1&3	21	POD5-as noted and POD30-WNL	
bharanini	1	2	3	2	I	<14	<14	paraumbilical hernia	anatomical&mesh repair	1	1	2	no	no	no	no	no	no	no	no	POD5-as noted and POD30-WNL	
malathi	1	2	3	2	I	<14	<14	paraumbilical hernia	anatomical&mesh repair	1	1	2	no	no	no	no	no	no	no	no	POD5-as noted and POD30-WNL	
rani	1	2	3	2	II	>14	>14	appendicitic	appendicectomy	1	1	2	no	no	no	no	no	no	no	no	POD5-as noted and POD30-WNL	1(DM)
deva	1	1	3	1	I	<14	<14	B/L varicose veins	B/L trendelenburg	1	1	1	no	no	no	no	no	no	no	no	POD5-as noted and POD30-WNL	
parthasarthi	1	1	4	1	I	<14	<14	B/L varicose veins	B/L trendelenburg	1	1	1	no	no	no	no	no	no	no	no	POD5-as noted and POD30-WNL	
krithika	1	1	2	2	I	<14	<14	cystic lesion thigh?hydatid	excision	1	1	1	no	no	no	no	no	no	no	no	POD5-as noted and POD30-WNL	
parkodi	1	1	4	2	II	>14	<14	SN Thyroid	Hemithyroidectomy	1	1	1	no	no	no	no	no	no	no	no	POD5-as noted and POD30-WNL	
mohammed	1	2	2	1	I	<14	<14	RDIH	hernioplasty	1	1	2	no	no	no	no	no	no	no	no	POD5-as noted and POD30-WNL	
nathan	1	2	2	1	I	<14	<14	RIIH	hernioplasty	1	1	2	no	no	no	no	no	no	no	no	POD5-as noted and POD30-WNL	
janardhan	1	2	2	1	I	<14	<14	RIIH	hernioplasty	1	1	2	no	no	no	no	no	no	no	no	POD5-as noted and POD30-WNL	
Jitendra	1	2	3	1	I	<14	<14	RIIH	hernioplasty	1	1	2	no	no	no	no	no	no	no	no	POD5-as noted and POD30-WNL	
gunasekar	1	2	3	1	I	<14	<14	RIIH	hernioplasty	1	1	2	no	no	no	no	no	no	no	no	POD5-as noted and POD30-WNL	
purshotham	1	2	3	1	I	<14	<14	RDIH	hernioplasty	1	1	2	no	no	no	no	no	no	no	no	POD5-as noted and POD30-WNL	
mani	1	2	3	1	I	<14	<14	RIIH	hernioplasty	1	1	2	no	no	no	no	no	no	no	no	POD5-as noted and POD30-WNL	
Subramani	1	2	4	1	I	<14	<14	LIIH	hernioplasty	1	1	2	no	no	no	no	no	no	no	no	POD5-as noted and	

																					POD30-WNL	
elumalai	1	2	4	1	I	<14	<14	LIIH	hernioplasty	1	1	2	no	no	no	no	no	no	no	no	POD5-as noted and POD30-WNL	1(old age+HTN)
ravi	1	2	4	1	I	<14	<14	RDIH	hernioplasty	1	1	2	no	no	no	no	no	no	no	no	POD5-as noted and POD30-WNL	
Subramani	1	2	5	1	I	<14	<14	RIIH	hernioplasty	1	1	2	no	no	no	no	no	no	no	no	POD5-as noted and POD30-WNL	
chalapathy	1	2	6	1	II	>14	<14	RIIH	hernioplasty	1	1	2	no	no	no	no	no	no	no	no	POD5-as noted and POD30-WNL	
sethu	1	2	4	1	I	<14	<14	R irreducible inguinal hernia	hernioplasty with partial omentectomy	1	1	2	no	no	no	no	no	no	no	no	POD5-as noted and POD30-WNL	
anand	1	1	1	1	I	<14	<14	rt congenital hernia	herniotomy	1	1	1	no	no	no	no	no	no	no	no	POD5-as noted and POD30-WNL	
saravanan	1	1	1	1	I	<14	<14	rt. Cong hernia	herniotomy	1	1	1	no	no	no	no	no	no	no	no	POD5-as noted and POD30-WNL	
kannan	1	1	1	1	I	<14	<14	rt congenital hernia	herniotomy	1	1	1	no	no	no	no	no	no	no	no	POD5-as noted and POD30-WNL	
logeshwari	1	1	3	2	I	<14	<14	umb hernia	mayo repair	1	1	1	no	no	no	no	no	no	no	no	POD5-as noted and POD30-WNL	
Ushandandini	1	1	1	2	I	<14	<14	MNG	NT thyroidectomy	1	1	1	no	no	no	no	no	no	no	no	POD5-as noted and POD30-WNL	
devi	1	2	4	2	I	<14	<14	GSD	open chole	1	1	2	no	no	no	no	no	no	no	no	POD5-as noted and POD30-WNL	
amanullah	1	2	4	1	II	<14	<14	ca stomach	palliative bypass	1	1	2	2	no	no	no	no	no	no	no	POD5-as noted and POD30-WNL	1(malignancy)
Salma	1	1	1	2	I	>14	<14	thyroglossal cyst	sistrunk operation	1	1	1	no	no	no	no	no	no	no	no	POD5-as noted and POD30-WNL	
murugan	1	1	5	1	II	<14	<14	B/L varicose veins	vein stripping	1	1	1	no	no	no	no	no	no	no	no	POD5-as noted and POD30-WNL	
