Common Risk Factors for AKI in our Setting:
Can We Prevent Them?

Chris Esezobor

Professor: College of Medicine University of Lagos

Consultant Paediatrician: Lagos University Teaching Hospital

Objectives & Outline

Objectives

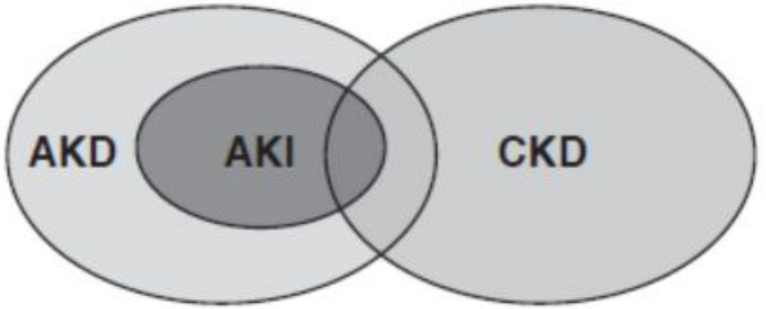
- To highlight the definition of AKI
- To review the consequences of AKI
- To identify the common causes of AKI in our region: exposures and susceptibility
- To identify ways to prevent AKI

Outline

- What is AKI?
- How common is AKI?
- What are the implications of AKI
- What are the common causes of AKI?
- Can we prevent AKI?

What is AKI?

- It is a clinical entity in which there is a sudden deterioration of kidney function (<7 days)
  - Depicted by rise in serum creatinine or fall in urine output occurring

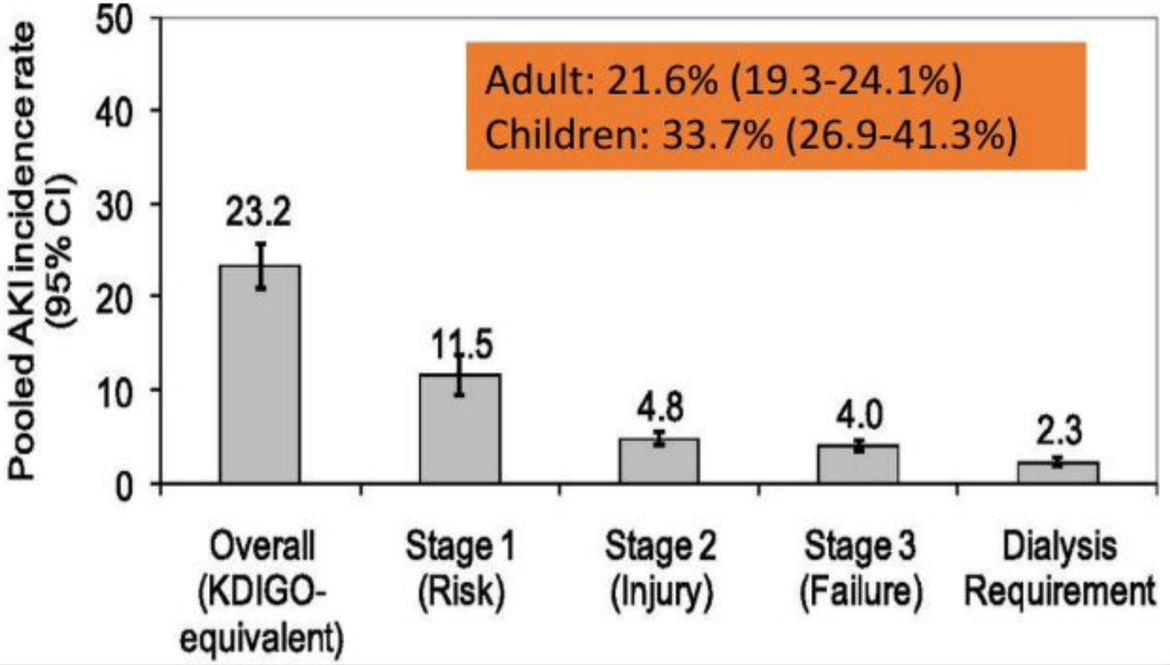


AKD= kidney disease <3 months
CKD= kidney disease >3 months

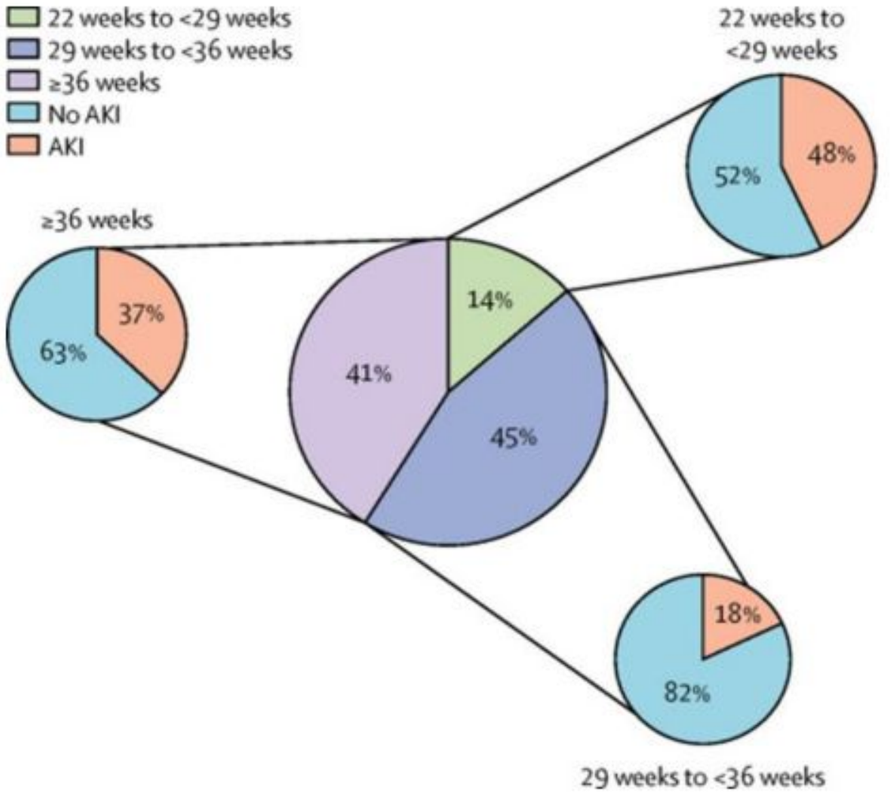
KDIGO Staging of AKI

Stage	Serum Creatinine	Urine Output
1	1.5–1.9 times baseline **OR** ≥0.3 mg/dl (≥26.5 µmol/l) increase	<0.5 ml/kg/h for 6–12 hours
2	2.0–2.9 times baseline	<0.5 ml/kg/h for ≥12 hours
3	3.0 times baseline **OR** Increase in serum creatinine to ≥4.0 mg/dl (≥353.6 mmol/l) **OR** Initiation of renal replacement therapy **OR**, In patients <18 yr, decrease in eGFR to <35 ml/min per 1.73 m2	<0.3 ml/kg/h for ≥24 hours or anuria ≥12 hours

AKI: How common is it?



