"A CLINICAL STUDY ON FOURNIER'S GANGRENE"

Dissertation submitted in

Partial fulfilment of the regulations required for the award of

M.S. DEGREE

In

General Surgery Branch - I

THE TAMILNADU

DR. M.G.R. MEDICAL UNIVERSITY

CHENNAI

APRIL, 2013.

CERTIFICATE

This is to certify that this dissertation titled "A CLINICAL STUDY ON FOURNIER'S GANGRENE " submitted to the Tamil Nadu Dr. M.G.R. Medical University, Chennai in partial fulfillment of the requirement for the award of M.S Degree Branch - I (General Surgery) is a bonafide work done by Dr. S.V. Vigneswara srinivasan, post graduate student in General Surgery under my direct supervision and guidance during the period of September 2011 to November 2012.

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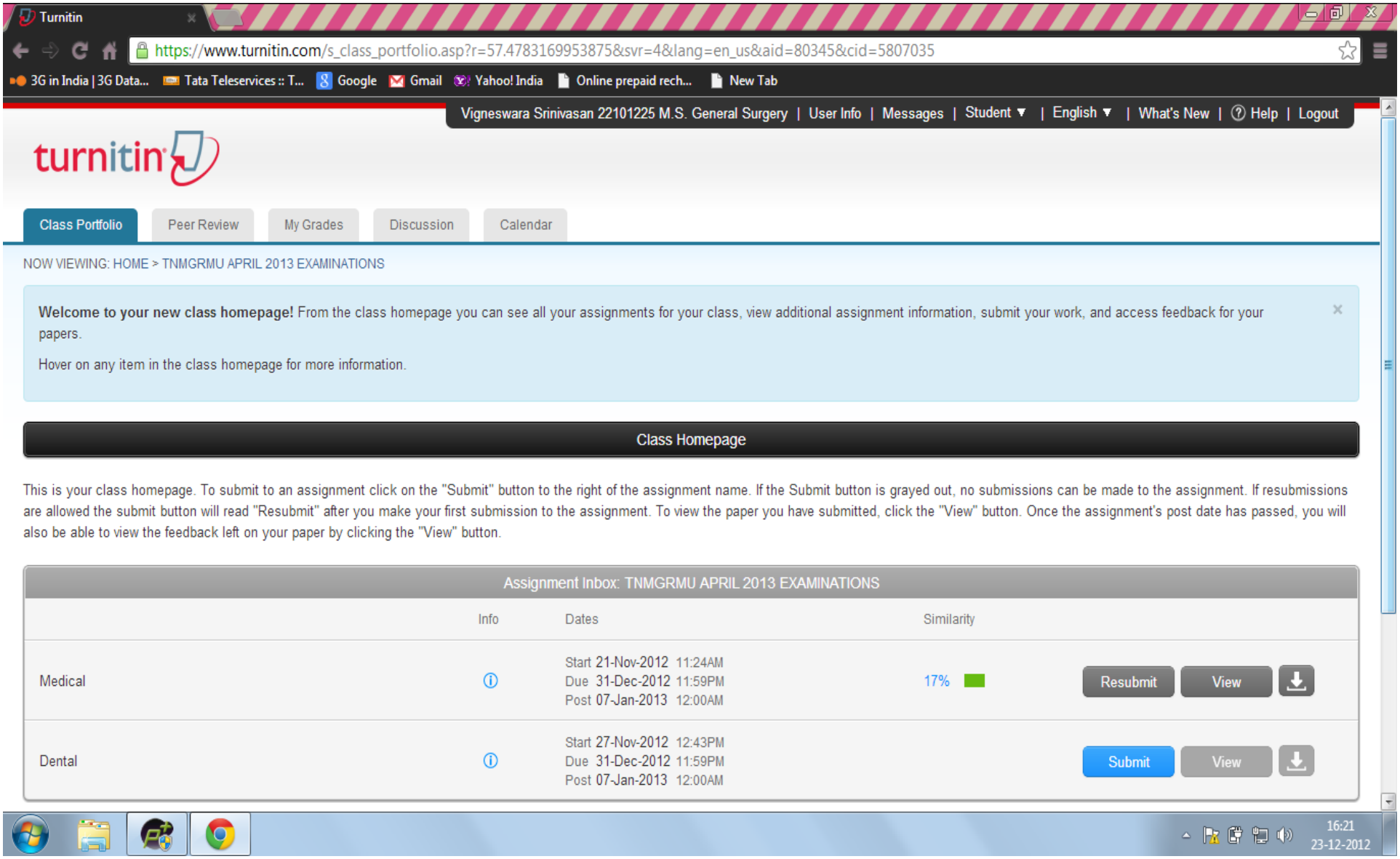
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DECLARATION

I hereby declare that the dissertation entitled ***"A CLINICAL STUDY ON FOURNIER'S GANGRENE"*** was done by me at Coimbatore Medical College Hospital Coimbatore – 641018 during the period of my post graduate study for M.S. Degree Branch-1 (General Surgery) from 2010 to 2013.

This dissertation is submitted to the Tamil Nadu Dr. M.G.R. Medical University in partial fulfilment of the University regulations for award of M.S., Degree in General Surgery.

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CONTENTS

LIST OF COLOUR PLATES

LIST OF TABLES

ABSTRACT

TITLE : A CLINICAL STUDY ON FOURNIER'S GANGRENE

BACKGROUND : Fournier's gangrene is necrotizing fasciitis of the external genitalia and perineum.

OBJECTIVE : To study the etiology, microbiology, reconstructive procedures and mortality associated with fournier's gangrene.

STUDY PLACE AND PERIOD : Coimbatore Medical College Hospital, September 2011 to November 2012.

METHODOLOGY : 34 patients presented to the outpatient department and emergency department were included in the study. Information regarding etiology, microbiology, reconstructive procedures and mortality was studied.

RESULTS : The disease most commonly originates from anorectal source (35.3%). Diabetes mellitus is the most commonly associated comorbid factor (38.2%). The disease is most commonly Polymicrobial (79.4%). The most commonly isolated organism is E coli (47%). Mean number of debridement performed is 2.9. Reconstructive procedure were performed in 50% of individuals and primary closure is the commonly

performed surgery (38.2%). Mortality associated with the series is 11.8%. FGSI is a useful indicator in predicting mortality.

CONCLUSIONS : Despite of recent advances the disease still carries significant mortality. Early resuscitation with aggressive debridement is required in most of the cases.

KEYWORDS : Fournier’s gangrene, necrotizing fasciitis, diabetes mellitus, Polymicrobial, mortality, reconstructive procedures.

Introduction

INTRODUCTION

Fournier's gangrene is the fulminant necrotizing fasciitis of the perineum and genitalia resulting from polymicrobial infection. This disease is known to be prevalent since many centuries.

Most patients have comorbid conditions like diabetes, alcoholism etc. At present, cause of the disease is identifiable in most of the cases. High mortality associated with Fournier's gangrene ranges from 6.3 to 50%.

Fournier's gangrene severity index (FGSI) is a useful indicator to predict the mortality and survival associated with Fournier's gangrene. Reconstructive strategies are needed when large tissue defects result from extensive tissue damage.

Hence an attempt to study the etiology, microbiology, reconstructive procedures and mortality associated with Fournier's gangrene is done.

AIM OF THE STUDY

- To study the etiology and microbiology associated with Fournier's gangrene.
- To study the reconstructive procedures done in a patient with Fournier's gangrene.
- To study the mortality associated with Fournier's gangrene and to study the usefulness of FGSI in predicting the mortality and survival.

Review of Literature

HISTORY OF FOURNIER'S GANGRENE

Fournier's gangrene is an antiquity disease. Emperor Herod of Judea was suspected to be suffering from perineal gangrene in association with Diabetes mellitus.

The history of Fournier's gangrene goes back to 18th century. In the year 1764, Baurienne originally described an idiopathic, rapidly progressive soft-tissue necrotizing process that resulted in gangrene of the male genitalia and perineum.

However, the disease was named after Jean-Alfred Fournier, a French venereologist who described the disease in detail. In 1883 he presented a series of cases (five) of perineal and scrotal gangrene in otherwise healthy males. He emphasised three characters of the disease

- Sudden onset
- Rapid progression
- Absence of a definitive cause (although cause is identifiable in most of the cases at present)

Since it was described by Fournier various changes have undergone in the definition of the disease and its various treatment methods. Now it has also been described in elderly patients and also in children (Woodside, 1980), women (Lowthian and Gillard Jr, 1980).

ANATOMY

The anatomy of the male genitalia and perineum is a complex one. It influences the onset and rapid progression of Fournier's gangrene. The spread of infectious process involves the superficial as well as the deep tissue fascial planes.

As the organisms responsible for the infection multiply, the infectious process spread along the anatomical tissue fascial planes. Muscles and to a variable degree the overlying skin is usually spared. But myonecrosis is also reported in rare circumstances. (Rye et al., 1987).

This particular phenomenon has implications on both initial debridement and subsequent reconstruction. .

Skin and superficial fascia

As Fournier's gangrene is a disease process involving the superficial and deep tissue fascial planes a good understanding of the anatomy of the skin and subcutaneous structures of the abdominal wall, genitalia and perineum is necessary.

The skin cephalad to the inguinal ligament is backed by superficial fatty camper's fascia. The superficial vessels to the skin run through this layer. Scarpa's fascia is membranous layer deep to Camper's fascia.

The Scarpa’s fascia blends into Colles fascia in the perineum. The colle's fascia is otherwise known as superficial perineal fascia. It also continues with Dartos' fascia of the penis and scrotum.

There is a potential space between Scarpa’s fascia and deep fascia of the anterior abdominal wall. It allows for the spread of infection from the perineum to the anterior abdominal wall. Superiorly, Scarpa’s and Camper’s fascia fuse and attach themselves to the clavicles, thereby limiting further spread of infection.

Colles’ fascia has attachments to the pubic arch and the base of the perineal membrane. And it continues with the superficial Dartos’ fascia of the scrotum.

The perineal membrane is otherwise called as the inferior fascia of the urogenital diaphragm. Along with the Colles fascia it defines the superficial perineal space.

The contents of this space include the bulbourethral glands, membranous and bulbar urethra. And also this space is in close proximity to the anterior anal wall and the ischio-rectal fossa.

And hence infections of the male urethra, bulbourethral glands, perineum or rectum can drain into the superficial perineal space, from where it can extend into the scrotum and to the anterior abdominal wall or

even up to chest wall to a level so cephalad as the clavicles (Saijo et al., 1990).

Blood supply to skin of the lower abdomen and genitals

The lower aspect of the anterior abdominal wall is supplied by the branches of the inferior epigastric artery and by the branches of the deep circumflex iliac artery. The scrotal wall is supplied by the branches from the external and internal pudendal arteries.

Most of these vessels travel via Camper's fascia, the exception being internal pudendal artery and hence become thrombosed in the progression of the infectious process.

The viability of the skin of the genitals and perineum is jeopardised by the thrombosis. More often than not skin of the posterior aspect of the scrotal wall, which is supplied by the internal pudendal artery remains unaffected. Hence the skin of the posterior aspect of the scrotal wall can be used in the process of reconstruction following resolution of the infection.

Penis and scrotum

The contents of the scrotum are testes with cord structures and the epididymis. They are surrounded by several fascial layers distinct from

the Dartos fascia. In this aspect many important anatomical relationships are to be considered.

The external spermatic fascia is the outermost superficial layer of the testis and cord. It is continuation of the external oblique aponeurosis . It is followed by the internal spermatic fascia, which is in continuity with the transversalis fascia.

Buck's fascia is the deep fascia that covers the erectile bodies of the penis, corpora cavernosa, and anterior part of urethra. Deep in the pelvis, Buck's fascia fuses with the dense, firm and fibrous tunica albuginea of the corpora cavernosa.

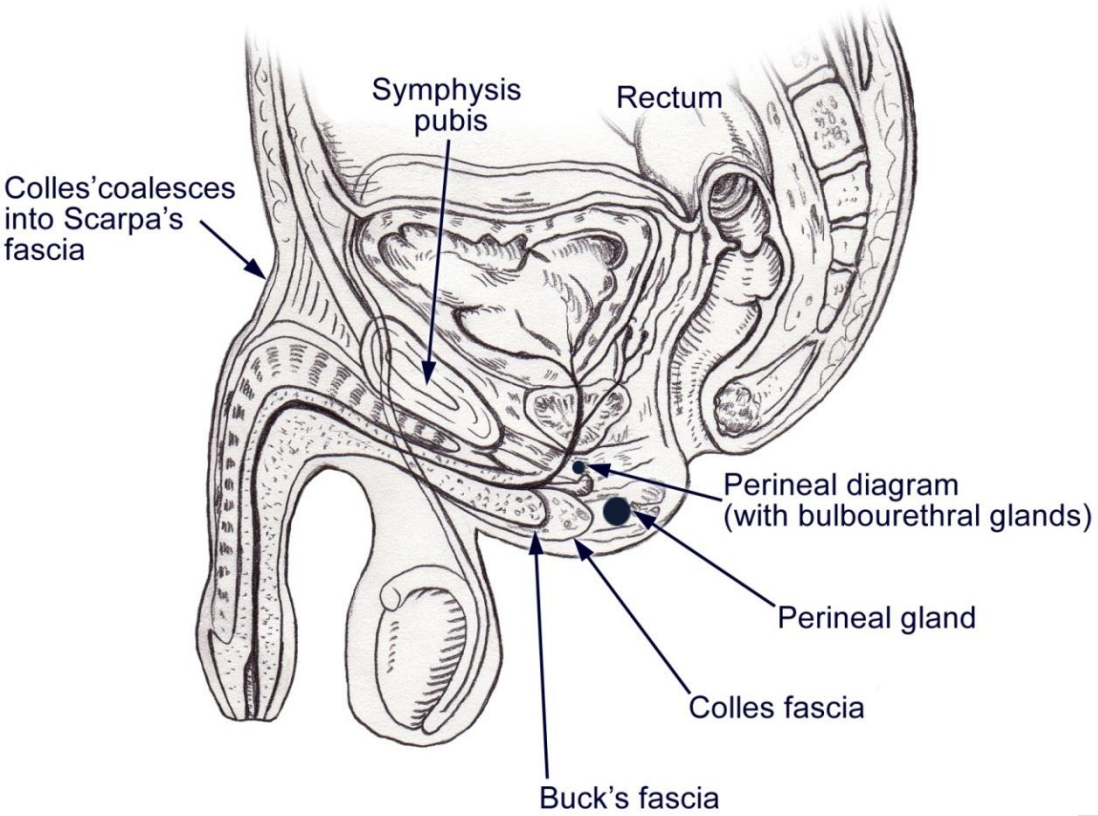
These fascial layers are not involved with an infection in the superficial perineal space. And hence can limit the depth of tissue invasion, in the spread of necrotizing infection of the genitalia.

So the usually unaffected structures in the Fournier's gangrene include

- Corpora cavernosa
- Urethra
- Testes (Gupta et al., 2007)
- Cord structures

The affected structures include skin and fascia

Perineal fascia



PATHOPHYSIOLOGY

Localized infection nearer to a portal of entry is the initiating event in the development of Fournier gangrene. The polymicrobial organisms are responsible for an array of reactions, activating different proteins and enzymes, thereby leading to aggregation of platelets, intravascular coagulation and ischemic changes in the tissues. The disease thereby rapidly progresses, causing thrombosis and irreversible necrosis of perineal and genitourinary areas.

Fournier gangrene is usually a polymicrobial infection. An average of 2~4microbes can be isolated in wound cultures from patients. The microbes involved act synergistically via various enzymes like collagenase and hyaluronidase to invade and destroy tissue fascial planes

So an obliterative endarteritis develops, and the resulting cutaneous and subcutaneous vascular necrosis leads on to localized ischemia facilitating more bacterial proliferation. Rates of tissue fascial destruction as high as 3 centimetres/hour have been reported in a few series. (Safioleas et al., 2006).

Infection of superficial perineal fascia (Colles fascia) may extend

- To penis and scrotum via Dartos fascia

- To the anterior abdominal wall via Scarpa's fascia.

Or it can be vice versa.

The Perineal fascia is attached to the perineal body and urogenital diaphragm posteriorly and to the pubic rami laterally. Hence the progression of the disease in these directions is halted. Testicular involvement is very rare, as the testicular arteries are the direct branches of aorta and have a blood supply separate from the affected region. (Gupta et al., 2007).

BACTERIOLOGY

Both aerobic and anaerobic organisms have been isolated in wound cultures from patients with Fournier's gangrene. It has been proposed as an essential bacteriological principle in the pathogenesis of Fournier's gangrene.