anandhan	1	2	5	1	II	<14	<14	RDIH	hernioplasty	1	1	2	no	no	no	pur exudate+erythema(20%)	15	pseudo-amik	1&3	31	POD5-as noted and POD30-WNL	1(old age and DM)
vijayan	1	2	5	1	II	<14	<14	LDIH	hernioplasty	1	1	2	no	no	no	pur exudate+erythema(40%)	4	cons-amik	1&3	34	POD5-as noted and POD30-WNL	1(DM+old age)
punithammal	1	2	5	1	II	<14	>14	paraumbilical hernia	anatomical & mesh repair	1	1	2	no	no	no	pur exudate+erythema+muscle necrose(50%)	4	klebsiella - amikacin	1&3	50	POD5-as noted and POD30-WNL	1(HTN)
bhavani	1	2	2	2	I	<14	<14	appendicitic	appendicectomy	1	1	2	no	no	no	pus+erythema(25%)	4	Proteus-Cefotax	1&3	21	POD5-as noted and POD30-WNL	
karpaswamy	1	2	5	1	II	<14	<14	LDIH	hernioplasty	1	1	2	no	no	no	pus+erythema(25%)	25	staph-amik	1&3	31	POD5-as noted and POD30-WNL	1(DM)

giridhar	1	2	2	1	I	<14	<14	RIIH	hernioplasty	1	1	2	no	no	no	pus+erythema(30%)	4	e. coli-amik	1&3	31	POD5-as noted and POD30-WNL	
ponni	1	2	3	2	II	<14	<14	inc hernia	mesh repair	1	1	2	no	no	no	pus+erythema(40%)	4	CONS-erythro	1&3	34	POD5-as noted and POD30-WNL	
sushe ela	1	2	3	2	II	<14	<14	GB stones	open chole	1	1	2	no	no	no	pus+erythema(40%)	4	proteus-amik	1&3	34	POD5-as noted and POD30-WNL	1(DM)
rani	1	1	5	2	II	<14	>14	ant abd. Lipoma	excision	1	1	1	no	no	no	pus+erythema(80%)	5	staph-amoxy	1&3	50	POD5-as noted and POD30-WNL	1(old age)
jayapr iya	1	1	1	2	I	<14	<14	cystic hygroma-neck	excision	1	1	1	no	no	no	pus+erythems(30%)	4	kleb-amikacin	1&3	21	POD5-as noted and POD30-WNL	
jeeva	1	1	2	1	I	<14	<14	lt lipoma	excision	1	1	1	no	no	no	ser exudate + erythema(25%)	4	no	1&3	19	POD5-as noted and POD30-WNL	
deepa k	1	2	3	1	I	<14	<14	RIIH	hernioplasty	1	1	2	no	no	no	ser exudate+ erythema(30%)	5	no	1&3	19	POD5-as noted and POD30-WNL	
maha devan	1	2	3	1	I	<14	<14	malign histiocytosis	laparotomy &biopsy	1	1	2	no	no	no	ser exudate+erythema(20%)	4	no	1&3	19	POD5-as noted and POD30-WNL	
kantha	1	2	1	2	I	<14	<14	RIIH	hernioplasty	1	1	2	no	no	no	ser exudate+erythema(30%)	5	no	1&3	19	POD5-as noted and POD30-WNL	
deepa k	1	2	3	1	I	<14	<14	LIIH	hernioplasty	1	1	2	no	no	no	ser exudate+erythema(30%)	4	no	1&3	19	POD5-as noted and POD30-WNL	1(DM)
ainava n	1	1	3	1	I	<14	<14	hydrocoele	S/T excision	1	1	1	no	no	no	ser exudate+erythema(30%)	4	no	1&3	19	POD5-as noted and POD30-WNL	
mani	1	1	3	1	II	<14	<14	hydrocoele	S/T excision	1	1	1	no	no	no	ser exudate+erythema(30%)	4	no	1&3	19	POD5-as noted and POD30-WNL	
laksh mi	1	1	2	2	I	<14	<14	Rt SNT	Hemithyroidectomy	1	1	1	no	no	no	ser exudate+erythma(30%)	5	no	1&3	19	POD5-as noted and POD30-WNL	
logan athan	1	2	6	1	II	<14	<14	LDIH	hernioplasty	1	1	2	no	no	no	ser+erythema(20%)	4	no	1&3	19	POD5-as noted and POD30-WNL	1(DM+HTN)
anjali	1	2	2	2	I	<14	<14	appendicitic	appendicectomy	1	1	2	no	no	no	ser+erythema(25%)	3	no	1&3	19	POD5-as noted and POD30-WNL	
seeth aram	1	2	3	1	I	<14	<14	LIIH	hernioplasty	1	1	2	no	no	no	ser+erythema(30%)	4	no	1&3	19	POD5-as noted and POD30-WNL	
palani	1	2	3	2	I	<14	<14	RIIH	hernioplasty	1	1	2	no	no	no	ser+erythema(30%)	5	no	1&3	19	POD5-as noted and POD30-WNL	
srinivasan	1	2	5	1	II	<14	<14	RDIH	hernioplasty	1	1	2	no	no	no	ser+erythema(30%)	4	no	1&3	19	POD5-as noted and POD30-WNL	1(DM)
bala	1	2	3	1	I	<14	<14	LIIH	hernioplasty	1	1	2	no	no	no	ser+erythema(50%)	4	no	1&3	21	POD5-as noted and POD30-WNL	
logesh	1	2	5	1	II	<14	<14	LDIH	hernioplasty	1	1	2	no	no	no	ser+erythema(50%)	4	no	1&3	21	POD5-as noted and POD30-WNL	1(old age)

vasantha	1	2	3	2	I	<14	<14	cholelithiasis	open chole	1	1	2	no	no	no	serosanguinous d/s(<20%)	5	no	1	19	POD5-as noted and POD30-WNL	
