ACUTE KIDNEY INJURY AND RENAL REPLACEMENT THERAPY IN CHILDREN

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KPA Precongress
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Case presentation

- SP
- 11-month-old
- Presenting complaint: bloody diarrhea, lethargy
- On exam: dehydration, pale
- Day 3 deteriorating renal function with anuria
Investigations

• FBC:
  – Hb 6.7g/dl, Platelets 40, shistocytes on smear
• Renal function:
  – Urea 15.2mmol/l, creatinine 178umol/l, potassium 4.0
  – GFR 13ml/min/1.73m² (shwartz formula)
• Coagulation studies:
  – INR 1.17, PTT 14/12, D DIMER NEGATIVE
• Stool culture: shigella
KIDNEY FAILURE?

URINE BIG TROUBLE
ACUTE KIDNEY INJURY

• Older children incidence 4/100 000
• Expected prevalence of 20% in ICU and 5% in admitted children
• Increasing incidence in association with multi-organ failure in paediatric ICU’s
• Renal impairment at RXH ICU:
  – Acidotic children due to gastro
  – Shock
  – Sepsis
  – Post-operatively including post-cardiac surgery
Local situation

- Prevalence of acute kidney injury in critically ill children at Kenyatta National Hospital
  
  *Dr Cecilia Muithya, Dr Bashir Admani*

- Prevalence of acute kidney injury in children undergoing cardiac bypass surgery in Kenya
  
  *Dr Kaiser Fitzwanga, Dr Bashir Admani*
Local situation

- 117 critically ill children at KNH 100 had acute kidney injury (86%)
- Acute kidney injury was significantly higher in the younger age group < 1yr
- It was significantly higher with children presenting with gastroenteritis and dehydration

- In cardiac bypass surgery almost 35% developed acute kidney injury
p RIFLE in critically ill children in KNH

p RIFLE CATEGORISATION

- Failure: 46%
- Injury: 33%
- Risk: 21%
INDICATIONS FOR DIALYSIS

ABSOLUTE:
• Severe Hyperkalaemia
• Severe Fluid Overload
• Refractory Acidosis
• Uraemic Symptoms
INDICATIONS FOR DIALYSIS

RELATIVE:

• Oliguria / Anuria
• Dysnatraemia / Electrolyte Disorders
• Hyperpyrexia / Hypothermia
• Removal of Toxins
INDICATIONS FOR DIALYSIS IN NAIROBI RETROSPECTIVE IN 3 HOSPITALS 2012-2014 n=146

- Fluid Overload: 56%
- Uraemia: 25%
- Anuria: 11%
- Hypokalemia: 5%
- Acidosis: 3%
PD visavis Haemodialysis

• Different centres have different preferences
• PD preferred here:
  • Easy access
  • Not much expertise needed
  • Availability of tubing and dialyzers
  • Haemodynamic stability
PD V/S HD IN NAIROBI

PD V/S HD

HD 12%

PD 88%

Column 1
HD
PD

KNH
AKUH
GGCH
PERITONEAL DIALYSIS

- Ease of obtaining access
- Lack of sophisticated equipment
- Personnel with prior technical expertise not required
- Severe life-threatening hyperK /acidosis
  - ease & rapidity with which this can be initiated
  - Haemodynamic instability where hypotension would prevent satisfactory haemodialysis
PD CAUTION

• If peritoneum not usable because of recent abdominal surgery / abdominal pathology
What does Peritoneal Dialysis do?

