Saving Young Lives

A partnership to deliver care of Acute Kidney Injury in low resource settings






Who we are - partners

SYL is a partnership of 4 global scientific societies in the field of nephrology

Who we are - team

The SYL Steering Committee


Brett Cullis (Chair), ISPD


Fredric Finkelstein, ISPD


Simon Davies, EUROPD


Mignon McCulloch, IPNA


William Smoyer, IPNA


Sydney Tang, ISN


Arvind Bagga, IPNA

Regional Advisors


Kim Yap, South East Asia


Abdou Niang, Western Africa


Nicola Wearne, South Africa


Stefano Picca, Central America & Africa


Guillermo Hidalgo, Latin America

ISN support


Kelly Hendricks
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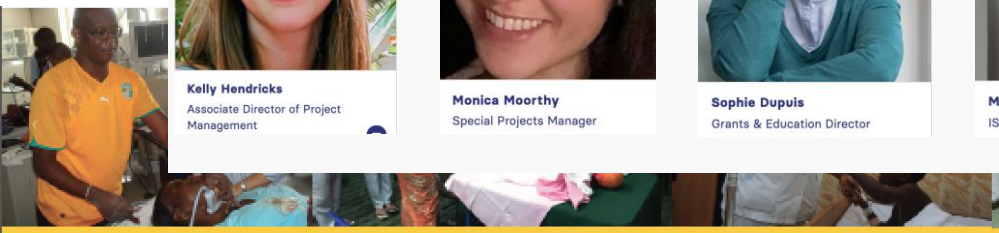
Special Projects Manager


Sophie Dupuis
Grants & Education Director


Mara Rodrigues
ISN Programs Coordinator



SYL Mission & Goals

Mission: To develop sustainable programs using peritoneal dialysis (PD) to treat AKI in resource poor countries (part of 0by25 Initiative)

Goals: To work in low-resource health settings to help establish and maintain hospital centers for care of AKI through:

- **Hospital Development**
- **Training and Education**
- **Community Awareness**
- **Advocacy**
- **Data Collection**

SAVINGYOUNGLIVES

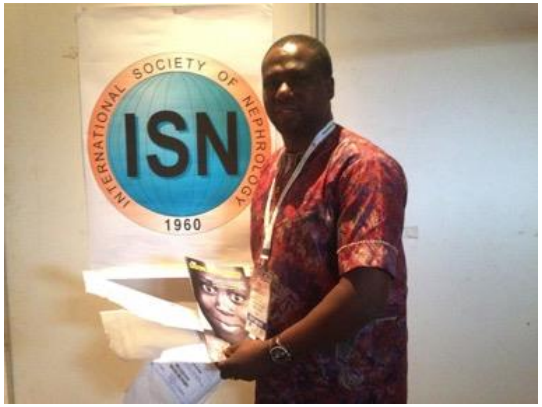
A partnership to deliver care for acute kidney injury in the developing world

Training and Education

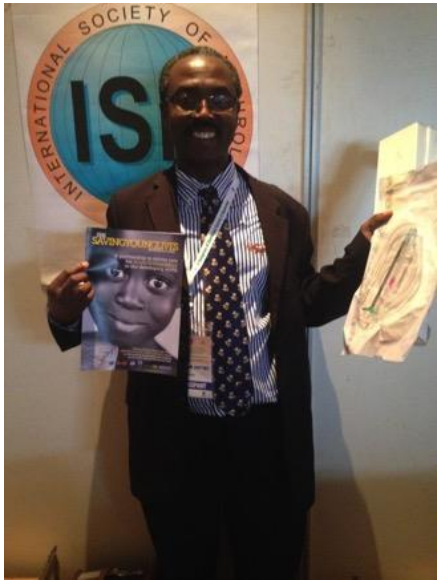
In the 2017-2022 time period, SYL trained 470 individuals in 42 different institutions from 26+ low resource countries.

Hospital development

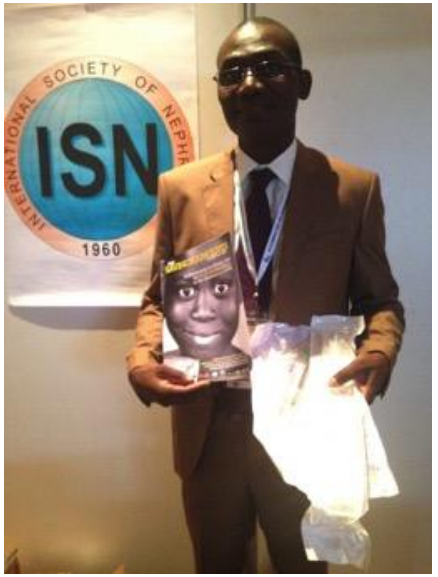
Assist SYL sites in availability & storage of supplies (in partnership with NGOs & Industry)



Chris Ezesobor, Pediatric nephrologist, Lagos, Nigeria



Sampson Antwi, Pediatric nephrologist, Kumasi, Ghana



Francis Layla, Pediatric nephrologist, Cotonou, Benin

Advocacy

Helping local nephrology leaders to push for equitable access to treatment of AKI






SYL Publications

International publications improve public awareness and knowledge of local health practitioners to prevent and identify children with AKI needing hospital care.

- **"Saving Young Lives" with acute kidney injury: the challenge of acute dialysis in low-resource settings**

William E. Smoyer, Fredric O. Finkelstein, Mignon I. McCulloch, Mary Carter, Ariane Brusselmans, John Feehally. Kidney International (**February 2016**) 89, 254-256.

- **Saving Young Lives: Provision of acute dialysis in low-resource settings**

William E Smoyer, Fredric O Finkelstein, Mignon McCulloch, Mary Carter, Ariane Brusselmans, John Feehally. The Lancet. 2016.

- **Peritoneal Dialysis, Acute Kidney Injury, and the Saving Young Lives Program**

Fredric O. Finkelstein, William E. Smoyer, Mary Carter, Ariane Brusselmans, and John Feehally. Perit Dial Int **July-August 2014** 34:478-480.

SAVINGYOUNGLIVES

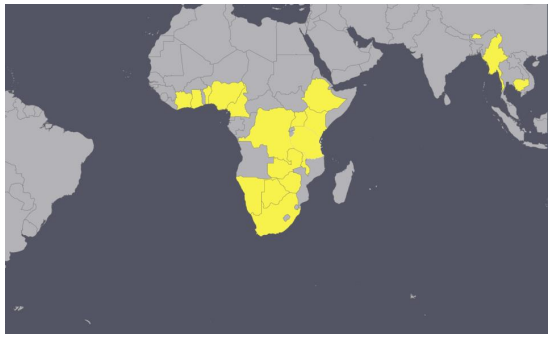
A partnership to deliver care for acute kidney injury in the developing world

SYL trained doctors and nurses have treated more than **500** PATIENTS W/AKI USING ACUTE PD with a **65%** SURVIVAL RATE

SYL Patient Outcomes

Complete Recovery of Renal Function	41.1%
Died in Hospital	24.5%
No Recovery of Renal Function and Expectation of Death (time of discharge)	10.7%
Other	8.7%
Partial Recovery of Renal Function (time of discharge)	6.7%
Recovered Renal Function (early definition)	8.3%
Overall Survival Rate without RRT	65%

Since 2017, SYL has trained **470** DOCTORS & NURSES from across **26** LOW-RESOURCE COUNTRIES



Many thanks for your attention and support

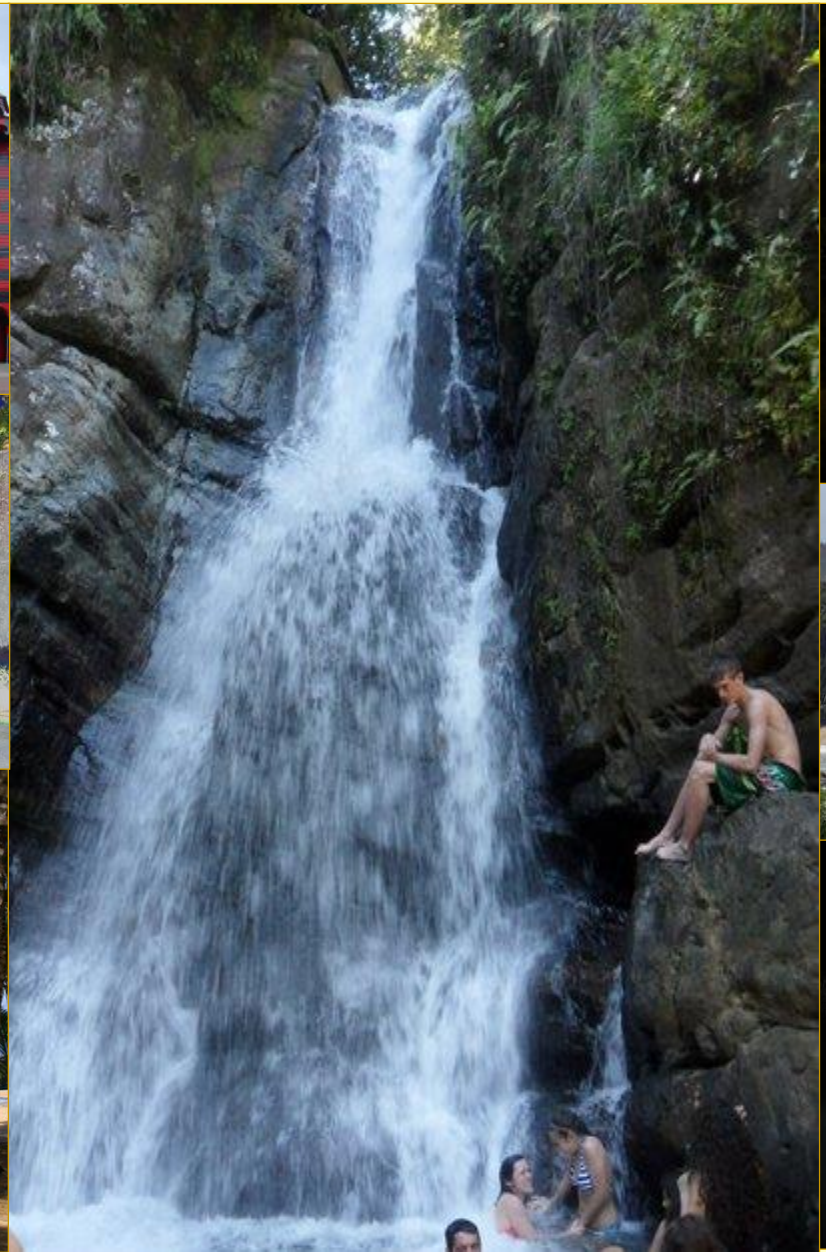
Acute Kidney Injury:
Definition, Epidemiology, and Initial Treatment

Melvin Bonilla Félix, M. D.

Pediatric Nephrology & Hypertension

University of Puerto-Medical Sciences Campus

Welcome to Puerto Rico!



Definition

- Abrupt decline in GFR (days to weeks)
  - Oliguric < 0.5 mL/Kg/hr
  - Non-oliguric or polyuric
    - Aminoglycoside toxicity
    - Obstruction

KDIGO Definition - Stages

Table 1. KDIGO AKI classification.

Stage	Serum creatinine	Urine output
1	1.5–1.9 times baseline OR $\geq$ 0.3 mg/dL ($\geq$ 26.5µmol/L) increase	<0.5ml/kg/h for 6–12 hours
2	2.0–2.9 times baseline	<0.5ml/kg/h for $\geq$ 12 hours
3	3.0 times baseline OR Increase in serum creatinine to $\geq$ 4.0mg/dL ($\geq$ 353.9 µmol/L) OR Initiation of renal replacement therapy OR, in patients <18 years, decrease in eGFR to < 35 mL/min per 1.73m^2	<0.3ml/kg/h for $\geq$ 24 hours OR Anuria for $\geq$ 12 hours

Definition of Neonatal AKI

TABLE 1 Neonatal AKI KDIGO Classification

Stage	SCr	Urine Output
0	No change in SCr or rise <0.3 mg/dL	≥ 0.5 mL/kg/h
1	SCr rise ≥ 0.3 mg/dL within 48 h or SCr rise ≥1.5–1.9 × reference SCr[a] within 7 d	<0.5 mL/kg/h for 6 to 12 h
2	SCr rise ≥2.0–2.9 × reference SCr[a]	<0.5 mL/kg/h for ≥ 12 h
3	SCr rise ≥3 × reference SCr[a] or SCr ≥2.5 mg/dL[b] or Receipt of dialysis	<0.3 mL/kg/h for ≥24 h or anuria for ≥12 h

Differences between the proposed neonatal AKI definition and KDIGO include the following:

[a] Reference SCr will be defined as the lowest previous SCr value.

[b] SCr value of 2.5 mg/dL represents <10 mL/min/1.73m^2.

*** For infants < 120 days of age**

Selewski DT et. al. Pediatrics (2015) 136

Consensus-Based Recommendations

- **Consensus Statement 1A (Recommendation)**
  - AKI epidemiology related to short-term outcomes is well-described in critically ill neonates and children from high-income countries; however, further study is needed in other health care contexts, such as low-middle income countries and in non-ICU and ambulatory settings and for socioeconomic and long-term outcomes.

Goldstein SL et. al JAMA Network Open. 2022;5(9):e2229442.

The NEW ENGLAND JOURNAL of MEDICINE

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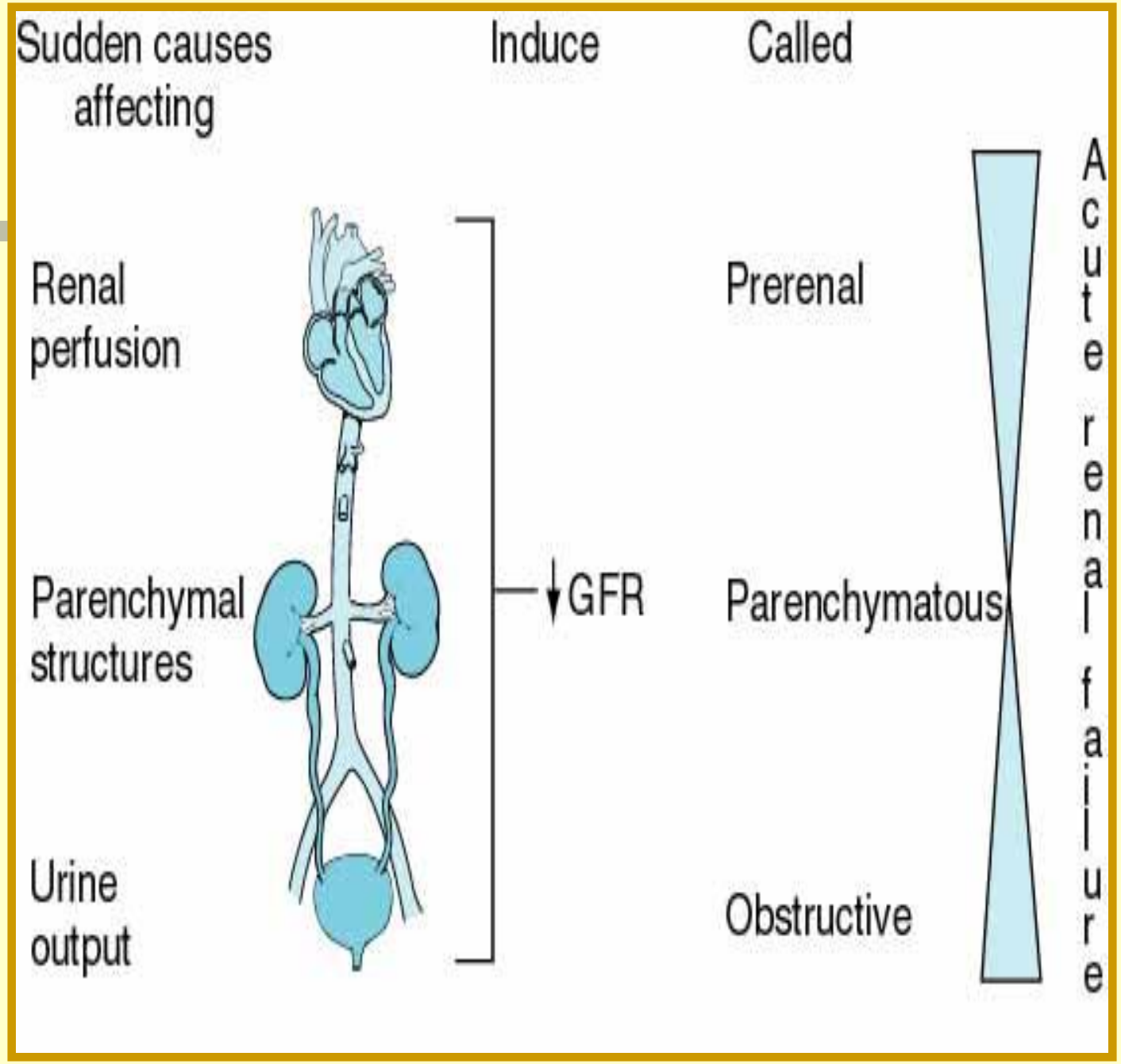
Epidemiology of Acute Kidney Injury in Critically Ill Children and Young Adults

Ahmad Kaddourah, M.D., Rajit K. Basu, M.D., Sean M. Bagshaw, M.D., and Stuart L. Goldstein, M.D., for the AWARE Investigators*

Causes


Sudden causes affecting
Induce
Called
Renal perfusion
Parenchymal structures
Urine output
GFR
Prerenal
Parenchymatous
Obstructive
Acute renal failure

AKI Incidence in PICU

- Require RRT
  - 1 - 2%
- Doubling creatinine
  - 1 – 21%
- pRIFLE
  - 35% (all PICU)
    - 82% (most critically ill children)

Zappitelli M, Golstein SL. Acute Kidney Injury: General Aspects, In Pediatric Nephrology in the ICU, Springer, 2009

Causes of Acute Kidney Injury

Table 1. Clinical Variables for Pediatric Patients With ARF Stratified by Age

Age (no. of patients)	GFR	Survival	ICU Stay/LOS	RRT*	Most Common ARF Cause
0-30 d (62)	11.5 ± 9.8	34 (56)	59 (97), 46	34 (58)	Ischemic 16 (26)
1-12 mo (37)	18.4 ± 14.3	22 (59)	32 (86), 26	10 (32)	Ischemic 13 (35)
1-5 y (43)	32.9 ± 20.1	36 (84)	30 (70), 21	8 (27)	Ischemic 10 (23)
6-15 y (83)	29.3 ± 20.4	61 (73)	49 (59), 18	28 (57)	Nephrotoxins 22 (26)
16-21 y (29)	35.5 ± 17	23 (79)	15 (52), 23	8 (53)	Nephrotoxins 6 (21)
Total (254)	35.2 ± 39.2	176 (70)	185 (73), 26	80 (43)	Ischemic 45 (22)

Hui-Stickle et al., Am J Kidney Dis 45: 96-101, 2005

Causes of Acute Kidney Injury

Primary diagnosis group at ICU admission — no. (%)§	
Shock	1244 (23.8)
Cardiovascular	210 (4.0)
Respiratory	1986 (37.9)
Surgical or trauma	1597 (30.5)
Central nervous system	958 (18.3)
Pain management or sedation	182 (3.5)

- AWARE (Assessment of Worldwide Acute Kidney Injury, Renal Angina, and Epidemiology): Prospective, observational study
- 5238 patients in 32 pediatric ICUs across Asia, Australia, Europe, and North America over 3 consecutive months in 2014
- Age: 3 months - 25 years of age with a predicted ICU stay of at least 48 hours

Kaddourah A et al., NEJM 376, 2017

AKI Incidence

- NICU
  - KDIGO Definition
    - 56% of NICU admissions*
    - 29.9% of NICU admissions+
      - ≥22 to <29 weeks = 47·9%
      - ≥29 to <36 weeks =18·3%
      - ≥36 weeks =36·7%

*Shalaby MA et. al. Pediatr Nephrol 2018 doi: 10.1007/s00467-018-3966-7
+Jetton JG et. al. Lancet Child Adolesc Health. 2017 Nov;1(3):184-194

AKI: High Risk Factors

Table 2. Bivariate and Multivariable Logistic-Regression Analysis of Predictors of Death by Day 28 after Admission.

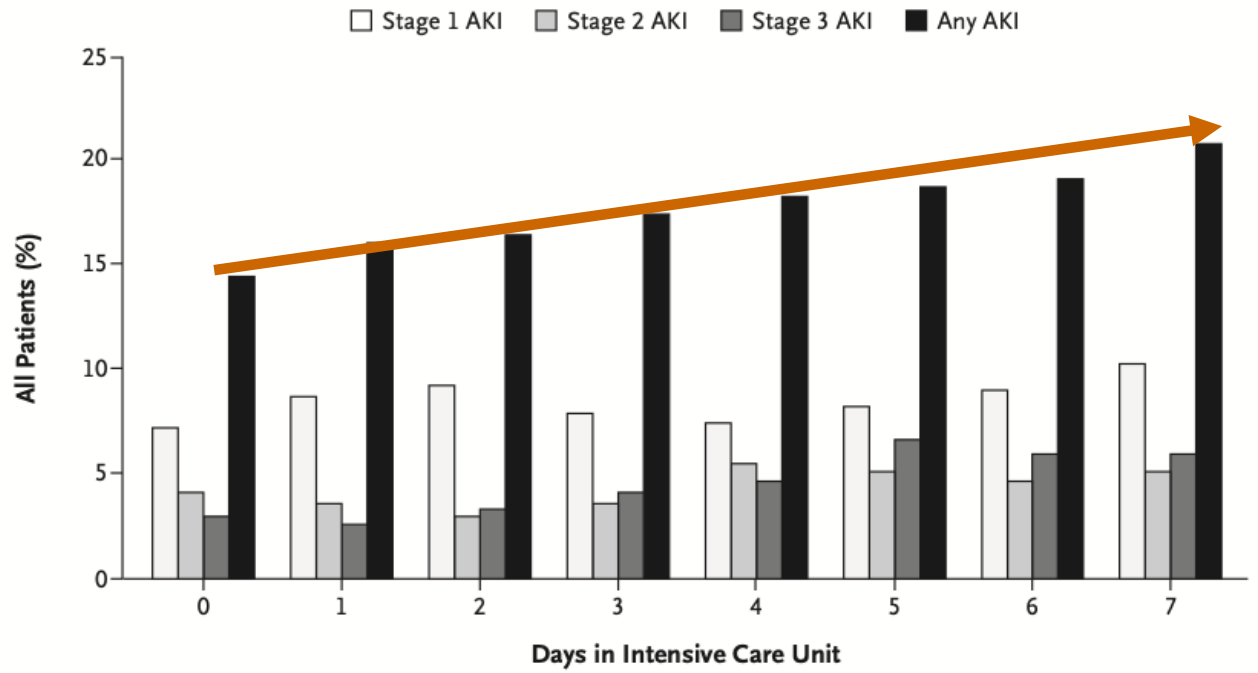
Variable	Bivariate Analysis			Multivariable Logistic-Regression Analysis
	Survivors (N=4815)	Nonsurvivors (N=169)	P Value	Odds Ratio (95% CI)*
Shock	1101 (22.9)	92 (54.4)	<0.001	1.93 (1.31–2.84)
Cardiovascular	178 (3.7)	28 (16.6)	<0.001	2.71 (1.50–4.89)
Respiratory	1814 (37.7)	87 (51.5)	0.003	1.27 (0.86–1.86)
Surgical or trauma	1481 (30.8)	12 (7.1)	<0.001	0.42 (0.22–0.80)
Central nervous system	873 (18.1)	46 (27.2)	0.003	2.42 (1.60–3.68)
Pain management or sedation	164 (3.4)	2 (1.2)	0.06	0.33 (0.07–1.54)
Cardiovascular	607 (12.6)	40 (23.7)	<0.001	1.20 (0.75–1.91)
Pulmonary	1785 (37.1)	60 (35.5)	0.68	—
Neurologic	1699 (35.3)	57 (33.7)	0.68	—
Gastrointestinal	875 (18.2)	32 (18.9)	0.80	—
Renal or urologic	307 (6.4)	14 (8.3)	0.34	—
Hematologic	307 (6.4)	35 (20.7)	<0.001	2.99 (1.86–4.82)
Oncologic	353 (7.3)	23 (13.6)	0.01	1.70 (0.97–2.90)
Immunologic	101 (2.1)	8 (4.7)	0.04	1.31 (0.54–3.18)
Infectious disease	351 (7.3)	25 (14.8)	0.006	1.06 (0.60–1.80)
Rheumatologic	61 (1.3)	1 (0.6)	0.38	—
Neuromuscular	601 (12.5)	21 (12.4)	0.98	—
Metabolic	539 (11.2)	22 (13.0)	0.16	—
History of transplantation — no. (%)	195 (4.0)	15 (8.9)	0.007	0.86 (0.43–1.70)
Estimated GFR — ml/min/1.73 m^2				
Median	120	120	0.95	—
Maximum stage of acute kidney injury — no./total no. (%)‡			<0.001	
No acute kidney injury	3339/4518 (73.9)	83/165 (50.3)		—
Stage 1	696/4518 (15.4)	22/165 (13.3)		—
Stage 2	280/4518 (6.2)	14/165 (8.5)		—
Stage 3	203/4518 (4.5)	46/165 (27.9)		—
Stage 2 or 3: severe acute kidney injury	483/4518 (10.7)	60/165 (36.4)	<0.001	1.77 (1.17–2.68)
Extracorporeal membrane oxygenation — no. (%)	20 (0.4)	6 (3.6)	0.002	1.12 (0.37–3.39)
Renal-replacement therapy — no. (%)	49 (1.0)	24 (14.2)	<0.001	3.38 (1.74–6.54)
Mechanical ventilation — no. (%)	1456 (30.2)	125 (74.0)	<0.001	3.02 (2.16–4.76)
Vasoactive support — no. (%)	618 (12.8)	108 (63.9)	<0.001	4.67 (3.18–6.87)

Kaddourah A et al., NEJM 376, 2017

Neonatal AKI: Risk Factors

- Cardiovascular surgery
- Perinatal hypoxia
- Necrotizing enterocolitis
- Sepsis
- Nephrotoxic drugs
  - 87% of neonates were exposed to at least 1 nephrotoxic medication
  - On average X 14 days during their NICU stay
  - Most commonly prescribed medication in the NICU
    - Gentamicin – 80% of neonates

Prevalence by Stage



All Patients (%)								
Stage 1 AKI	7.3	9.7	9.8	9.0	8.6	9.0	9.8	10.4
Stage 2 AKI	4.1	3.9	3.5	4.2	5.4	4.4	4.3	4.7
Stage 3 AKI	3.1	2.6	3.6	4.4	4.9	5.7	5.3	5.3
Any AKI	14.5	16.2	16.8	17.5	18.9	19.1	19.4	20.4

Figure 3. Prevalence of Acute Kidney Injury, According to Stage, during the First Week of ICU Admission.
For day 0, only the serum creatinine level was used to assess for acute kidney injury because data on urine output were not available. Patients with missing data to assess for acute kidney injury were excluded from analysis.

Kaddourah A et al., NEJM 376, 2017

AKI Epidemiology: GNI

Table 1. Comorbidities, risk factors and location of AKI diagnosis in GNI country categories.

Variables	N	All	HIC (n = 174)	UMIC (n = 72)	LLMIC (n = 108)	*P*
Age, years	354	2.0 (0.17, 11.0)	0.4 (0.03, 6.0)	8.0 (2, 16.5)	4.0 (0.3, 13.5)	<0.001
Boys	353	193 (54)	80 (46)	41 (57)	72 (67)	0.005
Community AKI	350	163 (46.0)	33 (19.0)	44 (61.1)	86 (79.6)	<0.001
Location at diagnosis						<0.001
Emergency		61(17.4)	10(5.8)	27(37.5)	24(22.6)	
Intensive care unit		136(38.9)	75(43.6)	25(34.7)	36(34.0)	
Outpatient		11(3.1)	2(1.2)	4(5.6)	5(4.7)	
Inpatient wards		142(40.6)	85(49.4)	16(22.2)	41(38.7)	
BMI, kg/m^2	188	17.0 (14.3, 21.3)	17.8 (15.3, 21.3)	18.1 (15.8, 22.2)	15.0 (12.5, 18.3)	0.001

Macedo E et. al PLOS ONE https://doi.org/10.1371/journal.pone.0196586

AKI Epidemiology: GNI

Table 1. Comorbidities, risk factors and location of AKI diagnosis in GNI country categories.

Variables	N	All	HIC (n = 174)	UMIC (n = 72)	LLMIC (n = 108)	*P*
Infection	104	29.38	33 (18.97)	23 (31.94)	48 (44.44)	<0.001
Nephrotoxic agents	71	20.06	23 (14)	14 (19)	33 (30)	0.3642
Primary kidney diseases	62	17.51	14 (8.05)	19 (26.39)	29 (26.85)	<0.001
Post-surgical	56	15.82	47 (27.01)	3 (4.17)	6 (5.56)	0.0218
Systemic diseases	48	13.56	23 (13.22)	16 (22.22)	9 (8.33)	<0.001
Cardiac diseases	41	11.58	34(19.54)	2(2.78)	5(4.63)	0.1334
Urinary obstruction	16	4.52	3(1.72)	4(5.56)	9(8.33)	0.0281

P value refers to difference among country categories (HIC, UMIC and LLMIC); HIC: high income country; UMIC: upper middle income country; LLMIC: low and lower middle income country. Values represent median (interquartile range) or number (proportion).

Macedo E et. al PLOS ONE https://doi.org/10.1371/journal.pone.0196586

AKI Mortality: GNI

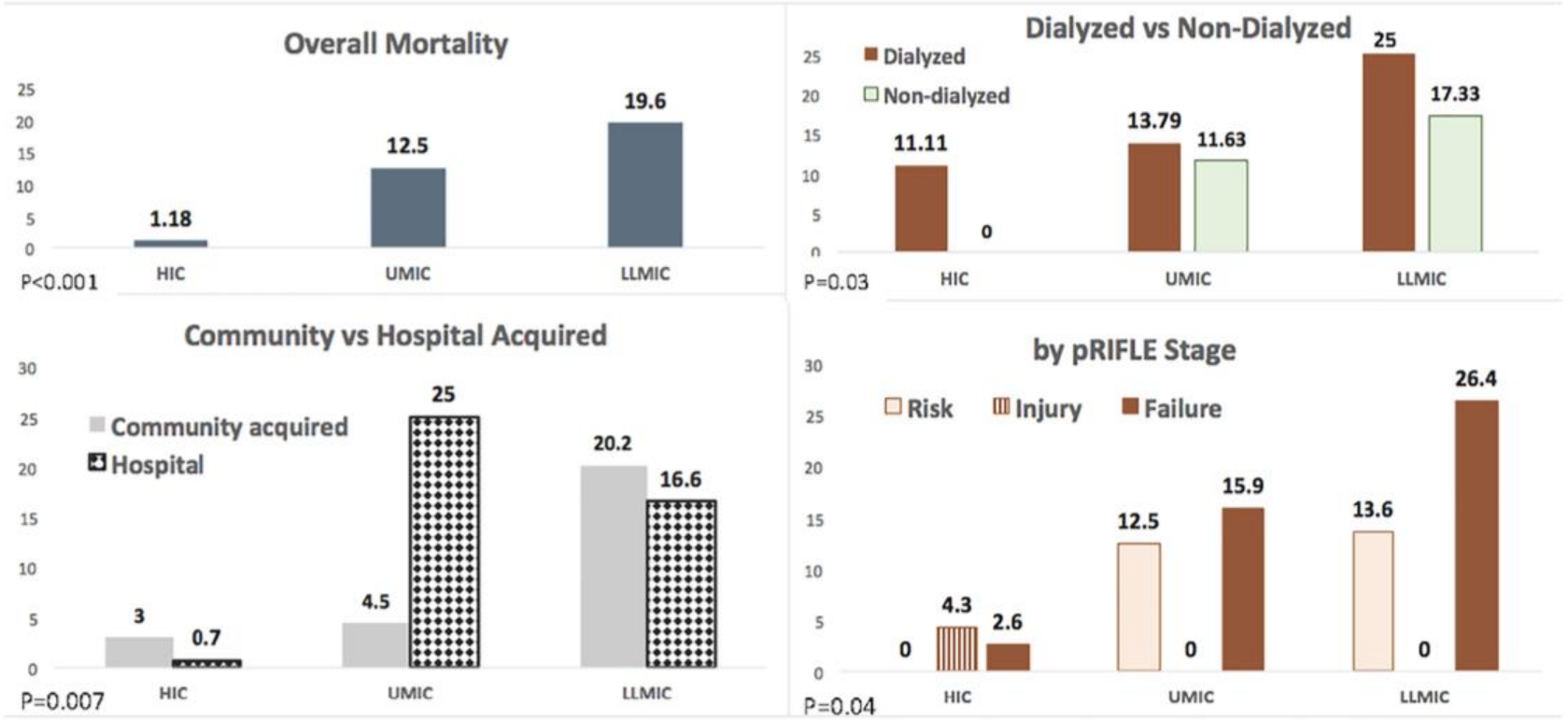


Fig 2. Mortality frequency in the overall cohort, and by AKI development location (community vs hospital acquired AKI), by need of ICU and renal replacement therapy. HIC: high income country; UMIC: upper middle-income country; LLMIC: low and lower middle income country. P values refer to difference within the GNI groups.

Macedo E et. al PLOS ONE https://doi.org/10.1371/journal.pone.0196586

AKI Mortality Risks: GNI

Table 5. Multivariable logistic regression for mortality in patients with AKI.

	Estimate	Odds Ratio	95% CI
(intercept)	-6.56	-	
UMIC*	2.43	11.45	1.02–318.63
LLMIC*	4.06	57.92	6.65–1616.44
Chronic heart disease	-0.48	0.62	0.007–21.17
Baseline eGFR	0.01	1.01	0.99–1.02
Hypotension	2.29	9.92	2.11–57.44
Cardiac causes	-0.28	0.75	0.01–33.11
Primary kidney diseases#	-0.76	0.46	0.02–3.58

* HIC as reference;

include glomerulonephritis, vasculitis, AIN, pyelonephritis.

UMIC: upper middle income countries; LLMIC: low and low middle income countries.

Macedo E et. al PLOS ONE https://doi.org/10.1371/journal.pone.0196586

Management

- Nutritional support
- Avoid electrolytes disturbances
- Treat infections aggressively
- Treat primary cause aggressively
- Close monitoring during recovery phase
- DIALYSIS?????

Evaluation

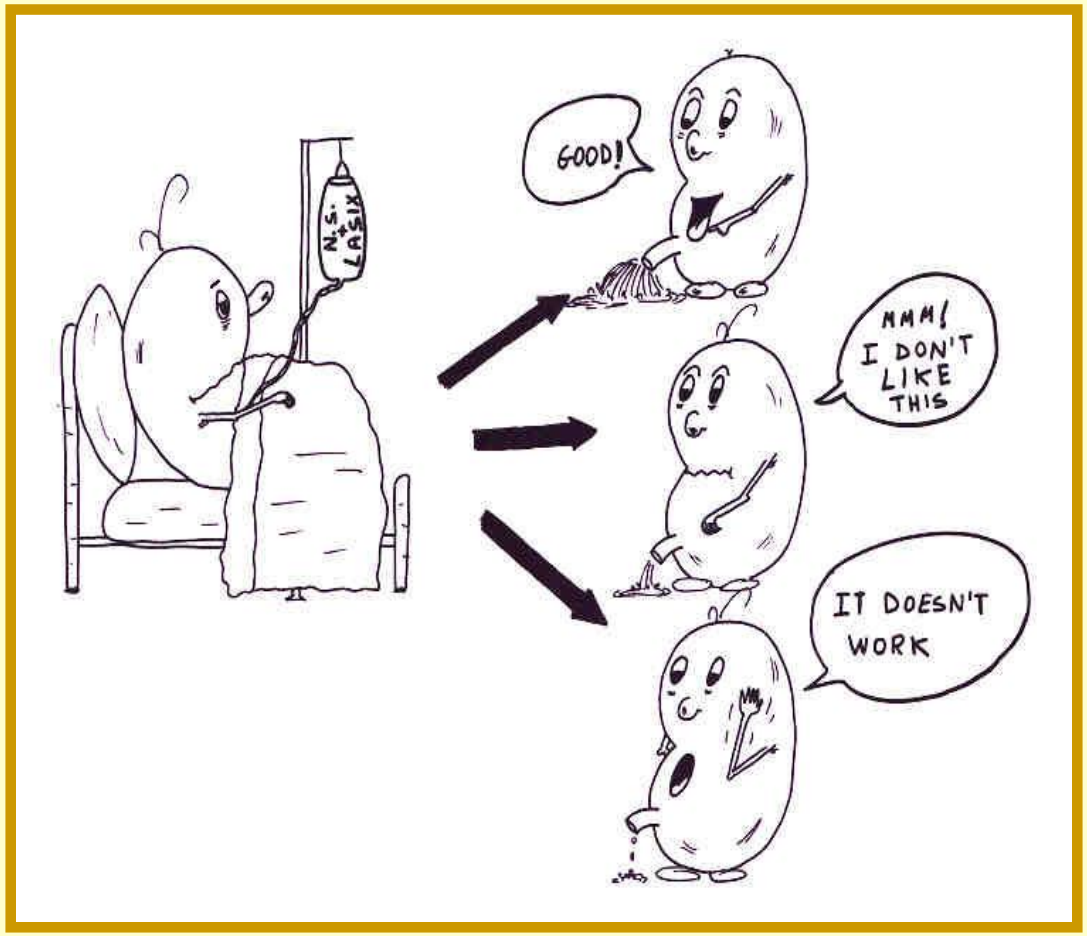
- Assess volume status
  - Match Intake and Output
  - Assess insensible losses
    - Phototherapy, warmer, fever
- Urinalysis
- Renal ultrasound
- Electrolytes (serum and urine) to calculate urinary indices
  - Interpretation of results is difficult in neonates
    - Lack of normative values

Renal Indices

	Pre-Renal
Fractional excretion of Na (FE_{NA})	< 1%
U Na^+	< 20 mEq/L
U/P Creat	> 30
BUN/Creat	> 20
U/P Osmolality	> 1.5

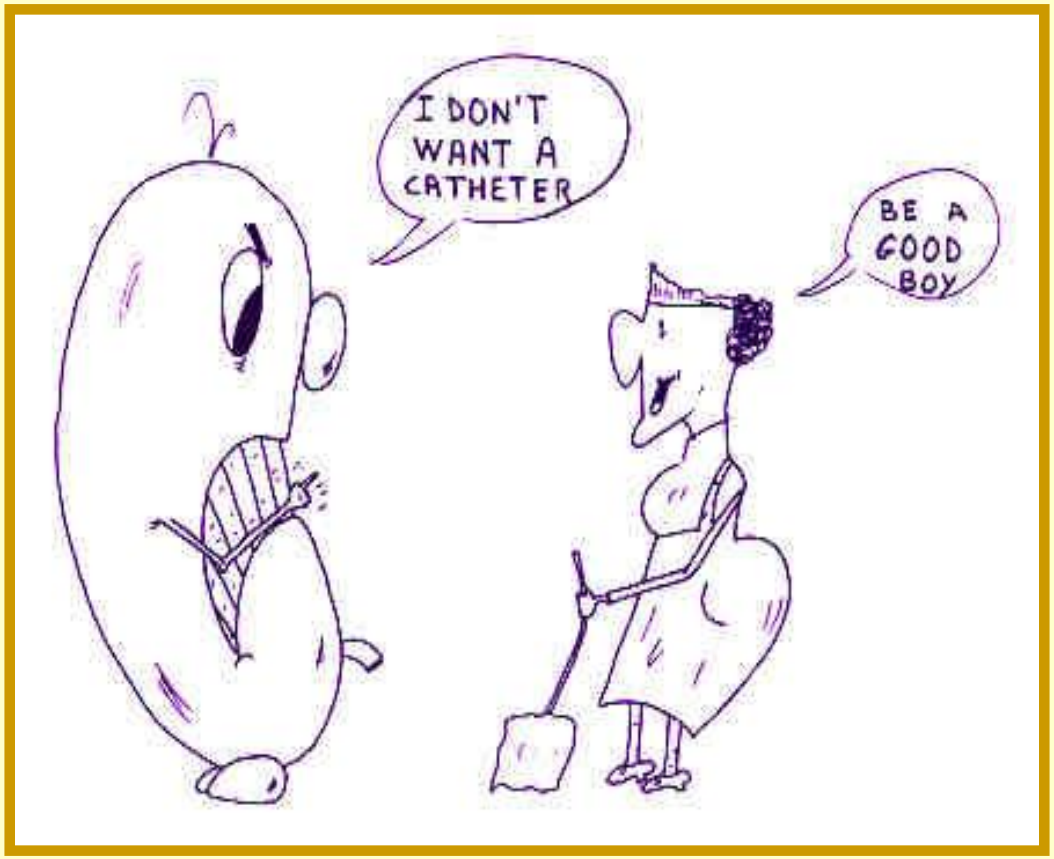
Management

- Fluid Challenge
  - Not if signs of hypervolemia
  - Give 10 – 20 ml/kg fluid bolus with isotonic solutions (NSS, Ringer's, Albumin) over 20 – 30 mins (full drip or push if shock)



Management

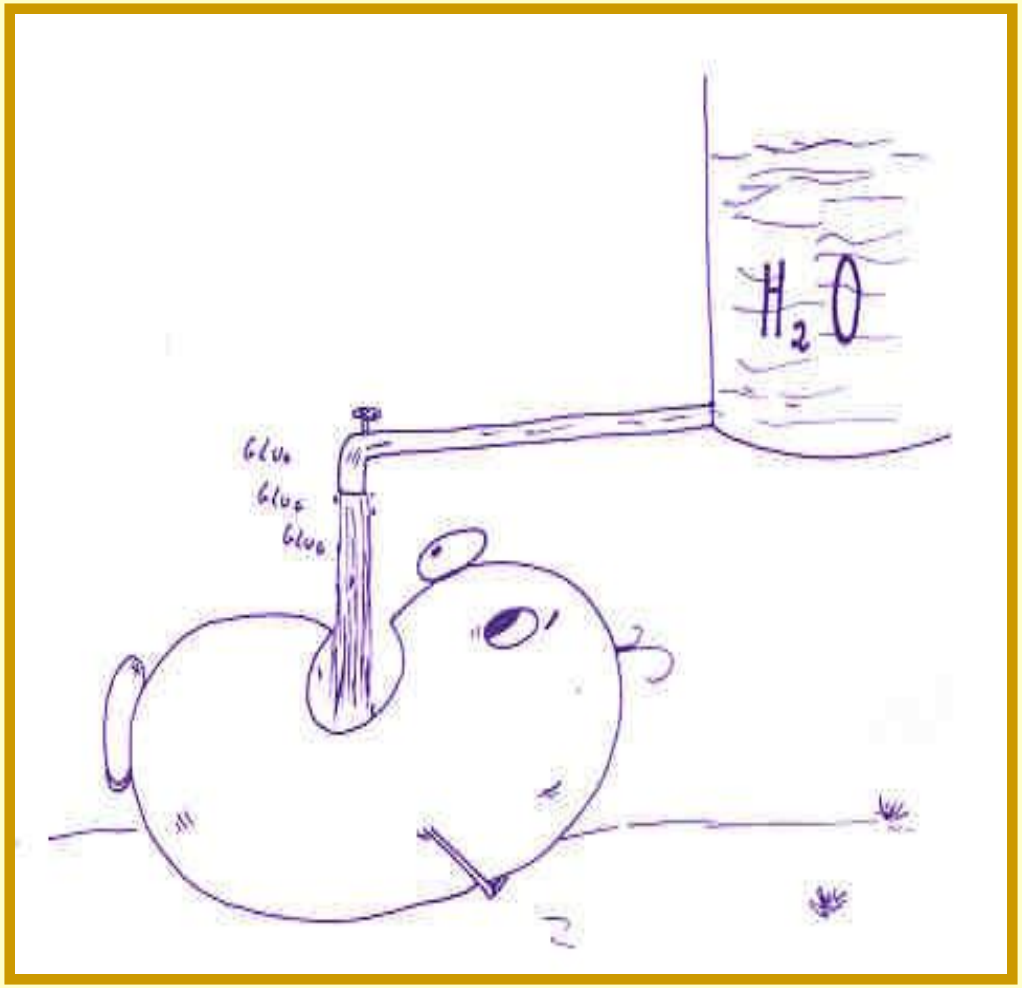
- If no response after 60 ml/kg or signs of fluid overload (edema, hypertension), consider catheterization



Fluid overload is a distinct pathologic state of positive fluid balance with adverse consequences.

Management

- If signs of fluid overload
  - Restrict fluids to insensible losses (400 – 600 ml/m^2/day) to avoid pulmonary edema



Fluid Balance

Consensus Statement 3A (Recommendation)

- Fluid balance is the difference between total input and output that can be expressed as “daily” and/or “cumulative” over a defined duration of time.
- The 2 methods most used to describe fluid balance are calculations from
  - Cumulative fluid inputs and outputs
  - Changes in measured body weight
- The weight change method has certain advantages because it accounts for unmeasured insensible losses, does not require an invasive bladder catheter, and is less resource intensive.
- A weight-change method is preferred in neonates to estimate fluid balance.

Goldstein SL et. al JAMA Network Open. 2022;5(9):e2229442.

Fluid Balance

eTable 1 - Definitions of Fluid Balance

Terminology	Measurement/Equation	Duration
Cumulative fluid input & output Methodology [22,26,27,40,74]		
Daily Fluid Balance	Fluid Intake (liters) – Fluid output (liters)	Over 24 hours
Cumulative Fluid Balance	∑ Fluid Intake (liters) - Fluid Output (liters)	Over a defined period of time
Percent Cumulative Fluid Balance	$\left(\sum [\text{Fluid Intake (liters) - Fluid Output (liters)}]\right) \times 100\%$ / Anchor weight (kg)	Over a defined period of time
Weight-based Methodology [23,31,38,75]		
Daily Fluid Balance	Current Weight (kg) – Weight from previous day (kg)	Over 24 hours
Cumulative Fluid Balance	Current Weight (kg) – Anchor Weight (kg)	Over a defined period of time
Percent Cumulative Fluid Balance	[Current Weight (kg) – Anchor Weight (kg)] x 100% / Anchor weight (kg)	Over a defined period of time

Anchor weight: The most common anchor weight used in the literature is ICU admission wt. It can be customized (e.g., pre-operative weight, birthweight in neonates during the first 2 postnatal weeks, hospital admission weight, outpatient weight prior to hospitalization, etc.).

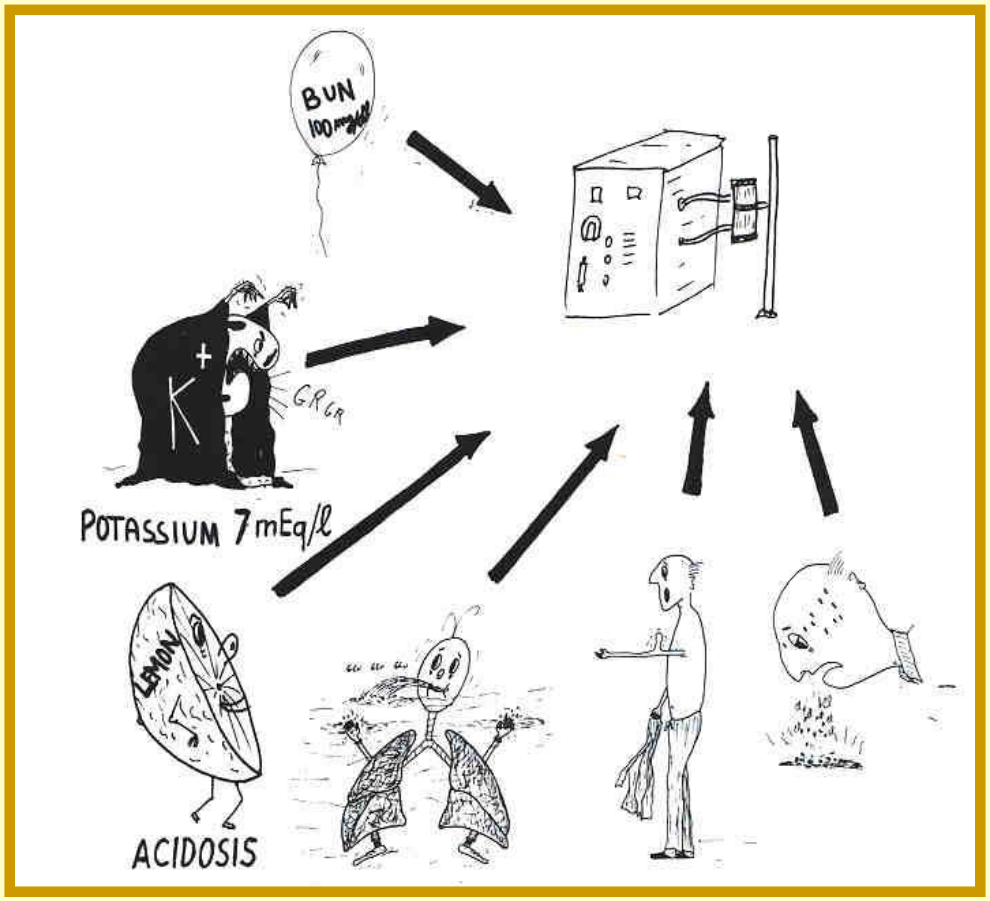
Goldstein SL et. al JAMA Network Open. 2022;5(9):e2229442.

Management

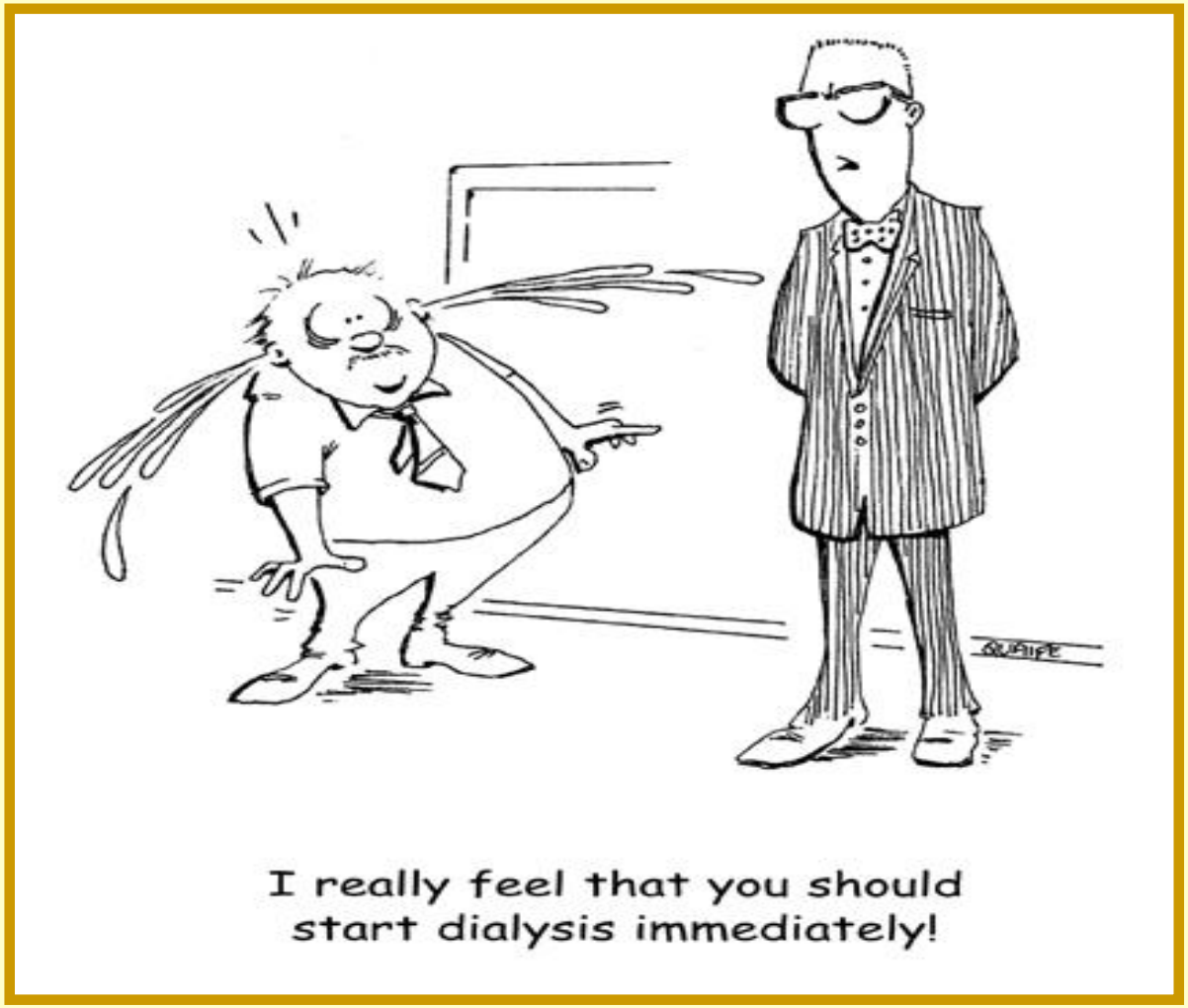
- Nutritional support
- Avoid electrolytes disturbances
- Treat infections aggressively
- Treat primary cause aggressively
- Close monitoring during recovery phase
- DIALYSIS?????

Indications for Dialysis

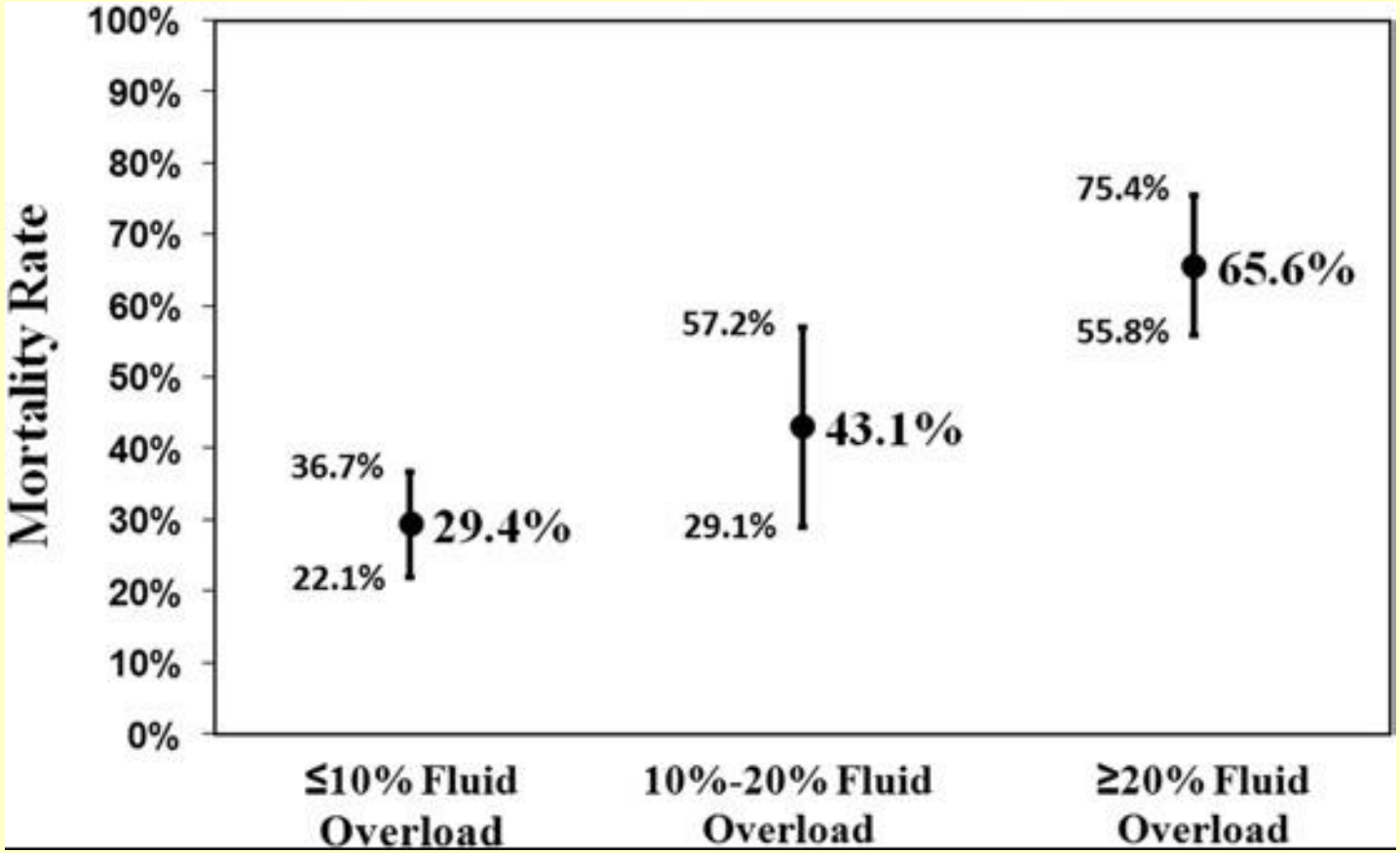
- Fluid Overload
- Intractable electrolyte problems (hyperkalemia, acidosis, hyperphosphatemia, hypo-, hypernatremia)
- Symptomatic uremia
- Metabolic disorders
- Intoxications



When to Start?



