

Postoperative Peritonitis

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Abstract

In the modern era, radiological investigations and higher antibiotics have improved the outcomes in postoperative abdominal abscesses; however, high mortality is still observed in patients of postoperative diffuse peritonitis. Postoperative diffuse peritonitis is potentially lethal and is usually caused by leakage of gut contents. The primary pathology, virulence of organisms, general condition of the patient at the time of first surgery, intra operative and postoperative course of the patient play a significant role.

Diagnosis of postoperative diffuse peritonitis is usually on clinical grounds where haematological and biochemical investigations will help to determine the outcome of the patient. However, radiological investigation will be of little use. Successful management depends on early diagnosis and treatment. Treatment consists of supportive measures & definitive management. Relaparotomy, planned relaparotomies (etappenlavage), laparostomy, continuous peritoneal lavage etc. are different definitive procedures; but truly there are, as yet, no standards in this field.¹⁴

INTRODUCTION

Postoperative peritonitis can be defined broadly to include postoperative abdominal abscesses or more specifically to include only diffuse peritoneal infection. In modern era, radiological investigations and higher antibiotics have improved the outcomes in postoperative abdominal abscesses; however, high mortality is still observed in patients of postoperative diffuse peritonitis. Postoperative diffuse peritonitis is potentially lethal and is usually caused by leakage of gut contents. Other causes are spread of residual infection, gut ischemia, etc. It is not always the faulty technique or the wrong judgment on the part of the surgeon that leads to post operative peritonitis but the primary pathology, virulence of organisms, general condition of the patient at the time of first surgery, intra operative and post operative course of the patient also play a significant role.

It is usually difficult to diagnose postoperative peritonitis at early stage. Diagnosis of postoperative diffuse peritonitis is usually on clinical grounds where haematological and biochemical investigations will help to determine the outcome of the patient, however, radiological investigation will be of little use. Successful management depends on early diagnosis and treatment. Treatment consists of fluid and nutritional resuscitation, peritoneal toilet, control of gut leakage and initiation of antibiotic treatment.

In the light of these, this study was planned to investigate different etiologies, clinical features and management of the patients with postoperative diffuse peritonitis.

AIMS & OBJECTIVES

The present study is undertaken to:

1. Study different etiological factors of post operative diffuse peritonitis.
2. Determine various risk factors accounting for postoperative diffuse peritonitis and its outcome.
3. Analyze the diagnostic criteria for postoperative diffuse peritonitis.
4. Overview the different management modalities for post operative diffuse peritonitis.

MATERIALS & METHODS

From March 2000 to October 2003, we treated 20 patients of postoperative diffuse peritonitis. Demographic details of each patient were noted with following specific details.

HISTORY OF PREVIOUS SURGERY:

Detail history of previous surgery was obtained from patient and the available documents. Primary pathology, general condition of patients and degree of severity of peritonitis

during first surgery was determined as etiological risk factors. Relation of emergency first surgery with postoperative peritonitis was also demonstrated.

ETIOLOGY:

Etiology of postoperative peritonitis was detected on second laparotomy. It was due to blow out of previous closure, spread of residual peritonitis, bowel ischemia or other causes. Outcome related to different etiologies was compared.

DIAGNOSIS:

Diagnosis of postoperative peritonitis was mainly on clinical ground. Patients who had been undergone laparotomy developed 3\more features of peritonitis in postoperative period were diagnosed as having postoperative peritonitis. Features of peritonitis were persistence or newly appearance of abdominal pain, abdominal distention, fever, nausea, vomiting, constipation, tachycardia, tachypnoea, hypotension or signs of peritonism(abdominal tenderness, guarding or rigidity). Patients were monitored for these features & their diagnostic significance was confirmed and prognostic value determined.

HEMATOLOGICAL INVESTIGATIONS:

All patients were undergone routine hematological investigations include- CBC with ESR, RFT with electrolytes, LFT with protein, HIV\HBsAg and Urine R/M. ABG, Blood c/s, etc. were done as per need. Intraoperative pus c/s was done but administration of antibiotics according to it or not was as per surgeon's choice. Sensitivity of polymorphonuclear leukocytosis as diagnostic and prognostic tool was confirmed. Significance of hemoglobin value and serum albumin level as prognostic factor was determined.