Wound cultures have revealed that it is a polymicrobial infection in most of the cases. An average of 2 - 4 organisms has been isolated in most of the cases. Streptococcus species, Escherichia coli are the most commonly isolated aerobes. Bacteroides are the most commonly isolated anaerobes(Patty et al., 1992)

Other commonly isolated organisms are:

- Klebsiella
- pseudomonas
- Staphylococcus
- Enterococcus
- Proteus
- Acinetobacter

Rarely isolated organisms include :

- Candida albicans (Kazuyoshi J, 2000)
- Clostridium tetani (Omotoso, 1990)
- Clostridium perferingens (Korhonen et al, 1998)

Increased incidence of methicillin resistant Staphylococcus aureus (MRSA) has been increasingly reported (Ndirika SC, 2010)

The microbes isolated are not independent predictors of outcome in most of the series (Ersay et al., 2007).

Frequency

It is a relatively uncommon disease. The real incidence of the disease is unknown. In a large population based study cases represented less than 0.02% of hospital admissions. The overall incidence was approximately 1.6/100,000 males.

Poor socioeconomic status contributes to the development of Fournier's gangrene. However regional prevalence and ethnic predisposition are not identified as risk factors.

Age and sex

Most cases occur in the age group of 30 – 60 years. Alfred Fournier originally described the Fournier's gangrene as a disease of young males. But the reported age of the patients with the disease has gradually increased in many of the recently published studies.

Male homosexuals are at a higher risk to acquire the disease because of the infections caused by drug resistant strains like methicillin-resistant Staphylococcus aureus (MRSA).

Most reported cases occur in age group of 30-60 years. A literature review found only 56 paediatric cases, with 66% of those in infants younger than 3 months. Now it is accepted that Fournier's gangrene can affect children (Montoya, 2009). The mortality associated with the

disease in children is lesser and the disease carries a favourable prognosis in children.

Male to female ratio in a large series is approximately 10 : 1 (Eke, 2000). The lower incidence of the disease in females may be because of better drainage of perineal secretions.

CAUSATIVE FACTORS

Although originally described as an idiopathic gangrene of the genitalia and perineum Fournier's gangrene has an identifiable cause in most of the cases (75 to 95%).The disease process commonly has source of infection in the anorectum, the urogenital tract, or the skin of the genitalia. Localized infection nearer to a portal of entry is often the inciting event in the development and progression of Fournier's gangrene.

Urogenital origin

- Surgery or other invasive procedures in urogenital territory like vasectomy, catheterisation, biopsies in prostate etc.
- Accidental local trauma
- Local infection such as epididymitis, chronic UTI, periurethral abscesses
- Urethral stricture is one of the most important causative factors. Urethral stricture may lead to urethral diverticula may eventually rupture inducing urine extravasation. Thus the leak of contaminated urine may lead to the origin of Fournier's gangrene. (Yanar H et al, 2006)
- In females additional causes include septic abortion, episiotomy, hysterectomy and bartholin's abscess (Eke, 2000)

Anorectal origin

- Perianal abscess is the important cause of Fournier's gangrene in this region
- Trauma to the anorectal region (Smith et al., 1998).
- Carcinoma of the colon and rectum
- Diverticulitis
- Haemorrhoidal interventions
- Perianal fistulotomy
- Anal fissures
- Colonic perforations

Cutaneous origin

- Scrotal furuncle
- Blunt perineal trauma
- Genital toilet (scrotum)

Idiopathic origin

- Currently idiopathic origin constitutes a lower percentage of cases.

PREDISPOSITION TO DISEASE

Any condition or pathology that reduces cellular immunity may predispose the patient to the development of Fournier's gangrene. The following is the list of common predisposing conditions

- Diabetes mellitus
- Chronic alcoholism
- Chronic renal disease
- Cirrhosis, liver diseases
- HIV infection
- Malignancy
- Leukaemia
- Morbid obesity
- Malnutrition
- Iatrogenic immunosuppression
- SLE, crohn's disease

Diabetes mellitus

In most of the series it is considered to be the most important predisposing factor. Hyperglycaemia has detrimental effect on cell mediated immunity. It may be due to

- Neutrophil dysfunction
- Reduced phagocytic activity

Tissue ischemia caused by small vessel disease is another contributing factor for enhanced spread of the disease. For these reasons case fatality rate of Fournier's gangrene in diabetic patients is higher. But it is not uniformly proven (Korkut et al., 2003).

Chronic alcoholism

It is considered to be the second commonest predisposing factor, according to most of the authors. In a few publications it is considered to be the most prevalent predisposing factor.

HIV

The rise in the incidence of HIV infections in recent years has opened up an increased amount of population at risk for development of the Fournier's gangrene.

CLINICAL FEATURES

The characteristic of Fournier's gangrene is the combination of severe pain and tenderness in the genital region. Usually the stepwise progression of the disease occurs in the following phases

- It starts with prodromal symptoms like fever and lethargy, for a period of 2-7 days
- Severe pain and tenderness in the genitalia and groin. Associated pruritis and skin oedema develops.
- Pain and tenderness progressively increases. Associated erythema develops.
- Skin appears dusky. Subcutaneous crepitations develop.(due to the presence of anaerobes, Hejase et al., 1996)
- Obvious gangrene of the genitalia with pus discharge from the wound, with or without the involvement of perineum.

In the early stages of Fournier's gangrene, pain is the predominant symptom. It is usually in out of proportion to the signs (smith et al., 1998). As gangrene ensues, pain gradually subsides as the nerve elements are destroyed.

There is wide variation in systemic effects. It ranges from nil toxic features to septic shock. Usually when the extent of necrosis is greater, the systemic effects are profound.

PHYSICAL EXAMINATION

The physical examination should comprise of the palpation of perineum and external genitalia. It also includes the per rectal examination, to assess for signs and to find the source of infection

Localized tenderness, subcutaneous crepitus, signs of fluctuation or occult wounds if any should be duly noted.

Skin over the affected region may be normal, erythematous, edematous, cyanotic, bronzed, indurated, blistered, and/or frankly gangrenous. The extent of skin involvement is not the marker for the extent of the underlying disease.

Anaerobic organisms in many instances produce a feculent odour. Crepitus can be present. But if it is not elicited the presence of Clostridium or other gas-producing organisms cannot be excluded.

The scrotal and perineal involvement is common. But testicular involvement is very rare because of testicular arteries being direct branches of aorta (Gupta et al., 2007).

The extent of involvement can be

- Limited to the genitals
- Extending to the perineum
- Extending to proximal thigh and anterior abdominal wall

Systemic symptoms like fever, tachycardia and hypotension may be present and is variable.

In summary the key to diagnosis of Fournier's gangrene is the presence of intense pain in perineal and genital region with rapid local changes accompanied by systemic symptoms that are often excessive to the initial clinical findings.

PROGNOSTIC SCORING SYSTEM

To study about the clinical features and prognostic factors in patients who are being treated for Fournier's gangrene, Acute Physiology and Chronic Health Evaluation (APACHE) II, Fournier's Gangrene Severity Index (FGSI) score and other scoring systems are being used.

Among them all the FGSI is very useful and it can predict mortality and survival with high accuracy for patients with Fournier's gangrene, according to several authors. The FGSI score is calculated twice, at the time of admission and at the time of discharge or death.

FGSI's modified scoring system has also been developed the commonly used one being The Uludag Fournier's gangrene severity index which also takes into consideration of the age and dissemination of the disease. (Yilmazlar T et al., 2007)

The FGSI is based on deviation from reference ranges of the following clinical parameters:

FGSI

	High Abnormal Values				Normal	Low Abnormal Values			
Physiologic Variables / Point assignment	+4	+3	+2	+1	0	+1	+2	+3	+4
Temperature (C) [	>41	39–40.9	—	38.5–38.9	36–38.4	34–35.9	32–33.9	30–31.9	<29.9
Heart rate (bpm)	>180	140–179	110–139	—	70–109	—	55–69	40–54	<39
Respiratory rate	>50	35–49	—	25–34	12–24	10–11	6–9	—	<5
Serum potassium (mmol/L)	>7	6–6.9	—	5.5–5.9	3.5–5.4	3–3.4	2.5–2.9	—	<2.5
Serum sodium (mmol/L)	>180	160–179	155–159	150–154	130–149	—	120–129	110–119	<110
Serum creatinine (mg/100 ml) (x2 for acute renal failure)	>3.5	2-3.4	1.5-1.9	—	0.6-1.4	—	<0.6	—	—
Hematocrit (%)	>60	—	50–59	46–49	30–45	—	20–29	—	<20
White blood count (91000/mm3)	>40	—	20–39.9	15–19.9	3–14.9	—	1–2.9	—	<1
Serum bicarbonate, (venous) (mmol/L)	>52	41–51	—	32–40	22–31	—	18–21	15–17	<15

Each parameter is given a score between 0 and 4, with the higher values indicating more deviation from normal. The FGSI represents the sum of all the parameter values.

Laor and colleagues stated that a FGSI greater than 9 associated with increased mortality.

The Uludag Fournier's gangrene severity index Yilmazlar T et al (2007)

Variables	+4	+3	+2	+1	0	+1	+2	+3	+4
a. Physiological parameters									
Temperature (C) [	>41	39–40.9	—	38.5–38.9	36–38.4	34–35.9	32–33.9	30–31.9	<29.9
Heart rate	>180	140–179	110–139	—	70–109	—	55–69	40–54	<39
Respiratory rate	>50	35–49	—	25–34	12–24	10–11	6–9	—	<5
Serum potassium (mmol/L)	>7	6–6.9	—	5.5–5.9	3.5–5.4	3–3.4	2.5–2.9	—	<2.5
Serum sodium (mmol/L)	>180	160–179	155–159	150–154	130–149	—	120–129	110–119	<110
Serum creatinine (mg/100 ml) (x2 for acute renal failure)	>3.5	2-3.4	1.5-1.9	—	.6-1.4	—	<0.6	—	—
Hematocrit (%)	>60	—	50–59	46–49	30–45	—	20–29	—	<20
White blood count (91000/mm3)	>40	—	20–39.9	15–19.9	3–14.9	—	1–2.9	—	<1
Serum bicarbonate, (venous) (mmol/L)	>52	41–51	—	32–40	22–31	—	18–21	15–17	<15
b. Dissemination score									
Fournier's gangrene confined to the urogenital and/or anorectal region, add "1"									
Fournier's gangrene confined to the pelvic region, add "2"									
Fournier's gangrene extending beyond the pelvic region, add "6"									
c. Age score									
Age ≥60 years, add "1"									
Age <60 years, add "1"									

UFGSI = A+B+C

DIFFERENTIAL DIAGNOSIS

The following differential diagnoses should be considered before making a diagnosis of Fournier's gangrene. The following are the main differential diagnosis of fournier's gangrene proposed by Smith et al., 1998

- Cellulitis
- Strangulated Hernias
- Scrotal abscesses
- Herpes simplex
- Vasculitis
- Gonococcal infections
- Local traumatism
- Pyoderma gangrenosum

Other differential diagnoses to be considered are

- Balanitis,
- Orchitis
- Epididymitis
- Torsion testis
- Gas gangrene
- Infected hydrocele

INVESTIGATIONS

LABORATORY INVESTIGATIONS

Complete hemogram

It is helpful in the following aspects

- The immunologic stress due to the infection is assessed
- The adequacy of the red blood cell mass is assessed.
- The potential for sepsis-induced thrombocytopenia is evaluated.

Coagulation profile (i.e., PT, APTT, platelet count, fibrinogen level)

It is helpful to diagnose sepsis-induced coagulopathy.

Blood culture

It is helpful to assess for septicaemia.

Other useful investigations are

- serum electrolytes
- Blood urea nitrogen [BUN]/creatinine ratio
- Random blood sugar
- Arterial blood gas (ABG) analysis provides an accurate assessment of acid/base imbalances

Corcoran et al. described significant differences in survival benefits based on laboratory parameters such as high serum Creatinine, lactate and calcium or low bicarbonate. Increased serum calcium may be due to renal failure, bacteraemia or because of parenteral nutrition. (Corcoran et al., 2008)

BUN level >50 mg% is statistically significant parameter for assessing the mortality associated with fournier's gangrene. (Clayton et al., 1990)

Altered serum creatinine, haematocrit, haemoglobin and alkaline phosphatase levels correlated with a bad prognosis in the non-survival group.

A few studies have demonstrated that hypomagnesaemia at the time of admission is associated with higher mortality in critical ill patients. Decreased intestinal absorption, increased urinary losses and intracellular shift are possible reasons for this effect.

Monitoring of serum magnesium levels in patients with Fournier's Gangrene may have prognostic and therapeutic implications and is used today in specialized groups. (Erol at al., 2010)

IMAGING

Imaging studies are useful

- in cases of atypical presentations
- to know the extent of the disease

Gas within the soft tissue is detected better with imaging modalities than with the clinical examination.

Conventional radiography

Conventional radiography should be the initial imaging modality. It is economical and readily available. It can demonstrate the following

- moderate-to-large amounts of soft-tissue gas
- foreign bodies if present
- Scrotal tissue edema.

Soft-tissue gas collections usually appear as an area of hyperlucency. Usually it becomes evident on radiography before they could become clinically apparent. However, absence of air on conventional radiography does not exclude the diagnosis of fournier's gangrene.

Computed Tomography

CT scan is the imaging modality of choice. The extent of the disease is defined better than plain films or ultrasound. Even smaller

amounts of soft-tissue gas that can be missed on conventional radiography can be diagnosed by CT scan. The fluid collections which track along the deeper fascial planes are also demonstrated.

Presence of collections, subcutaneous emphysema and its extent, including retroperitoneal extension, are better evaluated at CT. Findings in the CT scan include

- Soft-tissue and fascial thickening
- Soft-tissue gas collections
- Fat stranding

CT scan can also identify the underlying cause of the infection (e.g., perirectal abscess) in many cases. These findings may be helpful in surgical planning.

Post treatment follow-up CT scan can be used to predict improvement or worsening of the disease and may be helpful in planning additional surgical interventions.

Ultrasonography

Ultrasonography is useful to detect gas or fluid collections within the soft tissues of the scrotum. Gas in the scrotal wall is the "sonographic hallmark" of Fournier’s gangrene.

Gas can also be noted in perineal and perirectal areas. Scrotal wall edema can be seen. Testes and epididymes are unaffected under most circumstances.

Ultrasonography can also reveal other causes of acute scrotal pain like testicular injury, scrotal cellulitis, epididymo-orchitis, torsion testis, and complicated inguinal hernia.

The demerit of ultrasonography is the need for the application of direct pressure over the affected tissues. Patients of Fournier's gangrene with intense pain probably tolerate this procedure poorly.

Magnetic Resonance Imaging

Role of MRI in Fournier's gangrene is not clearly described in the literature. MRI yields better soft tissue details than CT scan. However, MRI scanning takes longer time, with limited ability for patient monitoring during the testing. Such practical problems can limit the practical usefulness of the MRI when the patient is critically ill. Also the use of MRI must not delay operative interventions if the diagnosis is highly suspected clinically.

HISTOLOGICAL FINDINGS

Histopathologic evaluation of the affected tissue may reveal the following pathognomonic features of fournier's gangrene

- Necrosis of the superficial and deep tissue fascial planes
- Fibrinoid thrombosis of the nutrient vessels
- Infiltration of Polymorphonuclear cells
- Microbes identified within the involved tissues

Fibrinoid thrombosis of the nutrient arterioles that supply the superficial and deep fascia is the most common finding in a case of Fournier disease.

Such extensive inflammatory process can present deep to intact skin. The skin itself is very often minimally affected with the inflammatory process until very late in the disease.

MANAGEMENT

Treatment of Fournier's gangrene involves several modalities.

MEDICAL MANAGEMENT

In cases where systemic toxicity manifest as hypoperfusion or organ failure, early aggressive resuscitation to restore normal tissue perfusion and function must take immediate priority over other diagnostic modalities, especially if these diagnostic modalities could jeopardize the resuscitative interventions.

Thus, the emergency management of patients with Fournier's gangrene involves aggressive resuscitation in anticipation of surgery as :

- Airway management if indicated
- Provision of supplemental oxygen
- Establishment of IV access
- Crystalloid replacement in patients who are dehydrated and displaying signs of shock with requirement of colloids in a few patients with severe dehydration
- Vasoactive drugs if necessary

Prompt broad spectrum antibiotics are indicated. Tetanus prophylaxis is usually indicated if associated soft tissue injury is present.