No. studies	154	112	108	108	189
No. patients	3,585,911	3,303,992	3,281,715	3,281,715	29,400,495



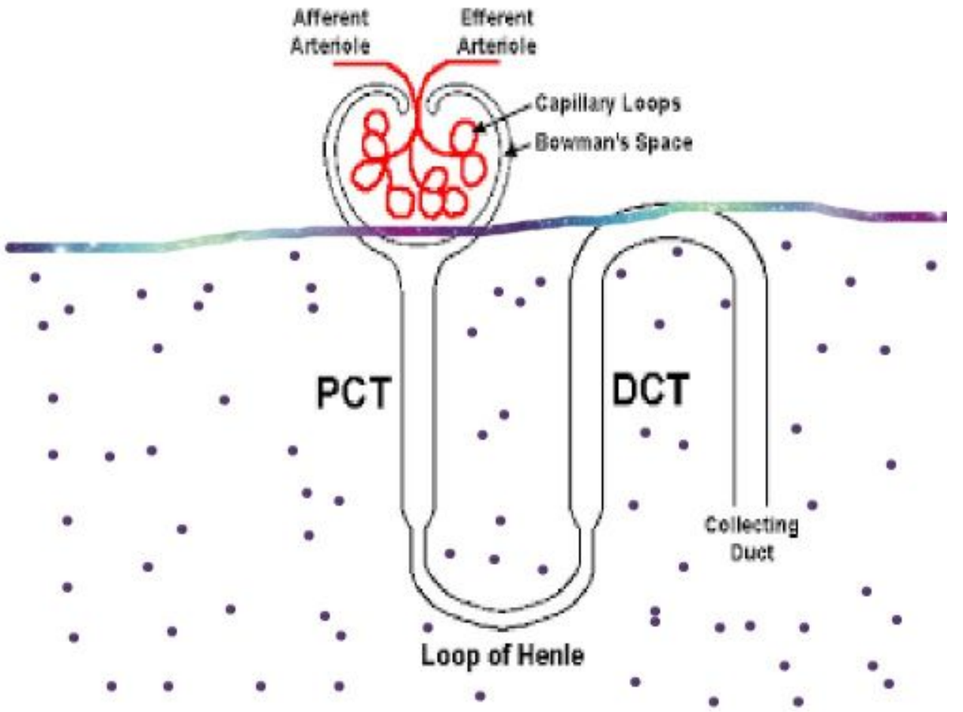
Neonatal AKI

Susantitaphong et al. CJASN 2013;8:1482-1493
Jetton et al. Lancet Child Adolesc Health 2017; 1: 184–94

AKI: Common causes

- Prerenal causes
- Intrinsic causes
- Post renal causes

	Children n=1643	Adults n=993
Infections (>80-90% septicaemia)	380 (23%)	274 (28%)
Glomerular diseases (mostly nephrotic syn & AGN)	350 (21%)	76 (8%)
Nephrotoxins (mostly malaria)	270 (16%)	182 (18%)
Intravascular depletion/hypotension (mostly gastro)	174 (11%)	50 (5%)
Obstructive uropathy (PUV and kidney stones)	146 (9%)	46 (5%)
Vascular disease or hemolysis (HUS)	116 (7%)	11 (1%)
Obstetric/gynaecological (septic abortion, pre-eclampsia, PPH)	-	157 (16%)
Perinatal asphyxia	27 (2%)	-



Oluwo et al: Lancet Glob Health 2016; 4: e242–50

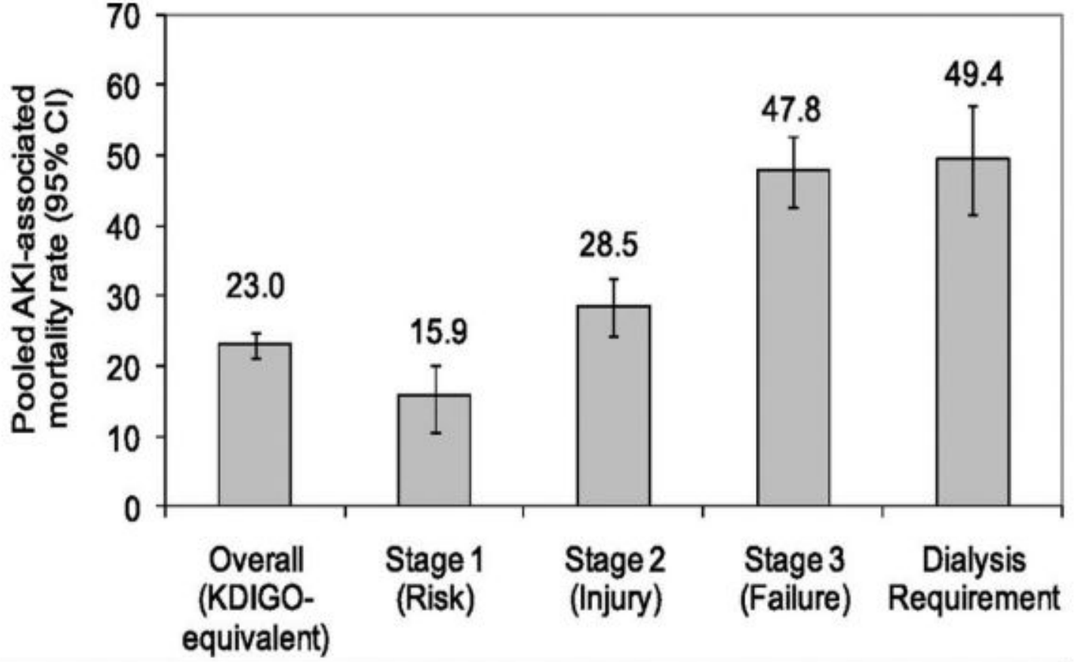
Exposures v Susceptibilities

Exposures	Susceptibilities
Sepsis	PUV other CAKUT
Malaria	Dehydration or volume depletion
Gastroenteritis	Young age
Burns	Chronic kidney disease
Perinatal asphyxia	Cancer
Shock	Anaemia
Major surgeries	ACEI/ARB
Nephrotoxins, radiocontrast	Chronic diseases