Fluid Overload and Mortality in Children Receiving CKRT



Sutherland et al. AJKD Feb 2010

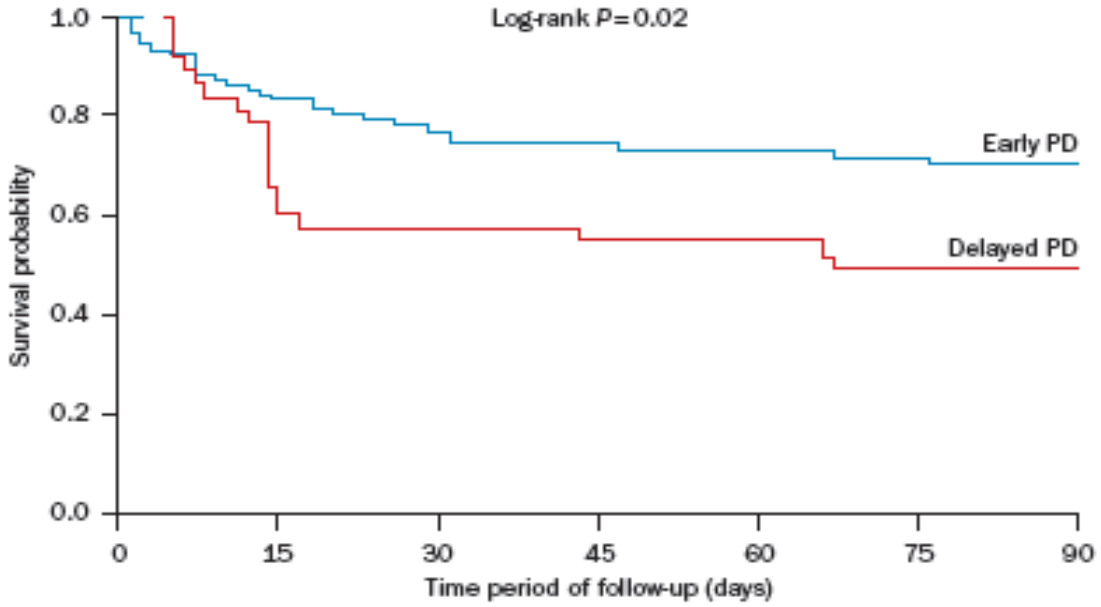
When to Start?

Table 3 Published reports of peritoneal dialysis after surgery for congenital heart disease (*NA* data not shown in the report)

Study (ref)	Age	Weight	Time to peritoneal dialysis	Duration	Ultrafiltrate	Mortality
Sorof et al. (*n*=20)	10 days (3–186)	3.8 kg (2.7–6.8)	22 h (5–40)	50 h (13–92)	–93 ml/kg per 24 h (43–233)	20%
Vricella et al. [13] (*n*=10)	1–31 days	2.9 kg	59 h	108 h	NA	30%
Book et al. [10] (*n*=15)	1 month to 14 years	NA	NA	2–12 days	NA	33%
Rigden et al. [1] (*n*=24)	1 day to 5 years	2.4–49 kg	3–80 h	1 h to 21 days	NA	38%
Werner et al. [5] (*n*=32)	22 months	9.2 kg	2.6 days	7.1 days	–48 ml/kg per day	47%
Giuffre et al. [12] (*n*=40)	2 days to 15 years	1.7–56 kg	NA	12.2 days	NA	57%
Fleming et al. [11] (*n*=21)	7 days to 11 years	6.7 kg (1.6–27 kg)	2.5 days (1–6 days)	136 h (4–360 h)	–9.2 ml/h (3.5–26 ml/h)	62%
Reznik et al. [8] (*n*=19)	NA	NA	9 days	NA	NA	79%

Sorof JM et al. Pediatr Nephrol 13: 641 – 645, 1999

When to Start?

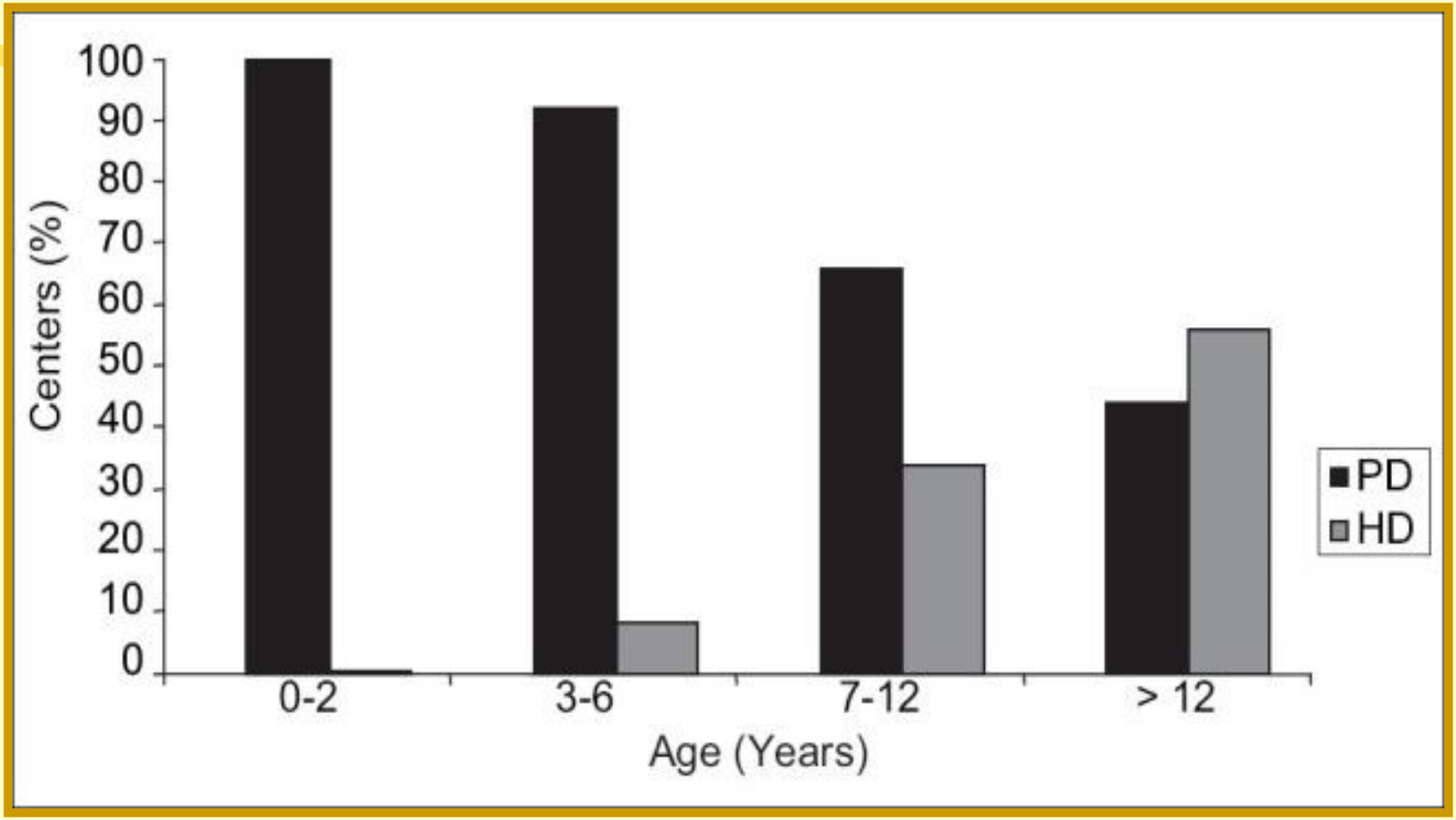


Number at risk							
Early PD	109	86	69	62	52	50	48
Delayed PD	37	24	21	19	19	16	15

Figure 1 | 90-day survival among patients with early and delayed PD. Survival is shown using Kaplan–Meier curves. Patients with PD commenced on the day of surgery or on the day following surgery ('early PD' group) had a better 90-day survival than did patients in whom PD was commenced on the second day following surgery or later ('delayed PD' group; 72.5% versus 48.7%). The *P* value refers to the between-group difference assessed by the result of the log-rank test = 5.7, with 1 degree of freedom. Abbreviation: PD, peritoneal dialysis. Permission obtained from Nature Publishing Group © Bojan, M. *et al. Kidney Int.* doi:10.1038/ki.2012.172.

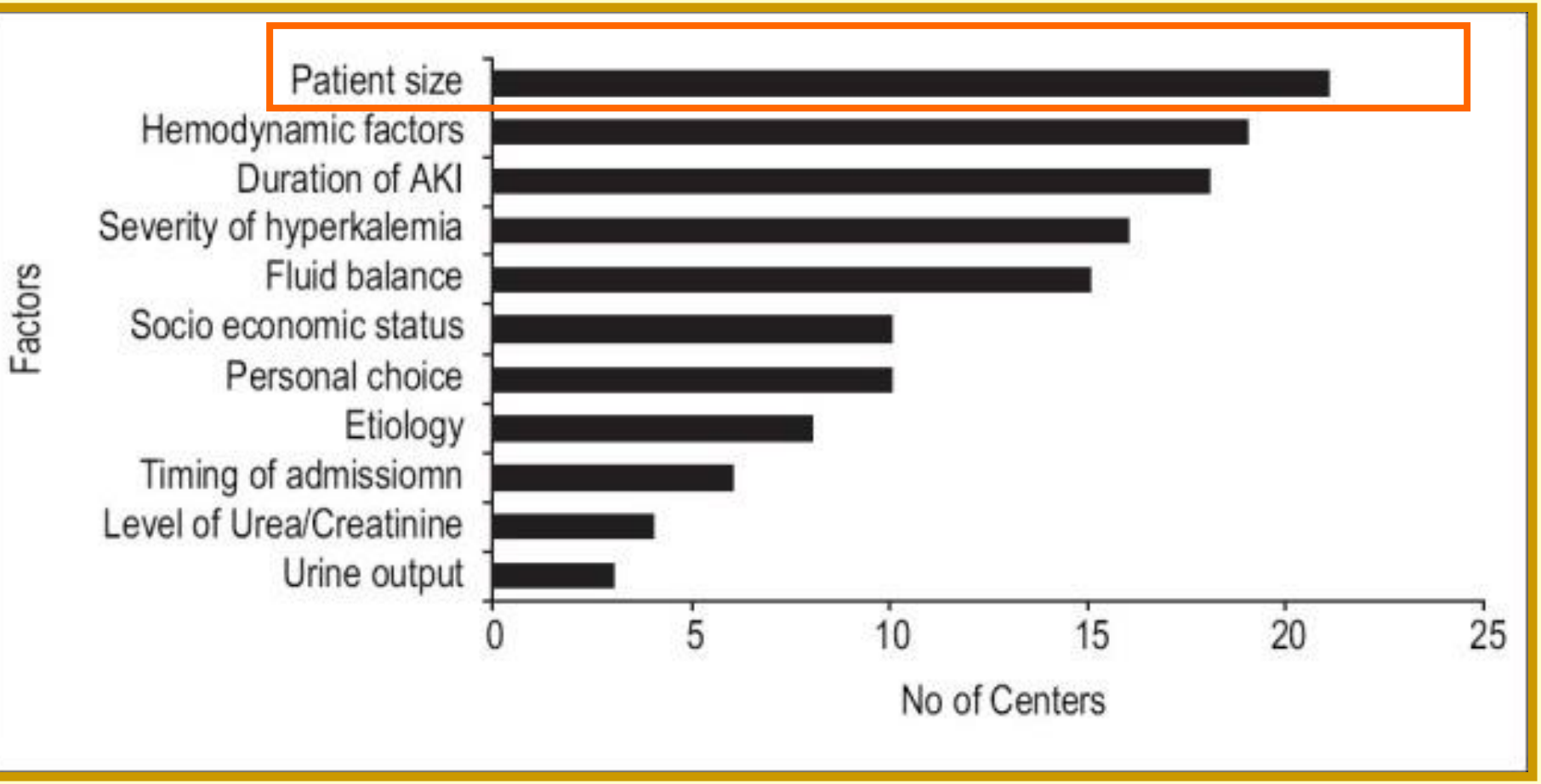
Bojan et al. Kidney International (2012) 82, 474–481

Dialysis Modality by Age



Vasudevan E. et. al. Indian J Nephrol. 2012; 22: 121–124

Factors Influencing Choice of Dialysis Modality



Vasudevan E. et. al. Indian J Nephrol. 2012; 22: 121–124

Cost Analysis

Modality	Manual peritoneal dialysis	Manual peritoneal dialysis	Automated peritoneal dialysis	Intermittent hemodialysis	Continuous hemofiltration
Device	Dialy-Nate Manual PD set	Ultra Set (Y-set)	Freeedom Cycler	C3	Prisma
Manufacturer	Utah Medical Products	Baxter	Fresenius	Gambro	Gambro
Cost per unit[a]	$88.75[b]	$6.95[c]	$12,295.00	$18,000.00	$25,000.00
Cost of additional supplies	1.5% Dianeal (Baxter) $24.43/2.0L	Peritoneal dialysate as at left	Pediatric tubing set $32.00 each Peritoneal dialysate as at left	100HG dialyzer $50.00 each; pediatric bloodlines $11.40 each	M60 hemofilter set (includes filter and bloodlines) $160.00 each Normocarb dialysate concentrate (Dialysis Solutions) $20.00/3.0L

[a] Manufacturer's list price
[b] New set required every 24–72 h
[c] New unit required for each exchange

Flynn JT. Pediatr Nephrol 17: 61 – 69, 2002

Which is the Best Modality?

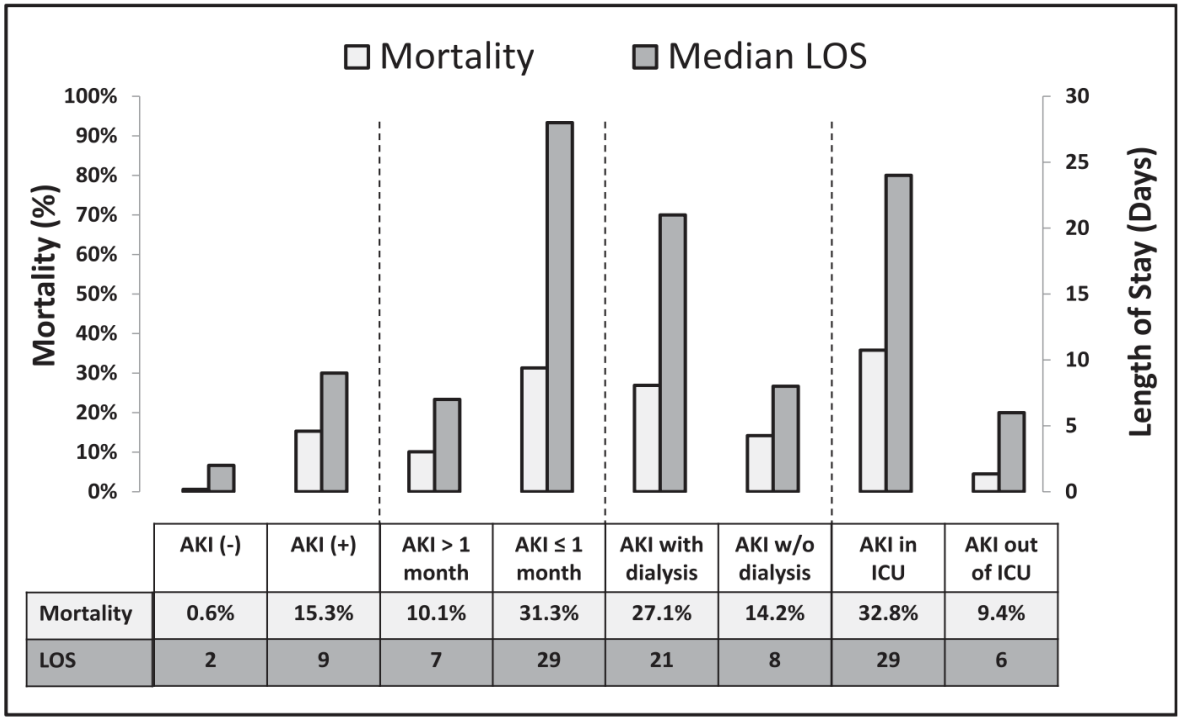
- Hemofiltration vs PD (Adults)
  - HF provided better metabolic control, lower mortality and morbidity rates than PD
    - Adults with sepsis (Vietnam)
- PD in children
  - PD mortality rates similar to CVVHD

1. Hoan Phu N et al. N Engl J Med 347: 895 – 8902, 2002
2. Cueva Lepe A et al. Rev Asoc Mex Med Crit Ter Int 15: 11-17, 2001

Which is the Best Modality?

Decision should be based on local expertise, resources, and patient's age and clinical status

Prognosis

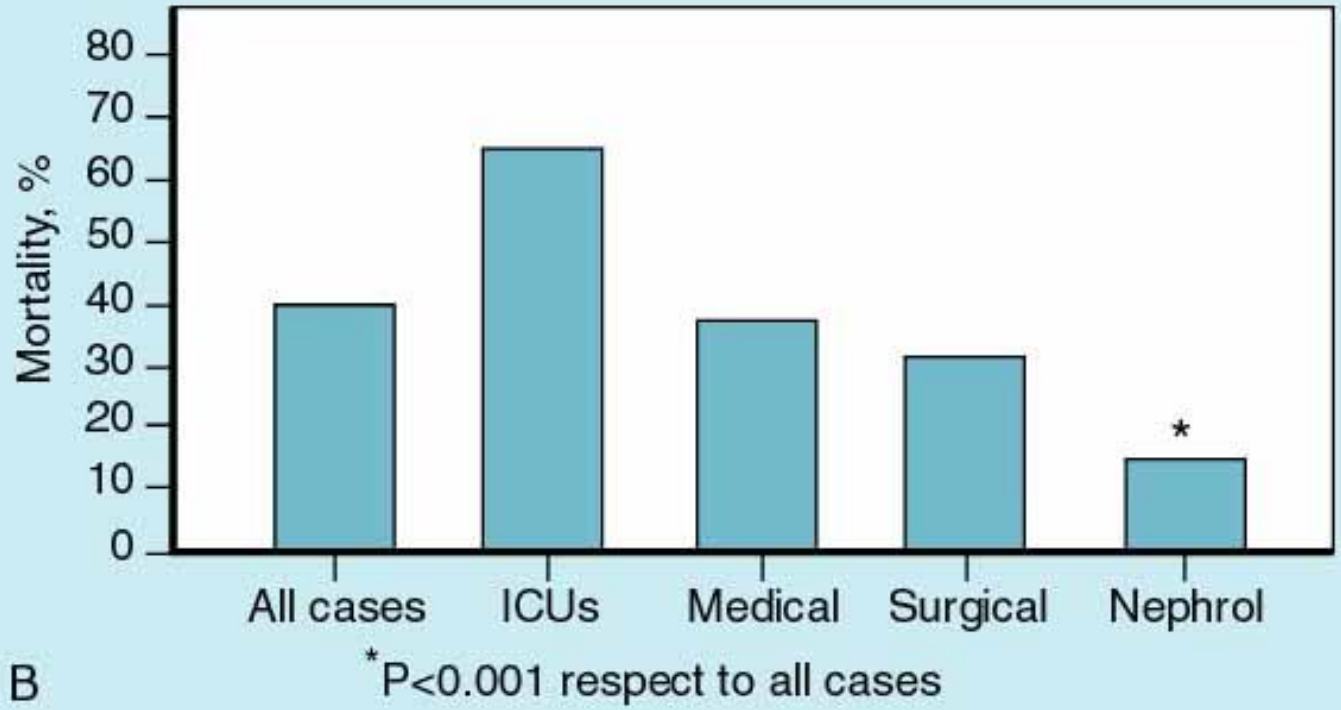


	AKI (-)	AKI (+)	AKI > 1 month	AKI ≤ 1 month	AKI with dialysis	AKI w/o dialysis	AKI in ICU	AKI out of ICU
Mortality	0.6%	15.3%	10.1%	31.3%	27.1%	14.2%	32.8%	9.4%
LOS	2	9	7	29	21	8	29	6

Figure 4. | **Outcomes.** Mortality rates (%) and length of stay (median days) are shown for patients with and without AKI, AKI patients >1 and ≤1 month of age, AKI patients who required and did not require dialysis, and AKI patients who received and did not receive critical care. ICU, intensive care unit; LOS, length of stay.

Sutherland SM et. al. Clin J Am Soc Nephrol 8: 1661–1669, 2013

Prognosis


Mortality, %
80
70
60
50
40
30
20
10
0
All cases
ICUs
Medical
Surgical
Nephrol
*
B
*P<0.001 respect to all cases

Puerto Rico Convention
SAN JUAN, PUERTO

¡SE EXTIENDE!

FECHA PARA INSCRIBIRSE
CON VALOR PREFERENCIAL
HASTA EL 16 DE JUNIO

XIII CONGRESO ALANEPE

15 - 18 NOVIEMBRE 2023

Puerto Rico

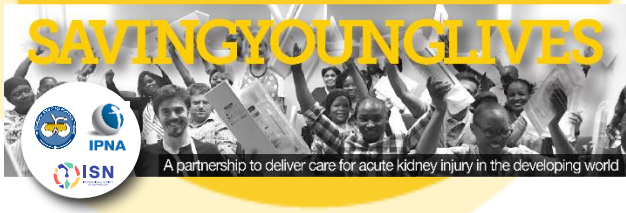
Dr. Melvin Bonilla Félix
Presidente ALANEPE

Dra. Nilka de Jesús González
Presidenta XIII Congreso ALANEPE

INSCRÍBASE AQUÍ

Alanepe

INSCRIPCIONES Y MÁS INFORMACIÓN info@alanepe.org www.alanepe.org



pAKI, initial treatment and RRT

Guillermo Hidalgo, M.D.

Hackensack Meridian Health
Children's Network.

Objetivos

- Breve revision de resuscitation
- Breve revision de sedacion
- Manejo conservador
- Opciones de dialysis.
- Rol de dialisis peritoneal.

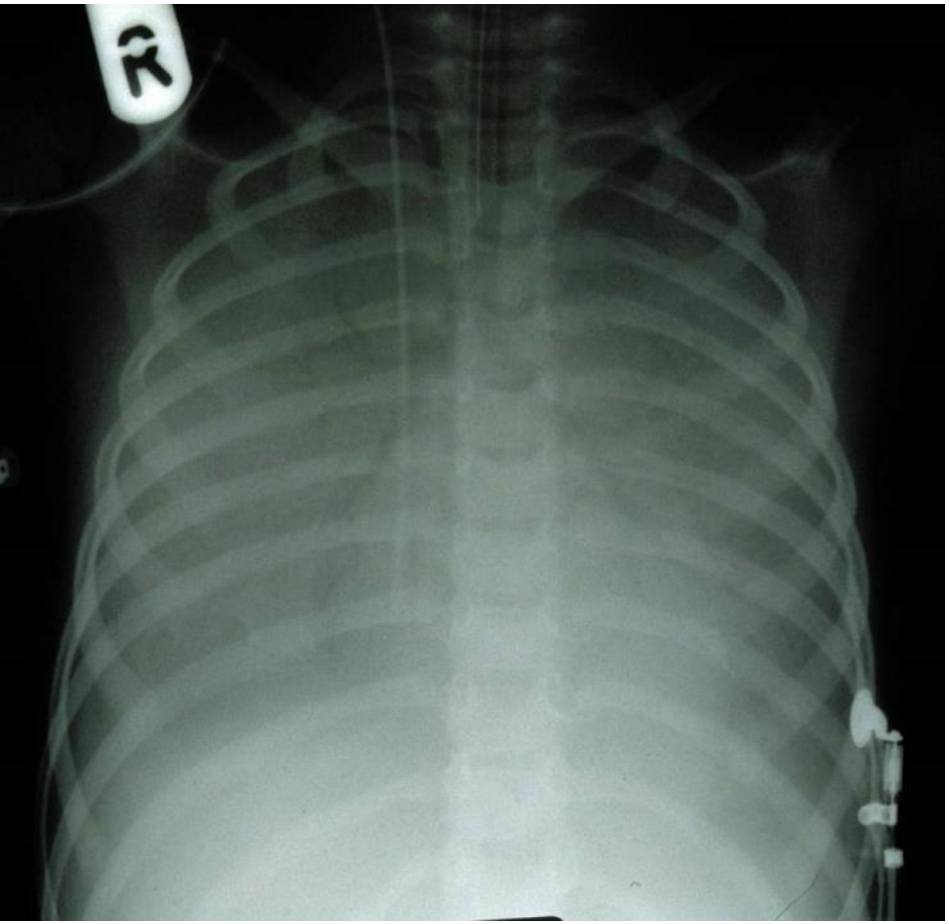
clinical patients

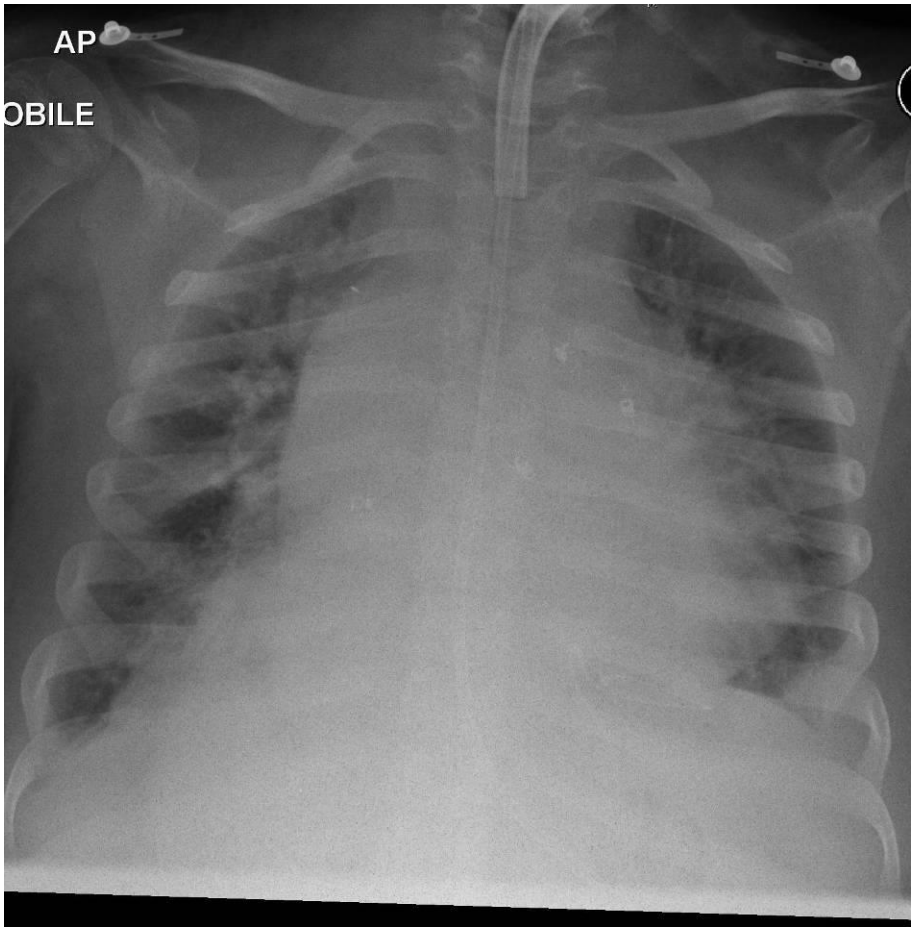
- Nino de 9 meses
- Con vomitando y con diarrea.
- en shock
- No assisted ventilation or inotropic support available
- Management?

Nina de 3.9 kg

- APGAR bajos
- Asfixia al nacer
- convulsiones
- No tiene produccion de orina.
- K 6.5
- What are your plans?

Clinical Problems Produced By AKI

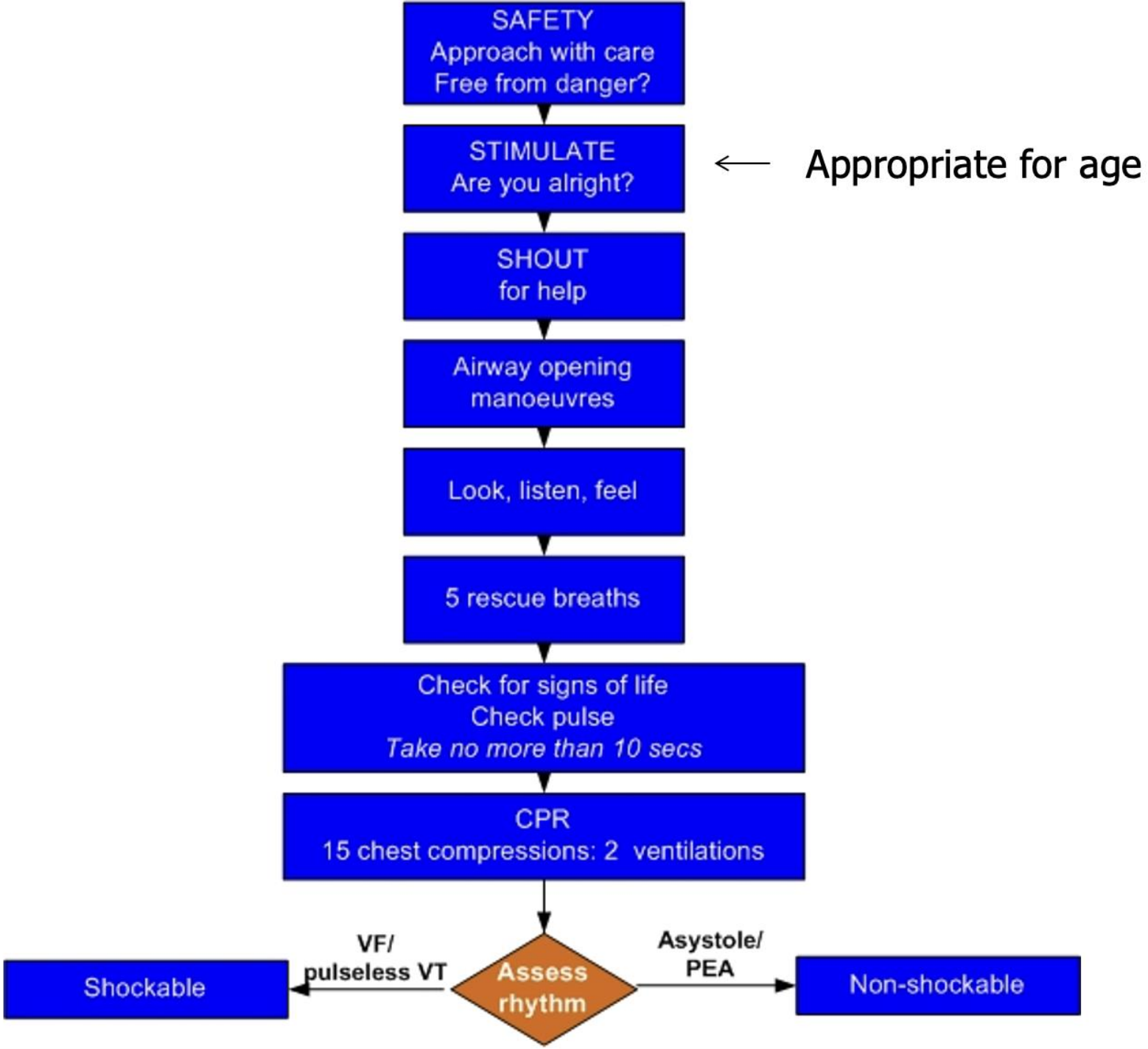


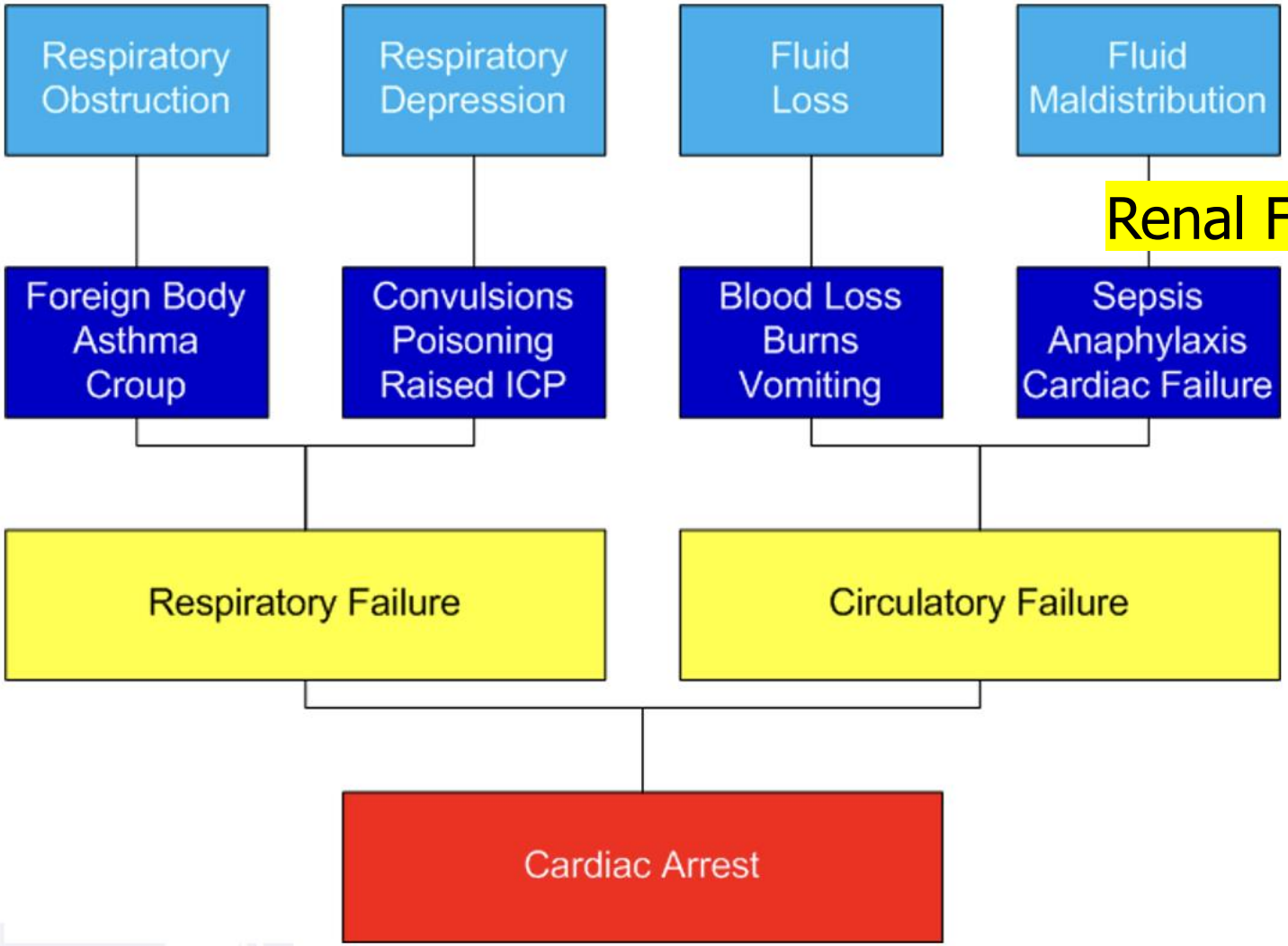


Advanced Paediatric Life Support
Systematic approach

- Primary assessment
- Resuscitation
- Secondary assessment – identification of key features
- Emergency treatment
- Stabilisation, transfer to definitive care

Advanced Life Support Group
A charity dedicated to saving life by providing training


SAFETY
Approach with care
Free from danger?
STIMULATE
Are you alright?
← Appropriate for age
SHOUT
for help
Airway opening
manoeuvres
Look, listen, feel
5 rescue breaths
Check for signs of life
Check pulse
Take no more than 10 secs
CPR
15 chest compressions: 2 ventilations
VF/
pulseless VT
Asystole/
PEA
Shockable
Assess
rhythm
Non-shockable



Advanced Life Support Group
A charity dedicated to saving life by providing training

Resuscitation

- Airway
- Breathing
  - Oxygen saturation monitor
  - Oxygen nasal cannula
  - Hi-flow
  - CPAP
  - Intubation and ventilation

Sedation

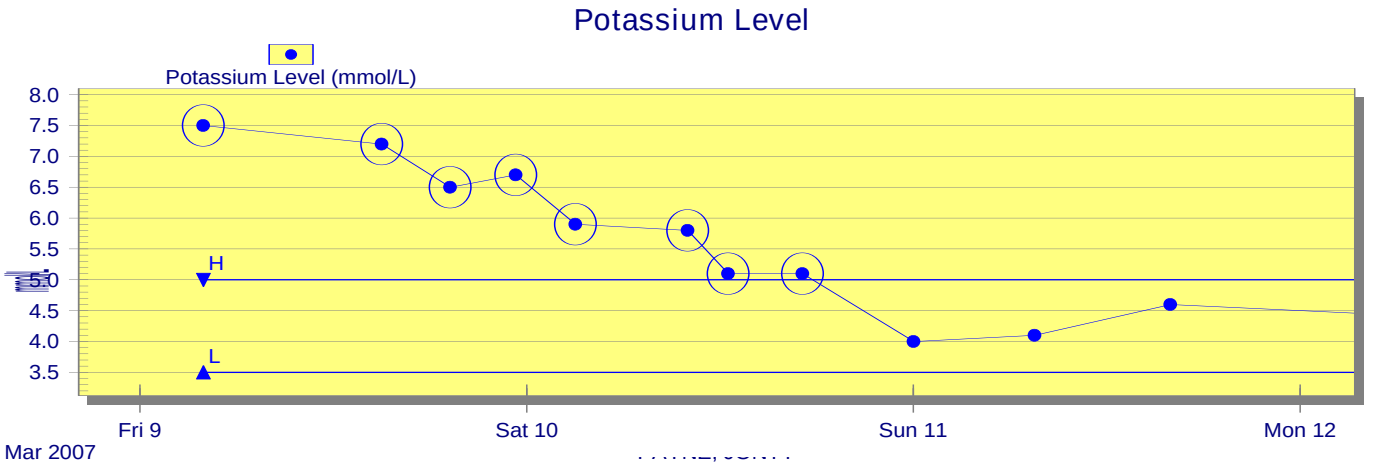
- Ketamine 1-2mg/kg ivi titrated
  - Start off low dose 1mg/kg and then add 0.5mg/kg at a time
- Midazolam 0.1-0.2mg/kg ivi/nasal or buccal
- Morphine – respiratory depressant
- Propofol – difficult to use

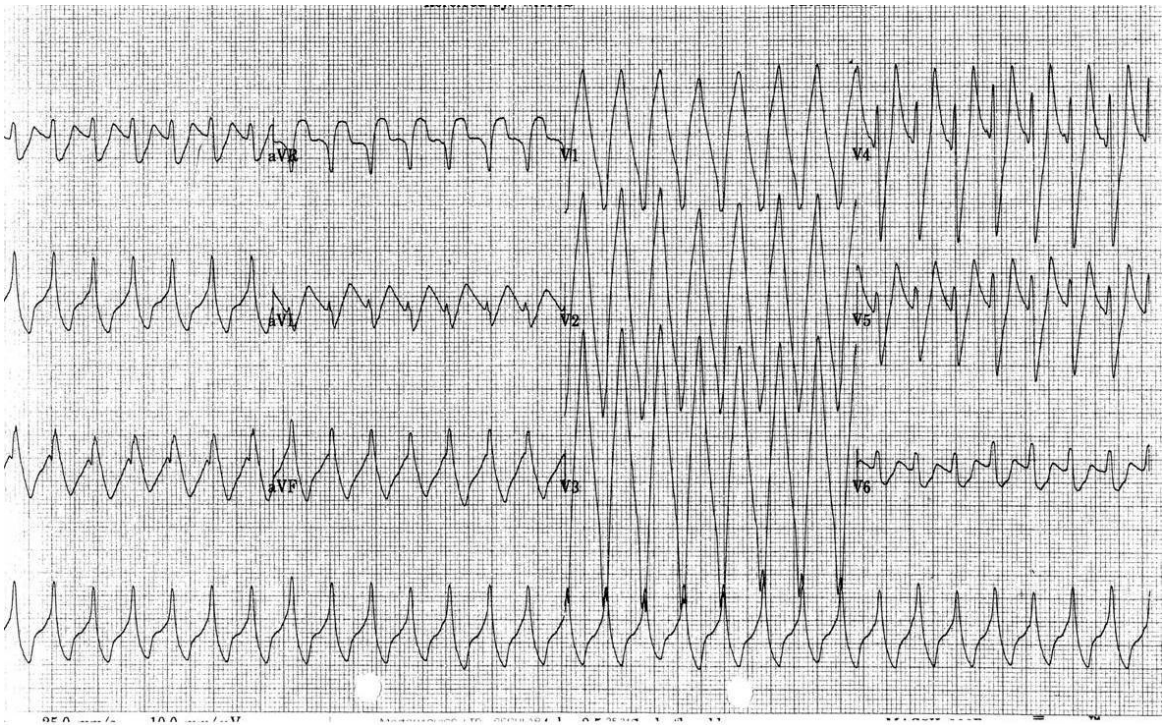
Circulation

- Capillary refill time
- Blood Pressure
- Lactate
- Urine output

Circulation

- Blood Pressure
  - Support Adrenaline peripherally
    - Dose 0.06mg/kg in 50ml 5% Dextrose:
    - 1ml/hr = 0.02mcg/kg/min
  - Central line
    - Dose 0.15mg/kg in 50ml 5% Dextrose:
    - 1ml/hr = 0.05mcg/kg/min
  - **No Dopamine**
  - Dobutamine in cardiac patients


Potassium Level
Potassium Level (mmol/L)
8.0
7.5
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
H
L
Fri 9
Mar 2007
Sat 10
Sun 11
Mon 12


aVR
V1
V4
aVL
V2
V5
aVF
V3
V6

Potassium Shifting

- 10% Ca Gluconate 0.5ml/kg ivi
- Sodium Bicarbonate 1-2mmol/kg ivi
- Frusemide 1mg/kg ivi
- Salbutamol nebs
- Kayexalate – 'out of fashion' - NEC
- Insulin and Dextrose – 'watch' glucose
  - Glucose bolus hen natural insulin

Does one need Insulin?

Nephron Physiol. 2014;126(1):1-8. doi: 10.1159/000358836. Epub 2014 Feb 22.

Bolus administration of intravenous glucose in the treatment of hyperkalemia: a randomized controlled trial.

Chothia MY[1], Halperin ML, Rensburg MA, Hassan MS, Davids MR.

Author information

1 Division of Nephrology, Department of Medicine, Stellenbosch University and Tygerberg Hospital, Cape Town, South Africa.

CONCLUSION: Infusion of a glucose-only bolus caused a clinically significant decrease in serum [K(+)] without any episodes of hypoglycemia.

What if fluid was considered as an IVI drug?

REVIEW ARTICLE

CRITICAL CARE MEDICINE

Simon R. Finfer, M.D., and Jean-Louis Vincent, M.D., Ph.D., *Editors*

Resuscitation Fluids

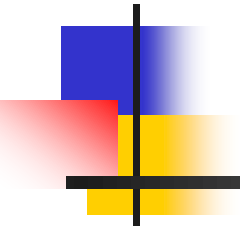
John A. Myburgh, M.B., B.Ch., Ph.D., and Michael G. Mythen, M.D., M.B., B.S.

FLUID RESUSCITATION WITH COLLOID AND CRYSTALLOID SOLUTIONS IS A ubiquitous intervention in acute medicine. The selection and use of resuscitation fluids is based on physiological principles, but clinical practice is determined largely by clinician preference, with marked regional variation. No ideal resuscitation fluid exists. There is emerging evidence that the type and dose of resuscitation fluid may affect patient-centered outcomes.

Despite what may be inferred from physiological principles, colloid solutions do not offer substantive advantages over crystalloid solutions with respect to hemodynamic effects. Albumin is regarded as the reference colloid solution, but its cost is a limitation to its use. Although albumin has been determined to be safe for use as a resuscitation fluid in most critically ill patients and may have a role in early sepsis, its use is associated with increased mortality among patients with traumatic brain injury. The use of hydroxyethyl starch (HES) solutions is associated with increased rates of renal-replacement therapy and adverse events among patients in the intensive care unit (ICU). There is no evidence to recommend the use of other semisynthetic colloid solutions.

From the University of New South Wales, the Division of Critical Care and Trauma, George Institute for Global Health, and the Department of Intensive Care Medicine, St. George Hospital — all in Sydney (J.A.M.); and the National Institute for Health Research, University College London Hospitals Biomedical Research Centre, London (M.G.M.). Address reprint requests to Dr. Myburgh at the Department of Intensive Care Medicine, St. George Hospital, Gray St., Kogarah 2217, Sydney, NSW, Australia, or at jmyburgh@georgeinstitute.org.au.

N Engl J Med 2013;369:1243-51.
DOI: 10.1056/NEJMra1208627



Resuscitation Fluid

Different Solutions

- Colloid solutions no substantive advantages over crystalloid solutions haemodynamically
- Albumin cost limitations and concerns in certain patient groups – traumatic brain injuries
- Hydroxyethyl starch(HES) solutions increased rates of RRT & adverse events in ICU
- Semisynthetic colloid solutions – no evidence for recommendation

Resuscitation Fluids*

Myburgh JA, Mythen MG NEJM 2013;369:1243-51

- No ideal fluid exists
- Clinical practice determined by
  - Clinician preference
  - Regional variation
- Type and dose may affect patient outcomes
- All resuscitation fluids used excessively contributes to interstitial oedema under inflammatory conditions

Ideal Resuscitation fluid

Myburgh JA, Mythen MG NEJM 2013;369:1243-51

- Predictable and sustained increase in intravascular volume
- Chemical composition close to extracellular fluid
- Metabolised & completely excreted without accumulation in tissues
- Does not produce metabolic or systemic adverse effects
- ***Cost effective***

	Na (mmol/L)	K (mmol/L)	Cl (mmol/L)	HCO3 (mmol/L)	Dextrose (gm/L)	Osmol (mOsm/L)	pH
0.9% Sodium Chloride	154	-	154	-	-	308	5.5
Ringers Lactate (RL)	130	4	109	28 **(lactate)**		271	6.75
Plasmalyte	140	5	98	-		295	7.4
5% Dex Saline (HIF)	154	-	154	-	50	564	
½ NS	77	-	77	-	-	154	
5%D + 0.45% NS (RHF)	77	-	77	-	50	432	
½ DD	61	17	52	-	50	434	
D5W	-	-	-	-	50	278	
NNL	33		33		100	627	
PMS	35	12	47		50	372	

Saline

- Isotonic sodium chloride(0.9%) – commonest ivi fluid in world
  - USA > 200million litres sold annually
- Large volumes of saline results in hyperchloraemic metabolic acidosis

Saline – the bad – hyperchloraemic acidosis

- Animal studies
  - Immune dysfunction
  - Decreased renal blood flow
- Human studies
  - Acidosis
  - Reduced renal cortical blood flow
  - Decreased and delayed urine output/AKI
  - Gastrointestinal dysfunction
  - Increased infectious complications
  - Large volume infusions of saline lead to coagulopathy

FEAST Trial ?

The NEW ENGLAND JOURNAL of MEDICINE

ORIGINAL ARTICLE

Mortality after Fluid Bolus in African Children with Severe Infection

Kathryn Maitland, M.B., B.S., Ph.D., Sarah Kiguli, M.B., Ch.B., M.Med., Robert O. Opoka, M.B., Ch.B., M.Med., Charles Engoru, M.B., Ch.B., M.Med., Peter Olupot-Olupot, M.B., Ch.B., Samuel O. Akech, M.B., Ch.B., Richard Nyeko, M.B., Ch.B., M.Med., George Mtove, M.D., Hugh Reyburn, M.B., B.S., Trudie Lang, Ph.D., Bernadette Brent, M.B., B.S., Jennifer A. Evans, M.B., B.S., James K. Tibenderana, M.B., Ch.B., Ph.D., Jane Crawley, M.B., B.S., M.D., Elizabeth C. Russell, M.Sc., Michael Levin, F.Med.Sci., Ph.D., Abdel G. Babiker, Ph.D., and Diana M. Gibb, M.B., Ch.B., M.D., for the FEAST Trial Group*

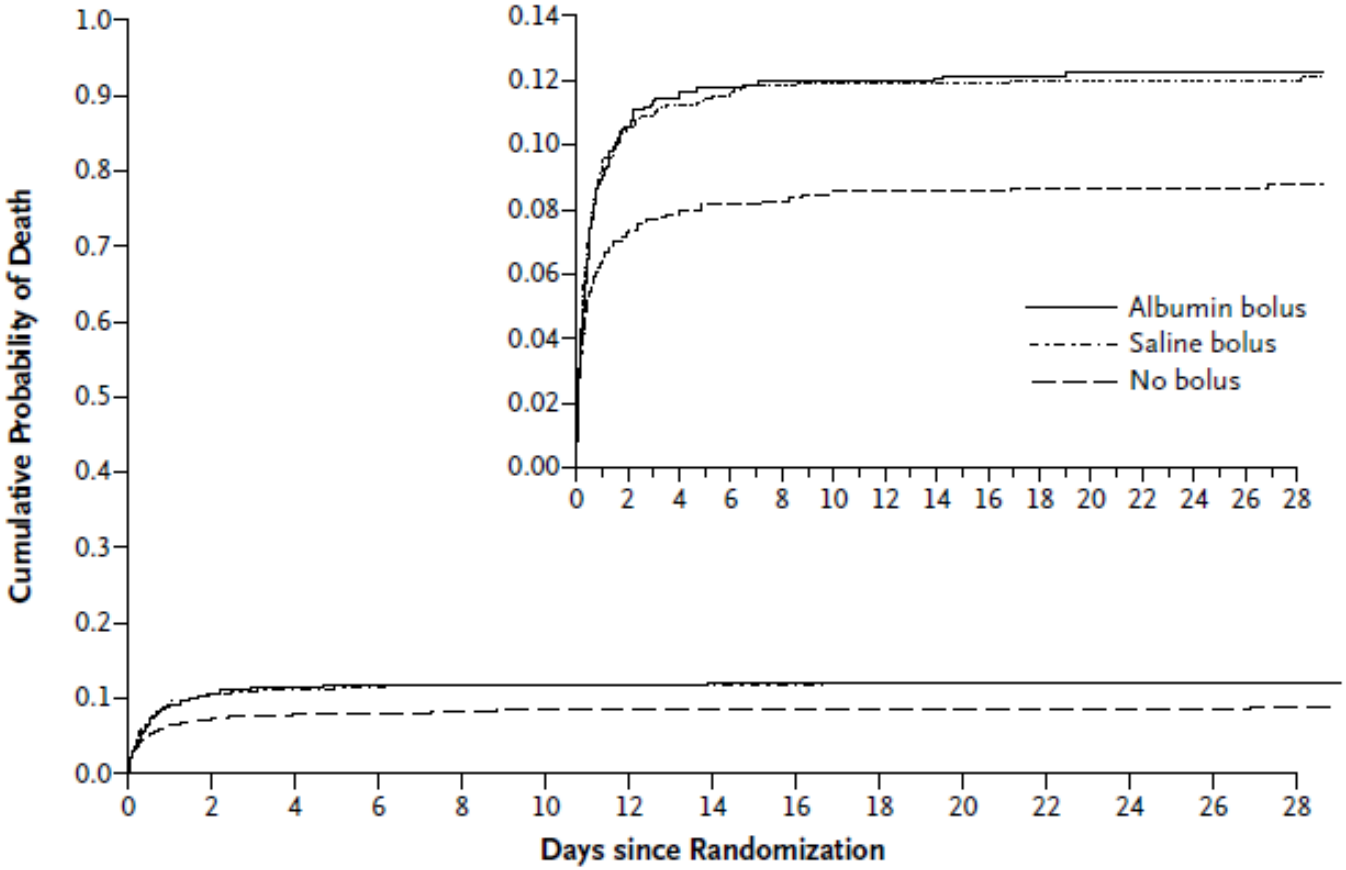
CONCLUSIONS

Fluid boluses significantly increased 48-hour mortality in critically ill children with impaired perfusion in these resource-limited settings in Africa. (Funded by the Medical Research Council, United Kingdom; FEAST Current Controlled Trials number, ISRCTN69856593.)

FEAST Study
(Fluid Expansion as Supportive Therapy)
NEJM June 30, 2011 Maitland et al

- Severe febrile illness & impaired perfusion randomised to:
  - Bolus 5% Albumin 20-40ml
  - **Bolus 0,9% Saline**
  - No bolus
- Halt recruitment **3141**/3600
  - 48hour mortality
  - 10.6% bolus vs 7.3% non-bolus(p=0.003)

B Mortality at 4 Weeks



	Day 1			Day 2			Day 3–7			Day 8–14			Day 15–21			Day 21–28		
	Albumin bolus	Saline bolus	No bolus	Albumin bolus	Saline bolus	No bolus	Albumin bolus	Saline bolus	No bolus	Albumin bolus	Saline bolus	No bolus	Albumin bolus	Saline bolus	No bolus	Albumin bolus	Saline bolus	No bolus
No. at Risk	1050	1047	1044	954	945	975	914	917	947	901	909	940	899	902	933	897	901	934
Died	95	97	67	16	13	9	11	7	7	2	6	2	2	1	4	2	1	1
%	9.0	9.3	6.4	1.7	1.4	0.9	1.2	0.8	0.7	0.2	0.7	0.2	0.2	0.1	0.4	0.2	0.1	0.2

Maitland et al, N Engl J Med, 2011

Controversies

- What fluid to give?
  - Saline vs Ringer's vs Plasmalyte B
- How much?
  - 5 or 10 or 20-40 or >60ml/kg
- How fast?
- What causative organism?
- What support is needed vs resources available?
- Where geographically?

WHO: emergency triage, assessment and treatment *

- "Shock treatment depends on the type of shock."
- Children in shock: 10-20ml/kg isotonic fluid over 30-60 min → reassess at completion of infusion → consider another 10ml/kg over 30 min if shock persist.
- Stop fluid if fluid overload signs, neuro deterioration, cardiac failure.

