ACUTE KIDNEY INJURY & CKD MANAGEMENT

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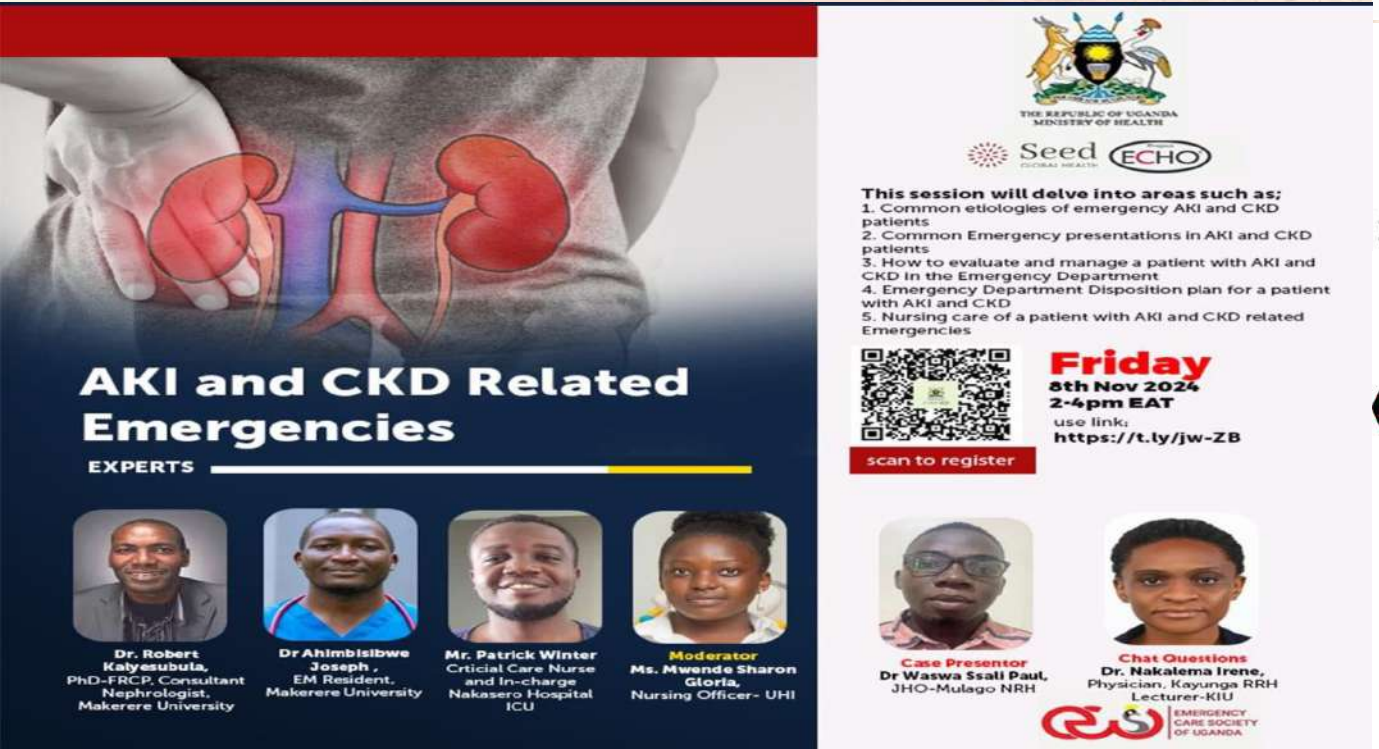

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X(Tweeter): @rkalyes1

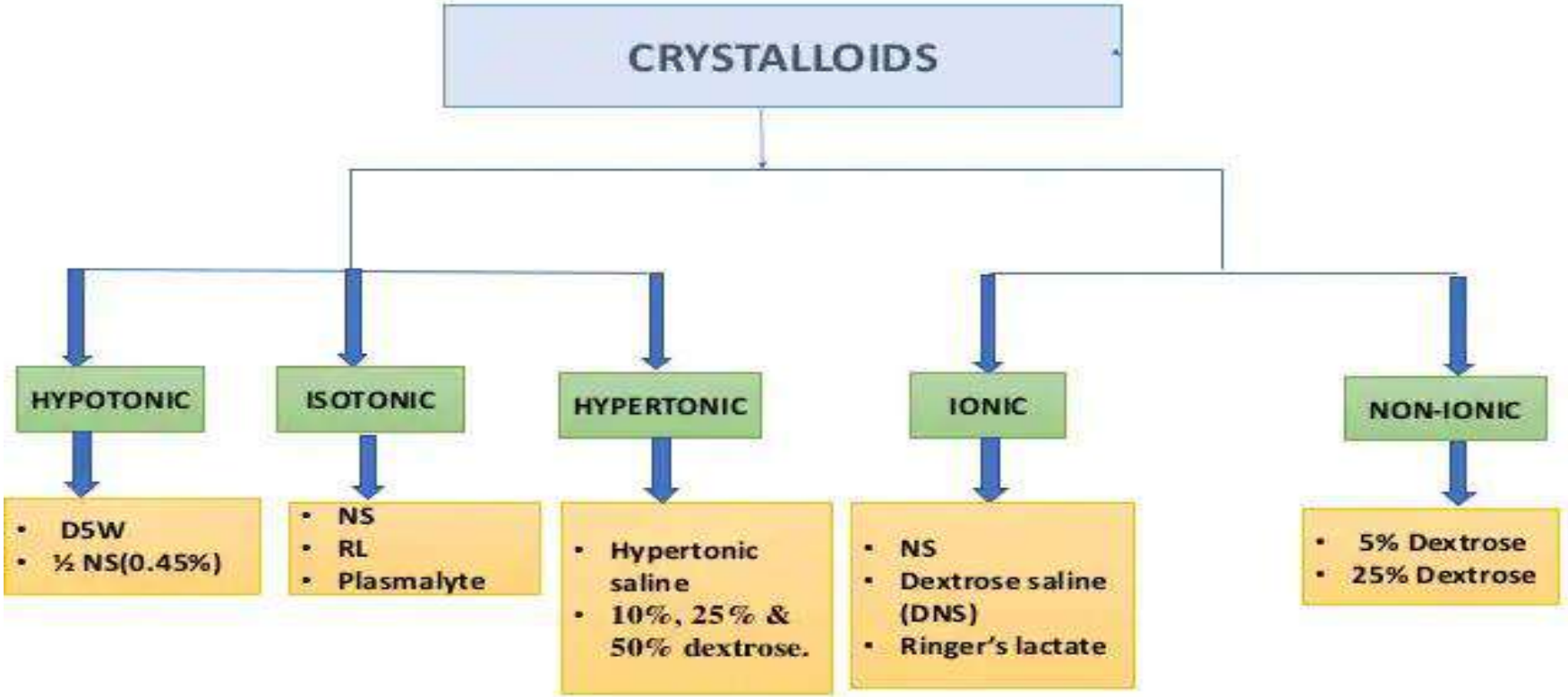
TALK SUMMARY

- AKI EMERGENCIES
- FLUID THERAPY SHOULD BE CLEARLY THOUGHT OUT AND GUIDED BY PATIENT STATUS
- FST IS EVOLVING
- DIALYSIS SHOULD BE USED FOR CLEAR INDICATIONS
- AKI CAN CAUSE CKD
- PREVENTION OF KIDNEY DISEASE
- CKD EMERGENCY MANAGEMENT