Antony	1	1	4	1	I	>14	<14	splenic infarct cyst	splenectomy	1	1	1	no	no	no	seroupurulent d/s(50%)	3	staph aureus - Amoxicillin	3	50	POD5-as noted and POD30-WNL	
Abdul	1	2	3	1	I	<14	<14	RIIH	hernioplasty	1	2	2	no	no	no	erythema+serous d/s(30%)	3	no	1&3	37	POD5-as noted and POD30-WNL	
dhanpal	1	2	1	1	I	<14	<14	acute appendictis	appendicectomy	1	2	2	no	no	no	no	no	no	no	no	POD5-as noted and POD30-WNL	
muniswamy	1	2	1	1	II	<14	<14	acute appendictis	appendicectomy	1	2	2	no	no	no	no	no	no	no	no	POD5-as noted and POD30-WNL	
Nandhini	1	2	1	2	I	<14	<14	acute appendictis	appendicectomy	1	2	2	no	no	no	no	no	no	no	no	POD5-as noted and POD30-WNL	
kalpana	1	2	1	2	I	<14	<14	acute appendictis	appendicectomy	1	2	2	no	no	no	no	no	no	no	no	POD5-as noted and POD30-WNL	
sathya	1	2	1	2	II	<14	<14	acute appendictis	appendicectomy	1	2	2	no	no	no	no	no	no	no	no	POD5-as noted and POD30-WNL	
soniya	1	2	1	2	II	<14	<14	acute appendictis	appendicectomy	1	2	2	no	no	no	no	no	no	no	no	POD5-as noted and POD30-WNL	
Sivakumar	1	2	2	1	II	<14	<14	acute appendictis	appendicectomy	1	2	2	no	no	no	no	no	no	no	no	POD5-as noted and POD30-WNL	
murugan	1	2	2	1	II	<14	<14	acute appendictis	appendicectomy	1	2	2	no	no	no	no	no	no	no	no	POD5-as noted and POD30-WNL	
ravi	1	2	2	1	II	<14	<14	acute appendictis	appendicectomy	1	2	2	no	no	no	no	no	no	no	no	POD5-as noted and POD30-WNL	1(malignancy)
gopinath	1	2	2	1	II	<14	<14	acute appendictis	appendicectomy	1	2	2	no	no	no	no	no	no	no	no	POD5-as noted and POD30-WNL	
Vetriselvi	1	2	2	2	I	<14	<14	acute appendictis	appendicectomy	1	2	2	no	no	no	no	no	no	no	no	POD5-as noted and POD30-WNL	
Sumathi	1	2	2	2	I	<14	<14	acute appendictis	appendicectomy	1	2	2	no	no	no	no	no	no	no	no	POD5-as noted and POD30-WNL	
jaya	1	2	2	2	II	<14	<14	acute appendictis	appendicectomy	1	2	2	no	no	no	no	no	no	no	no	POD5-as noted and POD30-WNL	
pari	1	2	3	1	II	<14	<14	acute appendictis	appendicectomy	1	2	2	no	no	no	no	no	no	no	no	POD5-as noted and POD30-WNL	
sitalakshmi	1	2	2	2	II	<14	>14	acute appendictis	appendicectomy	1	2	2	no	no	no	pur exudate+erythema+muscle necrosis (50%) deep inc	5	pseudo-cefotax	2&3	55	POD5-as noted and POD30-WNL	1(obesity)
damodar	1	2	2	1	II	<14	<14	acute appendictis	appendicectomy	1	2	2	no	no	no	pus+erythema(25%)	4	e.coli-amik	1&3	31	POD5-as noted and POD30-WNL	

saranya	1	2	1	2	II	<14	<14	acute appendictis	appendicectomy	1	2	2	no	no	no	pus+erythema(30%)	3	e.coli-amik	1&3	31	POD5-as noted and POD30-WNL	
sheela	1	2	2	2	II	<14	<14	twisted ovarian cyst	SO	1	2	2	no	no	no	pus+erythema(40%)	4	e.coli-amik	1&3	34	POD5-as noted and POD30-WNL	
jeeva	1	2	4	1	II	<14	<14	incarc RIIH(omentum)	hernioplasty	1	2	2	no	no	no	pus+erythema(80%)	3	staph-imipenem	1&3(suturing)	40	POD5-as noted and POD30-WNL	
lalitha	1	2	3	2	II	<14	<14	acute appendictis	appendicectomy	1	2	2	no	no	no	ser exudate+erythema(30%)	4	E.coli-Netil	1&3	19	POD5-as noted and POD30-WNL	
jaya	1	2	4	2	II	<14	<14	acute appendictis	appendicectomy	1	2	2	no	no	no	ser exudate+erythema(30%)	12	no	1&3	19	POD5-as noted and POD30-WNL	1(Dm &old age)
jayammal	1	2	2	2	II	<14	<14	acute appendictis	appendicectomy	1	2	2	no	no	no	ser exudate+erythema(40%)	5	E.coli-Amik	1&3	21	POD5-as noted and POD30-WNL	
dhanashri	1	2	2	2	II	<14	<14	acute appendictis	appendicectomy	1	2	2	no	no	no	ser exudate+erythema(60%)	4	klebsiella-amikacin	1&3	37	POD5-as noted and POD30-WNL	