UPDATED GUIDELINE

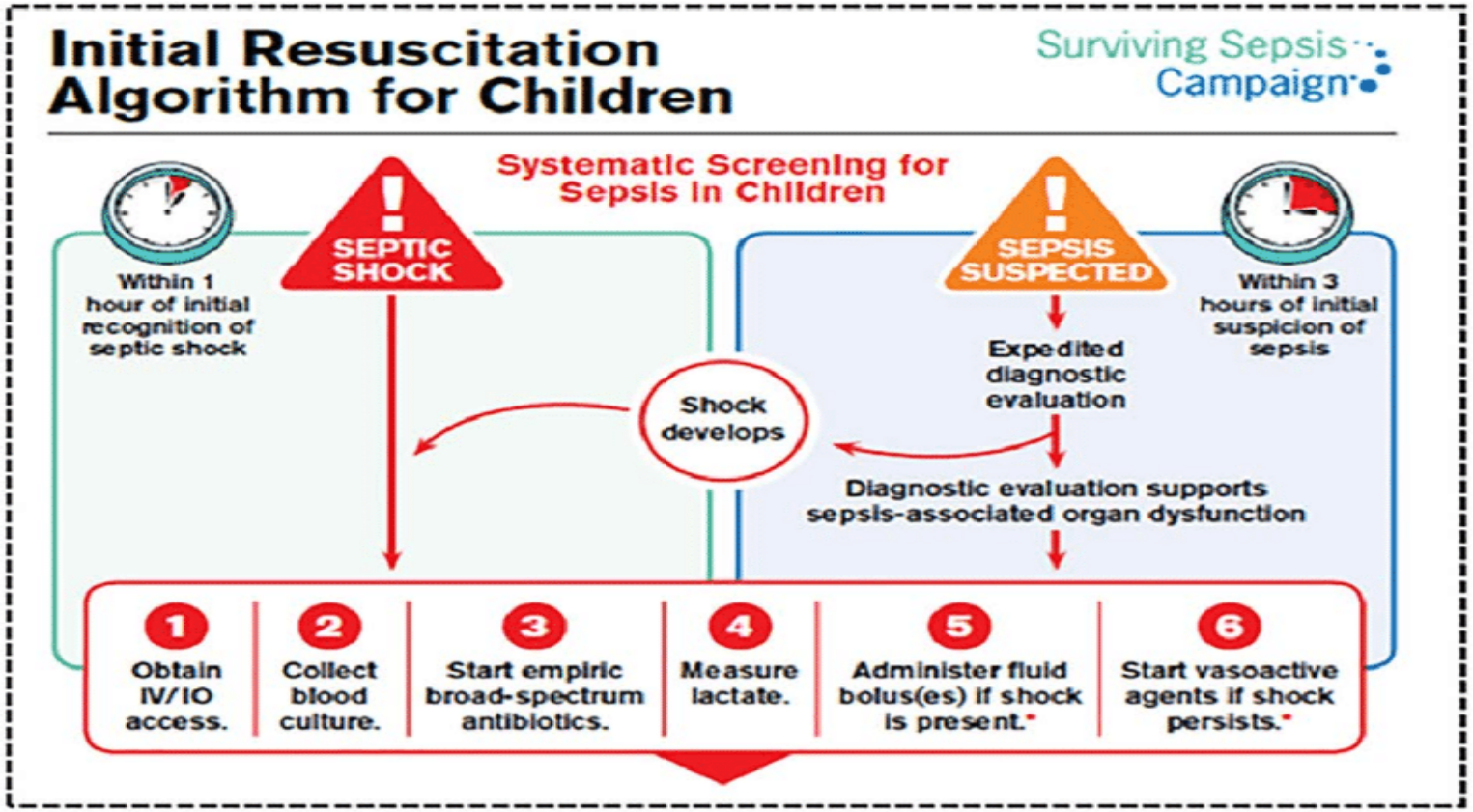
2. FLUID MANAGEMENT IN CHILDREN WITH SIGNS OF IMPAIRED CIRCULATION

Children who are not in shock but have signs of circulatory impairment

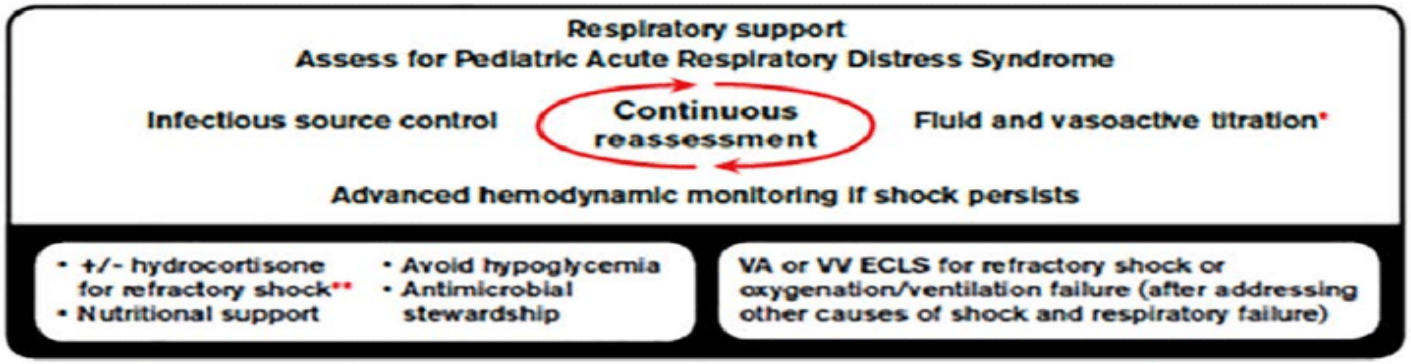
2.1	Children with only one or two signs of impaired circulation – cold extremities or capillary refill > 3 s or a weak and fast pulse – but who do not have the full clinical features of shock, i.e. all three signs present together, should not receive any rapid infusion of fluids but should still receive maintenance fluids appropriate for their age and weight.[b]	**Strong**	**High**
2.2	In the absence of shock, rapid IV infusion of fluids may be particularly harmful to children who have severe febrile illness, severe pneumonia, severe malaria, meningitis, severe acute malnutrition, severe anaemia, congestive heart failure with pulmonary oedema, congenital heart disease, renal failure or diabetic ketoacidosis.	**Strong**	**High**
2.3	Children with any sign of impaired circulation, i.e. cold extremities or prolonged capillary refill or weak, fast pulse, should be prioritized for full assessment and treatment and reassessed within 1 h.	**Strong**	**High**

World Health Organization

A



B



*See fluid and vasoactive algorithm. Note: Fluid bolus should be omitted from bundle if a) fluid overload is present or b) it is a low-resource setting without hypotension. Fluid in mL/kg should be dosed as ideal body weight.

**Hydrocortisone may produce benefit or harm.

Fluid and Vasoactive-Inotrope Management Algorithm For Children

Surviving Sepsis Campaign

SEPTIC SHOCK

Healthcare Systems WITH Intensive Care

Abnormal Perfusion with or without Hypotension

- If signs of fluid overload are absent, administer fluid bolus, 10-20 mL/kg.
- Repeat assessment of hemodynamic response to fluid and consider fluid boluses, 10-20 mL/kg, until shock resolves or signs of fluid overload develop.
- Assess cardiac function.
- Consider epinephrine if there is myocardial dysfunction or epinephrine/ norepinephrine if shock persists after 40-60 mL/ kg (or sooner if signs of fluid overload develop).

Healthcare Systems WITHOUT Intensive Care

Abnormal perfusion WITHOUT hypotension

- Do NOT give fluid bolus unless there are signs of dehydration with ongoing fluid losses (eg, diarrhea).
- Start maintenance fluids.
- Monitor hemodynamics closely.
- Consider vasoactive-inotropic support (if available).

Abnormal perfusion WITH hypotension*

- If signs of fluid overload are absent, administer fluid bolus, 10-20 mL/kg.
- Assess hemodynamic response to fluid and repeat fluid boluses, 10-20 mL/kg, until hypotension resolves or signs of fluid overload develop.
- Assess cardiac function (if available)
- Consider epinephrine/ norepinephrine if hypotension persists after 40 mL/kg or sooner if signs of fluid overload develop.

Fluid in mL/kg should be dosed as ideal body weight.

Shock resolved, perfusion improved

- Do not give more fluid boluses.
- Consider maintenance fluids.
- Monitor for signs/symptoms of recurrent shock.

*Hypotension in healthcare systems WITHOUT intensive care is defined as either:

- SBP < 50 mm Hg in children aged < 12 months
- SBP < 60 mm Hg in children aged 1 to 5 years
- SBP < 70 mm Hg in children aged > 5 years

OR

- Presence of all 3 World Health Organization criteria: cold extremities, prolonged capillary refill > 3 seconds, weak/fast pulse

ALS updated guidelines

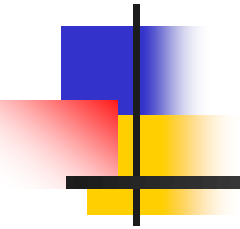
- **Fluid boluses of 10ml/kg in all types of shock** (including Sepsis and Anaphylaxis). Balanced isotonic crystalloids as first choice. If not available, 0.9% saline is acceptable alternative. Frequent reassessment of the child is still necessary.

- In haemorrhagic shock, keep crystalloids to a minimum (20ml/kg max). Consider blood products early with focus on improving coagulation
- **All paediatric ALS providers** should be competent in IO access and have **regular retraining** on devices used in their organisation
- Infants/ children with **febrile illness but no signs of shock should not receive fluid bolus therapy**
- Noradrenaline or adrenaline as first line vasoactive drugs. **Dopamine is no longer recommended** (but can be used if noradrenaline/ adrenaline are not available)
- **Paediatric ALS providers should be competent in the use of these drugs in the first hour of stabilisation in circulatory failure**

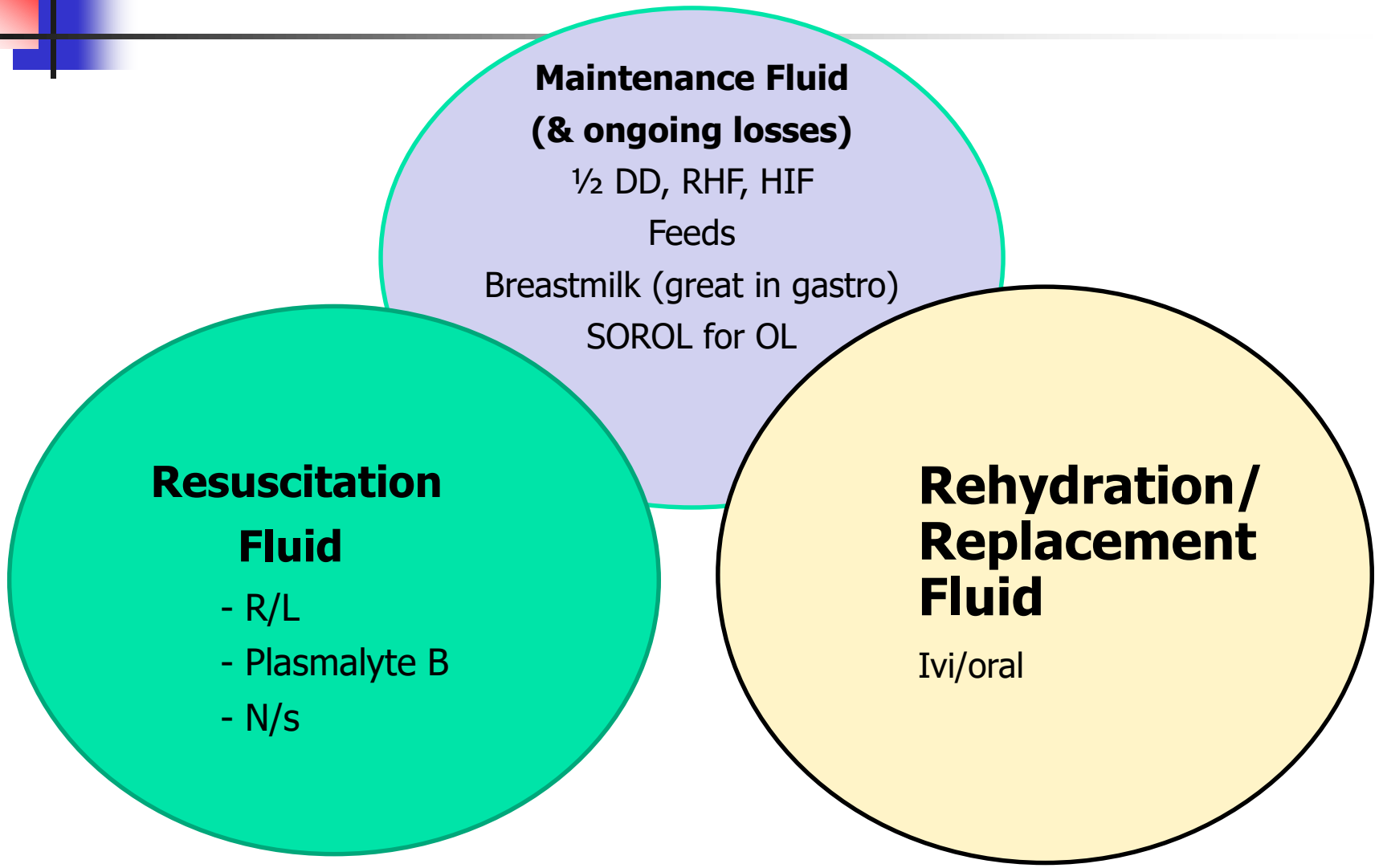
Bigger picture

- Fluid therapy only 1 component of complex haemodynamic resus strategy
- Primary target:
  - Restore intravascular volume
- Adjunctive therapies
  - Catecholamines – augment cardiac contraction and venous return
  - Changes to microcirculation
  - End-organ function

Rehydration & Maintenance Fluid



Fluids in children



Conventional Rehydration Regimen

1. **Rehydration volume:** Reassess hydration as above:
   - Some (5%) dehydration: 50ml/kg above Maintenance Volume spread over 24 hours
   - Severe (10%) dehydration: 100ml/kg above Maintenance Volume spread over 24 hours, oral, nasogastric or IV depending on vomiting history, degree of dehydration and willingness to feed, but always moving towards enteral fluids as quickly as possible. (The gut is an effective absorber of fluid. This approach will shorten the time to discharge)
2. **Maintenance volume:** in most cases this can **all be given as oral feeds** (breast or formula)

0-3 months	150ml/kg/day
3-12months & < 10kg	120ml/kg/d
10 -20kg	1000ml + 50ml/kg over 10kg
>20kg	1500ml + 20ml/kg over 20kg

Remember: Any child with diarrhoea asking for food or taking oral fluids can be fed

3. **Ongoing losses:** 10-15ml/kg for each loose stool or vomit, preferably using **oral rehydration fluid orally**. (This volume is a WHO standard)

Fluid overload multi organ effect

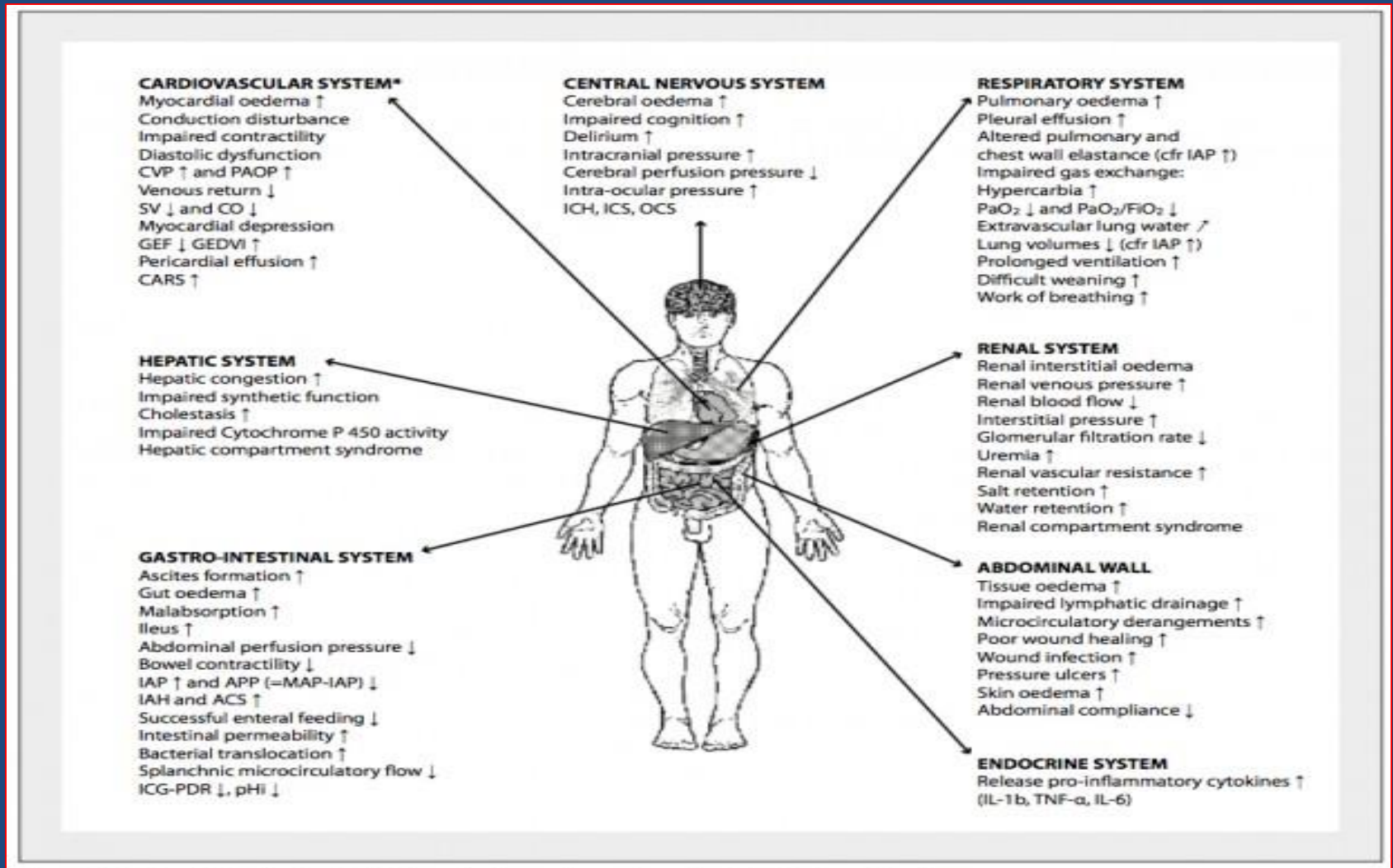
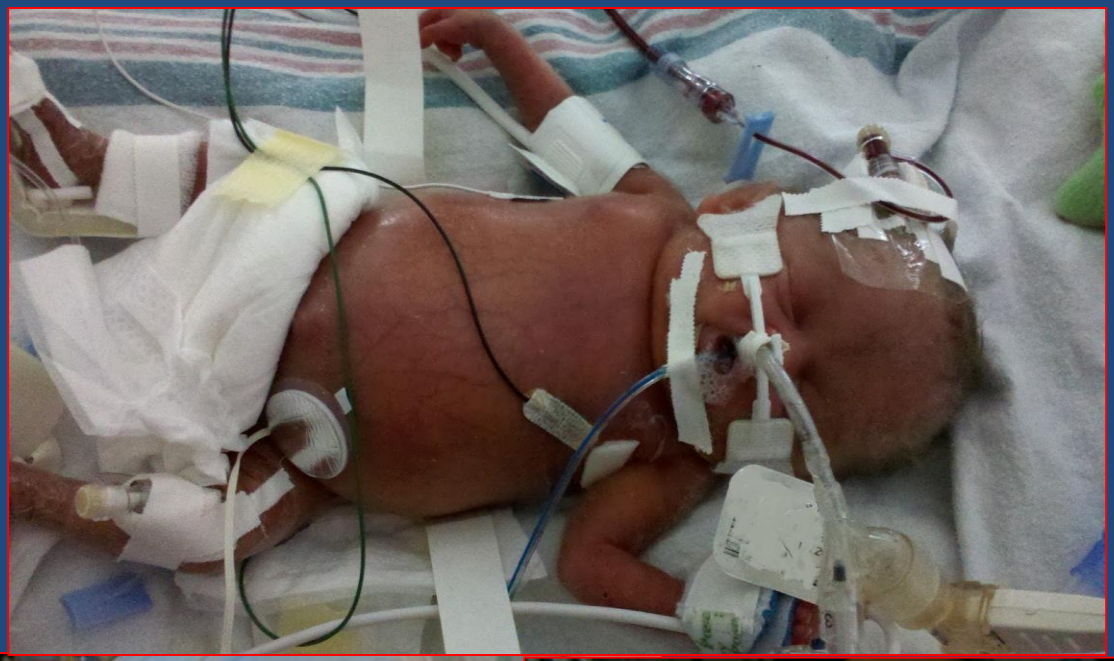
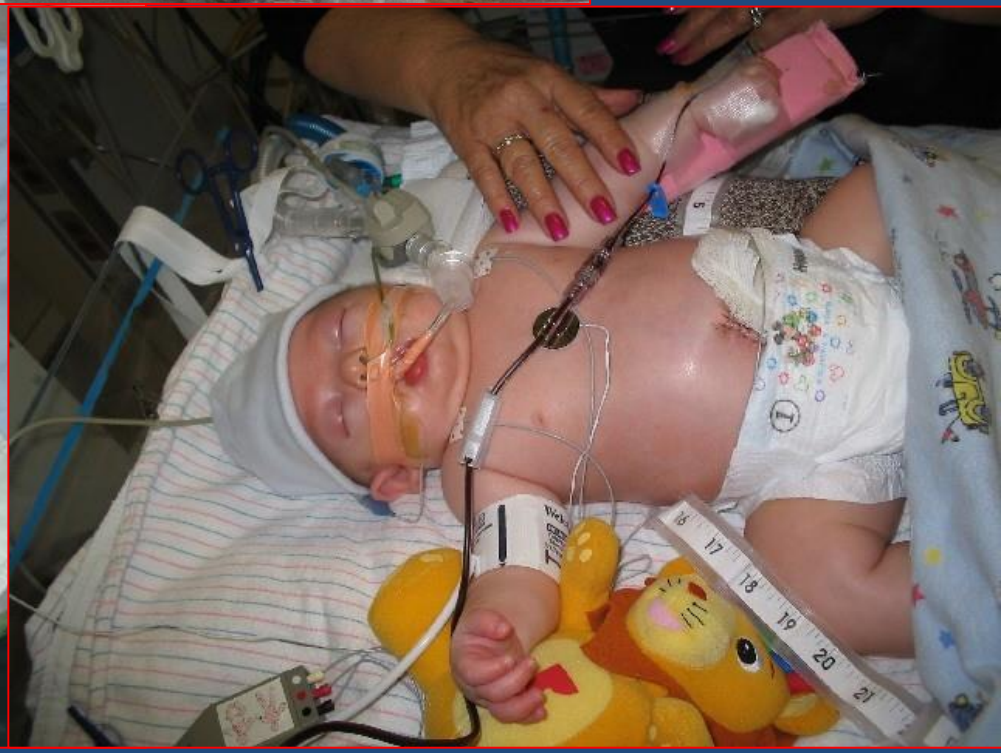


Figure 15. Pathophysiologic effects of fluid overload on end-organ function. See text for explanation
IAP — intra-abdominal pressure; IAH — intra-abdominal hypertension; ACS — abdominal compartment syndrome; ICH — intracranial hypertension; ICS — intracranial compartment syndrome; OCS — ocular compartment syndrome ; CARS — cardio abdominal renal syndrome





Fluid overload in children

- Increase ventilation days
- Increase ICU stay
- Increase mortality

Arikan Ped Crit Care Med 2012;13:253

Valentine Crit Care Med 2012 40:2883

Sinitsky Ped Crit Care Med 16:205

Bhaskar Intensive Care Medicine 2015 41: 1446

Paridon Critical Care 2015 19: 293

Role of Fluid after admission*

- FO >20% @ time of CRRT initiation

$$\%FO = \frac{(\text{Fluid In} - \text{Fluid Out})}{(\text{PICU Admission weight})} \times 100\%$$

Goldstein et al(2005). KI 67:653-658

- But what happens before?

Clinical Patients

- 9 month old boy
- Diarrhoea and vomiting
- Assessed as shocked
- No assisted ventilation or inotropic support available
- Management?
- Rehydrated him
- Fluid boluses – good perfusion
- Minimal or no urine output x 12hours
- BP good

Diarrhoea patient 9mths 10kg

- Frusemide trial WITHOUT fluid bolus
  - Frusemide ivi bolus slowly or
  - Infusion 0.2 – 1mg/kg/hr)
  - Aminophylin 1mg/kg/dose 6 hourly
- Urine output minimal
- AKI
  - previous days urine output
  - plus insensible losses

Diarrhoea patient 9mths 10kg

- No fluid boluses if perfusion ok
  - No Saline/No Bicarb boluses
- Strict Input and Output
  - Don't forget your medication volume (Bactrim, Gancyc)
  - Fluid balance 24hours:
  - In Maintenance 100ml/kg 10kg = 1000mls
    - Medication 200mls Total 1200mls
  - Out Urine 50mls/day = 0.2ml/kg/day
  - **Total Balance 1150mls positive** Weigh ideally

And the next day

- Weight up from admission 13kg
- Reduced Maintenance to 70ml/kg
  - 700mls
  - Medication 200mls
- Lets add feed 20mls 6hourly = 120mls
- Urine 100mls/day = 0.4ml/kg/day
- Total Balance 920mls positive

And on the 3rd day

- Puffy
- K 5
- Bicarb 15
- Urea 15
- Creat 200

Cut fluid to 60ml/kg/day

Please come and dialyse…

- Indications for dialysis:
  - Hyperkalaemia
  - Acidosis
  - Fluid overload
  - Feeds
  - Toxin

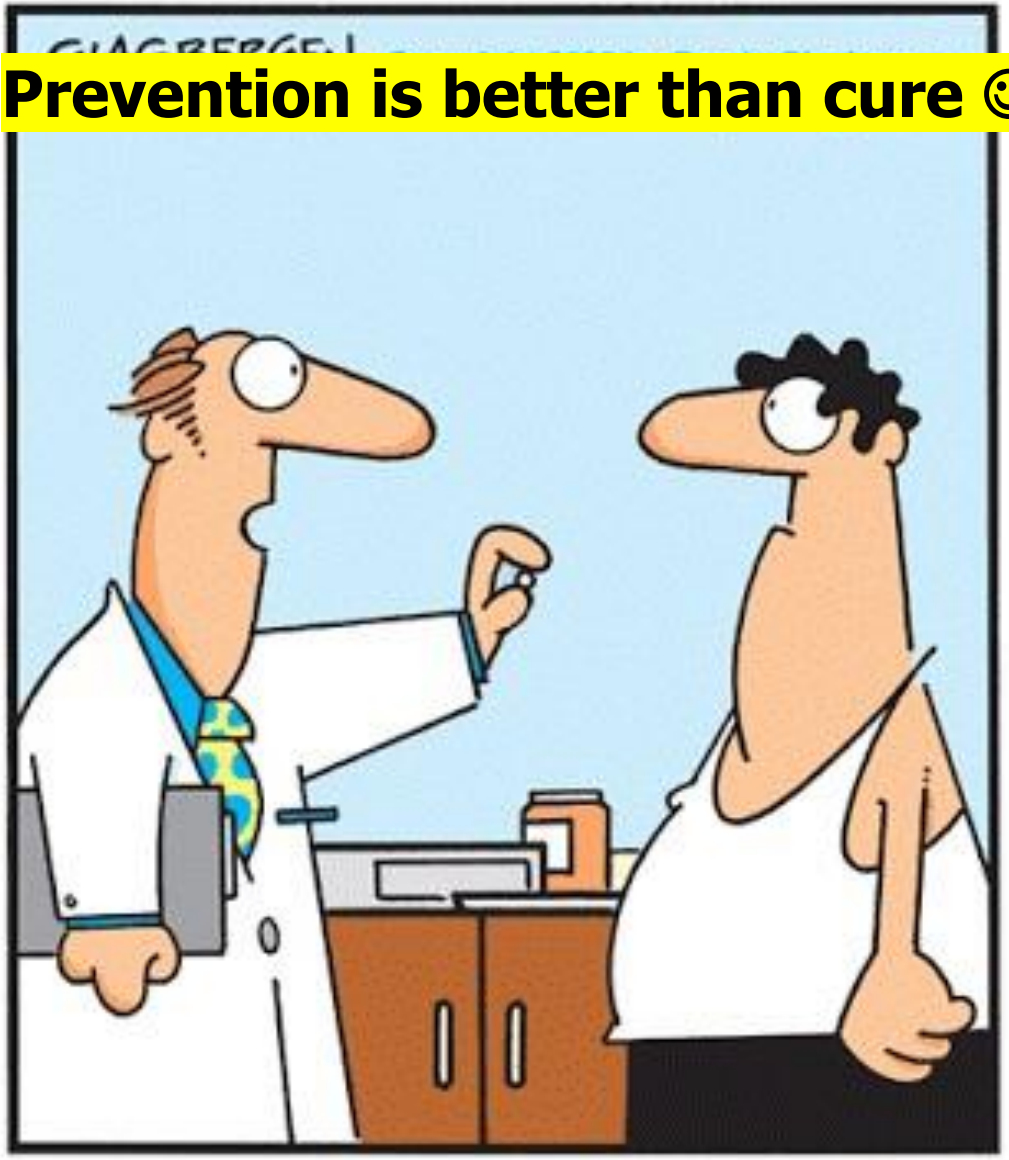
Nephrology advice

- Cut fluids in to UO + Insensible losses
  - 100mls + 10ml/kg = 200mls
  - ***Total 20ml/kg/day***
  - Watch glucose
- Try and give all fluid orally
- Concentrate drug fluids
- Stop K in drip
- Add Bicarb – orally

Fluid

- In vs Out = Daily balance pos/neg
- Drugs – hidden volume
- DON'T give Lasix with 1 litre fluid
- DON'T give Saline and Bicarb boluses
- AKI Rx Total Volume Fluid in:
  - Previous day's urine output plus insensible losses
  - NOT 100ml/kg cut to 60ml/kg/day….rather less
- E.g. total in a day 250mls/500mls/750mls

Prevention is better than cure ☺



"To prevent a heart attack, take one aspirin every day. Take it out for a run, then take it to the gym, then take it for a bike ride..."

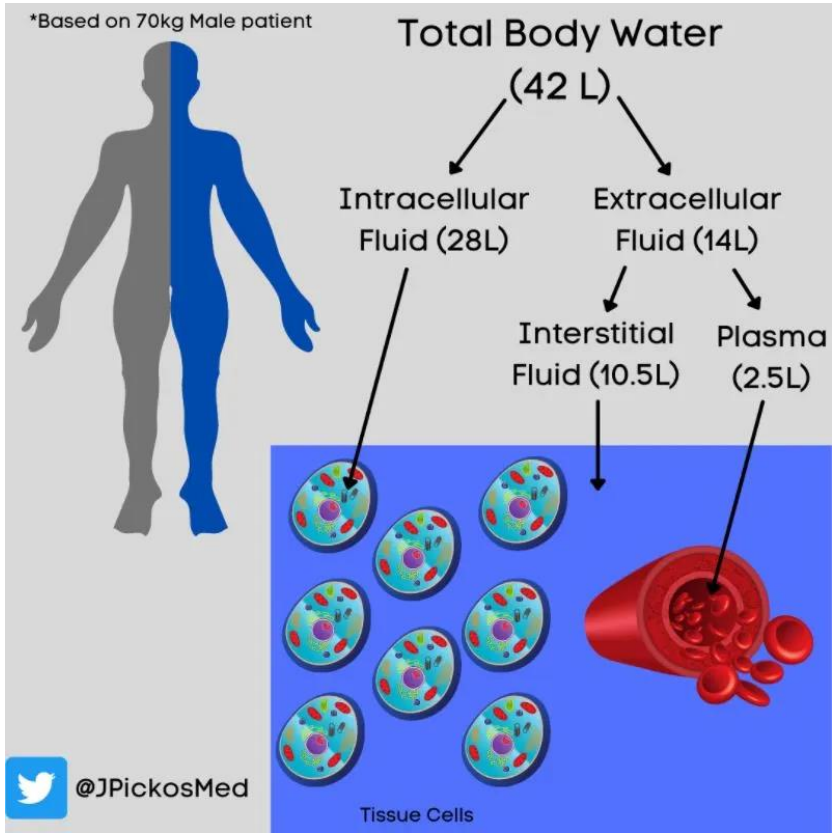
Myth Busters!

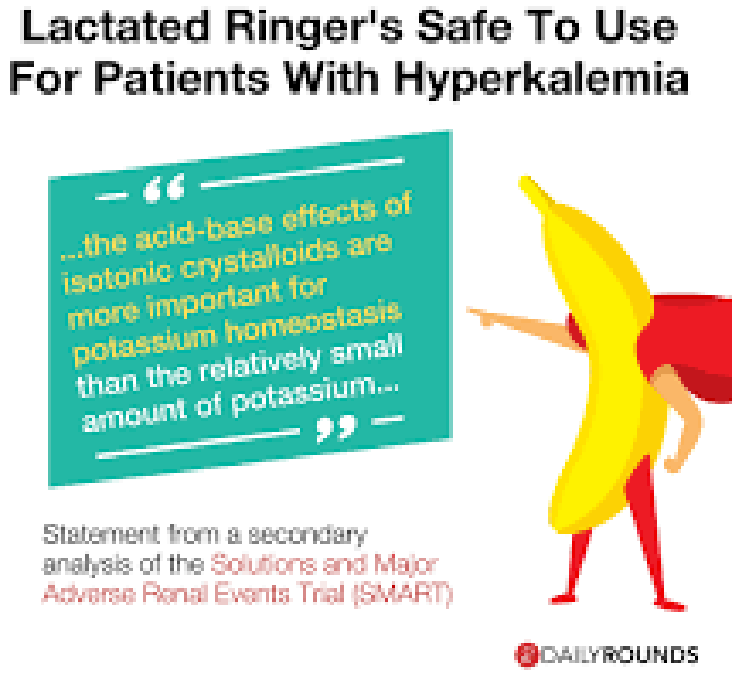
Ringer's Lactate DOES NOT cause hyperkalaemia….

- In Hyperkalaemic patient: RL [K^+] will always be lower than patient [K^+] and should pull potassium towards 4 mmol/L
- Volume of distribution of Potassium: K^+ equilibrates between intracellular & extracellular spaces
- 98% of [K^+] present INSIDE cells (140mmol/L), Acidosis will shift Potassium out of cells. RL does not cause acidosis BUT NS DOES

Myth Busters!

Ringer's Lactate DOES NOT cause hyperkalaemia….





Myth Busters!

Ringer's Lactate DOES NOT cause lactic acidosis:

- Content of RL: Sodium lactate NOT lactic acid.
- RL will cause excess lactate --> will be used by the body for energy
- Blood lactate levels does NOT correlate with Sodium lactate levels used in RL
- Adverse effect of worsening lactic acid is NOT seen with RL
- Some caution for patients with hepatic dysfunction (use bicarbonate-based solutions instead)

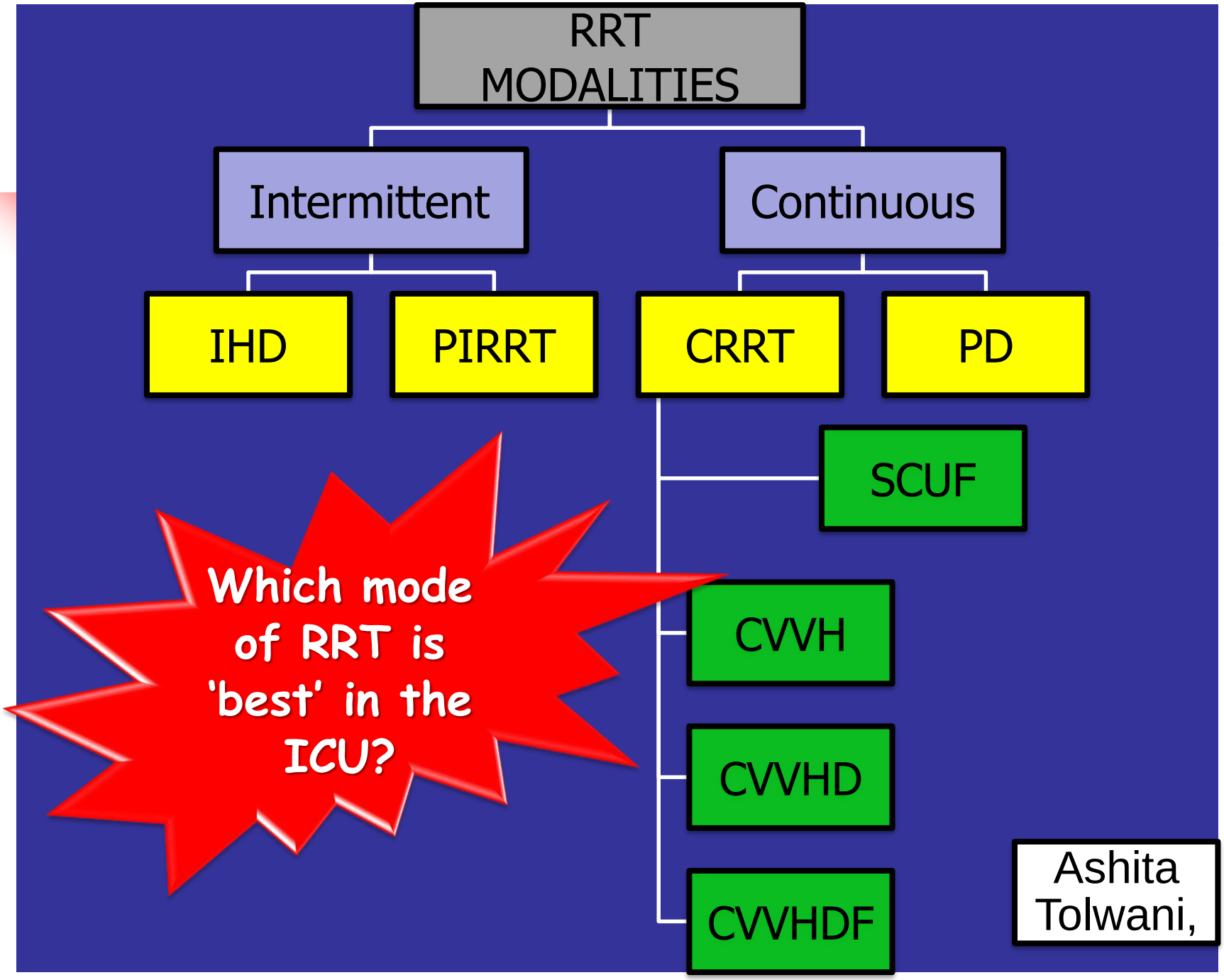

the CapeTowner
WE HAVE A WEE PROBLEM
INDEPENDENT COMMUNITY NEWSPAPERS, 122 ST GEORGE'S MALL, CAPE TOWN


10 L
HUMAN
BLOOD

AKI: Treatment Modality Selection

Ashita Tolwani, M.D., M.Sc.
University of Alabama at Birmingham

Critical Care Nephrology – Vicenza
June 2015


RRT MODALITIES
Intermittent
Continuous
IHD
PIRRT
CRRT
PD
SCUF
CVVH
CVVHD
CVVHDF
Which mode of RRT is 'best' in the ICU?
Ashita Tolwani,

PD as CRRT

- Alternative to Extracorporeal systems
- Difficult Venous access
- Small infants
- “Challenged” resources
  - No equipment
  - No surgical back-up appropriate
- Not about Chronic PD

Peritoneal Dialysis

Dr Mignon McCulloch

Evelina London Children's Hospital,

Guy's & St Thomas' NHS Trust

Evelina Children's Hospital

Andrew Durward *Personal Communication*

- PICU
- 8818 Admissions
  - 413 deaths
  - Mortality 4.7%
- 20 Beds
- Staffing:
  - 7 Consultants
  - 20 Fellows
  - **150 Nurses**
- Training in nurses:
  - CVVH 30% trained
  - PD in 100% nurses

Evelina Children's Hospital PICU 2002 – 2009

	CVVH	PD
Nos of Cases	119	188 139 Cardiac
Age in months	30	7.8 Med 0.22
Weight in kg	--	5.3 Med 3.3
Mortality	**30%**	**17%**

Red Cross Children's Hospital(RXH) University of Cape Town Experience

- Increasing incidence in association with multi-organ failure in paediatric ICU's
- 1 200 – 1 400 admissions per year
  - Acute medical cases 600/yr
  - Cardiac cases 250/yr
  - Burns 50/yr
  - Head injuries 50/yr
  - Other Rest
- Mortality 6% predicted 10-12%
- **Dialysis 3.5%**

Practicalities of PD

- It can be quickly set up. Preparation.
- Bed-side insertion by Paeds Nephrologist/Intensivist/Surgeons
  - (Surgeons as backup)
- Cook/Peel Away Tenckhoff/Formal Tenckhoff
- *611 PD cases bed-side insertion in 15 years*

Quick and Easy

Causes of Acute Kidney Injury

Sepsis	46(22%)
Post-cardiac surgery	36(17%)
Undiagnosed chronic renal disease	21(10%)
Gastroenteritis	19(9%)
Haemolytic uraemic syndrome	19(9%)
Necrotizing enterocolitis	15(7%)

Causes of Acute Kidney Failure

Leukaemia/Lymphoma	14(6%)
Myocarditis	11(5%)
Rapidly progressive nephritis	10(5%)
Trauma/Burns	8(4%)
Toxin ingestion	7(3%)
Kwashiorkor**	6(3%)

Practicalities of PD

- Prescription
  - 10-20ml/kg increase as tolerated to 50ml/kg
- Dialysis fluid
  - 1.5%/2.5%/4.25%
  - Dianeal(Lactate buffered) or Bicarb based
- Cycles: Fill/Dwell/Drain
  - 10/30-90/20mins
- Manual or Cycling Home choice > 3kg
- Adapted to ventilatory requirements

PD Catheters

- **Art of Medicine?** *Innovative and Creative*
  - Cannulaes
  - Naso-gastric tubes/Chest Drains
  - Venous Central lines
  - Rigid 'Stick' catheters
  - 'Peel away' Tenckhoff
  - Flexible Multi-purpose drainage catheters
    - *Auron A et al Am J Kidney Dis 2007*

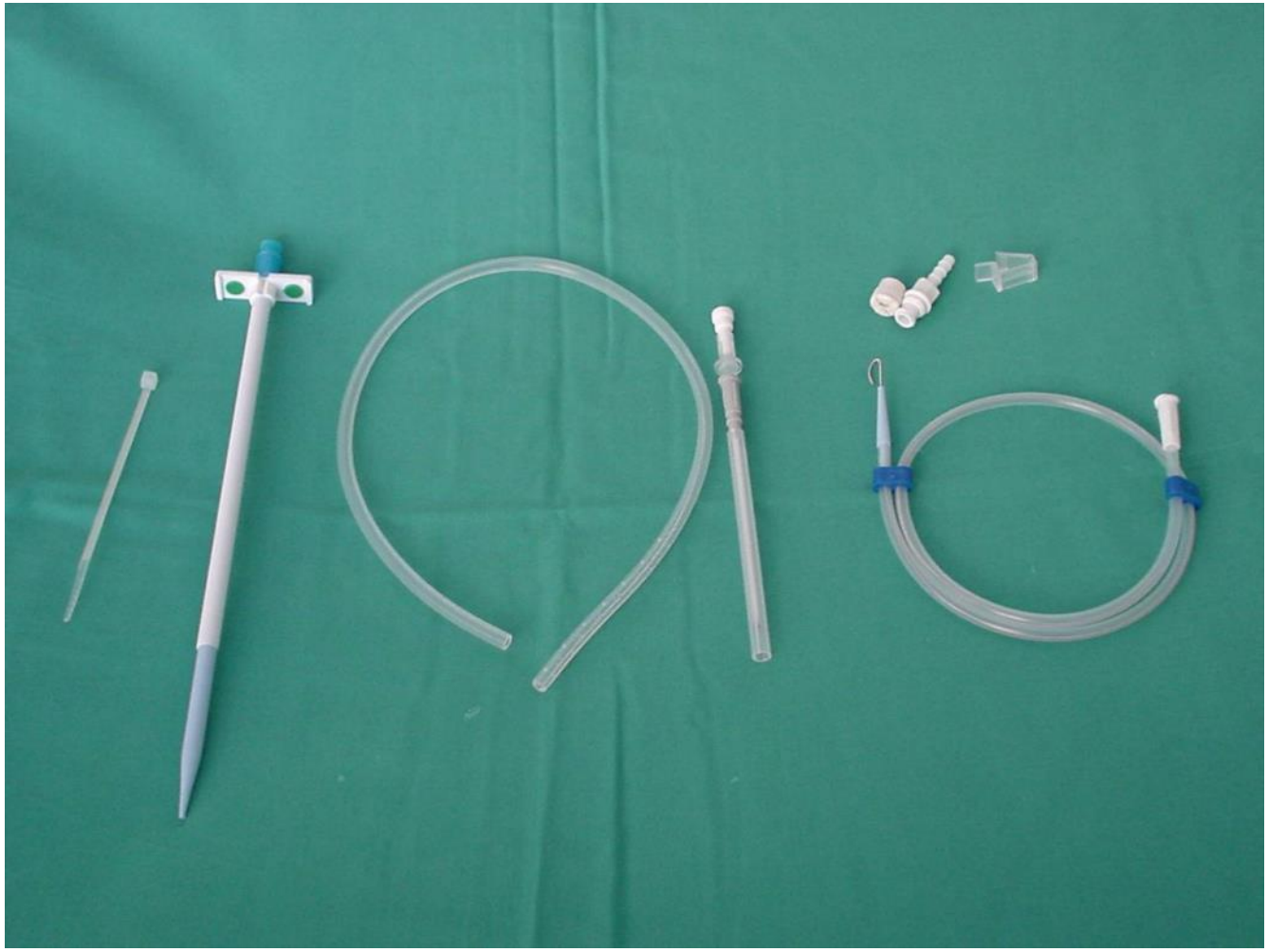
New Generation Cook and Covidien Catheters

Use of the Multipurpose Drainage Catheter for the Provision of Acute Peritoneal Dialysis in Infants and Children

Ari Auron, MD,[1] Bradley A. Warady, MD,[1] Steve Simon, PhD,[2] Douglas L. Blowey, MD,[1] Tarak Srivastava, MD,[1] Gulam Musharaf, MD,[1] and Uri S. Alon, MD[1]

Figure 1. CMMDC. (Top) Mac-Loc mechanism, (center) distal fenestrations, and (bottom) distal catheter coiling. (Reprinted with permission from Cook Inc, Bloomington, IN).

Kimal ‘Peel-away’ Tenckhoff

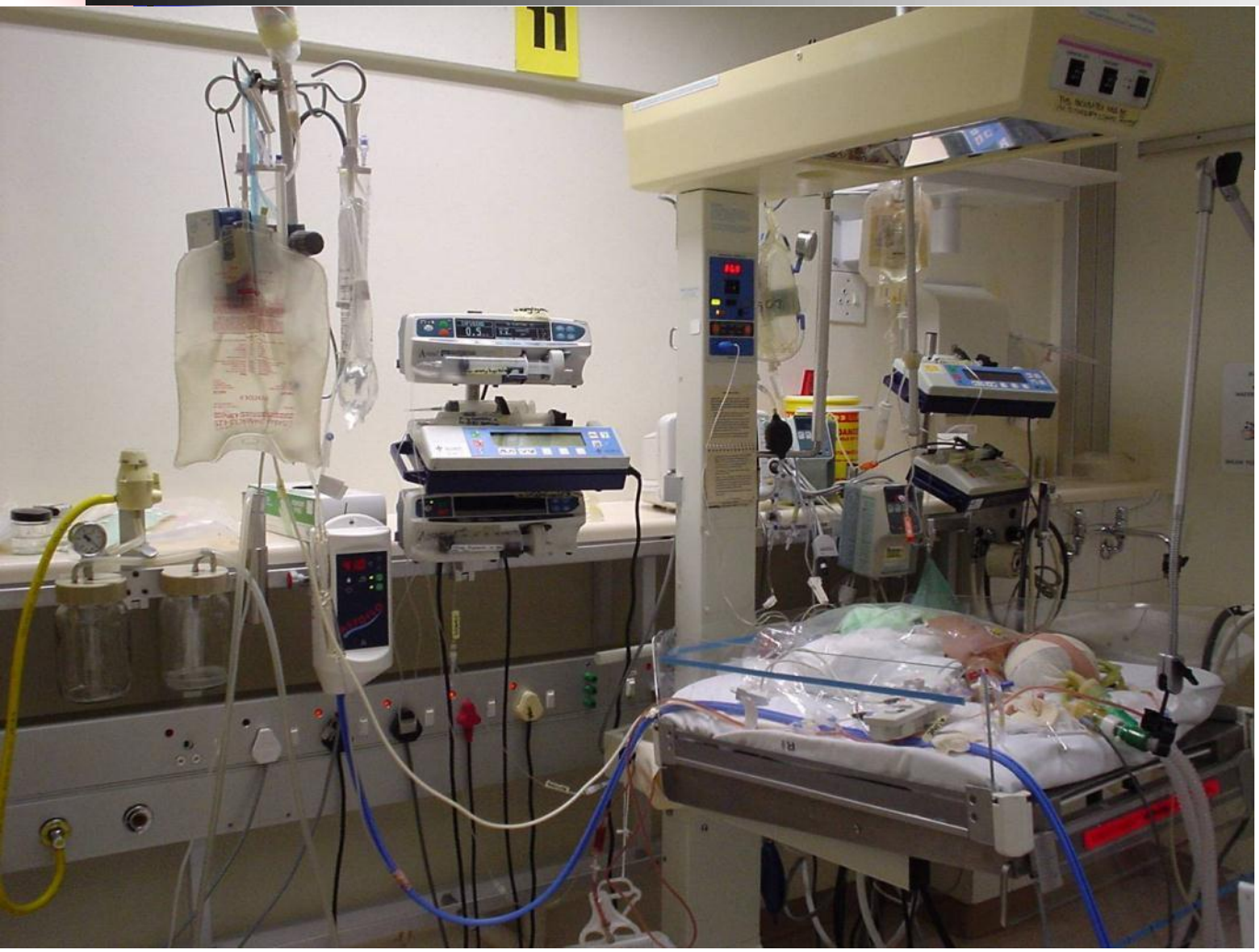


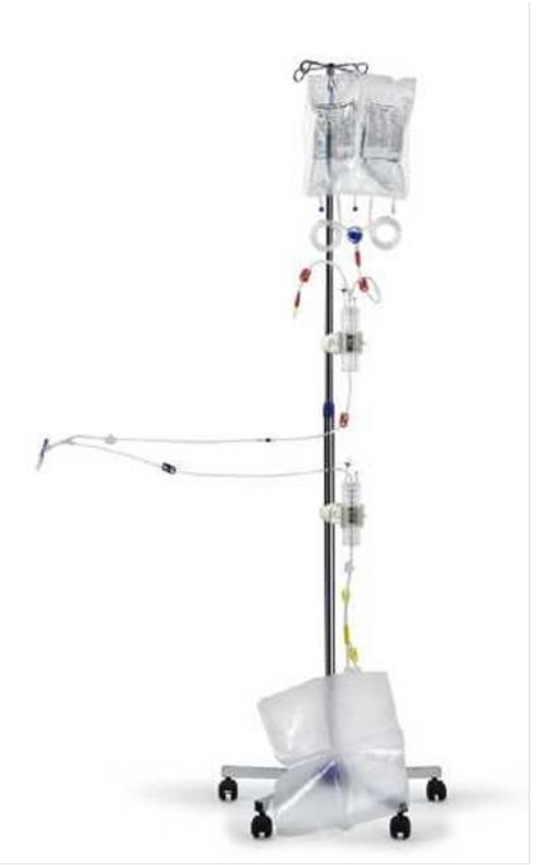
Complications of PD

- Dysequilibration Syndrome (rare in acute)
- Hypotension
- **Infection**
- **Blocked / Displaced catheter**
- Respiratory difficulties
- Diaphragmatic leak
- Hyperglycaemia

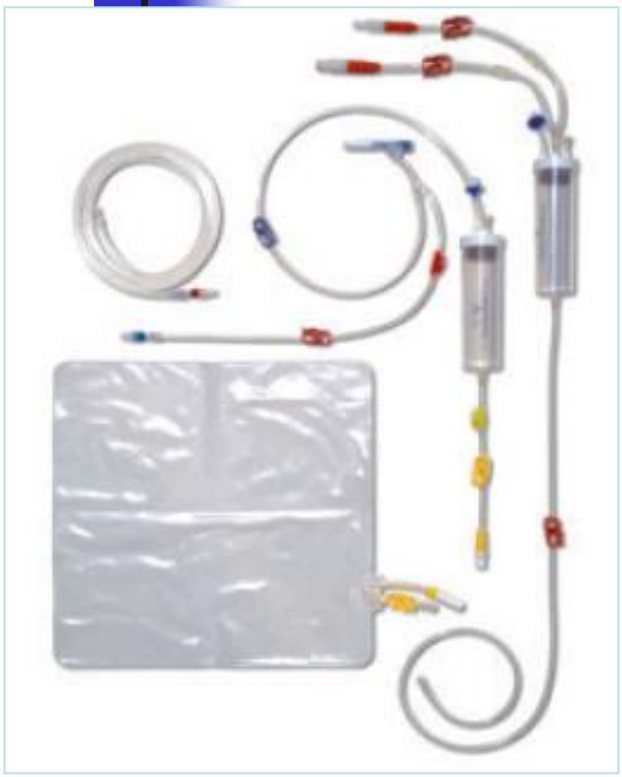
Automated Dialysis
Home choice machine

Manual Dialysis with Fluid Warmer





PD Paed system

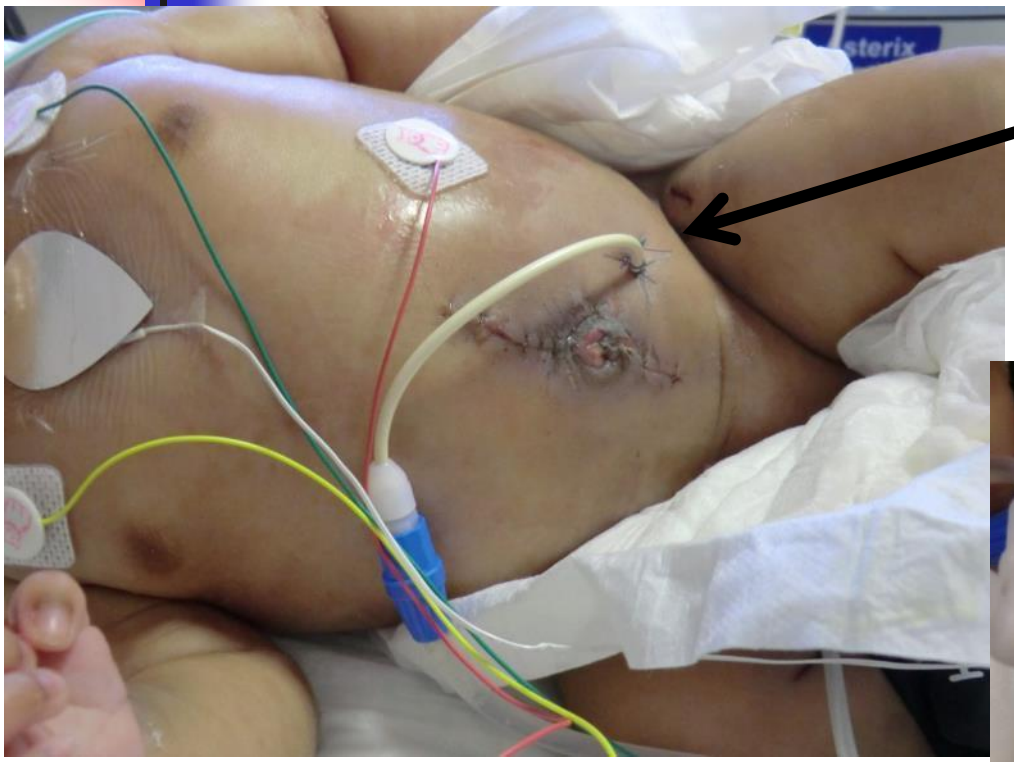


Acute PD
Long term outcome

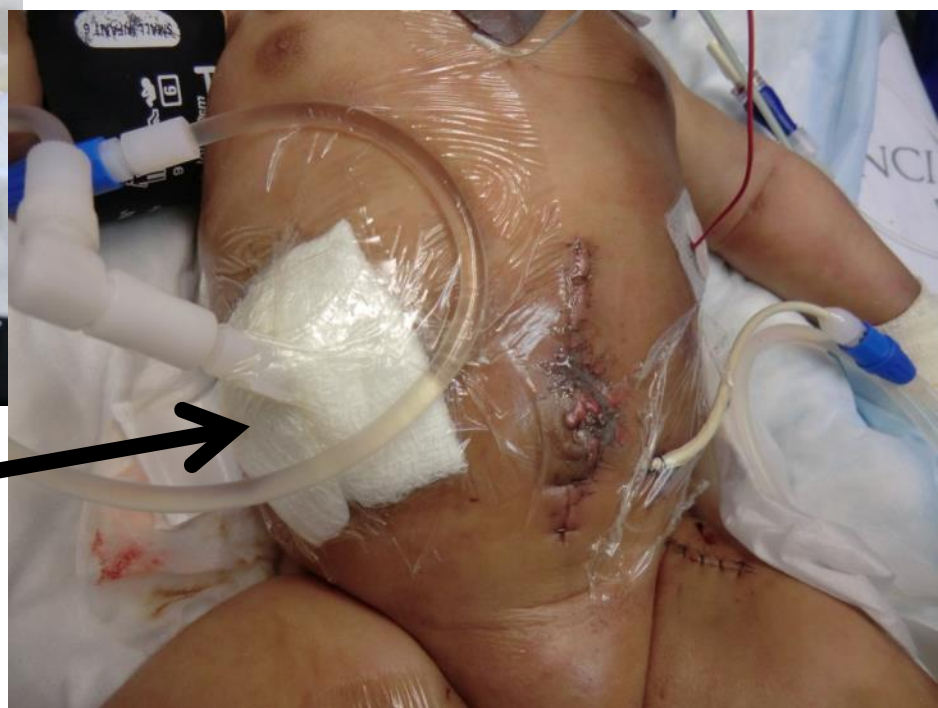
Survival following Acute PD	**130(61%)**
Chronic PD required following Acute PD	26(12%)
Total nos of patients requiring CVVHD (PD not possible)	20(9%)
Survival following CVVHD	**11(55%)**