AKI Emergencies

- Sudden Loss of Kidney Function
- Severe Dehydration
- Fluid Overload
- Electrolyte imbalances
- Medication Toxicity

CHOICE OF FLUIDS



Ringer's lactate VS Normal Saline

Ringer's Lactate

- Na-131; Cl-111;K-meq/l;Ca-2me/l; HCo3-29meq/l
- No disturbance on acid/base
- Possible clot formation(Ca)
- Increased lactate? (shock, liver)
- Most physiological
- Corrects volume, acidosis and electrolytes; DKA, surgery
- Avoid in severe liver dx, and severe HF

Normal Saline

- Na-154, Cl-154, Ph-5.7
- Increases intravascular volume
- Risk of metabolic acidosis
- Interstitial oedema
- Avoid in HTN, CCF, Liver or renal failure.
- Good for DeH20, EACV, water deficit, shock, brain injury, DKA, irrigation, drug vehicle

Albumin

Uses

- Emergency shock Rx-low plasma
- Severe Hypoalbuminemia
- Acute mgt of burns
- Resistant nephrotic syndrome
- SBP
- Plasmapheresis-replacement fluid
- Liver cirrhosis

Cautions

- Pulmonary oedema
- Heart failure
- Severe Anemia
- Do not use as parenteral nutrition
- Cost-effectiveness

Fluid Challenge

- Gold standard for diagnosing fluid responsiveness
- Volume infused must be sufficient to increase stroke volume
- Success-10-15% increase in stroke vol
- Fluid Responders
- Others issues of heart function, fluid delivery time affect test.

Fluid Challenge-How to do it

- Patient characteristics
- Type of fluid- use any crystalloid
- Rate of delivery: 250-1lite in 30 minutes; use crystalloids
- Indicated in:
  - Hypotension 2^0 to hypovolemia (MAP<65)
  - -Tachycardia due to hypovolemia
  - -Low urine output (<0.5mls/Kg/hr >2hrs)
  - -Low CO in underfilling (invasive cardiac monitoring)
- Safety limits -Monitor for pulmonary oedema, CVP, invasive monitoring

Fluid mgt in AKI

- Fluid restrict in edematous states and oliguric pts
- Fluid intake = UO+ 500mls(+-)
- Salt restrict
- Avoid hyperkalemia
- In pre-renal AKI consider fluid challenge with NS.
- If no response add Furosemide

Fluids for AKI

Non-Oliguric- sepsis, aminoglycosides of Interstitial nephritis

-Watch for acid base and hyper K

Oliguric AKI-

-ATN, 2-3 wks

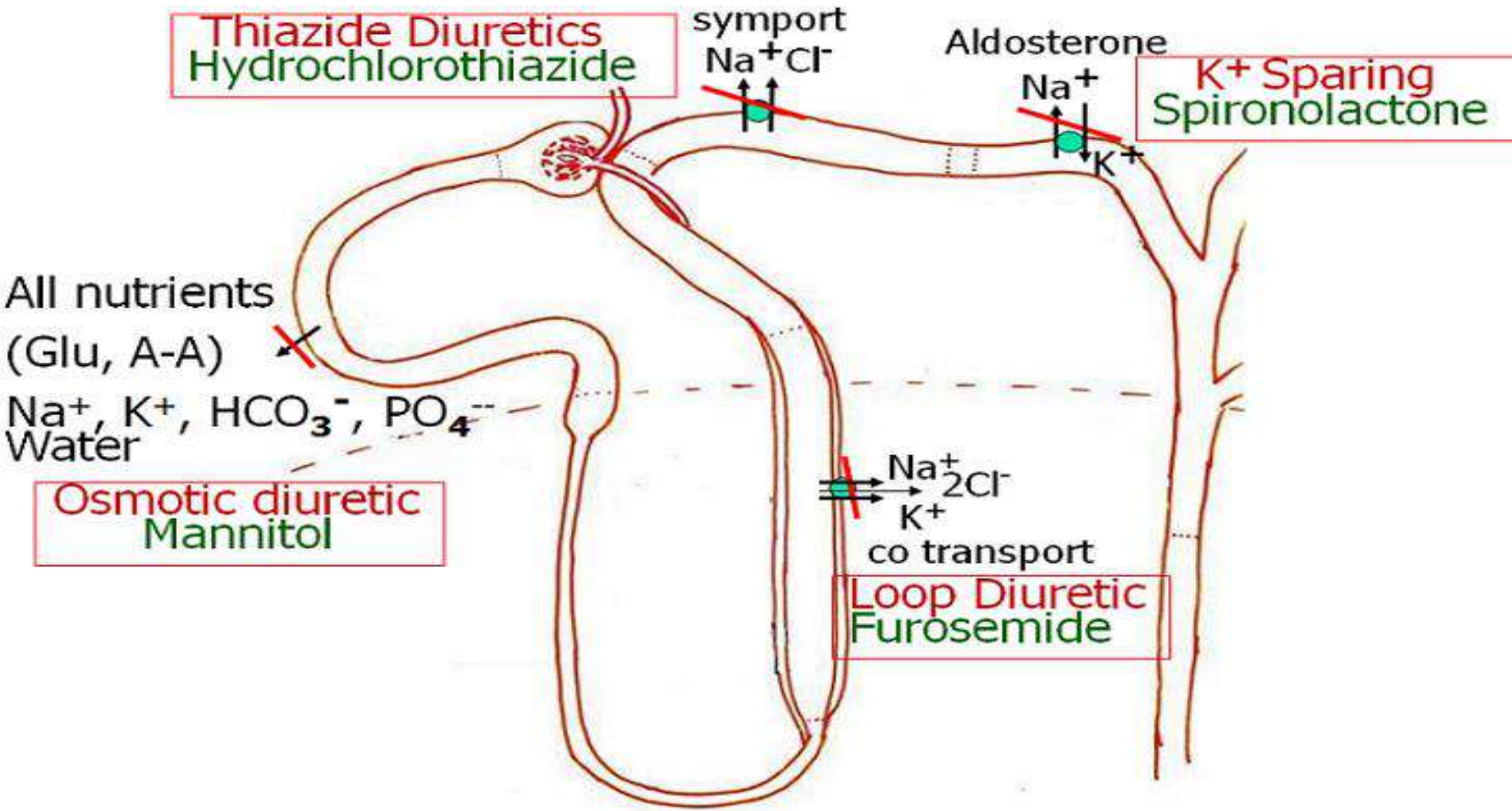
- U/O 400mls/24hrs, <0.5mls/Kg/hr
- Restrict fluid , salt and K
- Use dextrose 5 or 10% if fluid is needed