In addition accompanying comorbid conditions like diabetes and alcoholism must ultimately be addressed. Such comorbid conditions are very common in this group of patients. Failure to promptly address the comorbid conditions may jeopardise the success of the most appropriate medical and surgical interventions to resolve the Fournier's gangrene.

Broad spectrum antibiotics

Management of fournier's gangrene involves the institution of broad spectrum antibiotics. Empirical broad spectrum antibiotics should be started as early as possible till the culture reports could make way for culture directed antibiotics.

The antibiotic regimen chosen should cover staphylococci, streptococci, gram negative organisms, pseudomonas, E coli, clostridium, bacteroides etc.

Laucks, 1994 recommended the triple drug therapy comprised of 3rd generation cephalosporins or aminoglycosides plus a penicillin group of drug and metronidazole.

Other important empiric regimen consists of ciprofloxacin and clindamycin. Clindamycin is very useful in the management of necrotizing soft-tissue infections because of its activity over gram positive organisms and anaerobes.

In animal models of streptococcal infection the response rates of clindamycin have been found superior to that of penicillin and erythromycin. The reason being clindamycin in vitro studies have demonstrated toxin suppression as well as modulation of cytokine production (Stevens et al., 2005)

But clindamycin must always be administrated in association with other drugs because of high percentage of resistance to Bacteroides.

Vancomycin is useful to provide coverage against methicillin resistant Staphylococcus aureus – MRSA.

Current new clinical guidelines suggest the use of Carbapenems or piperacillin tazobactam . Tigecycline a new macrolide related antibiotic can be a good alternative in penicillin allergies patients. In case of colonisation by resistant bacteria adding up of linezolid or daptomicine is recommended (Stevens et al., 2005).

When there is associated sepsis syndrome, therapy with IV immunoglobulins which is thought to neutralize superantigens (streptotoxins A and B) have been proposed as a good adjuvant to antibiotics and extensive surgical debridement

If the tissue stains show fungi empirical antifungal agents like amphotericin B or caspofungin can be added.

SURGICAL DEBRIDEMENT

Once the diagnosis of Fournier's gangrene is well established all dead, nonviable, necrotic tissue must be vigorously excised. The skin is opened widely to expose the complete extent of necrosis of the fascial and subcutaneous tissues. The fascial planes that can be separated easily with blunt dissection are considered to be involved and therefore should be excised. The dissection is carried out to include the bleeding tissues.

The excised tissue should be sent for culture and sensitivity and for histologic assessment.

The overlying skin usually has an impaired blood supply and hence the skin should be excised if significantly undermined.

The testicles are usually spared of the necrotizing process. If there is testicular involvement in the disease process (very rare) or if its viability is questioned orchiectomy can be performed

Debridement of deep fascia as well as muscle is not usually recommended as these areas are also rarely involved similar to testes. Debridement must be stopped when the skin and subcutaneous tissue cannot be separated easily, because the extent of cutaneous necrosis is not a reliable marker.

Multiple surgical debridement of the necrotic tissue is the rule rather than the exception. In most of the studies an average of 3.5 debridements per patient is required.

It is widely recommend that the necrotic tissue should be debrided at the earliest. (Laor et al. 1995) could not make out significant difference between the time of onset of symptoms, early surgical debridement and mortality, but a few others studies by (kabay et al. 2008) and (Korkut et al. 2003) showed that lesser time interval associated with better results.

Asfar et al. published that insufficient debridements resulted in more mortality. Also repeated vigorous debridements with a few days' intervals have resulted in lesser mortality rates according to Kabay et al., 2008.

HYPERBARIC OXYGEN THERAPY (HBO)

Hyperbaric oxygen therapy involves placing the patient of fournier's gangrene in an environment of increased ambient pressure for breathing with 100% O2, thereby resulting in improved oxygenation of the blood and perfused tissues.

The indications of HBO includes

- Failure to resolve with conventional treatment
- Known case of clostridial involvement
- Myonecrosis and deeper tissue involvement

The benefits of hyperbaric oxygen demonstrated in in vitro studies include the following

- increased oxygenation for optimal neutrophil phagocytic function
- inhibition of growth of anaerobic organisms
- Improved fibroblast proliferation and also angiogenesis
- Resolving of edema by means of vasoconstriction and by increased transportation of intracellular antibiotics
- Hypoxia is also believed to reduce the efficacy of many antibiotics (vancomycin, ciprofloxacin etc.) whereas hyperoxia may have beneficial effect. For example

aminoglycosides act by crossing the cell membrane of the bacteria by an O2-depenent pump.

The disadvantages of HBO being

- toxic reaction to the central nervous system
- Barotrauma to the middle ear. In a few circumstances myringotomy may be required prior to the hyperbaric oxygen therapy.

The merits and demerits of Hyperbaric Oxygen Therapy continue to be a debate.

No long term prospective controlled study has been published for this modality of treatment. Though it is supported by a few small studies hyperbaric oxygen should not be a reason for delaying surgical debridement. (Riseman et al. 1990)

Not less than 6 studies have examined the effect of HBO therapy in the management of necrotizing soft tissues infections. Four of them report statistically significant survival benefits for patients and two of them not (Wilkinson & Doolette, 2004).

In most of the cases lack of infrastructure to perform hyperbaric oxygen therapy makes it difficult for any recommendations.

TOPICAL THERAPY

Naturally available unprocessed honey was used with encouraging results in the debridement areas. This beneficial effect is considered to be due to hypertonic environment and phenolic acids which provide the antibacterial effect.

Honey has a low pH of around 3.6. It contains enzymes which can digest necrotic tissues. The effects may be evident within a week of topical application of honey to the wound. But there is no randomized control study about the effectiveness of honey in these special situations.

Topical application of Sodium Hypochlorite 0.5 % solution (Dakin's Solution) and hydrogen peroxide (H_2O_2) in the postoperative period has been met with good results.

Topical application of hydrogen peroxide is justified when it is used in correct circumstances. But precautions should be taken when it is used in closed spaces or when under pressure, where liberated O_2 cannot escape. Dangerous side effects such as blood oxygen embolism have been reported under such circumstances.

Also subcutaneous crepitus produced by hydrogen peroxide solution can be confused with disease progression. (SLEIGH & LINTER, 1985)

Enzymatic debridements with application of lyophilized collagenase is other modality of local treatment that has been shown to be beneficial (Aşci et al., 1998)

Application of fibrin glue has been suggested recently in skin defects where there is no active infection (DeCastro & Morey, 2002).

The topical application of growth hormones and other trophic agents hold the potential to improve wound healing.

VACUUM ASSISTED CLOSURE SYSTEM (VAC)

The VAC system comprises of a foam dressing placed in debrided large areas with an overlying adhesive seal to regulate the pressure in the zone at sub-atmospheric levels. It works on the principle of local negative pressure treatment.

It has been found to

- bring down the local oedema
- Bring about improvement of local blood flow
- Improve granulation tissue formation.

The device can be cut for better fit in irregular wounds and cavities. The recommendations are to change the device every to 2-3 days.

The demerits are

- High costs
- Necessary patient immobilization

FAECAL DIVERSION

COLOSTOMY

Colostomy is a commonly employed technique performed for diversion in patients of fournier's gangrene with extensive perineal involvement. The rationale for faecal diversion includes a reduction in the number of microbes in perineal region as well as better wound healing. (Estrada et al., 2009)

Colostomy construction is justified in

- anal sphincter involvement
- faecal incontinence or continued contamination of the wound margins with faeces

In several studies the percentage of patients requiring colostomy is around 15% and it depends on the series (Yanar et al., 2006)).

In contrast to the papers of Corocan et al, a few others series reported that performing a diversion colostomy was associated with an increased mortality. Erol et al, Korkut et al reported a series of 45 cases of Fournier's gangrene and showed that mortality among the group not requiring a stoma was 7%, but were 38% in patients for whom stoma was required.

Diversion colostomy does not eliminate the need for multiple debridements, nor does it bring about reduction in the number of debridement procedures required. However it may allow an early oral intake, lessen the contamination of wounds thereby facilitating better wound healing.

However serious stoma- related complications have been described (Akcan et al. 2009). Also taken into the consideration should be the psychological consequences of a colostomy, in patients living with extensive mutilation of the body already.

RECTAL DIVERSION DEVICES

The Flexi-seal Fecal Management system is a silicone catheter that can divert fecal matter. It protects the wound from faecal soiling the same way to that of a colostomy. Thereby it reduces the risk of skin breakdown and repeated contamination with colonic organisms.

It is always recommended to explore the anal canal before placing the catheter so as to avoid rectal injuries. Estrada et al., 2009 proposed that these rectal diversion devices may also have financial benefits.

Contraindications include

- rectal neoplasm
- penetrating rectal injuries
- Fistulas.

Although a few authors suggest cystostomy for urinary diversion, many believe that urinary catheterization is sufficient in most of the cases (Yanar et al., 2006).

POSTOPERATIVE CARE

Renal complications

Renal failure is the most common complication in patients with fournier's gangrene. The potential fatal complications like uraemia, acidosis can be corrected by

- Fluid resuscitation
- vasoactive drugs
- Haemodialysis
- Administration of albumin in these septic patients, appears to improve survival in many trials.

Blood sugar control

Strict sugar control in the intensive care period is mandatory for the optimal homeostasis of the septic patient. In a few cases, insulin pump infusion may be necessary to achieve this objective.

Nutritional support

It has been a long recognized fact that stress causes an increase in basic energy requirements in septic patients. In patients with fournier's gangrene repeated surgical procedures and mechanical ventilation reduces the quantity and quality of oral intake.

In such cases provision of nutritional supplementation via parenteral nutrition alone will not assure adequate nutritional intake in a high percentage of patients. Few data show that such critically ill population requires a provision of calories at around 125% of basal energy requirements (Graves et al., 2004)

It can be achieved by providing additional enteral supplementation. Many articles have explained the theoretical benefit of addition of oligo-elements like arginine, citrulline and glutamine in the diet of these patients.

Plasma concentrations of L-arginine are markedly reduced in patients with sepsis and it has been known to be associated with worse prognosis. Arginine has many important physiological roles like wound healing and immune function. The arginine–NO system has an important role in the regulation of vascular tone and blood pressure.

Although further trials are mandatory to identify the potential utility arginine supplementation in septic patients.

Reconstruction

Reconstructive procedures are required in wider genital, perineal and abdominal wall skin defects. The results for such patients following reconstructive procedures are very encouraging.

The scrotum has extraordinary ability to heal and regenerate after the infection and necrotic process have subsided. The reconstructive surgery can be performed

- At the same time of admission (De la cruz et al., 1996)
- Or in the postoperative period when the acute infective process is completely resolved.

The reconstructive procedures are considered for patients presenting with an extensive healthy granulation tissue formation on the wound base.

Options for reconstruction include the following:

- Primary skin closure
- Local skin flap
- SSG
- Muscular flaps

- Small areas can be allowed to heal by secondary healing or can be reconstructed by delayed primary closure .
- The scrotal advancement technique can be used for small scrotal skin defects
- SSG can be beneficial in case of large area of skin loss, especially when it involves the abdominal wall.
- Myocutaneous flaps such as Gracilis muscle flap can be useful in many cases of reconstruction. Cases with a large perineal defect often require such techniques to reduce the dead space. The well vascularized muscle flap offers great resistance to bacterial contamination (Chen et al., 2010).
- Other alternative is a pudendal thigh flap. It is a superficial perineal artery based fasciocutaneous flap. The advantage of this flap is its relatively simplicity and good vascularity. The donor site can be managed by primarily closure and there is no loss of muscle function.

COMPLICATIONS

- Long term pain (present in 50% of individuals)
- Auto amputation of penis (Ong et al., 1996)
- Gangrene of testis (Tripathi, 1978), (Klutke CG, 1988)
- Infertility (Spirnak et al., 1984) (Baskin et al., 1990)
- Marjolin's ulcer from the raw area of the wound (Gerber, 1973)
- Tetanus (Schneider et al., 1986)
- Impaired sexual function (Ferreria et al., 2007)

Mortality

The mortality rate associated with Fournier's Gangrene may vary from 3 - 45 % depending on the series. The mortality rate is lower than that of others forms of necrotizing fasciitis. It is probably because, the scrotal area allows for a relatively more efficient surgical debridement (Eke, 2000).

Idiopathic Fournier's Gangrene is not an independent additional contributory factor to the mortality in many series (Kabay et al., 2008)

There is no universally accepted consensus on which clinical variables alone predict a poor outcome in a case of fournier's gangrene. The mortality rate in fournier's gangrene ranges from 3 to 45%

Increased mortality was reported in cases of

- Anal disease
- Elderly patients,
- Diabetes mellitus,
- Late presentation to the hospital,
- Invasion to abdominal wall and thigh,
- Sepsis at the time of presentation,
- Associated liver and renal diseases,
- Higher FGSI

Death usually results from systemic illness, such as sepsis, diabetic ketoacidosis, renal failure, coagulopathies or multiple organ failure.

In summary, the mortality risk may be directly proportional to

- Age
- Systemic toxicity
- Extent of the involvement of the disease

Materials and Methods

MATERIALS & METHODS

Study area

Coimbatore medical college hospital, (CMCH) Coimbatore.

Study period

September 2011 to November 2012

Study population

Patients presenting to the outpatient department and emergency department of CMCH.

Inclusion criteria

- Patients presenting with gangrene of genitalia and perineum
- Age more than 12 years

Exclusion criteria

- Age less than 12 years

Sample size

All patients eligible by inclusion and exclusion criteria were included in the study.

Study tools

- Clinical examination
- routine blood investigations
- pus, blood and urine culture and sensitivity
- X ray
- USG abdomen and pelvis
- CT abdomen and pelvis

Procedure

The study was conducted to the patients presenting to the OPD and emergency department with gangrene of the genitalia and perineum. They were admitted and with informed consent they were included in the study.

Thorough clinical examination and laboratory investigations were carried out. Regular debridement was done. Reconstructive procedures were performed according to the raw area and available skin. Patients were followed up for 2 months and the results were reported.