Post Cardiac Surgery
Nitric Oxide, Oscillator & PD

Contra-indication?
Post Abdominal Surgery



8Fr Cook
Pigtail multi-purpose drainage device

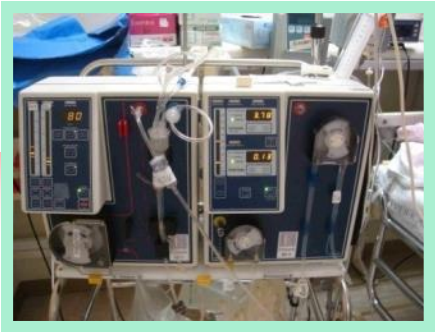


8Fr Cook PD
Catheter

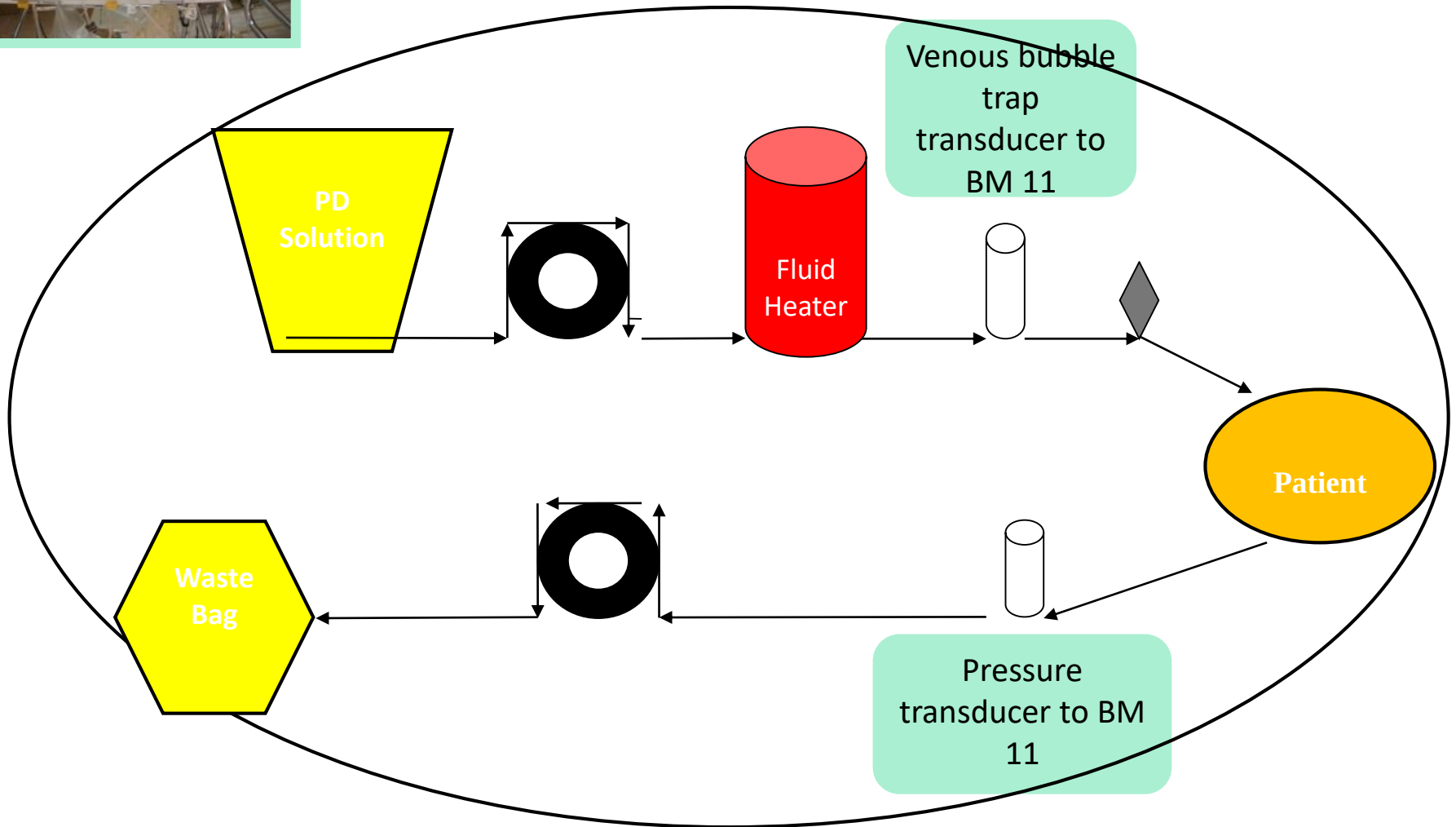
Continuous Flow Peritoneal Dialysis

Clin J Am Soc Nephrol. 2011 Feb;6(2):311-8

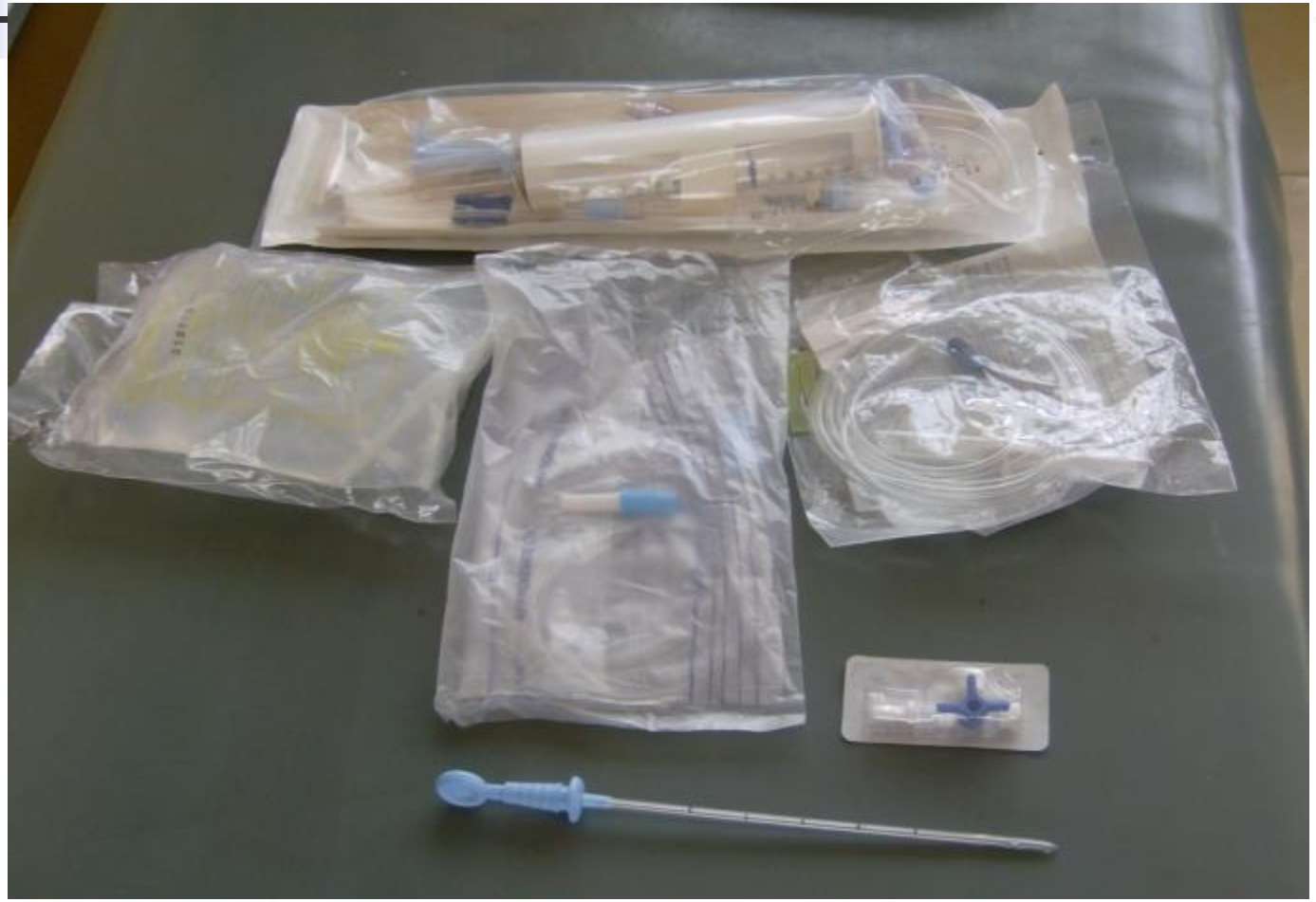
- CFPD useful for ARF *Ronco C Perit Dial Int 27:251-3, 2007*
- Especially in children
  - Especially if small haemodynamically infant
  - Developing and Developed countries
- Future
  - Larger studies in Paeds
  - Higher flow volumes
  - Improved catheter technology



Schematic drawing of CFPD



Improvised equipment and solution used in the procedure



CLINICAL SKILLS COURSE

In conjunction with Saving Young Lives (SYL)

Including Airway & Resuscitation, Vascular Access, Acute Peritoneal Dialysis

Aimed at Pairs of Doctor and Nurse Team

9 – 12 March 2015

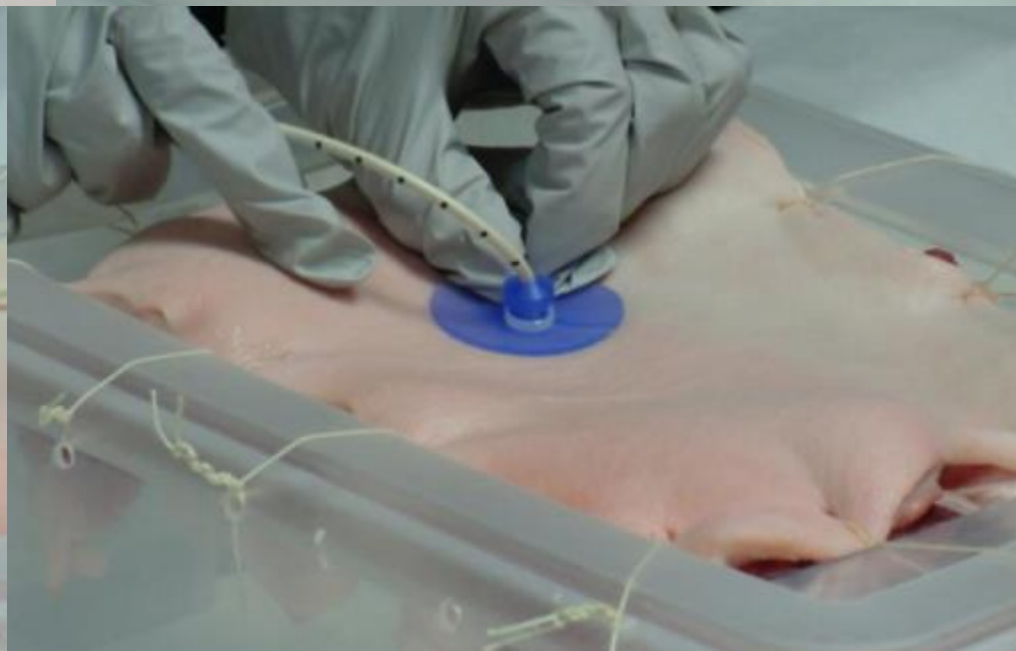
Registration: www.surgicalskills.co.za

Surgical Skills Training Centre
University of Cape Town
Red Cross War Memorial Children's Hospital
Departments of Paediatrics, Anaesthetics & Paediatric

2015

Surgical Support

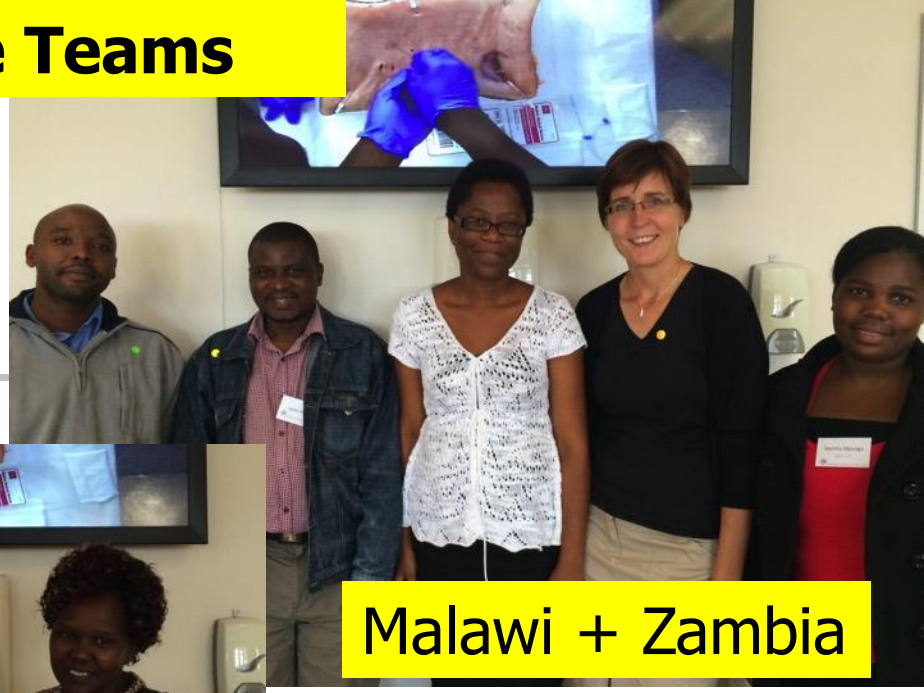


Learning is fun !

Doctor Nurse Teams

Bloemfontein, SA



Malawi + Zambia

Kenya

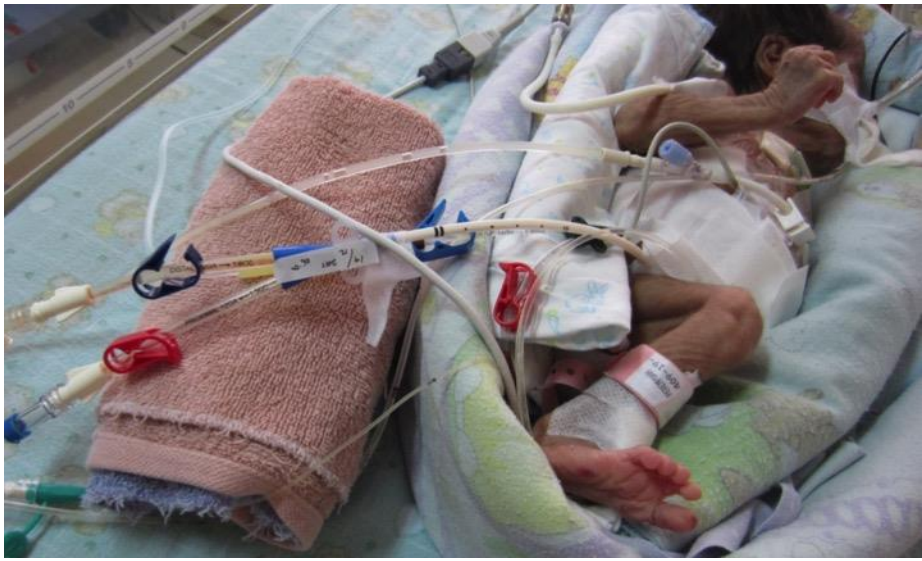
Ghana

Nigeria

Medication in PD – Intraperitoneal drugs

- Heparin 500-1000u/litre of PD
  - Prevents clots and fibrin blocking PD catheter
- Antibiotics varied – for peritonitis
  - Vancomycin/Amikacin
  - BEWARE ANTIFUNGALS
- Potassium replacement
  - Dialyse against 4mmol/litre of PD to equilibrate blood potassium to 4mmol

Pushing boundaries in Paediatrics



Take Home Message

- PD is **available** in resource poor environment
- PD is **appropriate** in acute setting in PICU
  - Not dependant on large nos and well trained staff members
- Certain patient groups **more suitable** for PD
  - Practical for small infants – access + stability
- Even in 'resource rich' hospital settings, there is a role for acute PD

ISPD Guidelines for Peritoneal Dialysis in Children with AKI

Melvin Bonilla-Félix, MD, FAAP, FISN

University of Puerot Rico – Medical Sciences Campus

ISPD Pediatric Guidelines

- 1.1 Peritoneal dialysis is a suitable renal replacement therapy modality for treatment of acute kidney injury in children. (1C)

Modality	Manual peritoneal dialysis	Manual peritoneal dialysis	Automated peritoneal dialysis	Intermittent hemodialysis	Continuous hemofiltration
Device	Dialy-Nate Manual PD set	Ultra Set (Y-set)	Freeedom Cycler	C3	Prisma
Manufacturer	Utah Medical Products	Baxter	Fresenius	Gambro	Gambro
Cost per unit[a]	$88.75[b]	$6.95[c]	$12,295.00	$18,000.00	$25,000.00
Cost of additional supplies	1.5% Dianeal (Baxter) $24.43/2.0L	Peritoneal dialysate as at left	Pediatric tubing set $32.00 each Peritoneal dialysate as at left	100HG dialyzer $50.00 each; pediatric bloodlines $11.40 each	M60 hemofilter set (includes filter and bloodlines) $160.00 each Normocarb dialysate concentrate (Dialysis Solutions) $20.00/3.0L

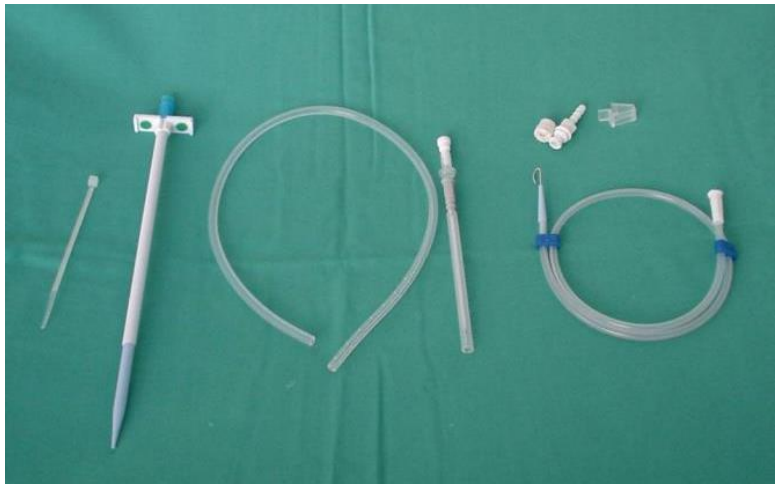
[a] Manufacturer's list price
[b] New set required every 24–72 h
[c] New unit required for each exchange

Flynn JT. Pediatr Nephrol 17: 61 – 69, 2002

- Rationale
  - In regions with poor infrastructure, PD is particularly useful as it requires less technical skill and is cheaper than both continuous extracorporeal therapies or HD.
  - Retrospective studies have shown that PD can be safely performed in children with hemodynamic instability and multiorgan failure requiring vasopressors.
  - Observational studies comparing modalities have shown no difference in mortality between children treated with PD and those receiving CKRT as treatment for AKI.

ISPD Pediatric Guidelines

- 2.1 We recommend a Tenckhoff catheter inserted by a surgeon in the operating theatre as the optimal choice for PD access. (1B) (optimal)
- 2.2 Insertion of a PD catheter with an insertion kit and using Seldinger technique is an acceptable alternative. (1C) (optimal)
- 2.3 Interventional radiological placement of PD catheters combining ultrasound and fluoroscopy is an acceptable alternative. (1D) (optimal)



- Rationale
  - The method of catheter implantation is usually based on patient factors and locally available skills.
  - Bedside catheter insertion by the Seldinger technique in children of all sizes, using soft flexible Cook or Tenckhoff catheters, is an acceptable alternative to surgical placement.
  - Bedside placed Tenckhoff PD catheters using the Seldinger technique with peel-away technology, with either non-tunnelled or tunnelled approaches, have been used successfully.
  - Interventional radiological placement of PD catheters combining ultrasound and fluoroscopy in adults is a cost saving, safe, less invasive, and at least as effective option when compared with traditional surgical placement. Scarce data in children

ISPD Pediatric Guidelines

- 2.4 Rigid catheters placed using a stylet should only be used when soft Seldinger catheters are not available, with the duration of use limited to <3 days to minimize the risk of complications. (1C) (minimum standard)
- 2.5 Improvised PD catheters should only be used when no standard PD access is a
(minimum

- Rationale
  - Rigid stylet catheters are associated with a high risk of leakage, dislodgement, viscus injury and peritonitis and are not advised to be used beyond 2–3 days. These catheters are, however, inexpensive and typically readily available.
  - Alternatively, intercostal chest drains, nasogastric tubes (with extra side holes cut) or Foley's urethral catheters inserted via a mini laparotomy in the operating room can serve as a catheter for dialysis. These have been very effective, although no formal comparative data are available. ***It should be noted that none of these options are recommended as first line; however, they have been shown to be life-saving and so it is suggested that they be used if no other option exists.***

ISPD Pediatric Guidelines

- 2.6 We recommend the use of prophylactic antibiotics prior to PD catheter insertion. (1B) (optimal)

- Rationale
  - Colonization of the Tenckhoff catheter and/or contamination at the time of insertion increases the risk of subsequent peritonitis.
  - Whereas prophylactic antibiotics do not always prevent infections if sterile technique is not followed, when used in conjunction with sterile technique, there is a decrease in the incidence of peritonitis.

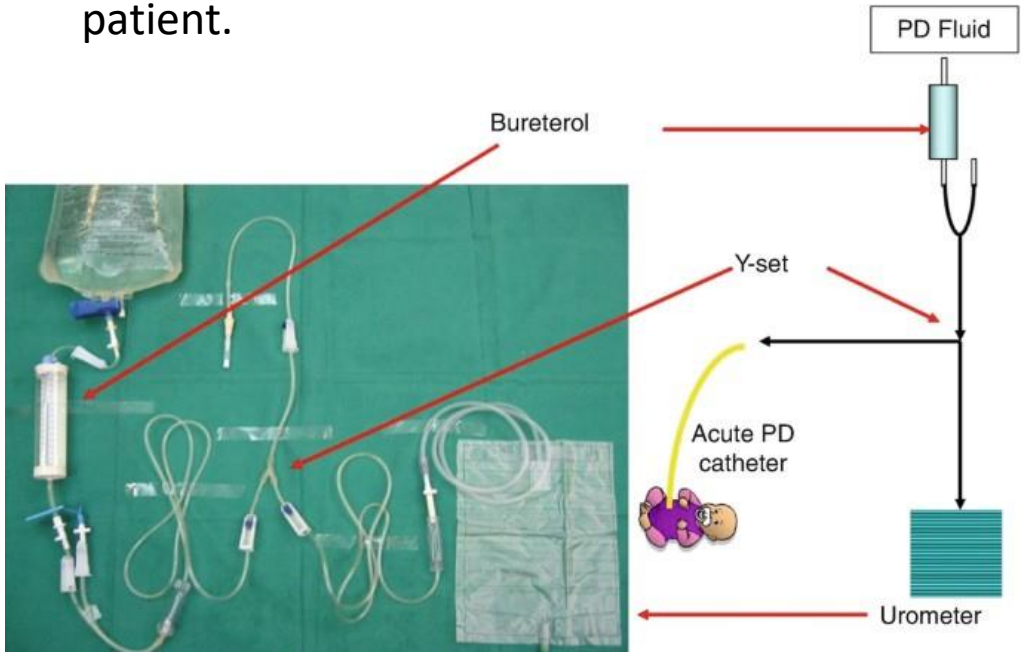
There are 4 RCTs on the use of perioperative iv cefuroxime, gentamicin, vancomycin, and cefazolin, as compared to no treatment. The overall benefit of prophylactic perioperative iv antibiotics was confirmed by a systematic review of these trials, but its effect on the risk of exit-site/tunnel infection is uncertain. Although first-generation cephalosporin may be slightly less effective than vancomycin, is still commonly used because of the concern regarding vancomycin resistance.

Each PD program should determine its own choice of antibiotic for

ISPD Pediatric Guidelines

- 2.7 A closed delivery system with a Y connection should be used. (1A) (optimal) A system utilizing buretrols to measure fill and drainage volumes should be used when performing manual PD in small children. (practice point) (optimal)
- 2.8 In resource limited settings, an open system with spiking of bags may be used; however, this should be designed to limit the number of potential sites for contamination and ensure precise measurement of fill and drainage volumes. (practice point) (minimum standard)
- 2.9 Automated peritoneal dialysis is suitable for the management of pediatric AKI, except in neonates for whom fill

- Rationale
  - A closed system is associated with lower peritonitis rates compared to the standard spiking system in chronic patients .
  - Strict fluid balance, which is of utmost impor- tance in the very young, is assisted by the use of buretrols which permit the precise measurement of inflow and drainage. This technique also minimizes the number of con- nections and therefore, the risk of touch contamination.
  - In the case of older children and/or if buretrols are not readily available, a scale may be used to weigh the PD bag while fluid flows into and out of the patient.



ISPD Pediatric Guidelines

- 3.1 The composition of the acute peritoneal dialysis solution should include dextrose in a concentration designed to achieve the target ultrafiltration. (practice point)
- 3.2 Once potassium levels in the serum fall below 4 mmol/l, potassium should be added to dialysate using sterile technique. (practice point) (optimal) If no facilities exist to measure the serum potassium, consideration should be given for the empiric addition of potassium to the dialysis solution after 12 h of continuous PD to achieve a dialysate concentration of 3–4 mmol/l. (practice point) (minimum standard)

- Rationale:
  - Acute PD is usually initiated with a 2.5% dextrose solution in order to achieve effective ultrafiltra-tion when FO exists, and the prescribed fill volume is small to avoid dialysate leakage. Initial use of a 1.5% solution may be appropriate when euvolemia or only mild fluid overload exists.
  - The [K+]concentration of the dialysis solution should be negligible (0–2 mmol/l) at treatment initiation as many patients will present with hyperkalaemia, often accompanied by metabolic acidosis. Once a normal serum potassium concentration is achieved, as typically occurs over the initial 6–12 h of dialysis, the concentration of potassium in the dialysis solution can be gradually increased to a concentration of 4 mmol/l with ongoing modification dependent on factors that influence the serum potassium level.

ISPD Pediatric Guidelines

- 3.3 Serum concentrations of electrolytes should be measured q 12 hrs for the first 24 h and daily once stable. (practice point) (optimal). In resource poor settings, sodium and potassium should be measured daily, if practical. (practice point) (minimum standard)
- 3.4 In the setting of hepatic dysfunction, hemodynamic instability and persistent/worsening metabolic acidosis, it is preferable to use bicarbonate containing solutions. (>1D) (optimal) Where these solutions are not available, the use of lactate containing solutions is an alternative. (2D) (minimum standard)
- 3.5 Commercially prepared dialysis solutions should be used. (1C) (optimal) However, where resources do not permit this, locally prepared fluids may be used with careful observation of sterile preparation procedures and patient outcomes (e.g. rate of peritonitis). (1C) (minimum standard)

- Rationale
  - Common practice is to add heparin (500 IU/l) to the dialysis fluid to prevent fibrin clots, however this practice does vary between centers.

ISPD Pediatric Guidelines

4.1 The initial fill volume should be limited to 10–20 ml/kg to minimize the risk of dialysate leakage; a gradual increase in the volume to approximately 30–40 ml/kg (800–1100 ml/m2) may occur as tolerated by the patient. (practice point)

4.2 The initial exchange duration, including inflow, dwell and drain times, should generally be every 60–90 min; gradual prolongation of the dwell time can occur as fluid and solute removal targets are achieved. In neonates and small infants, the cycle duration may need to be reduced to achieve adequate ultrafiltration. (practice point)

- Rationale:
- In general, the fill volume should not exceed 800 ml/m in patients <2 years because of the associated rise in IPP that can occur and the resultant reabsorption of ultrafiltrate through lymphatics.
- The use of short exchange times initially aims to accomplish the desired ultrafiltration and solute removal while the gradients between serum and dialysate are preserved.

ISPD Pediatric Guidelines

4.3 Close monitoring of total fluid intake and output is mandatory with a goal to achieve and maintain normotension and euvolemia.

4.4 Acute PD should be continuous throughout the full24-h period for the initial 1–3 days of therapy. (1C)

4.5 Close monitoring of drug dosages and levels, where available, should be conducted when providing acute PD. (practice point)

- Rationale:

- In general, the fill volume should not exceed 800 ml/m in patients <2 years because of the associated rise in IPP that can occur and the resultant reabsorption of ultrafiltrate through lymphatics.
- The use of short exchange times initially aims to accomplish the desired ultrafiltration and solute removal while the gradients between serum and dialysate are preserved.
- Despite the low fill volumes and frequent cycles used in pediatrics, clearances are achieved that surpass what is recommended in the adult literature (see adult ISPD guide-lines).

ISPD Pediatric Guidelines

- 5.1 Continuous flow peritoneal dialysis can be considered as a PD treatment option when an increase in solute clearance and ultrafiltration is desired but cannot be achieved with standard acute PD. Therapy with this technique should be considered experimental since experience with the therapy is limited. (practice point).
- 5.2 Continuous flow peritoneal dialysis can be considered for dialysis therapy in children with AKI when the use of only very small fill volumes is preferred (e.g. children with high ventilator pressures). (pracRationaletice point)
-

- Rationale
- Continuous flow PD has been shown in chronic adult PD patients to increase the clearance of small solutes threefold to eightfold and to significantly increase ultrafiltration compared to conventional PD.
- In two separate studies in children with AKI using CFPD, an approximately fourfold increase in small solute clearance and ultrafiltration was achieved compared to conventional PD.

CASE

- You are consulted to evaluate a 1-year-old infant (Weight: 10 Kg), in critical condition, with anuria, generalized edema and serum creatinine: 3.6 mg/dL. After the evaluation, you decide that he needs kidney replacement therapy. In the hospital where he is admitted there are no resources for pediatric hemodialysis, but it is possible to do peritoneal dialysis and there is a pediatric surgery service available.

Question # 1

- In this situation, the **BEST** option to place the dialysis catheter would be:

a. to place a nasogastric tube in the peritoneal cavity at the patient's bedside, using sedation and local anesthesia to speed up the process
b. consult the pediatric surgery service to place a Tenkhoff catheter in the operating room
c. place a Tenkhoff catheter with tunneling at the patient's bedside, using ultrasound guidance
d. place a rigid catheter with a stylet at the patient's bedside, using sedation and local anesthesia
e. place a soft catheter at the patient's bedside, following the Seldinger technique

Question # 2

- The patient has not had a fever and there are no signs of infection. Prior to catheter placement, the resident asks you if he should order antibiotics. You reply that:
  a. the use of prophylactic antibiotics is indicated to reduce the risk of infections associated with the procedure
  b. the use of prophylactic antibiotics is indicated only if the patient has fever
  c. the use of prophylactic antibiotics is indicated only if the patient is immunosuppressed
  d. the use of prophylactic antibiotics is indicated only if the patient has evidence of skin infection in the abdominal area or bacteremia
  e. the use of prophylactic antibiotics has no indication

Question # 3

- Once the catheter is in place, the dialysis nurse tells you that they do not have cyclers available at that time and asks which system she should use for infusion and drainage. You indicate that the **BEST** option would be:
  a. to wait until a cycler is available
  b. an open system with one bag for filling and one for draining to avoid confusion
  c. a closed system using a weight scale to measure the infusion and output volumes
  d. a closed system with buretrols to measure the infusion and output volumes
  e. let the intensivists decide because it makes no difference which system is used

Question # 4

- The patient has a 15% fluid overload, signs of pulmonary edema, and hypoxia. Of the following alternatives, the **BEST** protocol to start treatment would be:
  a. dialyze for 12 hours; Infusion volume: 50 mL; Changes every 60 mins; Dextrose concentration: 4.25%
  b. dialyze for 12 hours; Infusion volume: 100 mL; Changes every 60 mins; Dextrose concentration: 4.25%
  c. dialyze 24 hours/daily; Infusion volume: 100 mL; Changes every 60 mins; Dextrose concentration: 4.25%
  d. dialyze 24 hours/daily; Infusion volume: 200 mL; Changes every 180 mins; Dextrose concentration: 1.5%
  e. dialyze 24 hours/daily; Infusion volume: 400 mL; Changes every 90 mins; Dextrose concentration: 4.25%

Question # 5

- The nurse informs you that after 12 hours of treatment the serum potassium decreased from 6.2 mEq/L to 3.6 mEq/L. The patient has had a net weight loss of 720 grams of weight. Vital signs with Blood pressure: 64/32 mmHg; Heart Rate: 168/min. Of the following alternatives, the **BEST** way to modify therapy would be:
  - it does not need to be modified as you are removing fluid and correcting the potassium successfully
  - add potassium to the dialysis solution at a concentration of 3.5 meq/L, maintaining the same dextrose concentration and dwell time
  - maintain the same concentration of dextrose and potassium in the solution, but increase the dwell time
  - maintain the same concentration of dextrose in the solution, add potassium at a concentration of 3.5 meq/L and decrease the dwell time
  - lower the concentration of dextrose in the solution, add potassium at a concentration of 3.5 meq/L, maintaining the same dwell time

Questions?

Puerto Rico te espera!

Acceso para iniciar dialisis peritoneal. Preparacion, planes.

Guillermo Hidalgo, M.D.

Hackensack Meridian Health

Children's Network.

Objetivos

- Discusión de los diversos tipos de acceso para diálisis peritoneal.
- Breve mención de los pasos a tomar para la inserción percutánea de catéter de diálisis peritoneal

Objetivos de acceso peritoneal

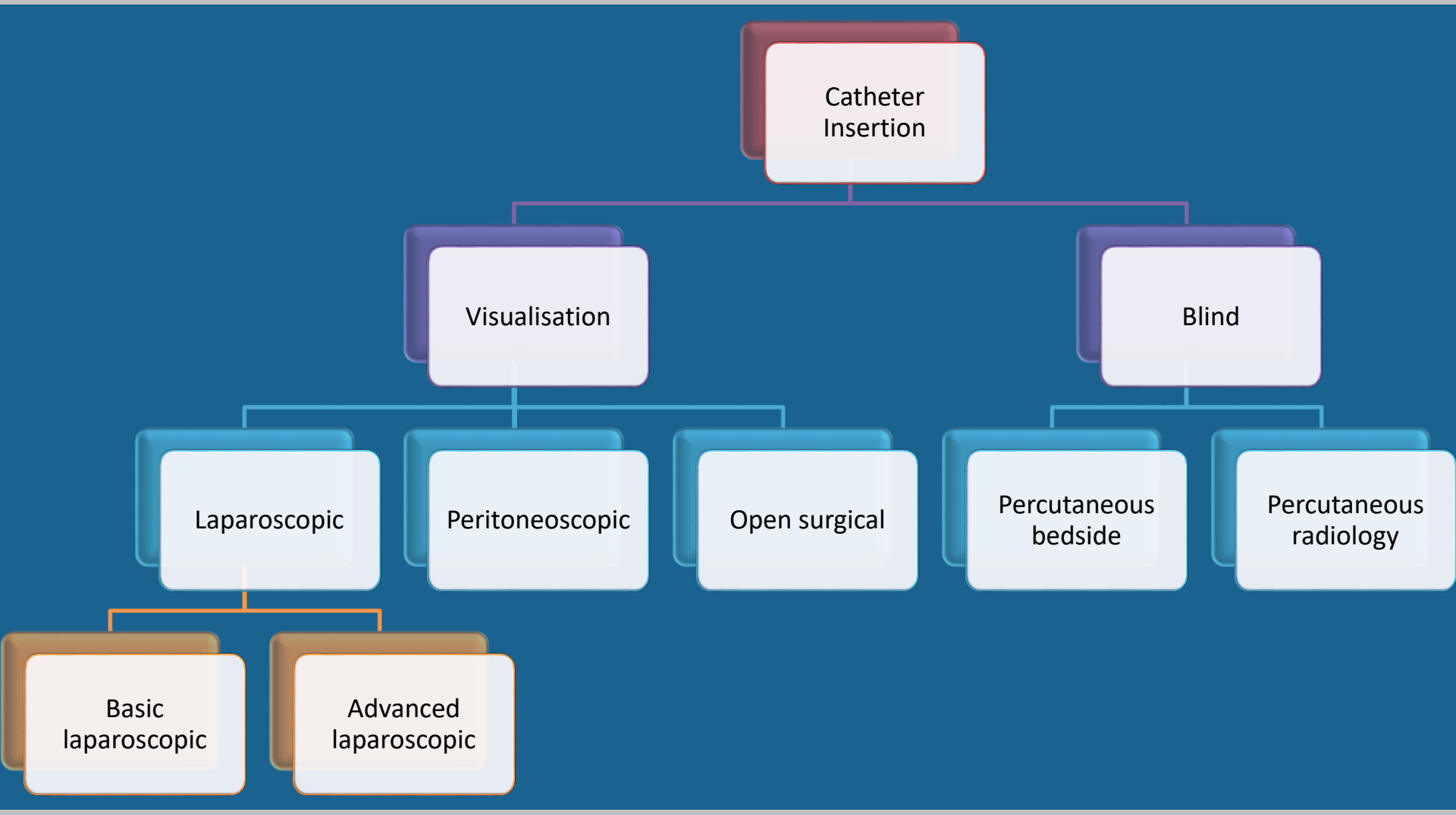
- función hidráulica óptima y funcional
- ccomunicación estable entre el catéter y el cuerpo
- libre de mantenimiento
- libre de infección
- libre de fugas

Qué factores influencian tu decisión de acceso, formato, máquina ?

- Efectividad
- Familiaridad
- Costo
- Disponibilidad

Qué factores influencia en tu decisión de acceso, formato y máquina

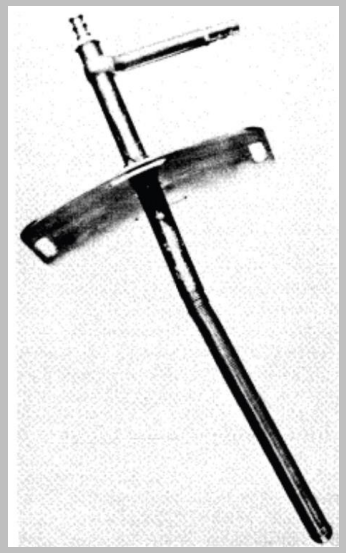
- Efectividad
- Familiaridad
- Costo
- Disponibilidad
- Disponibilidad
- Costo
- Familiaridad
- Efectividad


Catheter Insertion
Visualisation
Blind
Laparoscopic
Peritoneoscopic
Open surgical
Percutaneous bedside
Percutaneous radiology
Basic laparoscopic
Advanced laparoscopic

Practicalities of PD

- Quick in our setting
- Bed-side insertion by Paeds Nephrologist/Intensivist/Surgeons
  - (Surgeons as backup)
- Cook/Peel Away Tenckhoff/Formal Tenckhoff
- *611 PD cases bed-side insertion in 15 years*

- Inicialmente los cateteres fueron hechos de vidrio, cristal, metal, y hules/plasticos.
- 1964 Palmer – cateteres de silicone con punta curva resorteada, pasos tri-fasicos.



Colocación de catéter de diálisis peritoneal por vía abierta . Quirúrgica

Anestesia puede ser general o local

La mejor visualización posible

Es una buena opción para pacientes que han tenido cirugía previo o que son obesos

Es posible hacer una omentectomia.

Hay capacidad de hacer un abordaje para mediano, Y es posible tener una menor incidencia de hernias[1,2]

Hay una mayor incidencia de infección y fuga del líquido peritoneal que por la vía de inserción percutánea[3]

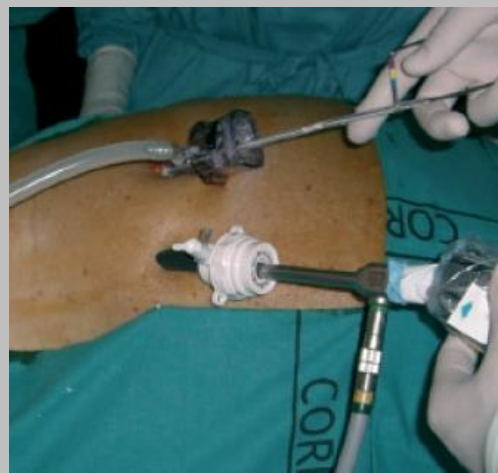
[1]Spence P surg gynaecol obstet 1985 [2] Hwang T Eur J Surg 1995 [3]Henderson S NDT 2009

Colocación de diálisis peritoneal por vía laparoscópica.

- Es posible hacer omentectomía y omentopexia.
- Beneficios
  - se puede visualizar directamente la ubicación de la punta del catéter.
  - Hay trauma mínimo y mucho menos fuga
  - Se puede crear un túnel músculo facial

Colocación de diálisis peritoneal por vía laparoscópica.

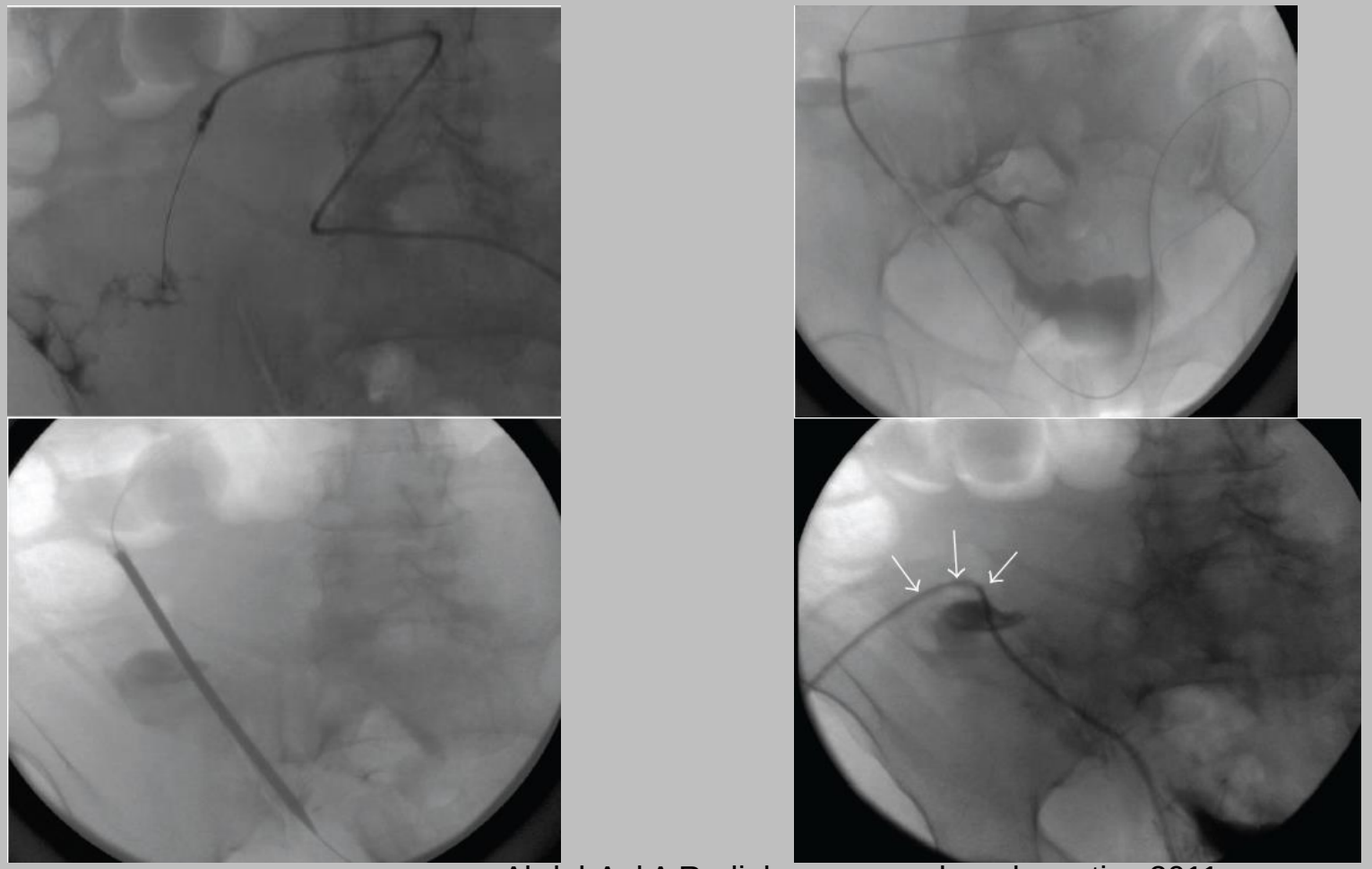
- Desventajas
  - Alto nivel de entrenamiento y práctica
  - Instrumentación de alto costo y mantenimiento



Inserciones guiadas por fluoroscopia

- Rosenthal et al 2008
- 101 pacientes – quirúrgica vs fluoroscopia
- Fuga – 13% vs 4%
- Mal función – 11% vs 9%
- Mal posición – 13% vs 6%
- Todas fueron diferencias no significativas

Rosenthal M J vasc interven radiol 2008



Abdel-Aal A Radiology research and practice 2011

Inserción por vía percutánea

- Técnica modificada de Seldinger
- Resultados son similares o mejores que los obtenidos con catéteres colocados a través de cirugía (en las manos correctas !!)
- No es posible en pacientes que han tenido cirugía abdominal previa.
- Mejoría en la la toma de PD.

Safety and efficacy of percutaneous insertion of peritoneal dialysis catheters under sedation and local anaesthetic

Scott Henderson, Edwina Brown and Jeremy Levy

NDT 2009

- 283 Percutáneos vs 150 quirúrgicos
- 21% vs 23% pobre drenaje.
- 6% vs 10% fugas
- 87% Funcionando después de un mes

Indication	Percutaneous insertion	Surgical insertion
First catheter insertion	242 (86%)	99 (66%)
Re-insertion	34 (12%)	33 (22%)
Repositioning	7 (2%)	18 (12%)

Table 3. Episodes of peritonitis within 1 month of catheter insertion

	Peritonitis	
Organism	Percutaneous insertion	Surgical insertion
Coagulase-negative staphylococcus	0	2
Methicillin-resistant *Staphylococcus aureus*	0	1
Pseudomonas aeruginosa	0	0
Enterococcus sp.	1	0
Klebsiella pneumonia	0	1
No growth	11	16
Total	**12**	**20**

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ORIGINAL ARTICLE

Percutaneous versus surgical insertion of PD catheters in dialysis patients: a meta-analysis

Lamya Boujelbane[1], Ning Fu[1], Kevin Chapla[1], David Melnick[2], Robert R. Redfield[3], Sana Waheed[1], Alexander S. Yevzlin[1], Jung-Im Shin[4], Brad C. Astor[1,4], Micah R. Chan[1]

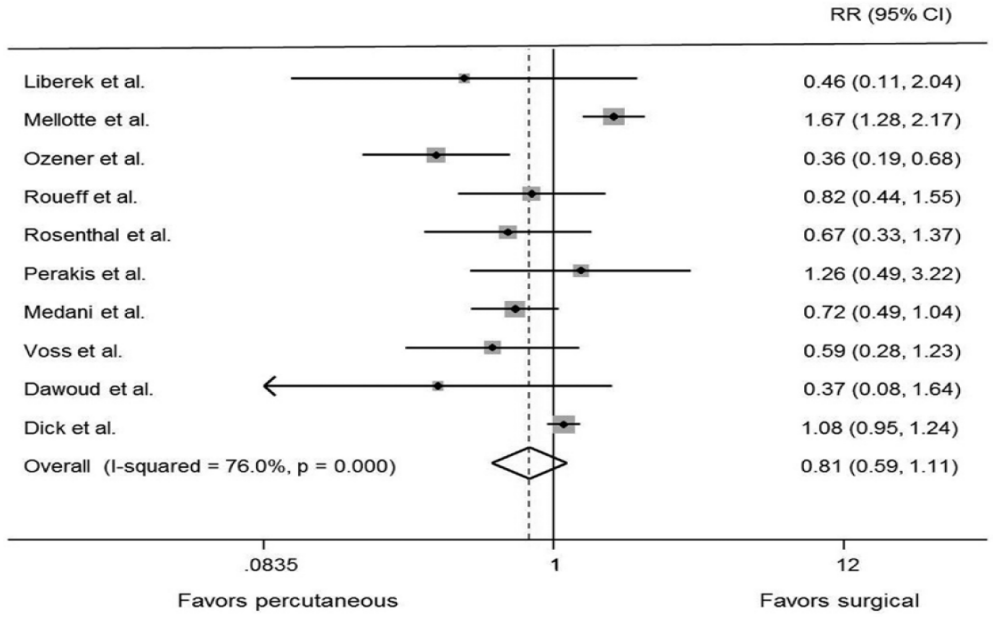
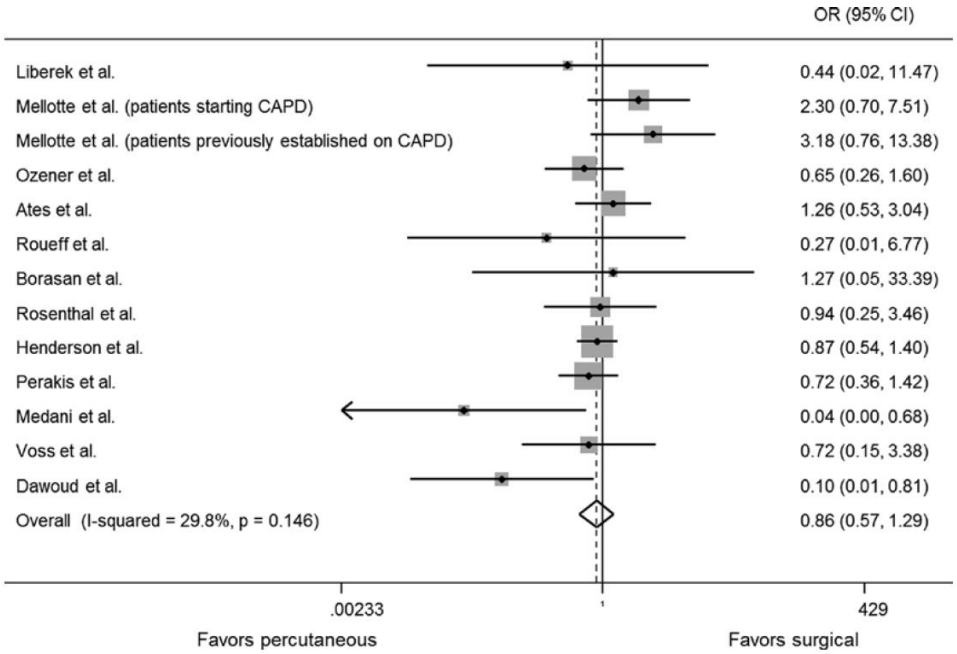


Fig. 2 - 1-Year PD catheter survival.



3 - PD catheter dysfunction.

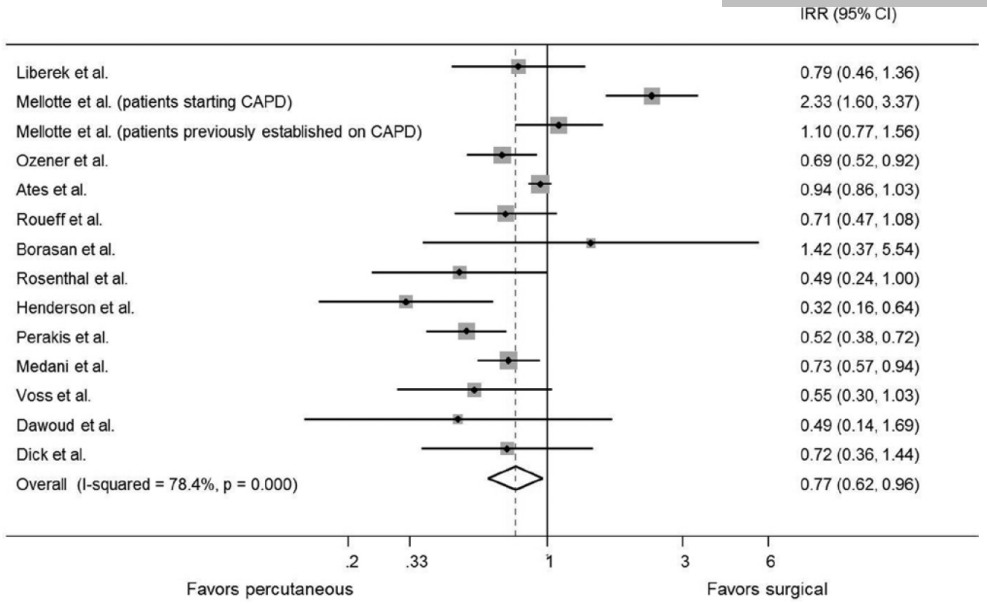


Fig. 5 - PD catheter-associated peritonitis.

