A COMPARATIVE STUDY OF SUBCUTANEOUS SUCTION DRAINAGE TUBE WITH CONVENTIONAL PRIMARY SKIN CLOSURE FOLLOWING ABDOMINAL SURGERIES, IN CASE OF PERITONITIS

A Dissertation submitted to

THE TAMILNADU DR.MGR MEDICAL UNIVERSITY

In partial fulfilment of the regulations for the award of the

Degree of M.S (GENERAL SURGERY)

BRANCH-1

DEPARTMENT OF GENERAL SURGERY

STANLEY MEDICAL COLLEGE AND HOSPITAL

TAMILNADU DR.MGR MEDICAL UNIVERSITY, CHENNAI

APRIL 2017

DECLARATION

I **Dr.M.ASHOK KUMAR** solemnly declare that this dissertation titled **"A COMPARATIVE STUDY OF SUBCUTANEOUS SUCTION DRAINAGE TUBE WITH CONVENTIONAL PRIMARY SKIN CLOSURE FOLLOWING ABDOMINAL SURGERIES, IN CASE OF PERITONITIS"** is a bonafide work done by me in the department of general surgery, Govt. Stanley Medical College and Hospital, Chennai under the supervision of **Prof. Dr. J.LALITH KUMAR** and my Head of the Department **Prof.Dr.D.NAGARAJAN.** This dissertation is submitted to the Tamilnadu Dr MGR Medical university, Chennai in partial fulfilment of the university regulations for the award of M.S.degree (General Surgery), branch – 1 examination to be held in APRIL 2017

September 2016 **Dr. M. ASHOK KUMAR**

Chennai

CERTIFICATE

This is to certify that the dissertation entitled **"A COMPARATIVE STUDY OF SUBCUTANEOUS SUCTION DRAINAGE TUBE WITH CONVENTIONAL PRIMARY SKIN CLOSURE FOLLOWING ABDOMINAL SURGERIES, IN CASE OF PERITONITIS"** is a bona fide work done by Dr.M.ASHOK KUMAR post graduate(2014-2017) in the department of general surgery, Govt. Stanley Medical College and Hospital, Chennai under my direct guidance and supervision, in partial fulfilment of the regulations of the TAMILNADU Dr. MGR MEDICAL UNIVERSITY Chennai for the award of M.S degree(General surgery) Branch-1 examination to be held in APRIL 2017

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ETHICS COMMITTEE APPROVAL

INSTITUTIONAL ETHICAL COMMITTEE, STANLEY MEDICAL COLLEGE, CHENNAI-1

Title of the Work	:	Comparative study of Subcutaneous Suction Drainage Tube with Conventional Primary Skin Closure Following Abdominal Surgeries in case of Peritonitis.
Principal Investigator	:	Dr. M. Ashok kumar
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The request for an approval from the Institutional Ethical Committee (IEC) was considered on the IEC meeting held on 24.03.2016 at the Council Hall, Stanley Medical College, Chennai-1 at 2PM

The members of the Committee, the secretary and the Chairman are pleased to approve the proposed work mentioned above, submitted by the principal investigator.

The Principal investigator and their team are directed to adhere to the guidelines given below:

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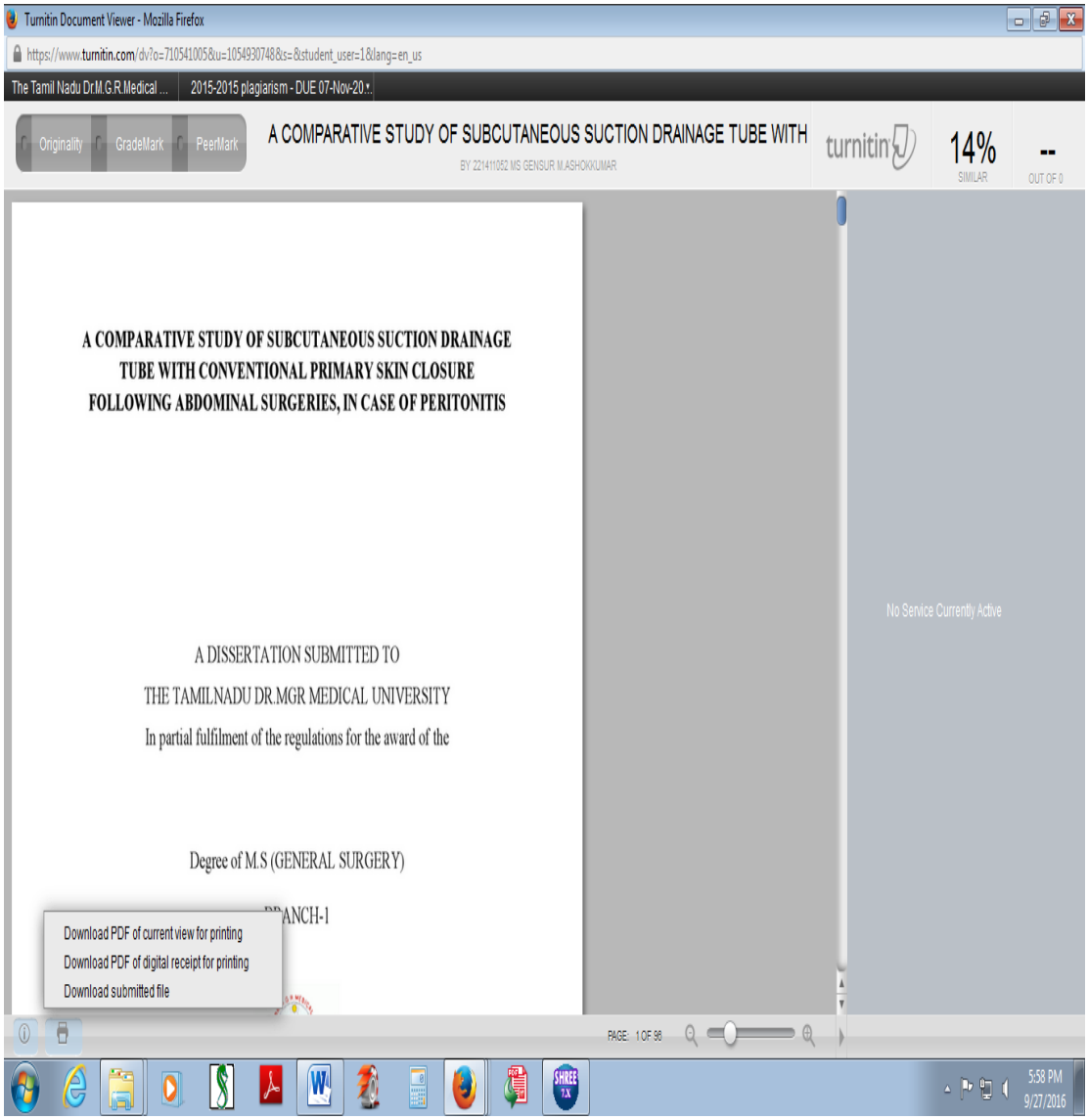
TURNITIN PLAGIARISM CHECK



CONTENTS

INTRODUCTION

Surgical Site Infection and delayed wound failure are reported more commonly in abdominal surgeries performed in cases of peritonitis than in other gastrointestinal surgeries. Post operative Surgical Site Infection (SSI) is a significant cause of morbidity in terms of prolonged hospital stay and increased expenses. Though pre-operative antibiotic prophylaxis and per operative thorough peritoneal lavage play a major role in preventing SSI, an effective method of closure of wound is also important. Burst abdomen following wound dehiscence in SSI is a major concern for surgeons as it can cause compromise of respiratory functions if reclosure is done, whereas, nosocomial infection can occur if the wound is left open. Subcutaneous negative suction drainage has been shown to reduce the incidence of SSI and wound dehiscence by causing drainage of the infective material and promoting wound healing. This study was done to compare the effectiveness of sub-cutaneous negative suction drainage tube and conventional abdominal wall closure in cases of peritonitis with regard to SSI, wound dehiscence, wound secondary suturing and duration of hospital stay.

PHYSIOLOGY OF WOUND HEALING

The understanding of wound healing mechanisms is important for the management of surgical site infections. The four phases of wound healing include

1. Hemostasis
2. Inflammation
3. Proliferation
4. Remodelling

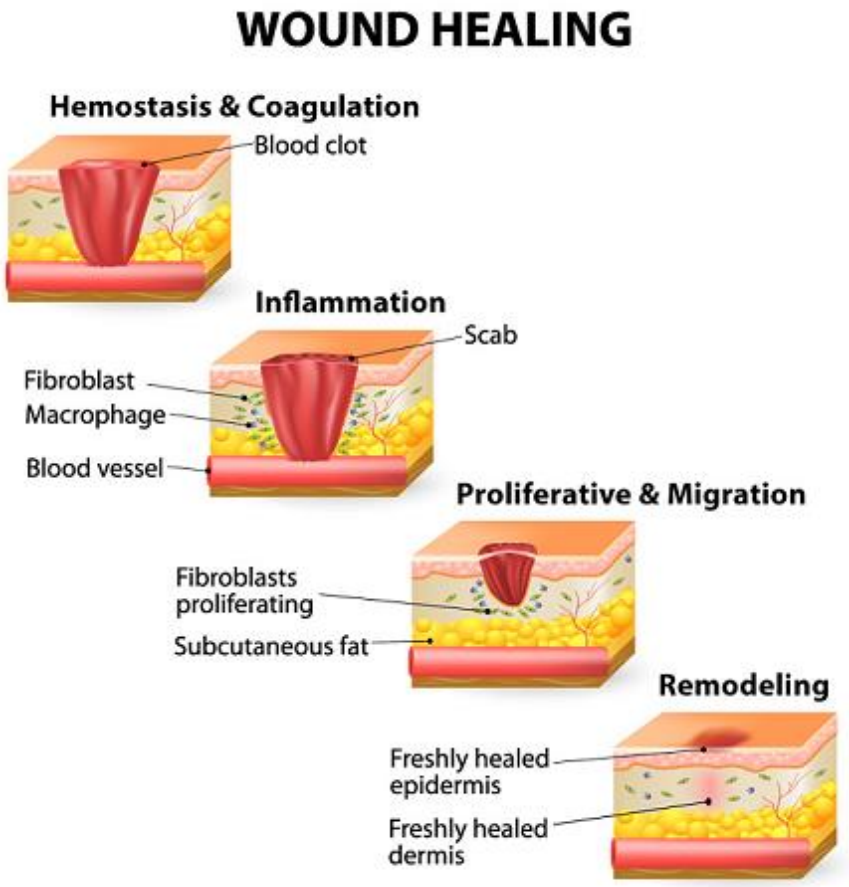


Fig 1: Normal wound healing process

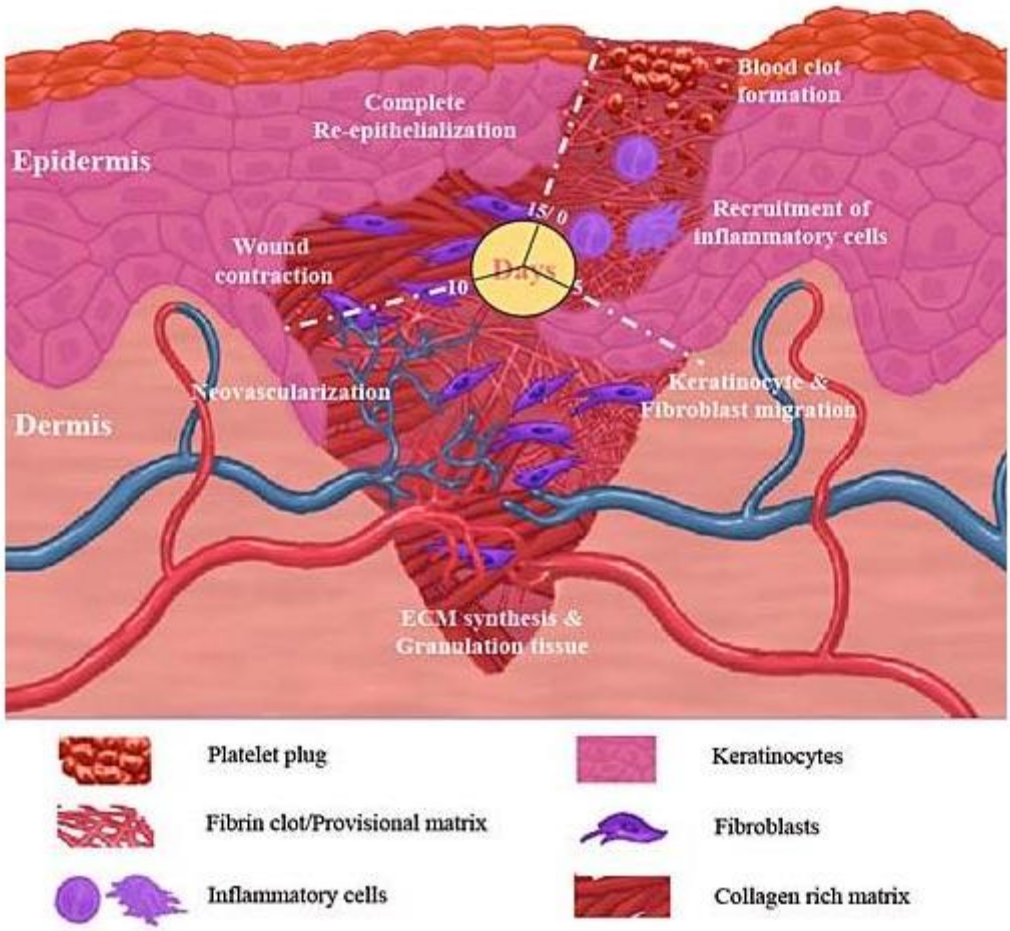


Fig 2: Role of various cells in wound healing.

SURGICAL SITE INFECTION

Surgical Site Infections (SSIs) refer to infections occurring in the wound created during an invasive surgical procedure. Surgical Site Infection weakens the abdominal wall and leads to wound dehiscence and at times, even an incisional hernia.

At least 5% of patients undergoing a surgical procedure develop a Surgical Site Infection. Surgical Site Infections constitute 40% of hospital acquired infections in the United States.