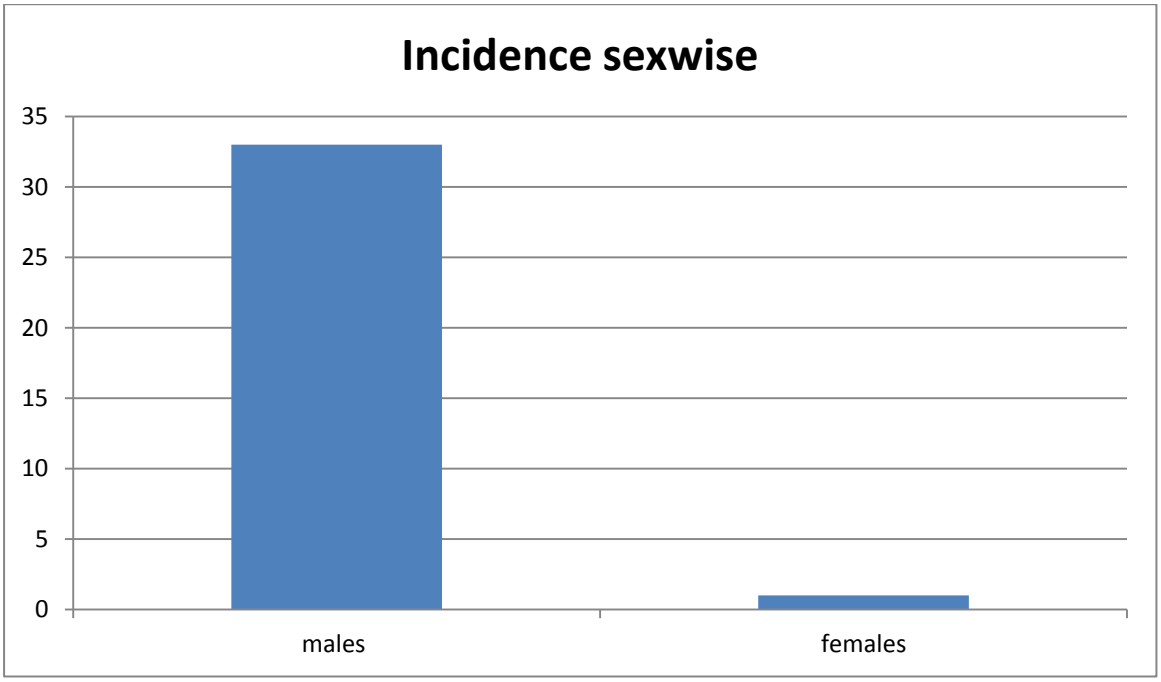
Observation and Analysis

SEXWISE INCIDENCE

Table 1

Sex	Number	Percentage
Male	33	97.1
Female	1	2.9

Figure

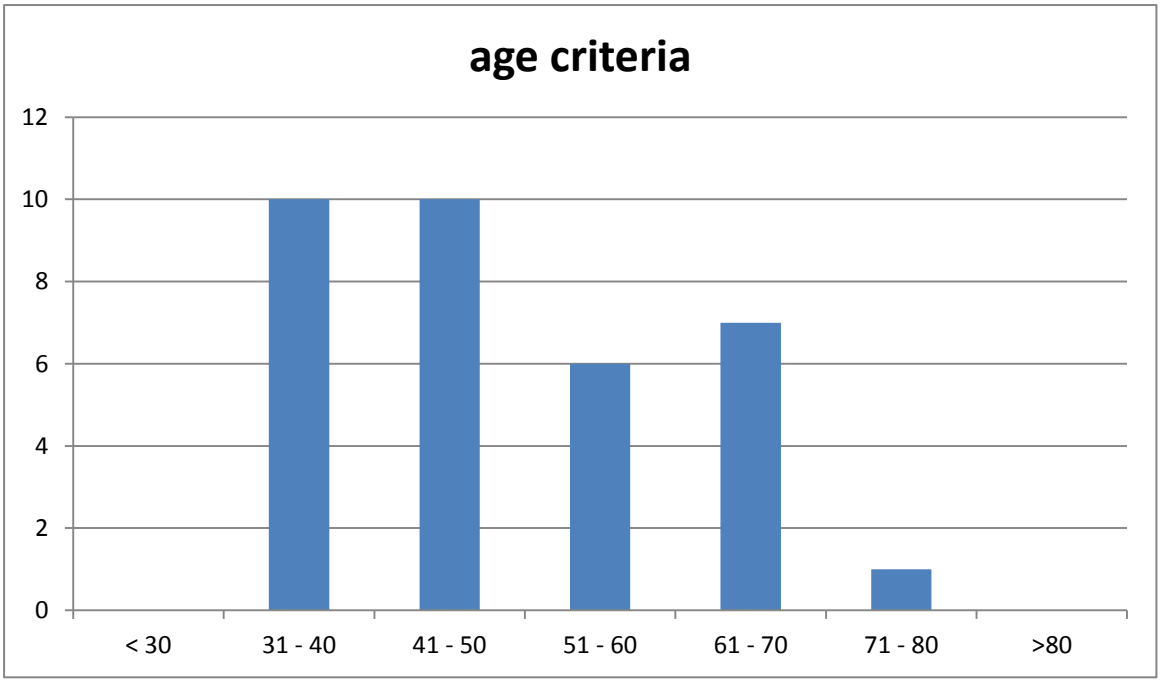


INCIDENCE AGEWISE

Table 2

Age group in years	Number of patients	Percentage of patients
< 30	0	0
31 - 40	10	29.4
41 - 50	10	29.4
51 - 60	6	17.7
61 - 70	7	20.6
71 - 80	1	2.9
>80	0	0

Figure



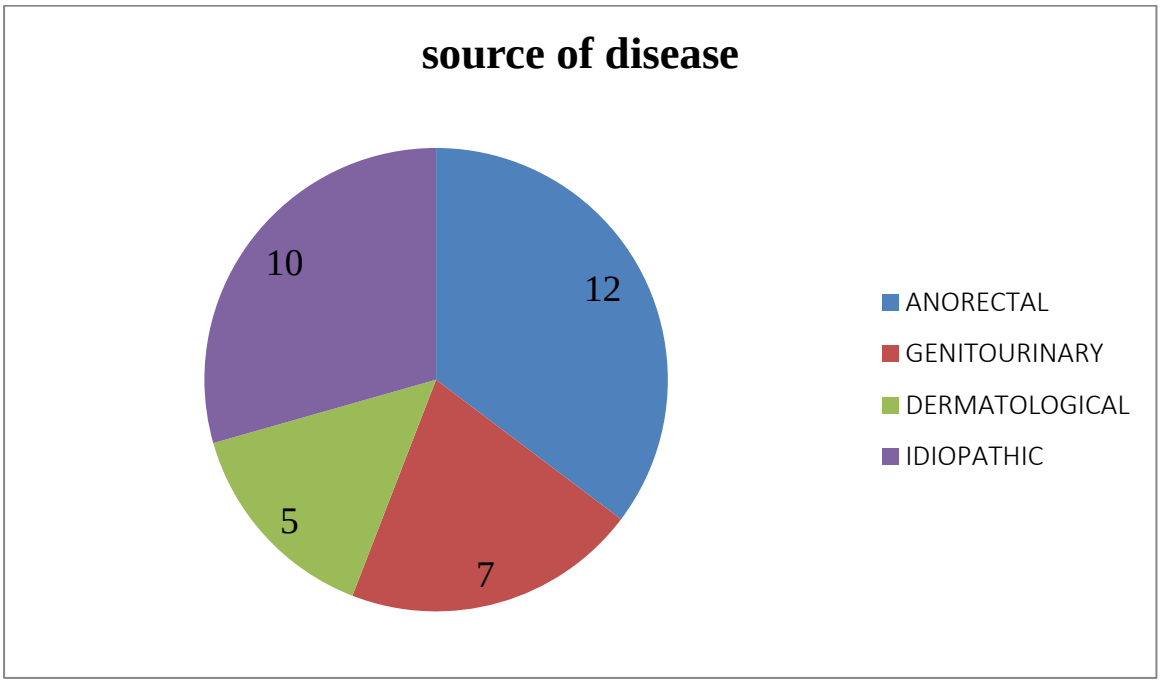
- Mean age of presentation among all patients – 50.0 years
- Mean age among survivors – 48.3 years
- Mean age among deceased – 63 years

CAUSATIVE FACTORS

Table 3

Source of the disease	Number of patients	Percentage of patients
Anorectal	12	35.3
Genitourinary	7	20.6
dermatological	5	14.7
idiopathic	10	29.4

Figure

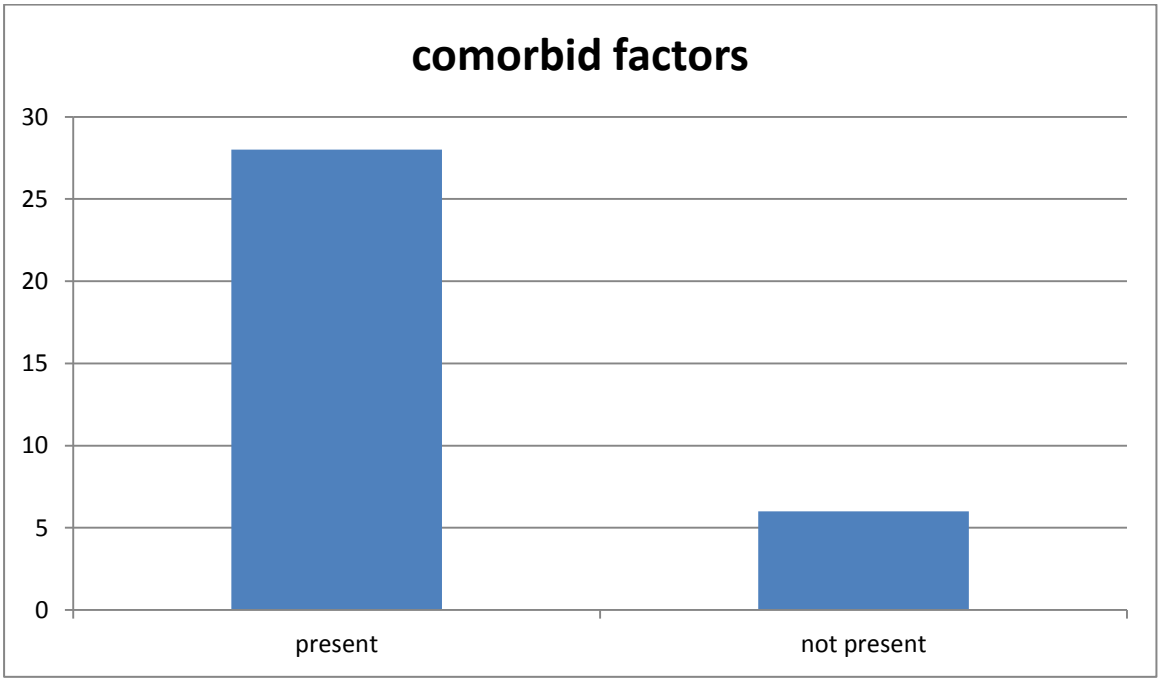


COMORBID FACTORS

Table 4

Comorbid conditions	Number of patients	Percentage of patients
present	28	82.4
Not present	6	17.6

Figure

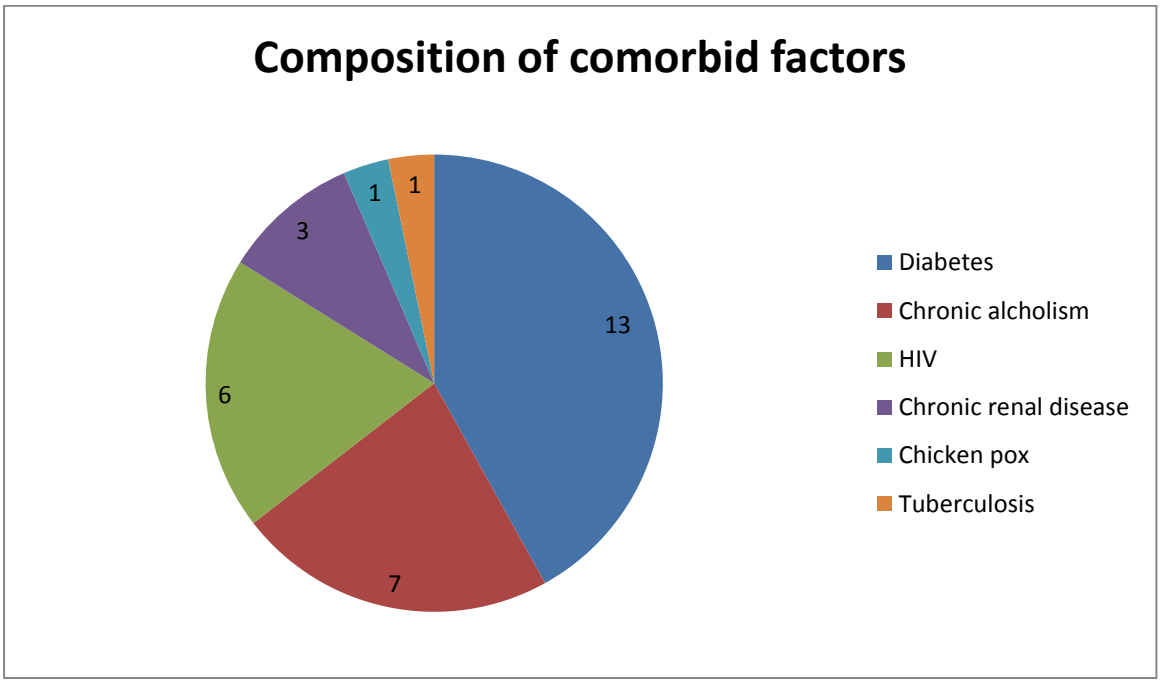


COMORBID FACTORS – COMPOSITION

Table 5

Comorbid conditions	No of cases	Percentage of cases
Diabetes	13	38.2
Chronic alcoholism	7	20.6
HIV	6	17.6
Chronic renal failure	3	8.9
Chicken pox	1	2.9
Tuberculosis	1	2.9

Figure



MICROBES ISOLATED

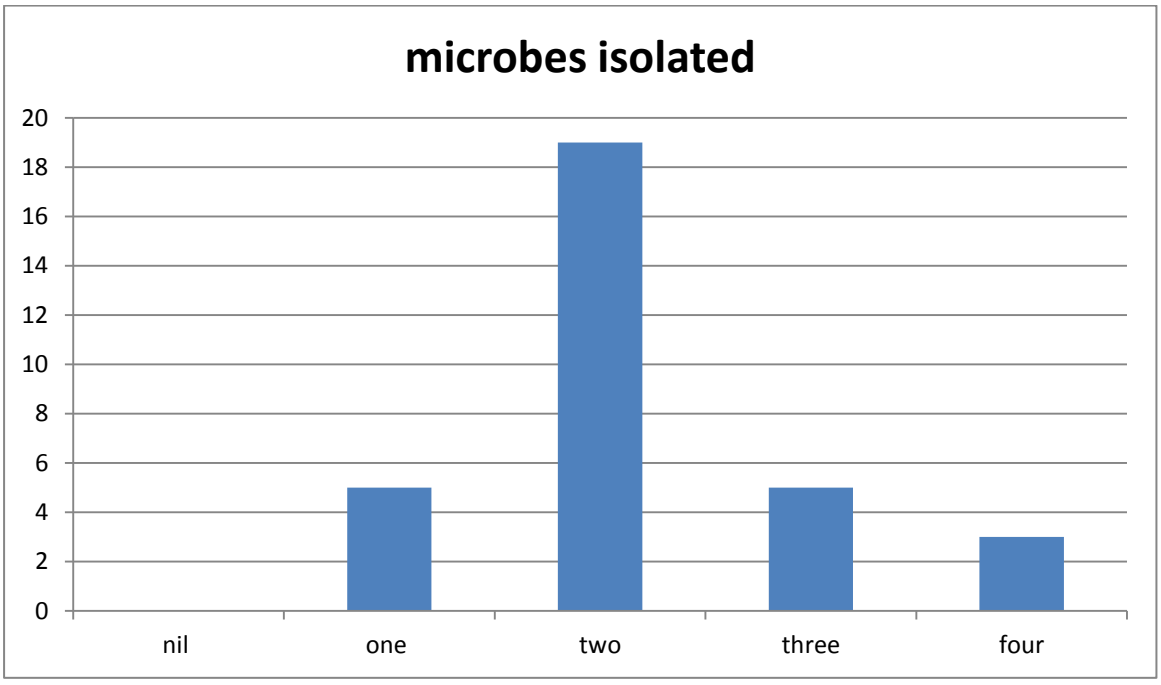
Table 6

Number of microbes isolated	Number of cases	Percentage of cases
Nil	2	5.8
One	5	14.7
Two	19	55.9
Three	5	14.7
Four	3	8.9

Polymicrobial presentation – 79.4%

Average number of isolates per culture – 2

Figure

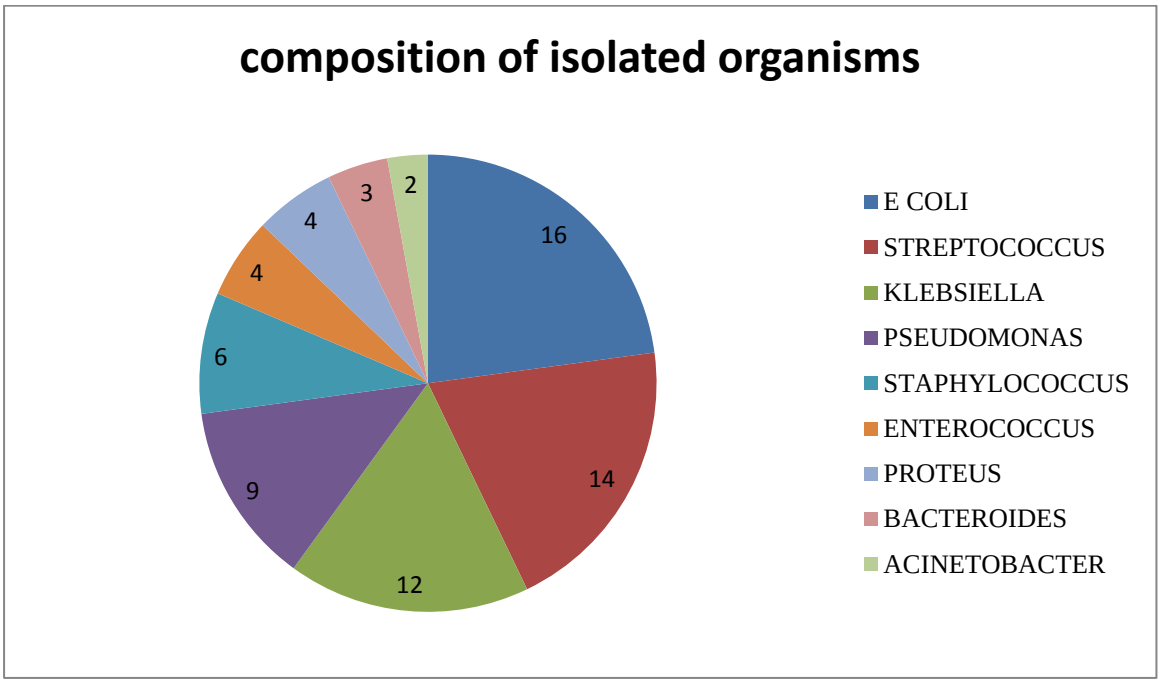


COMPOSITION OF ISOLATED ORGANISMS

Table 7

Isolated organisms	Number of cases	Percentage of cases
E coli	16	47.0
Streptococcus	14	41.1
Klebsiella	12	35.3
Pseudomonas	9	26.5
staphylococcus	6	17.7
Enterococcus	4	11.8
Proteus	4	11.8
Bacteroides	3	8.9
Acinetobacter	2	5.9