Children

- 108 children catheters inserted by blind techniques
- No cases of bowel perforation

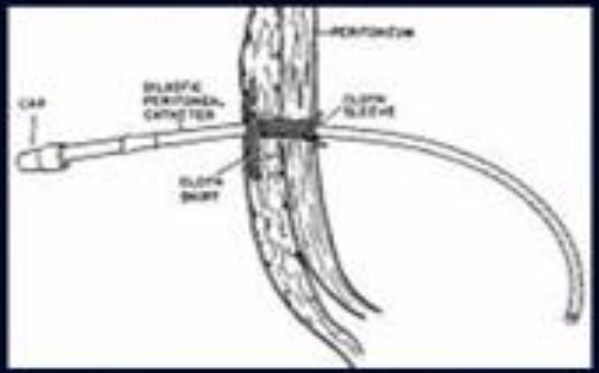
Asku N, Yavascan O, Anil M NDT 2007

Tenckhoff catheter

Gutch defined size of side holes and used straight silastic design 1964

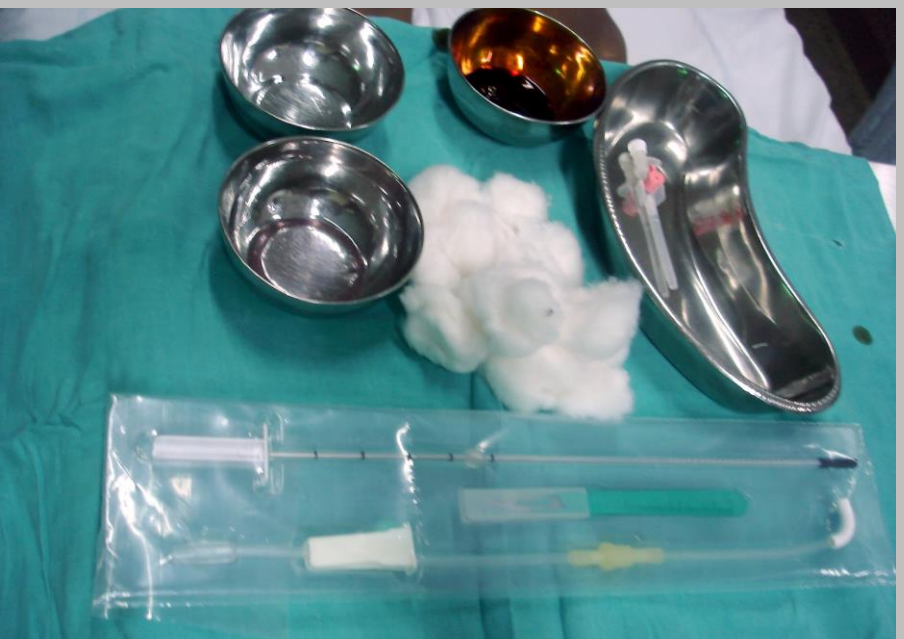
Palmer and Quinton laid the foundations for the basic catheter design and used a long subcutaneous tunnel 1964

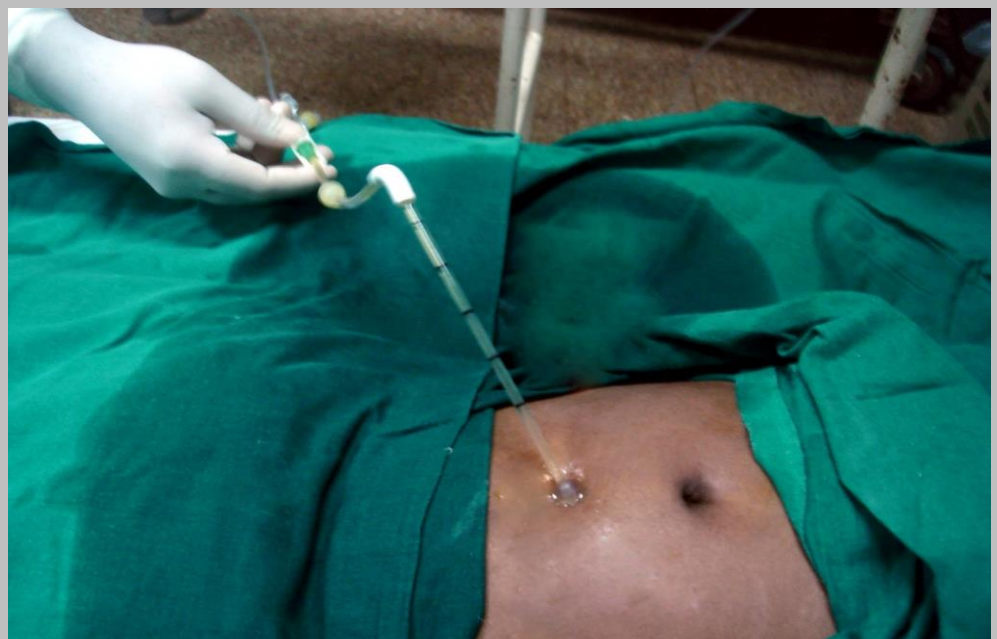
McDonald also introduced a Dacron sleeve to his straingt silastic catheter in 1968



Tenckhoff vs Rigid

- Rigid catheters cheaper (not necessarily more cost effective)
- Easier to learn rigid technique
- Poor dialysate flow, increased infections





Children

- 59 Children (mean age 1.4 years)
- Rigid catheter vs Tenckhoff
- Complications in 9% Tenckhoff vs 49% rigid catheter
- 13/37 had to be replaced
- Day 6 – 44% rigid catheters free of complication vs 90% Tenckhoff catheter

Chada V et al AJKD 2000

Archives of Disease in Childhood, 1988, **63**, 827–831

Comparison of temporary and permanent catheters for acute peritoneal dialysis

S N WONG AND D F GEARY

Division of Nephrology, Department of Paediatrics, Hospital For Sick Children, Toronto

	Group with Trocath catheters (n=33)	*Group with Tenckhoff catheters (n=34)*
Duration of dialysis:		
Total patient days	233	304
mean (range)	7·1 (1–15)	9·0 (1–30)
Overall complication rate: (Episodes per patient day)	0·19	0·10
Patients for whom catheter removed because of complications	19	5*
Patients requiring two or more catheters	12	1*
Complete recovery	18	15
Chronic renal failure	3	5
Death	12	14

*Fisher's exact test, $p<0·001$.

	Group with Trocath catheters (n=33) No (%)	*Group with Tenckhoff catheters (n=34) No (%)*
Leakage of dialysate	12 (36)	10 (29)
Outflow obstruction	10 (30)	2 (6)*
2-way obstruction	2 (6)	1 (3)
Dislodgement of catheters	3 (9)	0
Puncture site bleeding	1 (3)	1 (3)
Intraperitoneal bleeding	3 (9)	5 (15)†
Abdominal pain	3 (9)	2 (6)
Fibrin clots in dialysate	3 (9)	3 (9)
Peritonitis	5 (15)‡	5 (15)

Cook vs. Tenckhoff cath

- Comparison between Cook Multi purpose drainage catheter and Tenckoff catheter in children (mean age 6.4 months)
- 21 children
- No significant difference in length of time with complications between two types.

Auron A AJKD 2007

Pasos

- Intento de transferencia a un centro con cuidados renales.
- Si esto falla, y si hay cirujano disponible cómo colocación de catéter Tenckhoff.
- Si ninguno es posible, intento de colocación de catéter peritoneal en la cama del paciente

Pasos

- Agresivo manejo del estreñimiento.
- Asegurarse que el paciente está en decúbito una superficie plana, con monitor cardiopulmonar y de oxigenación. Equipo de resucitación disponible.
- Inserción de catéter urinario y vaciamiento de vejiga. Si es posible ultrasonido de vejiga.
- Un segundo médico es esencial para mantener monitoreo de signos vitals.

Pasos

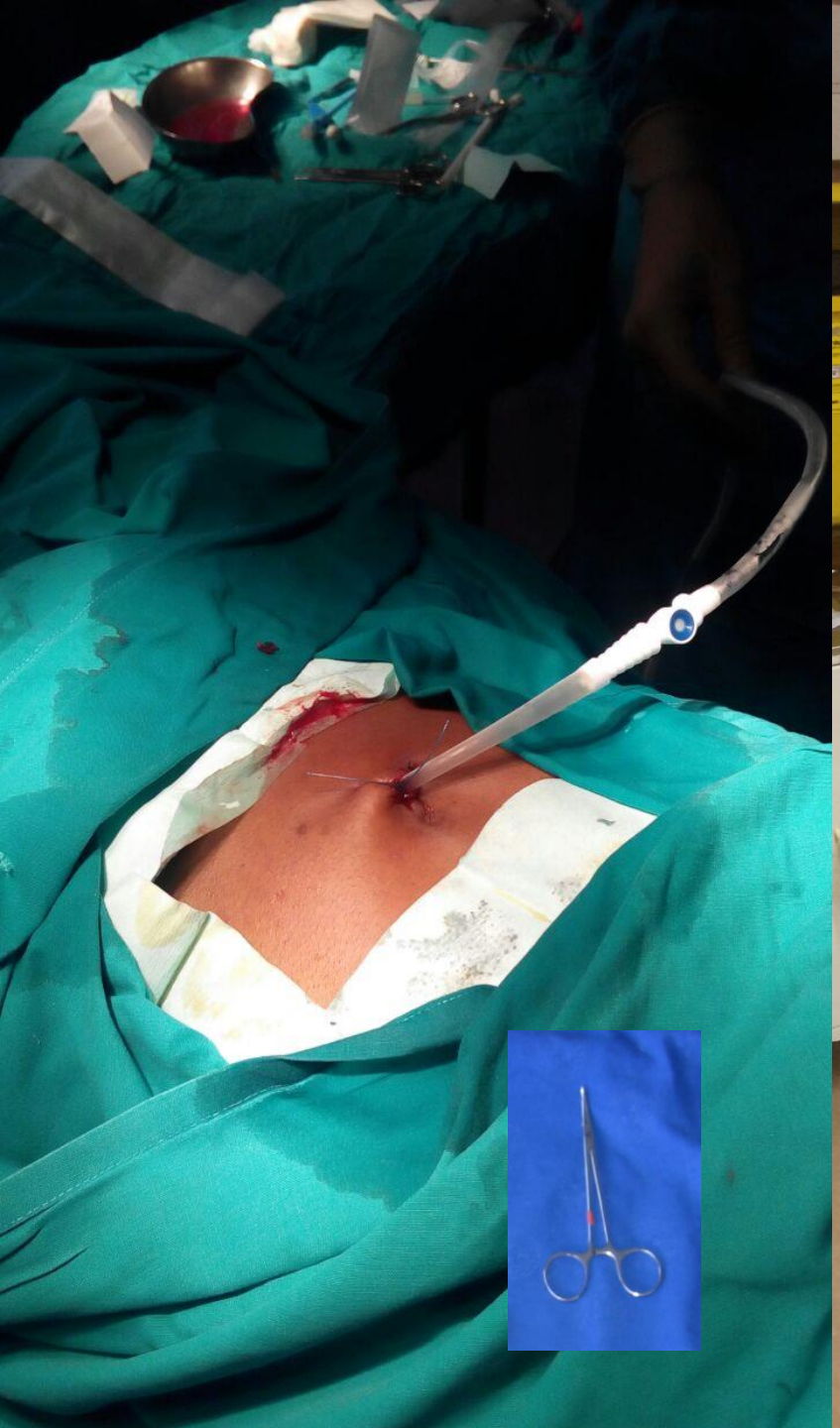
- Sedación
- Antibióticos pre procedimiento, Vancomicina 10 mg/kg/dosis u otro por protocolo, antes de inserción
- Asepsia y antisepsia. Estricto proceder de esterilidad quirúrgica. Gorro, mascarilla, gabachon y guantes. Campos quirurgicos.
- Medición de distancia aproximada desde el sínfisis pubis hasta el ombligo. Objetivo de ubicación de la punta del catéter en la fosa pélvica.

Pasos

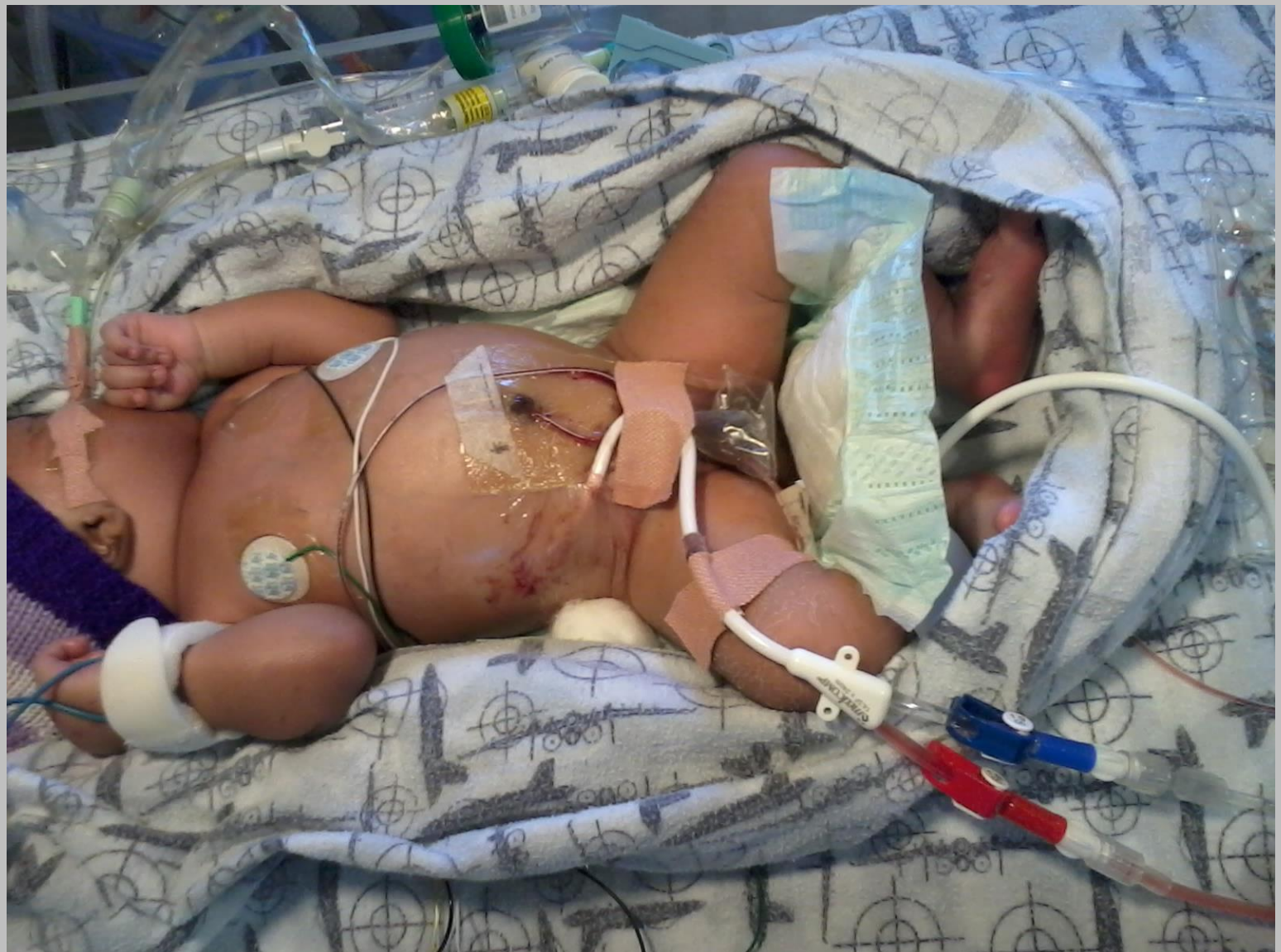
- Inyección con anestésico local, piel, tejido subcutáneo hasta cerca del peritoneo.
- Inserción de cánula endovenosa (18FR)en el sitio escogido .
- Avance la aguja de la canula por los tejidos suavemente y con cautela hasta perforar el peritoneo.
- Retiré la aguja y dejé en su lugar la cánula plástica y avance en su plenitud para luego insertar la guía de alambre.
- Instile a gravedad de 30 a 50 ml/kg de líquido ya sea solución salina normal o líquido de diálisis peritoneal hasta distender el abdomen. Monitoree oxigenación

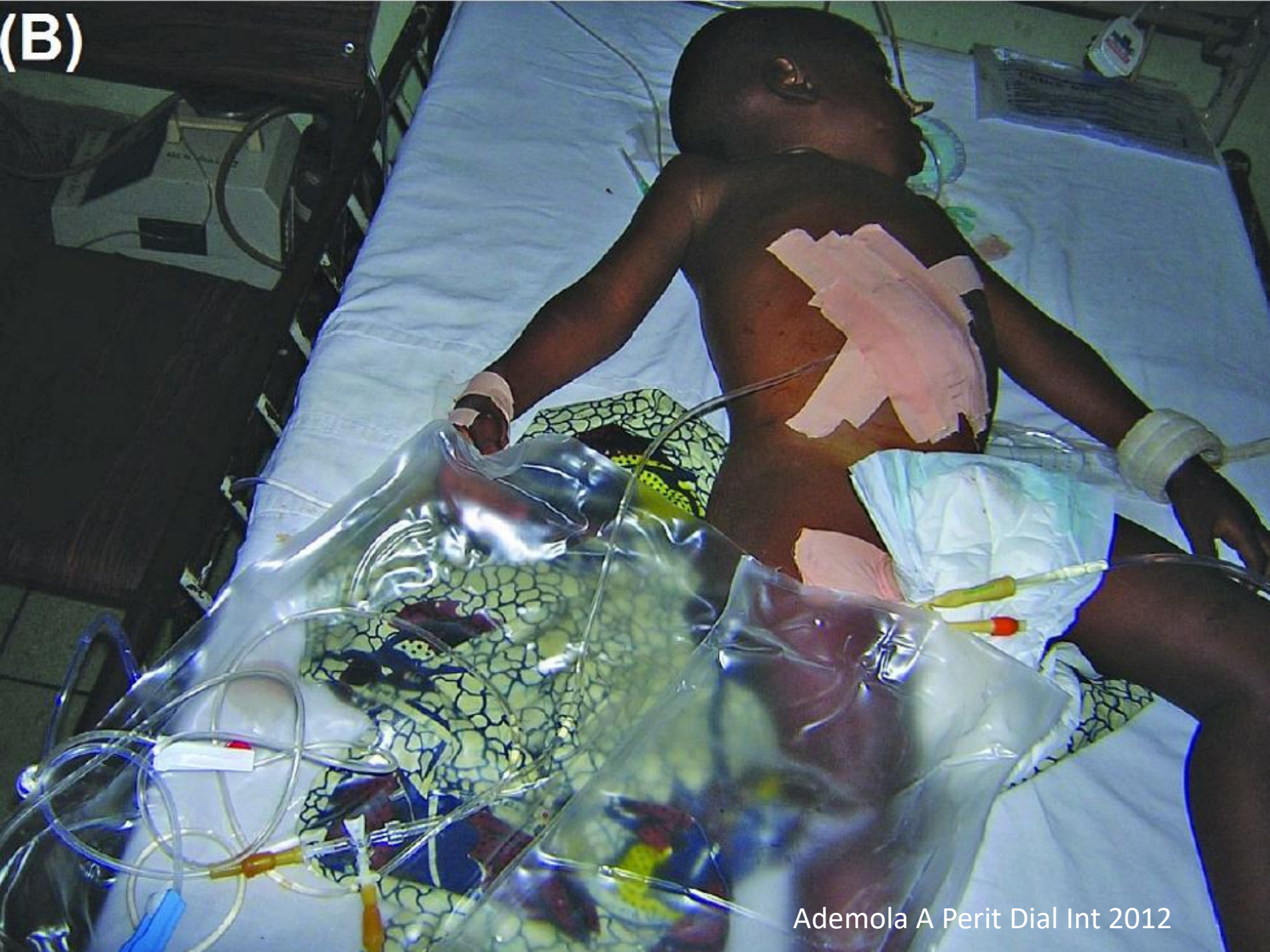
Pasos

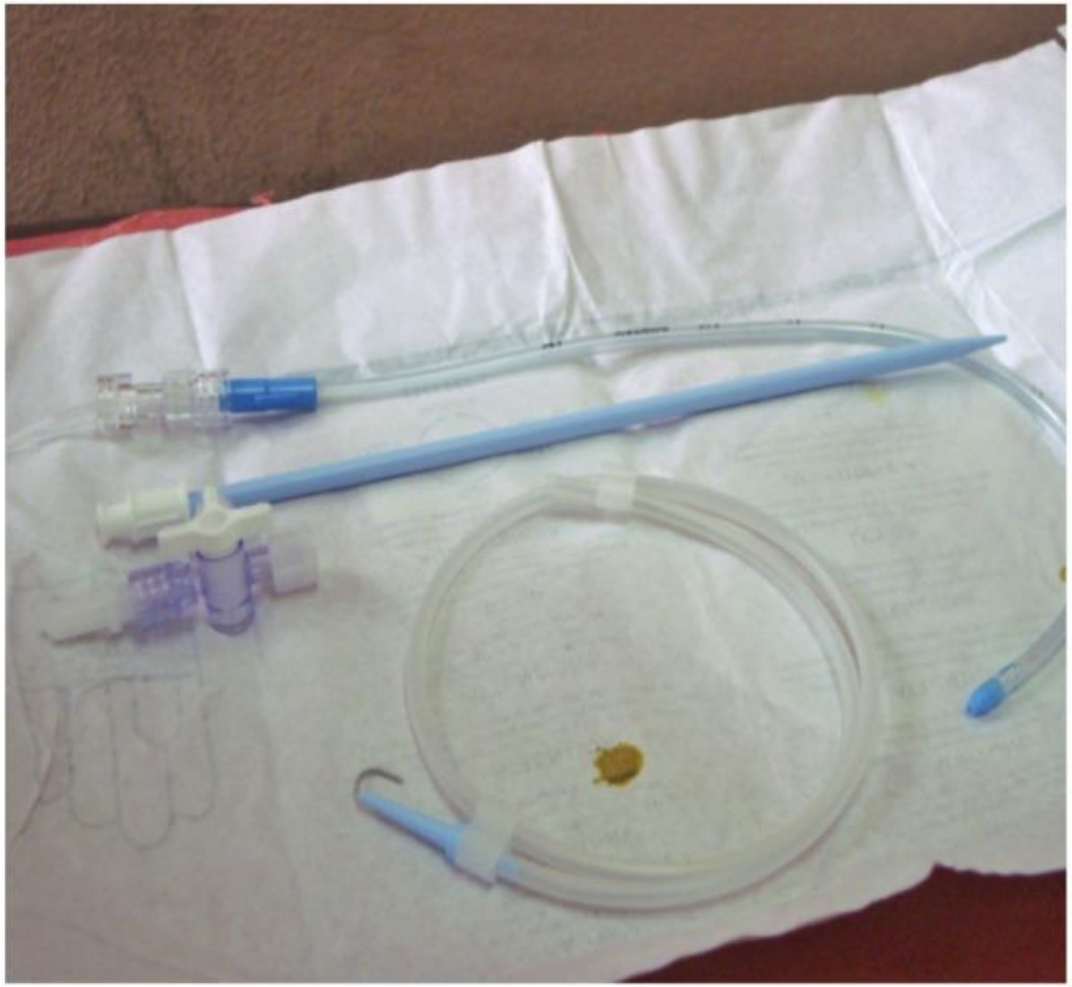
- Luego de la instilacion el fluido debe retornar con facilidad, si no es así retraiga la cánula un poco hasta tener flujo adecuado.
- Debe tomarse cuidado de no llenar de fluído el espacio entre la piel y el peritoneo. Monitoreo en la oxigenación
- Inserté el alambre con la técnica modificada de Seldinger a través de la cánula con una orientación hacia la pelvis, luego remueva la cánula dejando en su lugar el alambre.
- De ser necesario se puede utilizar una aguja de largo calibre para hacer una pequeña incisión en la piel teniendo cuidado de no hacerla muy larga para prevenir fugas.
- Inserte el catéter para diálisis peritoneal elegido.

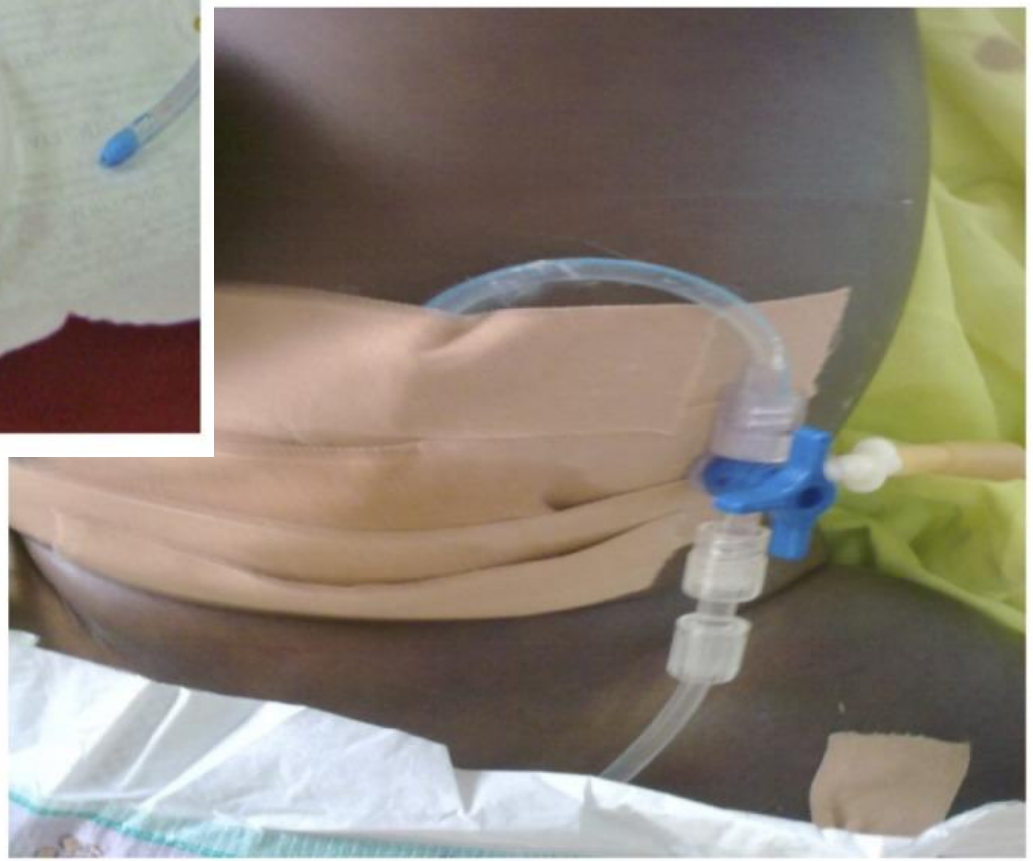


Improvised Catheters

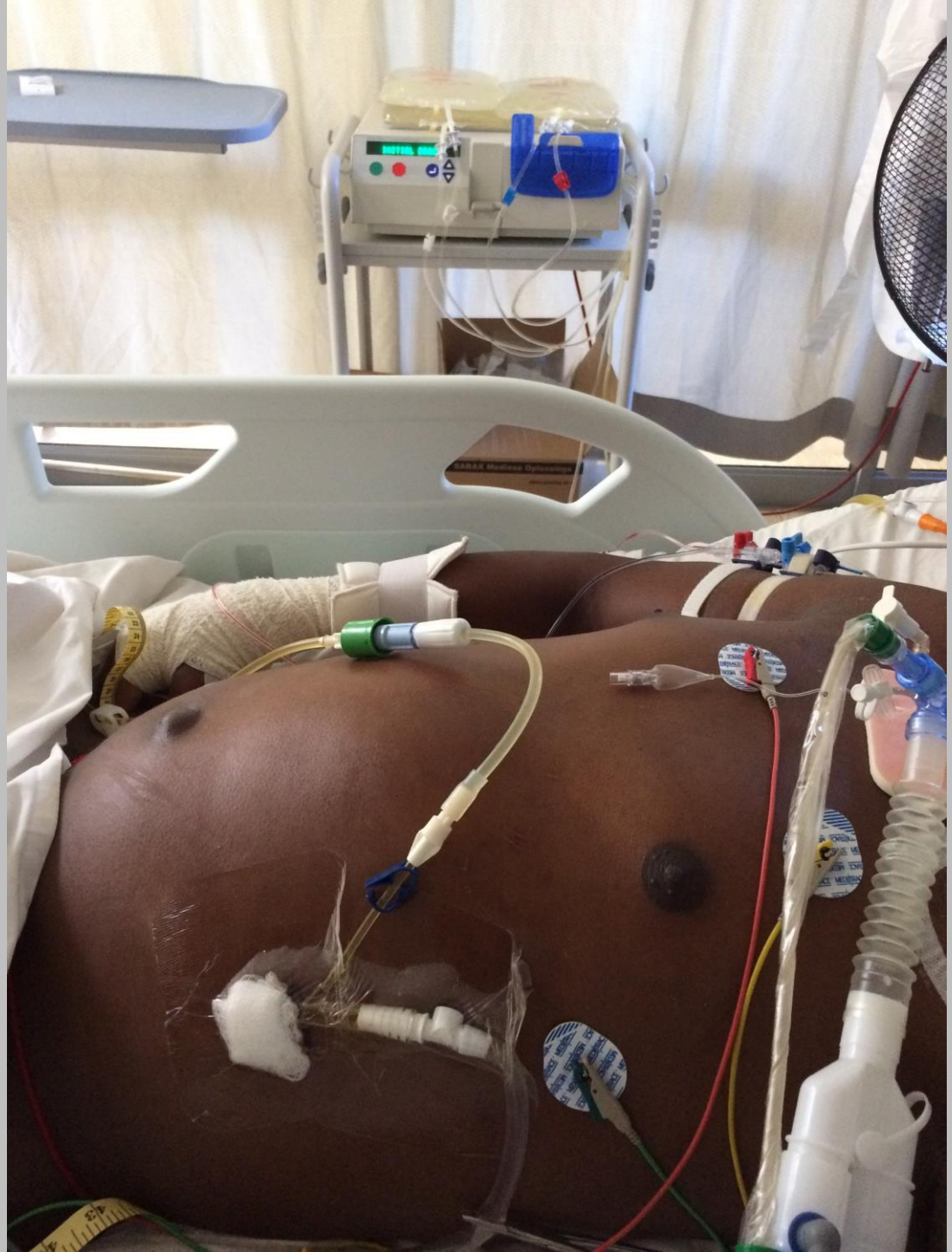



(B)
Ademola A Perit Dial Int 2012

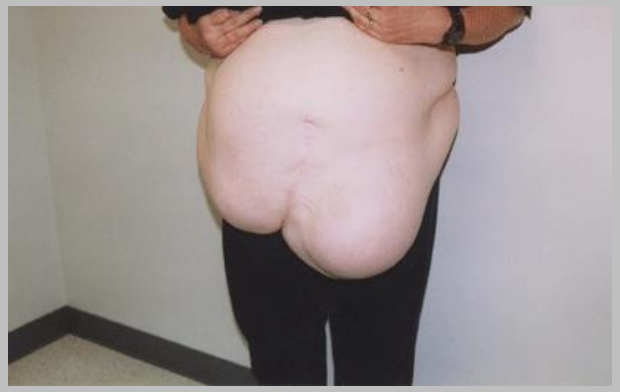




Esezebor C Perit Dial Int 2014



- Assess fitness for anaesthesia
- Suitable for blind or open approach?
- Any contra-indications?
- Determine exit site type and position
- Need for additional procedures
- Counsel patient re complications
- Constipation



Contra-indications

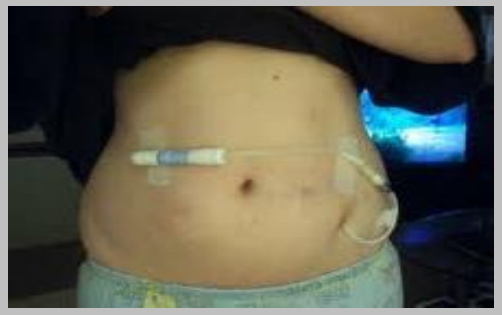
- Open abdomen
- Colostomy
- Unrepairable hernia

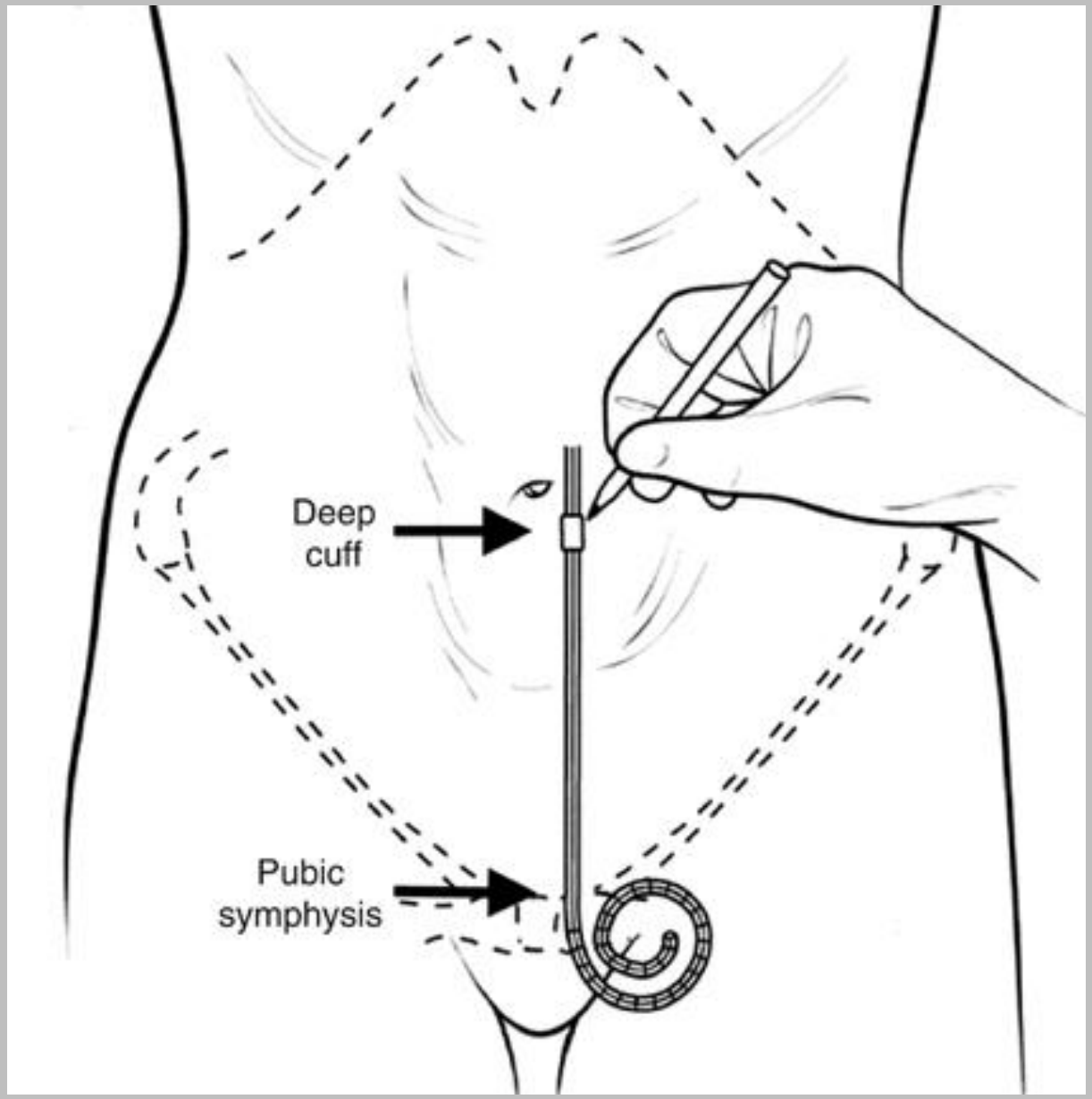
NOT contra-indications

- Previous surgery
- Previous peritonitis
- Polycystic kidney disease
- “Frozen pelvis”
- Urostomy
- Gastrostomy
- AAA repair

Choosing the exit site

- Stand and sit patient
- Exit needs to be visible for care
- Avoid belt line and fat folds
- Avoid stoma areas
- Avoid upward direction
- Cuff 2-3 cm from exit site




Deep
cuff
Pubic
symphysis

Sedation

- High complication rate if not performed correctly
- Procedure related mortality in 14000 endoscopies was 1:2000
- Risk of aspiration, cardiac or respiratory arrest
- Ascertain the need for analgesia or sedation

Quine et al GUT 1995

Monitoring

- Oxygen saturation monitor
- Cardiac monitor if high risk patient

Infection control

- <5% exit site infections and < 5% peritonitis (ISPD Guidelines 2011)
- No randomised controlled trials comparing surgical scrub procedure with no scrub
- Exact procedure varies – but should last 2-6 minutes
- Solution should be antiseptic and have lasting bacterial killing

Antibiotic prophylaxis

Peritonitis in 14 days	Vancomycin 1g (12hrs pre)	Cephazolin 1g (3hrs pre)	No prophylaxis
Number of cases	86	85	83
Peritonitis	1	6	10
Relative risk	1	6.45	11.6

Gadallah M AJKD 2000

- Cefuroxime 1.5g + 250mg in bag
- RCT – 38 pts –Cef vs placebo
- Followed to 10 days post op
- No growth in cef group but 30% of placebo group had positive culture (20% had clinical peritonitis)
- Organisms – CNS, SA, alpha –strep, bacteroides and clostridium fragilis

Wikdahl A NDT 1997

Analysis 3.1. Comparison 3 Peri-operative IV prophylaxis versus none (placebo/no treatment controlled trials), Outcome 1 Peritonitis (number of patients with peritonitis).

Review: Antimicrobial agents for preventing peritonitis in peritoneal dialysis patients

Comparison: 3 Peri-operative IV prophylaxis versus none (placebo/no treatment controlled trials)

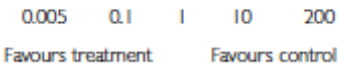
Outcome: 1 Peritonitis (number of patients with peritonitis)

Study or subgroup	Treatment n/N	Control n/N	Risk Ratio M-H,Random,95% CI	Weight	Risk Ratio M-H,Random,95% CI
Bennet-Jones 1988	1/13	6/13		16.7 %	0.17 [0.02, 1.20]
Gadallah 2000	7/148	10/73		62.9 %	0.35 [0.14, 0.87]
Lye 1992	2/25	1/25		12.1 %	2.00 [0.19, 20.67]
Wikdahl 1997	0/18	4/20		8.2 %	0.12 [0.01, 2.13]
Total (95% CI)	**204**	**131**		**100.0 %**	**0.35 [0.15, 0.80]**

Total events: 10 (Treatment), 21 (Control)

Heterogeneity: $Tau^2 = 0.06$; $Chi^2 = 3.22$, df = 3 (P = 0.36); $I^2 = 7\%$

Test for overall effect: Z = 2.49 (P = 0.013)



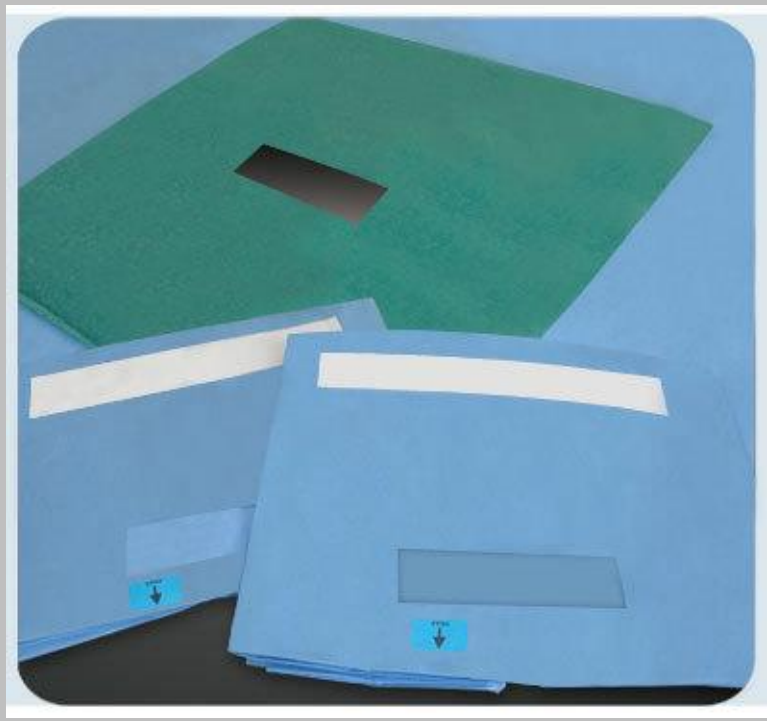
Cochrane review 2004

Antibiotic prophylaxis

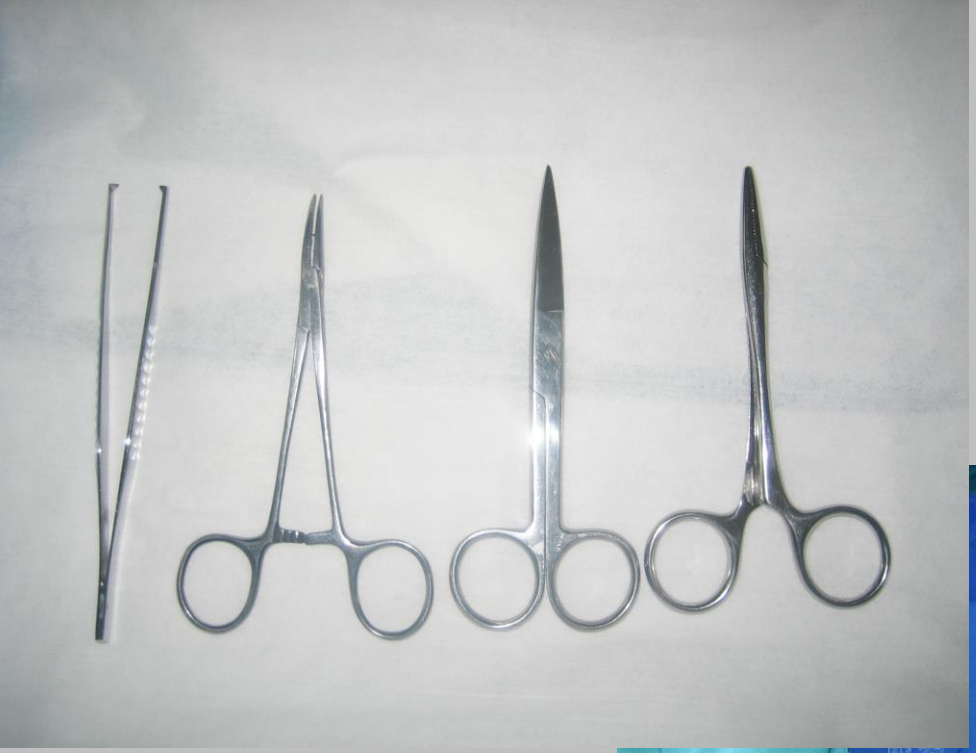
- No regimen significantly better than the other
- Most important that serum levels are adequate prior to starting the procedure
- Cefuroxime may be easier to administer in day-case procedures
- Recommend gram positive and gram negative cover (ISPD guidelines 2016)

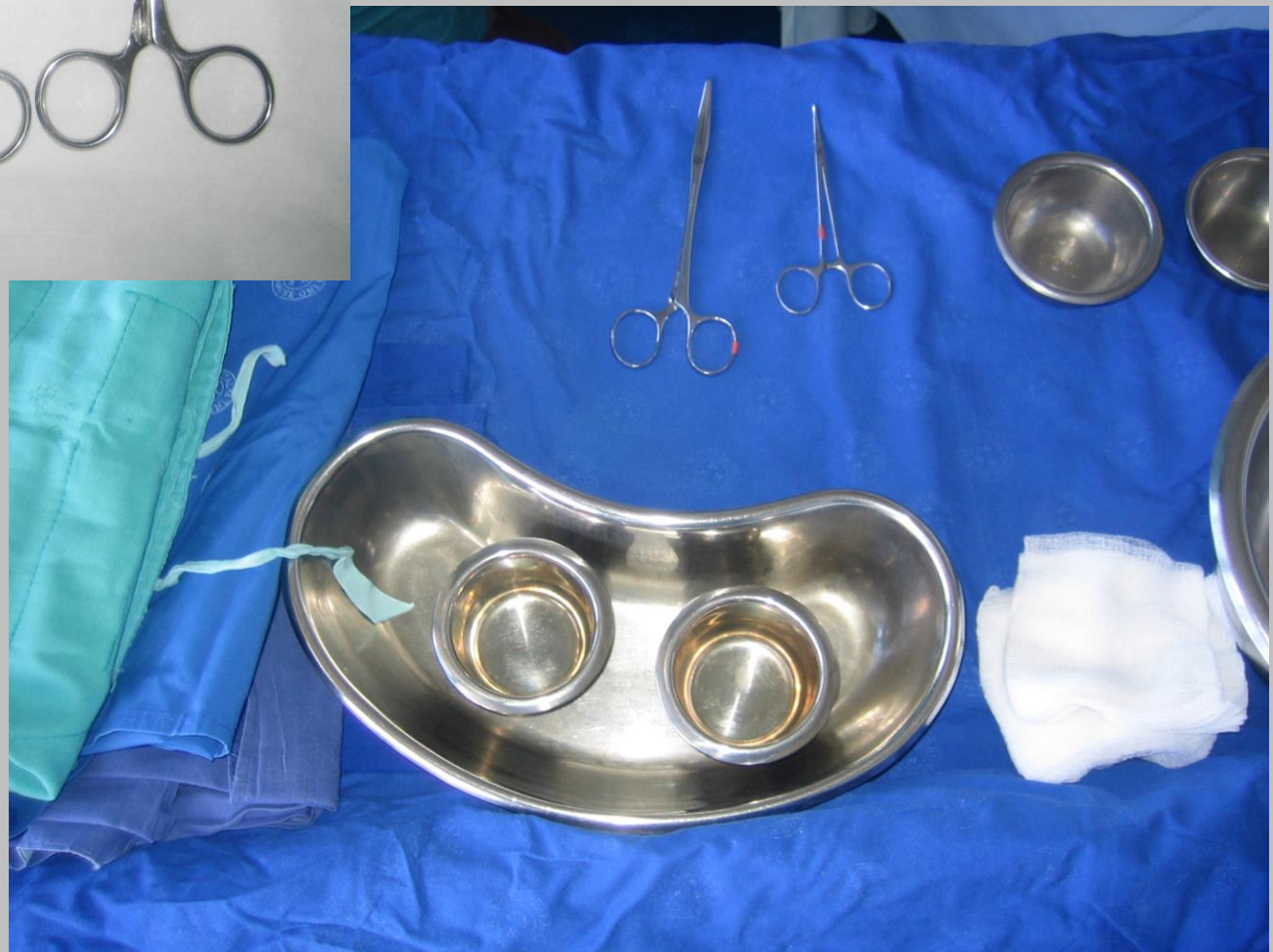
Linen

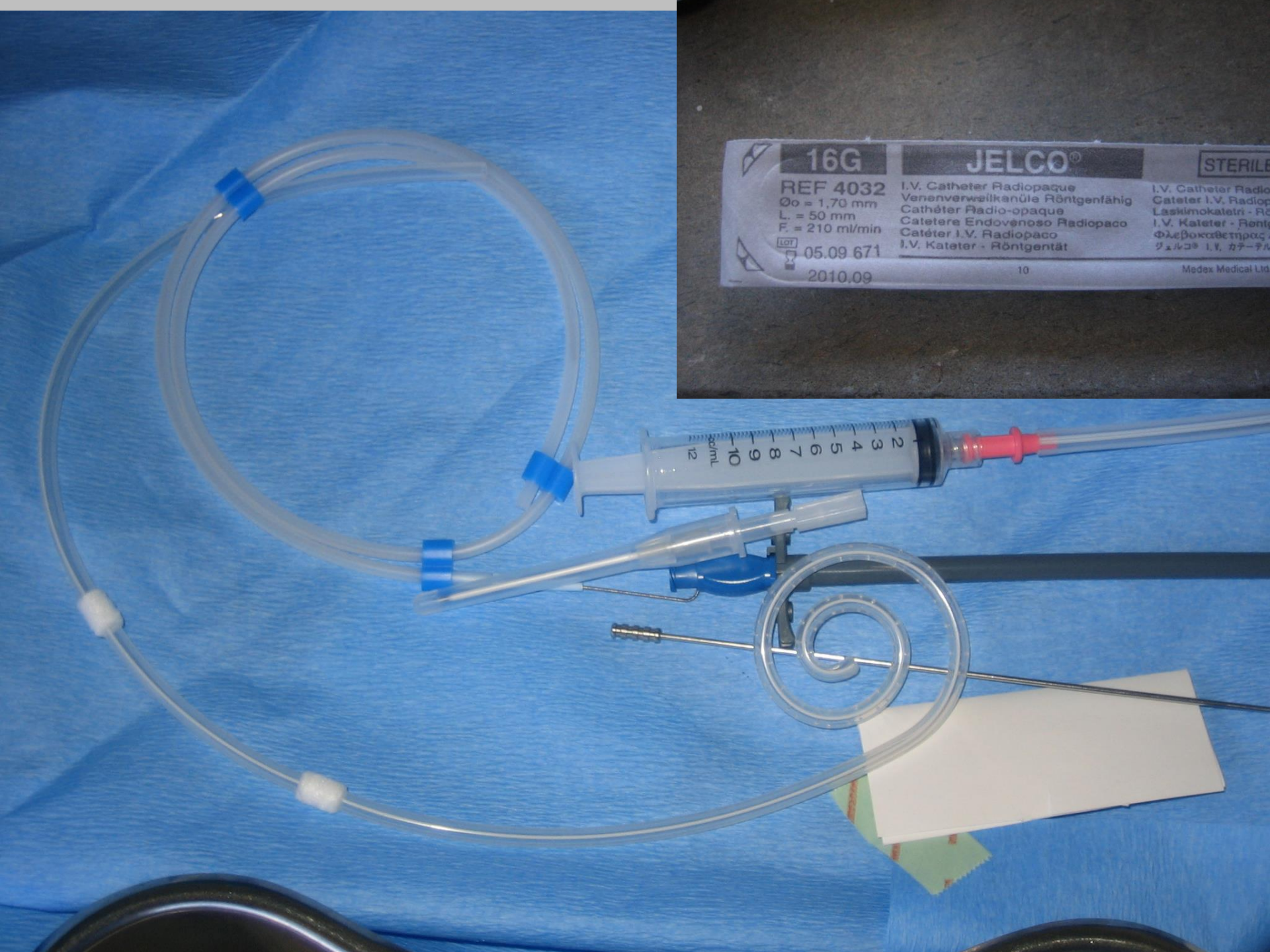
- Perforated drape
- 4 standard drapes
- 1-2 surgical gowns
- Gauze swabs X 10