KDIGO: Kidney Int 2012

AKI: Consequences

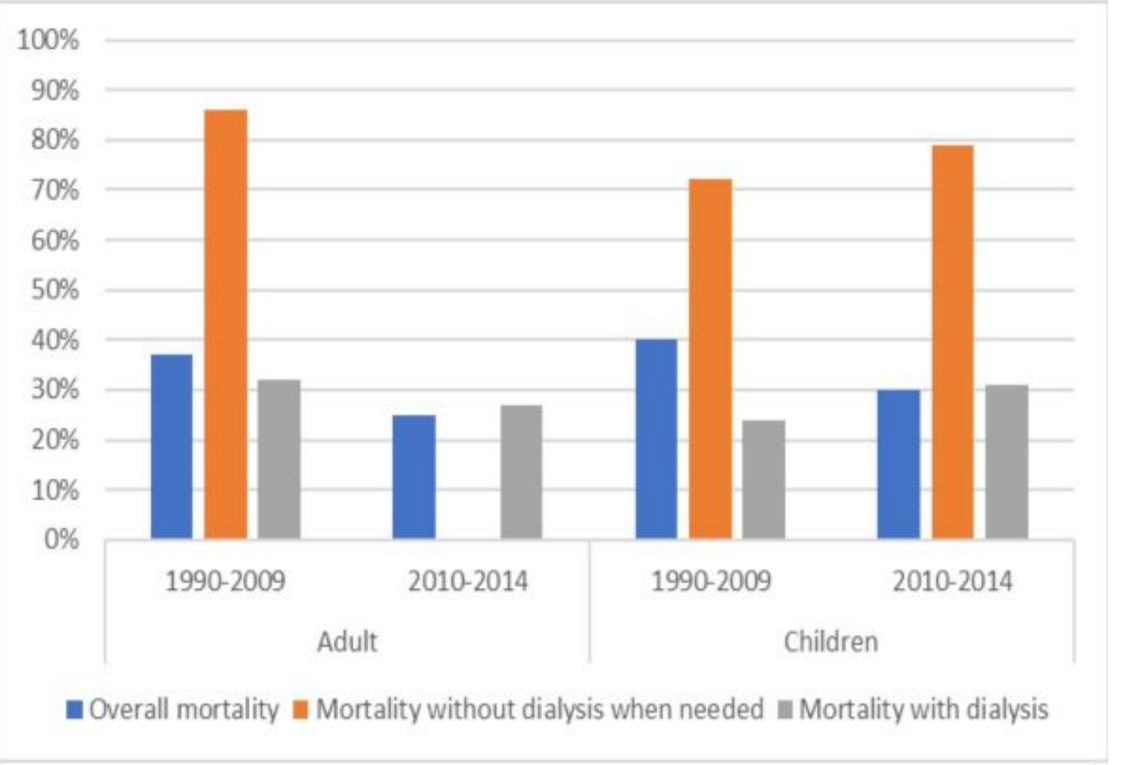
Children and adults worldwide



No. studies	110	26	25	25	31
No. patients with AKI	429,535	8,226	42,354	42,354	6,534

	Crude odds ratio or parameter estimate (95% CI)	p value	Adjusted odds ratio or parameter estimate (95% CI)	p value
Mortality	7·5 (4·5–12·7)	<0·0001	4·6 (2·5–8·3)*	<0·0001
Length of stay (days)	14·9 (11·6–18·1)	<0·0001	8·8 (6·1–11·5)†	<0·0001

Children and adults in Africa



Neonates

Susantitaphong et al. CJASN 2013;8:1482-1493
Jetton et al. Lancet Child Adolesc Health 2017; 1: 184–94
Oluwo et al: Lancet Glob Health 2016; 4: e242–50

AKI Consequences: Others

- Increased cost of hospitalisation
- Higher rates of adverse cardiovascular outcomes: hypertension, heart failure and myocardial infarction
- Higher rates of adverse kidney outcome: albuminuria, CKD

Criterion	Mean Unadjusted Increase in Total Cost ($)	Mean Adjusted (Marginal) Increase in Total Cost ($)
↑ SCr ≥ 0.3 mg/dl	$ 8,902	$ 4,886
↑ SCr ≥ 0.5 mg/dl	$12,656	$ 7,499
↑ SCr ≥ 1.0 mg/dl	$21,475	$13,200
↑ SCr ≥ 2.0 mg/dl	$33,161	$22,023
↑ SCr by 25%	$ 7,469	$ 3,721
↑ SCr by 50%	$10,125	$ 5,510
↑ SCr by 100%	$15,192	$ 8,999
↑ SCr by 50% to a minimum peak of 2.0 mg/dl	$19,517	$11,719
↑ SCr ≥ 0.5 mg/dl with baseline SCr < 2.0 mg/dl or ↑ SCr ≥ 1.0 mg/dl with baseline SCr ≥ 2.0 and < 5.0 mg/dl	$13,451	$ 7,982

Chertow et al JASN 2005
Odutayo et al JASN 2017
Parr et al Kidney Int 2018
Hsu et al JASN 2016

AKI: Can it be prevented?

- General health promotion: Appropriate housing, potable water, safe disposal of waste, antenatal care; avoidance of overcrowding
- Specific protection: use of insecticide treated net; immunisations; referral of high risk pregnancy; skilled manpower at delivery; safe abortion
- Early diagnosis and treatment: ORS for gastroenteritis, prompt diagnosis and treatment of malaria and other infections; trained sonographers to detect CAKUT
- Avoidance of nephrotoxic medications

AKI Prevention: Malaria

- Sleeping under insecticide treated net
- Prompt detection of malaria
- Appropriate treatment of malaria with ACT
- Paracetamol??

Clinical Infectious Diseases
MAJOR ARTICLE

Acetaminophen as a Renoprotective Adjunctive Treatment in Patients With Severe and Moderately Severe Falciparum Malaria: A Randomized, Controlled, Open-Label Trial

Katherine Plewes,[1,2,3] Hugh W. F. Kingston,[1,4] Aniruddha Ghose,[5] Thanaporn Wattanakul,[1] Md. Mahtab Uddin Hassan,[5] Md. Shafiul Haider,[6] Prodip K. Dutta,[6] Md. Akhterul Islam,[7] Shamsul Alam,[8] Selim Md. Jahangir,[9] A. S. M. Zahed,[5] Md. Abdus Sattar,[5] M. A. Hassan Chowdhury,[5] M. Trent Herdman,[1] Stije J. Leopold,[1,2] Haruhiko Ishioka,[1,10] Kim A. Piera,[4] Prakaykaew Charunwatthana,[1,10] Kamolrat Silamut,[1] Tsin W. Yeo,[4,11] Sue J. Lee,[1,2] Mavuto Mukaka,[1,2] Richard J. Maude,[1,2,12] Gareth D. H. Turner,[1,2] Md. Abul Faiz,[13] Joel Tarning,[1,2] John A. Oates,[14] Nicholas M. Anstey,[4] Nicholas J. White,[1,2] Nicholas P. J. Day,[1,2] Md. Amir Hossain,[5] L. Jackson Roberts II,[14] and Arjen M. Dondorp[1,2]