Table 1: CDC DEFINITION OF SSI

S.NO	CATEGORY	CRITERIA
1	Superficial Incisional SSI	Infection involving only skin or sub-cutaneous tissue of the incision AND atleast any ONE of the following: a.Purulent drainage with or without laboratory confirmation from the superficial incision b.Organisms isolated from an aseptically obtained culture of fluid or tissue from the superficial incision c.Atleast one of the following signs or symptoms of infection- pain or tenderness, localized swelling, redness, or heat.
2	Deep incisional SSI	Infection within 30 or 90 days after the procedure AND

		Involves deep soft tissues of the incision (e.g., fascial and muscle layers) AND at least one of the following: a. purulent drainage from the deep incision. b. a deep incision that spontaneously dehisces, or is deliberately opened or by a surgeon and organism is identified by a culture or non-culture based microbiologic testing AND patient has at least one of the following signs or symptoms: fever (>38°C); localized pain or tenderness. c. an abscess involving the deep incision that is detected on gross anatomical or histopathologic exam, or imaging
3	Organ/Space SSI	Infection within 30 or 90 days after the operative procedure AND Infection involves any part of the body deeper than the fascial/muscle layers AND at least one of the following: a. purulent drainage from a drain that is placed into the organ/space b. organisms are identified from an aseptically-obtained fluid or tissue in the organ/space by a culture or non-culture based microbiologic testing method c. an abscess involving the organ/space that is detected on gross anatomical or histopathologic exam, or imaging AND Meets at least one criterion for a specific organ/space infection site.

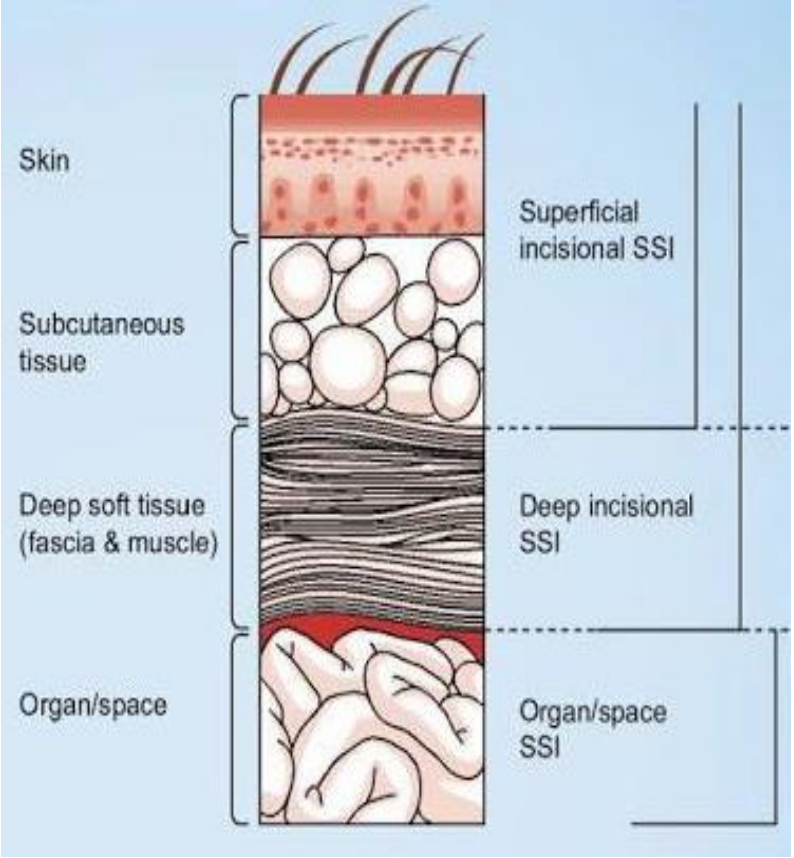


Fig 3: CDC definition of SSI

Surgical site infections in abdominal surgeries usually occur within 5 to 6 days of post-operative period. It can be caused by microorganisms from the abdominal cavity or from hospital acquired cross infection. Of these, infection due to contamination of the surgical wound with microorganisms from the patient's abdominal cavity is common than due to microorganisms from a source in the hospital after surgery.

On looking at the microbiology, Gram-positive cocci – (Staphylococcus aureus) constitute the major cause of the surgical site

infections. But Gram-negative bacilli (Escherichia coli) are the most common organisms to be isolated in gastro intestinal surgeries.

Most of the surgical site infections can be prevented by adopting various measures as listed below:

A. Pre-operative

1.Control of blood sugar level in diabetics

2.Weight reduction in morbid obesity

3.Supplements for malnourishment

4.Antibiotic prophylaxis

B. Intra-operative

1.Standard sterilization techniques with strict asepsis

2.Surgical steps like complete debridement of devitalized tissue, drainage of pus pockets with warm saline peritoneal lavage and wound wash.

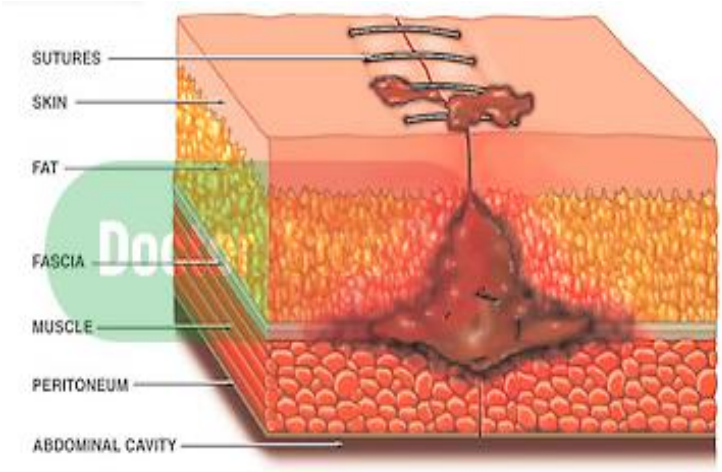
C. Post-operative

1. Improved care in the form of meticulous monitoring of surgical site for erythema, induration and discharge.

Despite this, surgical site infections still are a major concern for surgeons in terms of patient recovery.

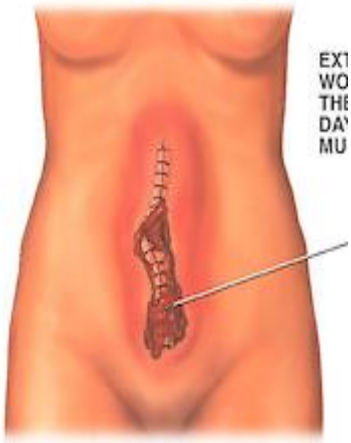
WOUND DEHISCENCE

Acute Wound Failure (wound dehiscence or burst abdomen) is defined as postoperative separation of musculo aponeurotic layers of the abdominal wall. It is of major concern as it can lead on to evisceration, the most dreaded postoperative complication that a surgeon could face.



The wound is not opened. The septic process is confined to the sub cutaneous space, making the fascia vulnerable to infection and dehiscence

Fig 4: Wound infection



External evidence of wound sepsis – Drainage from the wound

↓

Wound dehiscence

Fig 5: Wound infection progressing to wound dehiscence

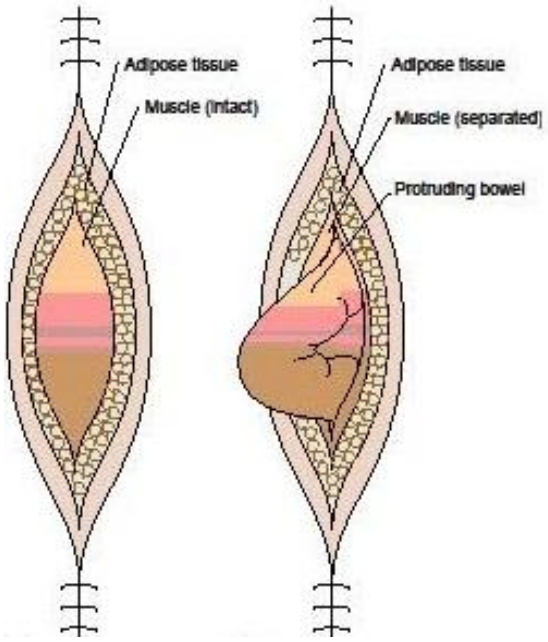


Fig 6: Wound dehiscence progressing to evisceration

It occurs in 1% - 3 % of all abdominal surgeries. The presentation is usually within 7 – 10 days of postoperative period, but can occur anytime from 1 – 20 days postoperatively. It can be identified when sudden drainage of large amount of salmon coloured fluid is noticed.

Among the various factors that can predispose to wound dehiscence, the important ones are listed below.

1. Wound infection
2. Intra-abdominal infection
3. Emergency surgeries
4. Improper abdominal wall closure
5. Obesity

6. Advanced age
7. Poor nutritional status
8. Diabetes mellitus
9. Immunosuppression

PREVENTION

1. To prevent wound dehiscence primary closure of the abdominal wall should be performed without undue tension.
2. When the intra abdominal pressure is high, interrupted closure of the abdominal wall is advised to avoid tension.

TREATMENT

Management of wound dehiscence depends on the extent of involvement.

1. A small dehiscence involving one suture can be managed conservatively with sterile dressings.
2. Dehiscence involving more than one suture is managed with removal of the involved sutures and application of sterile dressings until the wound heals and is then followed by resuturing.

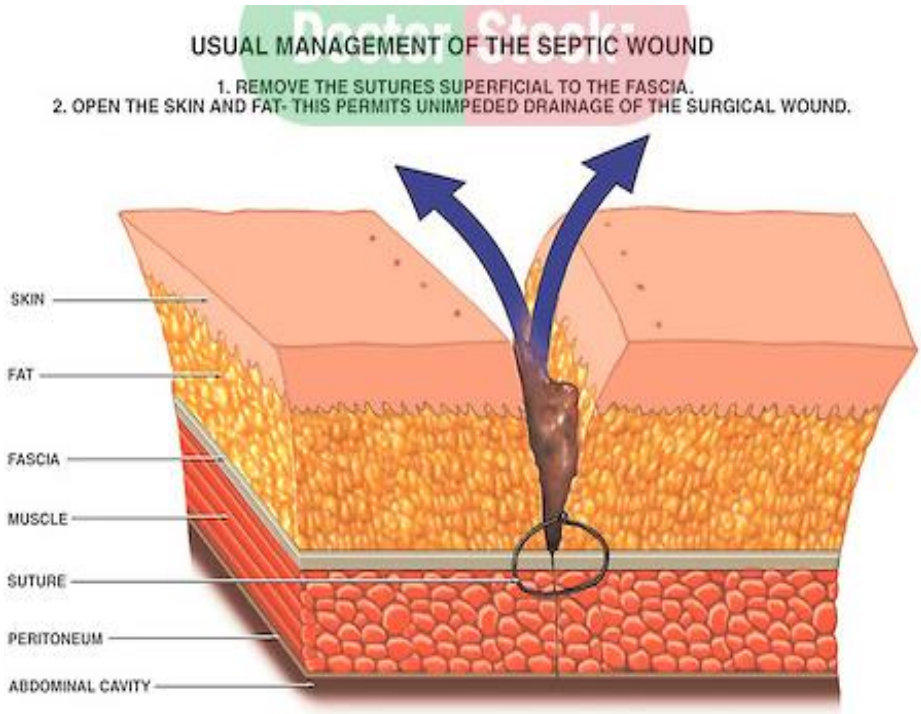


Fig 7: Removal of sutures in the area of dehiscence to allow wound healing

3. In the event of burst abdomen, exploration of the abdominal cavity is done in the operating room to identify the source of sepsis or leak, which is then managed accordingly followed by a single layer closure.

CDC DEFINITION OF SURGICAL WOUNDS

Classification of surgical wounds is important in every surgery as it helps to predict the chances of surgical site infection and take appropriate measures to prevent it. The CDC classification of surgical wound is universally accepted.

Table 2: CDC category of surgical wounds

CATEGORY	CRITERIA	INFECTION RATE
Clean	No hollow viscus entered Primary wound closure No inflammation No breaks in aseptic technique Elective procedure	1-3%
Clean contaminated	Hollow viscus entered but controlled No inflammation Primary wound closure Minor breaks in aseptic technique Mechanical drain Bowel preparation preoperatively	5-8%

CATEGORY	CRITERIA	INFECTION RATE
Contaminated	Uncontrolled spillage from viscus Inflammation apparent Open, traumatic wound Major break in aseptic technique	20-25%
Dirty	Untreated, uncontrolled spillage from viscus Pus in operative wound Open suppurative wound Severe inflammation	30-40%

SSI IN CASES OF PERITONITIS

The incidence of Surgical Site Infection increases with corresponding increase in contamination of wounds. Surgical wounds in peritonitis are classified as Contaminated (Category 3) or Dirty (Category 4) wounds based on CDC definitions.

Surgical Site Infections are hence reported more commonly after surgeries in cases of peritonitis / peritoneal abscess (5-15%) than in elective surgeries in cases with non-infectious etiology (<5%).