nithya	1	2	1	2	II	<14	<14	acute appendictis	appendicectomy	1	2	2	no	no	no	ser+erythema(30%)	5	Cons-erythro	1&3	29	POD5-as noted and POD30-WNL	
basha	2	2	3	1	II	<14	<14	B/L DIH	B/L hernioplasty	1	1	2	2	no	no	erthema+SE(30%)	3	no	1&3	19	POD5-as noted and POD30-WNL	1(HIV)
vidya	2	2	3	2	II	>14	>14	paraumbilical hernia	anatomical & mesh repair	1	1	2	2	no	no	erythema+ pur. Exudate(50%)	5	staph-amoxy	1&3(mesh removal &suturing)	44	POD5-as noted and POD30-WNL	1(anemia&obesity)
varadharajan	2	1	5	1	II	<14	<14	epigastric hernia	anatomical repair	1	1	1	1	no	no	erythema+seropurulent d/s(40%)	6	pseudomonas - imipenem	3	39	POD5-as noted and POD30-WNL	1(obesity)
kamini	2	1	4	2	II	<14	<14	epigastric hernia	anatomical repair	1	1	1	1	no	no	no	no	no	no	no	POD5-as noted and POD30-WNL	
kutti	2	2	3	1	II	<14	<14	B/L IIH	B/L hernioplasty	1	1	2	2	no	no	no	no	no	no	no	POD5-as noted and POD30-WNL	
chinnadurai	2	2	1	1	I	<14	<14	pseudocyst	CG	1	1	2	2	no	no	no	no	no	no	no	POD5-as noted and POD30-WNL	
babu	2	2	6	1	II	<14	<14	distal panr pseudocyst+splenic infarct	distal pancreatectomy+splenectomy	2	1	2	2	no	no	no	no	no	no	no	POD5-as noted and POD30-WNL	1(old age)
gowriammal	2	1	1	2	II	<14	<14	NHL-axillary LN	excision	1	1	1	no	no	no	no	no	no	no	no	POD5-as noted and POD30-WNL	1(malignancy)
ramesh	2	1	2	1	I	<14	<14	ankle bursa	excision	1	1	1	1	no	no	no	no	no	no	no	POD5-as noted and POD30-WNL	
asif	2	1	2	1	I	<14	<14	lipoma	excision	1	1	1	1	no	no	no	no	no	no	no	POD5-as noted and POD30-WNL	
kannan	2	1	5	1	II	<14	<14	lipoma	excision	1	1	1	1	no	no	no	no	no	no	no	POD5-as noted and POD30-WNL	1(old age)
david	2	1	1	1	I	<14	<14	rt.thigh lipoma	excision	1	1	1	1	no	no	no	no	no	no	no	POD5-as noted and POD30-WNL	

shamala	2	1	4	2	II	>14	<14	Rt. Cervical Lnpathy	excision biopsy	1	1	1	2	no	no	no	no	no	no	no	POD5-as noted and POD30-WNL	
vedha	2	1	5	2	I	<14	<14	?LN neck-parotid	excision biopsy	1	1	1	1	no	no	no	no	no	no	no	POD5-as noted and POD30-WNL	
ranjini	2	1	2	2	I	<14	<14	Rt. SNT	Hemithyroidectomy	1	1	1	1	no	no	no	no	no	no	no	POD5-as noted and POD30-WNL	
vasantha	2	2	4	1	I	<14	<14	RIIH	herioplasty	1	1	2	2	no	no	no	no	no	no	no	POD5-as noted and POD30-WNL	
selvam	2	2	2	1	I	<14	<14	RIIH	hernioplasty	1	1	2	2	no	no	no	no	no	no	no	POD5-as noted and POD30-WNL	
Gajendran	2	2	3	1	I	<14	<14	RIIH	hernioplasty	1	1	2	1	no	no	no	no	no	no	no	POD5-as noted and POD30-WNL	
radhamani	2	2	3	1	I	<14	<14	LIIH	hernioplasty	1	1	2	1	no	no	no	no	no	no	no	POD5-as noted and POD30-WNL	
prakash	2	2	3	1	I	<14	<14	LIIH	hernioplasty	1	1	2	1	no	no	no	no	no	no	no	POD5-as noted and POD30-WNL	
sanivel	2	2	3	1	II	<14	<14	RDIH	hernioplasty	1	1	2	2	no	no	no	no	no	no	no	POD5-as noted and POD30-WNL	
pradeep	2	2	3	1	II	<14	<14	RIIH	hernioplasty	1	1	2	2	no	no	no	no	no	no	no	POD5-as noted and POD30-WNL	
pandiyan	2	2	4	1	I	<14	<14	LIIH	hernioplasty	1	1	2	1	no	no	no	no	no	no	no	POD5-as noted and POD30-WNL	
abdulrahma	2	2	4	1	II	<14	<14	LDIH	hernioplasty	1	1	2	2	no	no	no	no	no	no	no	POD5-as noted and POD30-WNL	1(DM+HTN)
lazarus	2	2	4	1	II	<14	<14	RIIH	hernioplasty	2	1	2	2	no	no	no	no	no	no	no	POD5-as noted and POD30-WNL	1(COPD)
bhaskar	2	2	4	1	II	<14	<14	RDIH	hernioplasty	1	1	2	2	no	no	no	no	no	no	no	POD5-as noted and POD30-WNL	1(HTN+old TB)
subramani	2	2	4	1	II	<14	<14	RDIH	hernioplasty	1	1	2	2	no	no	no	no	no	no	no	POD5-as noted and POD30-WNL	1(HTN)
balaraman	2	2	5	1	II	<14	<14	LIIH	hernioplasty	1	1	2	1	no	no	no	no	no	no	no	POD5-as noted and POD30-WNL	