Diuretic phase of AKI-

-avoid fluid depletion

-replace fluid with half strength saline with K as needed

Sites of Action of Diuretics

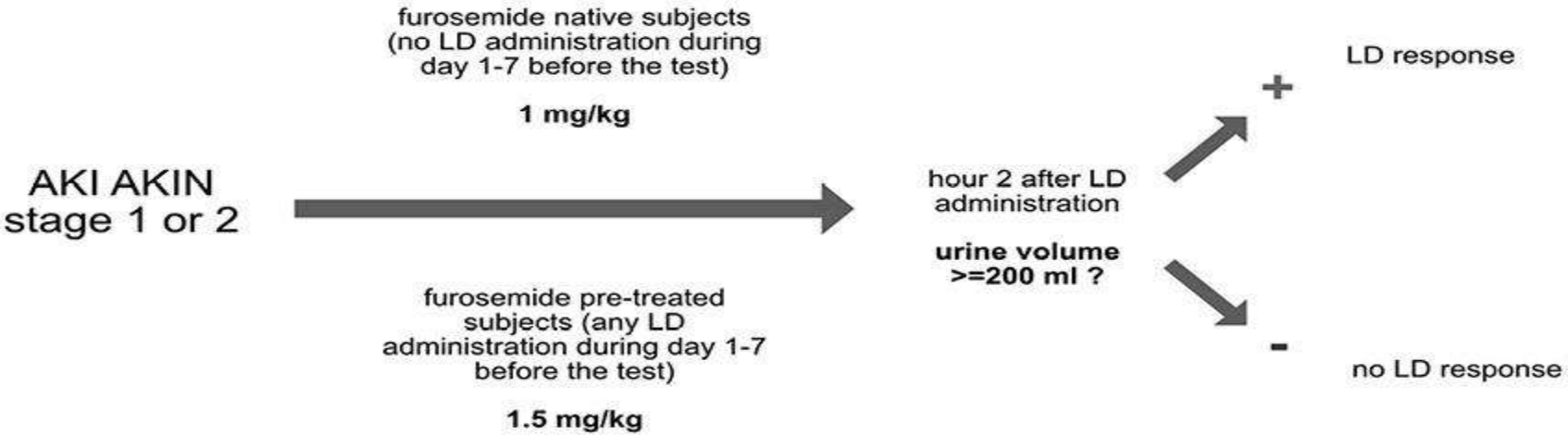


Use of Diuretics

- Not beneficial for AKI treatment if kidney-related endpoints are considered.
- Beneficial for euvolemia is maintained.
- Identification of AKI subjects at a higher risk of AKI progression

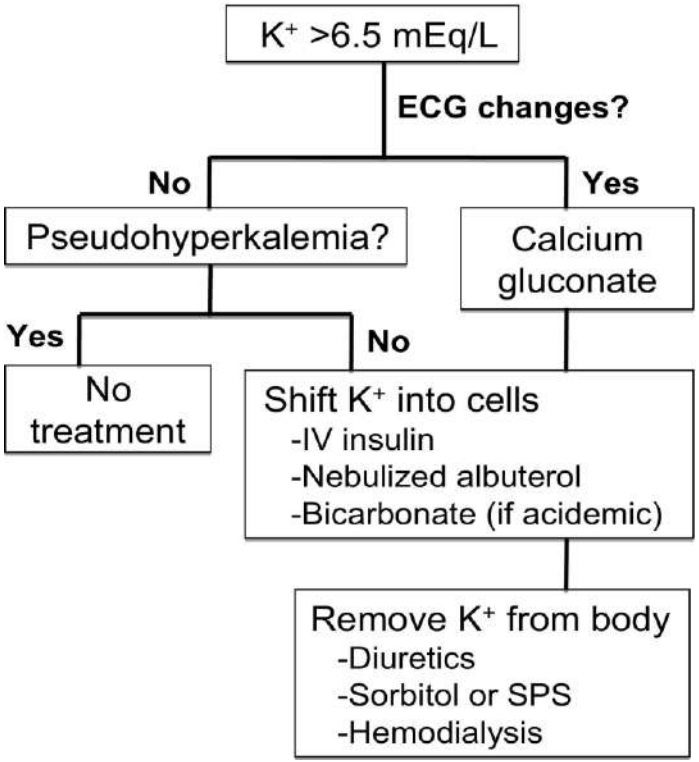
Furosemide Stress Test (FST)

- For AKI progression risk estm.
- The cutoff for predicting AKIN stage 3 was a urine output <100 mL/h during the next 2 h after furosemide administration