Figure

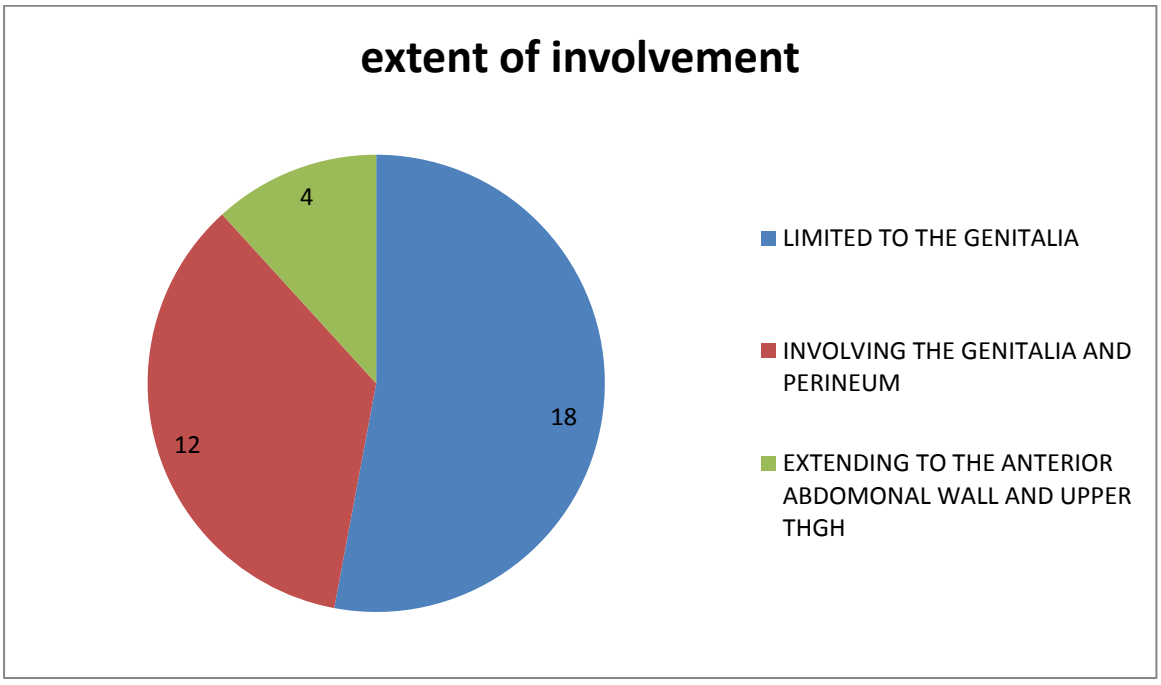


EXTENT OF INVOLVEMENT

Table 8

Extent of involvement	Number of cases	Percentage of cases
Limited to the genitalia	18	52.9
Involving the genitalia and perineum	12	35.3
Extending to the abdominal wall and proximal thighs	4	11.8

Figure



NUMBER OF DEBRIDEMENTS REQUIRED

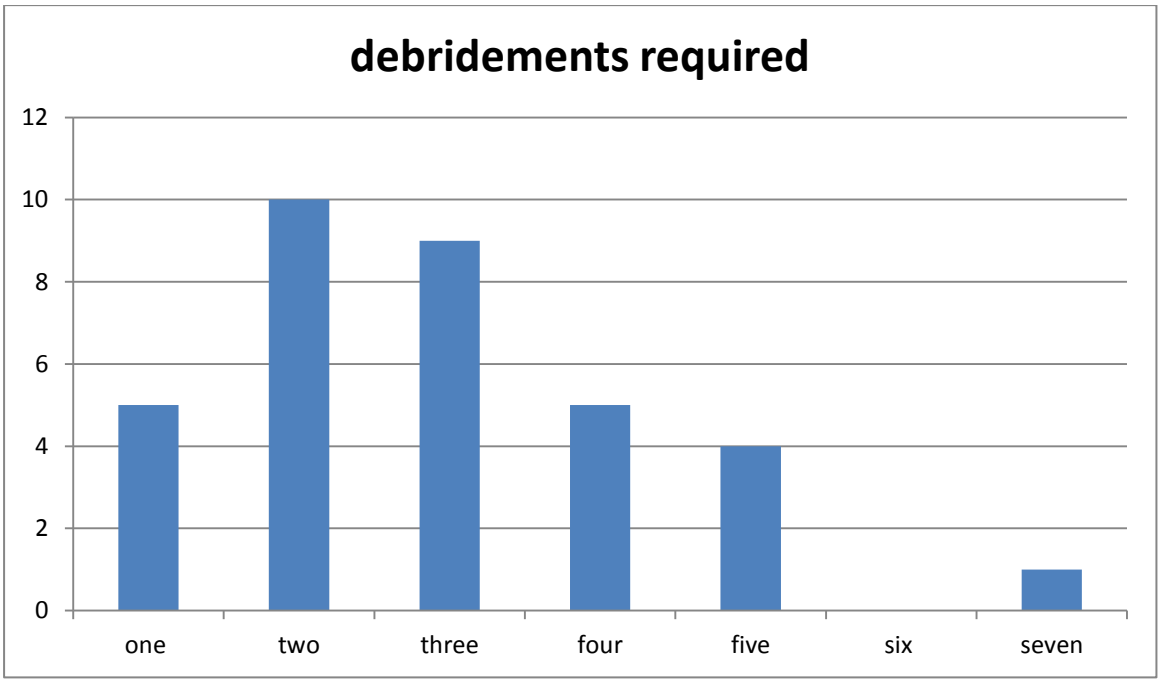
Table 9

Number of debridements done	Number of cases	Percentage of cases
One	5	14.7
Two	10	29.4
Three	9	26.5
Four	5	14.7
Five	4	11.8
Six	0	0
Seven	1	2.9

Average number of debridements done – 2.9

Maximum number of debridements in a single patient – 7

Figure

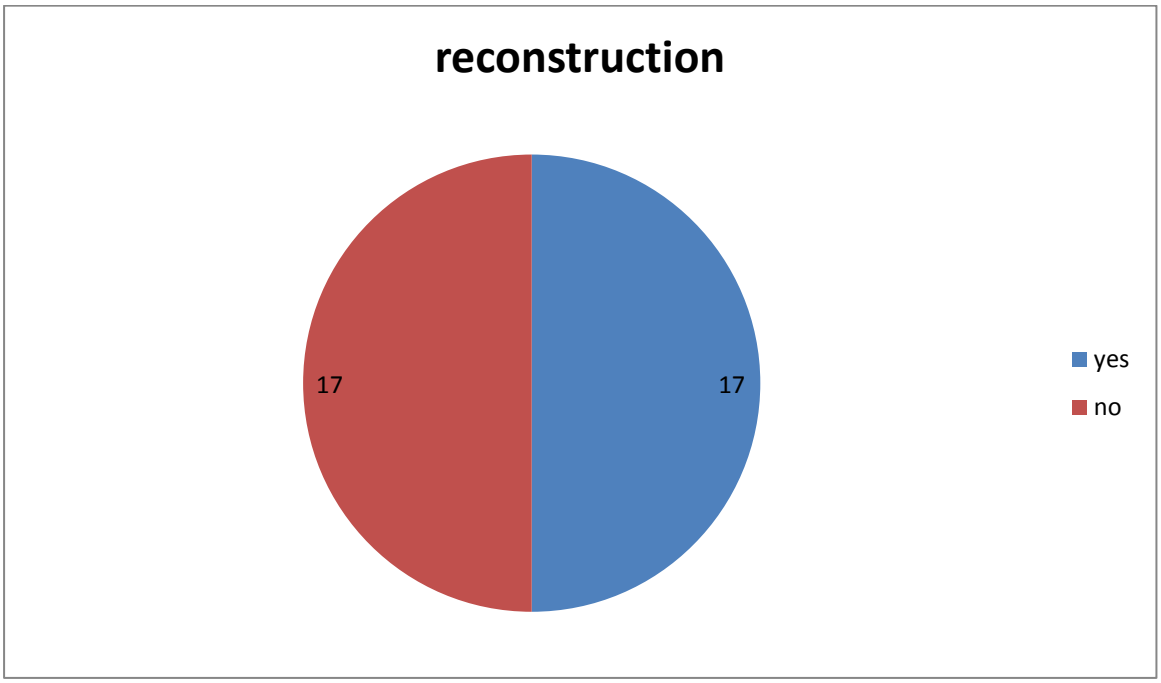


PATIENTS REQUIRING RECONSTRICTIVE PROCEDURES

Table 10

Reconstruction done	Number of cases	Percentage of cases
Yes	17	50
No	17	50

Figure

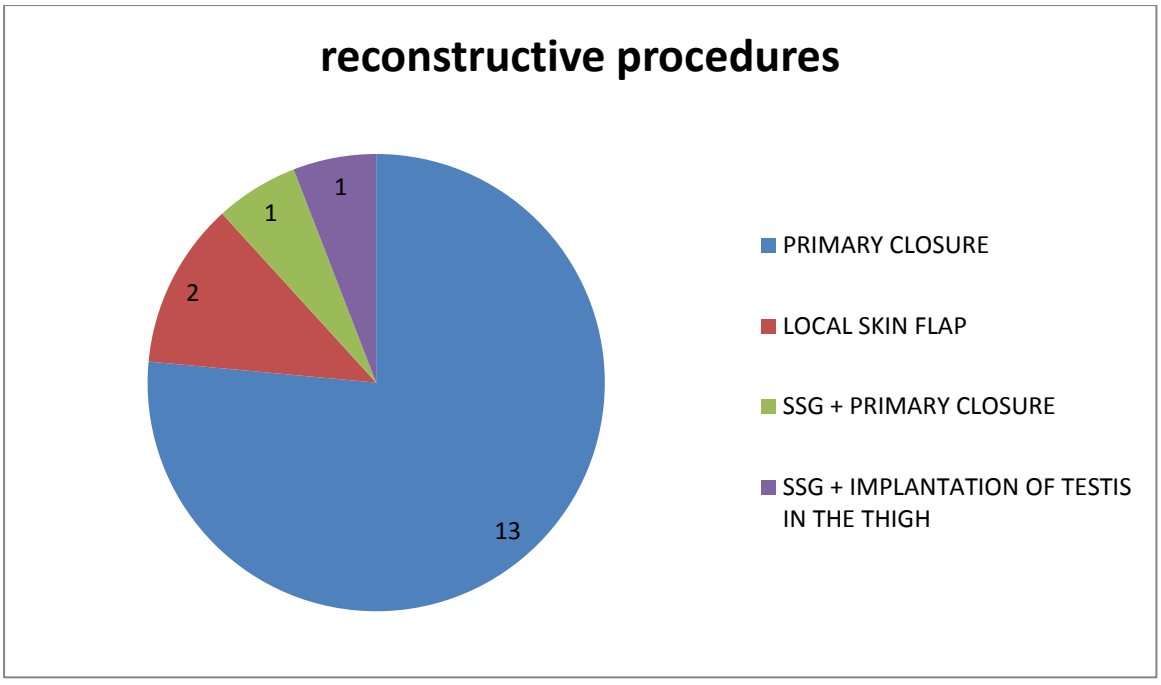


TYPES OF RECONSTRUCTIVE PROCEDURES NEEDED

Table 11

Reconstructive procedures performed	Number of cases	Percentage of cases
Primary closure	13	38.2
Local skin flap	2	5.9
SSG + primary closure	1	2.9
SSG + implantation of testis in thigh	1	2.9

Figure

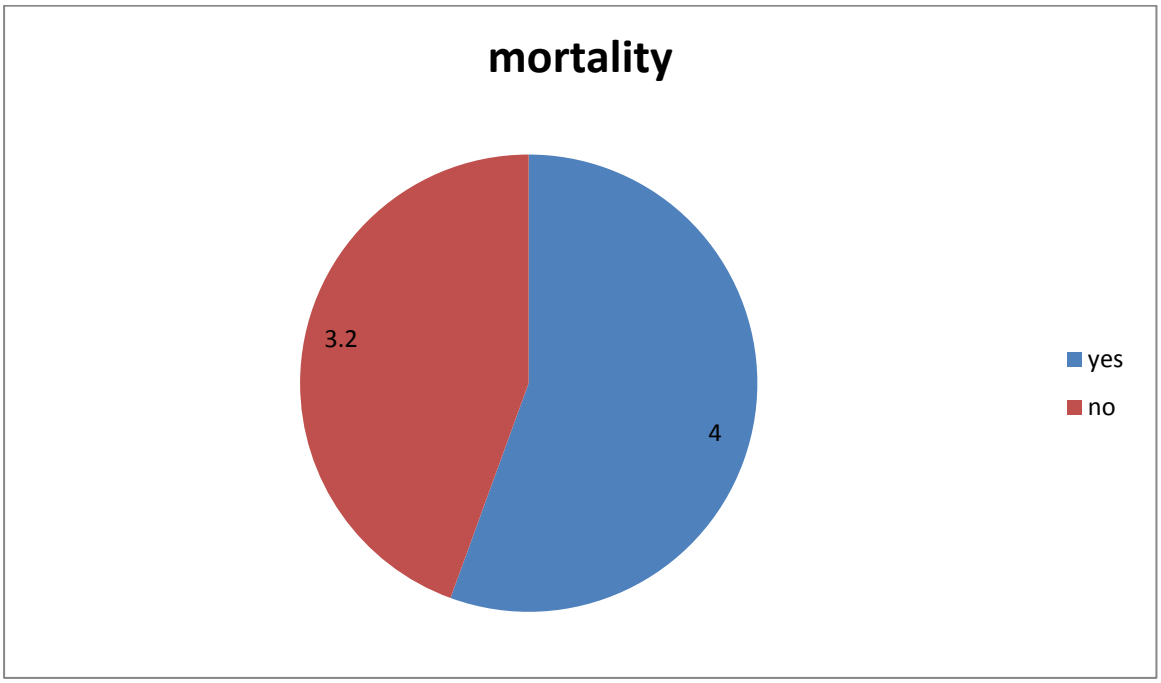


MORTALITY

Table 12

Mortality	Number of cases	Percentage of cases
Yes	4	11.8
No	30	88.2

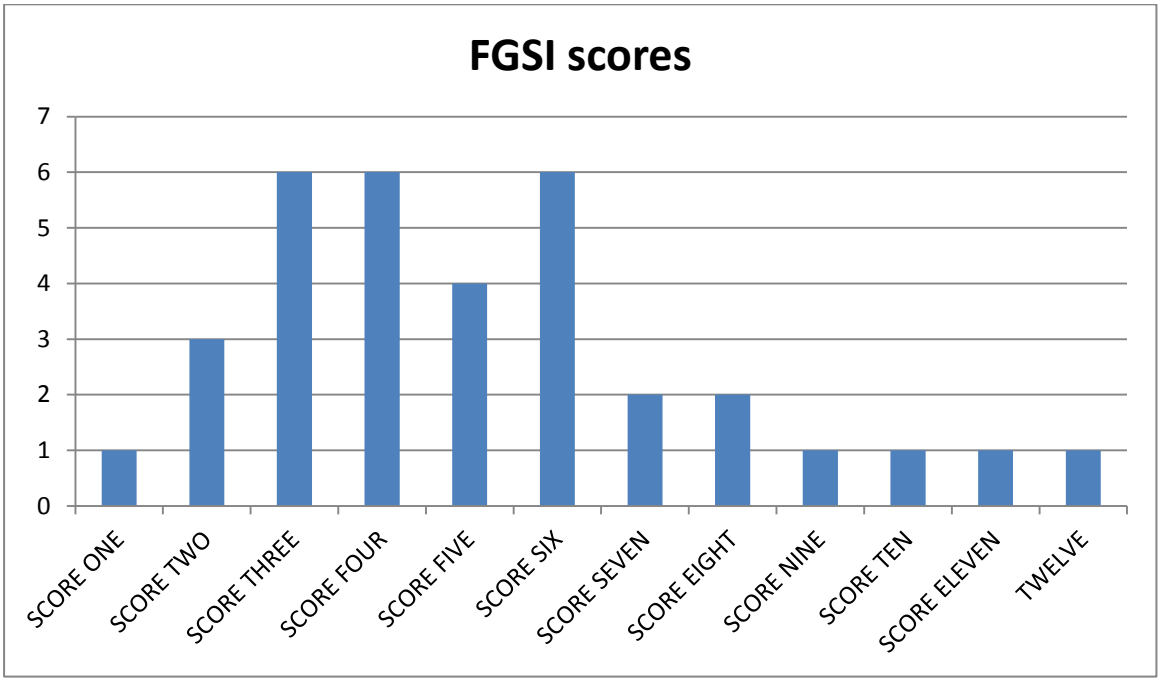
Figure



FGSI SCORES

Table 13

FGSI scores	Number of cases
Score One	1
Score Two	3
Score Three	6
Score Four	6
Score Five	4
Score Six	6
Score Seven	2
Score Eight	2
Score Nine	1
Score Ten	1
Score Eleven	1
Score Twelve	1