RADIOLOGICAL INVESTIGATION:

X-ray abdomen and USG abdomen were done to aid in diagnosis as per requirement. Presences of multiple air fluid level, free gas in peritoneal cavity, etc. were suggestive of peritonitis in X-ray abdomen. In USG-abdomen free intra peritoneal fluid with altered echos, absent bowel activity, prob tenderness, etc. were suggestive of peritonitis. Their sensitivity was also judged.

DURATION BETWEEN TWO SURGERIES:

Duration between first surgery and re-operation in days counted. Its relation with mortality due to postoperative peritonitis was determined

RESUSCITATION:

All patients were resuscitated with IV fluids, blood transfusions, O₂ inhalation etc. as per requirement. Central venous line was inserted in 7 patients. 2 patients required ventilatory support.

NUTRITION:

All patients were given parenteral nutrition for initial post operative period. Followed by oral hyperalimentation as early as possible

ANTIBIOTICS:

- All patients were given combination of 3rd generation cephalosporin and metronidazole. Aminoglycoside were added after confirming normal renal function.
- Antibiotics were changed according to pus c/s in 8 patients whereas rest of the patients given empirical antibiotics. Significance of antibiotic administration according to pus c/s was determined.
- Antibiotics were given till evidence of peritonitis subsides.

OPERATIVE TREATMENT:

19 patients were undergone re-operation for postoperative peritonitis whereas one patient expires before any intervention.

- Patients were reoperated as early as possible after diagnosis of postoperative peritonitis and appropriate resuscitation.
- Relaparotomy was performed through the same incision (midline or para median) of first surgery except in patients who had developed postoperative peritonitis following appendectomy through Grid Iron incision.
- Presence of purulent\fecal free fluid intraperitoneally, inflamed & dilated bowel loops, inter bowel adhesion, generalized pus flakes, disruption of previous intestinal closure, gangrenous bowel etc. confirmed diagnosis of post operative diffuse peritonitis.
- Intraperitoneal pus\fluid taken for c/s examination.
- Source of infection was eliminated in all patients.

Primary closure was done in patients with mild to moderate peritonitis with good bowel wall whereas exteriorization (iliostomy\colostomy) was done in patients with severe peritonitis. Primary closure of perforation with feeding jejunostomy was done in patients of postoperative peritonitis following peptic perforation closure.

- Peritoneal lavage given with normal saline, metronidazole and betadine in all patients.
- Bowel decompression done. Plastic tube drain put in pelvis and/or morisson's pouch.
- Abdominal closure was done in single layer with non-absorbable material. Tension suturing was done in patients who had burst abdomen or poor abdominal wall.
- To prevent and treat recurrent infection, laparostomy done in 3 patients. Conventional laparotomy on demand was compared with laparostomy.

OBSERVATIONS

The majority of patients were from middle age group. Average age of the patients was found to be 34.35 ± 3.01. Average age of the patients that died was found to be 33.33 ± 5.14 where as average age of the patients that survived was found to be 35.18 ± 3.72. The majority of the patients was found to be male.

ETIOLOGY:

Figure 1

Sr. no		No. Of patients	%Patients
1	Disruption of closure of perforation or anastomosis	10	50 %
2	Spread of residual infection	4	20 %
3	Gut ischemia	2	10 %
4	New perforation	2	10 %
5	Retraction of colostomy	2	10 %

The most common cause of postoperative diffuse peritonitis in our study was gross leakage of gut contents comprising 50% of the patients.

HISTORY OF PREVIOUS SURGERY:

Figure 2

Sr. No		Stomach duodenum	Jejunum Ileum	Appendix	Colon	Others	Total	No. of patients expired
1	Primary pathology • Perforations • Others	2 0	4 5	1 3	2 2	0 1	9 11	3 6
2	Peritonitis • Generalized • Localized • Absent	2 0 0	4 1 4	0 4 0	2 0 2	0 0 1	8 5 7	4 0 5
3	Procedure • Primary closure of perforation • Primary resection anastomosis • Proximal diversion • Adhesiolysis	2 0 0 0	4 4 0 1	1 3 0 0	0 1 3 0	0 0 0 0	7 8 3 1	2 3 2 1
4	Nature of first operation • Emergency • Elective	2 0	9 0	3 1	3 1	1 0	18 2	9 0
5	Total no. of patients	2	9	4	4	1	20	
6	Expired	1	5	0	2	1	9	
7	% expired	50	55.5	0	50	100	45	

The majority (45%) of patients in this study had undergone primary surgery for perforation. The rest of the patients had been operated for appendicectomy, intestinal obstruction, etc. There was 50% mortality noted among patients with generalised peritonitis during primary surgery, whereas no mortality among patients with localised peritonitis.