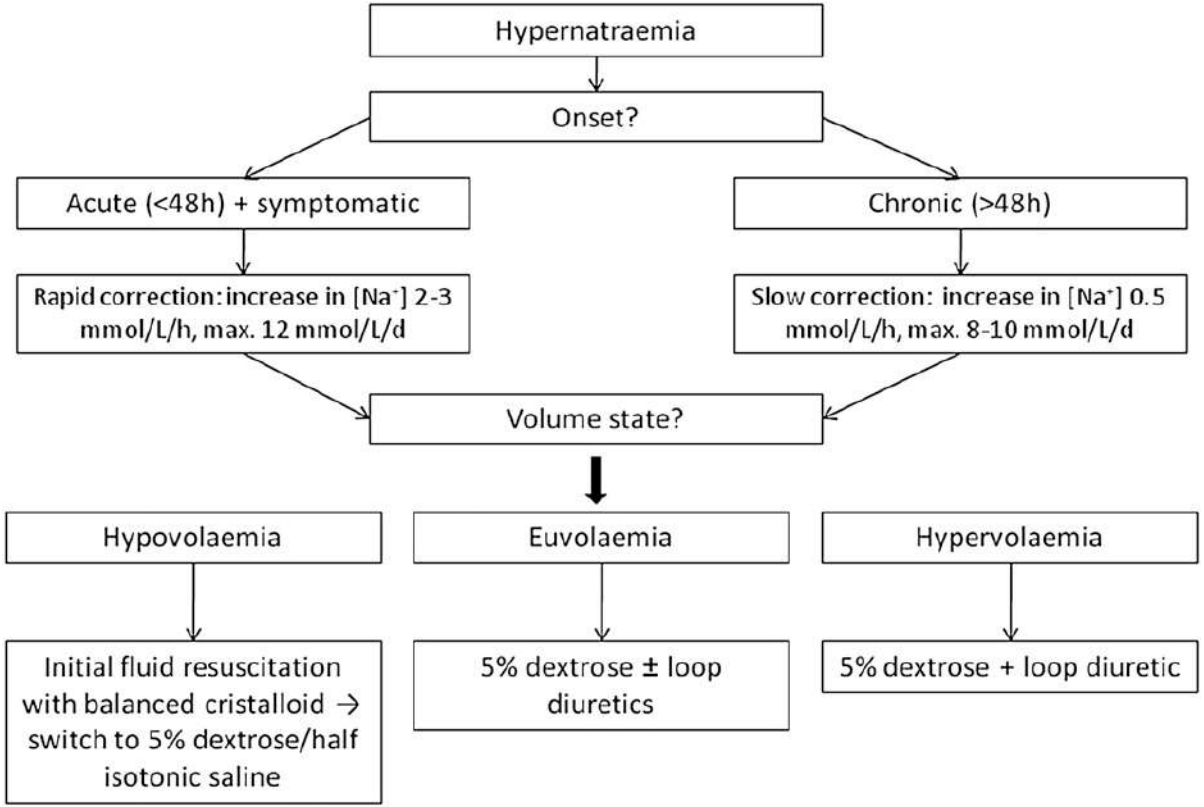


Hyperkalemia management

Effect	Agent	Dose	Onset	Duration
Membrane Stabilization	Calcium Gluconate (10%)	10mL IV over 10 min	Immediate	30 – 60 minutes
	Hypertonic (3%) Normal Saline	50mL IV push	Immediate	Unknown
Shifters	Insulin (Short Acting)	10 units IV push with 25 – 40 g dextrose (50% solution)	20 minute	4 – 6 hours
	Albuterol	10 – 20 mg in 4 mL of Normal Saline nebulized over 10 minutes	30 minute	2 hours
Excreters	Furosemide	40 – 80 mg IV x1	15 minute	2 -3 hours
	Sodium Bicarbonate	150mmol/L IV at variable rate	Hours	Duration of Infusion
	Sodium Polystyrene Sulfonate	15 – 30 g in 15 – 30 mL (70% sorbitol orally)	> 2 hours	4 – 6 hours
Definitive	Hemodialysis	-----	Immediate	3 hours



Hypernatremia management



EFWD Formula

$$\text{water deficit} = \%\ \text{body water} \times \text{mass (kg)} \times \left(\frac{\text{current Na} - \text{ideal Na}}{\text{ideal Na}} \right)$$

$$\text{water deficit} = 0.5 \times 70 \times \left(\frac{167 - 145}{145} \right)$$

$$\text{water deficit} = 35 \times \left(\frac{22}{145} \right)$$

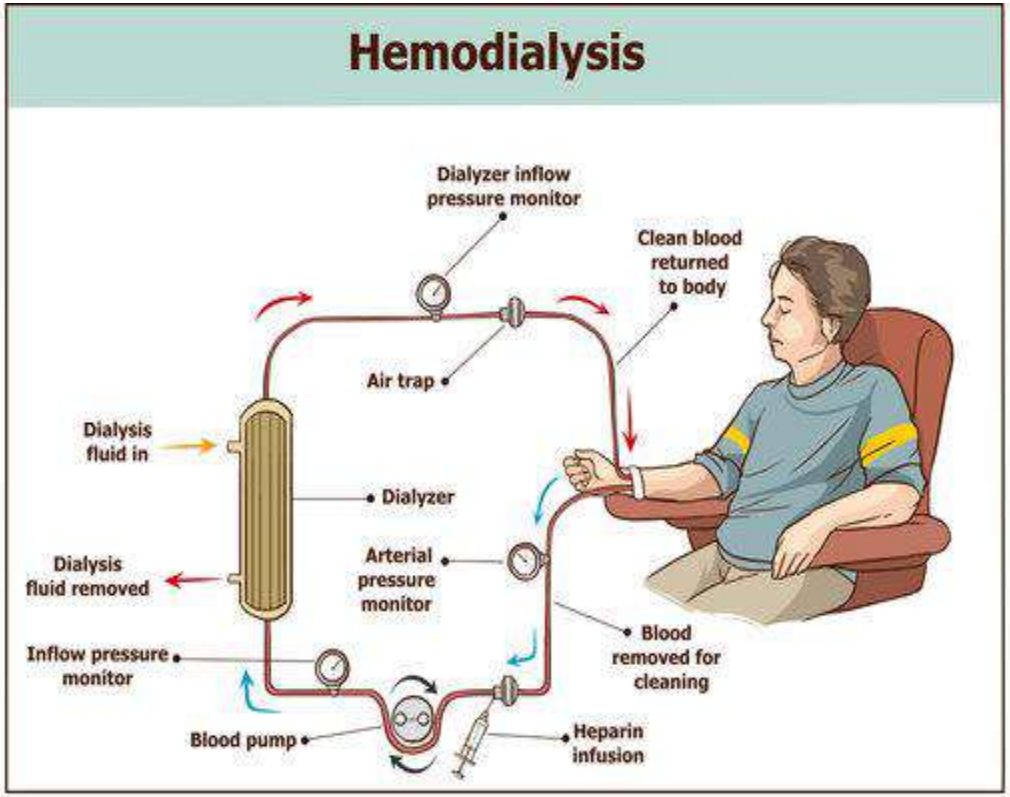
$$\text{water deficit} = 5.3 \text{ liters}$$

Sick Days Medication List

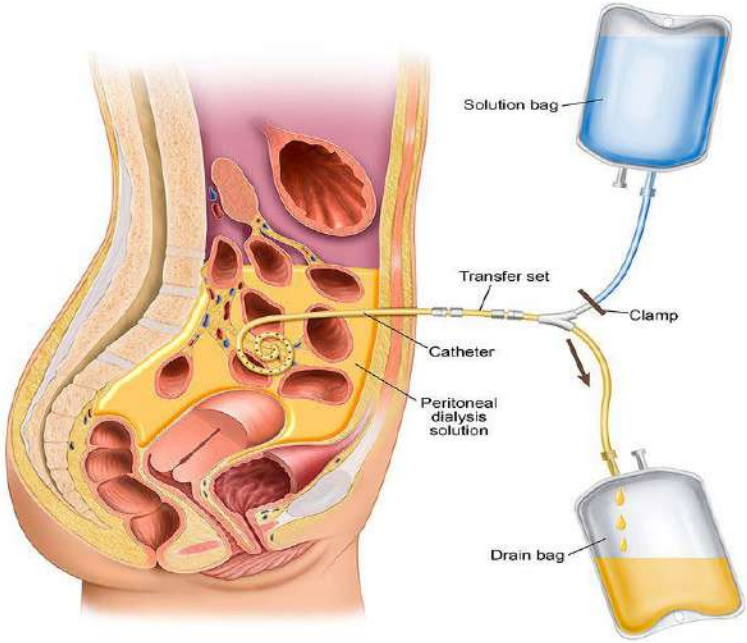
- ***O***piates
- **S**ulfonylureas:
- **A**ngiotensin enzyme inhibitors
- **D**iuretics
- **M**etformin
- **A**ngiotensin receptor blockers
- **N**on-steroidal anti-inflammatory agents
- **S**odium Glucose Linked Transport 2 inhibitors