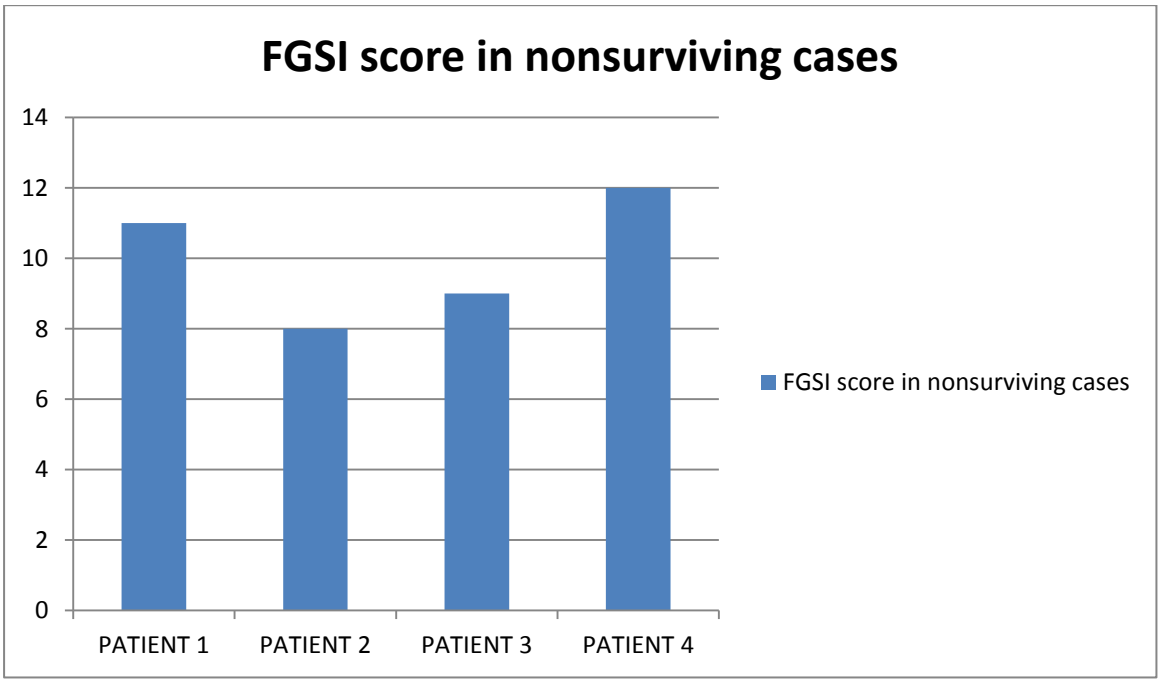


FGSI SCORE IN 4 NON – SURVIVOURS

Table 14

Non-survivor patient number	FGSI score
Patient 1	11
Patient 2	8
Patient 3	9
Patient 4	12

Figure



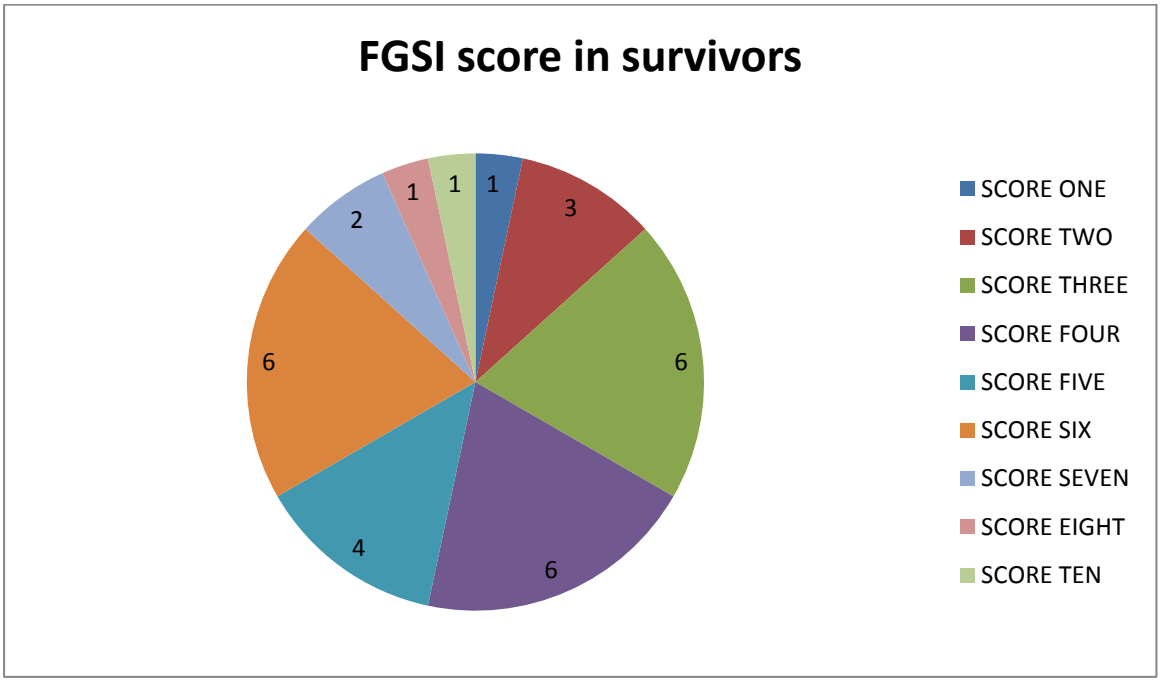
- MEAN FGSI SCORE IN NON – SURVIVORS – 10

FGSI SCORE IN SURVIVORS

Table 15

FGSI SCORE	Number of cases
Score one	1
Score two	3
Score three	6
Score four	6
Score five	4
Score six	6
Score seven	2
Score eight	1
Score ten	1

Figure



MEAN FGSI SCORE IN SURVIVOURS – 4.56

Discussion

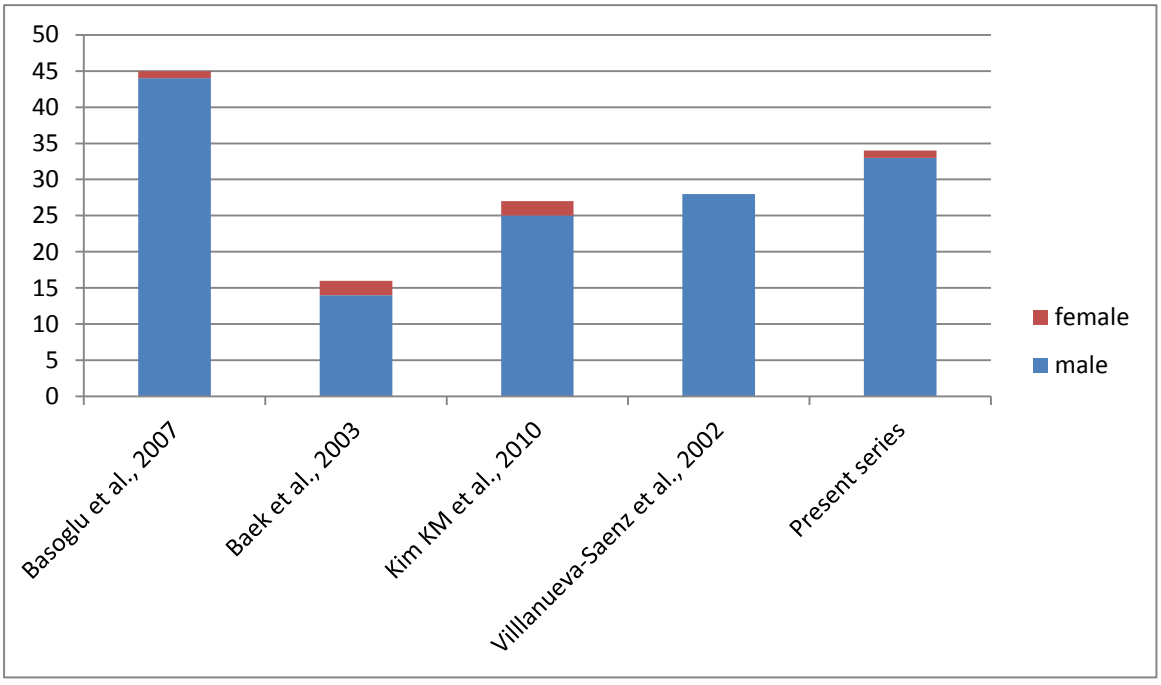
SEXWISE INCIDENCE

In a large series conducted male to female ratio was 10: 1 (Eke, 2000). The following is the list of male to female ratio in the various studies conducted

Table 16

Study	Male : female
Basoglu et al., 2007	44 :1
Baek et al., 2003	14 : 2
Kim KM et al., 2010	25 : 2
Villlanueva-Saenz et al., 2002	28 : 0
Present series	33 : 1

Figure



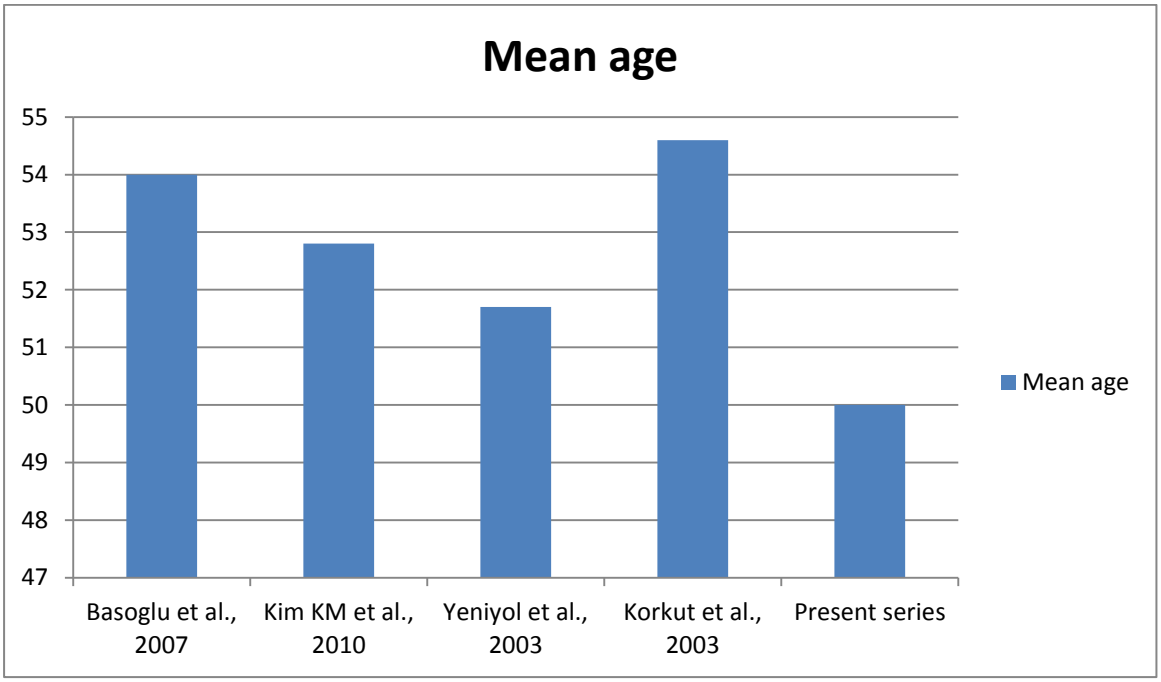
AGEWISE INCIDENCE

The average age of incidence in 1945 was 40.9 years. In many studies conducted at present it usually ranges from 50 to 70 years. The following is the list of age wise incidence in a few conducted studies.

Table 17

Study	Mean age (years)
Basoglu et al., 2007	54.0
Kim KM et al., 2010	52.8
Yeniyol et al., 2004	51.7
Korkut et al., 2003	54.6
Present series	50.0

Figure



Origin of infection

In a large series from Eke., 2000 the source of infection was 21% anorectal, 19% urological, 24% dermatological and idiopathic in the remaining 34% of cases.

In our study the source of infection is 35.3% anorectal, 20.6% urological, 14.7% dermatological and idiopathic in the remaining 29.4% of cases.

Anorectal origin is the most common source according to Brunet., 2000 – 34% and El Mejjad., 2002 – 42%

The following is the comparison of our study results with results of Corcoran et al., 2008

Table 18

Study	Anorectal origin (%)	Urogenital origin (%)
Corcoran et al.,2008	38.2	11.8
Present study	35.3	20.6

COMORBID CONDITIONS

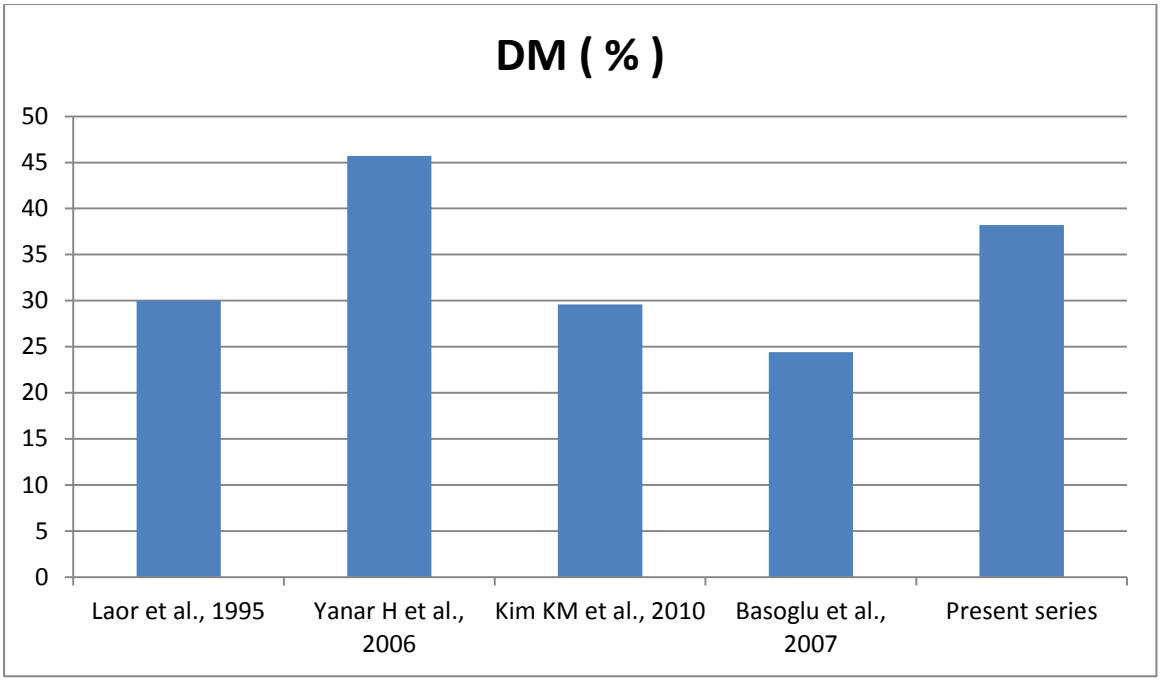
Diabetes mellitus

Diabetes mellitus is known to be associated in 20 – 70% of patients Fournier's gangrene (Morpurgo, 2002).

Table 19

Study	DM (%)
Laor et al., 1995	30.0
Yanar H et al., 2006	45.7
Kim KM et al., 2010	29.6
Basoglu et al., 2007	24.4
Present series	38.2

Figure



Chronic alcoholism

Chronic alcoholism is associated with 25 – 50% of cases with Fournier's gangrene (Clayton et al., 1990). In a few studies it is found to be the most common comorbid condition (Smith et al., 1998).