- Powder free sterile gloves






16G
JELCO®
REF 4032
Øo = 1,70 mm
L. = 50 mm
F. = 210 ml/min
05.09 671
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I.V. Catheter Radiopaque
Venenverweilkanüle Röntgenfähig
Cathéter Radio-opaque
Catetere Endovenoso Radiopaco
Catéter I.V. Radiopaco
I.V. Kateter - Röntgentät
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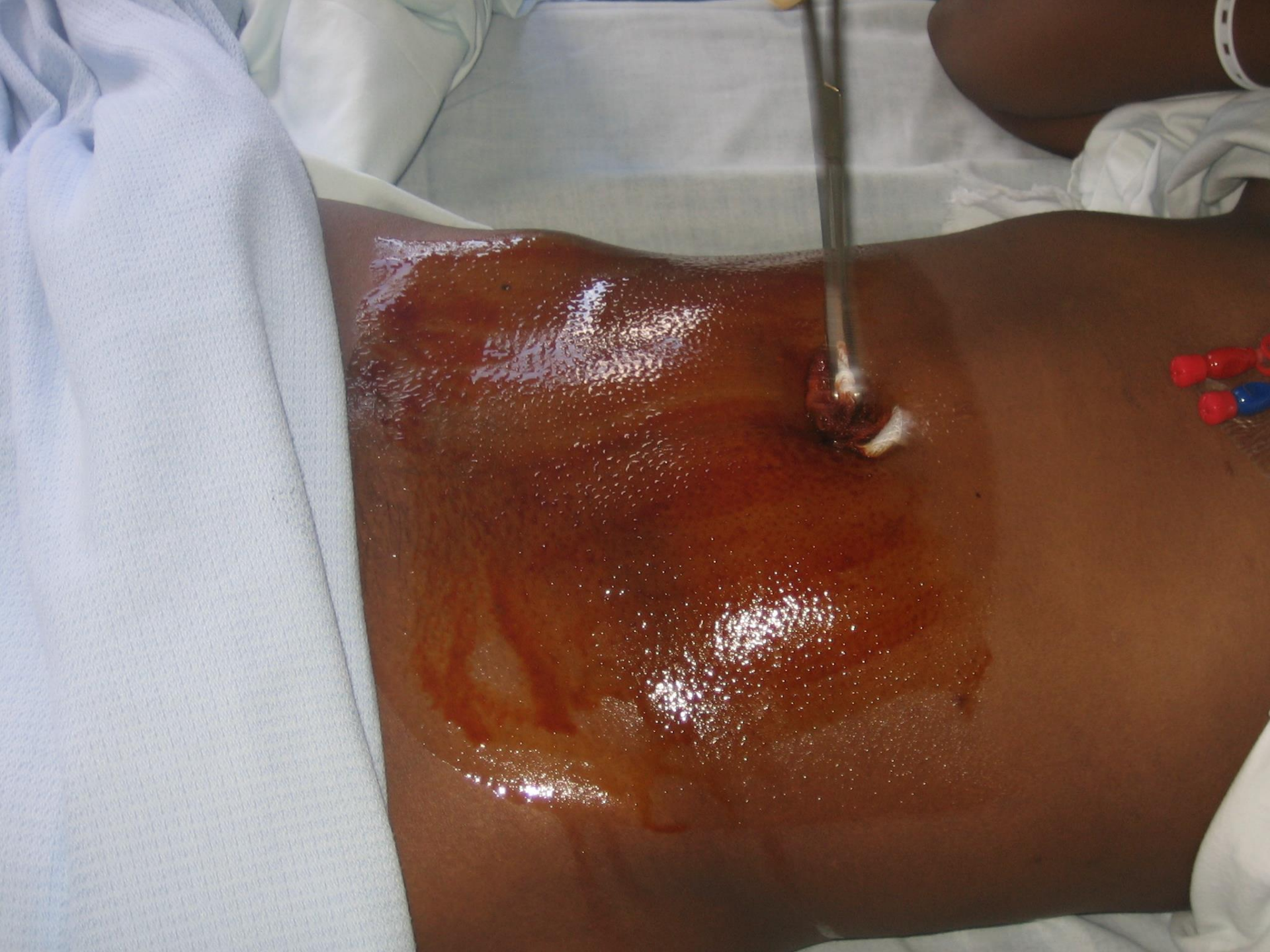
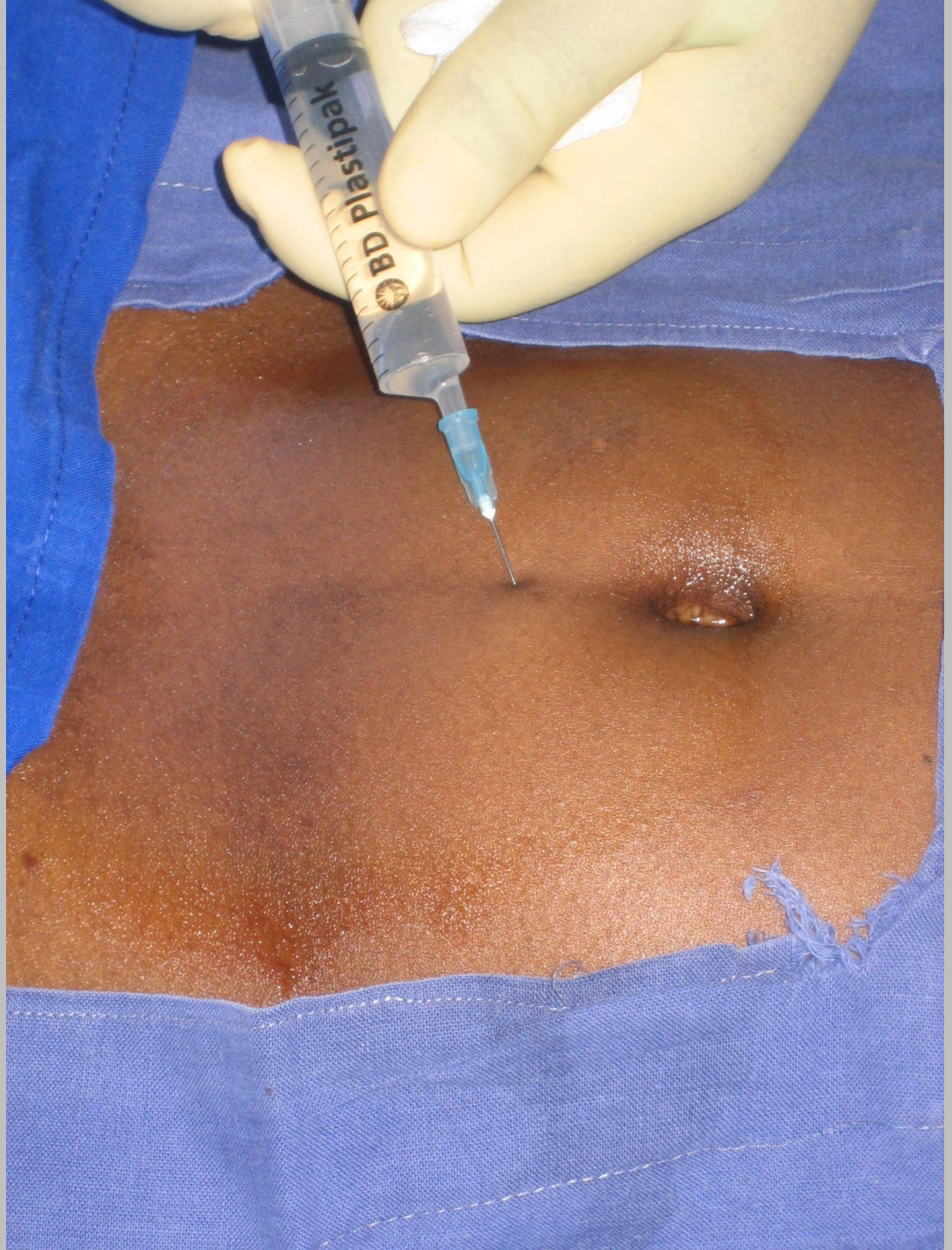
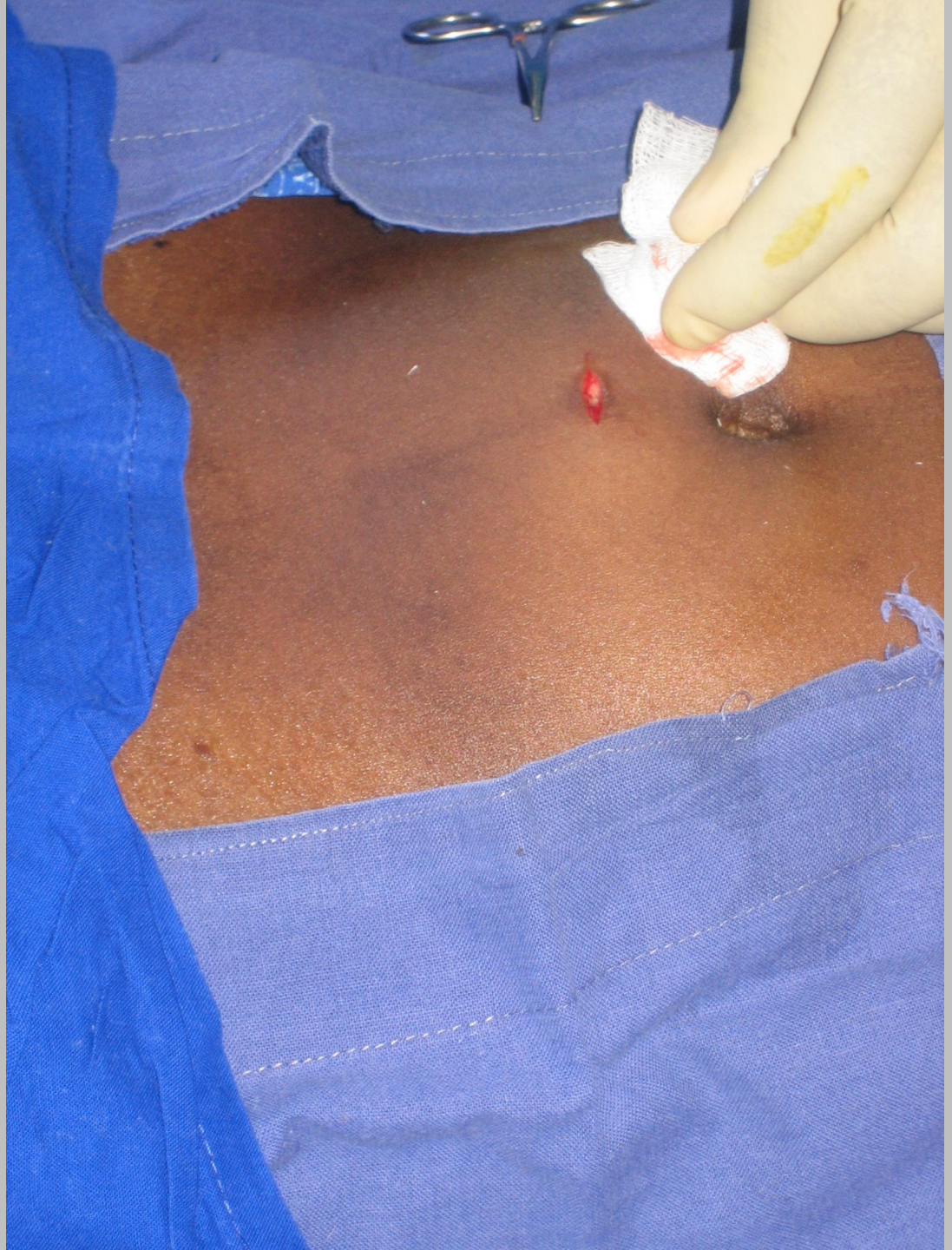
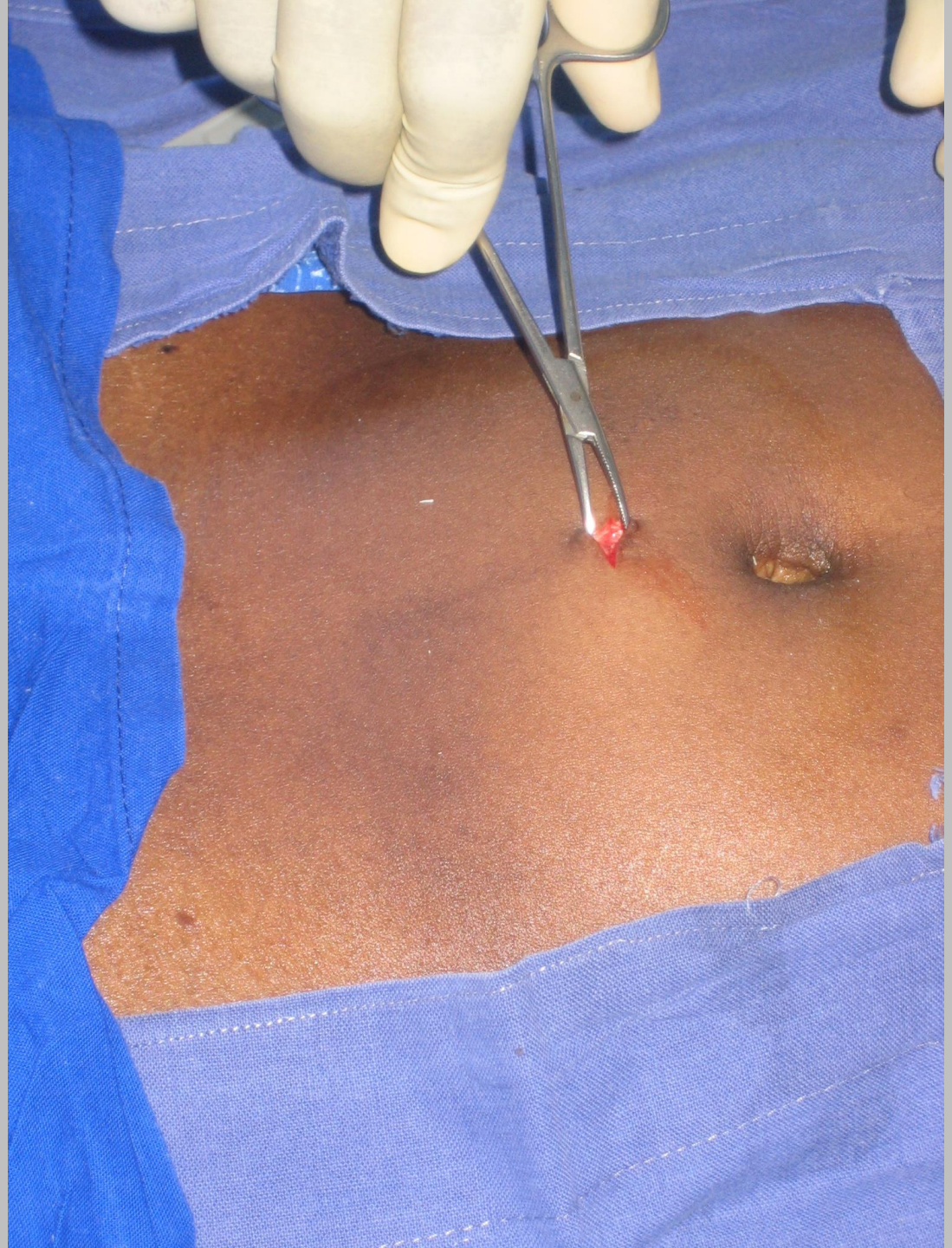
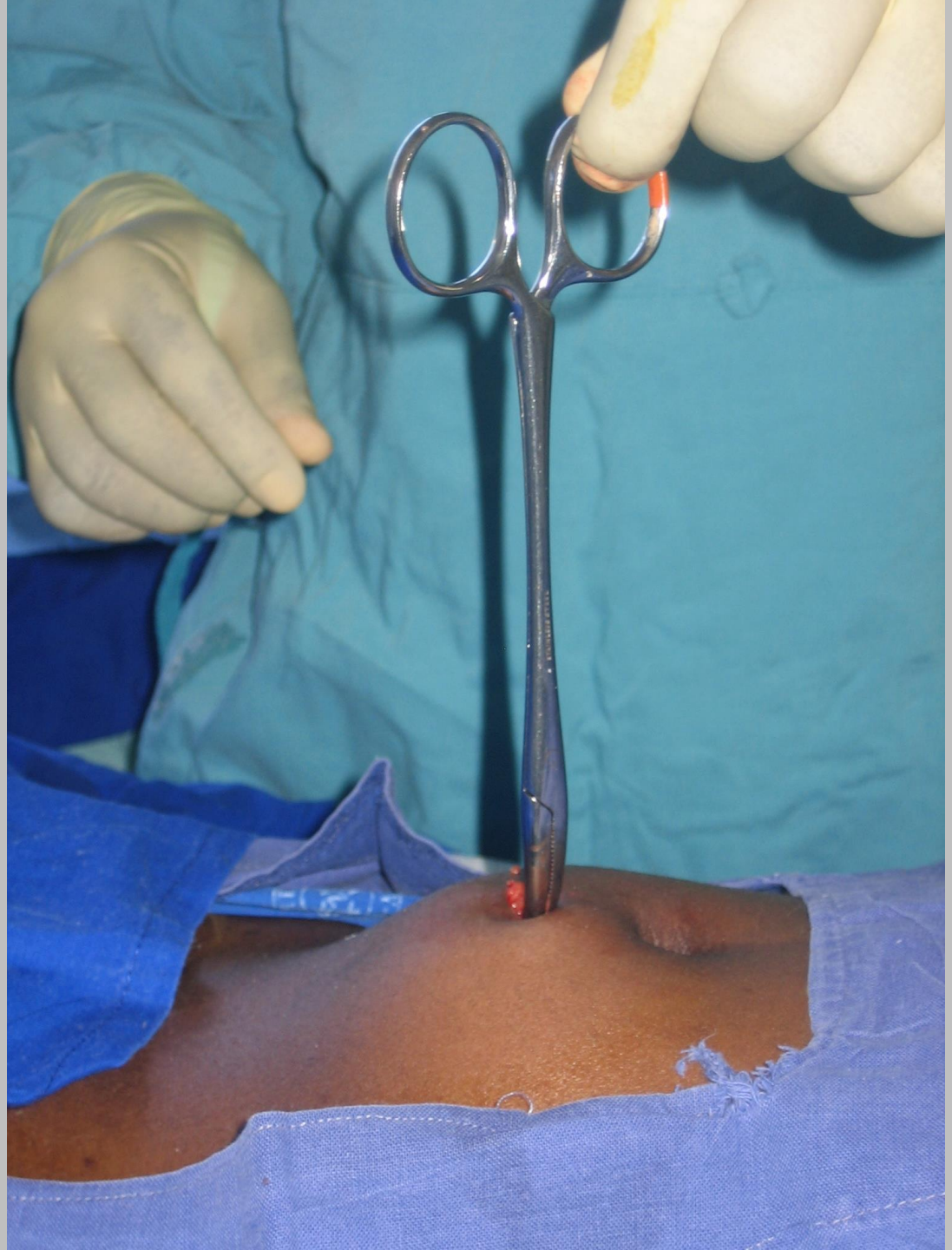
Medex Medical Ltd

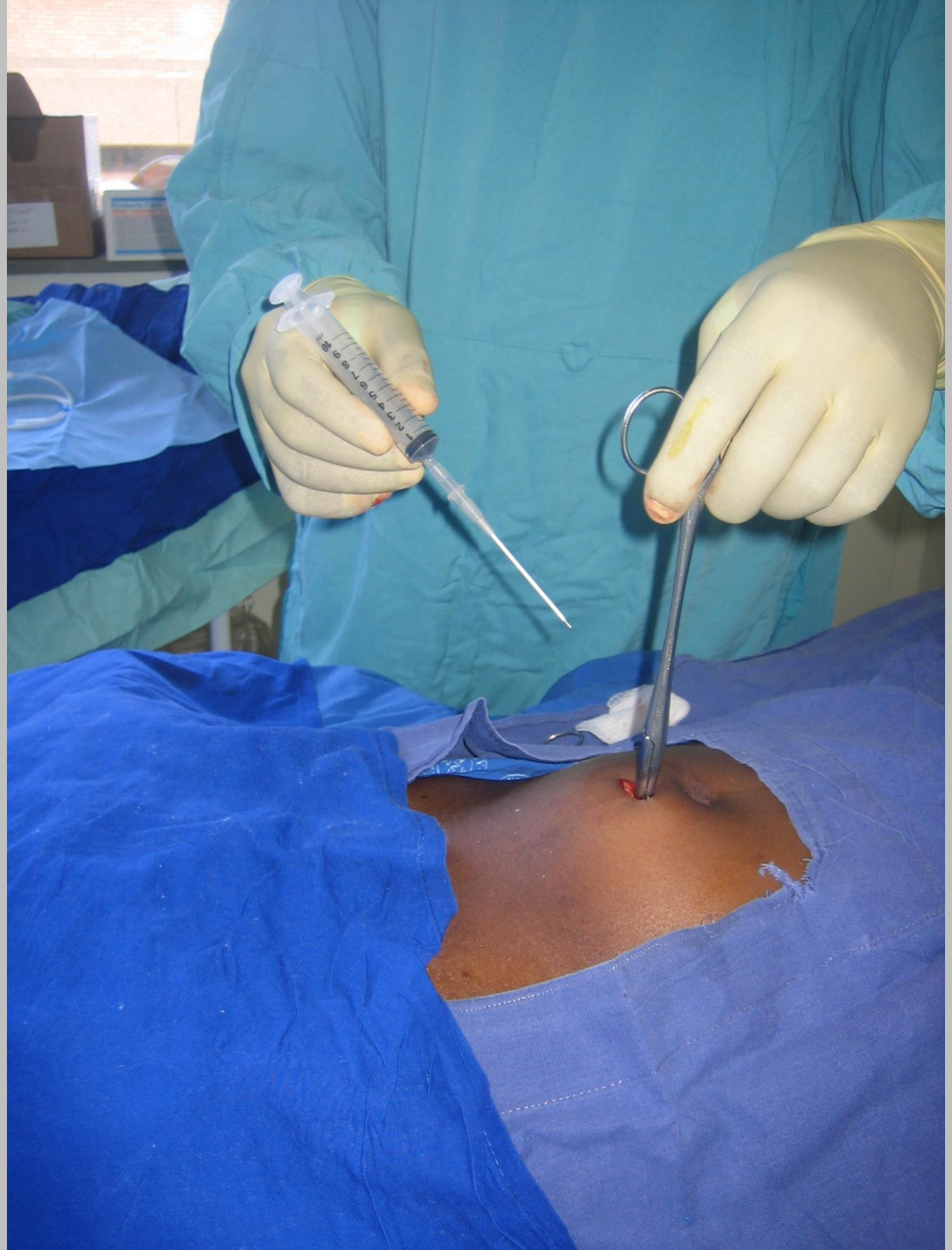



BD Plastipak

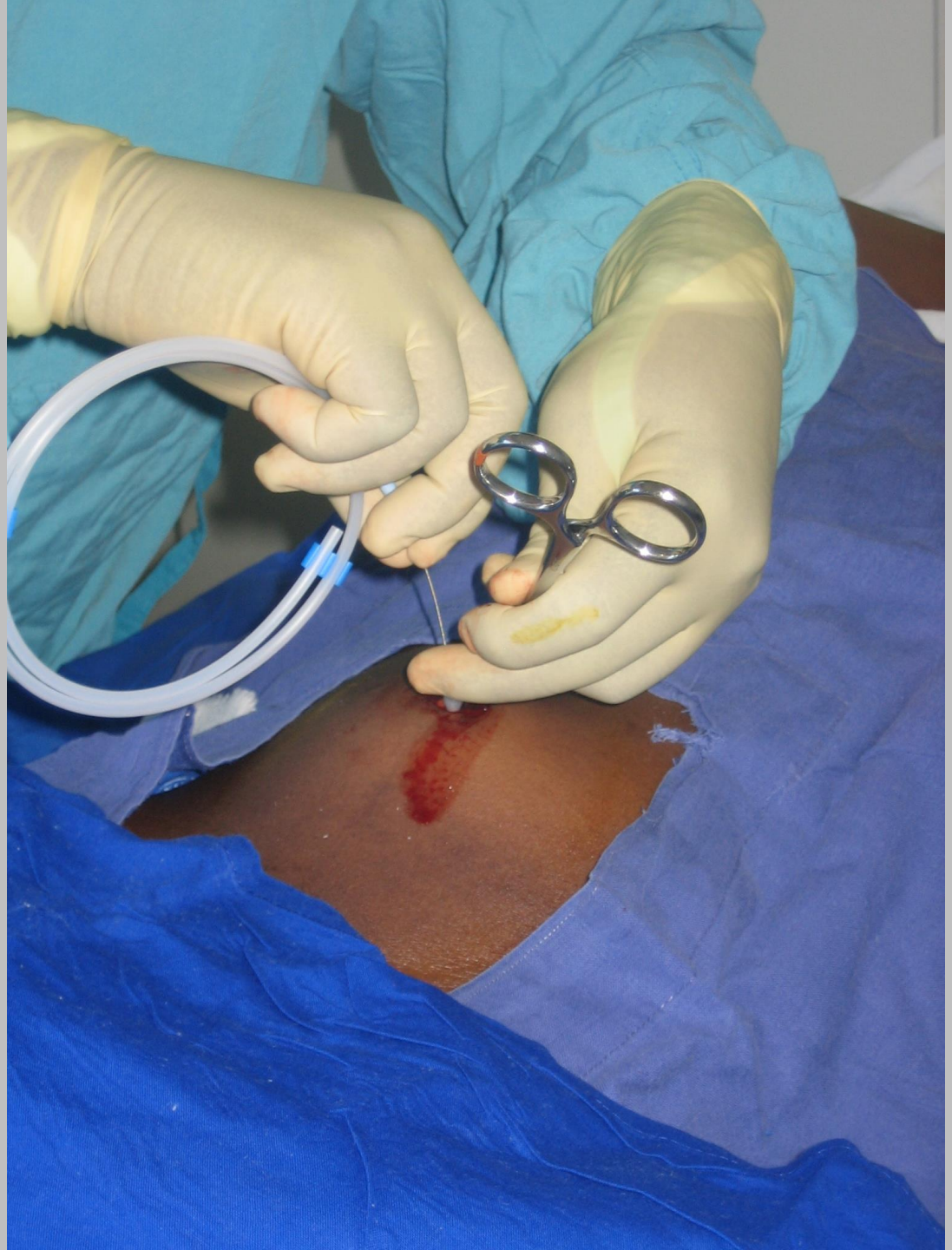






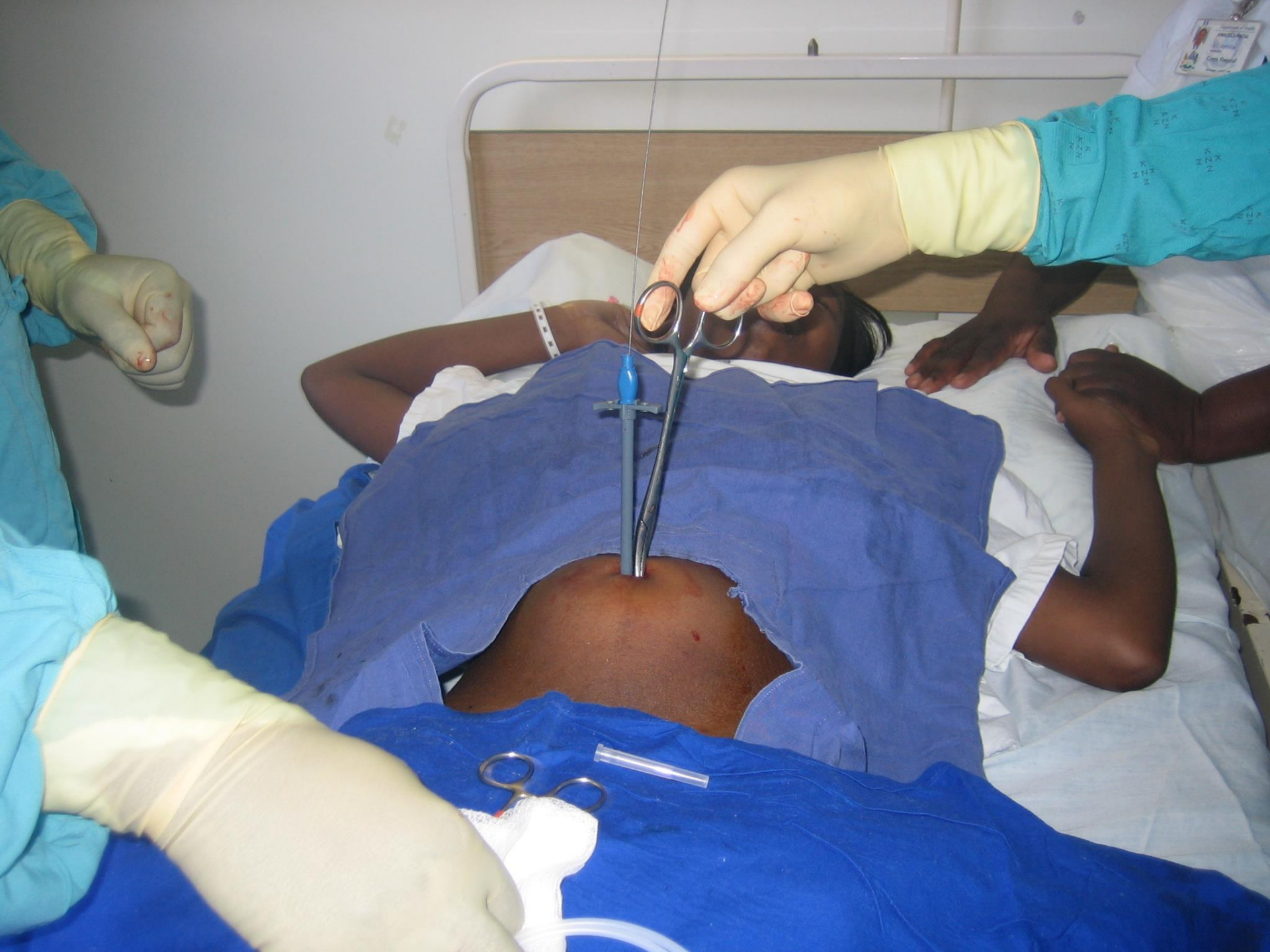


- Attach a 500ml bag of warmed 0.9% saline to the canula
- It should flow continuously
- If drop by drop then probably not in peritoneum or canula is kinked – remove and try again

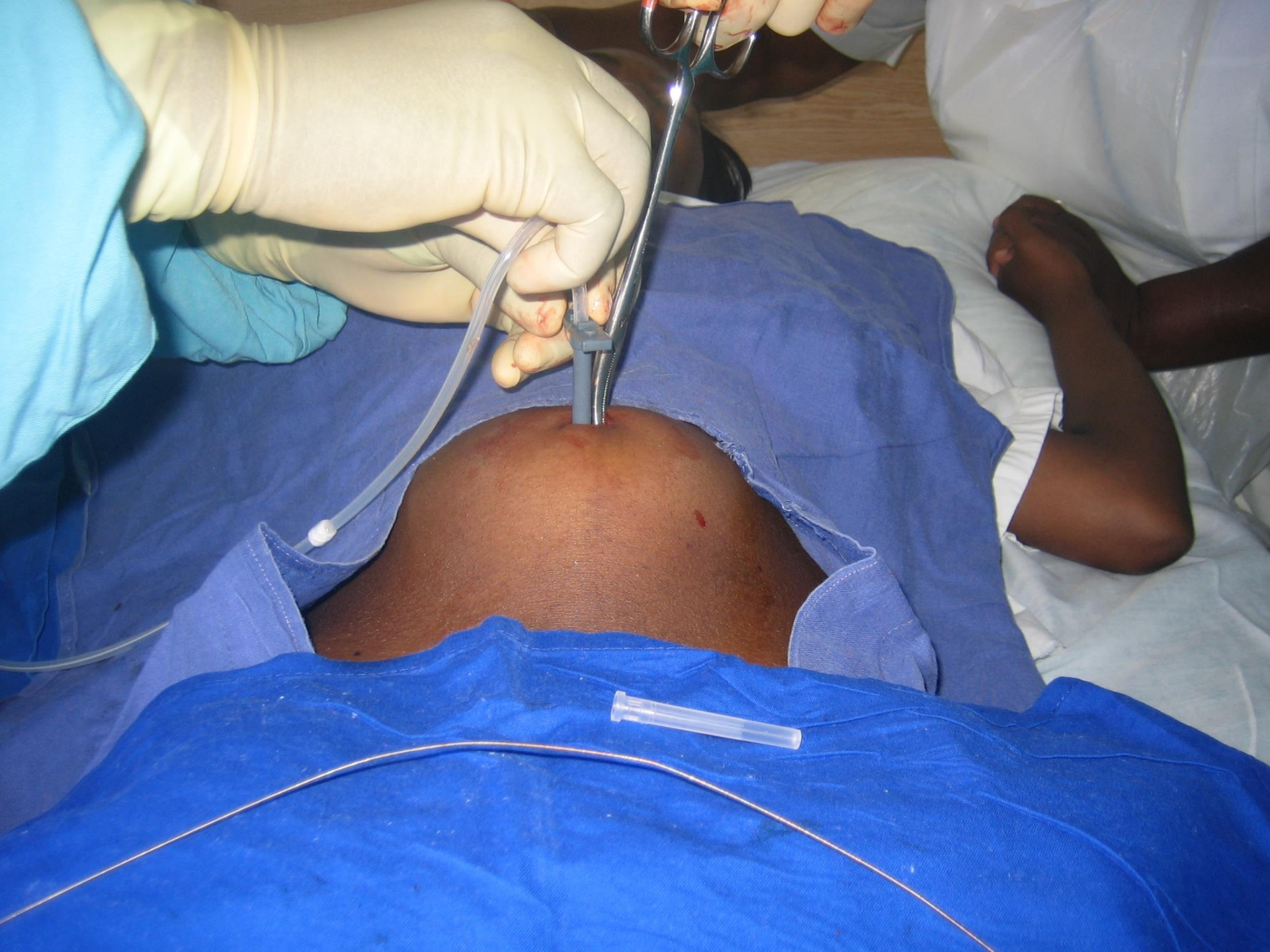


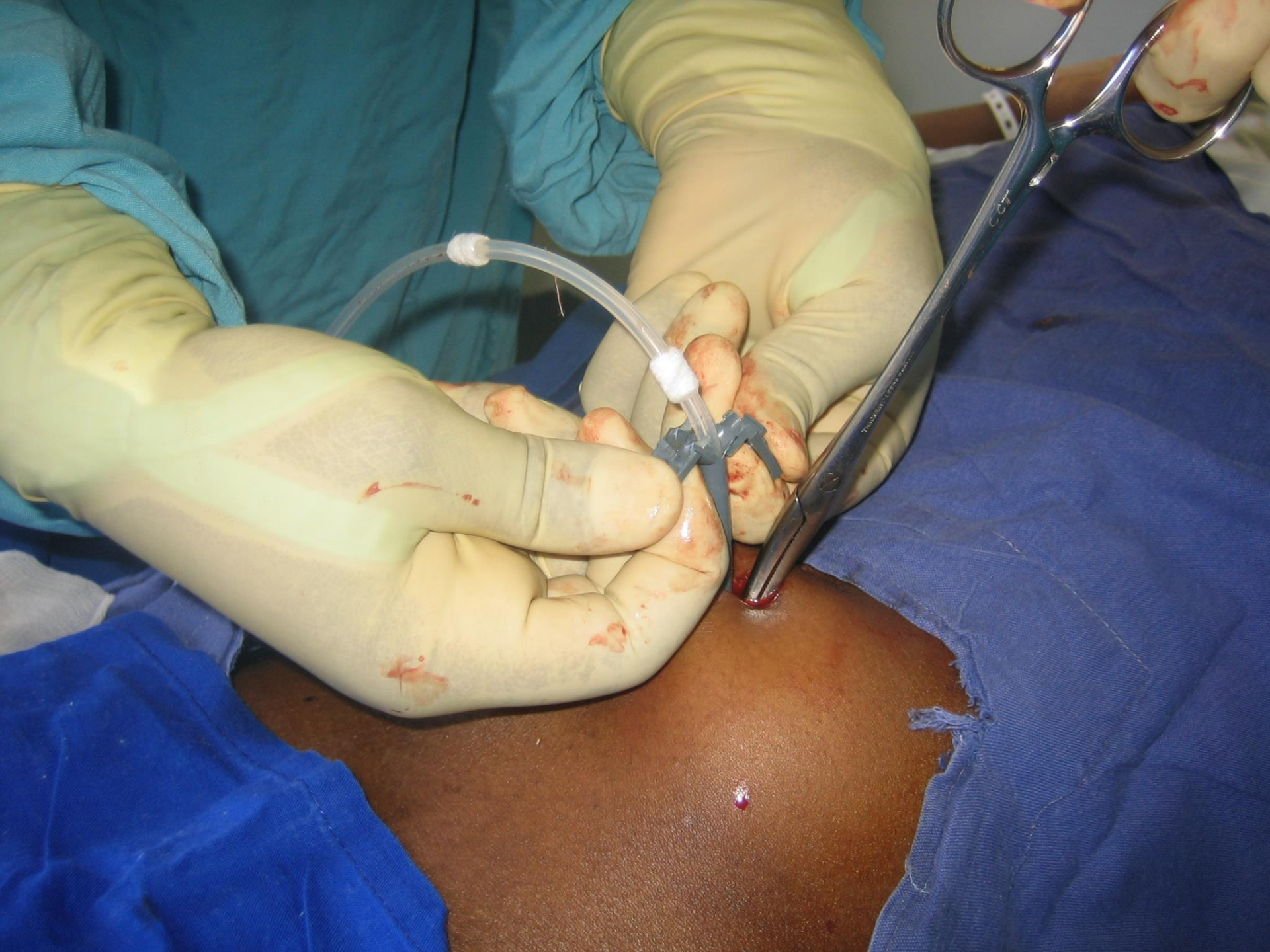
If resistance – stop!

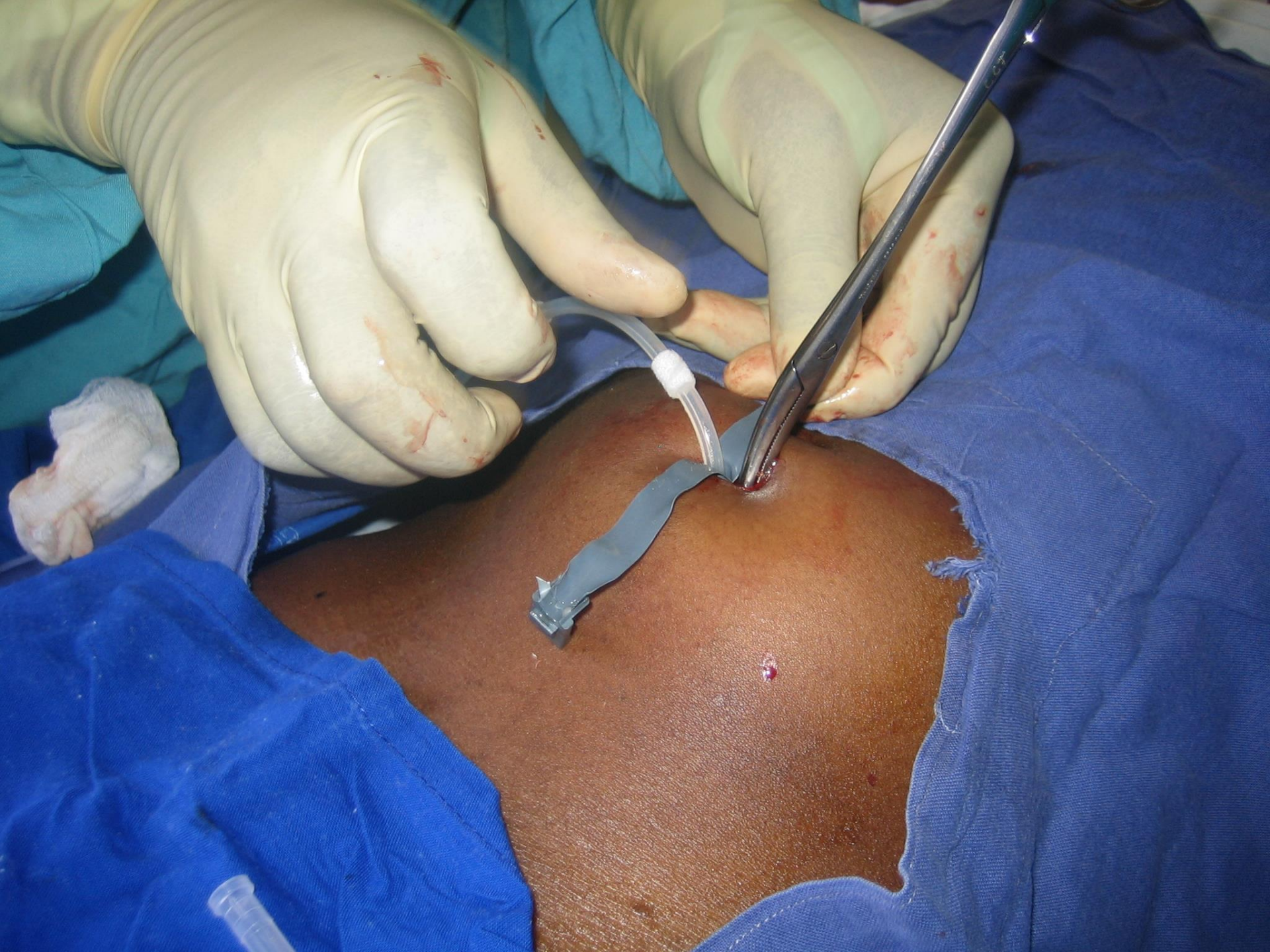
- Are you in the peritoneum?
  - Reconnect bag of warm 0.9%. Does it flow freely?
  - If yes gently apply pressure to guidewire, if it does not recoil then feeds easily continue
  - If recoils immediately then start again



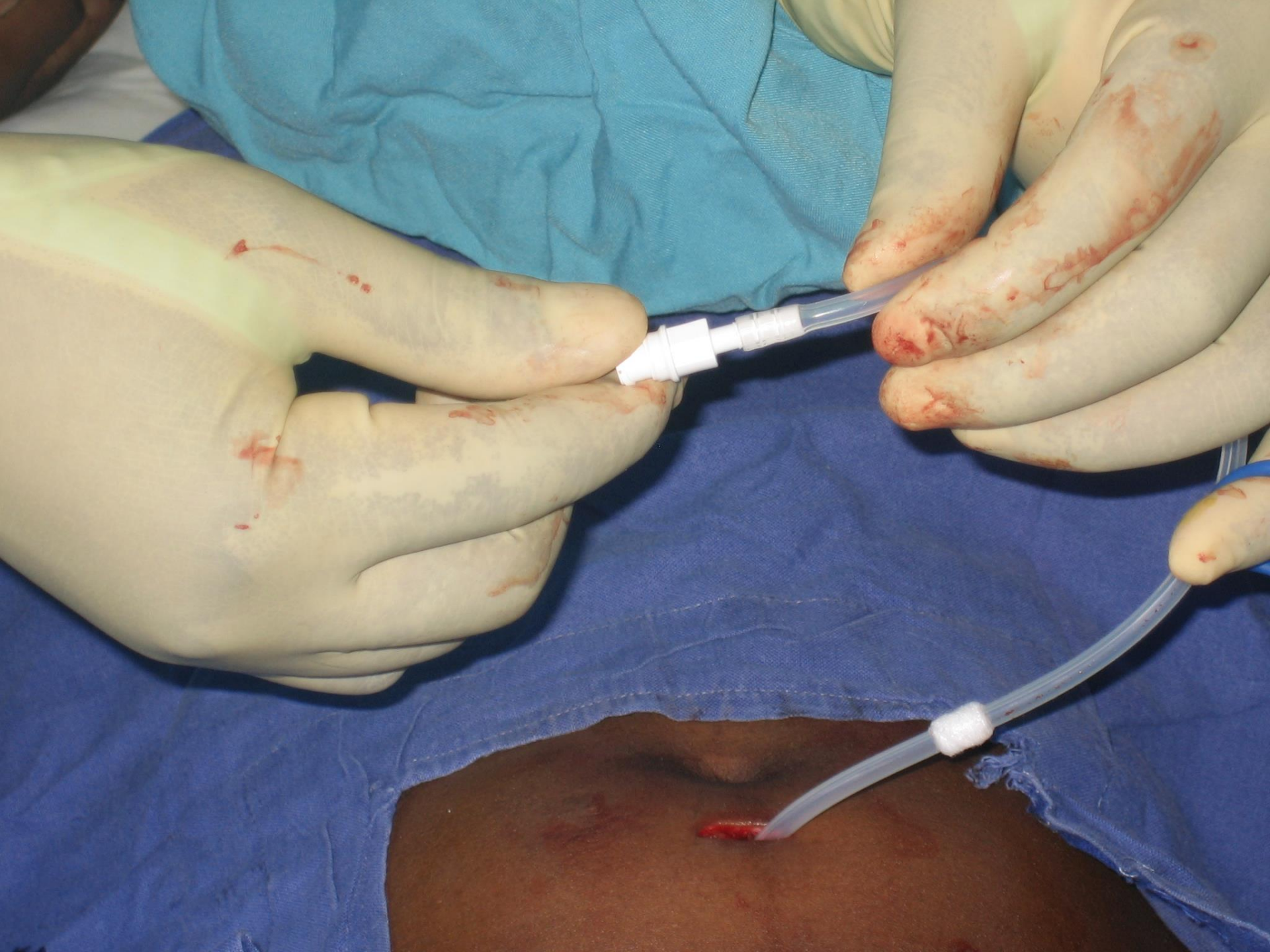
- Soak cuffs in saline
- KY (sterile) aqueous lubricant jelly to tip

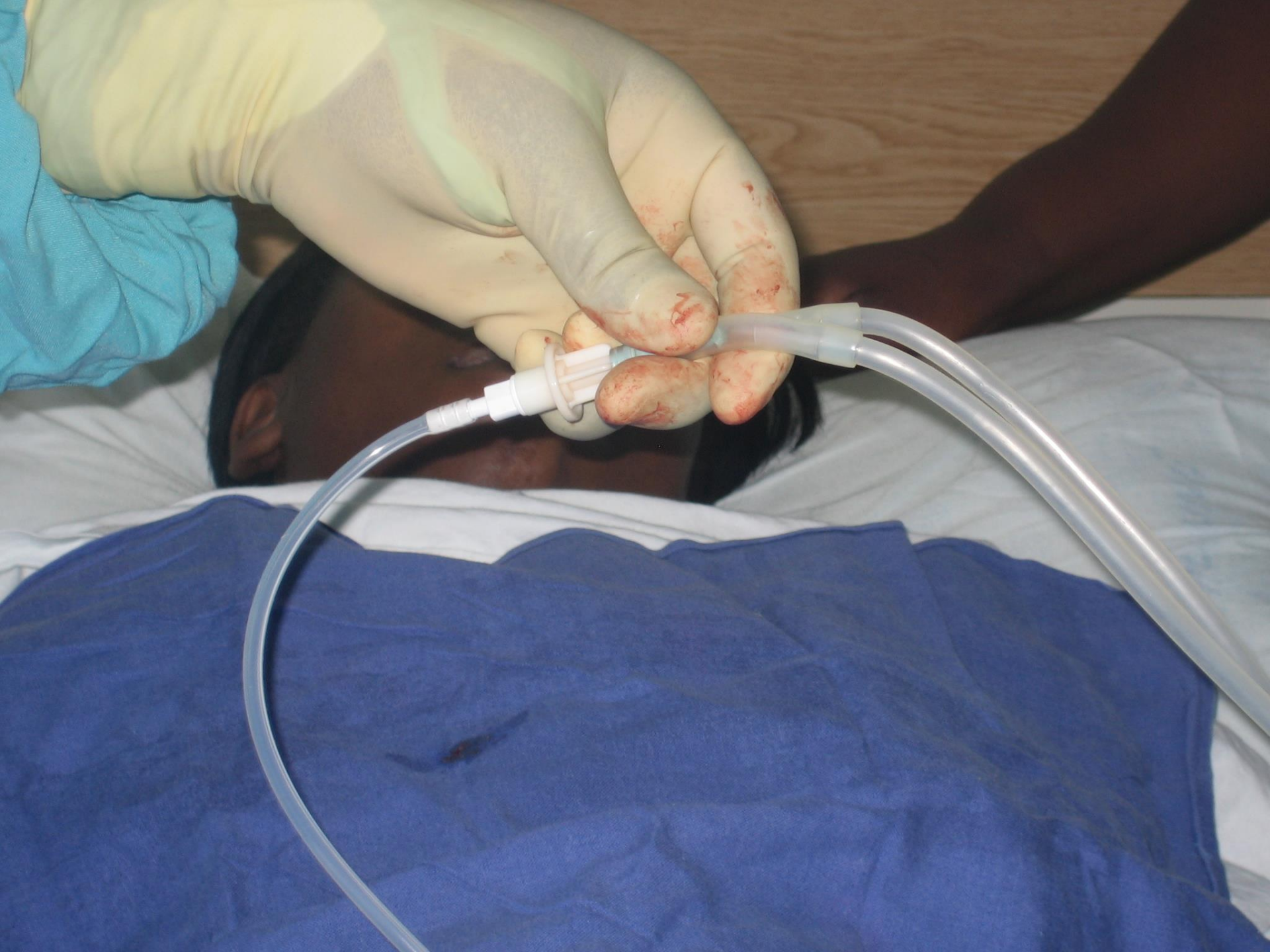


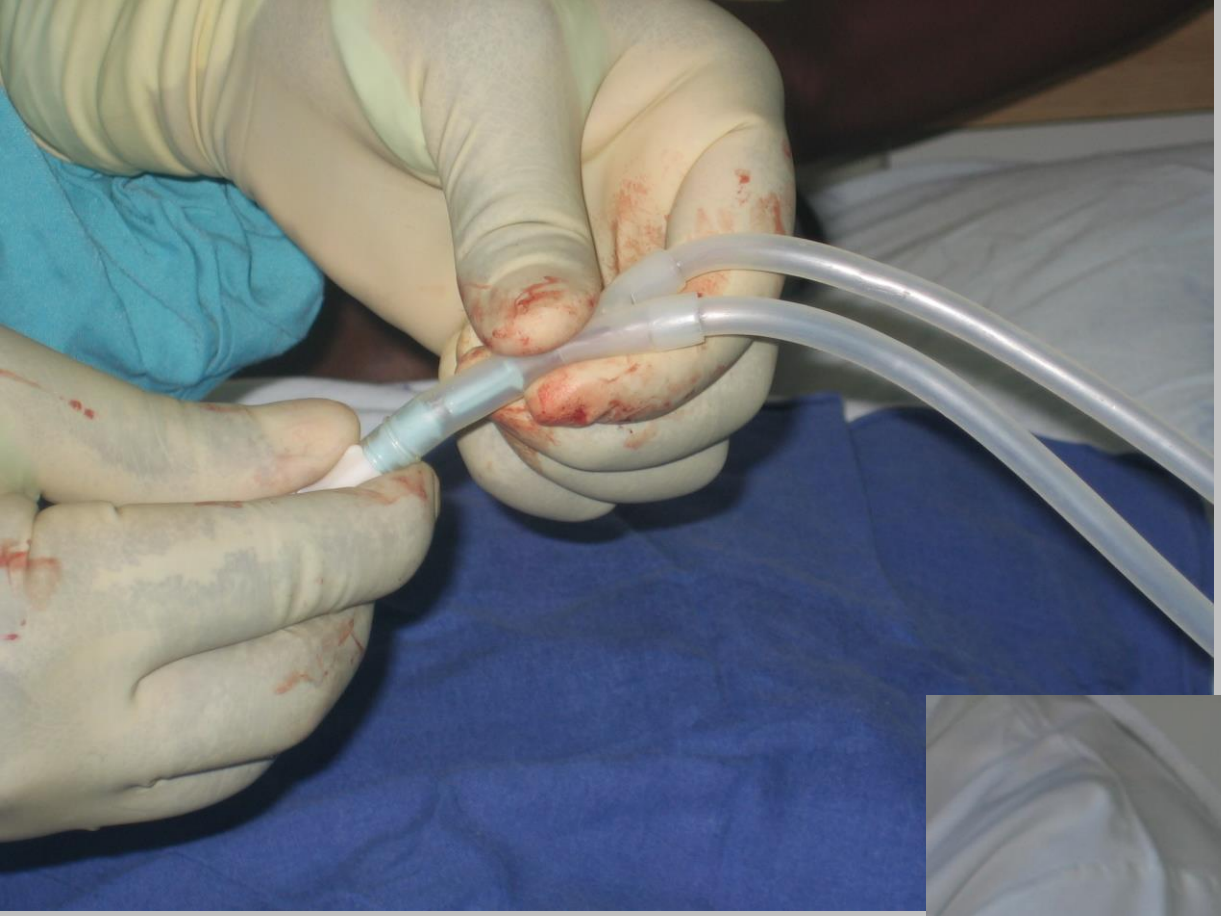


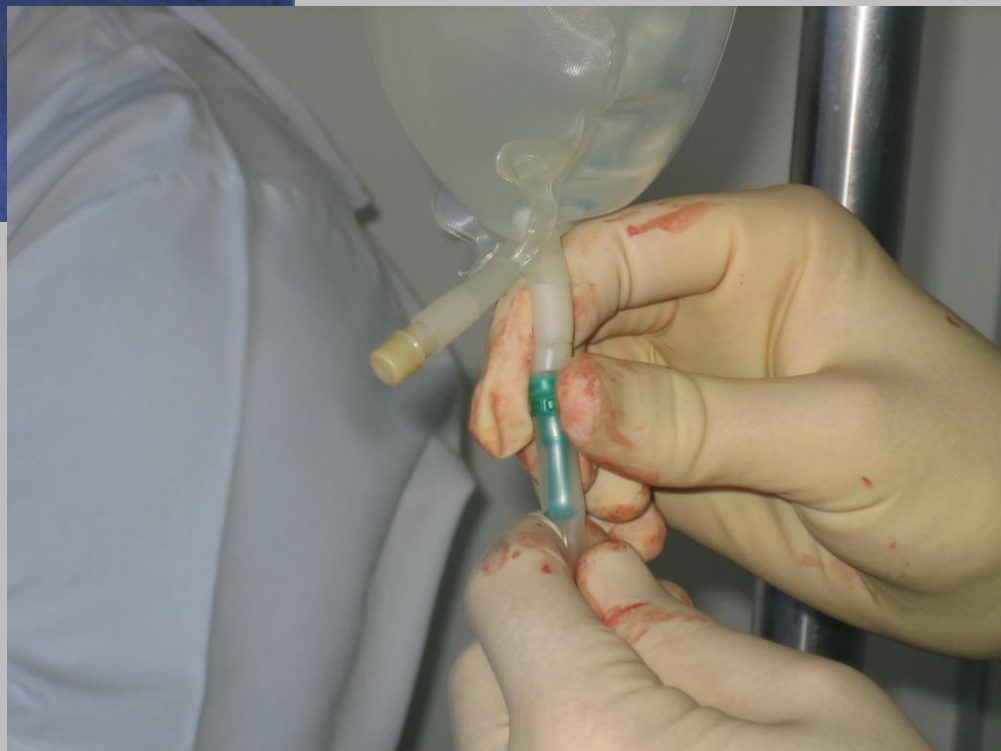


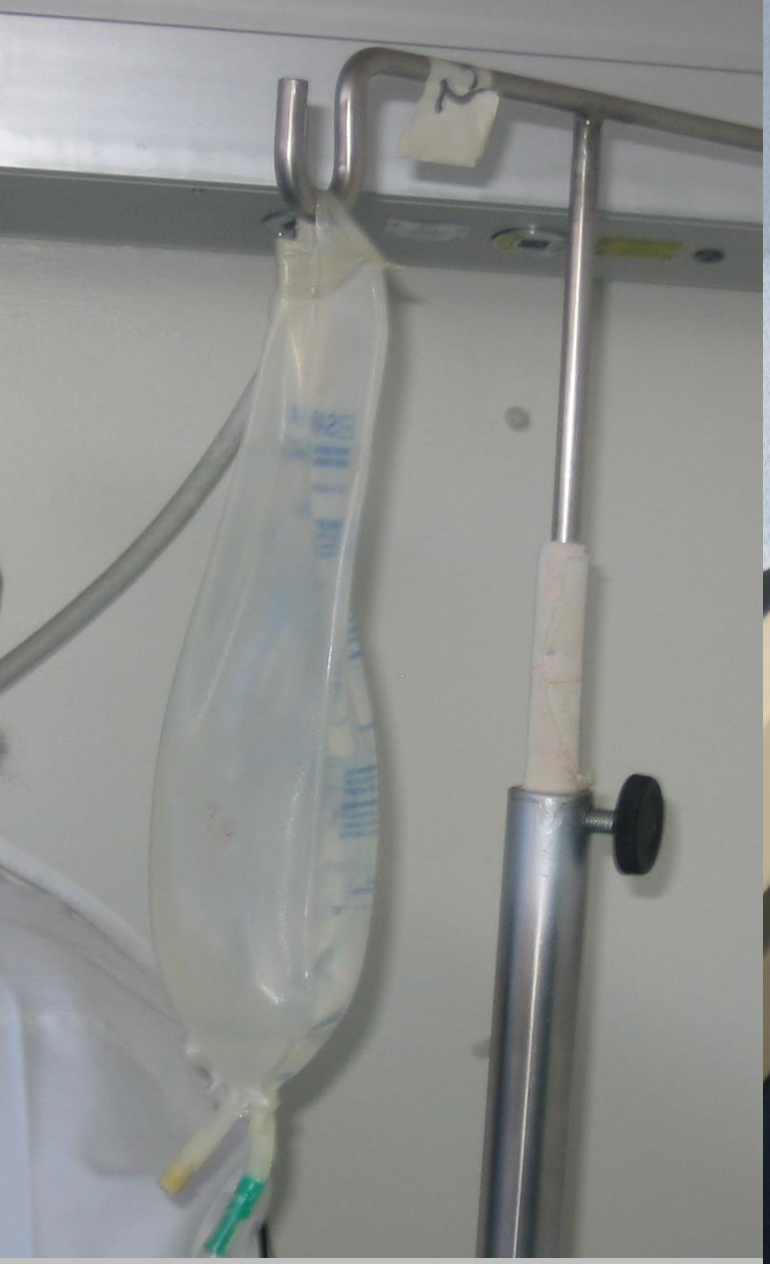
- 1st Cuff as close to linea alba as possible
- Ensure no kink