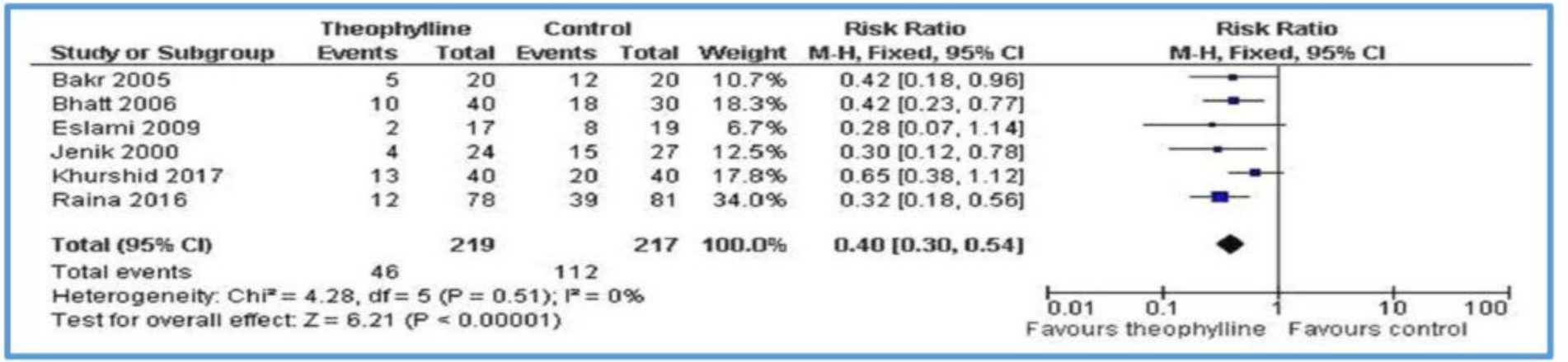
Plewes et al. CID 2018; Google

AKI Prevention: Gastroenteritis

Google

Maternal and Newborn Care

- High-quality antenatal care
  - Identify high-risk mother for appropriate referral
  - Avoid nephrotoxic medications in pregnancy: alcohol, ACEI/ARBS
  - Prenatal detection of CAKUT
- Health provider at delivery
  - prevent many cases of avoidable prenatal asphyxia
  - Prevent postpartum haemorrhage and sepsis
- Aminophylline for asphyxiated neonate



Bhatt et al. Arch Dis Child 2019; Google

Way to prevent (hospital acquired) AKI

A useful bedside aide memoir is STOP AKI

STOP AKI

SEPSIS – *Screen/treat*

TOXINS – *avoid*

OPTIMIZE BP/VOLUME STATUS

PREVENT HARM

- *Identify cause/urinalysis*
- *Treat complications*
- *Review medication doses*
- *Review fluid prescription*

Questions and Comments

Conclusion

- AKI is common among hospitalised patients
- It carries significant short and long term consequences
- A substantial number of AKI can be prevented by simple, low-cost and integrated strategies

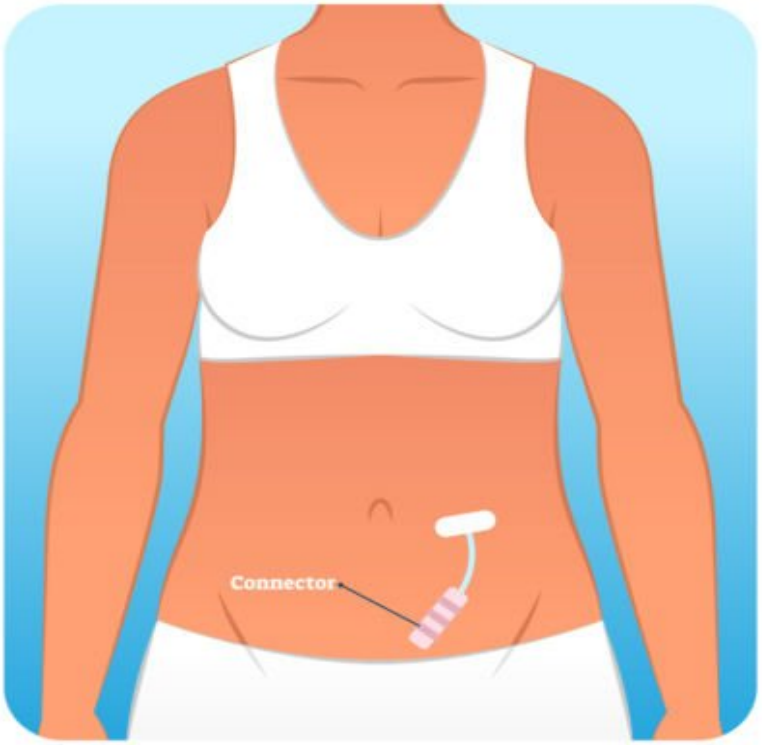
CHALLENGES WITH PERITONEAL DIALYSIS FLUID EXCHANGE

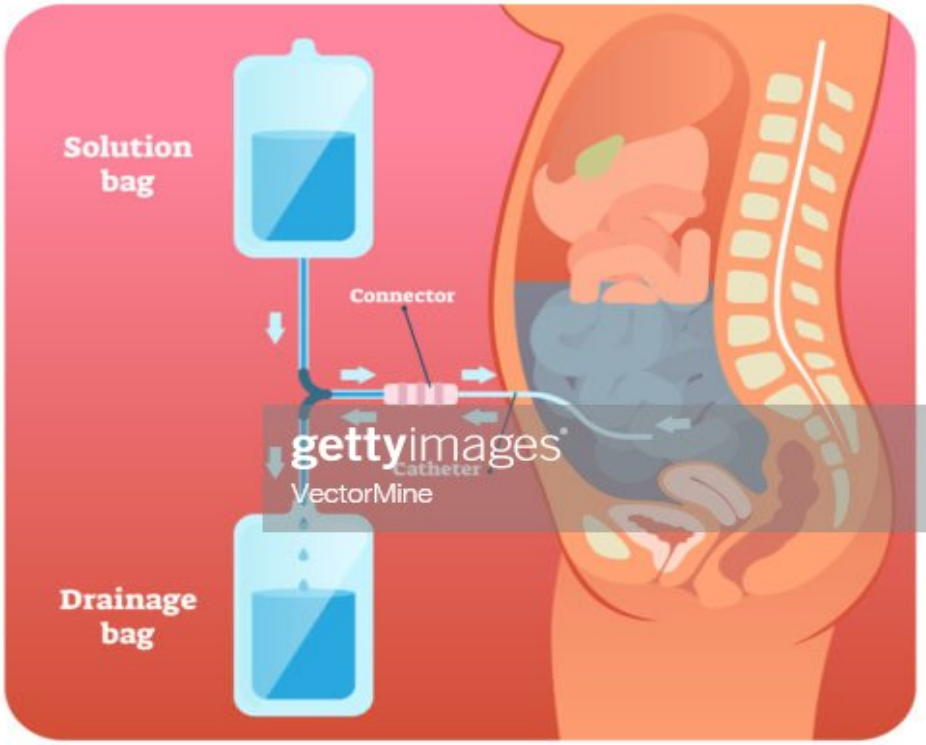
NR. TIJJANI RAIMI

INTRODUCTION

- Peritoneal dialysis is a type of dialysis that uses the peritoneum as the membrane through which fluid and dissolved substances exchange with blood
- PD has equivalent efficacy and comparable to IHD/ CRRT with regards to mortality and early recovery of renal function
- In low resource setting PD offers potential benefit that are hard to over look

