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Surgical complication of diabetic patients

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DEFINITION

- It is a syndrome characterized by chronic hyperglycemia due to relative deficiency of insulin or resistance or both.

- **CLASSIFICATION OF DM**

- Type 1 DM – usually adolescent onset but may occur at any age.
- Cause – Insulin deficiency from autoimmune destruction of insulin-secreting pancreatic β cells.
- Patients must have insulin and are prone to ketoacidosis and weight loss.

Diabetes Mellitus

- Type 2 DM (formerly non-insulin-dependent DM)
- Now appears to be prevalent at epidemic levels in many places, mainly due to lifestyle changes, but also because of better diagnosis and improved longevity
- Cause - \downarrow insulin secretion +/- \uparrow insulin resistance.
- Associated with obesity, lack of exercise, calorie and alcohol excess.
- Impaired glucose tolerance
- Impaired fasting glucose

Other causes

- Steroids
- Anti HIV drugs
- Some antipsychotics
- Thiazides
- Pancreatic pathology
- Cushing's disease
- Pheochromocytoma
- Hyperthyroidism

Risk factors of DM

Type 1

- Family history
- Environmental factors
- Presence of damaging immune system cells(autoantibodies)
- Geography

Type 2

- Weight
- Inactivity
- Family history
- Age
- Gestational diabetes
- Polycystic ovarian syndrome
- High blood pressure
- Abnormal cholesterol level

Symptoms and Signs

- Type 1

- Unexplained Weight loss
- Frequent urination
- Irritability and mood swings
- Blurred vision
- Fruit-scented breath
- Fatigue and weakness
- Excessive thirst

- Type 2

- Excessive thirst
- Unceasing hunger
- Headaches
- Dry mouth
- Frequent urination
- Numbness of hands and feet
- Fungal infections
- Slow healing of wounds

Preoperative Assessment

■ Historical features

- Cardiac history and current symptoms
- Other medical conditions
- Long term diabetic complications
- Baseline glycemic control
- Hypoglycemic events?
- Current diabetic treatment
- Type of surgery
- Type of anesthetic planned

Preoperative Assessment



- Examination
- Lab tests:
 - Glucose +/- Hgb A1C
 - Renal function
 - Electrolytes
- ECG
- Other

Surgery in Diabetic patients

- Diabetes patients are prone to develop sudden hyperglycemia or hypoglycemia during surgery. So, frequent monitoring of blood glucose is necessary
- Short acting insulin is given during surgery and in the immediate postoperative period.
- Patients are admitted a few days ahead of surgery
- Oral hypoglycemic drugs are stopped a few days before major surgeries and insulin is started, to bring about a better control of blood sugar. Insulin is continued for a few days in the postoperative period also.
- They are prone to cardiac arrest, thromboembolism and cerebrovascular accidents
- Wound healing is likely to be poor and prolonged.

Preoperative Assessment

- Aim for optimal glycemic control (depending on urgency of OR)
- Goal of blood sugar < 11.0
- Benefits
 - Normal fluid and electrolyte balance
 - Reduced insulin resistance
 - Improved endogenous Beta cell responsiveness (T2DM)
 - Decreased hepatic gluconeogenesis
 - Improved WBC function and wound healing

Preoperative Management

- General goal to avoid marked hyperglycemia and avoid significant hypoglycemia
- Procedures should be arranged as early in the day as possible

Postoperative Concerns

- TPN/Enteral Feeding
- Glucocorticoids
- Cardiac complications
- Poor Wound Healing
 - DM associated with increased frequency of wound infections
 - Collagen formation, phagocytic activity, chemotaxis and adherence of granulocytes adversely affected by hyperglycemia

Postoperative Concerns

- Postop infections
 - Impaired phagocytosis and Ab response
- Autonomic neuropathy
 - HR/BP, may have unpredictable response to surgical stress
- Peripheral neuropathy
 - Higher risk of pressure ulcers, skin necrosis
- Diabetic nephropathy
 - Challenging fluid and electrolyte balance
- Diabetic gastroparesis
 - May cause severe postop nausea and vomiting

Complications of DM

- Disappointing outcomes for patients with Diabetes
- Macrovascular complications – cause excess mortality and morbidities
- Microvascular complications – diabetic microangiopathy – contributes to mortality through renal failure by diabetic nephropathy.