narayanaswamy	2	2	6	1	II	<14	<14	RIIH	hernioplasty	1	1	2	1	no	no	no	no	no	no	no	POD5-as noted and POD30-WNL	
shankar	2	1	1	1	I	<14	<14	rt. Cong. Hydrocoele	herniotomy	1	1	1	2	no	no	no	no	no	no	no	POD5-as noted and POD30-WNL	
Amanullah	2	2	5	1	II	<14	<14	LDIH and hydrocoele	herniplasty & eversion	1	1	2	1	no	no	no	no	no	no	no	POD5-as noted and POD30-WNL	
rani	2	1	3	2	I	<14	<14	femoral hernia	high op	1	1	1	2	no	no	no	no	no	no	no	POD5-as noted and POD30-WNL	

adilakshmi	2	1	1	2	II	>14	<14	Lt solitart nodule thyroid	Lt hemithyroidectomy	1	1	1	1	no	no	no	no	no	no	no	POD5-as noted and POD30-WNL	
dhanasekar	2	1	1	1	I	<14	<14	Lt testis chronic torsion	Lt. high inguinal orchidectomy	1	1	1	1	no	no	no	no	no	no	no	POD5-as noted and POD30-WNL	
vedha	2	1	5	2	II	<14	<14	LN+Ca parotid	MRND+total parotidectomy	2	1	1	1	no	no	no	no	no	no	no	POD5-as noted and POD30-WNL	1(malignancy)
neelammal	2	2	5	2	II	<14	<14	GSD	open chole	1	1	2	1	no	no	no	no	no	no	no	POD5-as noted and POD30-WNL	1(old age)
giri	2	1	3	1	II	>14	<14	Carcinoma stomach	Palliative Anterior GJ with JJ	1	1	1	1	no	no	no	no	no	no	no	POD5-as noted and POD30-WNL	
fathima	2	2	5	2	II	<14	<14	ilial knotting	release	1	1	2	2	no	no	no	no	no	no	no	POD5-as noted and POD30-WNL	1(old age)
janikaran	2	1	3	1	I	<14	<14	hydrocoele	S/T excision	1	1	1	1	no	no	no	no	no	no	no	POD5-as noted and POD30-WNL	
sahira	2	1	1	2	I	<14	<14	thyroglossal cyst	sistrunk operation	1	1	1	1	no	no	no	no	no	no	no	POD5-as noted and POD30-WNL	
yuvarani	2	2	3	2	II	<14	<14	rt dermoid ovary	SO	1	1	2	2	no	no	no	no	no	no	no	POD5-as noted and POD30-WNL	1(malignancy)
malathi	2	2	3	2	I	<14	<14	multiple fibroids	TAH	1	1	2	2	no	no	no	no	no	no	no	POD5-as noted and POD30-WNL	
thangavel	2	2	4	1	II	<14	<14	GOO	TV+GJ	1	1	2	2	no	no	no	no	no	no	no	POD5-as noted and POD30-WNL	
sekar	2	2	3	1	II	>14	<14	CCP+splenic infarct	distal pancreatectomy+splenectomy	2	1	2	2	no	no	pur exudate+erythema(20%)	4	no	1&3	21	POD5-as noted and POD30-WNL	1(DM)
vaithiswaran	2	2	5	1	II	<14	<14	RDIH	hernioplasty	1	1	2	2	no	no	pur exudate+erythema(20%)	5	no	1&3	19	POD5-as noted and POD30-WNL	1(old PT, old age)
ganesan	2	2	2	1	I	<14	<14	post ileostomy	reanastomosis	1	1	2	2	no	no	pur exudate+erythema(30%)	4	ecoli-cefotax	1&3	31	POD5-as noted and POD30-WNL	
meera	2	2	4	2	II	<14	>14	fibroids	TAH	1	1	2	2	no	no	pur exudate+erythema(40%)	6	staph-imipenem	1&3	44	POD5-as noted and POD30-WNL	1(DM)
munuswamy	2	2	3	1	II	>14	>14	RIIH&Rt. Hydrocoele	hernioplasty& eversion of sac	1	1	2	1	no	no	purulent d/s (20%)	2	Staph aureus - amikacin	3	17	POD5-as noted and POD30-WNL	
chengiyan	2	2	4	1	II	<14	>14	cholelithiasis	open chole	1	1	2	1	no	no	purulent d/s (20%)	3	Staph aureus - amikacin	3	19	POD5-as noted and POD30-WNL	
swaminathan	2	1	4	1	II	<14	>14	ca penis	rt I/I block dissection	1	1	1	1	no	no	purulent d/s+erythema (~75%)	4	klebsiella - amikacin	1&3(secondary suturing)	47	POD5-as noted and POD30-WNL	1(malignancy)
senthil	2	1	1	1	I	<14	<14	paracytic cyst rt thigh	excision	1	1	1	no	no	no	pus+erythema(40%)	5	e.coli-cefotax	1&3	34	POD5-as noted and POD30-WNL	
sheikhassan	2	2	4	1	II	<14	<14	LDIH	hernioplasty	1	1	2	2	no	no	pus+erythema(70%)deep inc	4	klebsiella - amikacin	1&3	45	POD5-as noted and POD30-WNL	1(obesity& HTN)

periyaswamy	2	2	3	1	II	<14	<14	LDIH	hernioplasty	1	1	2	2	no	no	ser exudate+erythema(20%)	4	no	1&3	19	POD5-as noted and POD30-WNL	1(DM)