Parmar MS, 2027

DIALYSIS FOR AKI



Peritoneal Dialysis



Indications for Dialysis

- Indicated when medical management fails to control(Refractory *)

– Volume overload *

– Hyperkalemia *

– Severe metabolic acidosis

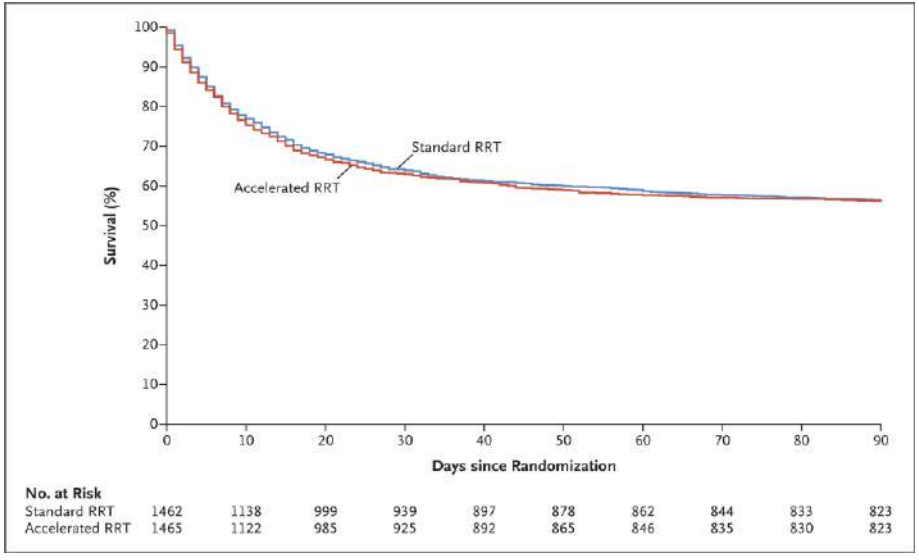
– Severe complications of uremia i.e. pericarditis, neuropathy, unexplained decline in mental status, uremic bleeding.

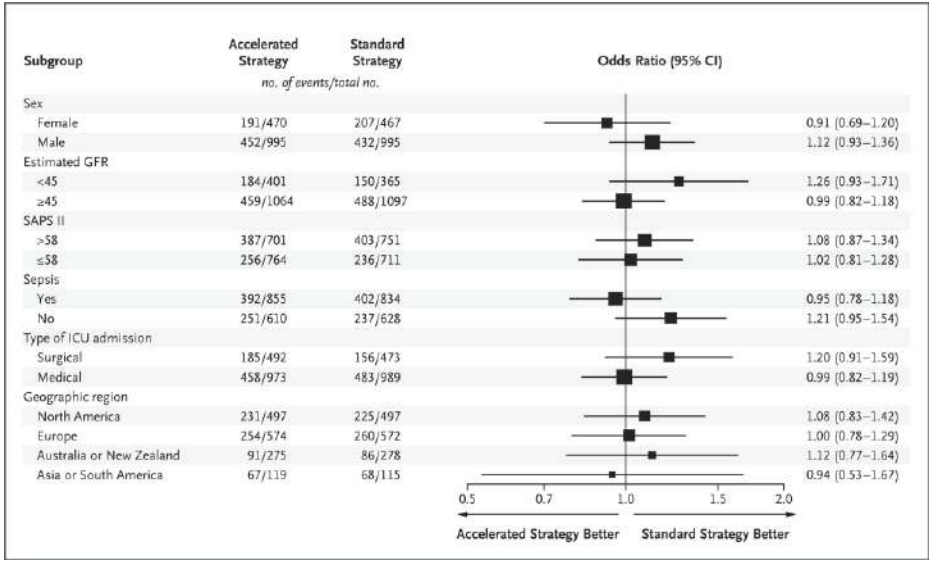
– Overdose with a dialyzable drug/toxin eg salicylate, methanol and lithium

Timing of Initiation of Renal-Replacement Therapy in Acute Kidney Injury

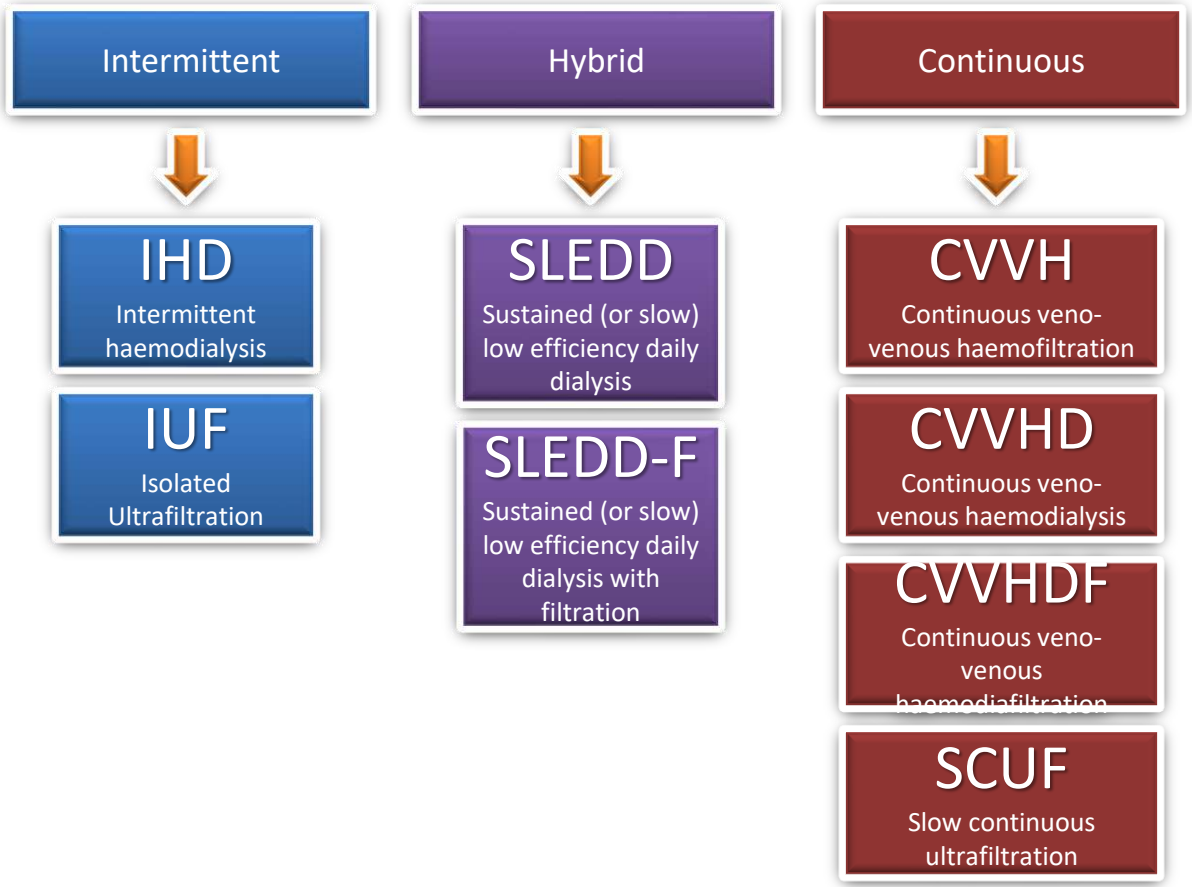
- 3019 pts randomized
- No difference in 90 day mortality