Complications of DM

Microvascular

- Retinopathy, cataract
 - Impaired vision

- Nephropathy
 - Renal failure

- Peripheral neuropathy
 - Sensory loss
 - Pain
 - Motor weakness

Macrovascular

- Coronary circulation
 - Myocardial ischemia/infarction

- Cerebral circulation
 - Transient ischemic attack
 - Stroke

- Peripheral circulation
 - Claudication
 - Ischemia

Complications of DM

microvascular

- Autonomic neuropathy
 - Gastrointestinal problems (gastroparesis; altered bowel habits)
 - Postural hypotension
- Foot disease
 - Ulceration
 - Arthropathy

Surgical Complications of DM

- Abscesses
- Carbuncles
- Chronic balanitis
- Diabetic foot
- Candidiasis
- mucormycosis
- Emphysematous Cholecystitis
- Emphysematous pyelonephritis
- Necrotizing fasciitis
- Fournier's gangrene
- Sexual dysfunctions

DIABETIC FOOT



DIABETIC FOOT

- Most feared and devastating complication of diabetes
- Most common cause for leg amputations
- Classic pathological triad of the diabetic foot is vascular disease, neuropathy and infection
- Occurs as a result of trauma (often trivial) in the presence of neuropathy and/or peripheral vascular disease, with infection occurring as a secondary phenomenon following disruption of the protective epidermis.

Classification

- Neuropathic foot
 - Sensory, autonomic and motor neuropathy contribute to the pathogenesis of Neuropathic foot.
 - Motor weakness leads to atrophy of the small muscles of the foot with an imbalance between the flexors and extensors. This results in clawing of the toes and prominent metatarsal heads. High foot pressure develops under the metatarsal heads.
 - Dry, brittle skin(as a result of autonomic neuropathy) and high foot pressure lead to a callus formation. The callus can cause tissue damage and ulceration.

Diabetic Foot

- Neuropathic foot continued
 - Glycosylation of collagen leads to a stiffness of the ligaments resulting in restriction of joint movement, aggravating foot pressure.
 - Sensory neuropathy permits continued ambulation despite tissue inflammation or breakdown
 - Neuropathic foot is at risk of ulceration, digital necrosis, fissures, bullae, neuropathic joint and neuropathic edema

Diabetic foot

- Neuro-ischemic Foot

- The ischemic foot has absent pulse and cold
- The vascular problem can be divided into
 - Macrovascular disease associated with generalized atherosclerosis and thrombosis
 - Microvascular disease consisting of occlusion of small arteries and arterioles and thickening of the basement membrane of the capillaries
- The ischemic foot leads to pain at rest, ulceration on the margins of the foot, digital necrosis and gangrene

Diabetic foot

- Infected foot
 - Foot has several compartments which intercommunicate. Lack of pain due to neuropathy allows the patient to continue ambulation, facilitating spread of infection from one compartment to another.
 - Even a small thorn prick can lead to severe infection and gangrene
 - Presence of infection leads to pressure effects on the neuro-vascular bundle, causing necrosis of tissues.