The edematous gut causes extravasation of fluid into the abdominal cavity, which if not evacuated adequately during surgery can track into the subcutaneous space of the surgical wound in cases with sepsis or peritonitis. This triggers colonization of microorganisms in the wound site which affect wound healing by the following ways:

1. Tissue hypoxia (due to utilization of oxygen by the microorganisms)
2. Deprivation of nutrients
3. Proteolysis caused by enzymes released by the microorganisms
4. Inhibits granulation tissue formation and cellular proliferation

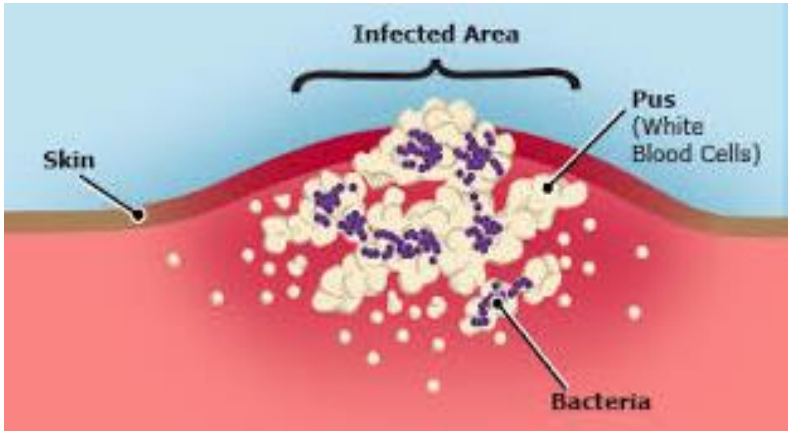


Fig 8: Colonization of microorganisms in SSI

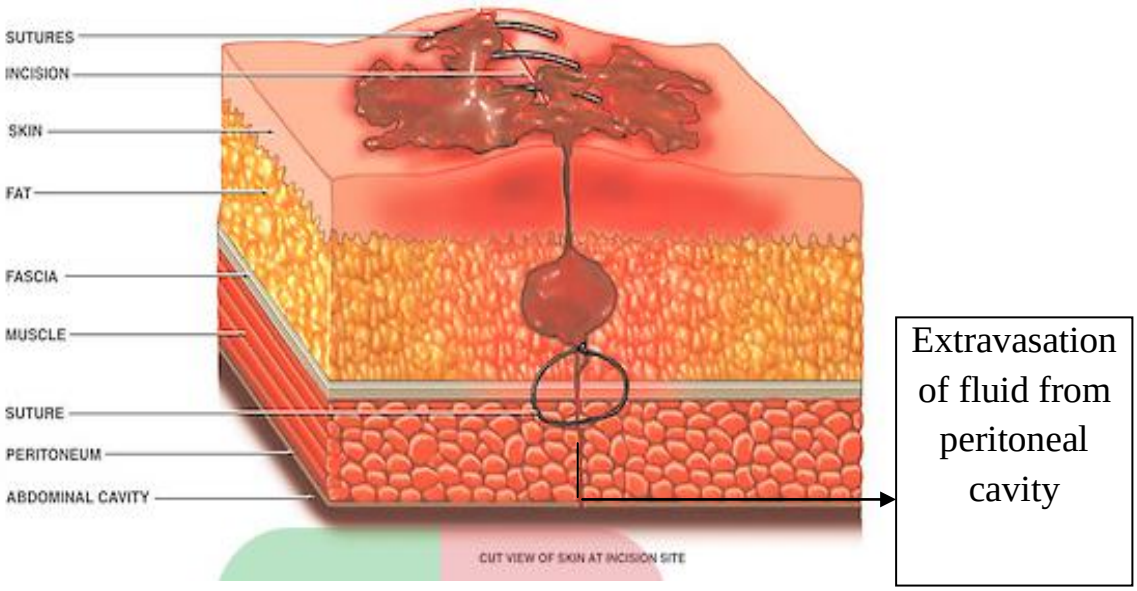


Fig 9: Mechanism of SSI in peritonitis

NEGATIVE PRESSURE WOUND THERAPY

The local environment of a wound and the role it plays in the process of wound healing has been studied widely in the recent past. A wide range of wound care devices are being used now and a lot of research activities are going on in developing such devices.

Negative pressure in the wound makes the local microenvironment of the wound conducive for healing by causing fluid removal from the wound. It achieves hemostasis, modulates inflammation by removing infiltrating lymphocytes, promotes cellular proliferation and enhances remodelling by promoting granulation tissue formation. The uniform negative pressure that the recent devices like Vacuum Assisted Closure create, stabilize the microenvironment of wound by causing microdeformation and macrodeformation. This is called ‘Negative Pressure Wound Therapy’.

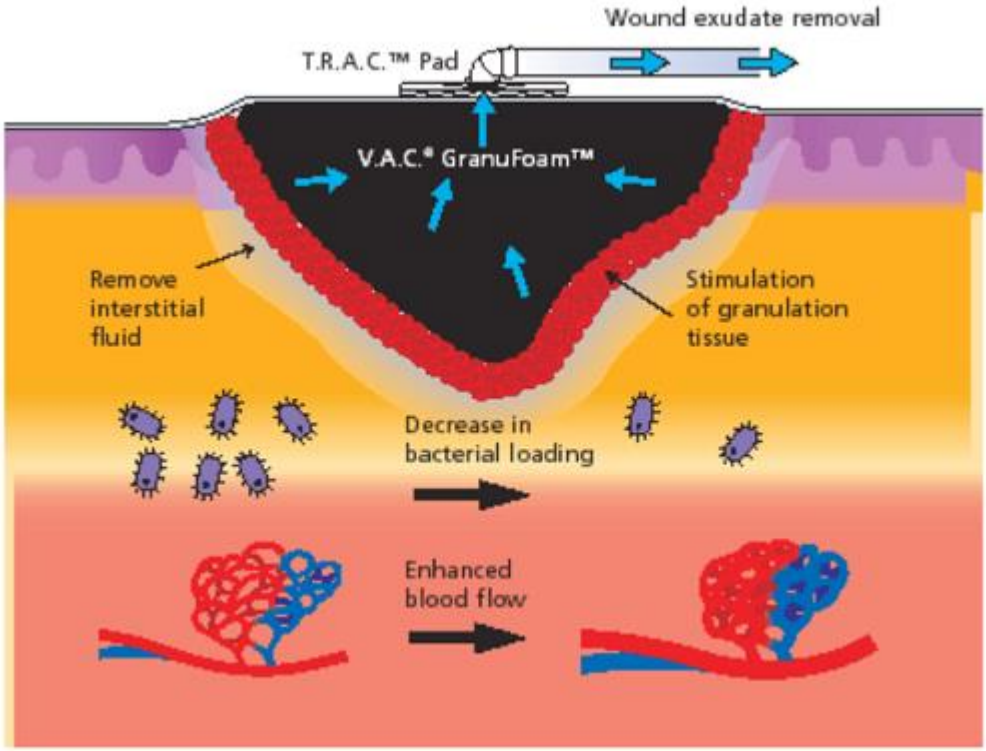


Fig 10: NPWT in VAC Drain

Though this concept of NPWT has been studied recently, it can be considered as an upgradation or advancement of the concept of ‘suction’, which was used way back in the third century by Hippocrates in medicine to manage empyema.

DRAINS

When the interstitial tissue in a wound undergoes disruption an abnormal space is created, which results in accumulation of blood or serum. This is called ‘dead space’. It becomes a potential culture medium for microorganisms causing wound infection.

A drain helps to eliminate the dead space by evacuating all the contents like blood, serous fluids or gas.

PRINCIPLE

A drain works on the principle of eliminating “dead space” in a wound. It helps to overcome various barriers to wound healing as listed below.

Table 3: Role of a drain in wound healing

BARRIERS TO WOUND HEALING	ROLE OF A DRAIN
Excess interstitial fluid	Evacuates fluid
Excess exudates	Removes exudates
Inadequate perfusion	Improves perfusion by relieving edema
Lack of granulation tissue	Promotes granulation tissue formation by reducing the dead space
Excess bacterial burden	Reduces the infection load

Fig 11: Dead space in a wound

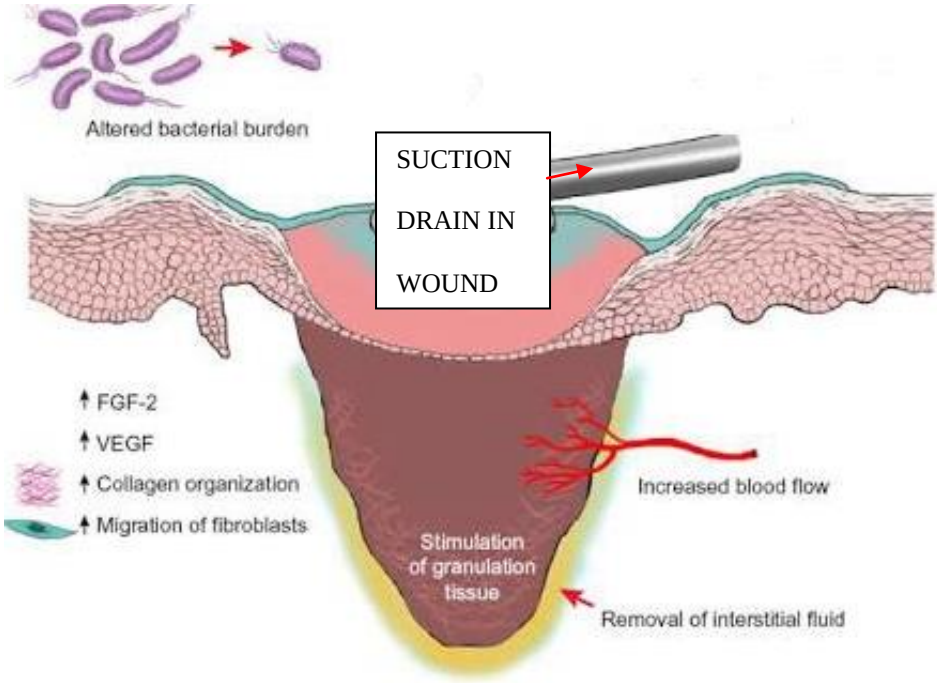


Fig 12. Function of a suction drain

TYPES OF DRAIN

Drains are of different types as follows:

A. 1.Flat drain

   2.Tube drain

B. 1.Passive drain – open type, closed type

   2.Active drain – continuous suction / intermittent suction

A.1.Flat drain:

The drainage is based on gravity and capillary action and is related to the surface area. Eg: Penrose drain

Table 4: Merits and demerits of flat drain

MERITS	DEMERITS
Soft & less painful	Gravity dependent
	Cannot be connected to suction
	Risk of infection as it allows bacterial ascent

A.2.Tube drain

The drainage occurs through a lumen of a tube with or without side holes. Single lumen and double lumen types are available.

Table 5: Merits and demerits of tube drain

MERITS	DEMERITS
Can be connected to suction	Risk of infection as environmental air is drawn inside in double lumen type
Can be used with closed collection system	Discomfort due to stiffness
Maintains patency for a longer time	

B.1.Passive drain

Drainage is based on differential pressure, gravity and overflow in a path of least resistance. They work based on the high pressure in the wound. Closed passive drain is preferred to open type.

Eg: Robinson tube drain

Table 6: Merits and demerits of passive drain

MERITS	DEMERITS
Prevents bacterial ingress	Gravity dependency influences location of drain
Enables evaluation of amount and nature of fluid collected	Easy clogging of the drain

B.2.Active drain

Drainage is vacuum dependent, based on negative pressure – suction effect. It can be intermittent or continuous. They evacuate fluid from the wound based on the negative pressure created by the vacuum device and the compression of the wound by the atmospheric pressure.

Eg: Redivac drains , Minivac darins, Jackson Pratt drains

Table 7: Merits and demerits of active drain

MERITS	DEMERITS
Effective fluid removal	Injury to tissues if high negative pressure is created
Gravity independent- can be placed anywhere	Clogging of drain
Enables evaluation of amount and nature of fluid collected	
Prevents bacterial ingress	

ACTIVE CLOSED SUCTION DRAINAGE

Active closed suction drainage is an effective method that evacuates air, blood and other fluids that are pooled in the dead space of a wound. The mechanism of closed suction drainage systems can be understood by the following principles as explained by Miller:

1. Haemostasis
2. External drainage
3. Negative pressure
4. Airtight wound

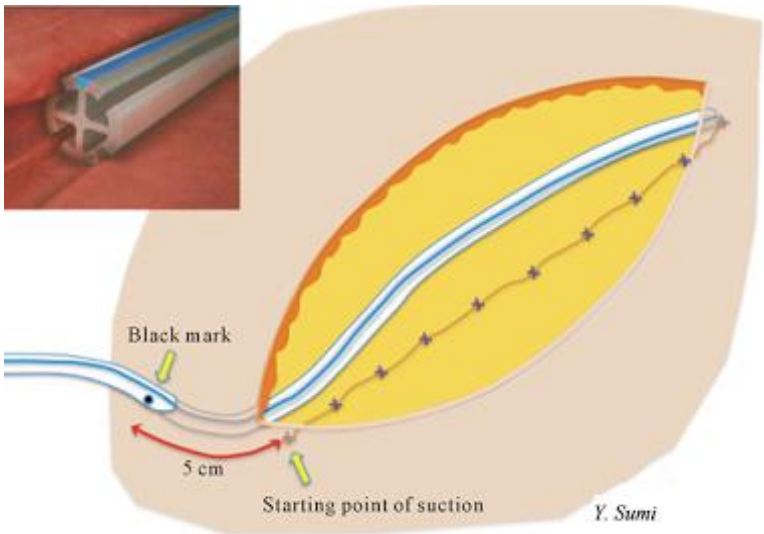


Fig 13: Example of an active closed suction drain and its placement.

REDON DRAIN

It is a type of active closed drain – tube type. It was developed by a French surgeon named Dr. Henry Kiefer Redon.

The parts of a Redon drain are

1. A container
2. A connecting tube and connector
3. A perforated radio opaque drain
4. A Needle

There are three types of Redon drains available for postoperative wound drainage. These include

1. High vacuum drainage
2. Low vacuum drainage
3. Gravity drainage

The type of Redon drain used in this study is the Redon mini set (Low vacuum drainage) which contains a manually compressible bellow container available in different capacities. The drain has cross perforations and measures 30 cms in length. The initial low vacuum is approximately 10,000 Pa.

Fig 14: A Redon drain – mini set

The advantages of this type of Mini-VAC Drainage System are:

1. Pressure is not so high and so tissue injury is avoided as drainage is not excessive

2. The drainage tube obstruction is prevented by the presence of slits in the Silicon drain, so suction can happen in other slits even if one slit is obstructed.

3. No special type of foam dressing is required as in VAC drains.

DRAIN PLACEMENT

Drains should be placed in an aseptic manner with the following points held in mind.

1. Drains should be placed in the space that requires the maximum drainage.
2. Drains should not be placed in close proximity to major blood vessels and nerves.
3. Drains should exit through a separate incision away from the primary suture line.
4. Drains have to be secured at the exit point with individual sutures.
5. Exit of the drains have to be protected from the environment by a bandage to cover them.

DRAIN MANAGEMENT

The volume and features of fluid in the container of the drain can be evaluated every day. The exit site of the drain should be cleaned every time the bandage is changed. Back- flushing of drains should be avoided to prevent retrograde infection.