STARRT-AKI; Nejm, 2020

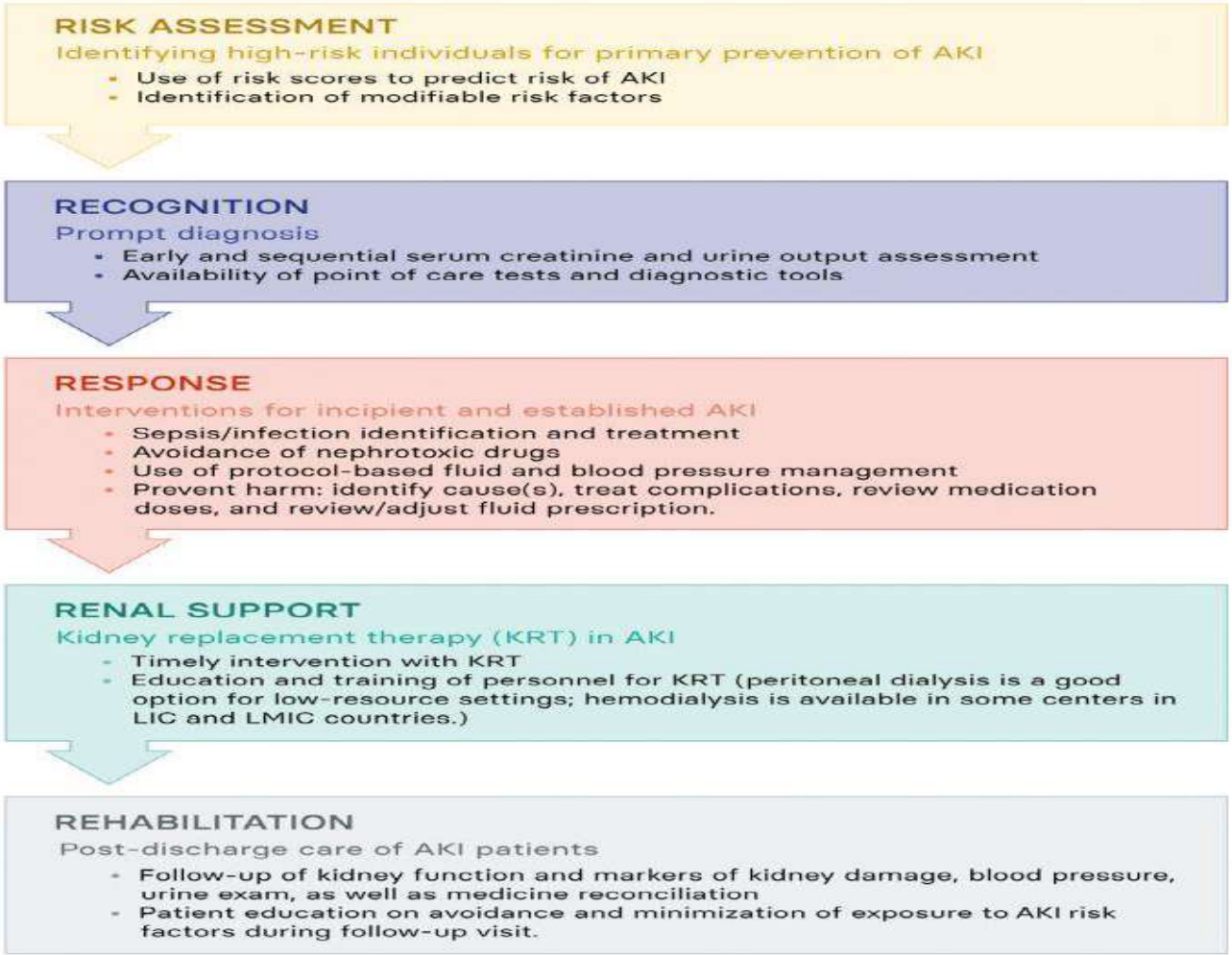


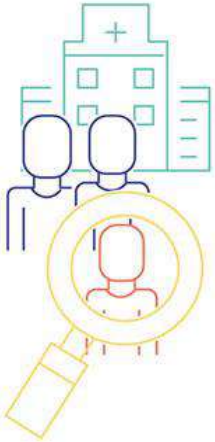


Major Renal Replacement Techniques



ISN AKI TOOLKIT 5Rs





PATIENT CHARACTERISTICS

- ☐ Pre-existing or past kidney disease
- ☐ Diabetes Mellitus
- ☐ Hypertension
- ☐ Kidney stone disease
- ☐ HIV
- ☐ Urinary tract infections or obstruction
- ☐ Heart Failure
- ☐ Acute or chronic liver disease
- ☐ Neonates, children, pregnant women, elderly
- ☐ Chronic lung disease
- ☐ Anemia (Hb<9 g/dL)
- ☐ Cancer

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EXPOSURES

- ☐ Tropical acute febrile illnesses
- ☐ Sepsis or septic shock
- ☐ Diarrheal illnesses
- ☐ Over the counter or alternative or herbal drug use
- ☐ Snakebite
- ☐ Wasp or bee stings
- ☐ Hemorrhage
- ☐ Adverse environmental or occupational exposures e.g. prolonged physical work in hot climate
- ☐ Other nephrotoxins

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SYMPTOMS/SIGNS

- ☐ Swelling over feet or body
- ☐ Decreased urine output
- ☐ Blood or pus in urine
- ☐ Dehydration
- ☐ Low BP or shock
- ☐ Dyspnea
- ☐ Confusion
- ☐ Jaundice
- ☐ Coma

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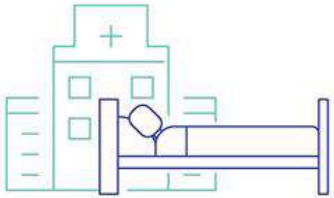
RISK FACTOR	POINTS
History of kidney disease	1
Presence of oliguria	4
Infection with fever	1
Hypotension or shock	2
Pregnancy with hypertension/seizures	2
Whole body swelling	2
Loss of appetite	1
HIV in HAART	1
Coma/Confusion	2
Anemia / pallor	1
MAX TOTAL	17