90 percent of the patients in our study were undergone emergency surgery. All 9 patients expired in the study were undergone first surgery in emergency condition.

CLINICAL FEATURES:

Figure 3

Sr. no	Clinical features	No. Of patients	% Of patients
1	Abdominal pain	19	95
2	Abdominal distension	15	75
3	Fever	16	80
4	Nausea/ vomiting/high RT aspiration	18	90
5	Absolute constipation	16	80
6	Fecal or purulent discharge	15	75
7	Tenderness/guarding/rigidity	18	90
8	Tachycardia	19	95
9	Tachypnoea	7	35
10	Hypotension	4	20

Diagnosis of postoperative peritonitis is mostly on clinical

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grounds. Diagnostic features are newly developed abdominal pain (95%), abdominal distention (75%), fever (80%), tachycardia (95%) with clinical evidence of peritonitis (tenderness, guarding, rigidity)(90%) in postoperative period.

Tachypnoea & Hypotension are poor prognostic features. There was 100% mortality noted among patients who developed hypotension that was poorly responding to vasoconstrictors.

Nausea, vomiting, high RT aspiration (90%) & absolute constipation (80%) with abdominal distention suggest paralytic ileus due to peritonitis. Fecal or purulent discharge from wound or drains (75%) suggests intraperitoneal leak or residual peritonitis, are important features.

INVESTIGATIONS:

TOTAL COUNT & DIFFERENTIAL COUNT:

These are investigations of diagnostic values well as prognostic value. Persistent leukocytosis (esp. neutrophilia) in postoperative period or rise in count suggests some infective foci in body. In our study 15 (75%) patients had persistent neutrophilia after first surgery.

Figure 4

Neutrophil count after 7days of second surgery	Patients who survived	Patients who died
Normal	8	1
Raised	3	8

Leukocyte counts never come to normal in 8 out of 9 patients who expired even after second surgery & antibiotic treatment. Only 3 patients out of 11 patients (who survived) had neutrophilia after 7 days of second surgery.

HEMOGLOBIN & SERUM ALBUMIN:

Figure 5

Sr. No.		All patients	Patients who survived	Patients who died
1	Hemoglobin (gm %)	9.03 ± 2.39	10.07 ± 1.15	7.75 ± 0.87
2	Serum albumin (gm %)	2.22 ± 0.75	2.5 ± 0.57	1.87 ± 0.77

Average Hb was just 9.03 gm %. But there was significant hypoalbuminemia (average 2.22 gm %). There was marked anemia & hypoproteinemia among patients who expired.

RADIOLOGICAL INVESTIGATIONS:

In our study only 11 patients undergone x-ray abdomen & 9

patients (82%) showed abnormal findings inform of free gas under diaphragm or multiple air fluid levels. Only 2 patient's x-rays were normal. Total 6 patients undergone USG abdomen, all showed free fluid in abdomen with echogenic material.

Figure 6

	No. of patients investigated		
	Total	Abnormal	Normal
X-ray abdomen	11	9	2
USG abdomen	6	6	0

DURATION BETWEEN PRIMARY OPERATION & REOPERATION:

Figure 7

	Average duration in days
All patients	5.1 ± 3.5
Patients who survived	6.64 ± 3.8
Patients who expired	3.2 ± 1.6

The duration was short among patients who expired as compared to those survive.

SUPPORTIVE MEASURES

RESUSCITATION:

All patients were resuscitated in form of IV fluids, blood transfusion, oxygenation, etc.. A total of 13 patients required intensive resuscitation with central venous line insertion & 2 patients given ventilatory support.

ANTIBIOTICS:

All patients were given preoperative broad-spectrum antibiotics (cephalosporin + metronidazole). Amino glycosides were added in postoperative period after normal RFT report. Antibiotics were changed according to pus c/s report in 8 patients where as empirical antibiotics were given in rest of the patients.