Peritoneal Dialysis





Contraindications of PD

- Intra abdominal infection-TB peritonitis
- Presence of hernia
- Distended bowel loop
- Features of peritoneal adhesion
- Diaphragmatic peritoneal-pleural connection
- Peritonitis/abdominal wall cellulitis
- AKI in pregnancy

PD FLUID

In low resource setting PD fluid is often reconstituted using Ringers lactate and Glucose

DEXTROSE

- 2.5 L- 1.5% Dextrose
- 4.5L – 2.5% Dextrose
- 8.5L – 4.25% Dextrose

Buffer; Lactate or Bicarbonate

In some case;

Potassium – added if patient have hypokalaemia

Insulin- added if patient is diabetes in some cases

Types of Catheters

- Best design catheter for PD should;
  - Give maximum inflow and outflow
  - Discourage infection
- Types
  - Flexible catheter– Tenckoff
  - Rigid catheter
  - **Improvised;** NG tube, rubber catheter, intercostal drainage catheter

CHALLENGES

- Slow dialysate inflow and outflow drainage, often occurs when rigid catheters are used
  - Reposition the patient and check tubing and catheter for kink
  - Flush the catheter with saline
  - Heparin solution can be use to flush if clot or fibrin is present in the catheter
- Hyperglycaemia due to added glucose
  - Add insulin to the dialysate as prescribed

CHALLENGES

- Poor patient compliance – due to higher number of connections disconnections and increase intra abdominal pressure, hernia and PD leak causing discomfort.
- Solution:
  - Patient education
  - Assessment of abdominal capacity
  - Reduce the volume of inflow PD fluid
  - Use of appropriate catheter size

CONCLUSION

- Long time outcome associated with PD are good
- It is an effective alternative to HD especially in low resource setting
- It is particularly good in patients who are new to renal replacement therapy and have less comorbidity.

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THANK YOU ALL

Improvised and acceptable PD Consumables

Chris Esezobor

Professor: College of Medicine University of Lagos

Consultant Paediatric Nephrologist: Lagos University Teaching Hospital

Peritoneal Dialysis Fluids

- Should achieve ultrafiltration, clearance of solutes and preserve peritoneal membrane integrity
- 3 major components:
  - Osmotic agents: Glucose, icodextrin, amino acids
  - Buffers: lactate, bicarbonate
  - Electrolytes: Sodium, calcium, magnesium, no potassium

PD Fluids & Ringers Lactate

	BicaVera	Balance	Gambrosol	Physioneal	Ringers Lactate
Sodium	132	134	132	132	130
Chloride	104.5	100.5	96	101	109
Calcium	1.75	1.25/1.75	1.75/1.35	1.75	1.5
Magnesium	0.5	0.5	0.25	0.25	0
Lactate	0	35	40	10	28
Bicarbonate	34	0	0	25	0
Osmolality	358-511	358-511	356-483	344-484	273
Potassium	0	0	0	0	4.0
P^H	7.4	7.0	5.5-6.5	7.4	6.4

PD Fluid: Alternatives

A. 1.5% 'PD' Fluid = Ringer's lactate [500 ml] +
50% Dextrose water [15 ml]

B. **2.3% 'PD' Fluid** = Ringer's lactate [500 ml] +
50% Dextrose water [23 ml]

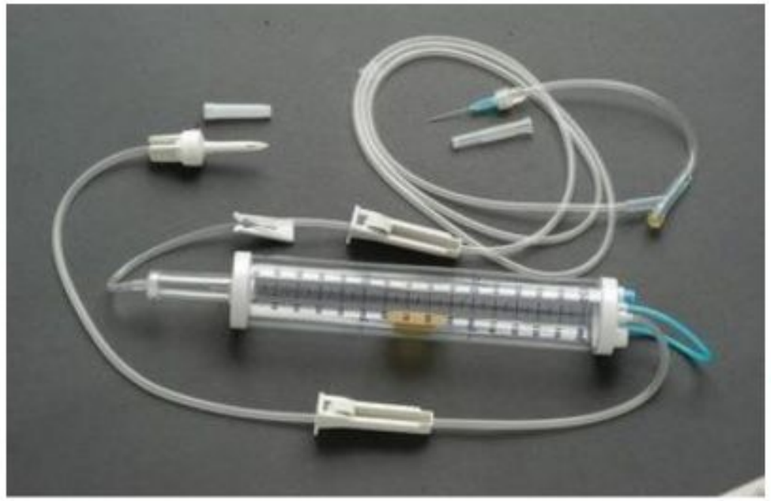
C. **4.25% 'PD' Fluid** = Ringer's lactate [500 ml] +
50% Dextrose water [42.5 ml]

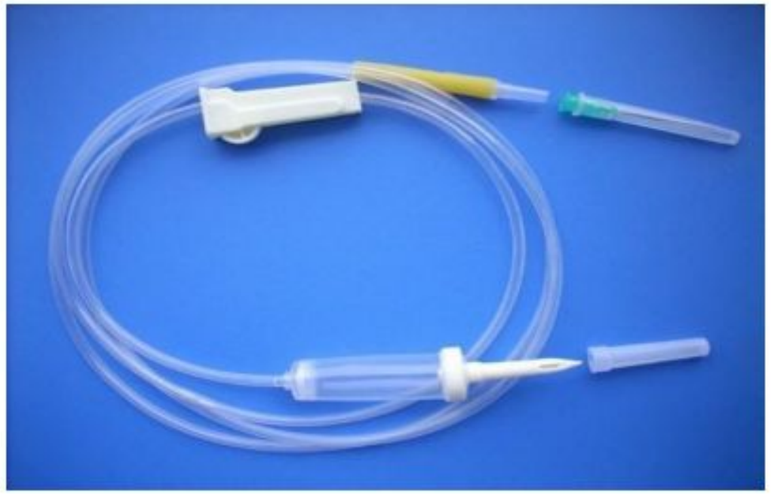
Adding glucose to ringer's lactate makes it similar to most commercial PD fluids in many important respect

PD Fluids: Alternatives

Ringer's Lactate **50% Dextrose water** **Potassium chloride and heparin**

PD Connectology: Alternatives





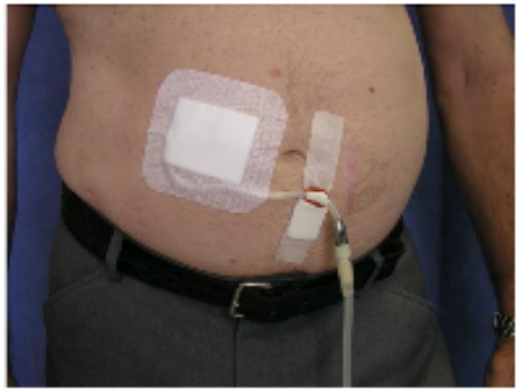
PERITONEAL DIALYSIS ASSOCIATED INFECTION