≥ 3 POINTS
MODERATE TO HIGH RISK OF AKI

POC sCr measurement
Urine dipstick



Intervention

Sepsis

Identifiy source and treat

Toxins

Avoid

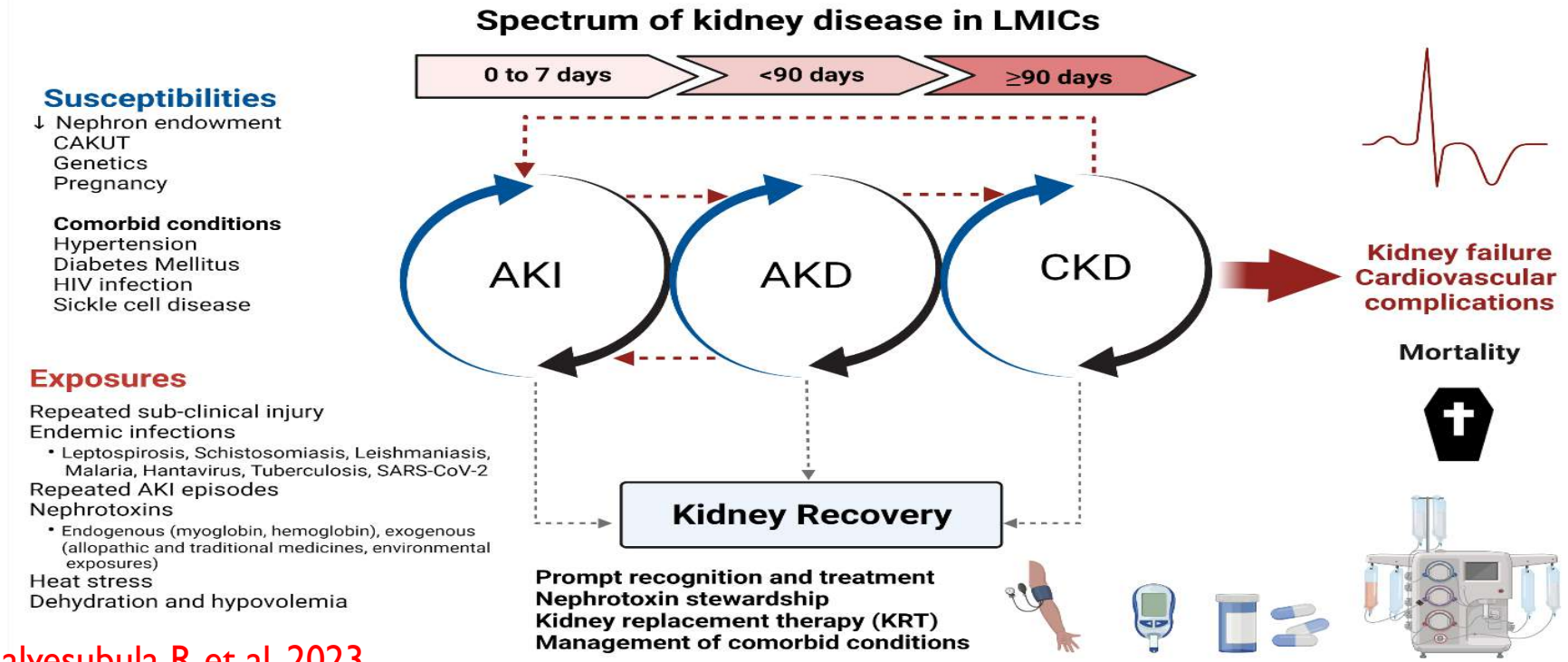
Optimise BP/ Volume Status

Rehydrate patient

Prevent Harm

- Identify cause – urinalysis, if not sepsis, toxins, low BP or dehydration consider obstruction or rarer kidney disease
- Treat complications – hyperkalemia/acidemia
- Review medication doses
- Review fluid prescription

KIDNEY DISEASE IN LMIC



Kalyesubula R et al, 2023

CKD Emergencies

- ESRD (Kidney Failure)
- Hyperkalemia
- Metabolic Acidosis
- Volume Overload
- Uremic Complications

A E I O U - Acute Indications for Dialysis

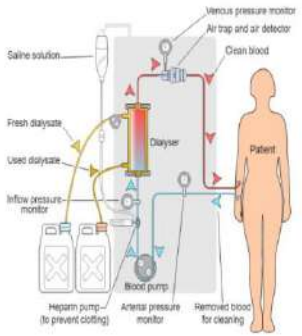
A Acidosis
(pH < 7.1)