Figure 8

Antibiotics acc. to pus c/s	Total	Patients survived	Patients expired
Yes	8	3	5
no	12	8	4

Chi square test (p>0.05)

No significant increase in survival was obtained by

administration of anti-biotic according to pus c/s

OPERATIVE MANAGEMENT:

PRINCIPLE 1: (CONTROL OF THE SOURCE OF INFECTION)

Figure 9

	Total patients	No. Of patients expired
Exteriorization	10	7
Primary closure	5	1

Chi square test (P>0.05)

In 15 patients on re exploration, there was leakage from gut requiring some form of control of the source of infection. In 4 patients, there was spread of residual infection whereas 1 patient expired before any intervention.

There was 70% mortality noted among the patients in whom exteriorization of proximal bowel was done as compared to 20 % mortality among the patients in whom primary closure was done.

PRINCIPLE 2: (EVACUATE BACTERIAL INNOCULUM, PUS AND ADJUVANT) (PERITONEAL TOILET)

All patients were given peritoneal lavage with combination of normal saline, betadine and metronidazole of about 3 - 4 litres. In all the patients, pelvic drain was put. In two patients with duodenal perforation and in 1 patient with spread of residual peritonitis following appendicectomy, drain was put in Morrison pouch.

PRINCIPLE 3: (DECOMPRESSION)

In all the patients, decompression of the bowel was done

PRINCIPLE 4 : (PREVENT OR TREAT PERSISTENT AND RECURRENT INFECTION)

In 3 patients, abdomen was kept open (laparostomy) out of which 2 expired whereas in rest of the patients conventional surgical procedure was done. Mortality was 66% among patients with laparostomy as compared to 47.05 % mortality in-patients who underwent conventional surgical procedures.

Figure 10

Mortality in %	Our study	Anderson et al 1983
Laparostomy	66%	60%
Traditional primary closure	47.05%	33%

DISCUSSION

ETIOLOGY: ,

Gross leakage of gut contents following initial laparotomy is the main cause of post operative abdominal infection

Other causes include: - residual contamination

- Gut ischemia

- Denovo onset of abdominal

infection from previously uninvolved sources.

The healing of internal suture line or anastomoses depends on:-

1. The balance between the lysis and synthesis and collagen. If the rate of lysis exceeds that of synthesis, not even the most apparently secured anastomoses can heal. This depends on general condition of patient including nutritional status, which can be determined by measurements of parameters like serum albumin. It also depends on local infection
2. Techniques: the technical deficiencies may be in the form of
4. The sutures were placed too near the cut edge of the viscus
5. The sutures did not embrace the submucous layer of the bowel
6. There was tension on anastomoses
7. The blood supply at the anastomoses was inadequate to Allow an efficient inflammatory response.
8. Bacteria at the site of the anastomoses cause an acute Inflammatory reaction and the disintegrating neutrophills release proteolytic enzymes that destroy the tissue of the bowel.
9. The peritoneum was excluded from anastomoses

DIAGNOSIS:

Diagnosis of postoperative peritonitis is usually a clinical one.

SYMPTOMS:

Abdominal pain, usually generalized, is a most common complaint. Sometimes it may be not significant as good analgesic is administered in postoperative period. It is very difficult to differentiate it from simple postoperative pain without presence of other findings, which point towards peritonitis. Such patients avoid movement due to pain.

Progressively increasing abdominal distention is the next most important finding. It leads to difficulty in respiration and decreased abdominal movement with respiration. It requires differentiation from paralytic ileus due to other causes of peritonitis

High-grade fever with rigors is a sign of infection in body. Thus, new appearance of fever in post operative period after laparotomy always points toward peritonitis.

As peritonitis causes paralytic ileus; high RT output, nausea, vomiting, constipation or watery diarrhea may develop.

Open wound, wound discharge, per drain discharge, etc. all suggest failure of primary surgery.

GENERAL EXAMINATION

Raised temperature, tachycardia, tachypnoea with hypotension suggest systemic inflammatory response syndrome and in post laparotomy patient mostly due to peritonitis

Poor nourishment, pallor, dehydration may be contributing factors for development of peritonitis due to poor immune response or it may be consequence of septicemia.

Icterus, cyanosis, edema may be indicators of MODS.

In terminal stage Hippocratic faces is characteristic.