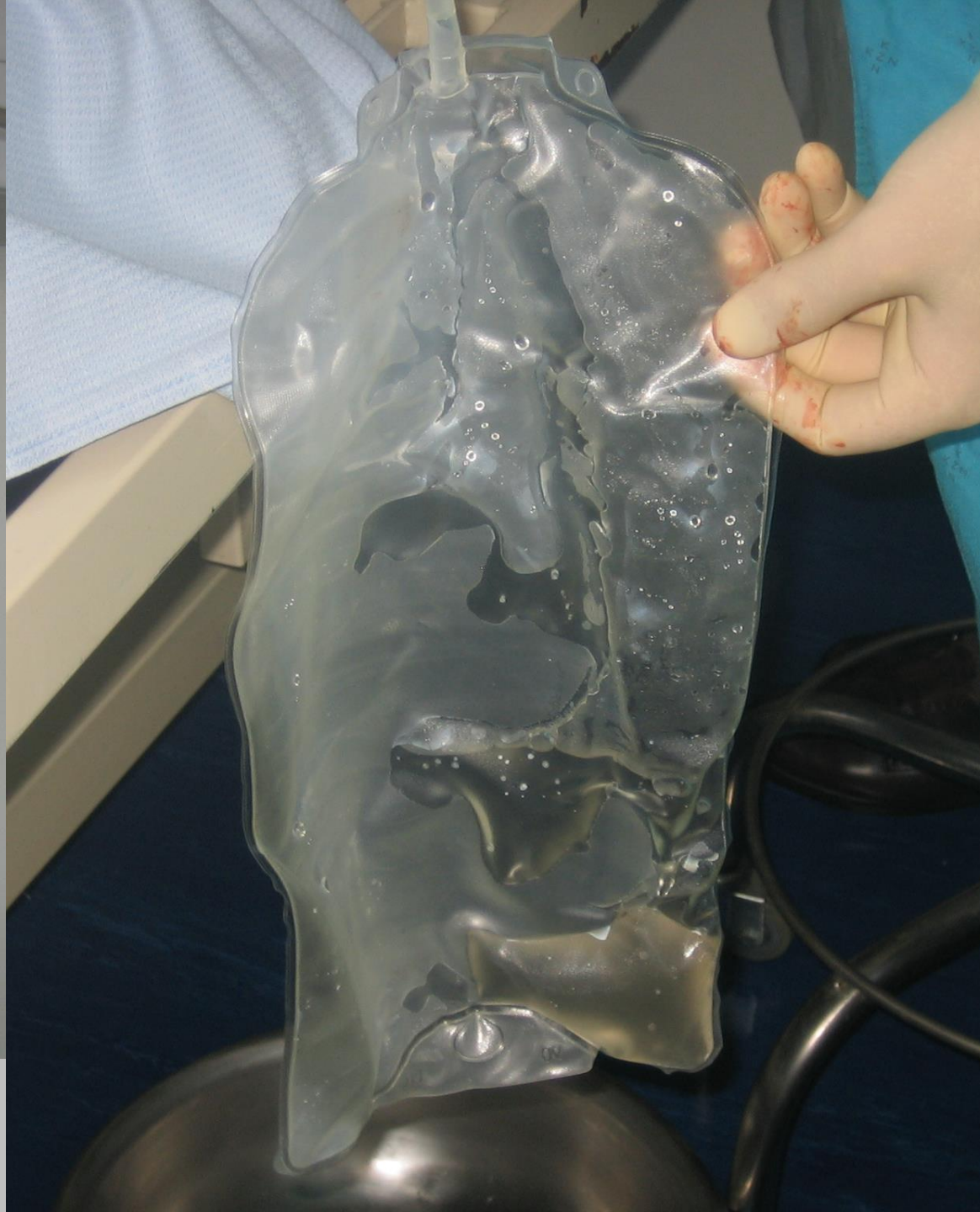


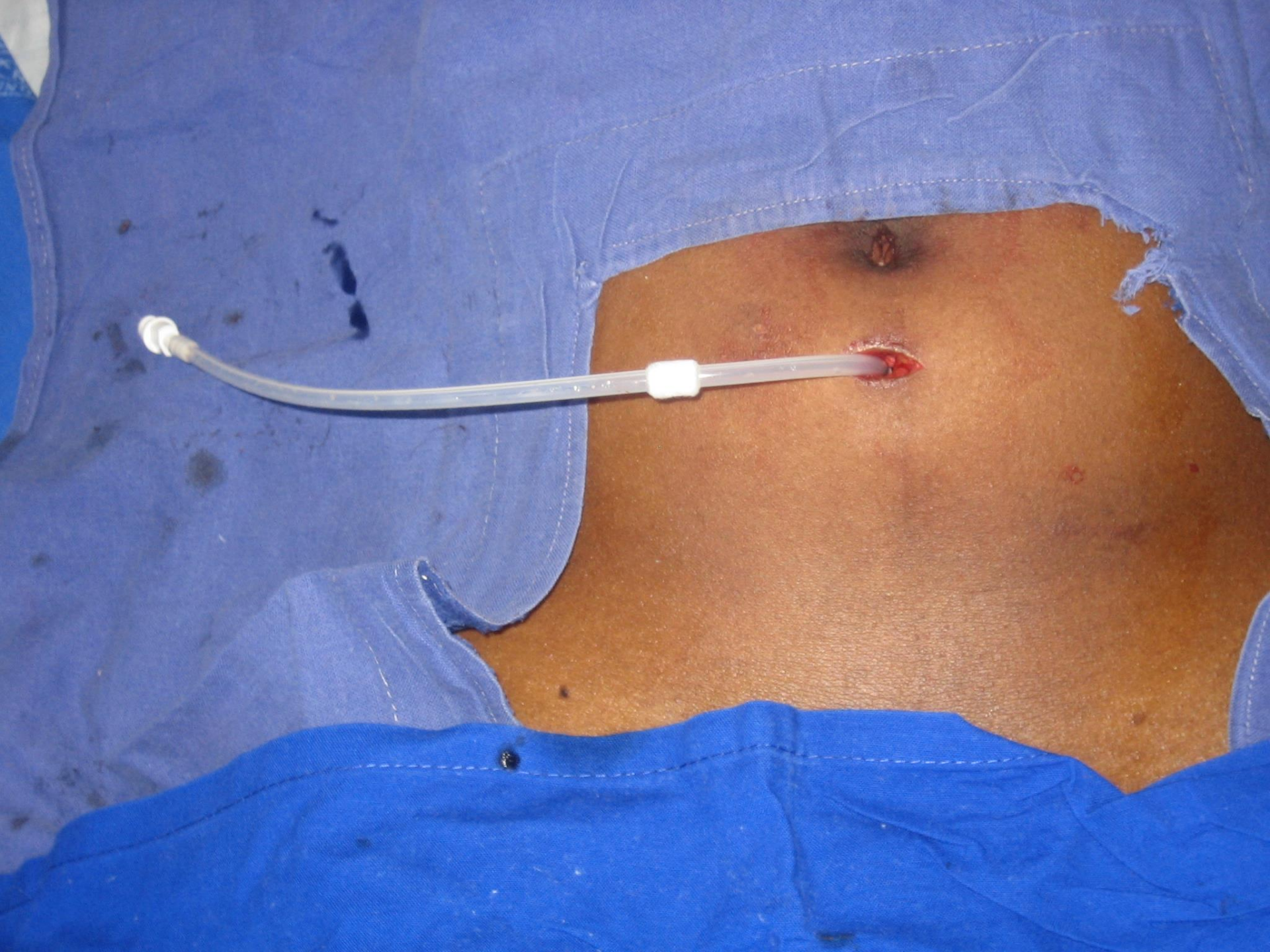


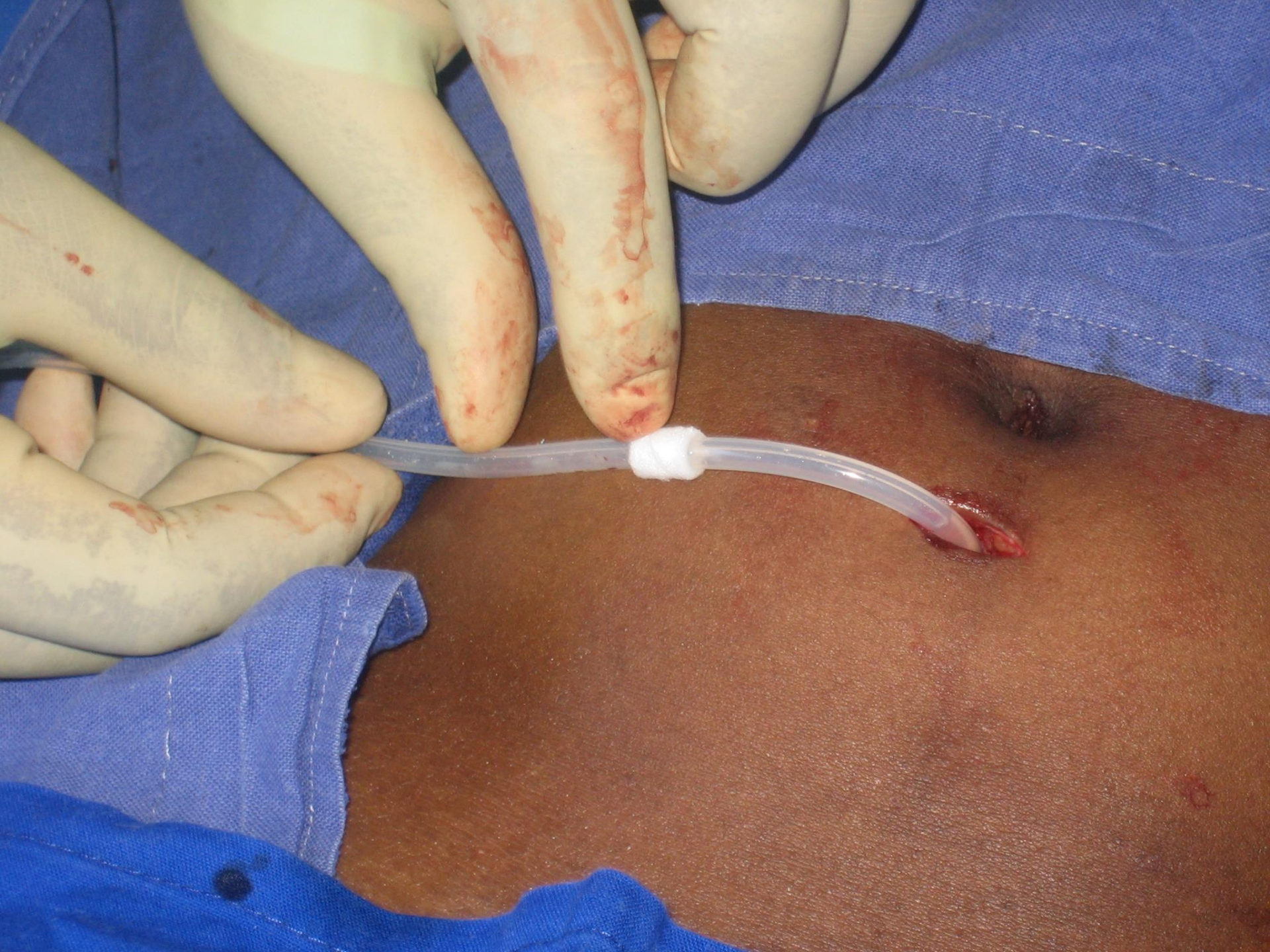


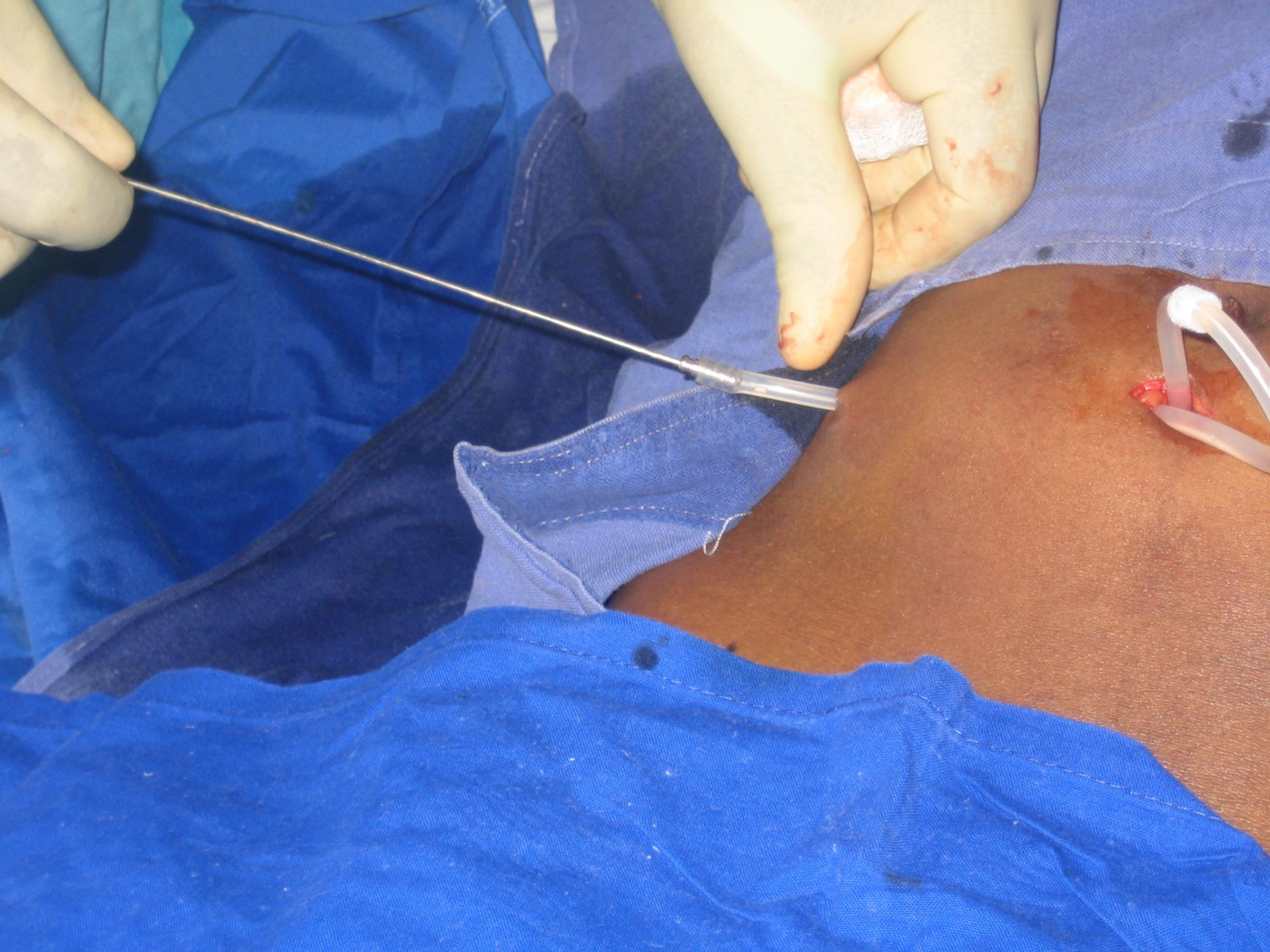


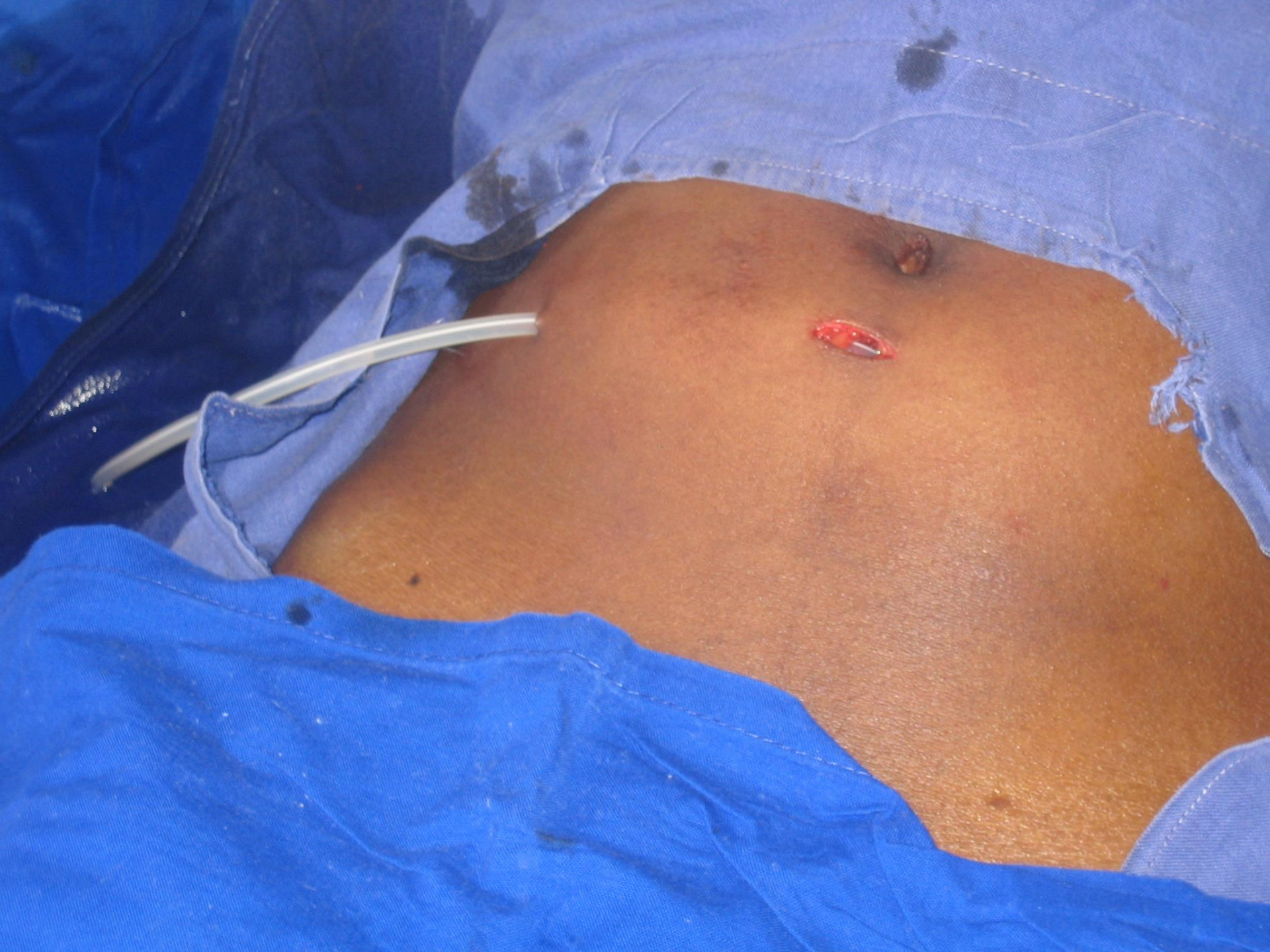


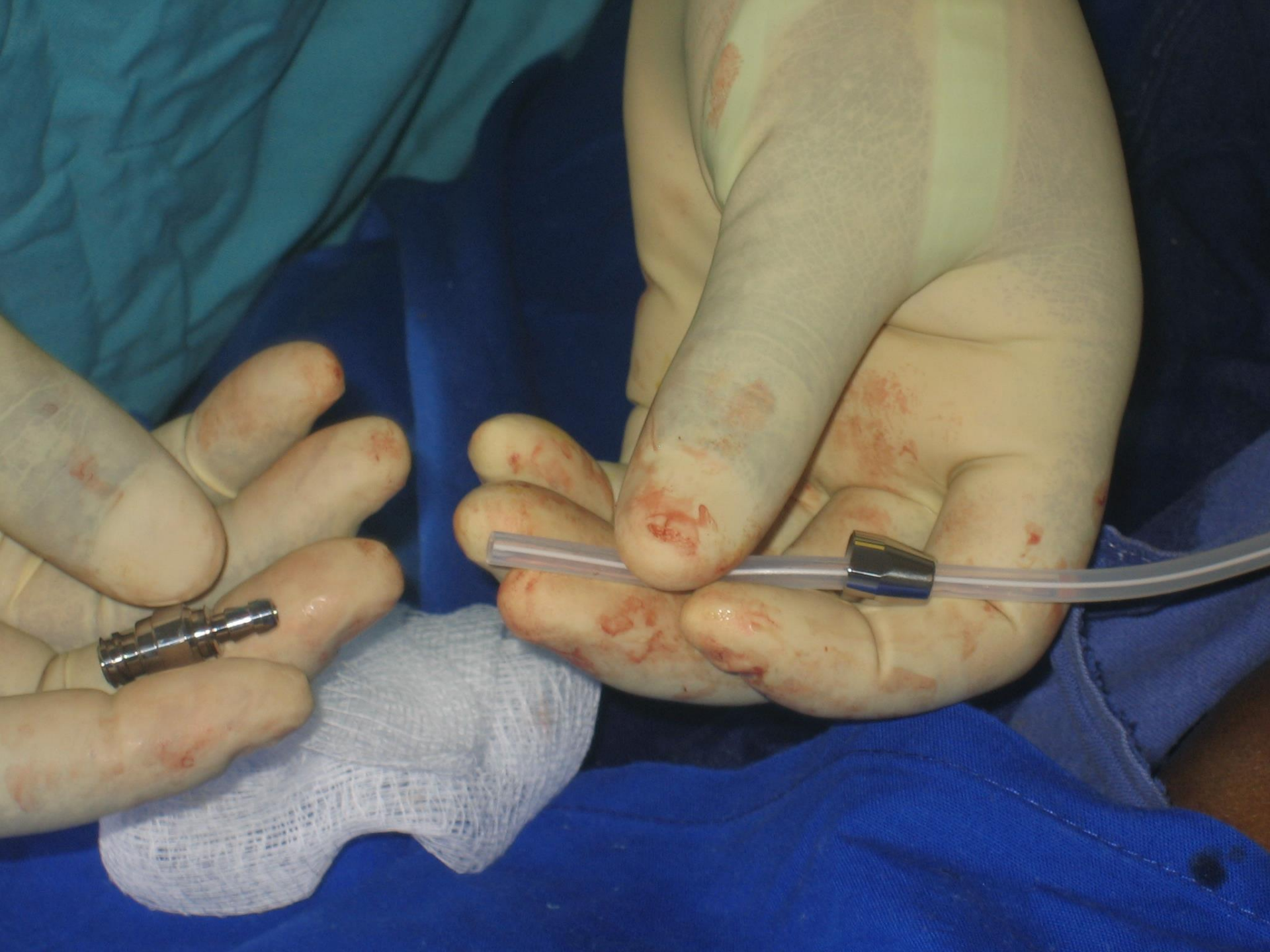


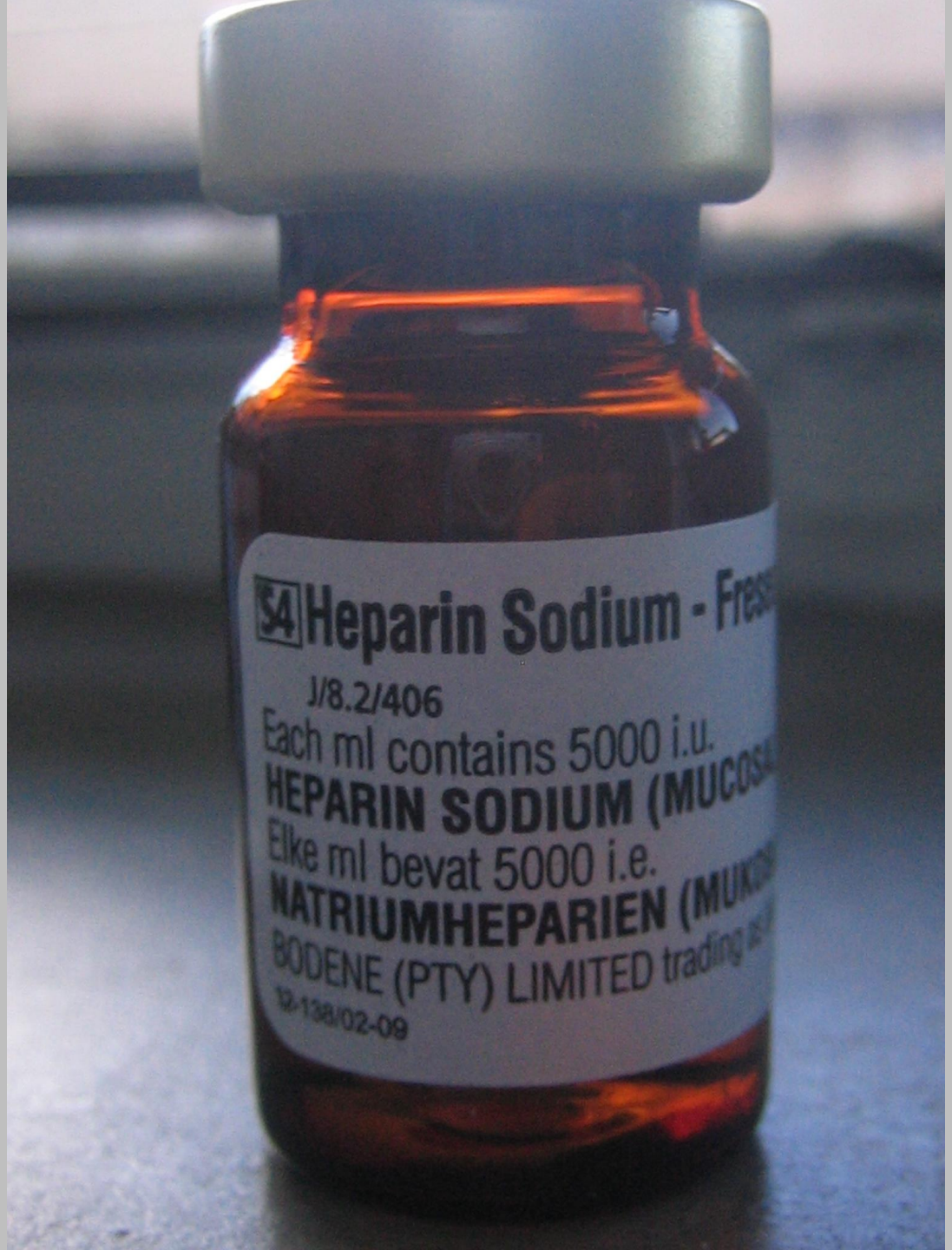








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J/8.2/406
Each ml contains 5000 i.u.
HEPARIN SODIUM (MUCOS
Elke ml bevat 5000 i.e.
NATRIUMHEPARIEN (MUK
BODENE (PTY) LIMITED trading a
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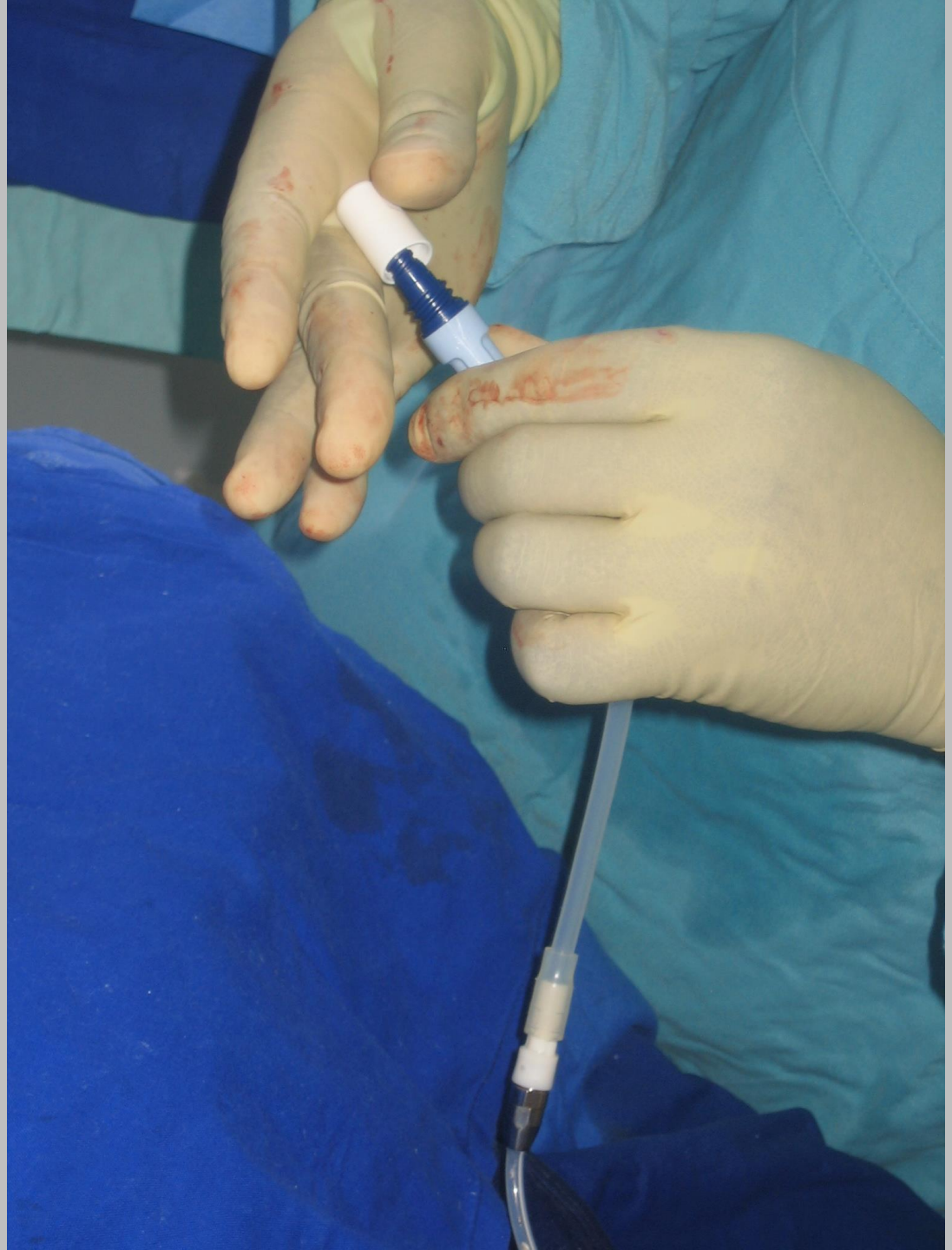

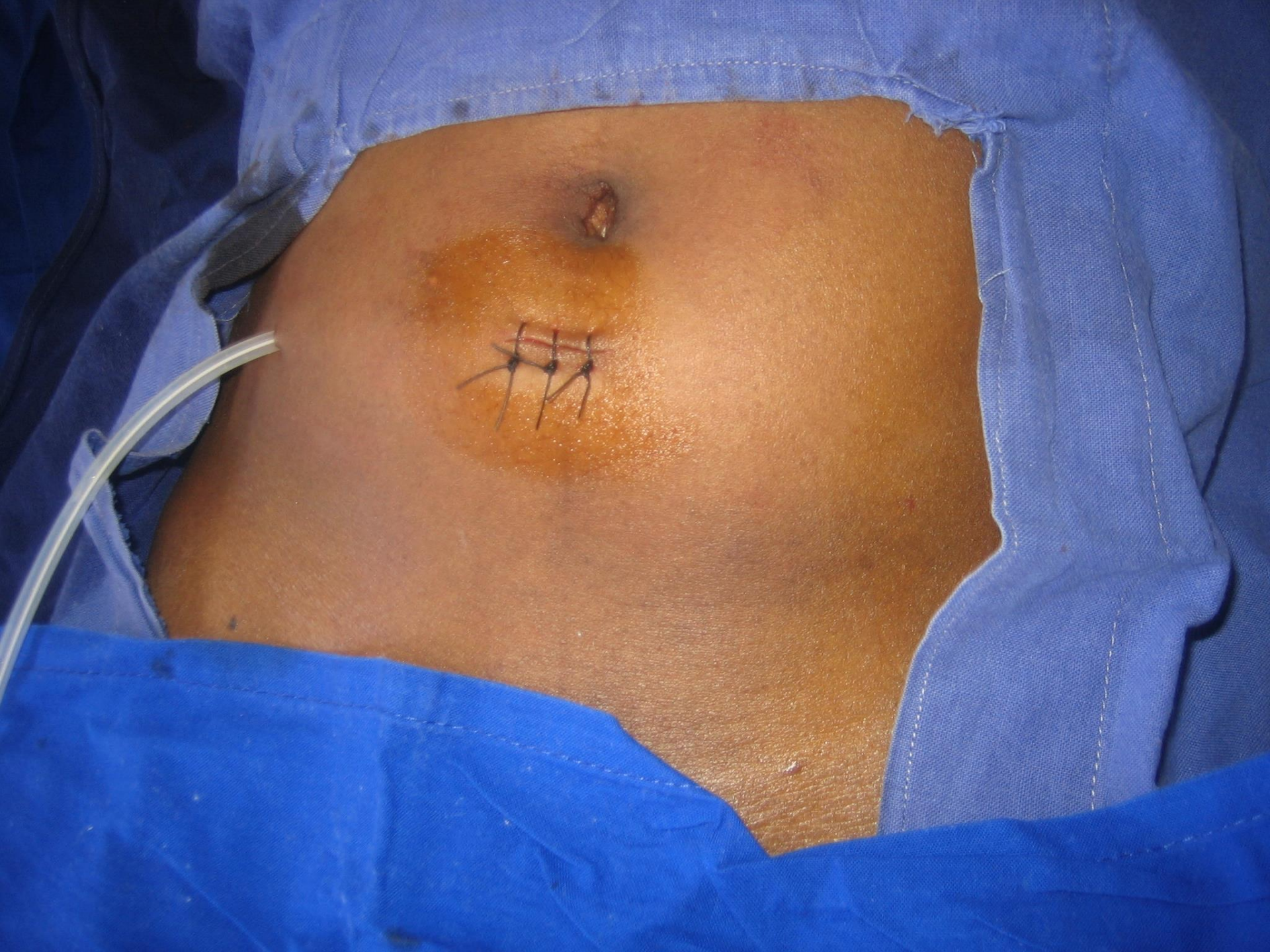

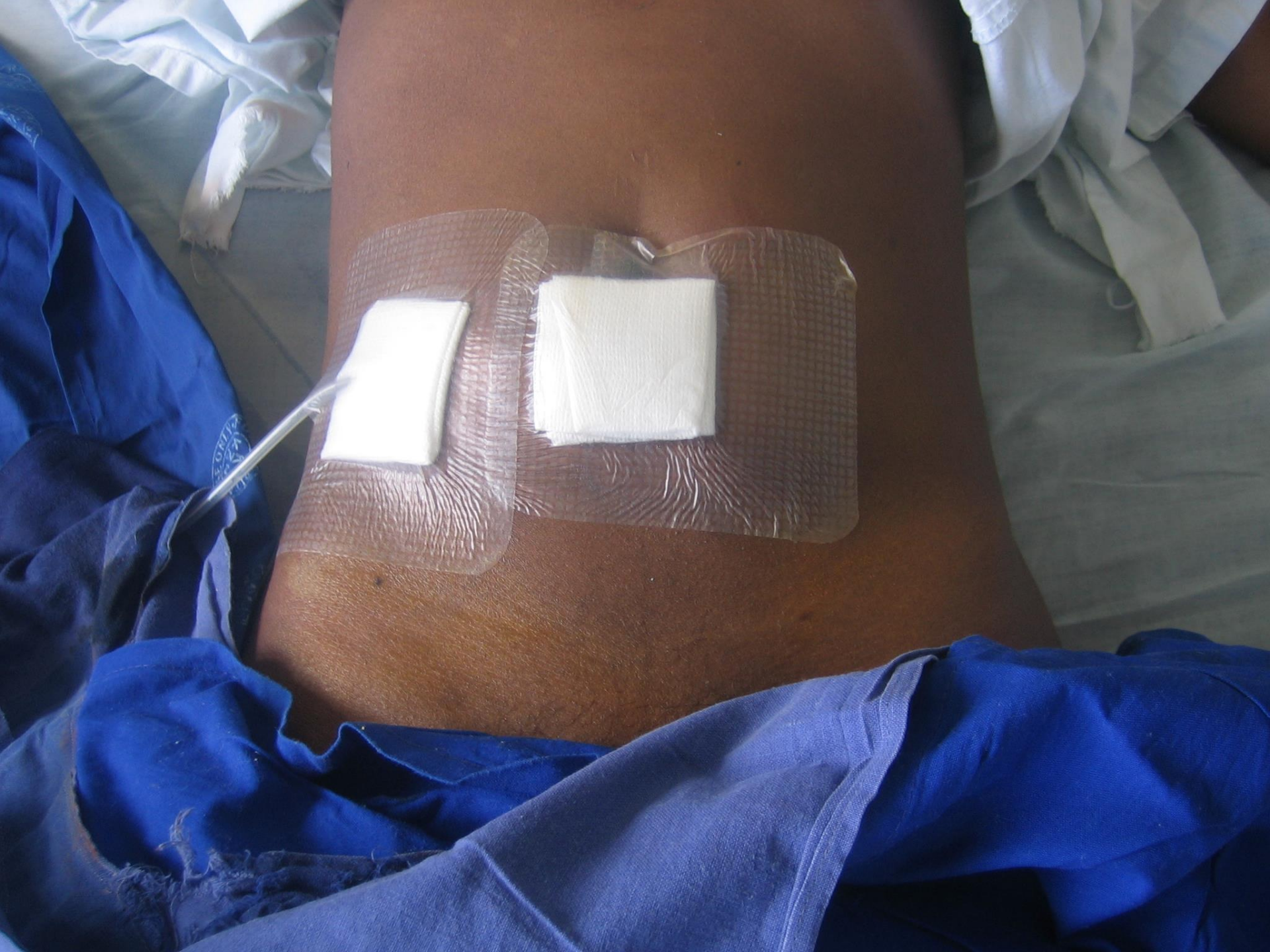

Post procedure goals

- Exit site and surgical wound free of infection
- No displacement of catheter
- Good flow of peritoneal dialysis fluid

Recommendations

- Do not suture exit site
- Treat nasal Staph carriage
- Do not remove dressing for 1 week unless visibly blood stained or exudate
- Trained nurse to dress the wound after cleaning with saline or chlorhexidine (sterile gloves)

Immobilise !!!


A
B
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Importance of generating data

SYL Refresher course and Train the Trainers Workshop

Guatemala 2023






INTERNATIONAL SOCIETY FOR PERITONEAL DIALYSIS

ISN
INTERNATIONAL SOCIETY
OF NEPHROLOGY

IPNA

World Kidney Day™

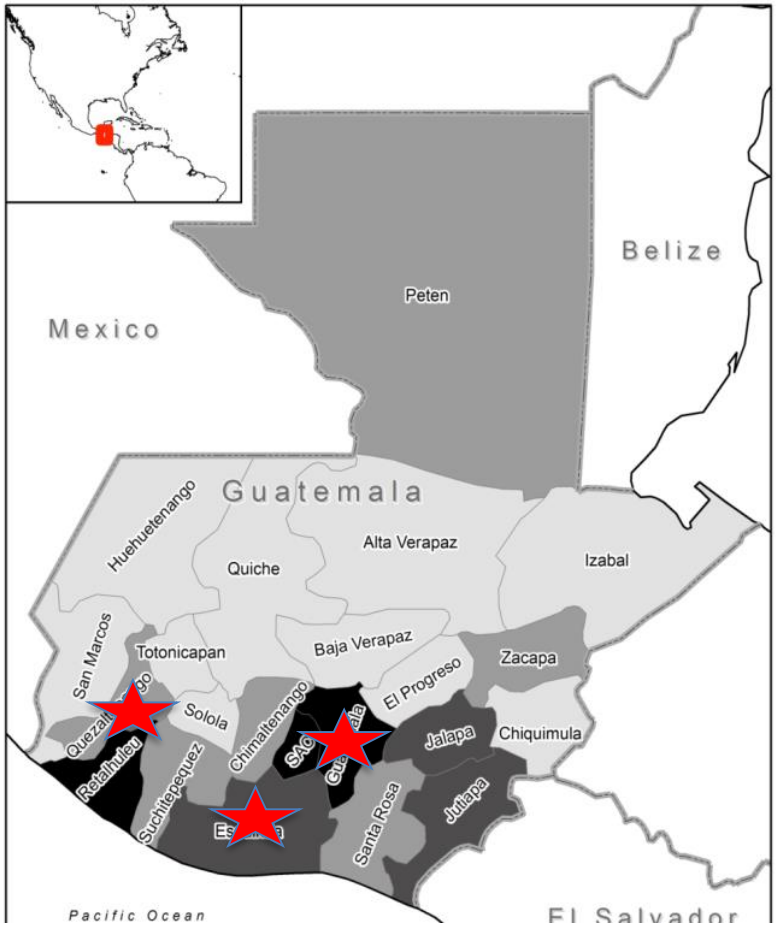
Fundanier
Fundación para el Niño Enfermo Renal

Mission: To develop sustainable programs using peritoneal dialysis (PD) to treat AKI in resource poor countries.

Goals: To work in low-resource health settings to help establish and maintain hospital centers for care of AKI through:

- **Hospital Development**
- **Training and Education**
- **Community Awareness**
- **Advocacy**
- ***Data Collection***

Cross Sectional Study

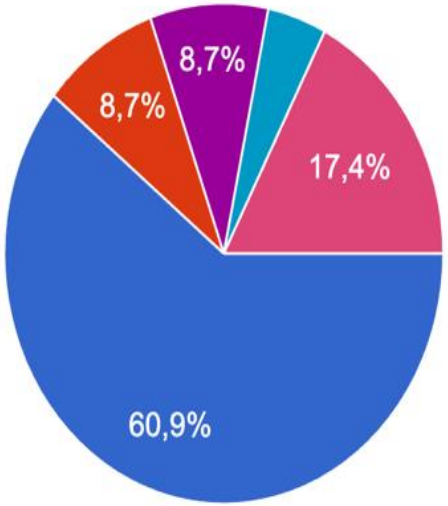


- In Guatemala
- 4 months, 8 hospitals
- Ex fellows
- AKI: need for KRT
- N = 23
- Dr. Mynor Patzán

Distribution: 8 hospitals

3. Hospital de Referencia

23 respuestas

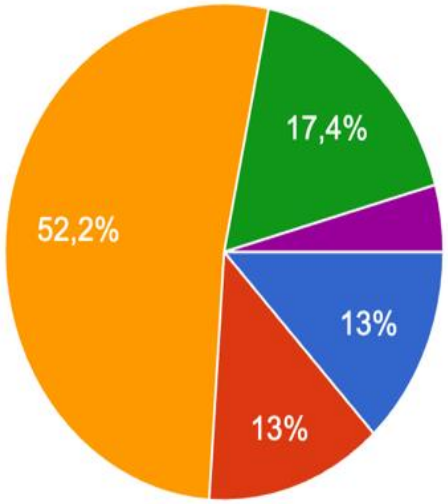


- Hospital Roosevelt
- Hospital Infantil de Infectología
- IGSS Zona 9 Ciudad Capital
- Hospital de Quetzaltenango
- IGSS de Quetzaltenango
- Hospital de Escuintla
- Hospital de Totonicapán / Hospital Coatepeque
- IGSS Escuintla

Age distribution

1. Grupo Etário

23 respuestas

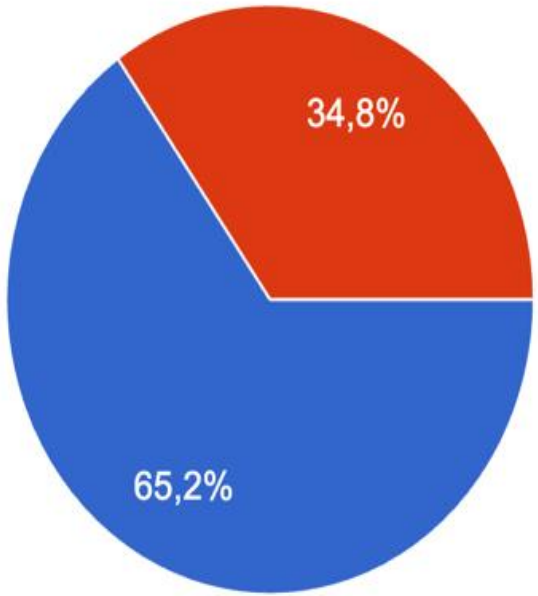


- RN Prematuro
- RN a Término
- >1 mes - 5 años
- 6 - 10 años
- 11 - 15 años
- > 15 años

Gender

2. Sexo

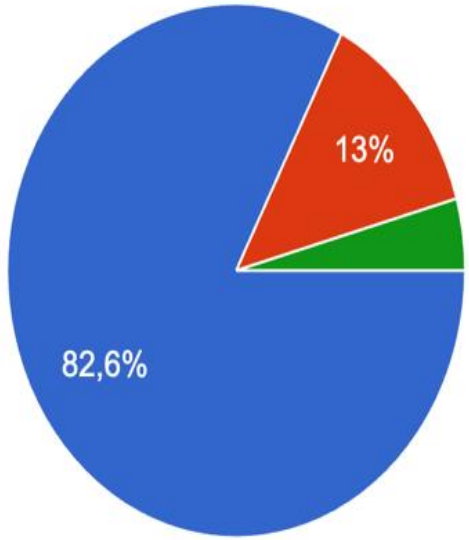
23 respuestas



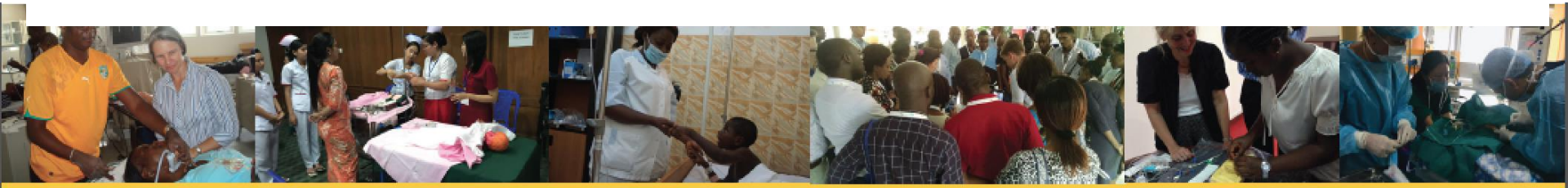
Etiology of AKI

7. Causa de daño renal

23 respuestas



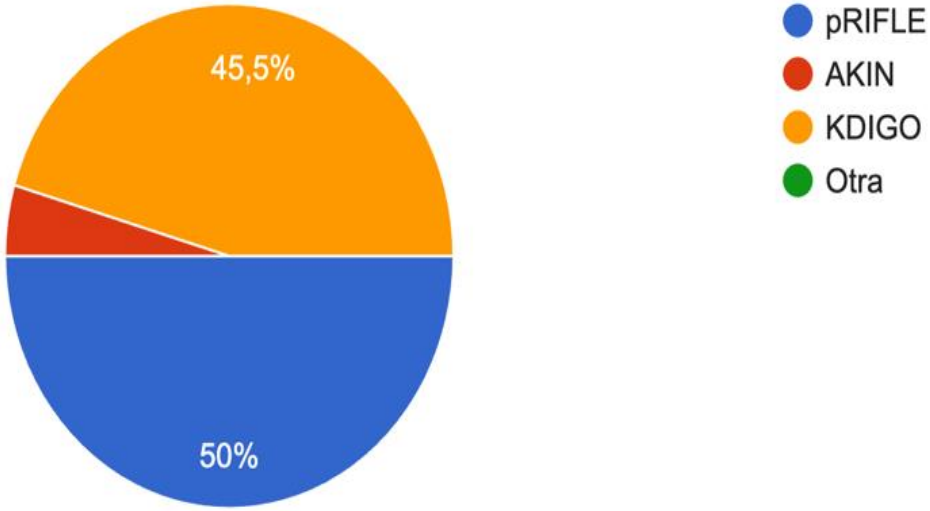
- Sepsis/Choque Séptico
- Choque Hipovolémico (SDA, Vómitos, Deshitración, Hemorragia)
- Trauma
- Intoxicación (tóxicos, medicamento, venenos, rabdomiólisis)



Type of Score/Classification

9. Clasificación de Daño Renal

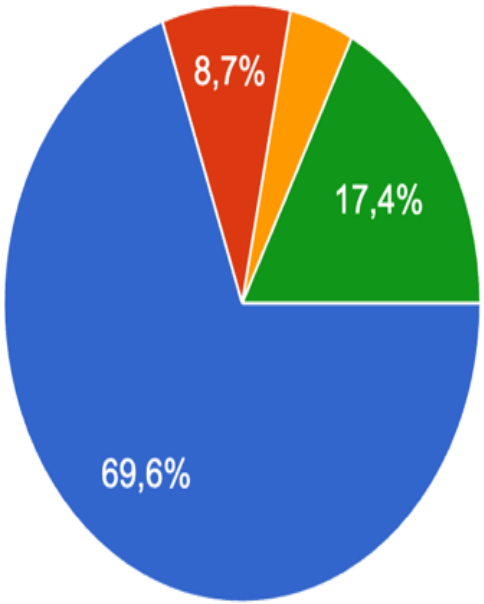
22 respuestas



Indication for KRT

6. Indicación de TRR

23 respuestas

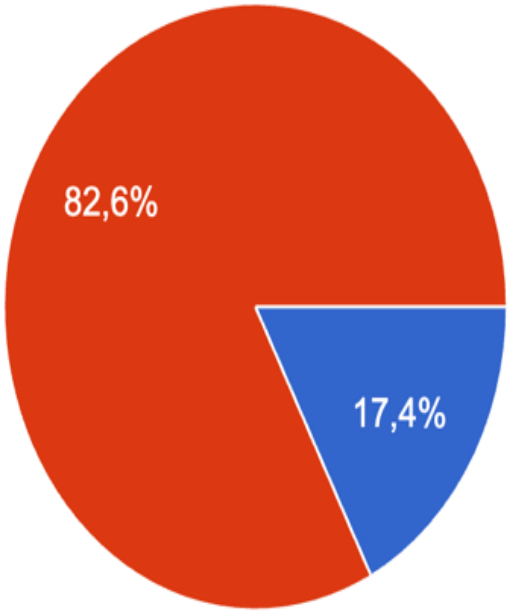


- Edema/hipervolemia
- Acidosis Metabólica Refractaria
- Hiperpotasemia
- Sx Uremico/hiperazoemia
- Intoxicación medicamentos/toxinas/ venenos
- Requerimiento por Nutrición

Type of KRT used

5. Tipo de Terapia de Reemplazo Renal (TRR)

23 respuestas



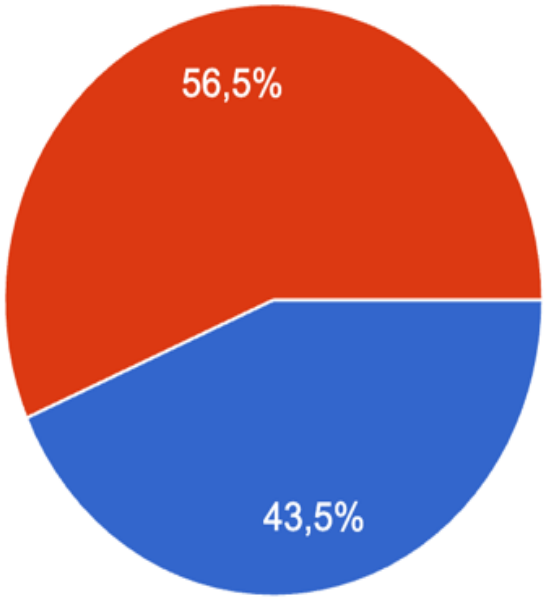
- Hemodiálisis
- Diálisis Peritoneal
- Hemofiltración
- Hemodiafiltración

Outcome of AKI event

Bad outcome 13/23 (56%)

10. Evolución de la Insuficiencia Renal Aguda

23 respuestas



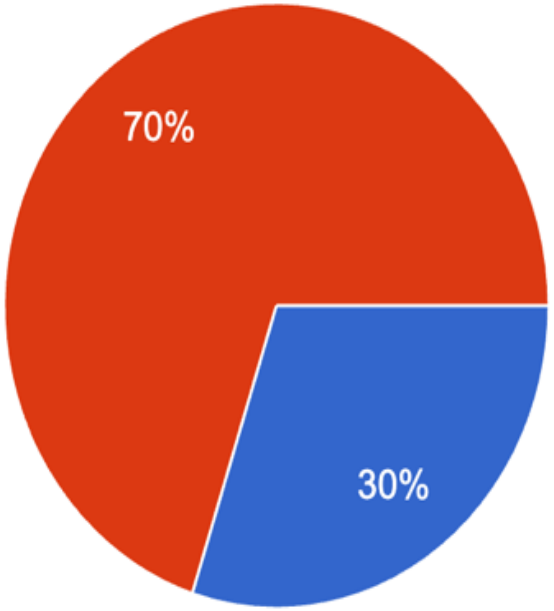
Resolved: 10
No resolved: 13

Mortality

9/23 (39%)

11. Pacientes que No Resolvieron la IRA

20 respuestas



- Resolved: 10
- No resolved: 13
  - Renal failure: 4
  - Dead: 9 (9/23)

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IPNA

ISN

A partnership to deliver care for acute kidney injury in the developing world






Reto 1:
Registro Nacional de AKI

- Continuar el corte transversal durante 2023.
- Presentar los datos parciales en Puerto Rico

Reto 2:
Cuestionario Post Curso

- En 3 meses
- Dra. Nancy Rivera

Reto 3:
“0 para el 25”

- Entrenar a 15 personas cada uno en 2023
- Llenar el registro de verificación
- ¡Podemos ayudarnos!

Reto 3:
“0 para el 25”

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GRACIAS






Saving Young Lives

Logistics and Data Collection

Overview

- Logistics
- Data Collection – SYL Surveys

Logistics – Overview & Suggested Timelines

- SYL workshops are typically 1.5 – 2 days.
- We suggest a minimum of 6 months planning time (or more if possible).
- Identify the venue and invite participants as early as possible (minimum 4 months before)
- When identifying participants, you can ask for recommendations from your colleagues (or SYL). You may also want to consider asking potential participants to write a short statement on why they want to attend the training before inviting them.

Logistics – Venue & Supplies

- Venue suggestions: your hospital or another you can secure for free or minimal cost
- Supplies: provided by faculty, or donated

Top Tips:

- Explore if the course can be connected to an existing congress or other event either as a pre-course or as part of the main programme.
- Consider applying for funding to run your workshop (for example an IPNA grant) and asking pharmaceutical companies to donate supplies.

Logistics - Participants

- We recommend participants come in pairs from their hospitals as this can help with implementation post-training. (Participants can include specialties outside of nephrology as well as nurses)

- We recommend 20-24 attendees for a workshop. (30 max)

- If participants are coming from outside the country the workshop is in, they may need a visa.
  - Depending on the country, this can sometimes be an issue, so consider this in the identification of pairs, and invite people early if they will need visas.

- Be prepared for last minute drops to the course. Consider having some last-minute attendees (but from the area local to the workshop so you do not need to plan for travel / accommodation).

Logistics – Information to Provide to Participants

- Date and times of course
- Location of course (with a map)
- Location of accommodation (if provided), details on type of room (e.g. if shared) and it's proximity to the venue
- Reimbursements / costs covered (if appropriate) and details on how to get the reimbursement
- Names of faculty
- Course agenda
- If participants will receive a certificate of completion at the end
- Pre-course survey
- Any deadlines for tasks participants need to complete prior to the course (confirming attendance, completing survey, etc)

Logistics - Faculty

- For a workshop with 20-24 attendees, we would suggest 4 faculty.
- Similar to participants, invite faculty early to ensure their availability.
- You are also welcome to approach SYL to ask if we can provide 1-2 faculty, but we cannot guarantee.

Logistics – Participant Expenses

- Dependent on
  - where you opt to hold the workshop / where your participants are based
  - funding you have available
  - If you think participants would be able to cover their costs for the workshop

- As an example, we typically cover:
  - Travel (based on participant location with respect to venue – we do try to ensure this amount covers the entire cost of their travel)
  - We try to ensure the venue for the training and accommodation is walkable
  - Accommodation (we do have participants share room)
  - Breakfast (provided via accommodation), lunch and coffee breaks
  - Visas
  - If a workshop is connected with a congress or other event, we try to ensure this is covered for them

Logistics – Faculty Expenses

- The same expense amounts we cover for participants we cover for faculty.

Data Collection

- **Surveys Timeline**
  - Pre Course – Send once invitation is accepted
  - Post Course – Ask the participant to fill out at the course or email just after
    - If sending the post course survey via email, send it before the certificate (if you are sending one)
  - 6-12 months post-course
    - Send via email. If no reply, follow up by phone

Top Tip**:** Use a survey platform like Microsoft Forms to more easily collect and analyze the data.

Data Collection – Survey Purposes

- Pre Course – Collect information on:
  - Background of attendee (Name, city, center name, specialty, etc)
  - Details on the services and needs in their country, city and center (e.g. access to water, PD catheters, pd fluid, etc)
  - Skills analysis

- Post Course – Ask the participant to fill out at the course or email just after
  - Understand how well the training addressed their needs
  - Capture any feedback on the course
  - Understand any challenges they may already be able to identify in implementation

- 6-12 months post-course
  - Capture how well they've been able to implement the training
  - Understand the barriers they have, and what further training they may require

*We can share templates of all of these surveys which you can adapt to the training you run and your context.

Data Collection

- Translate the language into the one you think participants are most comfortable answering in.
  - For example, we ran a course in Bogota and the surveys were all available in English and Spanish.

- Please share any key findings, suggestions for improvements, etc. with SYL.


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Thank you!

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¿Cómo prepar un curso de entrenamiento?

Guillermo Hidalgo, M.D.

Hackensack Meridian Health

Children's Network.

Seleccion de encargados de la logistica?

Responsable, capaz, dinamica, de rapida respuesta.

Coordinacion remota y local para aspectos de registracion, audiovisuals, transporte, pagos, etc.

Seleccion de topicos/speakers?

Seleccion es en base a enfoque y prioridades del curso.

Tiempo disponible

Importancia y actualizacion en los topicos

Metodos de educacion

- Presentaciones interactivas y participativas
- Casos clinico, locales or preparados
- Practicas

Trabajo previo

- Questionarios para saber el contexto de practica de los participantes.
- Lecturas requeridas previas al curso
- Responsabilidad de los participantes

Trabajo posterior

- Responsabilidad adquirida, implementacion y ensenanza a otros
- Retos propios a futuro y soluciones
- Reporte de exitos y fallos (solicitud de ayuda/apoyo)
- Reporte de casos en que vidas se han salvado o ayudado.

Many thanks for your attention and support

KIDNEY HEALTH FOR ALL

PREPARING FOR THE UNEXPECTED, SUPPORTING THE VULNERABLE!

World Kidney Day™

#worldkidneyday #kidneyhealth

www.worldkidneyday.org

World Kidney Day is a joint ISN IFK

AKI and DISASTERS : Lessons Learned from Hurricane María and other Calamities in Puerto Rico

Melvin Bonilla-Félix, MD, FAAP, FISN

University of Puerto Rico

Department of Pediatrics

Disclosures

Disclosure of Relevant Financial Relationships	I have no financial relationships to disclose.
Disclosure of Off-Label and/or investigative Uses	I will not discuss off label use and/or investigational use in my presentation.