Dr. YEMI R. RAJI, *MBChB, MSc, FMCP*

SENIOR LECTURER & CONSULTANT NEPHROLOGIST

DEPARTMENT OF MEDICINE,

COMUI & UCH IBADAN



OBJECTIVES

- To appreciate the magnitude of the infection problems associated with PD catheter use
- Highlight possible risk factors for PD Catheter infections
- Understand the diagnosis and management of PD catheter associated infection (exit and tunnel and

OUTLINE

- Introduction
- Burden of PDAI
- Spectrum of PDAI
- Treatment of PDAI
- Prevention
- Summary and conclusion
- Questions and answers

INTODUCTION I

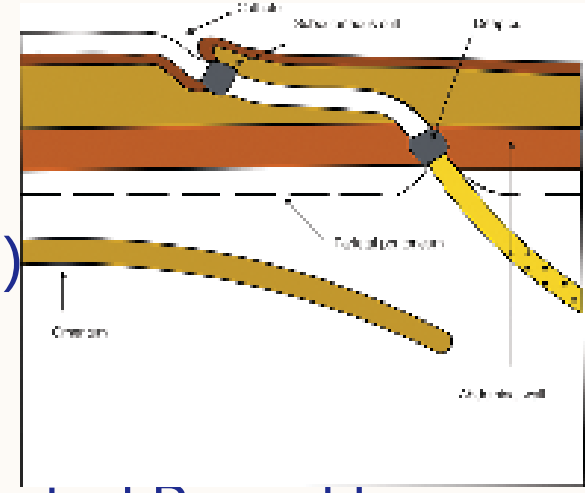
- The functionality of PD Catheter is key to effective PD
- However, the use of PD catheter could be associated with various complications
- Broadly classified as non-infectious and infectious PD catheter complications
- Non-infectious catheter complications – obstruction, dislocation, leakage (30-40%)
- Infectious complications – Exit Site Infection (ESI), subcutaneous Tunnel I (TI) and Peritonitis (50-65%)

INTRODUCTION

- Exit Site Infection (ESI) and Tunnel Infection (TI) pose little risks
- However, the possibility of them leading to PD peritonitis demands paying careful attention to them
- It is estimated that 12% of cases of ESI and TI result in PD peritonitis.

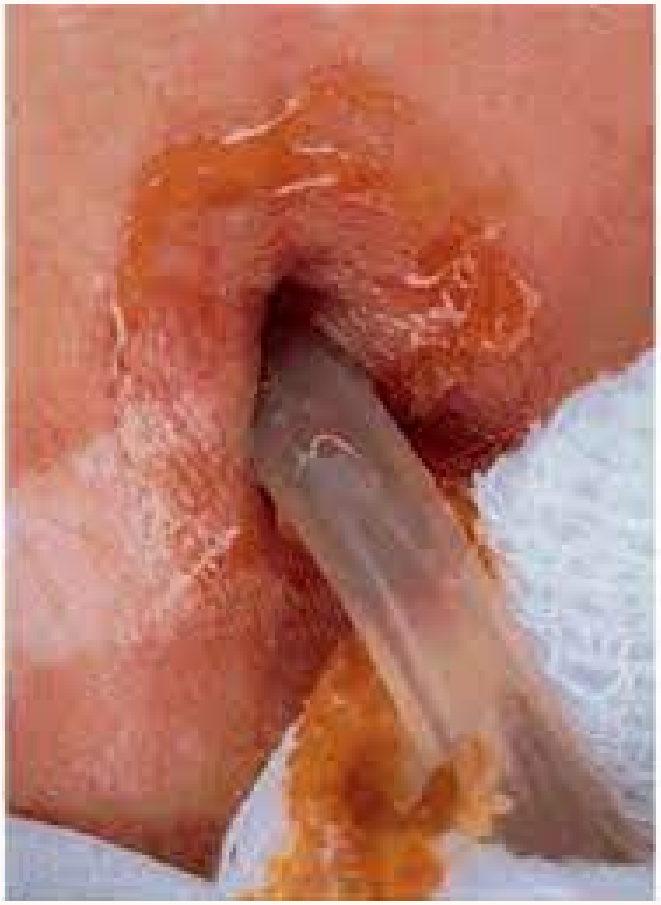
RISK FACTORS FOR PDAI

- ESI and TI are significant risk factors for PD associated Peritonitis
- Age, Family income, Education status, Poor hygiene
- Hot and Humid Tropical climate
- Type of PD catheter (1 cuff or 2 cuffs)
- PD Catheter Technique (exit pre-sternal or abdominal)
- Diabetes mellitus, hypoproteinemia
- Type of PD treatment – APD,
- Types of PD solution (acidic P_H and high glucose vs Neutral P_H and low glucose PD fluids)
- Nasal carriage of bacteria (MRSA)



EXIT SITE INFECTION (ESI)

- Approximately on-fifth of peritonitis is associated with ESI
- **ESI is characterised by drainage of pus/blood from the catheter exit and may be associated with redness, tenderness, swelling and overgrowth of granulation tissues in the acute phase.**
- Chronic ESI may be associated with excess granulation tissue and crust in addition to redness and tenderness.
- Incidence –One episode per 24-48 patient months
- ESI is predominantly caused by S. aureus and Gram negative organisms, particularly



PRESENTATION OF ESI

- Grade 1 – Area of redness around the exit site
- Grade 2 – Area of redness and small exudate around the exit site
- Grade 3 – Frank pus draining from the exit site
- Grade 4 – Abscess at the exit site
- Grade 5 – Redness, tenderness and subcutenous swelling along the catheter length – Tunnel Infection

TREATMENT OF ESI

- Staphyloccocus aureus – Flucloxacillin 250mg qds and Rifampicin 600mg PO daily for 2 weeks
- MRSA – Vancuomycin 30mg/kg IP once a week for 2-4 weeks
- Staphyloccocus Epidemidis - Flucloxacillin 250mg qds PO 10-14 days
- Pseudomonas Spp – Ciprofloxacin 500mg b.d and/or Gentamycin 0.6mg/kg daily for 3 weeks
- With topical antibiotic - mupirocin