PER ABDOMEN EXAMINATION

On inspection, generalized abdominal distension with decreased abdominal movement with respiration is characteristic

On palpation, evidence of peritonitis in form of generalized tenderness with rebound tenderness, guarding and / or rigidity are evident.

Scar of previous surgery with purulent / fecal discharge or similar kind of discharge in drains may be present

On percussion, free fluid in abdomen and on auscultation, absent bowel sounds are usual findings.

Per rectal examination may suggest bulging in anterior rectal wall with tenderness and raised temperature.

HEMATOLOGICAL AND BIOCHEMICAL INVESTIGATION

For diagnostic purpose total and differentiated WBC count done. It shows Leucocytosis with predominant neutrophils and premature cells.

Results of the investigations are important from etiological and prognostic view

RADIOLOGICAL INVESTIGATIONS:

X-ray abdomen may reveal obliteration of peritoneal fat planes and the psoas shadow, indicating peritoneal edema. Air filled loops of bowel, with thickened, opaque walls may be found when bowel edema and paralytic ileus is present.

Ultrasonography may show free fluid in abdomen with echogenic material, absent peristalsis or thickened peritoneum, mesentery or bowel wall. Diagnostic aspiration of fluid under USG guidance if possible is more reliable

CT and MRI are not indicated routinely. According to Hiyama & Bennion⁸ as written in Maingot's abdominal operations, in general USG, CT and especially MRI should not be routinely used in patients with acute peritonitis.

CAUSES OF DELAY IN DIAGNOSIS OF POSTOPERATIVE PERITONITIS:

It is always difficult to differentiate some clinical features of postoperative peritonitis from that of normal presentations after laparotomy. Abdominal pain usually complained by patients, especially sutureline pain or may be absent if very good analgesia achieved. Similarly, abdominal distention, absent bowel sounds, nausea, vomiting, absolute constipation, etc. suggestive of paralytic ileus; may be present as normal postoperative course or as manifestation of postoperative peritonitis. Fever, one of the important features of postoperative peritonitis, may appear due to even simple thrombophlebitis.

In the same way, clinical evidence of peritonitis (tenderness, guarding and rigidity) may not be that much confirmative as in other patients.

Leukocytosis, the only investigation with diagnostic value, may be present normally in postoperative period. But, newly

development of clinical features, reappearance of features after improvement or no improvement after expected time period suggests some underlying derangements, it may be postoperative peritonitis.

MANAGEMENT:

PRINCIPLES:

Supportive measures and Resuscitation

1. To combat hypovolemia and shock and maintain adequate tissue oxygenation.
2. To treat bacteria, not eliminated by surgery, with antibiotics.
3. To support failing organ system

Operative treatment

1. Repair: -control the source of infection
2. Purge: - evacuate bacterial inoculums, pus and adjuvant (Peritoneal toilet)
3. Decompress: - treat abdominal compartment syndrome
4. Control: - prevent or treat persistent and recurrent infection

The sine qua non of success is timely surgical intervention to stop delivery of bacteria and adjuvant into peritoneal cavity. All other measures are of little use, if the operation does not successfully abort the infective source and quantitatively reduce the inoculum of microorganism and adjuvants of infection so that they can be effectively handled by the patient's defense.

RESUSCITATION AND SUPPORTIVE MEASURES:

It is an axiom that in all cases of postoperative peritonitis, some degree of postoperative peritonitis, some degree of hypovolemia is present due to third space losses. The rapidity at which resuscitation is accomplished is dependent upon the degree of hypovolemia and the physiologic status of patient. The effectiveness of fluid replacement efforts can be judged by the normalization of pulse rate, blood pressure and mental status. Placement of urinary catheter is essential since restoration of urine output is a reliable indicator of adequate fluid resuscitation. Invasive peripheral arterial and central cardiac pressure monitoring catheters should be

placed in patients with frank septic shock, advanced age or cardiac, pulmonary or renal insufficiency to provide more precise determination of intravascular volume and cardiac output.

Supplemental oxygen may be necessary and in more extreme circumstances, endotracheal intubation and mechanical ventilation may be needed.