Diabetic Foot

	Neuropathy	Ischaemic
Symptoms	None	None
	Paraesthesiae	Claudication
	Pain	Rest pain
	Numbness	
Structural damage	Ulcer	Ulcer
	Sepsis	Sepsis
	Abscess	Gangrene
	Osteomyelitis	
	Digital gangrene	

Wagner's classification

- Grade 0: High risk foot. No ulceration
- Grade 1: superficial ulceration
- Grade 2: deep ulceration penetrating up to tendon, bone or joint
- Grade 3: osteomyelitis or deep abscess
- Grade 4: localized gangrene
- Grade 5: extensive gangrene requiring major amputations

WAGNER'S CLASSIFICATION



Diabetic Foot(management)

- Remove callus
- Wound drainage
- Give rest to ulcer by immobilization
- Application of plaster cast
- Give plantar metatarsal pads under pressure points to redistribute weight.
- Infections are treated by wound debridement, institution of proper antibiotics, proper control of blood glucose
- Exercise
- Cessation of smoking
- Use of drugs like Aspirin and thrombolytic agents to improve blood supply.

Diabetic Foot (management)

- Attempt to convert wet gangrene to a dry one by repeated dressings and proper antibiotics
- Once gangrene sets in, decide for amputation.

Care of the feet in patients with Diabetes

Preventive advice to all diabetic patients:

- Inspect feet everyday
- Wash feet everyday
- Moisturise skin if dry
- Cut or file toenails regularly
- Change socks or stockings everyday
- Avoid walking barefoot
- Check footwear for foreign objects
- Wear suitable, well-fitting shoes
- Cover minor cuts with sterile dressings
- Do not burst blisters
- Avoid over-the-counter callus remedies

CARBUNCLE



Carbuncle

- Results from infection of the hair follicles not in areas such as the back of the neck, back of the trunk, the hairy surfaces of the hand or fingers, the lip and scalp, well endowed with thick columns of subcutaneous fat projecting around the follicles.
- The special arrangement permits the ready spread of infection from the hair follicles along the fat columns and subsequent extension radially between the skin and deep fascia.
- Diabetics are particularly prone to this complication.

Carbuncle

- it is an infective gangrene caused by Staph. Aureus
- An indurated and tender swelling appears which later on becomes suppurated.
- It may spontaneously breakdown discharging pus and leaving multiple sieve like openings and ashy grey slough
- Later the openings coalesce, leave an excavated ulcer.
- Considerable constitutional symptoms occur.

NECROTIZING FASCIITIS



NECROTIZING FASACIITIS

- A fulminant bacterial infection that affects the deeper layers of the skin and subcutaneous tissue and spreads along the fascia planes resulting in extensive skin gangrene while sparing the muscles.
- It occurs in immunocompromised individuals commonly, but has been reported to occur in normal and healthy individuals as well
- In many patients one or more of the following could be found: Diabetes, Alcoholism/drug abuse/smoking, chronic systemic disease including AIDS and malignancy.

Necrotising fasciitis

- Affected sites are the limbs following trauma, operation sites (especially after laparotomy), perineum, genitalia (Fournier's gangrene), submandibular region and the neck (Ludwig's angina).

- CAUSES

There are two forms based on the causative organisms:

- Type I, which is the most frequent type (85%) is polymicrobial and caused by:
 - Facultative aerobes
 - Streptococcus species and/or coliforms and
 - anaerobes

Necrotising fasciitis

- Type II accounts for 15% of cases and it's caused by a single organism:
Group A streptococcus
- Exotoxins produced by these organisms cause severe systemic toxicity.

- Presentation

In the initial stages of the disease it is indistinguishable from cellulitis.

However, these warning features will heighten the suspicion:

Necrotising fasciitis

- Excruciating pain that is out of proportion to the other signs of local infection.
- High fever and severe systemic toxicity that may be attended by an organ failure
- Blisters and bullae
- Discharge of foul-smelling haemorrhagic fluid from the wound
- Crepitus
- Patch or extensive skin gangrene

NECROTISING FASCIITIS



Necrotising Fasciitis

- Investigations

- FBC to diagnose anaemia and raised white cell count
- C-reactive protein
- Serum glucose
- BUE&CR to determine the levels of sodium and creatinine
- X-ray of the affected part may show gas in the subcutaneous tissue