Generally, drains should be removed as early as possible, i.e. on an average 2-4 days. The drain can be left longer under certain conditions as mentioned below:

1. When treating known infections
2. When blood or fluid is evacuated from a cavity
3. When dead space in a wound has to be cleared off.

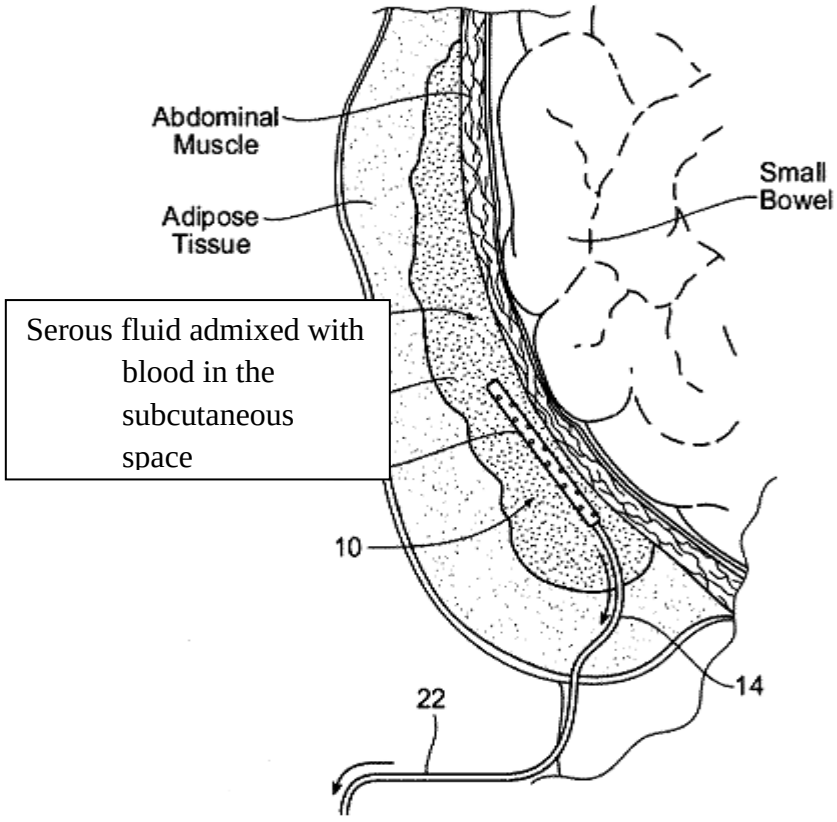


Fig 15: Subcutaneous suction drain in a wound with dead space

Removing the drain too early can also cause seroma in the wound. The drain can be safely removed when the volume of the collection in the container of the drain reduces significantly and the discharge turns into serous type of fluid. The sutures at the exit of the drain are cut and the drain can be removed under aseptic conditions. The exit wound can be covered with a dressing to absorb the fluid and is allowed to heal by secondary intention.

COMPLICATIONS OF DRAINS

1. Foreign body reaction and nosocomial infection can occur, which can be serious if the organism isolated is MRSA.
2. Improper placement of the drain can cause injury to the vasculature or the nerves.
3. Incisional hernia can occur if the drain placement and exit are both in the primary incision or if the exit wound is large
4. Suture dehiscence can occur if the drain is not placed properly.
5. Premature removal of the drain can cause seroma of the wound.
6. Pain and discomfort can occur in rigid drains

ABSTRACT

AIM

To compare and find out the effective method of abdominal wall closure in cases of peritonitis between subcutaneous suction drainage tube and conventional primary skin closure.

STUDY DESIGN

Prospective study

MATERIALS AND METHODS

60 patients who presented at the emergency department with acute abdominal pain and operated for the same, with features s/o peritonitis were enrolled into the study. 30 of them were managed with subcutaneous negative suction drainage tube during abdominal wall closure (Group A). 30 other patients underwent conventional method of abdominal wall closure (Group B). On table pus c/s was sent for all 60 cases. The surgical wound was observed for signs of infection. Any sero-purulent collection from the drain or any discharge from the wound was sent for c/s and the results of which were compared with the results of on table pus c/s. If wound dehiscence was noted, secondary suturing was

done after the wound healed. The duration of suction drain placement and stay in the hospital were noted in all cases.

STATISTICAL ANALYSIS

The results were analyzed with Chi-square test and Student t test (unpaired) and p values were calculated. A p value of less than 0.05 was considered significant.

RESULTS

The incidence of SSI was significantly less in Group A (23%) than in Group B (60%). Similarly, wound dehiscence occurred in 43% of SSI cases in Group A as against 89% of SSI cases in Group B, the difference of which was statistically significant. The mean duration of hospital stay was significantly less when subcutaneous suction drain was placed (9 days).

CONCLUSION

Subcutaneous suction drainage tube is an effective method of abdominal wall closure in cases of peritonitis when compared to conventional primary skin closure as it significantly reduces the incidence of SSI, wound dehiscence, wound secondary suturing and duration of hospital stay.

STUDY JUSTIFICATION

Abdominal wall closure in cases of peritonitis is a challenge to the surgeon because of increased risk of surgical site infection and wound dehiscence. This is reported in our centre also. Various techniques are being adopted in such cases. Open skin technique though not followed commonly in the recent trend, is controversial. Conventional primary abdominal wall closure can lead to wound dehiscence and even burst abdomen if the intra abdominal pressure is high. Other techniques like subcutaneous negative suction drainage tube, vacuum assisted closure systems have been studied to be effective in reducing the rate of surgical site infections in cases of sepsis/peritonitis. But there are some controversial studies which show that subcutaneous drains can lead to retrograde infection. These studies were made in clean wounds. In the case of contaminated or dirty wounds, subcutaneous suction drains have been effective in controlling the infection. This study was done to compare the effectiveness of subcutaneous suction drainage tube and conventional primary skin closure in cases of peritonitis in our centre.

AIMS AND OBJECTIVES

AIM

To compare and find out the effective method of abdominal wall closure in cases of peritonitis between subcutaneous suction drainage tube and conventional primary skin closure

OBJECTIVES

- PRIMARY OBJECTIVE: To compare post operative wound healing between subcutaneous suction drainage tube and conventional primary skin closure in abdominal wall closure in cases of peritonitis

- SECONDARY OBJECTIVE: To assess if the surgical site infection is due to abdominal cavity infection or hospital acquired cross infection

MATERIALS AND METHODS

STUDY POPULATION

The study was conducted among all eligible patients taken up for emergency surgery at Govt. Stanley Medical College and Hospital who satisfied the inclusion criteria.

STUDY DESIGN

Prospective study.

SAMPLE SIZE

60 cases

1. In 30 cases, subcutaneous suction drain was used in abdominal wall closure – Group A

2. In 30 cases, conventional primary skin closure was done - Group B

INCLUSION CRITERIA

- All adult patients who have undergone emergency abdominal surgery for peritonitis in the department of General Surgery in Stanley medical college and hospital, Chennai -01.

  * It includes midline laparotomy surgeries[ex-duodenal perforation etc]

  * Right subcostal incision [ex-perforated empyema of GB]

  * Grid iron and below umbilicus midline mini laparotomy incision for appendicular abscess.

EXCLUSION CRITERIA:

- Patients with immunogenic disease or on immunosuppressive therapy

- Patients who need laparostomy

- Pediatric patients

- Patients with less than one month post-operative follow-up

METHODOLOGY

Patients presenting at the emergency department who meet the inclusion criteria were recruited into the study. After obtaining a detailed history, all patients presenting with acute abdominal pain were isolated in the emergency ward.

DIAGNOSTIC CRITERIA FOR PERITONITIS

Clinically:

- Acute pain abdomen, nausea, vomiting
- Fever , Tachycardia
- Guarding, rigidity
- Absent or decreased bowel sounds

On investigations:

- Leucocytosis
- X Ray- Abdomen erect-Free air under diaphgram, distended bowel loops.
- USG Abdomen-Free fluid in peritoneal cavity

Laparotomy findings:

- Whether pus fluid is present or abdominal cavity is contaminated with bowel contents.

Patients who met the above mentioned diagnostic criteria for peritonitis were included in the study.

Consent for participation in the study was obtained from the patients after pre-consent counselling. The consent for participation in the study was obtained simultaneously with the consent for surgery.

30 cases underwent abdominal wall closure with subcutaneous suction drain and were assigned to Group A. 30 other cases underwent conventional primary skin closure and were assigned to Group B.

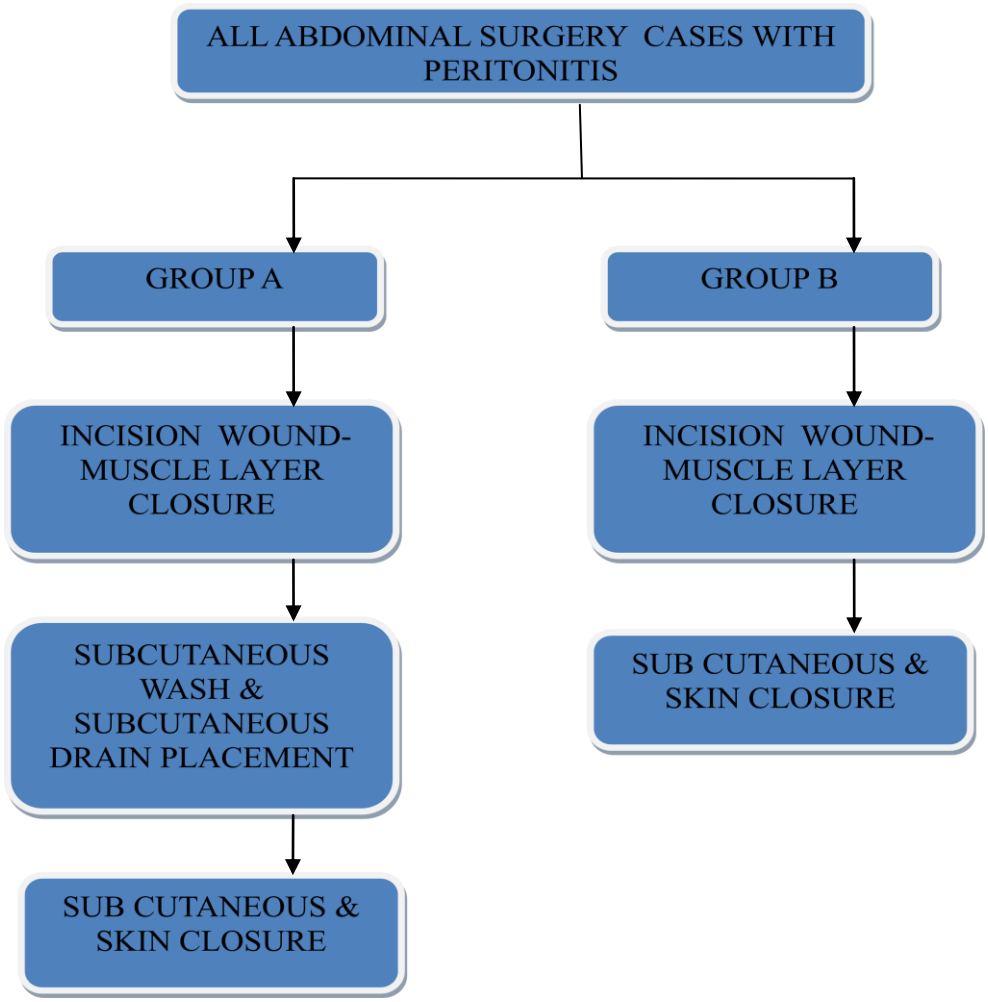


Fig 16: Methodology

TYPE OF DRAINAGE TUBE- CLOSED WOUND SUCTION SYSTEM.

Here REDON DRAIN [perforated catheter tube] was placed subcutaneously, and brought out away from the incision site with the help of curved needle and connected to a connecting tube. The connecting tube was connected to a bellow container which had the negative suction pressure capacity.

FOLLOW UP

DOS – On table pus c/s was sent. Empirical antibiotic therapy was started

POD 2/3/4 - If wound discharge/sero purulent discharge in bellow container was present, pus c/s was sent.

POD 3- Antibiotic changed according to on table pus c/s result

POD 4/5/6 - Comparison of on table pus c/s with wound/ bellow container discharge pus c/s was done to identify whether infection is due to abdominal cavity infection or hospital acquired cross infection.

- The collection in the bellow container was emptied and measured every post operative day. If the collection in the drain was nil for two consecutive days and wound apposition was good, the suction drain was removed.

- Average period of suction drain placement was analyzed.

WOUND INFECTION - Superficial Incisional SSI was assessed based on the CDC criteria for surgical site infection as follows:

Infection involving only skin or sub-cutaneous tissue of the incision

AND

Atleast any ONE of the following:

a. Purulent drainage with or without laboratory confirmation from the superficial incision

b. Organisms isolated from an aseptically obtained culture of fluid or tissue from the superficial incision

c. Atleast one of the following signs or symptoms of infection- pain or tenderness, localized swelling, redness, or heat.

Wound dehiscence was identified as per the definition, i.e. postoperative separation of musculo aponeurotic layers of the abdominal wall.

Post-operative follow up was for 30 days. The day the patient was discharged by the attending surgeon was used for calculating the duration of hospital stay. The patients were reviewed at two and four weeks from the date of discharge.

DATA HANDLING AND STATISTICAL ANALYSIS

Data was collected by the principal investigator using pre-designed data collection sheets. Frequency tables and summary statistics were made for the socio-demographic characteristics and the various outcome variables in the two groups of the study. Means, medians were calculated and compared between the two groups of the study. To describe about the data descriptive statistics frequency analysis, percentage analysis were used for categorical variables and the mean & S.D were used for continuous variables. To find the significant difference between the bivariate samples in independent groups, unpaired Student t-test was used. To find the significance in categorical data Chi-Square test was used. In all the above statistical tools the probability value 0.05 is considered as significant level.

ETHICAL CONSIDERATIONS

The study commenced upon approval by the Department of Surgery and Institutional Ethical Committee (IEC). Informed consent was obtained from each participant prior to enrolment in the study. A pre-consent counselling of the participants was done .The next of kin signed consent on behalf of participants who were unable to do so. Those who declined participation were not denied treatment they deserved because of their decision not to participate. There was no extra cost incurred for participating in the study.