thomas	2	2	6	1	II	<14	>14	Lt recurrent, RDIH	b/l hernioplasty	2	1	2	2	no	no	ser exudate+erythema(70%) b/l	5	E.coli-Amik	1&3	33	POD5-as noted and POD30-WNL	1(old laryngeal ca on RT, old age)
nanda kumar	2	2	5	1	II	<14	<14	LDIH	hernioplasty	1	1	2	2	no	no	ser+erythema(25%)	4	no	1&3	19	POD5-as noted and POD30-WNL	1(old age+HTN)
jancy rani	2	1	2	2	II	<14	<14	NG Lt thyroid lobe	Lt hemithyroidectomy	1	1	1	2	no	no	serous d/s(<20%)	7	no	1	17	POD5-as noted and POD30-WNL	
mangammal	2	2	2	2	II	<14	<14	acute appendictis	appendicectomy	1	2	2	2	no	no	erythema+ ser. Exudate(<25%)	3	proteus - Amikacin	1&3	31	POD5-as noted and POD30-WNL	
nanda kumar	2	2	1	1	II	<14	<14	acute appendictis	appendicectomy	1	2	2	2	no	no	no	no	no	no	no	POD5-as noted and POD30-WNL	
hansraj	2	2	1	1	II	<14	<14	acute appendictis	appendicectomy	1	2	2	2	no	no	no	no	no	no	no	POD5-as noted and POD30-WNL	
ravi	2	2	1	1	II	<14	<14	acute appendictis	appendicectomy	1	2	2	2	no	no	no	no	no	no	no	POD5-as noted and POD30-WNL	
syed	2	2	1	1	II	<14	<14	acute appendictis	appendicectomy	1	2	2	2	no	no	no	no	no	no	no	POD5-as noted and POD30-WNL	
narayanan	2	2	1	1	II	<14	<14	acute appendictis	appendicectomy	1	2	2	2	no	no	no	no	no	no	no	POD5-as noted and POD30-WNL	
devaruban	2	2	1	1	II	<14	<14	acute appendictis	appendicectomy	1	2	2	2	no	no	no	no	no	no	no	POD5-as noted and POD30-WNL	
vasanthi	2	2	1	2	I	<14	<14	acute appendictis	appendicectomy	1	2	2	1	no	no	no	no	no	no	no	POD5-as noted and POD30-WNL	
dhivyavani	2	2	1	2	I	<14	<14	acute appendictis	appendicectomy	1	2	2	1	no	no	no	no	no	no	no	POD5-as noted and POD30-WNL	
Rathna	2	2	1	2	I	<14	<14	acute appendictis	appendicectomy	1	2	2	1	no	no	no	no	no	no	no	POD5-as noted and POD30-WNL	
varalakshmi	2	2	1	2	I	<14	<14	acute appendictis	appendicectomy	1	2	2	1	no	no	no	no	no	no	no	POD5-as noted and POD30-WNL	
devi	2	2	1	2	II	<14	<14	acute appendictis	appendicectomy	1	2	2	2	no	no	no	no	no	no	no	POD5-as noted and POD30-WNL	
kumar	2	2	1	2	II	<14	<14	acute appendictis	appendicectomy	1	2	2	2	no	no	no	no	no	no	no	POD5-as noted and POD30-WNL	
poongudi	2	2	1	2	II	<14	<14	acute appendictis	appendicectomy	1	2	2	2	no	no	no	no	no	no	no	POD5-as noted and POD30-WNL	
latha	2	2	1	2	II	<14	<14	acute appendictis	appendicectomy	1	2	2	2	no	no	no	no	no	no	no	POD5-as noted and POD30-WNL	
Subramani	2	2	2	1	I	<14	<14	acute appendictis	appendicectomy	1	2	2	1	no	no	no	no	no	no	no	POD5-as noted and	

																				POD30-WNL	
mahalakshmi	2	2	2	2	I	<14	<14	acute appendictis	appendicectomy	1	2	2	1	no	no	no	no	no	no	no	POD5-as noted and POD30-WNL	
annammal	2	2	2	2	II	<14	<14	acute appendictis	appendicectomy	1	2	2	2	no	no	no	no	no	no	no	POD5-as noted and POD30-WNL	1(HTN)
banumathi	2	2	2	2	II	<14	<14	acute appendictis	appendicectomy	1	2	2	2	no	no	no	no	no	no	no	POD5-as noted and POD30-WNL	
muthukrishnan	2	2	3	1	II	<14	<14	acute appendictis	appendicectomy	1	2	2	2	no	no	no	no	no	no	no	POD5-as noted and POD30-WNL	
rafiq	2	2	3	1	II	<14	<14	acute appendictis	appendicectomy	1	2	2	2	no	no	no	no	no	no	no	POD5-as noted and POD30-WNL	
babu	2	2	3	1	II	<14	<14	acute appendictis	appendicectomy	1	2	2	no	no	no	no	no	no	no	no	POD5-as noted and POD30-WNL	
bharathi	2	1	2	2	II	<14	<14	twisted broad ligament cyst	excision	1	2	1	2	no	no	no	no	no	no	no	POD5-as noted and POD30-WNL	
masilamani	2	2	6	1	II	<14	<14	RIIH	hernioplasty	1	2	2	1	no	no	no	no	no	no	no	POD5-as noted and POD30-WNL	
nazeema	2	2	2	2	I	<14	<14	acute appendictis	appendicectomy	1	2	2	1	no	no	purulent d/s(<20%)	3	kleb-amikacin	3	17	POD5-as noted and POD30-WNL	