- Laboratory Risk Indicator for Necrotising Fasciitis (LRINEC)

- CRP > 150mg/L = 4 points
- WBC($\times 10^9/L$)
 - <15 = 0 point
 - 15-25 = 1 point
 - >25 = 2 points
- Haemoglobin(g/dl)
 - >13.5 = 0 point
 - 11-13.5 = 1 point
 - <11 = 2 points
- Sodium(mmol/l) < 135 = 2 points
- Creatinine(umol/l) > 141 = 2 points
- Chloride(mmol/l) > 108 = 1 point

Necrotising fasciitis

Treatment

- Patient should be treated in high dependency unit or in an intensive care unit
- Intravenous fluid therapy should be instituted early and then tailored to the patients needs.
- Organ support, when necessary
- IV antibiotics, must include a penicillin, metronidazole/clindamycin/vancomycin, and an aminoglycoside/cephalosporin/quinolone
- Debridement, fasciotomy or amputation
- Hyperbaric oxygen

FOURNIER'S GANGRENE



Fournier's gangrene(necrotizing fasciitis of the genitalia and perineum)

- An acute, rapidly progressive and potentially life threatening necrotizing fasciitis involving the external genitalia and perineum.
- Cause by synergistic, and opportunistic infection due to both aerobic and anaerobic organisms, including Staphylococcus, micro-aerophilic hemolytic Streptococcus, E. coli, Klebsiella and Bacteroides from the patient.
- The aerobes reduce the oxygen tension which enables the anaerobes to thrive
- An accompanying thrombosis of the small subcutaneous vessels leads to necrosis of the overlying skin

Fournier's gangrene

- Clinical Features

- May start suddenly as a painful, tense swelling of the scrotum or initially with cellulitis adjacent to the portal of entry of the bacteria.
- Local crepitations may be detected in some patients
- Shortly after, gangrene sets in.
- Usually there is a fever and the patient is seriously ill.
- The gangrene is progressive and has a sharp border with healthy tissue.
- There is typically a fetid odour due to dead tissues and organisms.
- The gangrene involves the whole thickness of the scrotum which is eventually sloughed off exposing the testes which are completely unaffected by the gangrenous process.

Fournier's gangrene

- Nearly always the anterior surface of the scrotum is involved, but the whole scrotal sac may be involved, but the whole scrotal sac may become gangrenous.
- The process may spread to involve the skin of the penis, anterior abdominal wall and thighs.

FOURNIER'S GANGRENE



Fournier's gangrene

- Investigations

- Diagnosis is clinical
- However because patient is generally unwell – FBC, BUE&CR, WOUND SWAB, URINALYSIS, URINE C/S
- Sometimes imaging studies (USG, CT scan, MRI) may be required to know the extent of the disease or detect underlying cause.

Fournier's gangrene

- Treatment

- Urological emergency
- Treatment entails an aggressive multimodal approach, comprising hemodynamic stabilization, broad spectrum antibiotic therapy and surgical debridement.
- Resuscitation with intravenous fluid and/or blood is required in patients who are very ill or hemodynamically unstable.
- Broad spectrum antibiotics pending results of bacteria culture
- Selection of antibiotics should cover gram-positive, gram-negative and anaerobic organisms.

Fournier's gangrene

- Empirical Antibiotic combinations
 - Ciprofloxacin plus Clindamycin
 - Ceftriaxone (or any third generation cephalosporin or Gentamicin) plus Penicillin plus Metronidazole
 - Meropenem plus Clindamycin
- Early surgical debridement is vital in enhancing overall outcome
- In most cases, multiple sessions of debridement is necessary to achieve a complete one.
- Hyperbaric chamber when used in combination with antibiotics and debridement, has shown to enhance wound healing.