Nasogastric decompression should be used in the presence of an ileus to prevent pulmonary aspiration and reduce abdominal distention

ANTIBIOTIC THERAPY: ,

- Prolonged experiments suggested that *E. coli* and *B. fragilis* are main target organisms in postoperative peritonitis. 5
- The current practice of early empirical administration of antibiotics against these bacteria is well established.
- Issues to be considered are:
 - Choice and timing of drugs
 - Need for operative cultures
 - Duration of postoperative administration

CHOICE AND TIMING OF DRUGS:

The emerging concepts suggest that less, in terms of the number of drugs and the duration of treatment is better. To hit the primary endotoxin producing target organism *E. coli*, an antibiotic that kills all strains and thus does not induce resistance is required. Third generation cephalosporins meet this requirement. The once popular 'triple' regimen of the 1970s (ampicillin, an aminoglycoside and metronidazole or clindamycin) has become obsolete. Aminoglycosides are significantly more nephrotoxic than third generation cephalosporins, are inefficient in the low pH level of the infected peritoneal environment and are no longer first choice of antibiotics in initial treatment of intraabdominal infection.

B. fragilis (& other anaerobes) easily covered by metronidazole or clindamycin.

Half of the patients in one series by Stone H H et al, 1983; had been cured of infection with antibiotics to which their aerobic bacteria were resistant. , This suggests that in many

instances, operation alone may be curative, a well-known reality in the premicrobial era, when the mortality rate was reduced from 90% to 40% by introducing operative management.

NEED FOR OPERATIVE CULTURES: ,

The value of obtaining routine intraoperative peritoneal cultures has become questionable because the results rarely influence clinical decisions and usually they are available only when therapy is no longer necessary

DURATION OF POST OPERATIVE ADMINISTRATION

If a patient is afebrile, have a normal leukocyte count and a band count of less than 3%, the chance of recurrent sepsis following discontinuation of antibiotic therapy is virtually zero¹². On the other hand, the probability of recurrent sepsis if the temperature or leukocyte count is elevated ranges from 33% to 50%¹³.

If patient has a persistent leukocytosis or fever by postoperative day 7-10, a diligent search should be initiated to locate the source of persistent sepsis.

Acc. to Whittman et al, 1996; group of surgeons believe that persistent of post operative pyrexia or other clinical and laboratory signs of infection is not an indication to continue, restart or change antibiotics.²

OPERATIVE TREATMENT:

PRINCIPLE 1: CONTROL THE SOURCE OF INFECTION.

Generally, the choice of the procedure and whether the ends of resected bowel are anastomosed, exteriorized, or simply closed depends on anastomotic source of infection, the degree of peritoneal inflammation and generalized septic response, and the patient's premorbid reserves.

The prevailing trend has been to minimize the immediate risk of complication by avoiding any intestinal suture lines in presence of severe peritonitis.²

In the present study mortality was more in the group of patients who undergone extereiorisation, because their general condition were very poor as compared to rest of the patients.

PRINCIPLE 2: PURGE

That means to evacuate bacterial inoculum, pus and adjuvants [peritoneal toilet]

Any dead or foreign material, including haemoglobin, in the peritoneum potentiates the action of bacteria and for fewer are required to cause serious infection if foreign material is present⁶. So, all infectious fluids should be aspirated and particulate matter should be removed¹⁴.

Three different approaches have been suggested¹⁴

- Mechanical cleansing
- Peritoneal lavage
- Aggressive debridement

MECHANICAL CLEANSING:

Cleansing the peritoneal cavity with swab especially the local part was thought to reduce spread of bacteria and localize the process. But now it is evident that bacterial contamination is rapidly disseminated throughout the peritoneal cavity by so called intraperitoneal circulation.¹³

PERITONEAL LAVAGE:

What could be more natural, then, that surgeons since the time of Lister and Halsted have attempted to "wash" wound and peritoneum clean by using copious quantities of saline, solution of antiseptics or solutions of antibiotics.