In the present series chronic alcoholism is identified as a comorbid condition in 20.6% of cases.

Microbiology

Paty et al., 1992 and Smith et al ., 1998 reported E coli, streptococcus and Bacteroides as the most commonly isolated microbes. Laor et al proposed that most common organisms were E coli and streptococcus. According to them staphylococcus and enterococcus were commonly isolated more than Bacteroides.

It is postulated that, anaerobes even when present are less frequently isolated because of difficulty in preserving these samples

In the present series E coli (47.0%) and streptococcus (41.1%) are the most commonly isolated aerobes. Bacteroides are the most commonly isolated anaerobes (8.9%).

Hejase et al., 1996 reported polymicrobial isolation in 90% of cases and no growth in 5% of patients. Ferreira et al., reported polymicrobial growth in 82.9% of cases.

In the present series polymicrobial isolation is found in 79.4% of cases and no growth reported in 5.9% of patients.

According to laor et al mean microbial number of 2 was identified in culture tests. According to thwaini et al., 2006 the mean number of isolates are approximately 3.In the present series the average number of isolates found per case are 2.3.

Extent of involvement

Ferrira et al., 2007 proposed that scrotal involvement found in 93.3% of cases and perineal involvement in 37.2% of cases.

In the present series in 52.9% of cases only genitals were involved. In 35.3% of cases genitals and perineum were involved. In 11.8% of cases genitals, perineum and anterior abdominal wall were involved.

And hence in the present series genital involvement is noted in 100% of cases, perineal involvement in 47.1% of cases and anterior abdominal wall involvement in 11.8% of cases.

MANAGEMENET

The following admission clinical parameters were studied to predict the outcome and mortality of the disease including temperature, heart rate and respiratory rate. The laboratory parameters that were studied include white blood cell count, haematocrit, serum bicarbonate, serum creatinine, serum sodium and potassium.

Pus culture and sensitivity sampling was done from deeper tissues obtained during wound debridement. Also blood sugar was measured, arterial blood gas analysis done, blood and urine culture and sensitivity was done.

Coagulation parameters and fibrin degradation product levels were studied to rule out disseminated intravascular coagulation.

In our series imaging could not be done uniformly to all patients as most of them presented late with extensive disease.

The patients were empirically started on broad spectrum antibiotics to cover gram positive organisms, gram negative organisms and anaerobes, and the antibiotics were changed accordingly after culture and sensitivity reports. Associated comorbid conditions and complications were managed accordingly and the patient was taken for multiple wound debridements.

Topical application of hydrogen peroxide was done in all patients. In no patients vacuum assisted closure or hyperbaric oxygen therapy was used.

In all patients per-urethral catheterisation was done. Suprapubic catheterisation and colostomy was not done in any of the patients. Rectal diversion device was not used in any of the patients.

Orchidectomy and penectomy were not performed in any of the patients. This is supported by the evidence from the studies conducted from the Yanar et al., 2006. They have stated that in cases where orchidectomy was performed due to severe infection in peritesticular tissues testicles were found to be normal pathologically.

Surgical debridements

100% mortality from Fournier's gangrene has been reported when surgical debridements not performed (Adinolfi MF, 1983), (Okeke LI., 2000), (Hasdemir AO, 2009).

In a study of 43 patients by Ferreira et al., 2007 single debridement was performed in 35 patients, 7 patients were debrided twice and 1 patient was debrided thrice.

The average number of debridements required is 3.5 procedures per patient according to Chawla S N, 2003.

In the present series, most patients underwent multiple surgical debridements. Maximum of 7 debridements were done in a patient. The average number of debridements done is 2.9.

RECONSTRUCTIVE PROCEDURES

After the acute phase of the infection has subsided the scrotum can be left alone for healing by secondary intention as it has remarkable capacity to regenerate (Thomas, 1956).

The reconstructive procedures can be performed at the same time of admission (De la cruz et al., 1996) or after the resolution of acute infectious process. In the present series all the reconstructive procedures were performed after the resolution of acute infectious process.

S Prakash, 1984 published a series of 43 cases. In most of the cases cover was provided with scrotal skin for the scrotal defects and the penile skin defects were covered with inner layer of prepuce which remained intact. Only in three cases where the defect was extensive and had spread beyond genitalia split skin grafting had to be supplemented.

In the present series reconstructive procedure was performed for 17 patients out of 34 (50%). 15 patients were managed by primary closure and local skin flap. 1 patient required Split skin grafting + Primary closure. And 1 patient required Split skin grafting + Implantation of testis in the thigh.

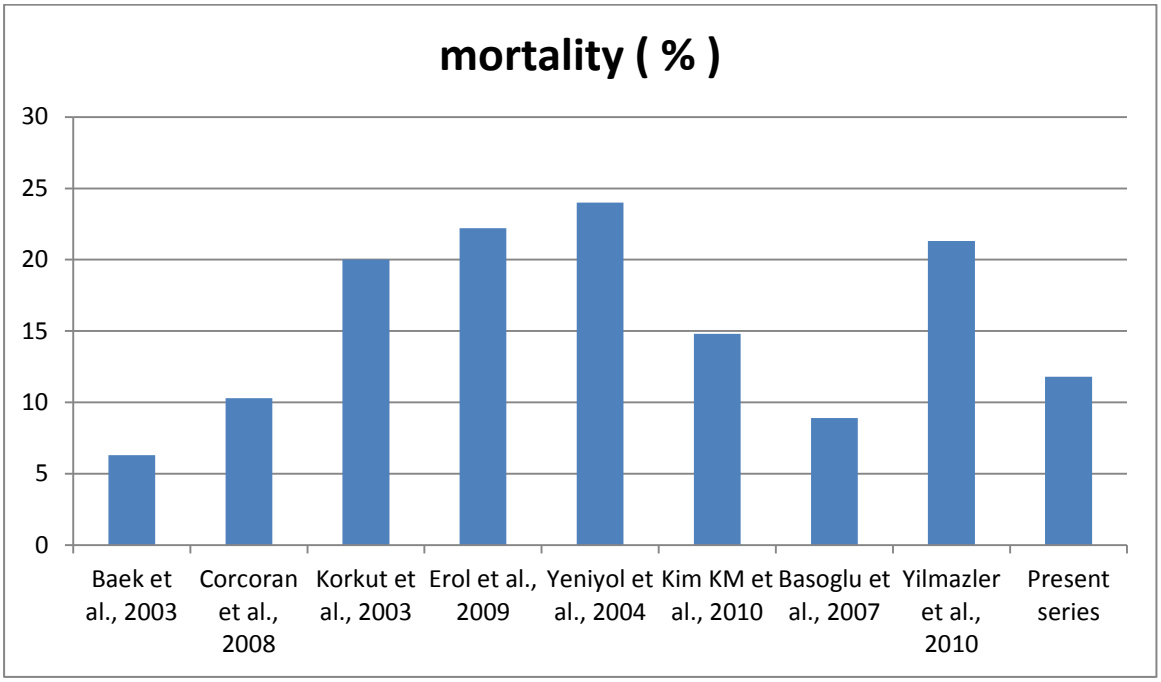
Mortality

The mortality rate from the present series is 11.8%. The mortality rate from the various series is compared with the present series is compared with the present series in the following table

Table 20

Study	Number of cases	Mortality (%)
Baek et al., 2003	16	6.3
Corcoran et al., 2008	68	10.3
Korkut et al., 2003	45	20
Erol et al., 2009	18	22.2
Yeniyol et al., 2004	25	24
Kim KM et al., 2010	27	14.8
Basoglu et al., 2007	45	8.9
Yilmazler et al., 2010	80	21.3
Present series	34	11.8

Figure



The mortality rates in the present series are on par or significantly lower than most of the studies conducted internationally.

FGSI SCORE

The mean FGSI score among survivors in our study is 4.6 +/- 2.0. The mean FGSI score among non-survivors is 10 +/- 1.6. Various other studies have shown FGSI scores as illustrated below (Table 21)

Study	FGSI – Survival	FGSI - Mortality
Yeniyol et al., 2004	3.0 +/- 1.8	12.0 +/- 2.4
Kim KM et al., 2010	4.7 +/- 0.4	9.3 +/- 3.2
Erol et al., 2009	5.0 +/- 2.9	13.5 +/- 2.6
Laor et al., 1995	6.9 +/- 0.9	13.5 +/- 1.5
Yilmazlar et al., 2010	4	14
Corcoran et al., 2008	5.1 +/- 3.4	10 +/- 4.5
Present series	4.6 +/- 2.0	10 +/- 1.6

Laor et al., 1995 have reported that an FGSI score more than 9 indicated 75% probability of mortality whereas a score of 9 or less than 9 was associated with a 78% probability of survival.

Kabay et al., 2008 proposed that FGSI score of less than 10.5 associated with 96% of survival and FGSI score of more than 10.5 associated with 96% of death. In the present series FGSI score of more than 10.5 is associated with 100% mortality and a score of less than 10.5 is associated with 93.3% of survival.

Summary and Conclusion

SUMMARY

- Thirty four patients were treated in the Coimbatore medical college hospital during the period from September 2011 to November 2012.
- Highest number of patients was from fourth and fifth decade of life and the mean age of presentation is 50 years.
- The mean age of presentation among deceased is 63 years which is significantly higher than the mean age among survivors which is 48.3 years.
- The male to female ratio is 33 : 1
- The source of the disease is most commonly anorectal (35.3%) followed by genitourinary (20.6%) and dermatological (14.7%) source. The cause is idiopathic in 29.4% of cases.
- Diabetes mellitus (38.2%) is the most common comorbid factor present followed by chronic alcoholism (20.6%) and HIV (17.6%).
- Most commonly the disease is polymicrobial (79.4%).
- Most commonly isolated organisms include E coli (47.0%) followed by streptococci (41.1%) and klebsiella (35.3%). The bacteroides are the most commonly isolated anaerobes (8.9%).
- In majority of cases the disease is limited to the genitalia (52.9%).

- Multiple wound debridements are required. The average number of wound debridements required is 2.9.
- Primary closure was the most common reconstructive procedure performed (38.2%).
- Mortality associated with the disease was 11.8%
- FGSI is a useful indicator for predicting survival and mortality associated with Fournier’s gangrene.
- FGSI score of more than 10.5 is associated with 100% mortality and a score lesser than 10.5 is associated with 93.3% of survival.

CONCLUSION

Fournier's gangrene is commonly a disease of middle aged and elderly males. The source of infection is identifiable in most of the cases. Diabetes mellitus is the most common comorbid factor. The disease is polymicrobial in most of the cases.

Early diagnosis of the disease and multiple wound debridements are required for improved survival. Extensive raw area following the infection and wound debridements can be managed by reconstructive procedures.

In spite of aggressive management the disease carries significant mortality. Fournier's gangrene severity index (FGSI) is a useful indicator for predicting survival and mortality associated with Fournier's gangrene.

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Proforma

Case No.

PROFORMA

Name: Age: Sex: IP No.:

Address:

D.O.Admission:

D.O.Discharge /

Death

Duration of Illness:

History:

1. Fever
2. Lethargy
3. Pain
4. Pruritis
5. Redness of skin
6. Other skin changes
7. Purulent discharge
8. Obvious gangrene
9. Anorectal symptoms
10. Urogenital symptoms
11. History of skin infections
12. History of comorbid illness
13. History of recent invasive procedures
14. History of alchol intake

GENERAL EXAMINATION

Pulse

BP

Temperature

Respiratory rate

Nutrition

Hydrational status

LOCAL EXAMINATION

Fluctuations

Localizing tenderness

Crepitations

Occult wounds

Skin changes

Feculent odour

Subcutaneous crepitations

Digital examination of the rectum

Testicular involvement

Extent of the disease

INVESTIGATIONS

Complete hemogram

B . urea

B . sugar

S . creatinine

S . electrolytes

S . bicarbonate

Arterial blood gas analysis

Blood culture

Pus culture

Urine culture

Chest X ray

USG abdomen

CT abdomen

MRI abdomen

FGSI score :

MANAGEMENT

Debridement details :

Number of debridements :

Recovery period :

Culture and sensitivity reports :

Reconstructive procedures :

Postoperative period :

Outcome :

Follow up :

Master Chart

S no	Name	Age/sex	IP no	Causative factor	comorbid factor	Microbes isolated
1	Durairaj	37 / m	55233	Periurethral abscess	Nil	E coli, streptococcus
2	Manokaran	56 / m	62703	Anorectal abscess	Nil	E coli, Klebsiella, Proteus
3	Karuppusamy	80 / m	15603	Idiopathic	Chronic renal disease, Diabetes	Streptococcus, psedomanas
4	Halik	40 / m	67880	Furuncle scrotum	HIV	Klebsiella , staphylococcus, Pseudomonas
5	Suresh babu	35 / m	65003	Idiopathic	HIV	Pseudomonas
6	Palanisamy	40 / m	69318	Anorectal abscess	Chronic alcholism	Staphylococcus, enterococcus
7	Rajendran	47 / m	40347	Idiopathic	Diabetes	E coli, streptococcus, proteus, pseudomonas
8	Manokaran	62 / m	45512	Anorectal abscess	Diabetes	streptococcus, bacteroides
9	Mariyappan	68 / m	20899	urethral catheterisation	chronic renal disease	Ecoli
10	Radhakrishnan	55 / m	8452	Idiopathic	Chronic renal disease	E coli, staphylococcus
11	Velusamy	61 / m	59595	Furuncle scrotum	Diabetes	Enterococcus
12	Mylsamy	55 / m	73255	Idiopathic	Chronic alcholism	E coli, streptococcus
13	Kandasamy	61 / m	26397	Periurethral abscess	Diabetes	Nil
14	Marimuthu	46 / m	39366	Periurethral abscess	Tuberculosis, Chronic alcholism	klebsiella , Streptococcus, E coli
15	Kittan	45 / m	36823	Anorectal abscess	HIV	Klebsiella, proteus, Pseudomonas, enterococcus
16	Raja	32 / m	20379	Furuncle scrotum	Nil	E coli, streptococcus
17	Natarajan	48 / m	57464	Anorectal abscess	HIV	Klebsiella, Enterococcus, Streptococcus
18	Paramasivam	36 / m	4656	Anorectal abscess	Nil	E coli, Klebsiella, Pseudomonas
19	Adalarasu	38 / m	67161	Idiopathic	Chronic alcholism	Klebsiella, Acinetobacter
20	veeran	48 / m	47163	Periurethral abscess	Chronic alcholism	E coli, Staphylococcus
21	symen	40 / m	23748	Idiopathic	Nil	Streptococcus, psedomanas
22	Bhuvaneswaran	65 / m	39938	Idiopathic	Chronic Alcholism, chicken pox	Klebsiella, Streptococcus
23	Palanisamy	50 / m	10132	Idiopathic	Chronic alcholism	Pseudomonas, Acinetobacter
24	Mani	60 / m	10219	Anorectal abscess	Diabetes	E coli, Klebsiella
25	Subramani	55 / m	56140	Anorectal abscess	Diabetes	Staphylococcus, bacteroides
26	Palanisamy	45 / m	45951	Anorectal abscess	Diabetes	Streptococcus, E coli, Klebsiella, pseudamonas
27	Angamuthu	40 / m	50157	Periurethral abscess	Nil	Klebsiella, proteus
28	Arumugam	57 / m	55665	Anorectal abscess	Nil	E coli, staphylococcus
29	Jeyakumar	38 / m	69980	Idiopathic	Diabetes	Nil
30	Kalingaraj	45 / m	4615	Furuncle scrotum	HIV	E coli, streptococcus
31	Kaniyappan	60 / m	8709	Furuncle scrotum	Diabetes	Streptococcus
32	Kittusamy	62 / m	71001	Periurethral abscess	Diabetes	Klebsiella
33	gnanambal	50 / f	75136	bartholins abscess	Diabetes	streptococcus, E coli
34	Sekar	44 / m	71744	Anorectal abscess	HIV	Bacteroides, E coli

Extent of pathology	No of debridements	Reconstructive procedures	FGSI	Mortality
Limited to genitalia	One	Primary closure	2	No
Involving the genitalia and perineum	three	Primary closure	6	No
Extending to infraumblical region, upper thigh	One	Nil	11	Yes
Limited to genitalia	Two	Nil	3	No
Limited to genitalia	Two	Primary closure	4	No
Involving the genitalia and perineum	five	Local skin flap	6	No
Limited to genitalia	Three	Nil	3	No
Involving the genitalia and perineum	one	Nil	8	Yes
Limited to genitalia	One	Nil	6	No
Limited to genitalia	two	Primary closure	5	no
Limited to genitalia	two	Nil	5	No
Limited to genitalia	four	Primary closure	4	No
Limited to genitalia	two	Nil	4	No
Involving the genitalia and perineum	Three	Nil	6	No
Involving the genitalia and perineum	two	Nil	9	Yes
Limited to genitalia	Two	Primary closure	3	No
Involving the genitalia and perineum	Four	Nil	5	No
Involving the genitalia and perineum	five	Local skin flap	6	No
Limited to genitalia	three	Primary closure	2	no
Limited to genitalia	four	Primary closure	4	No
Limited to genitalia	Three	Nil	3	No
Extending to infraumblical region, upper thigh	One	Nil	12	Yes
Extending to infraumblical region, upper thigh	seven	SSG + Implantation of testis in thigh	10	No
Involving the genitalia and perineum	four	Primary closure	7	No
Involving the genitalia and perineum	Four	Nil	5	no
Extending to infraumblical region, upper thigh	five	SSG + Primary closure	8	No
Limited to genitalia	Two	Primary closure	1	No
Involving the genitalia and perineum	Three	Primary closure	6	No
Limited to genitalia	three	Primary closure	3	No
Limited to genitalia	Two	Nil	4	No
Limited to genitalia	Three	Primary closure	3	No
Limited to genitalia	Two	Nil	7	No
Involving the genitalia and perineum	three	Nil	2	No
Involving the genitalia and perineum	Five	Nil	4	No

Consent Form

CONSENT FORM

It has been explained to me in my mother tongue and I completely understand my condition, its related complications and the treatment options available. I have been explained in detail regarding this study – “ A CLINICAL STUDY ON FOURNIER’S GANGRENE “ . I hereby give my consent to participate in the above mentioned study.