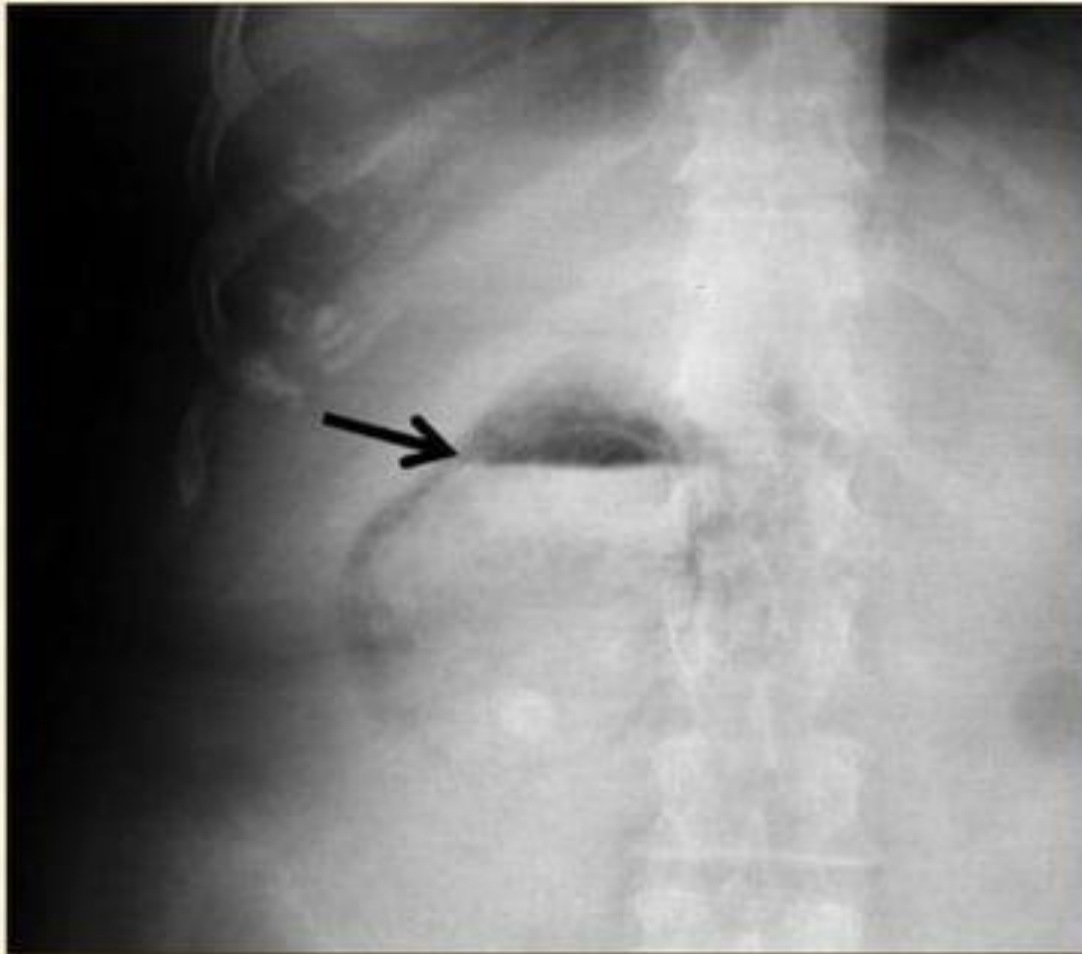
Fournier's gangrene

- Wound management after debridement is aimed at encouraging separation of slough and the acceleration of granulation formation.
- Some of the topical agents used for wound dressing include normal saline, povidine iodine, sodium hypochlorite, and honey