The problem is that bacteria rapidly become attached to tissues, often by reaction between bacterial surface ligands and cell receptors.¹⁵ These bacteria cant be removed by gentle washing, although they can be removed by "pulsating jet lavage" at pressure upto 70 psi.¹⁶

Experimental studies on rat suggested that antimicrobial lavage produced an immediate decrease in mesothelial microbial recovery. The results were transitory and the microbial populations achieved or exceeded pre lavage levels at 24 hr post lavage.¹⁵

Lavages with antiseptic solutions like povidone-iodine, chlorhexidine, etc., have not established safely or efficacy in experimental or clinical trials.¹⁷

Lavage with solutions of antibiotics during operation for bacterial peritonitis is a little better established. In Britain, audit from Aberdum on use of peritoneal and wound lavage with several liters of 0.1% tetracycline had reduced rate of wound infection to 8% and intraabdominal infection to 4% in 187 patients.⁶ In USA, Noon and associates had observed the same results. It might be assumed that the concentration in the peritoneal exudates of antibiotics given systemically

parallels the concentration in serum while local application results in an unequal distribution within peritoneal cavity. Local therapy may be advantageous because penetration to the infected spaces during systemic therapy is markedly reduced.¹⁴

In my study all patients were given through peritoneal lavage.

AGGRESSIVE DEBRIDEMENT:

Recently, this modality of treatment reopened by Hydspeth.¹⁸ He felt that main benefit attained from lavage was its debridement effect. He used to open all peritoneal cavities and meticulous dissection of fibrinous exudates and debris was done. He found promising results.

There are several objections to this method, the most serious being that bleeding from damaged surfaces results in hemoglobin and fibrin deposition, both known to be potent adjuvants to infection.

In a prospective randomized trial, Polk & Fry¹⁹ found no differences in terms of hospital mortality or the frequency of reoperation.

It seems, therefore, that a general recommendation of aggressive debridement in all cases of peritonitis cannot be given.¹⁴

According to Kisschner "The early cleansing fanaticism to eliminate fibrin deposits by barbaric procedures of wiping and ripping is to be condemned"¹⁴

At the termination of intra abdominal procedure, the question remains whether a drain or several drains should be left behind. Nobody would object to the statement that it is better to allow dead and live bacteria to be drained out continuously instead of being absorbed.

But there are still several objections to drainage of peritoneal cavity²⁰

- Fibrous tract will develop within a short period, which do not communicate with abdominal cavity as such.
- Contamination from the outside might occur.
- Visceral erosion with fistulization and bleeding has been reported.
- Drains may interfere with proper sealing of

anastomoses.

Drains will be effective in evacuating abscesses, establishing a controlled fistula, or offering a pathway for visceral secretions^{2,14}

PRINCIPLE 3: CONTROL [PREVENT OR TREAT PERSISTENT AND RECURRENT INFECTION.]

It is an attempt to continue peritoneal toilet post operatively. 3 major approaches have emerged.¹⁴

- Continuous postoperative peritoneal lavage.
- Planned relaparotomies
- Laparotomy (the lift open abdomen)

CONTINUOUS POST OPERATIVE PERITONEAL LAVAGE:

TECHNIQUE

This may be performed by different means. Two inflow catheters in the subphrenic spaces and two outflow catheters in the pelvis are the most prevalent arrangements.

The time period of either intermittent or continuous lavage usually ranges from 1 to 5 days. Most authors add antibiotics to the lavage fluids.

The basic question in all lavage procedure is whether it is possible to irrigate the abdomen properly or whether drainage tracts develop. So that only the drains communicate and one irrigated continuously.

Hallerback & Andersson²¹ had evaluated continuous peritoneal lavage in the treatment of purulent peritonitis in a prospective randomized study and found no clinical benefit of it.

PLANNED RELAPAROTOMIES OR ETAPPENLAVAGE:

Indications for staged abdominal repair²

1. critical patient's condition
2. excessive peritoneal edema preventing abdominal closure without undue tension, intra abdominal pressure > 15mmHg
3. massive abdominal wall loss
4. impossibility to eliminate or to control source of infection

5. incomplete debridement of necrotic tissue.
6. uncertainty of viability of remaining bowel
7. uncontrolled bleeding (the need for 'packing')

It has been suggested for patients with diffuse peritonitis being at high risk of developing MODS.

TECHNIQUE:

Planned relaparotomies or also known as "Etappenlavage" is defined as a series of planned multiple operative procedures performed at a 24 hrs interval ²². It includes a commitment to reexplore the patient's abdomen at the initial corrective operation.

The abdomen can be closed temporarily utilizing extension suture, a simple zipper, a slide fastener and Velcro analogues.