TUNNEL INFECTION

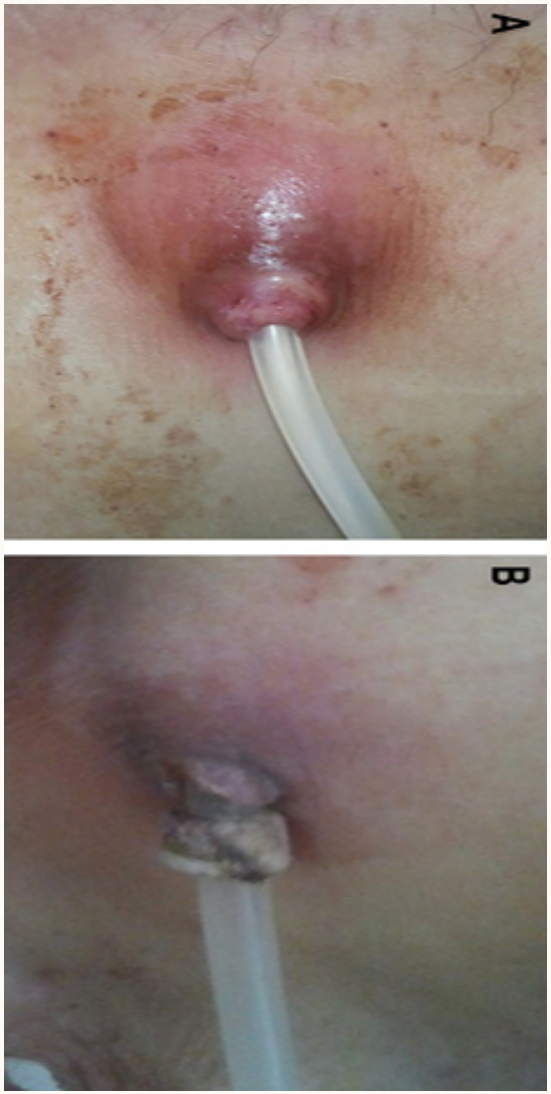
- TI is infection along the PD catheter within the subcutenous tissue

- TI may be present as erythema, edema, or tenderness over the subcutaneous pathway but is often clinically occult,

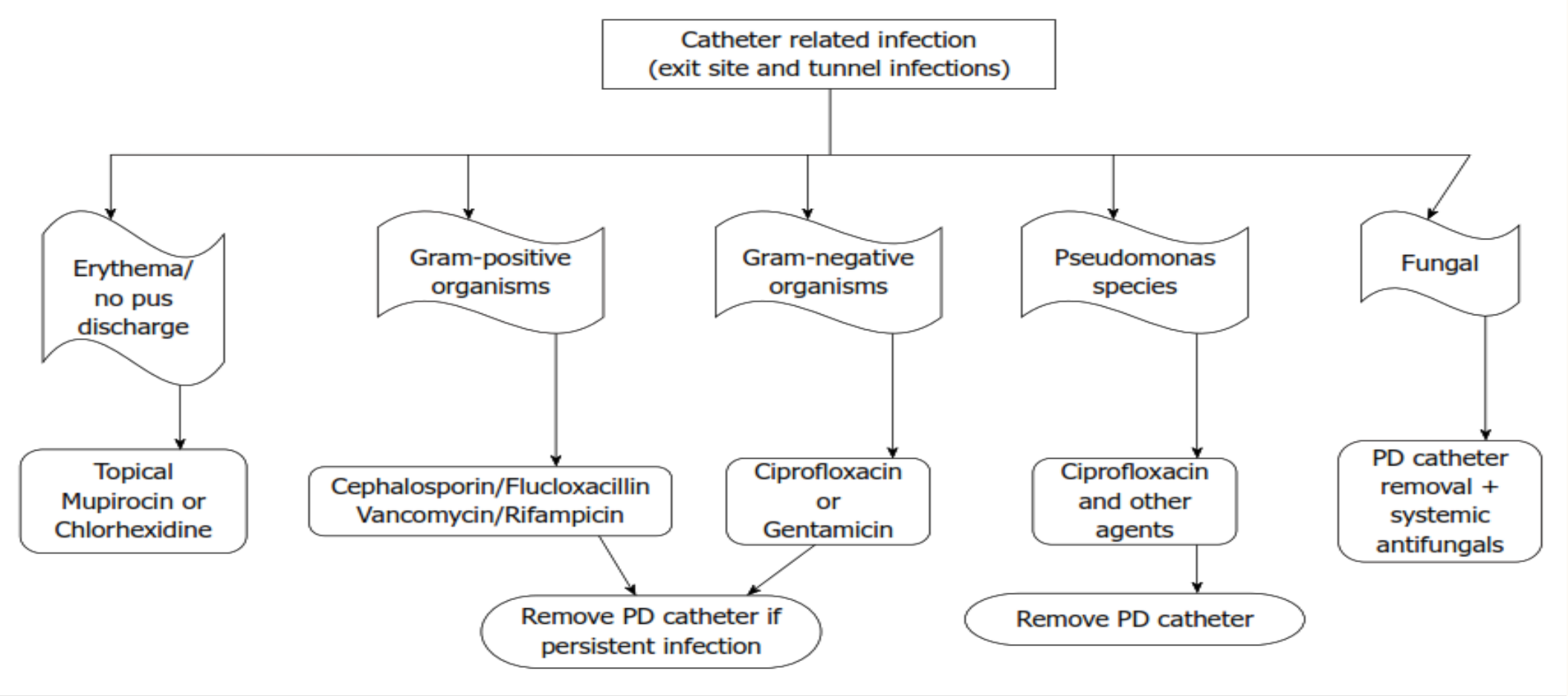
- Incidence – 0.11 – 0.22 per patient year – clinical diagnosis
  - 0.35 per patient year - USS diagnosis

- Associated with PD peritonitis in 15 – 25% of patients

- Treatment with appropriate antimicrobial based on



OVERVIEW OF ESI & TI TREATMENT



PERITONITIS 1

- Peritoneal dialysis (PD)-associated peritonitis – Inflammation of the peritoneal membrane and it is a serious complication of PD.
- Leading cause of **hospitalization, catheter loss and a risk of death among PD patients.**
- The overall rate PDAI is between 0.24 to 1.66 episodes per patient year on dialysis
- PD peritonitis usually has an excellent prognosis with resolution within days but it can lead occasionally to the much dreaded **Sclerosing Encapsulated Peritonitis (SEP),** if not promptly detected

PERITONITIS 2

- Although several organisms are involved in causing PD associated infections (PDAI), **coagulase negative staphylococci (CoNS)** appears to be the most common