Emphysematous Cholecystitis

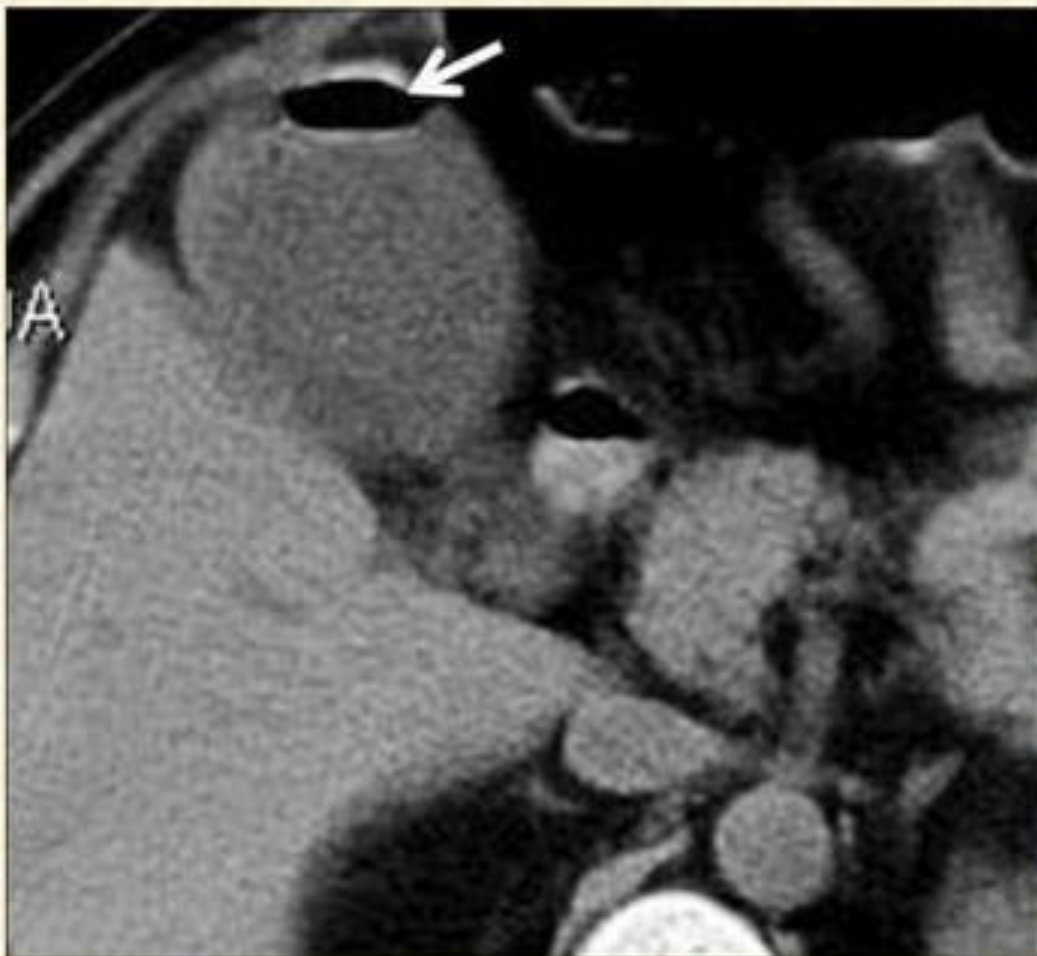
- EC is a severe form of acute cholecystitis.
- Rapidly fatal, risk for gangrene and perforation, high risk mortality.
- Life-threatening anaerobic infection. Gas-forming bacteria (*Clostridium welchii/perfringens*, *Escherichia coli* and *Bacteroides fragilis*)
- Men are affected twice as commonly as women. Mostly patients are between 50 and 70 years of age, and have underlying diabetes melitus.
- Can be detected using CT or USG. Gas in gallbladder or abnormal communication with GIT
- Pain in right upper quadrant.