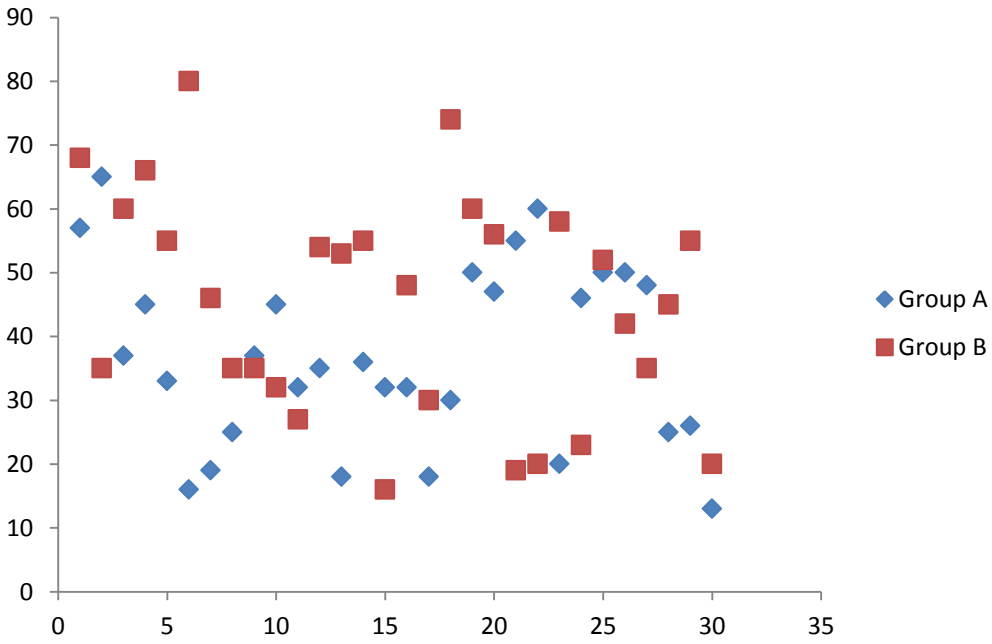
RESULTS

The results of the study are explained below in detail with charts and tables for better understanding. The demographic details of the groups, followed by the outcome measures- SSI, wound dehiscence, secondary suturing, duration of stay and the cause of SSI are explained.

AGE

The age of the patients in this study ranged from 13 to 80 years. In group A patients aged from 13 to 65 years and in group B from 16 to 80 years.

Chart1: Age distribution of patients in the study



The mean age in group A was 39.5 years and in group B was 45.3 years. This is not statistically significant, as the p value is 0.07, calculated by Student unpaired t test. The two groups do not differ significantly with regard to age distribution.

Chart 2: Mean age of patients in the study

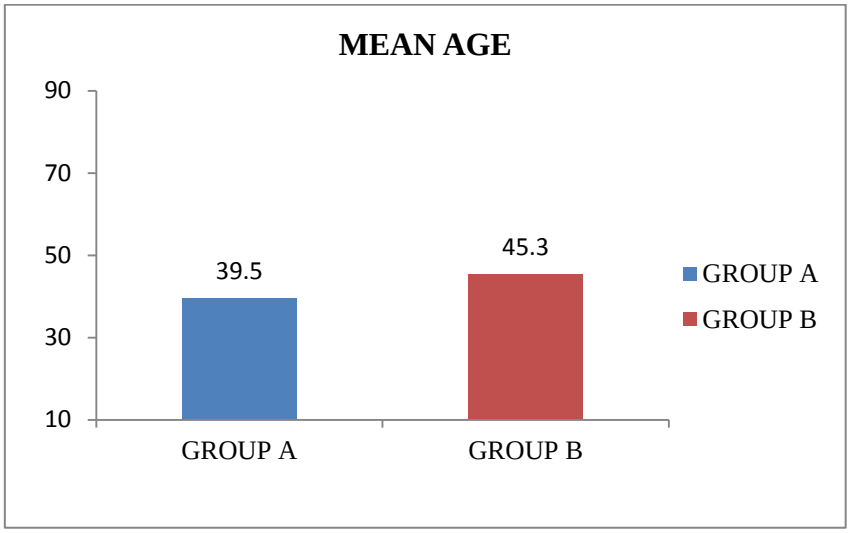


Table 8: Statistical significance of age distribution in the study

Demography	Group A (n-30)	Group B (n-30)	P value	Statistical test of significance
Mean Age (years)	39.5	45.3	0.07	Student unpaired t test

SEX

The difference in the male:female ratio between the two groups was not statistically significant, i.e. males were common in both the groups.

Chart 3: Sex distribution of the patients in the study

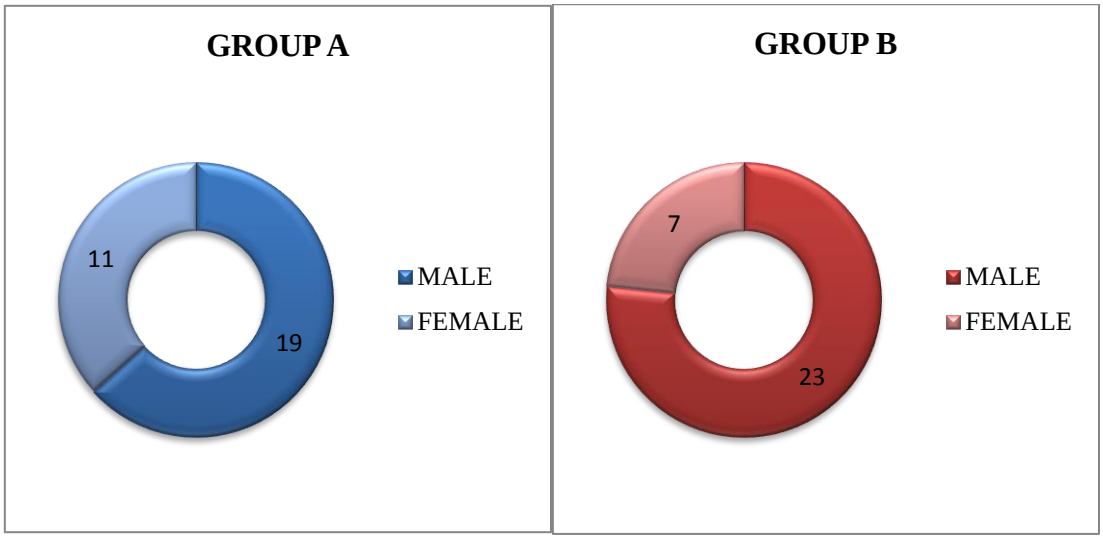


Table 9: Statistical significance of age distribution in the study

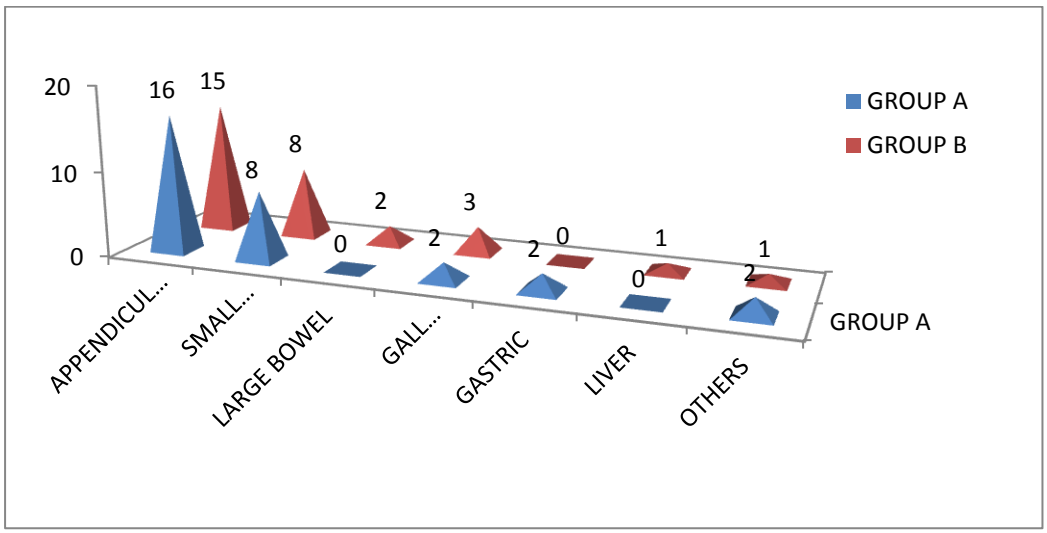
Demography Sex	Group A (n-30)	Group B (n-30)	P value	Statistical test of significance
Male/Female	19/11	23/7	0.2	Chi square test

INDICATIONS OF SURGERY

The following were the indications for surgery in all peritonitis cases (on table finding - pyoperitoneum / fecal peritonitis) in the order of decreasing frequency:

1. Appendicular perforation/ mass – (Most common)
2. Small bowel perforation- duodenal/ ileal, obstruction with pyo peritoneum
3. Cholecystitis
4. Large bowel perforation- colon/ recto sigmoid
5. Gastric – antro pyloric
6. Liver abscess
7. Parietal wall abscess with pyo peritoneum, post appendicectomy fecal peritonitis, obstructive umbilical hernia with pyo peritoneum

Chart 4: Peritonitis- indications for surgery



The difference in the indications of the surgery in both the groups was not statistically significant, i.e. the indications were similar in both the groups.

Table 10: Statistical significance of difference in indications for surgery

Demography Indications of surgery	Group A (n-30)	Group B (n-30)	P value	Statistical test of significance
Appendicular	16	15	0.8	Chi square test
Small bowel	8	8		
Gall bladder	2	3		
Large bowel	0	2		
Gastric	2	0		
Liver	0	1		
Others	2	1		

TYPE OF INCISION

The most common incision performed was midline laparotomy in both the groups. Grid iron and right subcostal were the other incisions performed. There was no statistically significant difference in the type of incisions performed between the two groups.

Chart 5: Type of incisions in both the groups

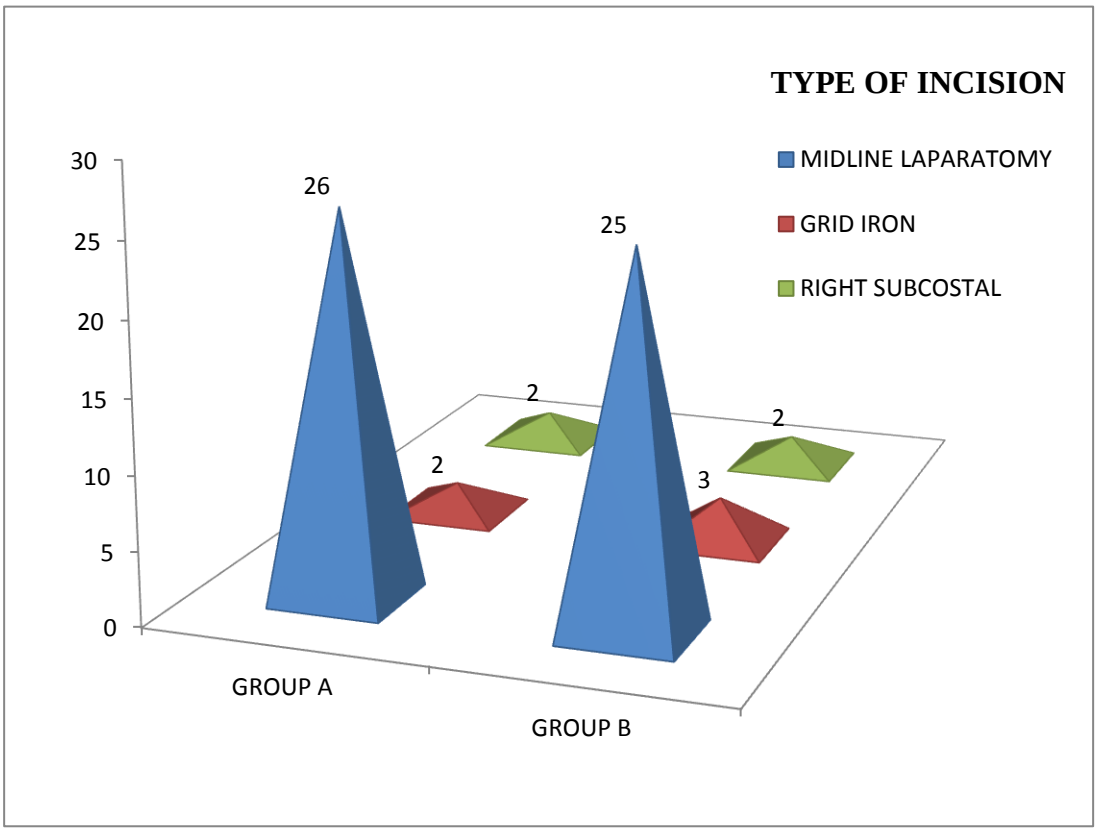


Table 11: Statistical significance of difference in the type of incisions performed

Demography Type of incision	Group A (n-30)	Group B (n-30)	P value	Statistical test of significance
Midline laparotomy Grid iron Right subcostal	26 2 2	25 3 2	0.9	Chi square test

Hence, there was no statistical difference in all the demographic parameters like age, sex, indication for surgery and type of incision between both groups.

SURGICAL SITE INFECTION, WOUND DEHISCENCE AND WOUND SECONDARY SUTURING

Overall Superficial Incisional Surgical Site Infection rate was 42% (25 out of 60 cases were infected), 23% in group A and 60% in group B.

Dehiscence occurred in 76% of SSI cases (19 out of 25 overall cases), 43% of SSI cases (3 out of 7) in group A and 89% of SSI cases in group B (16 out of 18). The wound healed without dehiscence in 4 out of 7 patients in group A and 2 out of 18 patients in group B.

All patients with wound dehiscence were taken for secondary suturing.