E Electrolytes
Refractory Hyperkalemia

I Intoxication / Ingestions
Toxic Alcohols, Salicylates, Lithium, etc

O Overload
Congestive Heart Failure

U Uremia
Uremic Pericarditis, Uremic Encephalopathy

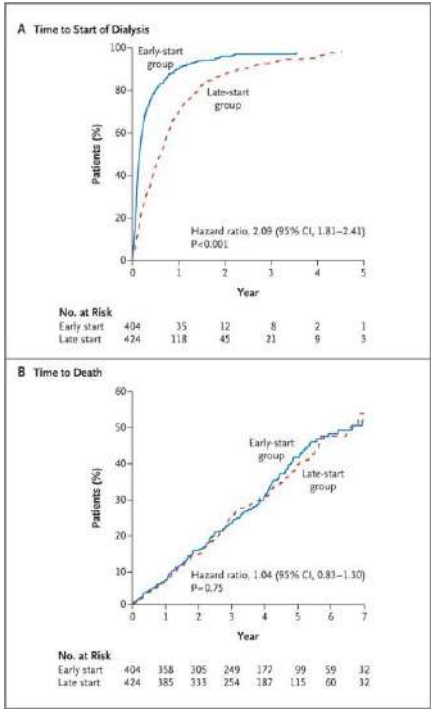


@grepmed

Early Vs Late Initiation of Dialysis in CKD-5

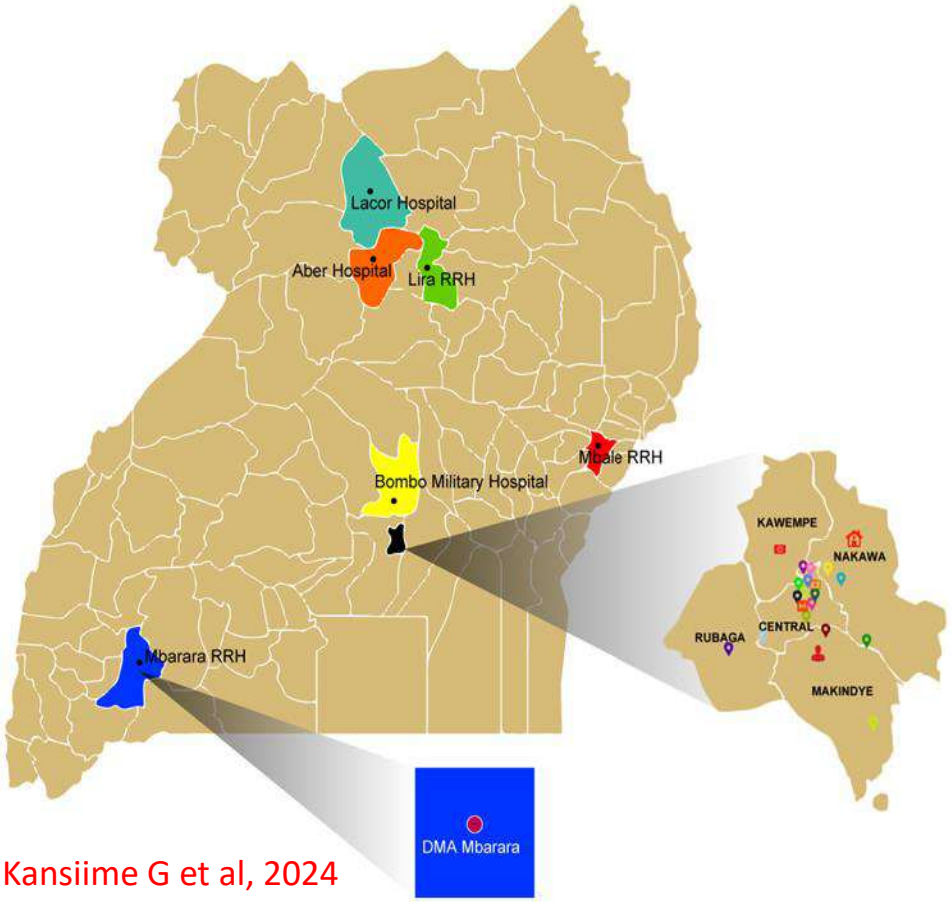
832 pts from 32 Centers
No difference in when HD was started early or late

Cooper BA et al, 2010, NEJM



Subgroup	Early Start	Late Start	Hazard Ratio (95% CI)	P Value for Interaction
	no. of deaths/no. of patients (%)			
GFR C–G				0.74
<12.5 ml/min/1.73 m²	56/139 (40)	56/137 (41)		
≥12.5 ml/min/1.73 m²	96/265 (36)	99/287 (34)		
GFR MDRD				0.58
<9.5 ml/min/1.73 m²	58/195 (30)	57/203 (28)		
≥9.5 ml/min/1.73 m²	94/209 (45)	98/221 (44)		
Age				0.26
<60 yr	39/180 (22)	38/194 (20)		
≥60 yr	113/224 (50)	117/230 (51)		
Sex				0.28
Female	55/143 (38)	58/143 (41)		
Male	97/261 (37)	97/281 (35)		
Diabetes				0.63
No	65/232 (28)	63/241 (26)		
Yes	87/172 (51)	92/183 (50)		
Body-mass index				0.59
<25.0	40/102 (39)	46/126 (37)		
25.0–29.9	53/143 (37)	52/146 (36)		
≥30.0	59/159 (37)	57/152 (38)		
Baseline history of cardiovascular disease				0.47
No	64/244 (26)	69/262 (26)		
Yes	88/160 (55)	86/162 (53)		
Albumin				0.67
<35 g/liter	38/68 (56)	44/81 (54)		
≥35 g/liter	110/325 (34)	109/336 (32)		

Dialysis in Uganda; current status. 2024



Unit	Status	No of Machines per centre	Patients per centre**	Males	Females	% dialysis for AKI per centre
Mbarara RRH	Gov't	07	25	35%	65%	20%
Kiruddu NRH	G	30	200	65%	35%	<5%
Mulago super specialized Hospital	G	25	200	75%	25%	**5%**
Bombo Military Hospital	G	03	14	55%	45%	**00**
Lira RRH	G	05	34	60%	40%	**5%**
Mbale RRH	G	04	50	80%	20%	**<5%**
Lubaga Hospital	PNFP	03	2	-	100%	**30%**
Mengo Hospital	PNFP	03	12	75%	25%	**<5%**
Nsambya Hospital	PNFP	04	8	80%	20%	**5%**
Lacor Hospital	PNFP	01	-	-	-	**100%**
Panorama Medical Centre	P	07	05	25%	75%	00
UMC Victoria Hospital	P	04	14	60%	40%	**2%**
IHK	P	04	02	-	100%	**70%**
BHL dialysis Centre	P	05	10	70%	30%	**5%**
Case Hospital	P	03	4	15%	85%	**60%**
Nakasero Hospital	P	05	24	80%	20%	5<%
DMA Mbarara	P	02	01	100%	-	00
Healing way center Kololo	P	02	02	100%	-	00
Platinum Hospital	P	01	-	-	-	**100%**
Kampala Hospital	P	01	01	100%	-	**>90%**
Kibuli Hospital	P	04	02	100%	-	**<5%**
Urocare Hospital	P	02	01	100%	-	**80%**
Medipal Hospital	P	01	-	-	-	**100%**
HOME HD	P	02	02	100%	-	00
Norvik Hospital	P	06	17	60%	40%	**2%**
CRRT						
TMR Hospital	P	01		-	-	**100%**
UHI	P	03		-	-	**100%**
Peritoneal dialysis						
Aber Hospital machines	PNFP	03	-	-	-	**100%**
Lacor Hospital	PNFP	Improvised	-	-	-	**100%**
On and off at Mulago and Mbarara	G	Improvised	-	-	-	**100% (children)**

Total patients on chronic dialysis

Kansiime G et al, 2024

Potassium in the Diet

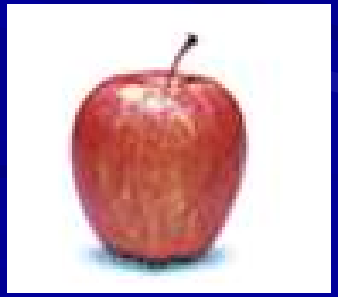
- **High (> 400 mg/serving)**
  - **Banana**
  - **Potato**
  - **Avocado**
  - **Orange juice**

- **Moderate (>200 mg/serving)**
  - **Berries**
  - **Broccoli**
  - **Tomato**

Low Potassium Fruit & Vegetables

>100 mg/serving

- **Cranberries**
- **Apple**
- **Corn**
- **Lettuce**
- **Pineapple**
- **String beans**



SUMMARY

- AKI IN ICU IS COMMON
- FLUID THERAPY SHOULD BE CLEARLY THOUGHT OUT AND GUIDED BY PATIENT STATUS
- FST IS EVOLVING
- DIALYSIS SHOULD BE USED FOR CLEAR INDICATIONS
- AKI can cause CKD
- Prevent kidney disease at all costs.