rajammal	2	2	4	2	II	<14	<14	adhesive obstruction	adhesiolysis	1	2	2	2	no	no	pus+erythema(40%)	5	CONS-amox	1&3	34	POD5-as noted and POD30-WNL	
arun	2	2	2	1	II	<14	<14	acute appendictis	appendicectomy	1	2	2	2	no	no	ser exudate+erythema(<20%)	3	no	1&3	17	POD5-as noted and POD30-WNL	
ramesh	2	2	2	1	I	<14	<14	acute appendictis	appendicectomy	1	2	2	1	no	no	seropurulent d/s(<20%)	3	pseudo-cefotax	1	17	POD5-as noted and POD30-WNL	
rajendran	3	1	3	1	I	<14	<14	epigastric hernia	anatomical repair	1	1	1	no	8ml;5ml;4ml;2ml(serosanguinous);nil	5	no	no	no	no	no	POD5-as noted and POD30-WNL	
thaithri	3	1	2	2	II	<14	<14	pap ca	completion thyroidectomy	1	1	1	no	15ml;5ml;nil	4	no	no	no	no	no	POD5-as noted and POD30-WNL	
thathathri	3	1	2	2	II	>14	<14	Rt SNT	Hemithyroidectomy	1	1	1	1	no	no	no	no	no	no	no	POD5-as noted and POD30-WNL	
ganesh	3	2	1	1	II	<14	<14	RIIH	hernioplasty	1	1	2	no	5ml; 3ml; minimal	4	no	no	no	no	no	POD5-as noted and POD30-WNL	
jayakumar	3	2	2	1	I	<14	<14	RDIH	hernioplasty	1	1	2	no	5ml:4ml:nil	3	no	no	no	no	no	POD5-as noted and POD30-WNL	
ashwin	3	2	2	1	I	<14	<14	RDIH	hernioplasty	1	1	2	no	8ml;3ml;nil	4	no	no	no	no	no	POD5-as noted and POD30-WNL	
kumar	3	2	3	1	I	<14	<14	RIIH	hernioplasty	1	1	2	no	8ml;5ml;nil(serosang)	7	no	no	no	no	no	POD5-as noted and POD30-WNL	

sathya narayana	3	2	4	1	II	<14	<14	LIIH	hernioplasty	1	1	2	no	8ml;nil	5	no	no	no	no	no	POD5-as noted and POD30-WNL	
krishnan	3	2	4	1	I	<14	<14	LDIH	hernioplasty	1	1	2	no	8ml;6ml;nil	3	no	no	no	no	no	POD5-as noted and POD30-WNL	
vedhachalam	3	2	5	1	II	<14	<14	LIIH	hernioplasty	1	1	2	no	7ml;5ml;5ml;4ml(serosanguinous);nil	5	no	no	no	no	no	POD5-as noted and POD30-WNL	
panchacharam	3	2	6	1	I	<14	<14	RIIH	hernioplasty	1	1	2	no	10ml;5ml;nil(serosang)	7	no	no	no	no	no	POD5-as noted and POD30-WNL	
Manikandan	3	1	1	1	I	<14	<14	RIIH	hernioraphy	1	1	1	no	8ml;5ml;3ml;minimal(serosanguinous)	4	no	no	no	no	no	POD5-as noted and POD30-WNL	
suresh	3	1	1	1	I	<14	<14	RIIH	herniorraphy	1	1	1	no	12ml'7ml;4ml;nil(sersang)	4	no	no	no	no	no	POD5-as noted and POD30-WNL	
barani	3	1	2	1	I	<14	<14	RIIH	herniorraphy	1	1	1	no	5ml;minimal	4	no	no	no	no	no	POD5-as noted and POD30-WNL	
Pandiyan	3	1	1	1	I	<14	<14	lt. cong hernia	herniotomy	1	1	1	no	5ml;nil	2	no	no	no	no	no	POD5-as noted and POD30-WNL	
sridar	3	1	1	1	I	<14	<14	Lt testis torsion	Lt LIO	1	1	1	no	<2ml;nil	2	no	no	no	no	no	POD5-as noted and POD30-WNL	
savithri	3	2	5	2	II	<14	<14	incisional hernia	mesh repair	1	1	2	no	40ml;5ml(serosang)	8	no	no	no	no	no	POD5-as noted and POD30-WNL	1(diabetes)
valaimathi	3	2	4	2	II	<14	<14	GSD	open chole	1	1	2	no	8ml;4ml;nil	4	no	no	no	no	no	POD5-as noted and POD30-WNL	
deva	3	2	5	1	II	>14	<14	benign GOO	TV+GJ	1	1	2	no	8ml;<2ml;nil	5	no	no	no	no	no	POD5-as noted and POD30-WNL	
shobana	3	1	1	2	I	<14	>14	rt breast cyst	WLE	1	1	1	no	12ml;5ml;nil	6	no	no	no	no	no	POD5-as noted and POD30-WNL	
manormani	3	1	4	2	II	<14	<14	Lt breast ca	WLE	1	1	1	no	10ml;2ml;nil	6	no	no	no	no	no	POD5-as noted and POD30-WNL	1(malignancy)
rathnammal	3	1	4	2	I	<14	<14	breast cyst	WLE	1	1	1	no	20ml;8ml;nil	6	no	no	no	no	no	POD5-as noted and POD30-WNL	
dhanalakshmi	3	2	3	2	II	<14	>14	incisional hernia	anatomical & mesh repair	1	1	2	no	20ml;15ml;failed	4	pur exudate+erythema(60%)	4	strpt-imipenem	1&3(mesh removal &suturing)	47	POD5-as noted and POD30-WNL	1(HTN)