Plain Abdominal Radiograph



Abdominal radiograph (frontal projection) shows intraluminal air (arrow) with air-fluid levels

CT



Axial CT scan shows air (arrow) in the gall bladder lumen with an air-fluid level

- EPN most often occurs in persons with diabetes mellitus, especially women.
- Presentation is similar to that of acute pyelonephritis
- But often has a fulminating course, and can be fatal if not recognized and treated promptly

Epidemiology

- Mean age of patients with EPN is 55 years, with a range of 19-81 years.
- 6 times more common in women.
- Ninety-five percent of patients have diabetes.
- In most patients, the diabetes is uncontrolled, with high levels of glycosylated hemoglobin (72%) or of blood sugar.
- Renal stones are another predisposing condition and therefore affect the frequency of EPN
- Left kidney is affected more commonly than the right. Bilateral cases have also been reported.

Other reported factors associated with the development of EPN are

- drug abuse,
- neurogenic bladder
- Alcoholism
- anatomic anomaly like polycystic kidney disease

RISK FACTOR



Diabetes
Mellitus



Urinary Tract
Obstruction



Elderly



Women

CLINICAL FEATURE

CLINICAL FEATURES

Acute

Fever &
Chills



Nausea /
Vomiting

Flank /
Abdominal
Pain



Insidious

Signs and symptoms

- Fever (79%)
- Abdominal or flank pain (71%)
- Nausea and vomiting (17%)
- Dyspnea (13%)
- Acute renal impairment (35%)
- Altered sensorium (19%)
- Shock (29%)
- Other possible findings include the following:
 - Crepitus over the flank area may occur in advanced cases of EPN
 - **Pneumaturia** is uncommon unless emphysematous cystitis is present
 - **Subcutaneous emphysema and pneumomediastinum** have been reported
 - Comorbidities include alcoholism, malnourishment, renal calculi, and diabetic ketoacidosis

Diagnosis

- Laboratory findings include :
 - Leukocytosis
 - Pyuria
 - Infected urine
 - Thrombocytopenia
 - An elevated creatinine level
 - Positive blood culture results

DIAGNOSIS

69%

Ultrasound



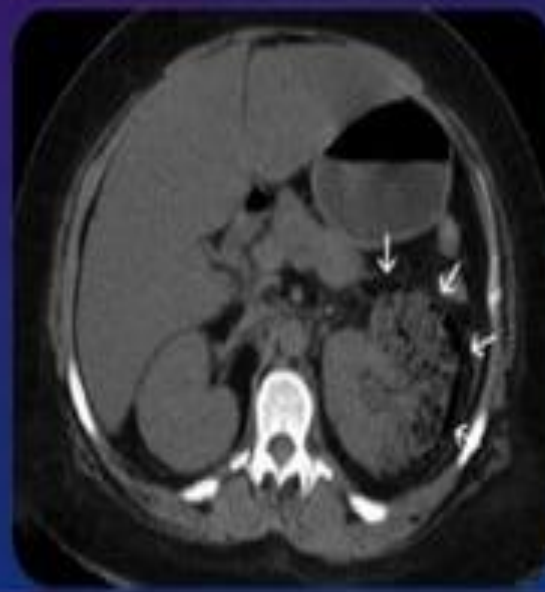
65%

Plain Radiograph



100%

Computed Tomography



APPROACH TO PATIENTS

1

Antibiotics +/- PCD (Abscess)

2

Antibiotics + PCD

3

Antibiotics + PCD +/- Nephrectomy (High Risk)

4

Antibiotics + PCD, Nephrectomy (Last Option)

Prognosis

Untreated cases of emphysematous pyelonephritis (EPN) result in death.

- An overall **EPN mortality rate of 19%**.
- Reported significant treatment success rates with percutaneous drainage and antibiotics (66%) and with nephrectomy (90%).
- Factors associated with a **poor prognosis** in patients with
 - Altered level of consciousness,
 - multiple organ failure,
 - hyperglycemia, and
 - leukocytosis.
- EPN that receives only medical treatment may lead to uncontrollable sepsis that requires surgical intervention.

Thank You