Chart 6: Incidence of SSI, wound dehiscence, secondary suturing

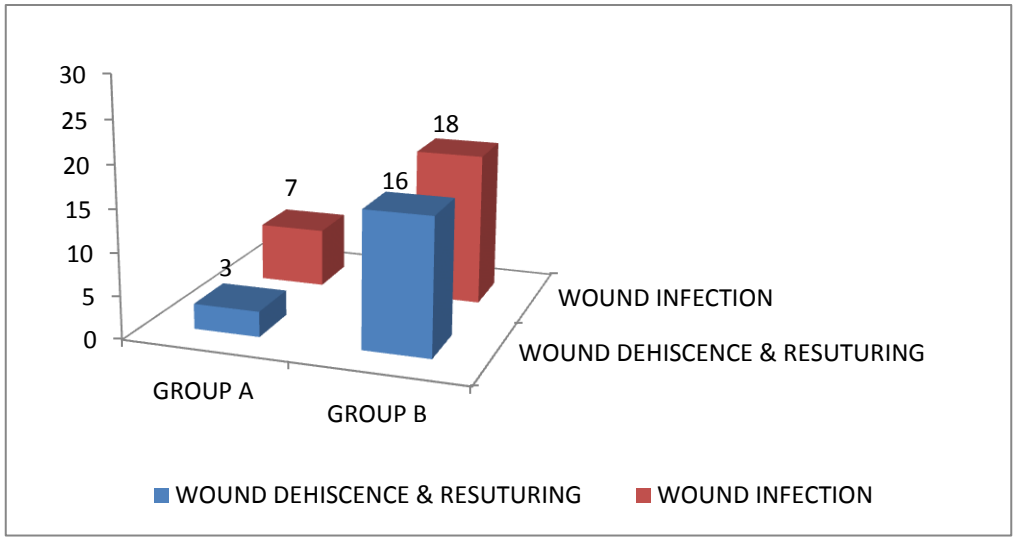


Table 12: Statistical significance of difference in the incidence of SSI, wound dehiscence, secondary suturing

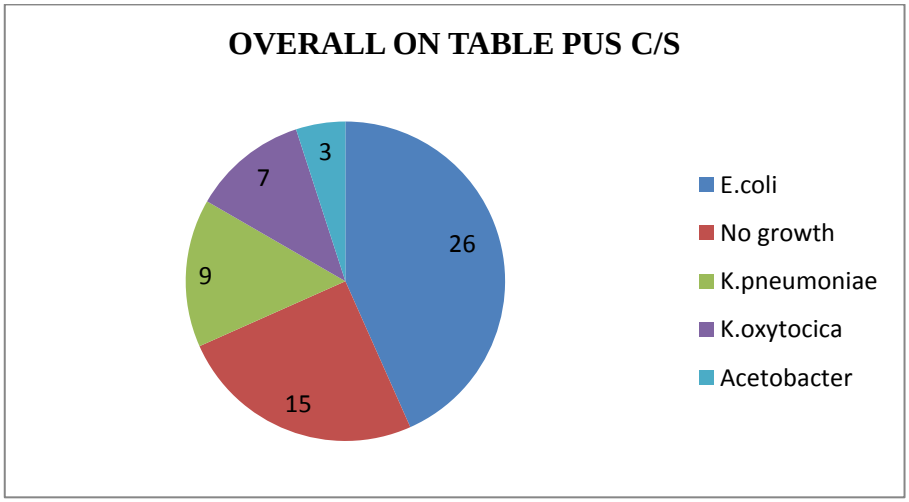
Outcome	Group A (n-30)	Group B (n-30)	P value	Statistical test of significance
SSI	7 (23%)	18 (60%)	0.003	Chi square test
Wound dehiscence & secondary suturing	3	16	0.015	Chi square test

The incidence of SSI was significantly less in group A than in group B. Similarly, among the SSI cases the incidence of wound dehiscence was also significantly less in group A than in group B.

CAUSE OF SSI

The various organisms isolated from the on table cultures taken on the day of surgery include Escherichia coli, Klebsiella pneumoniae, Klebsiella oxytocica and Acetobacter. Of these, Escherichia coli was the most common isolate overall in both the groups (43%). It is to be noted that overall, no growth was isolated in 25% of the cases.

Chart 7: Overall on table C/S



The sero purulent / purulent collection in the drain and the discharge from the surgical site was taken for C/S. The incidence of isolates in both the groups was not statistically significant. The most common organism to be isolated was Escherichia coli in both the groups (overall- 48%, 57% in group A, 44% in group B).

Chart 8: Drain sero-purulent collection/ wound discharge C/S in group A and group B

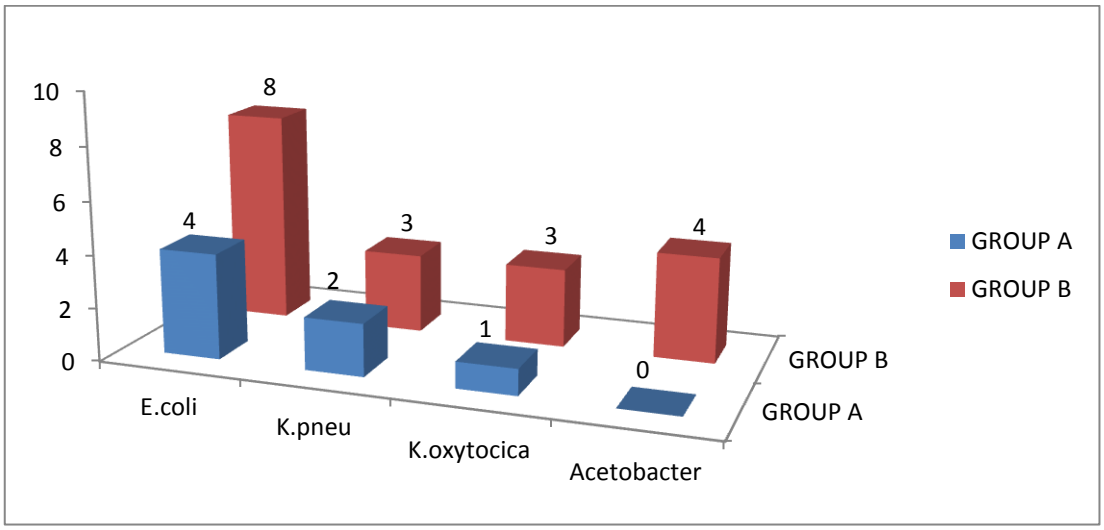


Table 13: Significance of drain sero-purulent collection/ wound discharge C/S reports

Drain sero-purulent collection/ wound discharge	Group A (n-30)	Group B (n-30)	P value	Statistical test of significance
Escherichia coli	4	8	0.55	Chi square test
Klebsiella pneumonia	2	3		
Klebsiella oxytocica	1	3		
Acetobacter	0	4		

On comparing the on table C/S reports with the drain collection / wound discharge C/S reports the following findings were observed. SSI was more commonly due to abdominal cavity infection in both the groups, the incidence being 71%in group A and 78% in group B.

Chart 9: Cause of SSI – Abdominal cavity infection vs hospital acquired infection

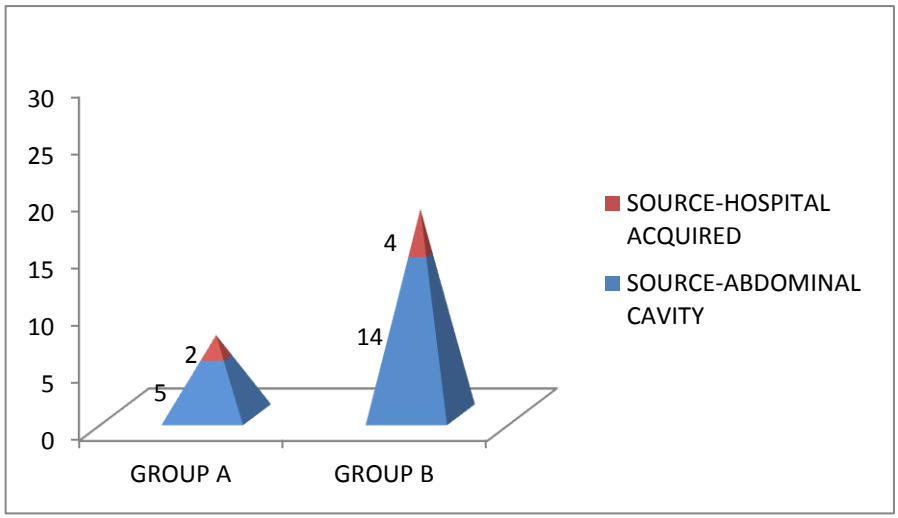


Table 14: Significance of the incidence of abdominal cavity infection and hospital acquired cross infection

Cases of SSI	Group A (n-7)	Group B (n-18)	P value	Statistical test of significance
Abdominal cavity infection	5 (71%)	14 (78%)	0.73	Chi square test
Hospital acquired cross infection	2 (29%)	4 (22%)		

There was no statistical difference between the incidence of abdominal cavity infection and hospital acquired cross infection in both the groups (p value 0.73), i.e. SSI was more commonly due to abdominal cavity infection than hospital acquired infection in both the groups.

ROLE OF DRAIN IN EARLY IDENTIFICATION OF SSI

Sero purulent collection from the drain was picked up and sent for C/S as early as POD-2 in 86% of SSI cases in group A. Whereas, in group B, 56% of the SSI cases were detected on POD 4 by the presence of wound discharge.

Chart 10: POD of detection of SSI cases

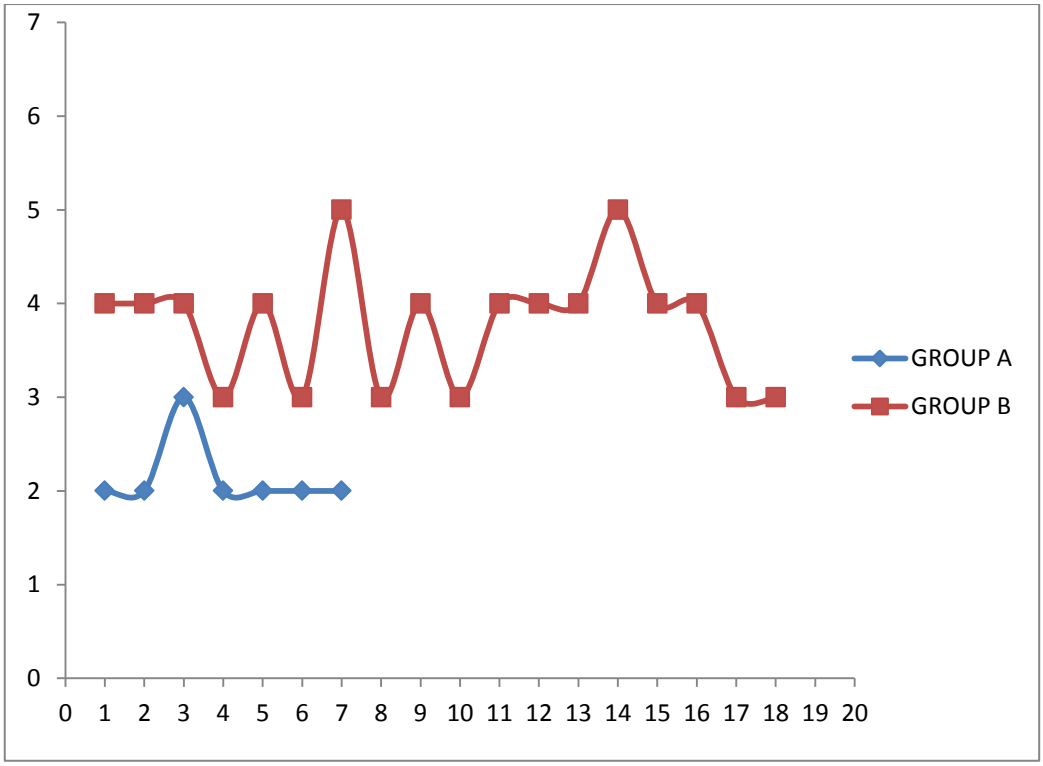


Table 15: Significance of early detection of SSI

SSI cases-POD of detection	Group A (n-7)	Group B (n-18)	P value	Statistical test of significance
POD 2	6	-	0.0001	Chi square test
POD 3	1	6		
POD 4	-	10		
POD 5	-	2		

There was statistically significant early detection of SSI due to the presence of drain in group A when compared to conventional closure in group B.

DURATION OF STAY

The mean duration of hospital stay was significantly less when subcutaneous suction drain was placed.