mumtaz	3	2	4	2	I	<14	>14	incisional hernia	anatomical & mesh repair	1	1	2	no	25ml;15ml;failed	3	pur exudate+erythema(60%)	4	pseudo-amik	1&3(mesh removal &suturing)	47	POD5-as noted and POD30-WNL	
chellammal	3	2	6	2	II	<14	>14	incisional hernia	anatomical & mesh repair	1	1	2	no	20ml;15ml;failed	5	pus+erythema(100%)	4	pseudo-amik	1&3(mesh removal &suturing)	50	POD5-as noted and POD30-WNL	1(old age)
shakira banu	3	2	4	2	II	<14	>14	inc hernia+GB stones	chole+mesh repair	1	1	2	no	20ml;5ml;nil	6	pus+erythema(40%)	5	e.coli-cefotax	1&3	44	POD5-as noted and POD30-WNL	1(DM)
sulochana	3	1	4	2	II	>14	<14	irreducible umbilical hernia	anatomical repair	1	2	1	no	15ml;30ml;20ml	7	induration& purulentd/s (20%)	5	proteus - Amikacin	3	21	POD5-as noted and POD30-WNL	

selvi	3	1	2	2	I	<14	<14	incisional hernia	anatomical repair	1	2	1	no	50ml;15ml;minimal(serosang)	6	no	no	no	no	no	no	POD5-as noted and POD30-WNL	
vikram	3	2	1	1	I	<14	<14	acute appendictis	appendicectomy	1	2	2	no	5ml;1ml;nil	3	no	no	no	no	no	no	POD5-as noted and POD30-WNL	
karthikeyan	3	2	1	1	I	<14	<14	acute appendictis	appendicectomy	1	2	2	no	5ml;3ml;nil(serosang)	5	no	no	no	no	no	no	POD5-as noted and POD30-WNL	
saheeb	3	2	1	1	I	<14	<14	acute appendictis	appendicectomy	1	2	2	no	7ml;2ml;minimal	6	no	no	no	no	no	no	POD5-as noted and POD30-WNL	
arulkumar	3	2	1	1	II	<14	<14	acute appendictis	appendicectomy	1	2	2	no	5ml;3ml;nil(serosang)	3	no	no	no	no	no	no	POD5-as noted and POD30-WNL	
prabhu	3	2	1	1	II	<14	<14	acute appendictis	appendicectomy	1	2	2	no	9ml;2ml;nil	5	no	no	no	no	no	no	POD5-as noted and POD30-WNL	
rajeshwari	3	2	1	2	I	<14	<14	acute appendictis	appendicectomy	1	2	2	no	4ml; 3ml	2	no	no	no	no	no	no	POD5-as noted and POD30-WNL	
gopika	3	2	1	2	I	<14	<14	acute appendictis	appendicectomy	1	2	2	no	4ml;3ml;nil(serosang)	3	no	no	no	no	no	no	POD5-as noted and POD30-WNL	
saranya	3	2	1	2	I	<14	<14	acute appendictis	appendicectomy	1	2	2	no	10ml;8;7;5;3;nil(serosang)	7	no	no	no	no	no	no	POD5-as noted and POD30-WNL	
Jamuna	3	2	1	2	II	<14	<14	acute appendictis	appendicectomy	1	2	2	no	5ml;1.5ml	3	no	no	no	no	no	no	POD5-as noted and POD30-WNL	
geetha	3	2	1	2	I	<14	<14	acute appendictis	appendicectomy	1	2	2	no	5ml;2ml;nil	4	no	no	no	no	no	no	POD5-as noted and POD30-WNL	
nandhini	3	2	1	2	I	<14	<14	acute appendictis	appendicectomy	1	2	2	no	6ml;3ml;nil	4	no	no	no	no	no	no	POD5-as noted and POD30-WNL	
sapna	3	2	1	2	II	<14	<14	acute appendictis	appendicectomy	1	2	2	no	3ml;nil	2	no	no	no	no	no	no	POD5-as noted and POD30-WNL	
Siva	3	2	2	1	I	<14	<14	acute appendictis	appendicectomy	1	2	2	no	6ml;3ml;<2ml	4	no	no	no	no	no	no	POD5-as noted and POD30-WNL	
sonia	3	2	2	2	II	<14	<14	acute appendictis	appendicectomy	1	2	2	no	8ml;5ml;nil(serosang)	4	no	no	no	no	no	no	POD5-as noted and POD30-WNL	
lakshmipriya	3	2	2	2	II	<14	<14	acute appendictis	appendicectomy	1	2	2	no	8ml;5ml;nil(serosang)	3	no	no	no	no	no	no	POD5-as noted and POD30-WNL	
Subramani	3	2	3	1	I	<14	<14	acute appendictis	appendicectomy	1	2	2	no	30ml;3ml	5	no	no	no	no	no	no	POD5-as noted and POD30-WNL	
shanthi	3	2	3	2	I	<14	<14	acute appendictis	appendicectomy	1	2	2	no	10ml;4ml;nil	4	no	no	no	no	no	no	POD5-as noted and POD30-WNL	
devi	3	2	2	2	II	<14	<14	rt twisted ovarian cyst	rt. Oopherectomy	1	2	2	no	10ml;2ml;nil	5	ser exudate+erythema(30%)	5	proteus-norflox	1&3	29	POD5-as noted and POD30-WNL	
jayammal	3	2	2	2	II	<14	<14	acute appendictis	appendicectomy	1	2	2	no	8ml;3ml;nil	4	ser exudate+erythema(35%)	3	prot-netil	1&3	29	POD5-as noted and POD30-WNL	