- Performed by introducing small volumes of dialysis solution (dextrose containing salt solution) into peritoneal cavity
- By diffusion & ultra filtration, toxic materials removed into dialysis solution
- Removal from body of waste products occurs when dialysate is drained
Principles of PD

• Fluid and solute removal across the peritoneum

• 3 layers
  • Capillary endothelium
  • Interstitium
  • Mesothelium

• 3 pore model
  • Ultrasmall pores – convection and osmosis
  • Small pores - diffusive
  • Large pores – convection large molecules
Principles of PD

- Solute removal – diffusion and convection
  - Concentration gradient
  - Molecular size
- Ultrafiltration
  - Osmotic gradient
  - Different concentration of glucose (1.5%, 2.5%, 4.25%)
Smiling in adversity.....only children can!!!
Type of Catheter

- **Acute Cook PD Catheter** - 5 Fr  
  Bunchman TE. Perit Dial Int 1996

- **Intravenous Catheter**

- **Stylet Catheter**

- **Guide wire-inserted femoral catheter**  
  Kohli HS et al. Ren Fail 1997

- **Bed – side Tenckhoff – Kimal “peel away”**

- **Surgically placed Tenckhoff Catheters**  
  Reznik VM et al. Ped Neph 1991
Advantages of Tenckhoff Catheters

- Partial omentectomy at time of insertion
- Good peritoneal fluid drainage
- No intraperitoneal haemorrhage
  Kohli HS et al. Ren Fail 1997
- Peritoneal dialysis cycler found to decrease risk of infection and hypothermia
  Kohli HS et al. Ren Fail 1995
ASSESSMENT OF EARLY SURGICAL COMPLICATIONS OF PERITONEAL DIALYSIS CATHETERS FOR ACUTE KIDNEY INJURY IN CHILDREN AT KENYATTA NATIONAL HOSPITAL.

DR. ODIRA EDWIN OMONDI
STUDY FINDINGS

- Study at KNH Renal unit Peds
- 5 MONTHS IN 2016 n= 31
- Age: 4 days to 9 years
- All surgically placed catheters
- Omentectomy done in 22%
- Complications:
  - leakage (25%)
  - Outflow dysfunction (6%)
  - Peritonitis in 1/31
PD Fluid Prescription

- **Volumes**
  - 20 – 50mls/kg starting with smaller volumes

- **Cycles**
  - Fill / Dwell / Drain
  - Acute – total 1 – 2 hr cycles

- **Dialysate**
  - 1.5% and 4.25% (2.5%)

- **Aim:**
  - Fluid overload – increase sugar solution
  - Solute removal e.g., K+ - increase frequency of cycle
Haemodialysis
Challenges haemodialysis

- Access
- The right lines
- Tubing
- Pump speeds
- It can be done
- CK probably the youngest we have done hemodialysis on
Finally........
OUTCOMES IN THE LOCAL SETTING
DURATION OF DIALYSIS

- Ranged from 1 day to more than 30 days
- Median duration was 10 days
- This trend seen in all 3 hospitals
- Patients on haemodialysis had on average 20.7 days
  peritoneal dialysis had average 6.9 days
- Children diagnosed with acute on chronic kidney injury
  had mean duration of 27 days
OUTCOMES

• Mean age:
  • Surviving children 59 months
  • Those who died 13 months (p=0.04)

• Indication for dialysis:
  • 47% of children who had ureamia died
  • 7% in children with fluid overload died

• Mortality in children diagnosed with sepsis on dialysis was 33% compared to those with ATN which had mortality rate of 4%

• KNH study
  • mortality rate in critically ill children with AKI 24% compared to 6.25% in those without (p=0.05)
OUTCOMES IN THE 2016 STUDY

- Resolution of AKI 87%
- Mortality in 6%
outcomes

• Risk of death increases with severity due to AKI by p Rifle criteria
CRRT
Way forward

• More local data needed to improve care
• Newer biomarkers to be studied for earlier diagnosis and intervention
  • Urine ngal in asphyxia neonates
My Vision

• Demystify acute peritoneal dialysis
• ACUTE PD SHOULD NOT BE ONLY FOR NEPHROLOGISTS
• Make it available in every county, can be done (African problems can only have African solutions).
• We use local fluids and catheters
• We start training one ped and one nurse from each county with hands-on training every 6 months
• Cover all counties in 2 years
• Will involve saving young lives, ISN and IPNA
• Set up a registry for acute PD for the region
THANK YOU