Chart 11: Duration of hospital stay (days)

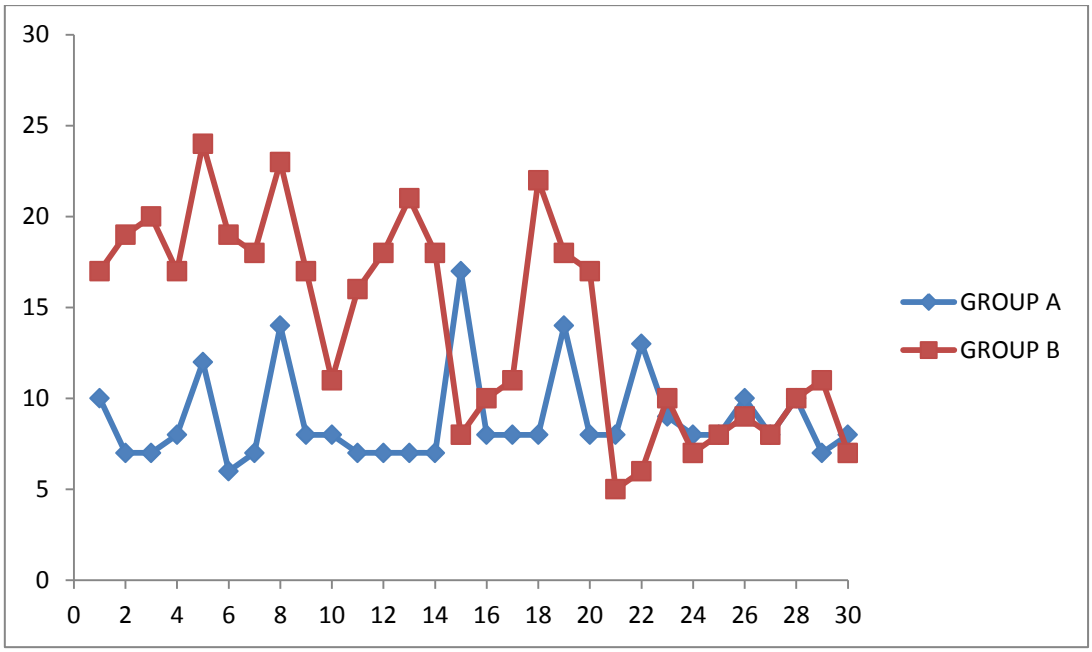


Chart 12: Mean duration of hospital stay

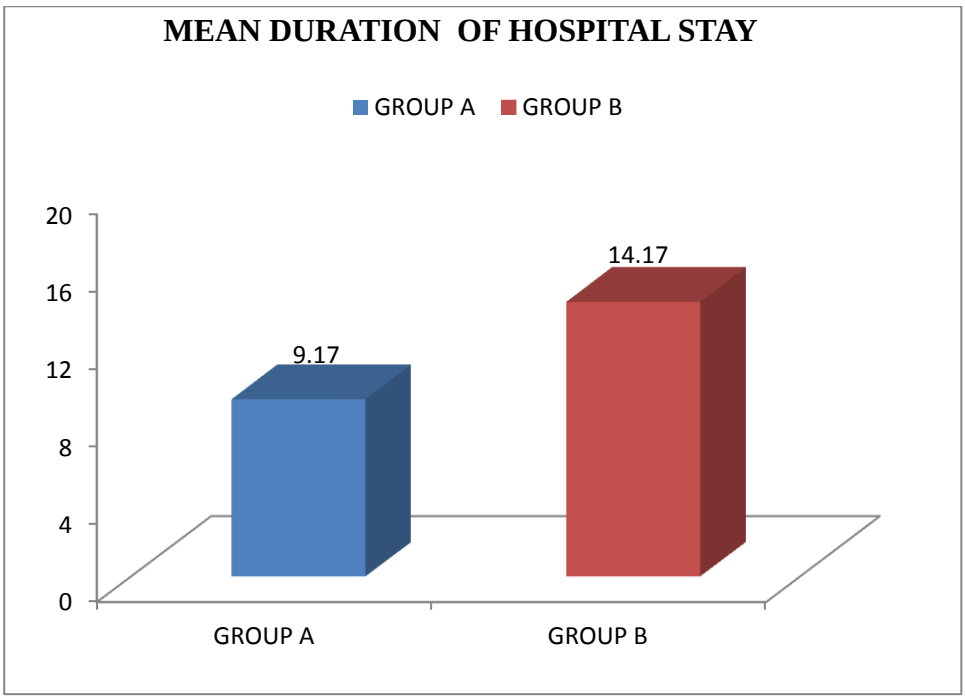


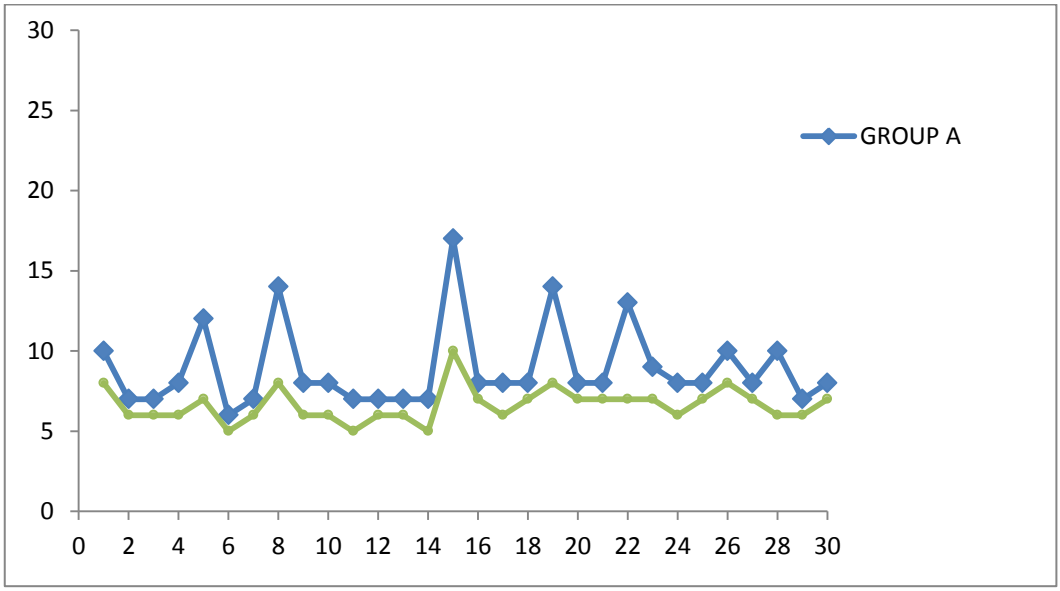
Table 16: Mean duration of hospital stay

OUTCOME MEASURE	Group A (n-30)	Group B (n-30)	P value	Statistical test of significance
Mean duration of hospital stay (days)	9.17	14.17	0.00001	Student unpaired t test

DURATION OF SUCTION DRAIN PLACEMENT IN GROUP A

The mean duration of suction drain placement in Group A was 6.63 days.

Chart 13: Duration of suction drain placement vs hospital stay in group A



CLINICAL PHOTOGRAPHS

1-Subcutaneous placement of suction drain

2-Subcutaneous suction drain showing collection with good approximation of wound on 5th POD

3- Good approximation of wound after subcutaneous drain removal in a patient on 6th POD

4- Healed wound after suture removal

5- Subcutaneous suction drain in a patient with right subcostal incision

6- Subcutaneous suction drain functioning in the immediate post operative period

7- Subcutaneous suction drain in grid iron incision

DISCUSSION

The demographic parameters like age and gender were not statistically significant in both the groups (p values 0.07 and 0.2 respectively). The mean age was 39.5 years in group A and 45.3 years in group B. This is in concordance with Sohn et al who in a study on 280 cases noted an average of 39 years. Males were common in both the groups. This result was similar to a study by Hernandez et al in 2005 who reported 65.6% males and 34.4% females among SSI cases.

The indications for surgery were similar in both the groups (p value 0.8) Appendicular causes topping the list in both the groups. The most common incision performed was midline laparotomy in both the groups. Similar to this a recent study was done at D.Y.Patil Medical Hospital, Pune from2013 to 2015 in 100 patients who were taken up for elective laparotomy, in which cholecystectomy was the most common surgery and right subcostal was the most common incision performed.

The incidence of SSI was significantly less in group A (23%) than in group B (60%), with a p value of 0.003. Among the SSI cases the incidence of wound dehiscence and secondary suturing was also significantly less in group A (43%) than in group B (89%) with a p value

0.015. Whatever be the cause for peritonitis, whatever be the type of incision, subcutaneous negative suction drains are effective in reducing the incidence of SSI, wound dehiscence, wound secondary suturing rate when compared to primary conventional abdominal wall closure. There are a lot of studies on open vs closed technique/ primary vs delayed abdominal wall closure in sepsis/peritonitis cases. Similarly studies for and against the placement of subcutaneous drains in various scenarios like elective laparotomy wounds, colorectal surgeries are also available.

- Studies on closed suction drain date back 1973. Cruse et al. in their prospective study on 23,659 surgical wounds showed a lesser SSI rate of 1.8% in closed suction drain as against 2.4% in a Penrose wound drain and hence, closed suction drains were preferred to open drains since then.

- A randomized clinical trial which was done in 2001 concluded that primary closure should be done in clean contaminated and contaminated laparotomy wounds whenever possible. This study compared the rates of complication in clean-contaminated and contaminated laparotomy wounds between those primarily closed and those left open. There was a statistically significant difference (p=0.002) in wound infection rate between those wounds left open

(30.2%) and those closed primarily (2.1%). There was no significant difference in the incidence of wound dehiscence between the two groups as p value was >0.05.

- Another study in 2006-2007 was conducted to evaluate the outcome of wound healing in laparotomy wounds in terms of delayed vs primary skin closure. Sixty patients were enrolled into this study. Thirty patients (group A) underwent delayed closure. Thirty other patients (group B) underwent primary closure. Wound infection leading to wound dehiscence occurred in 10 out of 60 patients (16.66 %). The incidence was less in group A(4 cases- 13.33%) than in group B(6 cases- 20 %) . This difference was statistically significant ($p<0.05$). The infection rate was significantly high in advanced age ($p <0.01$). The mean duration of stay was 7.7 days in group A as against 10.3 days in group B. Open abdomen technique of dirty wounds was found to reduce SSI.

- A prospective study in 154 patients was done at the Department of surgery in Gazi University Medical School at Turkey aimed to evaluate the effectiveness of subcutaneous suction drains. All patients had underwent laparotomy for peritonitis. After the

closure of the musculo fascial layers, a subcutaneous negative suction drain was placed. The average period of placement of drains in patients was 5.3 (4-15) days. 13.1% patients developed SSI, detected by drainage of pus from the drain. One patient who developed evisceration was reoperated. In two patients the wounds were left open. In 90.4% patients with surgical site infection, the drains were placed for a day and the wound had remained healthy until and thereafter. It was substantiated that subcutaneous closed suction drainage of the surgical incision in colorectal surgery results in significant reduction in surgical site infections.

- A prospective study to investigate the effectiveness of negative suction in abdominal wall closure in cases of sepsis was done in 2013. A total of 100 cases of perforation peritonitis were taken into the study. They had studied 100 cases of perforation peritonitis. Patients were divided into two groups A and B. Patients who had abdominal wall closure with negative suction drain were assigned to group A and patients who had abdominal wall closure without drain were assigned to group B. Patients in group A had low incidence of SSI and wound dehiscence than patients in group B. Average time for wound healing was 10 days in group A and 14 days in group B.

- A study from Japan's Gunma University showed that subcutaneous drains help in reducing the incidence of SSI in colorectal surgery in obese patients. Obese patients are at increased risk of SSI due to increased thickness of the subcutaneous fat. The incidence of SSI in obese patients with drain was 14.3% and without drain was 38.6%.

- Chowdri et al in their study, had shown 8% SSI in cases without drain vs no SSI in cases with subcutaneous drain

- In a similar study by Kim et al, 2.8% infection rate was shown in the group with drain vs 7.8% in the group with conventional closure.

- A recent study was done at D.Y.Patil Medical Hospital, Pune from 2013 to 2015 in 100 patients of elective laparotomy. The SSI rate with drain was 6% and without drain was 20%.

- In contrast to these, Gallup et al in a study showed no statistically significant difference in wound complication rate, between the groups with and without subcutaneous drain – 20% vs 31% with a p value of 0.09.

- Cardosi et al in a randomized control trial studied the use of subcutaneous suction drain in which no significant difference in infection rate was noted between the control group and the study group - 17.9% vs. 15.6% with a p value of 0.70

The most common organism to be isolated in drain/wound discharge was Escherichia coli in both the groups (overall- 48%, 57% in group A, 44% in group B). Similar observations were made in the study at Pune in elective laparotomy cases (10%) and also in a study conducted by Sahu et al and Fadnis et al.

SSI was more commonly due to abdominal cavity infection than hospital acquired infection in both the groups (p value 0.73). Most of the SSI are due to abdominal cavity source.

There was statistically significant early detection of SSI due to the presence of drain in group A when compared to conventional closure in group B (POD 2 in group A vs POD 4 in group B, p value 0.0001). Subcutaneous negative suction drains not only help in reducing the incidence of SSI, but also help in early identification of SSI, and thus allowing us to ensure early treatment and prevention of wound dehiscence.

The mean duration of suction drain placement in Group A was 6.63 days. The mean duration of hospital stay was significantly less when subcutaneous suction drain was placed (9 days vs 14 days, p value 0.00001). This parameter has been studied by others.

- Kim et al in a study evaluated the hospital stay period in patients with and without wound drain. It was found to be 8 days in the group with drain and 11 days in the group without drain.

- A similar study was done by Zhen et al. It was found that the closed suction group had lesser period of stay (9 days) than the group without drain (20 days).

STRENGTHS AND LIMITATIONS OF THE STUDY

The major strengths of the study are the following:

- ❖ This is a prospective study.
- ❖ The sample size is good for a study period of one year.
- ❖ The results were statistically analyzed and proven.

The main limitations are as mentioned below:

- ❖ The study is not randomized.
- ❖ The study can be extended for a longer period with a larger sample size for better results.
- ❖ The subcutaneous negative suction drain used in this study was cost effective, but VAC drains using advanced negative pressure wound therapy can also be used for better wound healing, if cost constrains are not present.

CONCLUSION

- Surgical site infection is commonly due to abdominal cavity infection rather than hospital acquired cross infection.

- Subcutaneous suction drainage tube is an effective method of abdominal wall closure in cases of peritonitis when compared to conventional primary skin closure as it significantly reduces the incidence of wound infection, dehiscence, wound secondary suturing and duration of hospital stay in SSI.

- Subcutaneous suction drainage tube enables improved rate of recovery and finally decreased morbidity and early rehabilitation. Hence, subcutaneous suction drainage tube should be considered in abdominal wall closure in patients who undergo surgery for peritonitis.

LIST OF ABBREVIATIONS

- SSI - Surgical Site Infection
- CDC- Centers for Disease Control and prevention
- VAC- Vacuum Assisted Closure
- NPWT- Negative Pressure Wound Therapy
- Pa- Pascal (SI unit of pressure)
- MRSA- Methicillin Resistant Staphylococcus Aureus
- GB- Gall Bladder
- USG- UltraSonoGram
- DOS- Day Of Surgery
- POD- Post Operative Day
- SD- Standard Deviation
- IEC- Institutional Ethics Committee
- C/S- Culture and Sensitivity

LIST OF FIGURES

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- Drains- proper use and management; Katrin Saile, DVM, MS, DACVS Louisiana State University Baton Rouge, LA.

INFORMED CONSENT

Name: Age/ Sex: IP:

I herewith declare that I have been explained in a language fully understood by me regarding the purpose of this study, methodology, proposed intervention, plausible side effects, if any and sequelae.

I have been given an opportunity to discuss my doubts and I have received the appropriate explanation.

I understand that my participation in this study is completely voluntary and that I am free to withdraw from this study at anytime without any prior notice &/ or without having my medical or legal rights affected.

I permit the author and the research team full access to all my records at any point, even if I have withdrawn from the study. However my identity will not be revealed to any third party or publication.