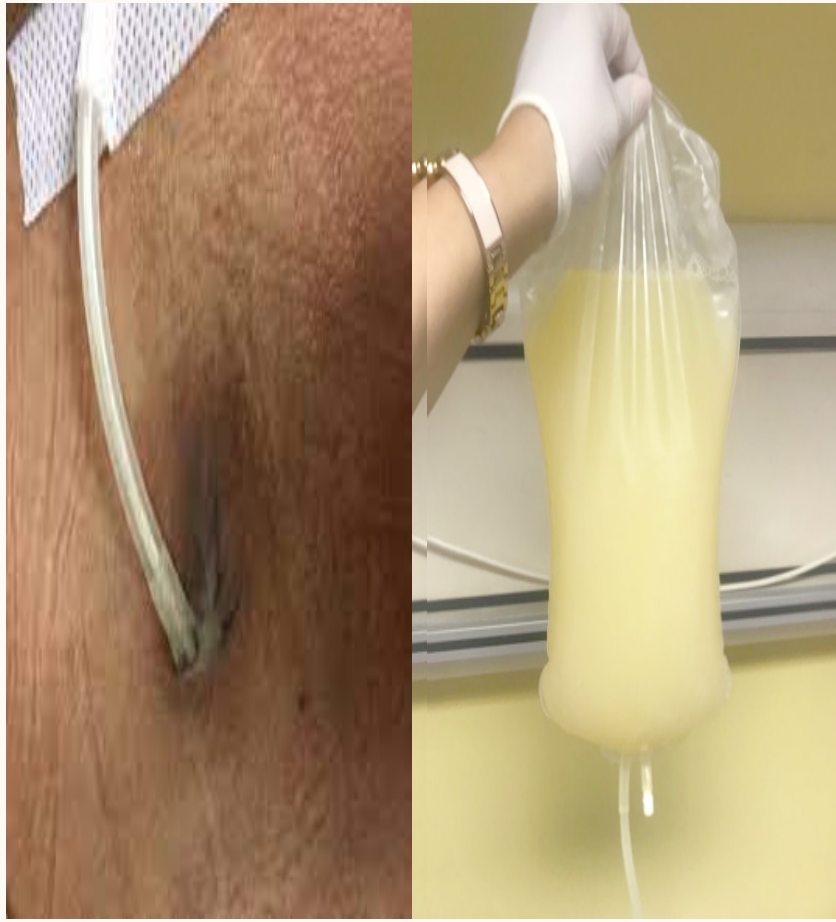
- However, rare forms of PD infection, for example, rapidly growing non-tuberculous mycobacterium are associated with catheter loss (80%) and significant mortality (40%)

PERITONITIS 3

- May be characterized by pain with or without purulent PD effluent
- **Diagnosed when at least two of the following are present:**

1. clinical features consistent with peritonitis, that is, abdominal pain and/or cloudy dialysis effluent;

2. dialysis effluent white cell count > 100/μL or > 0.1 × 10^9/L (after a dwell time of at least 2 h), with > 50% polymorphonuclear leukocytes (PMN);



3. positive dialysis effluent culture

TREATMENT OF PD ASSOCIATED PERITONITIS

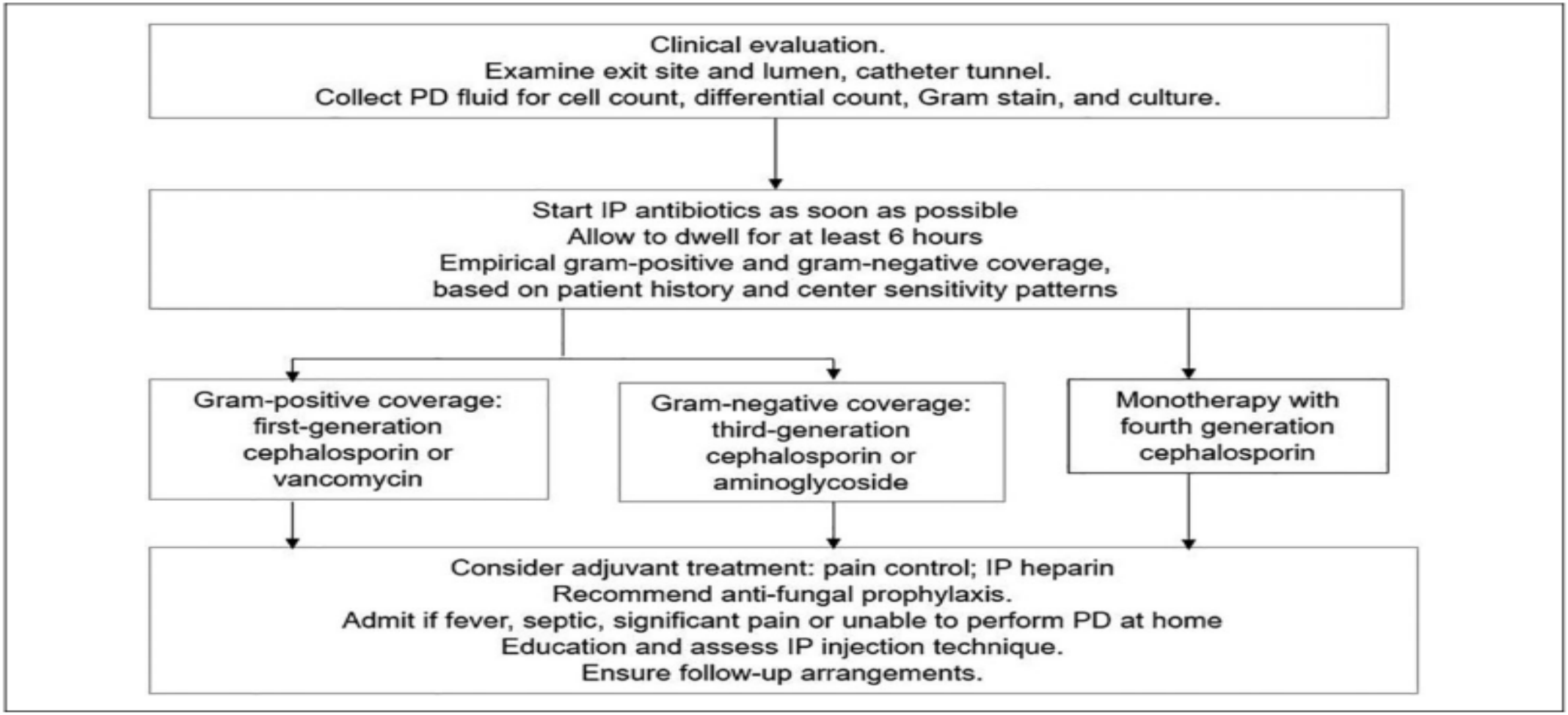


Figure 1. The algorithm of initial management for PD patients presenting with a clinical diagnosis of peritonitis. PD: peritoneal dialysis.

INDICATIONS FOR PD CATHETER REMOVAL IN PD CATHETER ASSOCIATED INFECTION

- Catheter infection associated with peritonitis
- Infection of the inner cuff of the catheter
- Sepsis caused by catheter infection (rare)
- Catheter infections not responding to prolonged antibiotics
- Recurrent infection (ESI, TI and Peritonitis)
- Pseudomonas aeruginosa or Fungal TI or peritonitis

PREVENTION

- In order to obtain a reduction of the complications, achieve prolonged catheter duration and a better quality of life for PD patients, the surgical technique requires strict adherence to a standardized procedure and a dedicated team

- Action to decrease the risk of PDAI should start in the pre-catheter insertion phase – Patient Education, reduce nasal carriage of bacteria, PD staff training etc

- Improved diagnosis, increased awareness of causative agents in addition to other measures will facilitate prompt management of PDAI and salvage of PD modality

SUMMARY

- PDAI is major problem among patients on PD
- It is associated with poor outcomes (morbidity and mortality) and a major cause of transfer to haemodialysis
- ESI and TI are risk significant risk factors for PD associated peritonitis
- Prompt diagnosis and treatment of PDAI is key to a favourable outcome
- Patient education and staff training are important aspects of prevention strategies

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