DATE :

PLACE :

SIGNATURE OF THE PATIENT AND NAME :

SIGNATURE OF THE RELATIVE AND NAME :

SIGNATURE OF THE WITNESS AND NAME :

ABBREVATIONS

FGSI – Fournier's Gangrene severity Index

HBO – Hyperbaric Oxygen therapy

VAC – Vacuum Assisted Closure

BUN – Blood Urea Nitrogen

CT – Computed Tomography

MRI – Magnetic Resonance Imaging

USG – Ultrasonography

NO – Nitric Oxide

UTI – Urinary Tract Infection

SLE – Systemic Lupus Erythematosus

HIV – Human Immunodeficiency Virus

PT – Prothrombin time

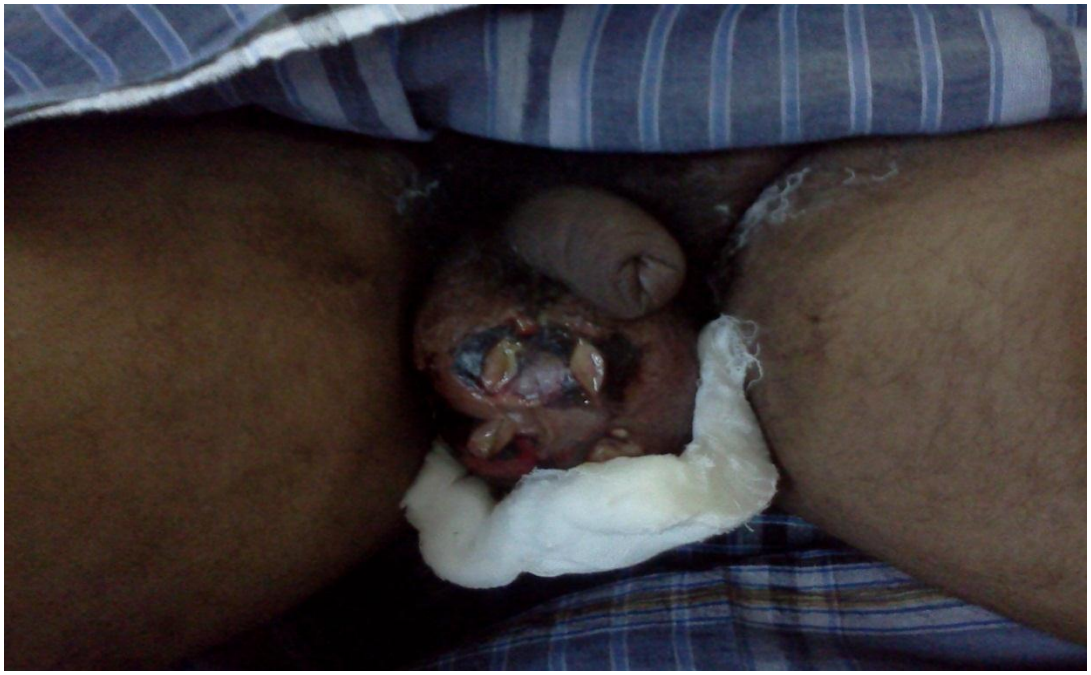
APTT – Activated Partial Thromboplastin Time

ABG – Arterial Blood Gas

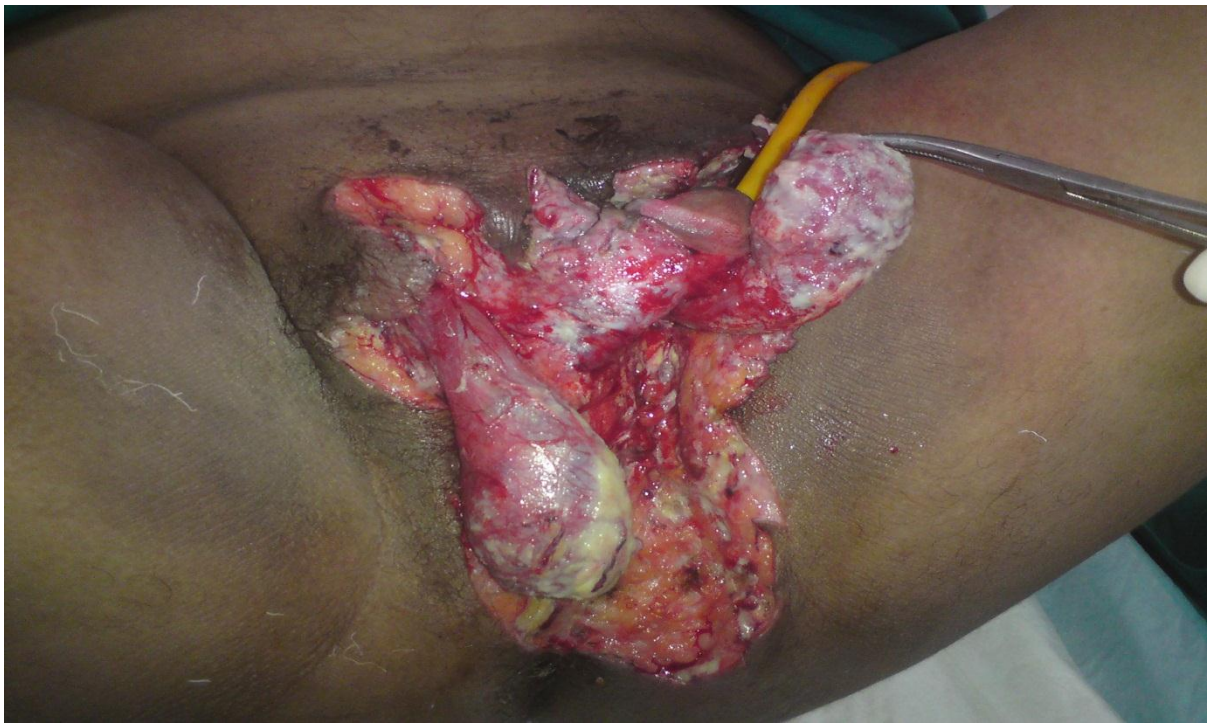
MRSA – Methicillin Resistant Staphylococcus Aureus

COLOUR PLATE NO 1

FG limited to genitals

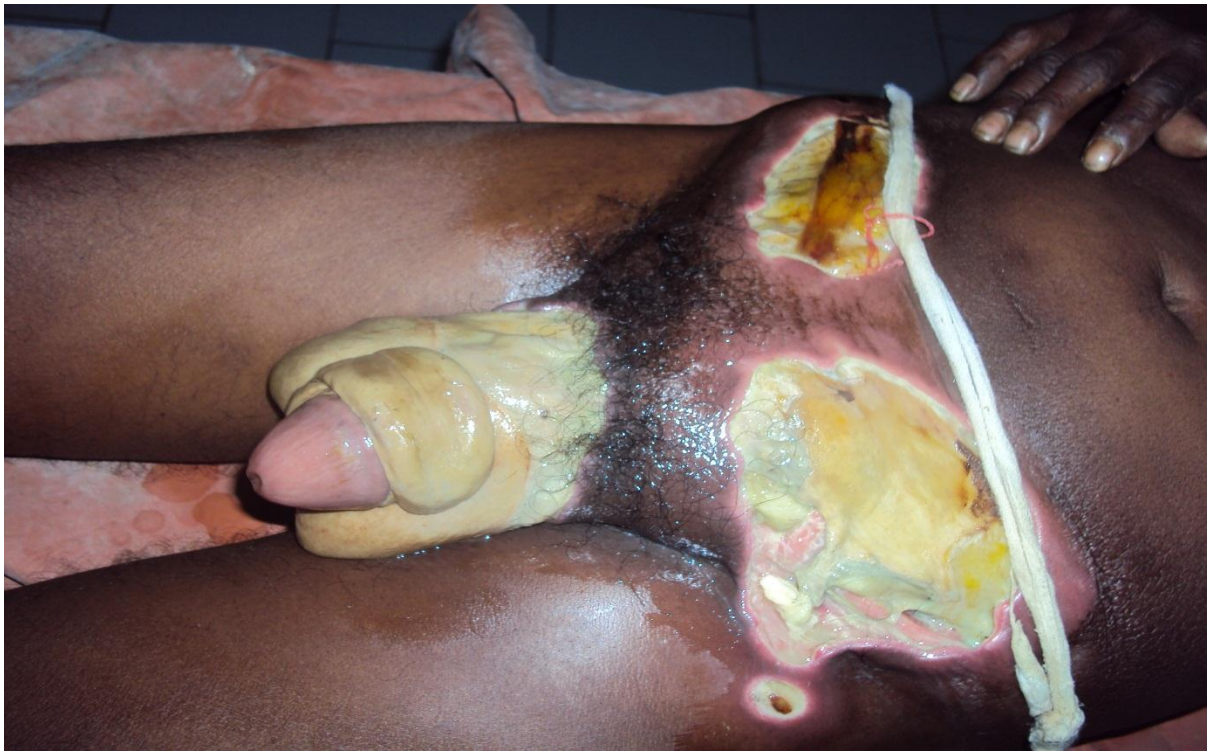


FG extending to perineum



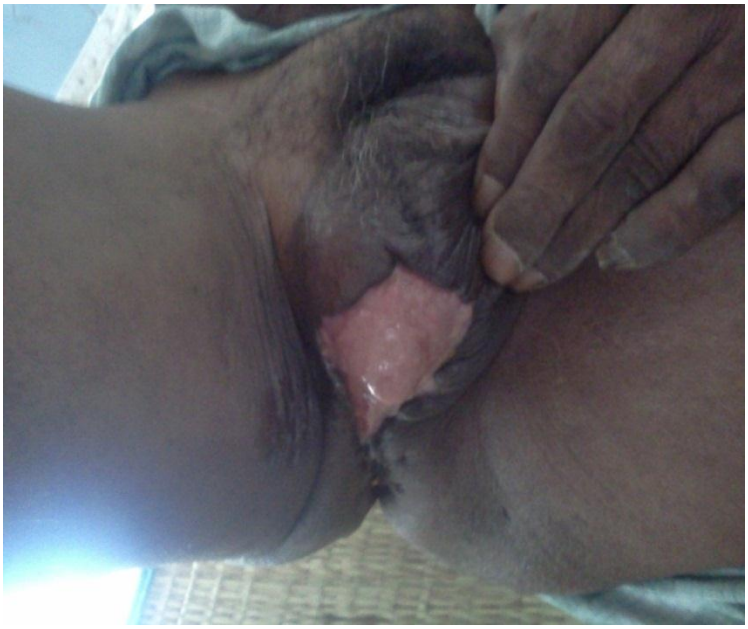
COLOUR PLATE 2

FG extending to anterior abdominal wall

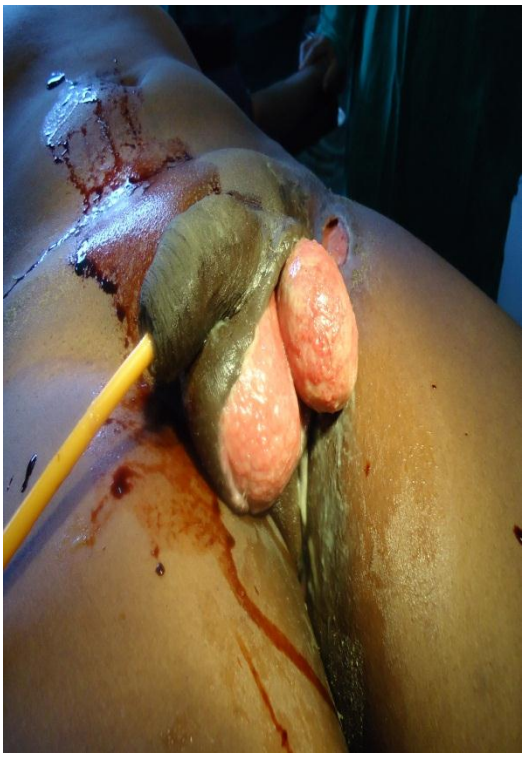


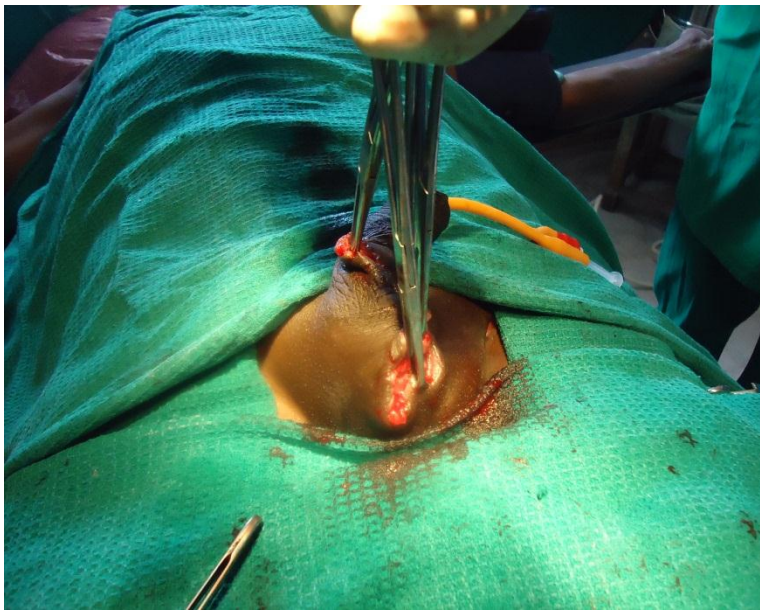
COLOUR PLATE 3

Secondary healing



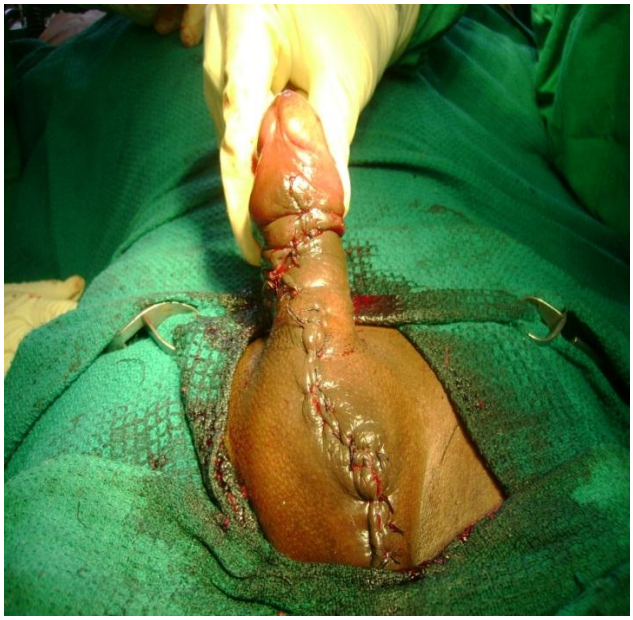
Primary closure





COLOUR PLATE 4

Local advancement flap



SSG with implantation of testis in the thigh