I herewith permit the author and the research team to use the results and conclusions arising from this study for any academic purpose, including but not limited to dissertation/ thesis or publication or presentation in any level.

Therefore, in my full conscience, I give consent to be included in the study and to undergo any investigation or any intervention therein.

Patient's Sign **Investigator's Sign**

DR.ASHOKKUMAR.M

PATIENT INFORMATION MODULE

You are being invited to be a subject in this study.

Before you participate in this study, I am giving you the following details about this trial, which includes the aims, methodology, intervention, possible side effects, if any and outcomes:

All patients diagnosed with peritonitis will be included in this study. A detailed clinical history will be taken following a standardized proforma. A detailed clinical examination will be made and relevant basic investigations will be done at the time of admission. The effects of subcutaneous suction drain vs primary abdominal wall closure will be analyzed. The results arising from this study will be analyzed and used for academic purposes. You will be given clear instructions at every step and you are free to ask/ clarify any doubts. Your identity will remain confidential. You are free to withdraw from this trial at any point of time, without any prior notice &/ or without any medical or legal implications.

I request you to volunteer for this study.

Thanking You,

Investigator's Sign Patient's Sign

(Dr.ASHOK KUMAR.M) (Name:)

PROFORMA

A Comparative study of subcutaneous suction DT with conventional primary skin closure following abdominal surgeries in cases of peritonitis.

Name : SL. NO:

Age/ sex: IP NO:

Clinical diagnosis:

Provisional diagnosis:

Laparotomy findings:

On table pus C/S:

Method of laparotomy closure: Group A or Group B

Follow up:

DOS- Empirical antibiotic therapy given:

POD2- Wound discharge +/- If (+) , pus C/S sent

POD3- Antibiotic changed as per pus C/S result:

POD5- On table pus C/S and Wound discharge pus C/S results compared,

Wound infection due to abdominal cavity infection or hospital acquired cross infection ?

Wound dehiscence +/-?

Whether taken for secondary suturing ?

CONCLUSION: GROUP A / GROUP B

Post operative wound healing:

1. Duration of stay
2. Wound infection +/-
3. Wound dehiscence +/-
4. Wound secondary suturing +/-
5. Duration of suction drain placement in patients in group A

Cause of Surgical site infection

Pus C/S reports- on table pus C/S & wound discharge pus C/S-

Abdominal cavity infection or hospital acquired cross infection?

MASTER CHART FOR GROUP – A PATIENTS

S. No	Name	Age	Sex	IP No	Diagnosis	Laparotomy Findings	Type of incision	On table pus C/S	Wound discharge ✓/×	Wound/drain discharge-pus C/S	Abdominal cavity/ Hospital acquired	Wound dehiscence ✓/×	Wound secondary suturing	Duration of stay-days	Duration of suction drain placement-days
1	Thulukananam	57	M	1611224	Hollow viscus perf	Antro pyloric perf + pyoperitoneum	Lap	✓ E.coli	×	×	-	×	×	10	8
2	Krishnaveni	65	F	1609450	Appendicitis + perf	+ Abscess	Lap	✓ E.coli	×	×	-	×	×	7	6
3	Vadivel	37	M	1612758	Stab injury abd+ peritoneum breach	Multiple small bowel perf	Lap	✓ NG	×	×	-	×	×	7	6
4	Senthur	45	M	1617491	Hollow viscus perf	Gastric perf + pyo peritoneum	Lap	✓ K.oxytocica	×	×	-	×	×	8	6
5	Rajesh kumar	33	M	1612800	Hollow viscus perf	Small bowel perf + pyoperioneum	Lap	✓ Acetobacter	×	×	-	×	×	12	7
6	Rajkumar	16	M	1623501	Appendicular perf	+ Abscess	Lap	✓ NG	×	×	-	×	×	6	5
7	Preethi	19	M	1630994	Appendicitis + perf	+ Abscess	Lap	✓ E.coli	×	×	-	×	×	7	6
8	Razia begum	25	F	1634480	Appendicitis + perf	+ Pyoperitoneum	Lap	✓ E.coli	✓	✓ E.coli	A	✓	✓	14	8
9	Shankar	37	M	1639645	Appendicular perf	+ Abscess	Lap	✓ NG	×	×	-	×	×	8	6
10	Sudhesan	45	M	1641568	Appendicular mass	+ Abscess	Lap	✓ NG	×	×	-	×	×	8	6

S. No	Name	Age	Sex	IP No	Diagnosis	Laparotomy Findings	Type of incision	On table pus C/S	Wound discharge ✓/×	Wound/drain discharge-pus C/S	Abdominal cavity/ Hospital acquired	Wound dehiscence ✓/×	Wound secondary suturing	Duration of stay-days	Duration of suction drain placement-days
11	Deepalaxmi	32	F	1644512	Appendicular perf	+ Abscess	Lap	✓ E.coli	×	×	-	×	×	7	5
12	Mahalaxmi	35	F	1628081	Appendicular perf	+Mass+ Abscess	Lap	✓ K.oxytocica	✓	✓ E.coli	H	×	×	7	6
13	Thulasi	18	F	1648012	Appendicular perf	+ Abscess	Lap	✓ E.coli	×	×	-	×	×	7	6
14	Prabhakari	36	F	1648024	Appendicular perf	+ Abscess	GI	✓ E.coli	×	×	-	×	×	7	5
15	Seshadhri	32	M	1642634	Hollow viscus perf	Duodenal perf	Lap	✓ E.coli	×	×	-	×	×	9	7
16	Nirmala	32	F	1654710	Post appendicectomy + fecal peritonitis	+ pyoperitoneum	Lap	✓ K. pneu	×	×	-	×	×	8	7
17	Naveenkumar	18	M	1651062	Hollow viscus perf	Multiple ileal perf + pyoperioneum	Lap	✓ K. pneu	✓	✓ K. pneu	A	✓	✓	17	10
18	Munusamy	30	M	1567563	Hollow viscus perf	Duodenal perf + pyoperioneum	Lap	✓ E.coli	×	×	-	×	×	8	7
19	Vajrammal	50	F	1606571	Appendicitis + perf	+ Abscess	Lap	✓ E.coli	✓	✓ E.coli	A	✓	✓	14	8
20	Sudharshan	47	M	1609452	Appendicitis + perf	+ Abscess	Lap	✓ K. pneu	✓	✓ K. pneu	A	×	×	8	7
21	Kalaiarasi	55	F	1611234	Acute cholecystitis	+ Empyema	Rsc	✓ NG	×	×	-	×	×	8	7

S. No	Name	Age	Sex	IP No	Diagnosis	Laparotomy Findings	Type of incision	On table pus C/S	Wound discharge ✓/×	Wound/drain discharge-pus C/S	Abdominal cavity/ Hospital acquired	Wound dehiscence ✓/×	Wound secondary suturing	Duration of stay-days	Duration of suction drain placement-days
22	Kuppusamy	60	M	1632771	Hollow viscus perf	Duodenal perf	Lap	✓ E.coli	✓	✓ K.oxytocica	H	×	×	13	7
23	Husain	20	M	1654617	Appendicular mass	+ Abscess	Lap	✓ NG	×	×	-	×	×	8	6
24	Gnanasekar	46	M	1656433	Appendicular mass	+ Abscess	GI	✓ E.coli	✓	✓ E.coli	A	×	×	8	7
25	Arumugam	50	M	1636166	Obst umbilical hernia	+pyoperitonem	Lap	✓ E.coli	×	×	-	×	×	8	7
26	Sulochana	50	F	1654858	Hollow viscus perf	Duodenal perf	Lap	✓ E.coli	×	×	-	×	×	10	8
27	Ravi	48	M	1654632	Acute cholecystitis	+ Empyema	Rsc	✓ K. pneu	×	×	-	×	×	8	6
28	Selvaraj	25	M	1630993	Sub acute intest obst	Small bowel internal hernia+ fecal peritonitis	Lap	NG	×	×	-	×	×	10	6
29	Rajiv gandhi	26	M	1641198	Appendicitis + perf	+fecal peritonitis	GI	✓ E.coli	×	×	-	×	×	7	6
30	Latha	13	F	1650409	Appendicitis + perf	+fecal peritonitis	Lap	✓ NG	×	×	-	×	×	8	7

MASTER CHART FOR GROUP – B PATIENTS

S. No	Name	Age	Sex	IP No	Diagnosis	Laparotomy Findings	Type of incision	On table pus C/S	Wound discharge ✓/×	Wound discharge-pus C/S	Abdominal cavity/ Hospital acquired	Wound dehiscence ✓/×	Wound secondary suturing	Duration of stay-days
1	Neelakandan	68	M	1675391	Hollow viscus perf	Duodenal perf	Lap	✓ E.coli	✓	✓ E.coli	A	✓	✓	17
2	Rani	35	F	1638172	Perf appendicitis	Perf appendicitis + abscess	Lap	✓ NG	✓	✓ E.coli	H	✓	✓	19
3	Selvaraj	60	M	1644886	Hollow viscus perf	Ileal perf	Lap	✓ K. pneu	✓	✓ K. pneu	A	✓	✓	20
4	Mannan	66	M	1651956	Perf appendicitis + abscess	+ small bowel gangrene	Lap	✓ E.coli	✓	✓ E.coli	A	✓	✓	17
5	Paneerselvam	55	M	1630592	Hollow viscus perf	FB in R-S junction + Perf	Lap	✓ E.coli	✓	✓ E.coli	A	✓	✓	24
6	Subramani	80	M	1632546	Parietal wall abscess	+ pyo peritoneum	Lap	✓ NG	✓	✓ Acetobacter	H	✓	✓	19
7	Kumar	46	M	1638402	Hollow viscus perf	Duodenal perf	Lap	✓ Acetobacter	✓	✓ Acetobacter	A	✓	✓	18
8	Ramesh	35	M	1643435	Hollow viscus perf	Multiple Ileal perf + pyo peritoneum	Lap	✓ K. pneu	✓	✓ K. pneu	A	✓	✓	23
9	Das	35	M	1643690	Appendicular perf	+ pyo peritoneum	Lap	✓ E.coli	✓	✓ E.coli	A	✓	✓	17
10	Mohan	32	M	1643871	Multiple liver abscess	Multiple liver abscess	Lap	✓ NG	×	×	-	×	×	11
11	Prasad	27	M	1644670	Appendicular perf	+ Abscess	Lap	✓ NG	✓	✓ Acetobacter	H	✓	✓	16
12	Balaji	54	M	1636111	Acute cholecystitis	+ gangrene	Lap	✓ E.coli	✓	✓ E.coli	A	✓	✓	18
13	Natarajan	53	M	1637698	Appendicular perf	+ Abscess	Lap	✓ K.oxytocica	✓	✓ K.oxytocica	A	✓	✓	21
14	Thangavel	55	M	1649583	Appendicular mass	+ Abscess	Lap	✓ K. pneu	✓	✓ K. pneu	A	✓	✓	18

S. No	Name	Age	Sex	IP No	Diagnosis	Laparotomy Findings	Type of incision	On table pus C/S	Wound discharge ✓/×	Wound discharge-pus C/S	Abdominal cavity/ Hospital acquired	Wound dehiscence ✓/×	Wound secondary suturing	Duration of stay-days
15	Dhilip	16	M	1632709	Appendicular abscess	+ pyo peritoneum	Lap	✓ E.coli	×	×	-	×	×	8
16	Manoj	48	M	1625763	Blunt injury abdomen-Hollow viscus perf	Ileal perf + fecal peritonitis	Lap	✓ E.coli	✓	✓ Acetobacter	H	×	×	10
17	Rikson	30	M	1625682	Acute intest obst + perf	+colon perf	Lap	✓ E.coli	✓	✓ E.coli	A	×	×	11
18	Naraiyanammal	74	M	1636938	Appendicular perf	+ Abscess	Lap	✓ E.coli	✓	✓ E.coli	A	✓	✓	22
19	Munniyammal	60	F	1649616	Appendicular perf	+ Abscess	Lap	✓ K.oxytocica	✓	✓ K.oxytocica	A	✓	✓	18
20	Kulanthaitheresa	56	F	1653176	Appendicular perf	+ Abscess	GI	✓ K.oxytocica	✓	✓ K.oxytocica	A	✓	✓	17
21	Fathima	19	F	1650333	Appendicular perf	+ Pyo peritoneum	GI	✓ E.coli	×	×	-	×	×	5
22	Murugaveni	20	F	1646076	Appendicular perf	+ Abscess	Lap	✓ E.coli	×	×	-	×	×	6
23	Ganapathy	58	M	1630539	Hollow viscus perf	Duodenal perf	Lap	✓ K. pneu	×	×	-	×	×	10
24	Munusamy	23	M	1637688	Appendicular perf	+ Abscess	Lap	✓ K. pneu	×	×	-	×	×	7
25	Syeed ameer	52	M	1647861	Acute cholecystitis	+ Emphysema	Rsc	✓ NG	×	×	-	×	×	8
26	Shankar	42	M	1651007	Appendicular perf	+ Abscess	Lap	✓ Acetobacter	×	×	-	×	×	9
27	Rekha	35	F	1639399	Acute cholecystitis	Gangrene+ Pyoperitoneum	Rsc	✓ E.coli	×	×	-	×	×	8
28	Murugan	45	M	1631497	Acute intest obst + perf	+ileal perf	Lap	✓ NG	×	×	-	×	×	10
29	Subramani	55	M	1646455	Sub acute intest obst + perf	+ileal perf	Lap	✓ E.coli	×	×	-	×	×	11
30	Murugaveni	20	F	1646076	Appendicular perf	+ Pyo peritoneum	Lap	✓ NG	×	×	-	×	×	7

KEY TO MASTER CHART

M	-	Male
F	-	Female
C/S	-	Culture and Sensitivity
Perf	-	Perforation
Abd	-	Abdomen
Intest obst	-	Intestinal obstruction
Obst	-	Obstruction
Lap	-	Laparotomy
GI	-	Grid iron incision
Rsc	-	Right subcostal incision
E.coli	-	Escherichia coli
NG	-	No Growth
K.oxytocica	-	Klebsiella oxytocica
K. pneu	-	Klebsiella pneumoniae
A	-	Abdominal cavity infection
H	-	Hospital acquired cross infection
FB	-	Foreign Body
R-S	-	Recto sigmoid