The advocates of an absorbable mesh claims that it reduces intra abdominal pressure, prevents evisceration, and allows for effective drainage of the abdominal cavity; however, the development of diffuse, patchy necrosis of the bowel wall resulting in fistula formation has been described. ¹⁴

Wittman²² found Velcro analogue as the most practical device for temporary abdominal closure. In the same study he found reduction of overall mortality due to diffuse peritonitis from between 34.93% to 24%. Penninekx et al 1983 ²⁵ also found planned relaparotomies beneficial in patients with severe peritonitis and reduction of mortality from 73% to 29%.

Whereas Anderws ²³ compared planned reoperation with the policy of observation following the primary operation when indicated by signs of continuing infection and he found no difference in mortality. Similarly Christou et al 1993 ²⁴ had not found any significant difference in mortality between patients treated with a " closed abdomen technique" (31% mortality) and those treated with variation of the " open abdomen technique" (44% mortality).

Also, with this approach patients need to ventilate mechanically for longer period post operatively. As in series of Wittman the average period of mechanical ventilation was 17 days. So, turely, there are, as yet, no standards in this field.¹⁴

LAPAROSTOMY (LEFT OPEN THE ABDOMEN)

Technique:

Open packing of the peritoneal cavity with delayed closure had been advocated as useful technique in operative management of patients with diffuse peritonitis. This method treats the entire abdominal cavity as if it was on abscess cavity and theoretically establishes optimum drainage.

Steinberg 1979 ²⁵ had attempted this technique & had found dramatic improvement in outcome. Duff & Moffat 1981 ²⁷ confirmed that findings and conclude that leaving the abdomen completely open facilitates the widest possible drainage, uncompromising debridement of abdominal wall, and is compatible with good recovery. Mortality was 34%. Anderson et al 1983 ²⁸ found no advantage of keeping abdomen open in-patient with severe peritonitis. Contrary he reported 60% mortality as compare to 33% in control group and increased post operative complications. Like ettapenlavage in this technique patients need mechanical ventilatory support post relaparotomies. Average period of ventilatory support in series of Duff and Moffat was 44 days.

We also tried this modality in our three patients but did not found any more advantage.

Much remains to be done in this field in order to develop standards of management that can be generally accepted.

Figure 11

TREATMENT OF RESIDUAL AND PREVENTION OF RECURRENT INFECTION		
PRINCIPLE	ADVANTAGES	OBJECTIVES
Continous post operative peritoneal lavage	<ul style="list-style-type: none"> o Continous wash out of infectious material o Possibility of local antibiotic treatment o No anesthesia required 	<ul style="list-style-type: none"> o Complication of drains o Risk of fluid overload o Development of adhesion lined drainage tracts preventing adequate lavage
Planned Relaparotomies	<ul style="list-style-type: none"> o Prompt recognition of complication o No psychologic problem in reintervention o No drainage 	<ul style="list-style-type: none"> o Prolonged intubation o Repeated damage to the abdominal wall o Rebleeding and risk of additional damage
Laparotomy	<ul style="list-style-type: none"> o Spontaneous drainage o Relief of intra abdominal pressure o Simplified reintervention 	<ul style="list-style-type: none"> o Retraction of the abdominal wall o Succulence of the intestine o Fistula formation o Prolonged morbidity and major reintervention necessary

PREVENTION:

" PREVENTION IS BETTER THAN CURE "

- As there is very high mortality and morbidity associated with postoperative peritonitis, prevention should be the main goal.

- The main etiological factor for postoperative peritonitis is disruption of anastomotic site, that to be prevented.
- The prevention of anatomic disruption and following post operative peritonitis starts from pre operative period that includes:
 - good bowel preparation that may not be possible pre operatively in emergency condition, in that circumstances one may go for intraoperative mechanical lavage and avoidance of soilage.
 - Systemic antibiotic pre operatively and throughout procedure.
 - Improve patient's nutrition. Parameters showing poor nutritional status are
 - weight loss of 10-15% of total body weight over
 - 3-4 months or shorter period
 - S. Albumin < 3 gm %
 - S. Transferrin < 220mg %
 - energy to injected recall antigen
 - inability to perform usual tasks because of weakness
 - or easy fatigability
- intra operative measures
 - sound surgical procedure
 - anastomosis to be done in healthy bowel with adequate blood supply
 - meticulous haemostasis
- if there is severe peritonitis on first operation than avoidance of anastomosis and exteriorization of bowel.
- Post operative measures:
 - prevent hypotension
 - maintain good nutrition status
 - adequate antibiotic coverage

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