Objectives

1

Define Natural Hazards and Disasters and establish the difference

2

Review the relationship between poverty and disaster risk

3

Discuss the impact of disasters

- Use our experience in Puerto Rico with hurricanes and earthquakes in the midst of financial and political instability

4

Make recommendations for preparation of dialysis units prior to disasters

Disaster Nephrology

- Area of nephrology dealing with the problems of acute and chronic kidney patients during and subsequent to disasters

Natural Hazards vs Natural Disasters

- Natural Hazards
  - Earthquake, floods, hurricanes, typhoons, wildfires
    - Trigger disasters
- Climate Change
  - Intensify occurrences of hazards
- Vulnerability and Exposure
  - Key determinants of disaster risk and the main drivers of disaster losses

Ismail-Zadeh A. Natural Hazards (2022) 111:2147–2154

Disaster

- “A sudden, calamitous event that seriously disrupts the functioning of a community or society and causes human, material, and economic or environmental losses that *exceeds* the community’s or society’s ability to cope using its own resources.”
  International Federation of Red Cross and Red Crescent Societies (IFRC)
- “An occurrence, disrupting the normal conditions of existence and causing a level of suffering that ***exceeds*** the capacity of adjustment of the affected community.” World Health Organization Department of Emergency and Humanitarian Action (WHO/EHA)

https://apps.who.int/disasters/repo/7656.pdf. Accessed 4 June 2022
https://www.undrr.org/terminology/disaster

Exposure

- The situation of people, infrastructure, housing, production capacities and other tangible human assets located in hazard-prone areas

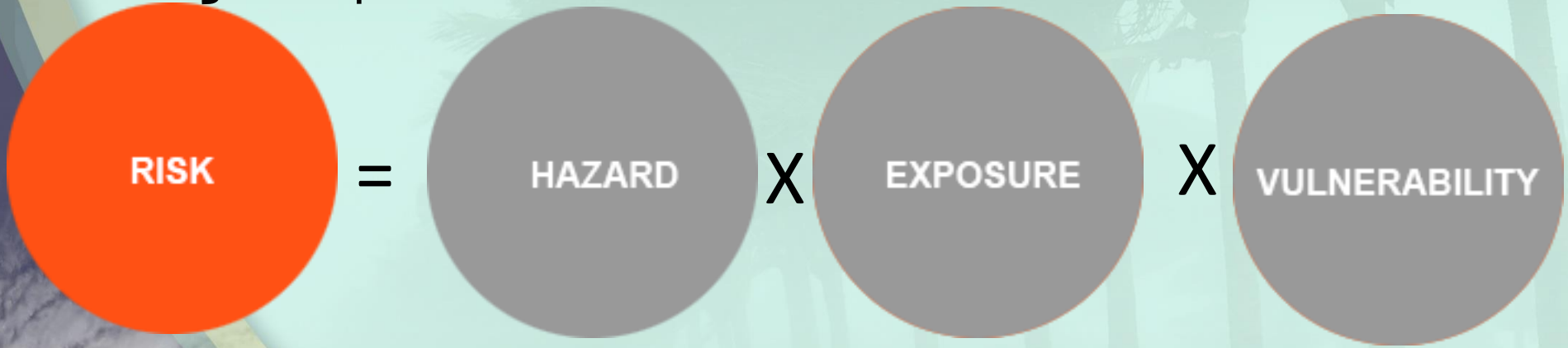
Vulnerability

- The characteristics determined by physical, social, economic and environmental factors or processes which increase the susceptibility of an individual, a community, assets or systems to the impacts of hazards
- The human dimension of disasters
  - The wider environmental and social conditions that limit people and communities to cope with the impact of hazards

https://www.preventionweb.net/understanding-disaster-risk/component-risk/vulnerability

Disaster Risk

Likelihood of loss of life, injury or destruction and damage from a hazard in a given period of time



https://www.preventionweb.net/understanding-disaster-risk/component-risk/disaster-risk

How Natural are Natural Disasters?

Natural Hazards are natural processes that are not ***COMPLETELY*** controlled by humans.

However, a disaster is the product of economic, social, political, and environmental factors that increase the vulnerability of a population by limiting their capacity to cope with the natural hazard. *These factors are the product of human acts and ARE NOT NATURAL.*

(https://www.preventionweb.net/blog/time-say-goodbye-natural-disasters)

Disaster Events Attributed to Natural Hazards

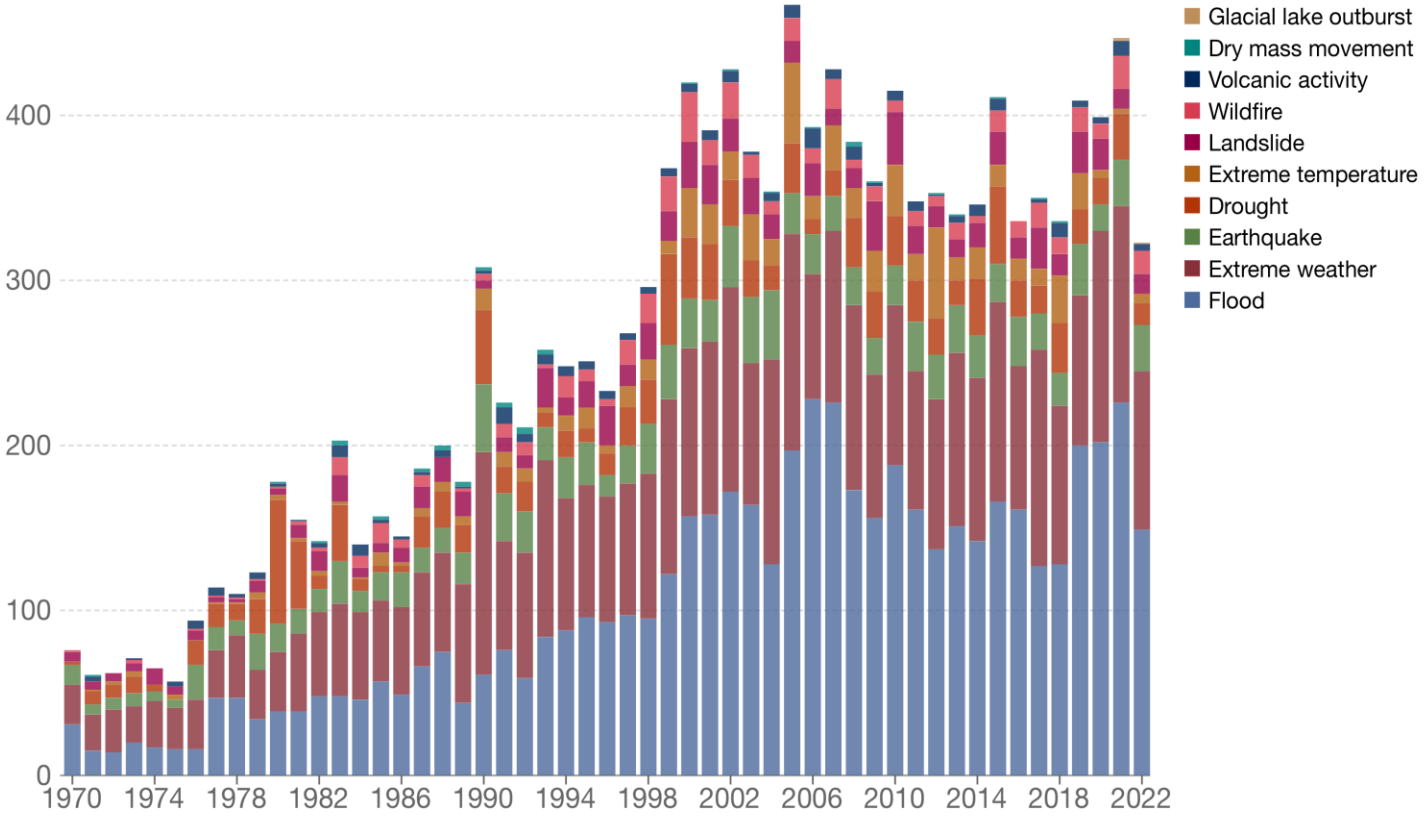
- In the last decade > 2.6 billion people have been affected by natural hazards
- In 2021
  - 432 disastrous events related to natural hazards worldwide
  - 10,492 deaths
  - Affected 101.8 million people
  - Caused approximately 252.1 billion US$ of economic losses
  - Asia was the most severely impacted continent
    - 40% of all disaster events
    - 49% of the total number of deaths
    - 66% of the total number of people affected

https://www.who.int/publications/i/item/9789241596053

Global reported natural disasters by type, 1970 to 2022

The annual reported number of natural disasters, categorised by type. This includes both weather and non-weather related disasters.

Our World in Data



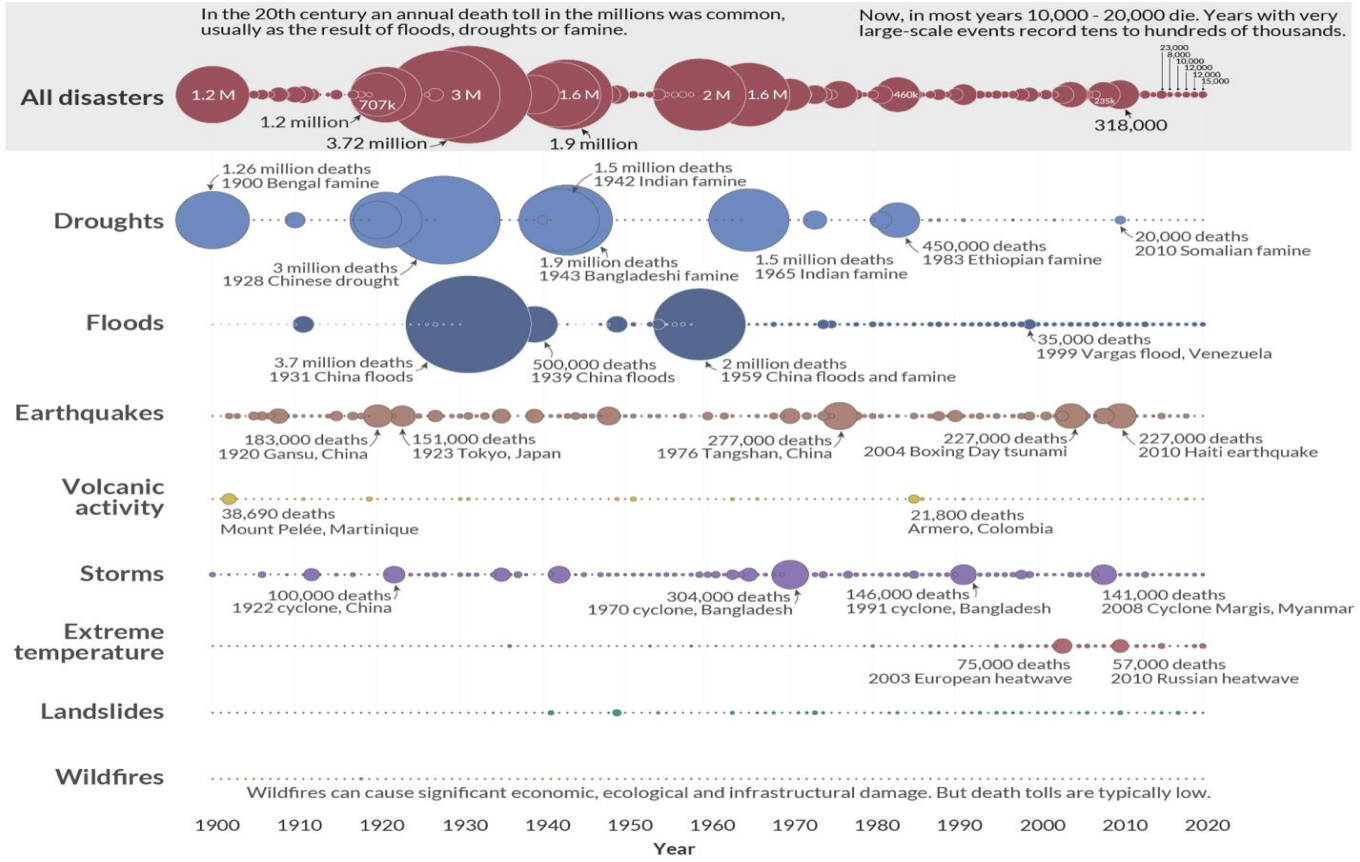
Source: EM-DAT, CRED / Université catholique de Louvain, Brussels (Belgium)

OurWorldInData.org/natural-disasters • CC BY

Global deaths from disasters over more than a century

The size of the bubble represents the estimated annual death toll. The largest years are labeled with this total figure, alongside large-scale events that contributed to the majority – although usually not all – of these deaths.

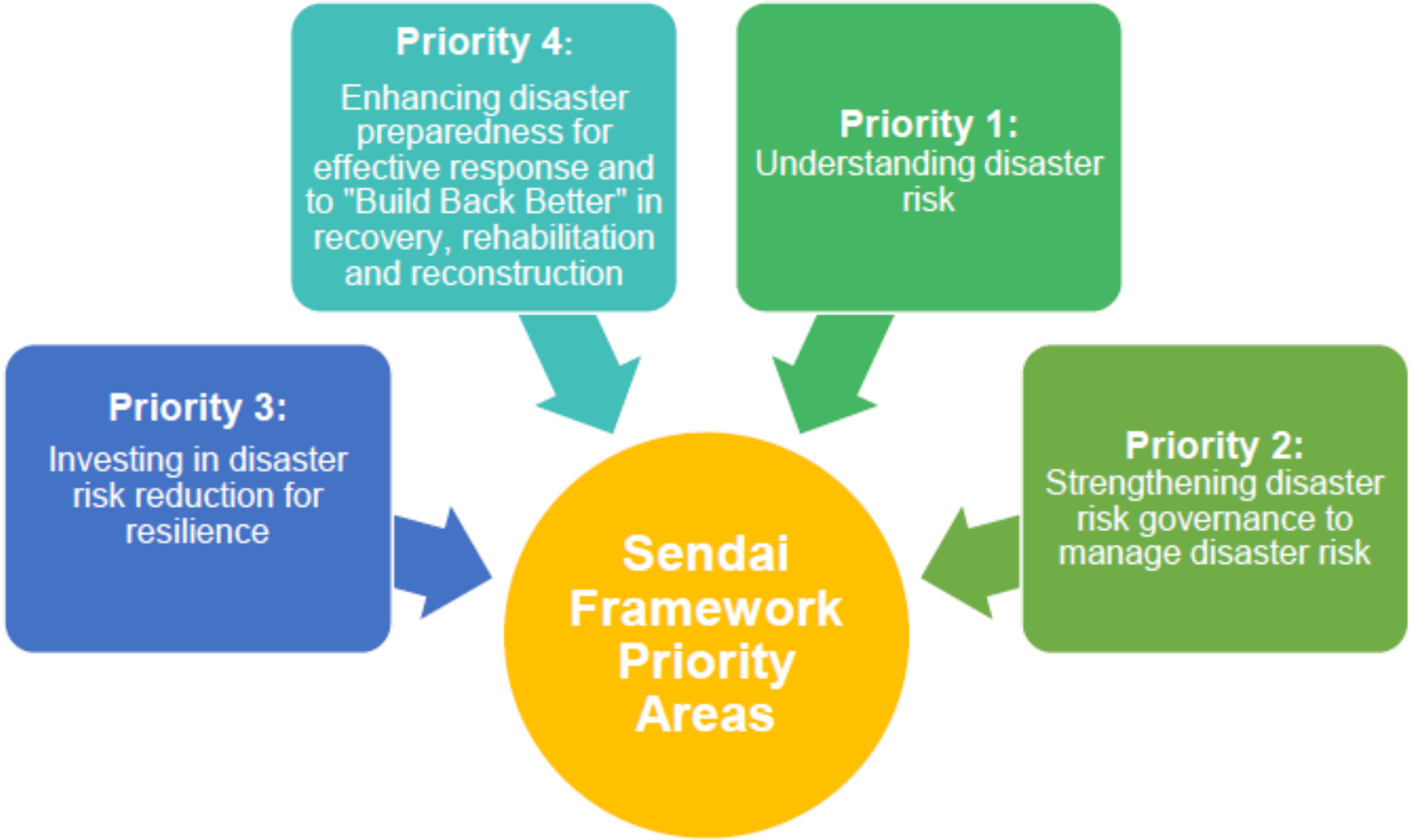
Our World in Data



Data source: EM-DAT, CRED / UCLouvain, Brussels, Belgium – www.emdat.be (D. Guha-Sapir).
OurWorldinData.org – Research and data to make progress against the world's largest problems.

Sendai Framework for Disaster Risk Reduction 2015-2030

- The first major agreement of the post-2015 development agenda of the United Nations Office for Disaster Risk Reduction and provides Member States with concrete actions to protect development gains from the risk of disaster.
- Endorsed by the UN General Assembly following the 2015 Third UN World Conference on Disaster Risk Reduction
- Advocates for:
  - Substantial reduction of disaster risk
  - Recognizes that the State has the primary role to reduce disaster risk, but that responsibility should be shared with other stakeholders including local government and the private sector


Priority 4:
Enhancing disaster preparedness for effective response and to "Build Back Better" in recovery, rehabilitation and reconstruction
Priority 1:
Understanding disaster risk
Priority 3:
Investing in disaster risk reduction for resilience
Priority 2:
Strengthening disaster risk governance to manage disaster risk
Sendai Framework Priority Areas


7 GLOBAL TARGETS
Reduce
Mortality/
global population
2020-2030 Average << 2005-2015 Average
Affected people/
global population
2020-2030 Average << 2005-2015 Average
Economic loss/
global GDP
2030 Ratio << 2015 Ratio
Damage to critical infrastructure
& disruption of basic services
2030 Values << 2015 Values
Increase
Countries with national
& local DRR strategies
2020 Value >> 2015 Value
International
cooperation
to developing countries
2030 Value >> 2015 Value
Availability and access
to multi-hazard early warning
systems & disaster risk
information and assessments
2030 Values >> 2015 Values

Children and Poverty

150 million additional children plunged into poverty due to COVID-19, UNICEF, Save the Children say

New analysis reveals the number of children living in multidimensional poverty – without access to education, health, housing, nutrition, sanitation, or water – has increased by 15% since the start of the pandemic

16 September 2020

World Population

Reached 8 billion in November 2022

Children population: 30%
2.4 billion (<18y/o)

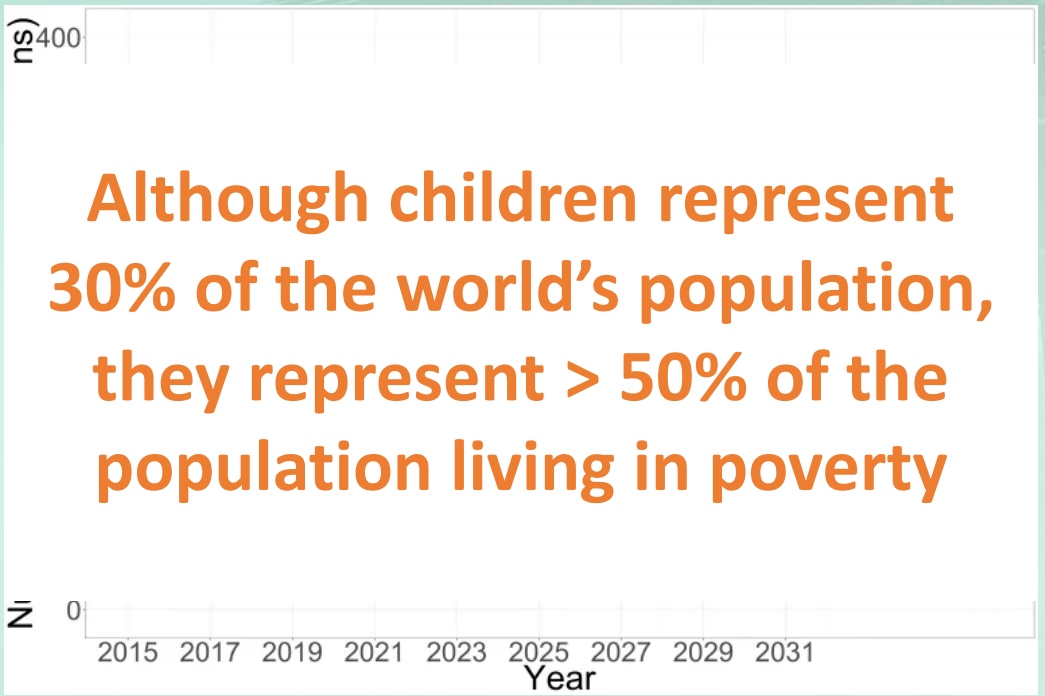
85% of children live in LMIC

1.2 billion (50%) live in countries affected by widespread poverty, conflict and discrimination

380 million children (17%) lives in extreme poverty (<$1.90/day/person)

https://www.prnewswire.com/news-releases

Distribution of Poverty by Age



https://www.brookings.edu/blog/future-development/2019/06/20/more-than-half-of-the-worlds-poor-are-children/

Children are more Vulnerable to Disasters

The population injured during the October 2005 earthquake in Northern Pakistan showed a higher proportion of children ≤10 years old

Haiti 2010 Earthquake
Higher risk of death in children

Fahad S et. al . Prehospital and Disaster Medicine (2009) 24: 535 – 539
Lobe AR et. al Medicine, Conflict and Survival (2010) 26: 281-297

Natural Disasters and Low-Income Countries What do we know? Where is the data?

- Review of the evidence-based data for disaster

People living the experience are excluded from authorship

- Only 20% of publications about disasters which occurred in LIC were written by authors with affiliations in LIC

Chee Keng Lee A et. al Emerg Med J 2014 Oct;31(e1):e78-83.
Tansey CM et. al PLoS Curr 2018 Aug 30;10:ecurrents.dis.

Natural Disasters and Inequalities

Cruel fact:

Natural disasters unmask poverty and social inequalities that were present long before the disaster

1Fothergill A et. al Natural Hazards 32: 89–110, 2004.
2Klinenberg, E. Heat Wave: A Social Autopsy of Disaster in Chicago; University of Chicago Press: Chicago, IL, USA, 2002

Natural Disasters and Inequalities

Children with kidney disease living in LMIC are extremely vulnerable to natural disasters

Natural disasters force 26 million people – worldwide- into poverty every year

https://www.unicef.org/lac/media/22556/file/The-invisible-covid-19-graveyard-intergenerational-losses-for-the-poorest.pdf

How do we Respond?

Humanitarian Medicine

Humanitarian medicine aims to provide essential relief to those destabilized by crises.

Includes, **as a right**, the provision of aid to those suffering the consequences of war, natural disasters, epidemic or endemic diseases, or displacement.

Amy Kravitz and Tammam Aloudat

https://blog.oup.com/2019/08/the-future-of-humanitarian-medicine

How is Humanitarian Aid Distributed?

Is there a fair distribution of humanitarian aid?

Humanitarian Needs vs Distribution?

Cruel fact:

Funding to relieve suffering is often tied to political interests and affected by media presence and trade interests, rather than based on need alone.

https://blog.oup.com/2019/08/the-future-of-humanitarian-medicine

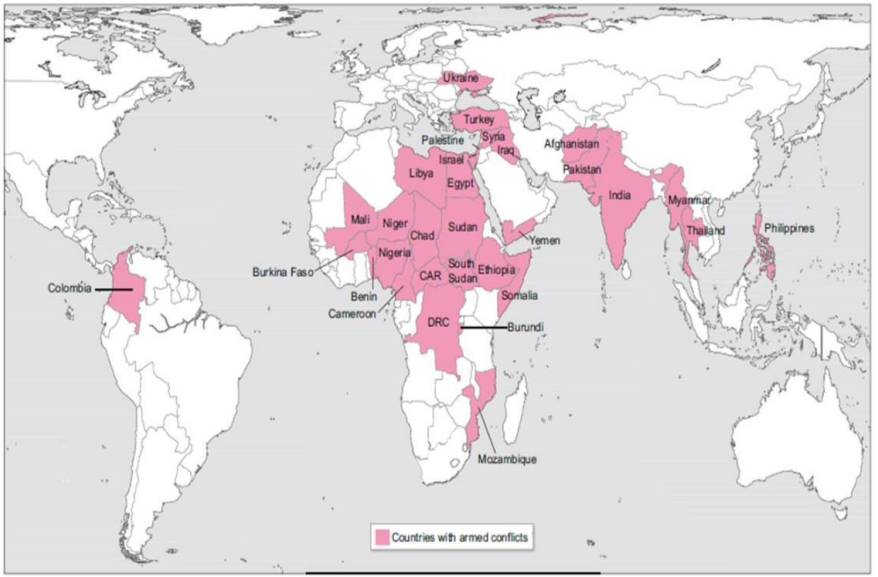
Haiti, the forgotten island

- Unfortunately,

Haiti is ***not listed*** in the countries with man-made disasters the last years

~~SECURITY~~

Countries with armed conflicts



IPNA-ASPN Global Nephrology Symposium February 8th, 2023

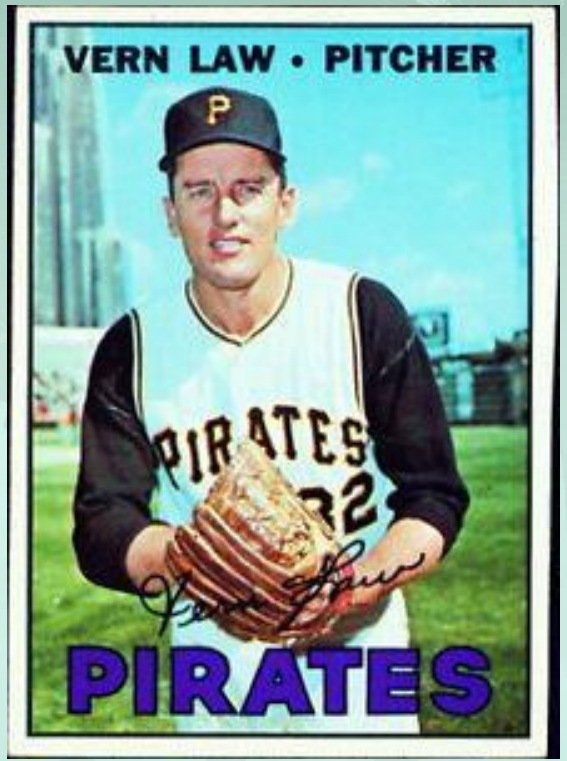
Courtesy of Dr Judith Exantus - Haiti

The Puerto Rican Experience

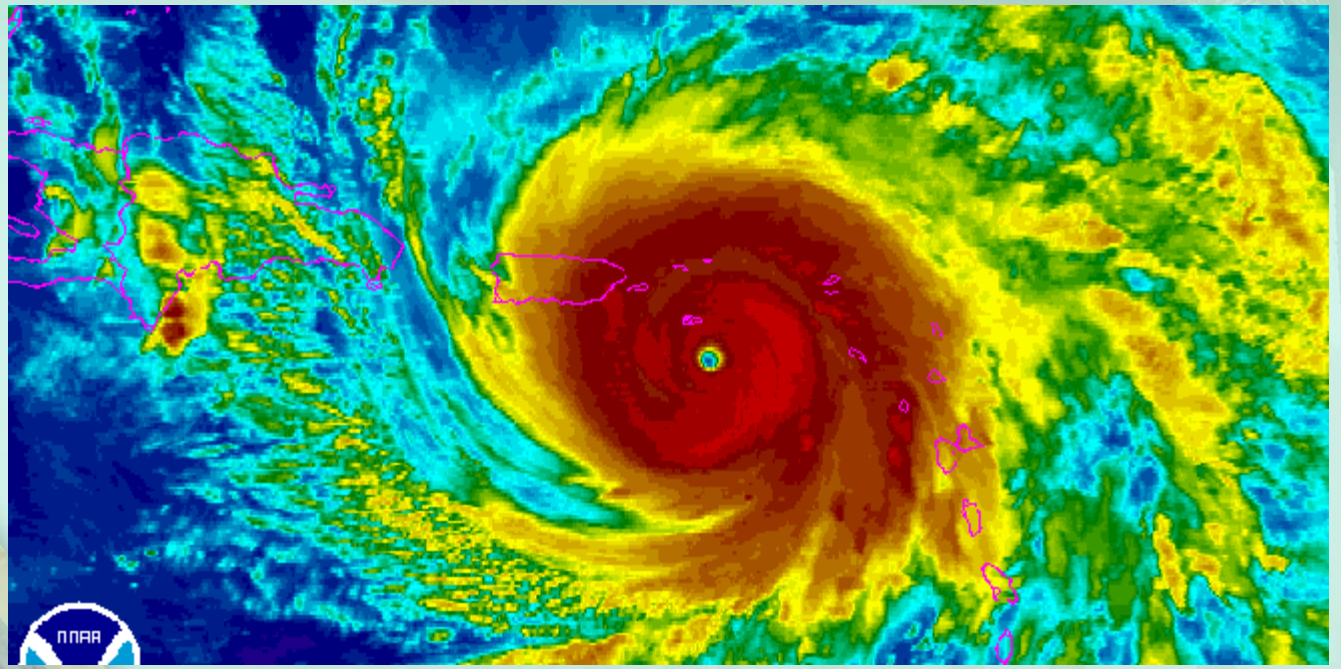
- Hurricane Maria and other Calamities

“Experience is a hard teacher. She gives the test first and the lessons afterwards.”

Vernon Sanders Law



Preparation




S.O.S
NecesiTAMOS
Agua/Comida !!


S.O.S
NecesiTamos
Agua/Comida !!

NATIONAL

Hurricane Maria killed as many as 9/11

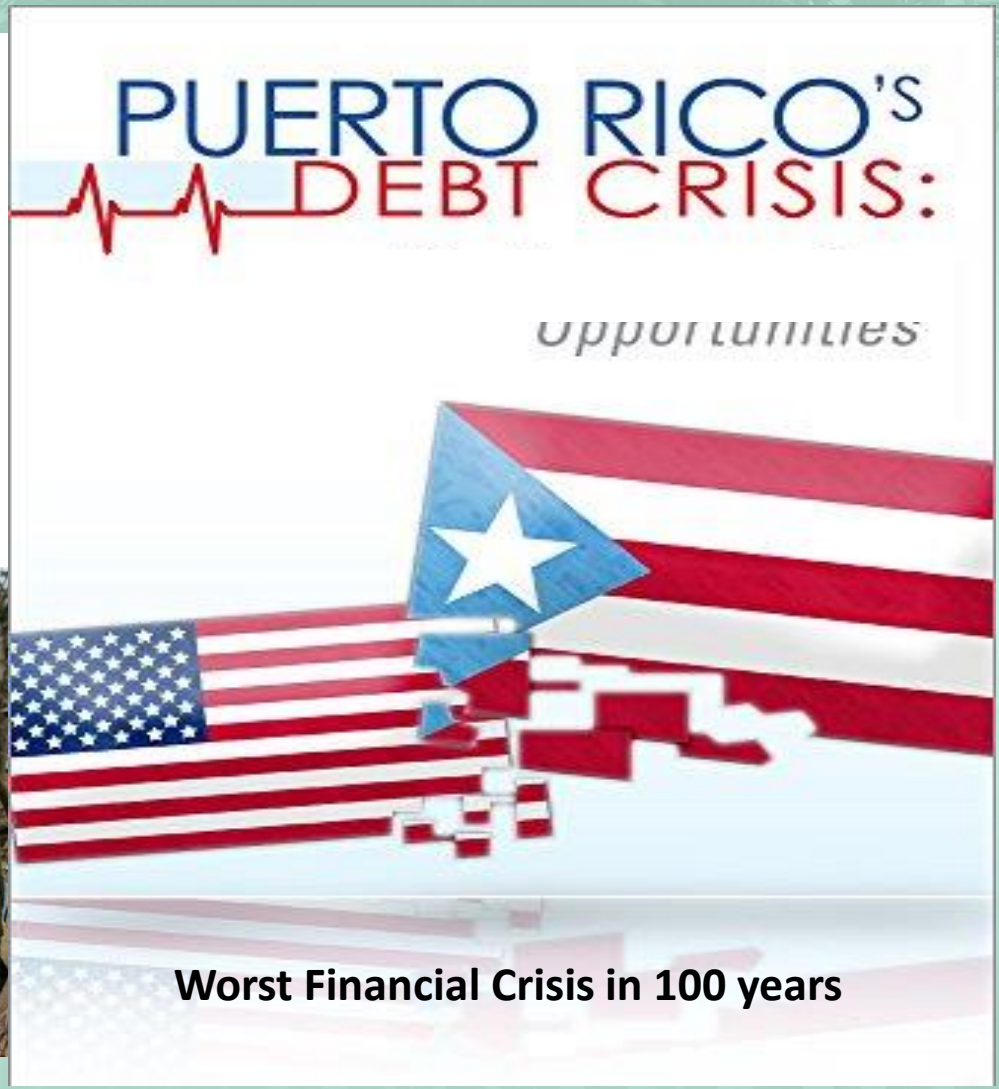
Death toll upgraded from 64 to 2,975

By NICOLE CHAVEZ, CNN

Posted: 6:08 AM, August 29, 2018
Updated: 6:08 AM, August 29, 2018

September 2017

4,645



Worst Financial Crisis in 100 years

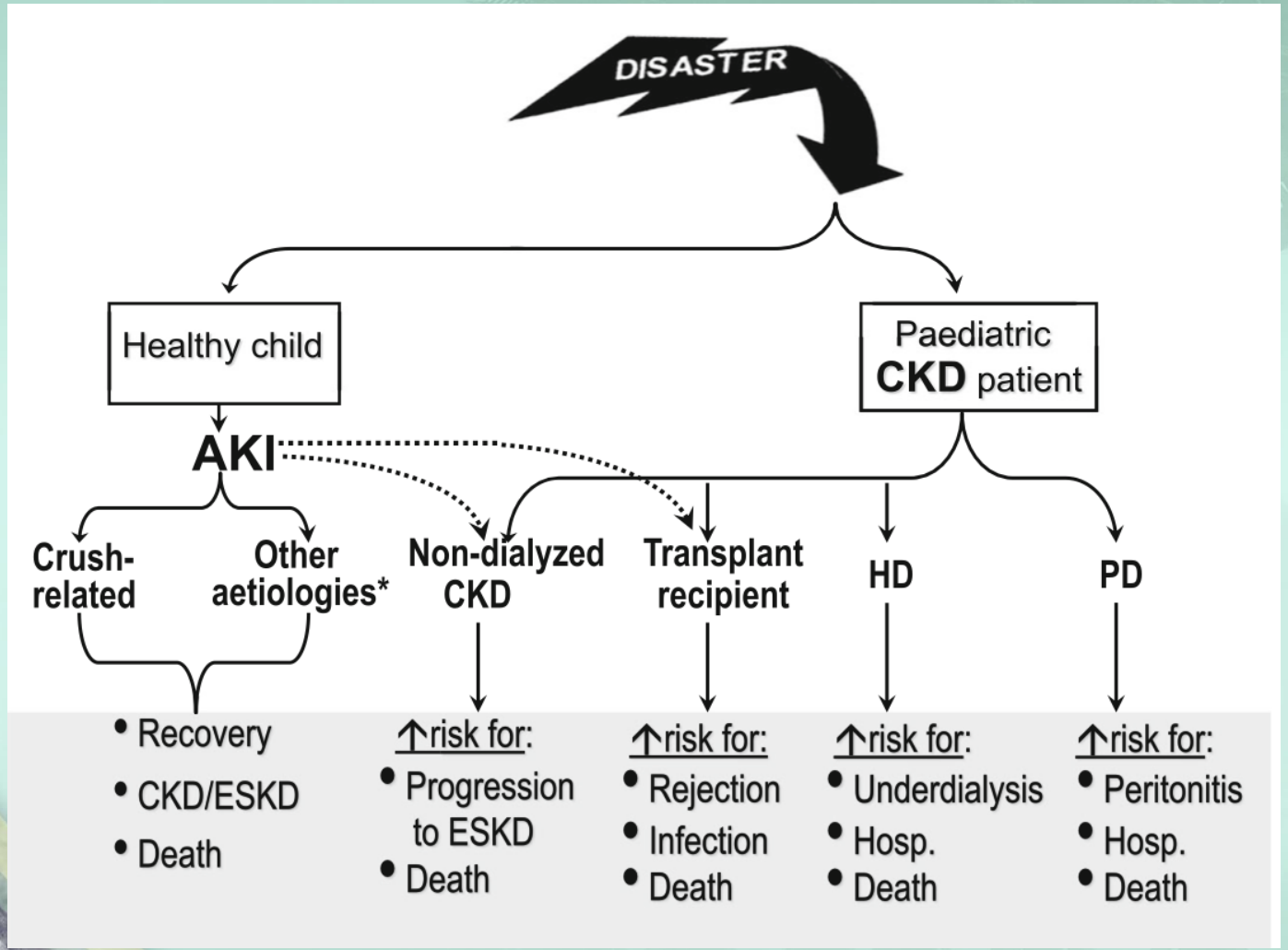
January 2020
Strongest earthquake in 100 years

Political Instability
Biggest manifestation in Puerto Rico's history JULY2019

March 2020
COVID Pandemia

Populations

- Patients with preexisting kidney disease
  - Increased risk of AKI
  - Increased risk of progresssion of CKD
  - Increased risk of rejection
- Patients without kidney disease who develop AKI after the disaster
  - Crush injuries
  - Other chronic diseases
    - Diabetes mellitus, hypertension, neurodevelopmental delay, patients using nephrotoxic drugs



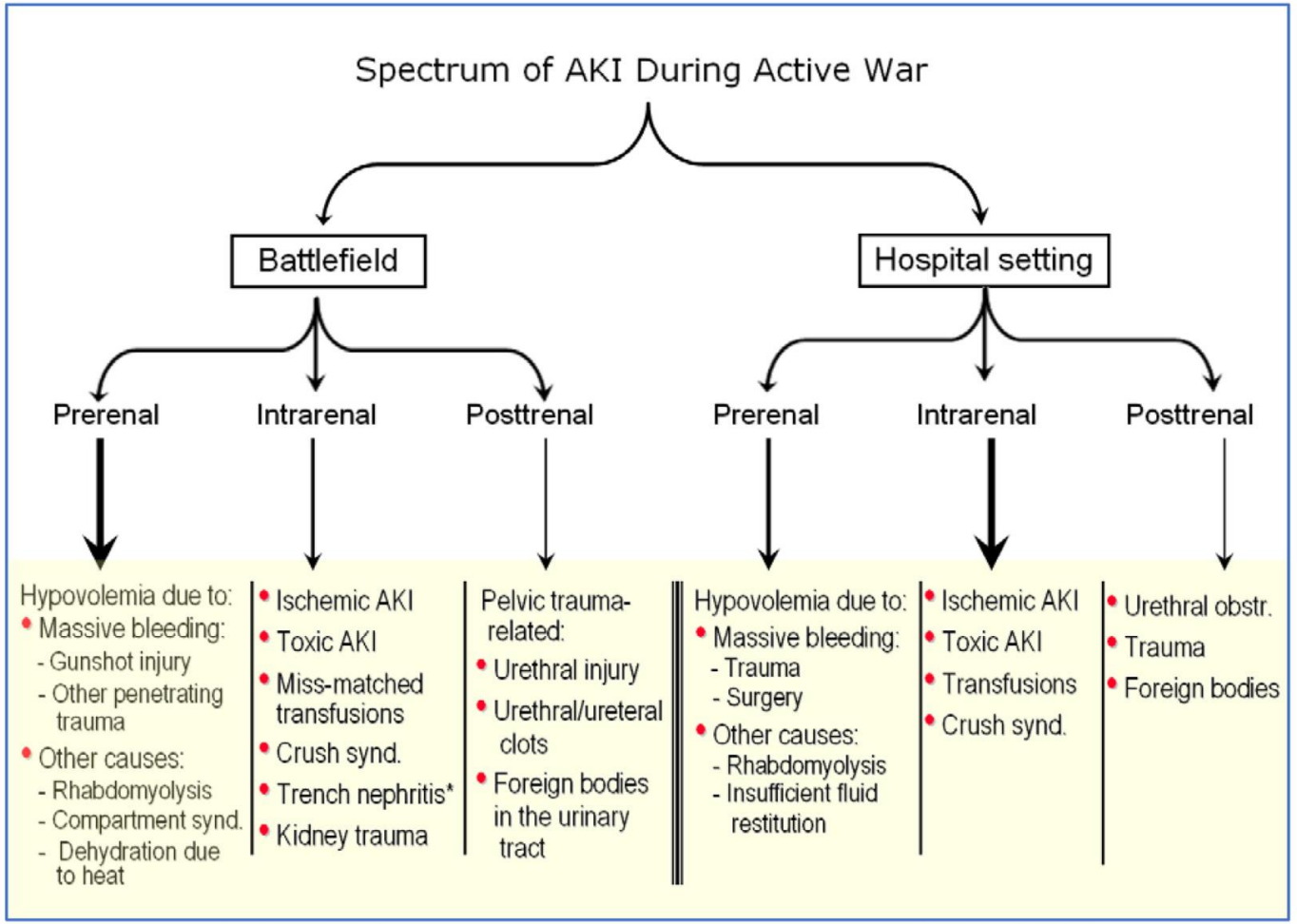
Sever MS et. al. Pediatric Nephrology https://doi.org/10.1007/s00467-019-04310-x

Risk of AKI in Conflicts

- WW II
  - 18% of severely injured
- Korea
  - 0.5% of all casualties had AKI
- Vietnam
  - 0.17% of all casualties had AKI

- Syrian civil war, the proportion of children among civilian deaths
  - 9% in 2011
  - 23% in 2016
- Given their proportionally larger heads, skull injury is more common
- Because of their high metabolic rates, malnutrition and dehydration are more frequent
- Due to lower fluid reserves, children need higher amounts of water as compared to adults

Sever MS et. al. Semin Nephrol 40:341−353 ! 2020



Sever MS et. al. Semin Nephrol 40:341−353 ! 2020

AKI: Crush Syndrome

- Definition
  - Systemic manifestations following muscle crush injury due to direct traumatic impact or ischemia-reperfusion injury
- Manifestations
  - Tense, edematous and painful muscles
  - Hpovolemic shock
  - AKI
  - Hyperkalaemia/Acidosis
  - Arrhythmias, cardiac and respiratory failure
  - Infections
  - Psychological trauma
- Pathogenesis
  - Rhabdomyolysis, resulting in the release of intracellular components into the systemic circulation, ultimately triggering many clinical and laboratory abnormalities
    - In mass disasters, most, if not all, cases of crush syndrome are caused by traumatic crush injury

Sever MS et al. Clin Kidney J (2015) 8: 300–309

AKI: Crush Syndrome

- Management
  - Early intensive fluid administration to crush victims, if possible even before extrication

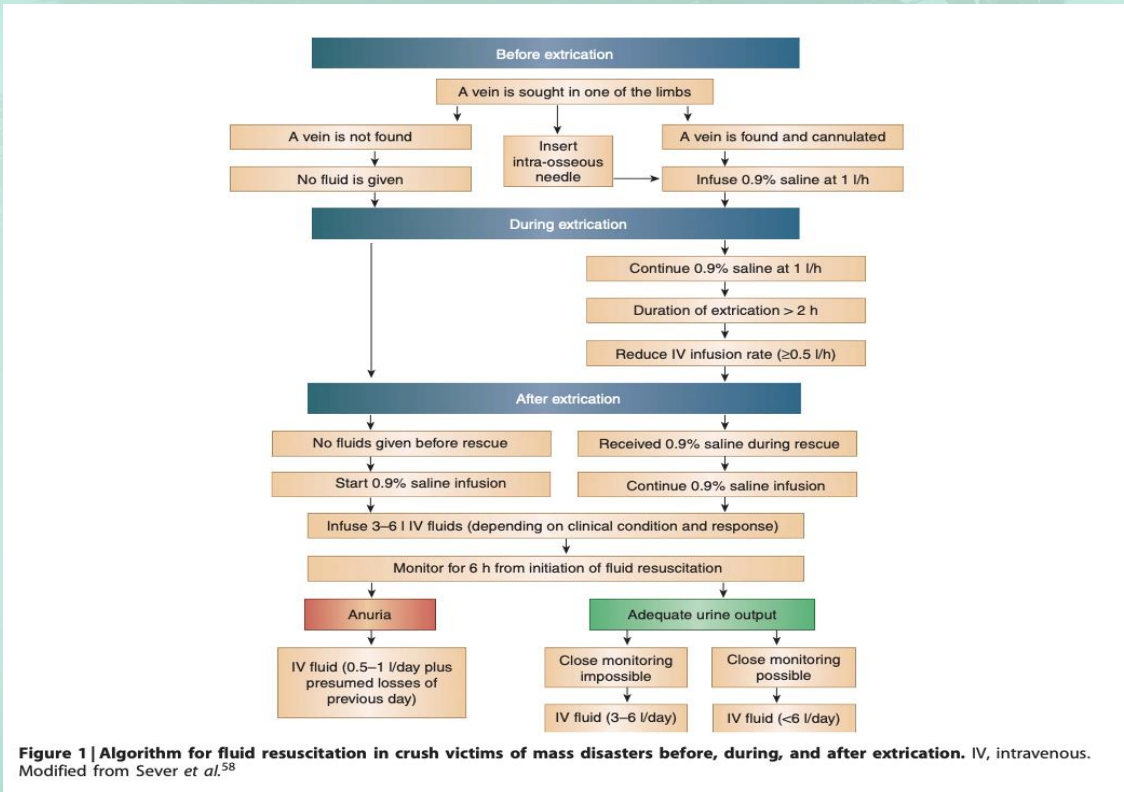


Figure 1 | Algorithm for fluid resuscitation in crush victims of mass disasters before, during, and after extrication. IV, intravenous. Modified from Sever *et al.*[58]

Sever MS et al. Clin Kidney J (2015) 8: 300–309

Gibney RTN et. al. Kidney International (2014) 85, 1049–

Table 1 Comparison of specific challenges associated with different types of natural and man-made disasters resulting in AKI

Type of disaster	Most frequent injuries	Therapeutic interventions[a]
Earthquake	• Blunt and penetrating serious injuries causing sudden death • Traumatic rhabdomyolysis due to crush injuries following collapse of buildings	• Early fluid resuscitation • Dialysis, if established AKI ensues
Hurricanes	• Sudden death due to drowning • Traumatic rhabdomyolysis due to crush injuries following collapse of buildings	• Early fluid resuscitation • Dialysis, if established AKI ensues
Wars	• Blunt and penetrating serious injuries leading to sudden death • Gunshot wounds • Injuries from explosions and irradiation as well as chemical and airborne toxin exposure • Traumatic rhabdomyolysis due to crush injuries following collapse of buildings	• Specific interventions targeting the underlying aetiologies (e.g. surgical repair of the wounds, antidotes for various toxins, catheterization for urinary tract obstructions) • Early fluid resuscitation • Dialysis, if established AKI ensues

Various types (prerenal, intrinsic renal and postrenal) of AKI may be seen in all types of disasters

[a] Logistic problems cause significant difficulties in the treatment of all types of disaster casualties

AKI acute kidney injury

Sever MS et. al. Pediatric Nephrology https://doi.org/10.1007/s00467-019-04310-x

Immediate Challenges

Energy Crisis

Communication Crisis

Fuel Crisis

Water Crisis

Electric Power

- Hospitals and Physician's offices
- Medications, Vaccines, Medical equipment
- Hospital Personnel and responders homes
- Traffic
- Safety at night

Non-Dialysis Patients

- Nephrotic syndrome and other Chronic GN
- Advanced stages of CKD
- Transplant patients
- Neuropathic bladders

- Not able to get their routine laboratory tests
- Limited access to medication refills
  - Some of the patients had to temporarily switch to a different medication of the same class because pharmacies were closed
- Limited access to their primary physicians

Dialysis Population

- Extremely vulnerable
  - Direct physical damage to healthcare facilities
  - Lack of electric power
  - Lack of tap water
  - Shortage of disposable products
  - Inability to get to treatment centers
  - Inability to get chronic medications

Hemodialysis Population: Preparation

- Identify patients at risk
  - Proactively admit to the hospital patients who live in vulnerable areas
- Preemptive Dialysis
  - Providing early dialysis in advance of the disaster is the first step
  - This prevents missed treatments
  - Reduces rush in the dialysis unit after the hurricane
  - Preemptive dialysis can help patients avoid serious complications such as hyperkalemia and fluid overload, if their treatments are delayed after the disaster

Hemodialysis Population: Preparation

- Preparation of Hemodialysis Unit
  - Emergency generator
    - Fuel for the generator
  - Water tanks
  - Contingency plan to move patients to another center should be prearranged in case the unit majorly suffers and is rendered nonfunctional after the storm

Water Crisis

- Hospital hygiene and infection control
- Patient needs
  - Catheterizations
  - Home dialysis
- Personnel needs
  - Personal hygiene
  - Food

Peritoneal Dialysis: Electricity

- Review technique for manual exchanges
  - Risk of peritonitis

Peritoneal Dialysis: Tap Water

- Water safety should be reinforced
- Water for dialysis patients should meet Environmental Protection Agency drinking water standards
  - If safe for consumption, then it may be used

Communication Crisis

- Hospital
  - Personnel
  - Patients
    - The rest of their families
- Family
  - Within Puerto Rico and Outside
- Coordination of rescue efforts

No Internet, mobile phones, radio, TV

People in the highway looking for mobile phone signal

Approach to Communication Challenges

- Registry
  - Updated contact information for patient and relatives
    - Hard copy kept accessible to personnel as EHR may not work
  - Physical address
    - To dispatch rescue unit if necessary
  - US DHHS Internet tool
    - Identifies, by municipality, Medicare beneficiaries who rely on electricity-dependent medical equipment

Communication Crisis

- Use non-technological tools
  - Analog phones
    - POTS(Plain Old Telephone Service)
  - Blackboard
    - POBB, not the Software
  - Maps
- Share resources
  - Hospitals will go back to normality before other institutions or homes
    - Good choice for headquarter

Fuel Crisis

- Generators for hospitals, medical offices, homes
- Gasoline for hospital personnel and responders
  - Call schedule

People lining up at gas stations for hours to buy fuel for their cars and generators

Responders and Volunteers

- Support
  - Exposed to heartbreaking scenes
    - Breakdown
      - Debriefing
  - Sense of fulfillment
    - Energy and drive

Coordinate with community leaders

Community is the first to provide emergency assistance

Building capacity at the community level

Government

Cruel Fact:

Most politicians are always politicians

Private Sector and Non-Profit Organizations

- Private Sector
  - Significant donations
  - Facilitate their resources
- Non-profit organizations and volunteers
  - Have an organized structure
  - Use to work with disadvantage communities
    - Puerto Rico
    - US
    - International ….
  - Document and be grateful

Hemodialysis

- ☐ Preemptive dialysis within 24 hours prior to event
- ☐ Preventive admission if living in vulnerable areas
- ☐ Backup transportation

Peritoneal Dialysis

- ☐ Home generator
- ☐ 2-week supply of disposables at home
- ☐ Review technique for manual exchanges
- ☐ CAPD orders

- ☐ Preemptive dialysis within 24 hours prior to event
- ☐ Preventive admission if living in vulnerable areas
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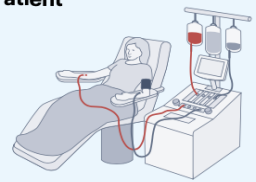
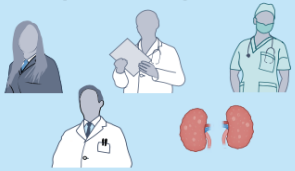
Peritoneal Dialysis

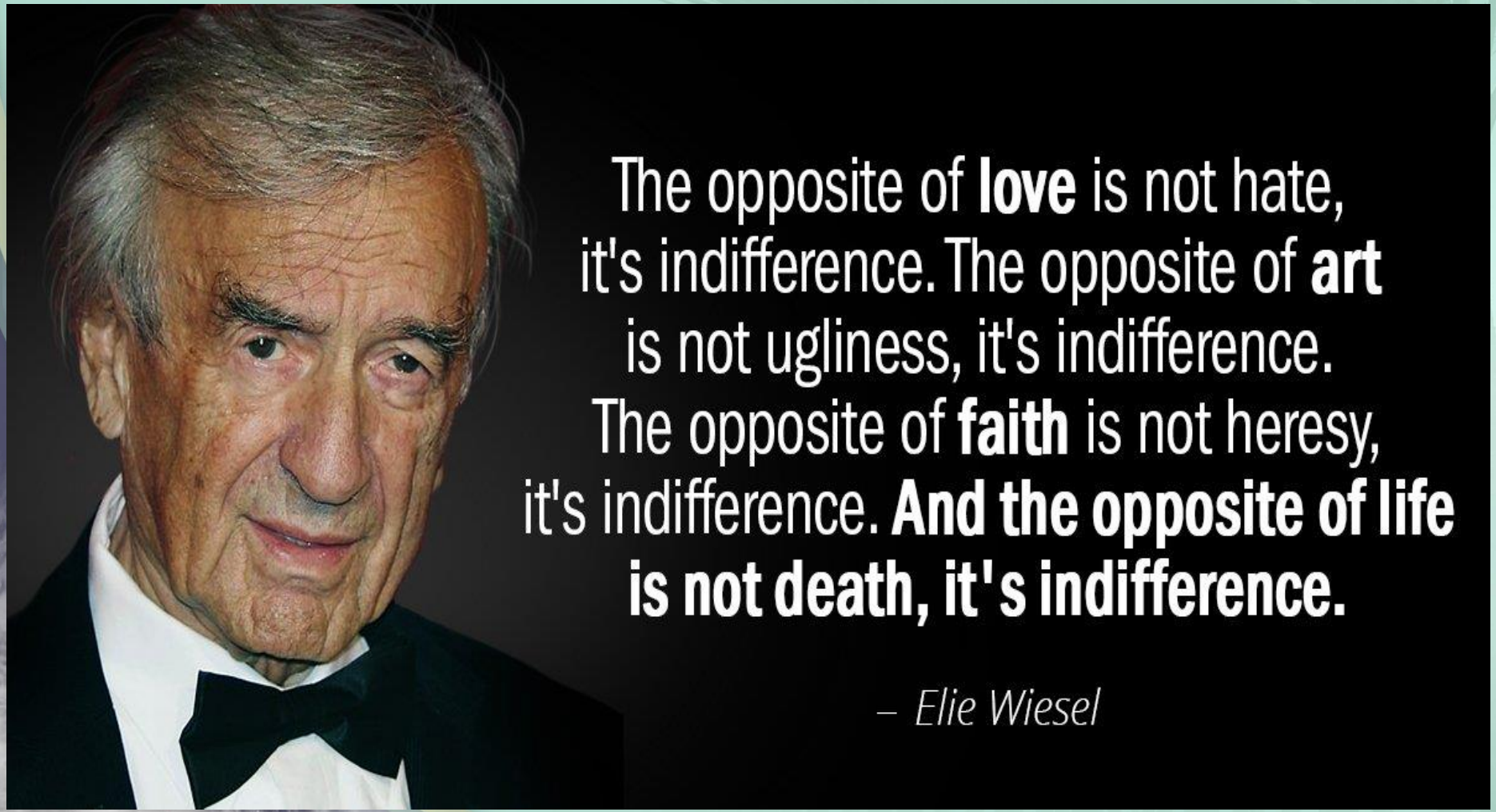
- ☐ Home generator
- ☐ 2-week supply of disposables at home
- ☐ Review technique for manual exchanges
- ☐ CAPD orders

Bonilla-Félix M, Suárez-Rivera M. Blood Purif 2018; 5: 1- 6

Preparation

	Kidney care preparedness for natural disasters			
Patient 	• Carry patient ID card • Obtain insurance documents • Update phone numbers • Attend annual preparedness training	• Obtain backup medication • Stock up on peritoneal dialysis supplies • Identify potential locations for evacuation	• Identify backup clinics • Receive additional dialysis if needed • Notify immediate plan to clinic • Evacuate	• Notify clinic of location • Check KCER portal for facility status • Answer calls from clinic
Clinics 	• Issue patient ID cards • Conduct annual preparedness training • Obtain generators • Conduct contingency planning for staff shortages	• Test generators, ensure adequate fuel supply • Enhance capacity to accommodate additional dialysis	• Review and/or modify staff shortage contingency plan • Provide early dialysis	• Activate staff shortage contingency plan • Coordinate with KCER • Track and/or account for patients and staff • Facilitate patient treatment at backup facility
Kidney community 	• Develop sub-seasonal to seasonal KHT capacity • Generate long-range KHT forecasts informed by seasonal weather forecasts • Train volunteers	• Generate extended-range KHT forecasts using sub-seasonal weather forecasts • Coordinate plan with local and/or state agencies • Allocate resources	• Generate short-range KHT forecasts • Activate volunteers and evacuation plans • Establish separate hotlines for patients and clinicians	• Manage hotlines
	Ready: 30–90 days before disaster	**Set:** 10–30 days before disaster	**Go:** 1–10 days before disaster	Disaster onset **Disaster response:** 1–10 days after disaster

Sapkota A et. al. Nature Reviews Nephrology (2023) 19: 141-142.


The opposite of **love** is not hate,
it's indifference. The opposite of **art**
is not ugliness, it's indifference.
The opposite of **faith** is not heresy,
it's indifference. **And the opposite of life**
is not death, it's indifference.
– *Elie Wiesel*

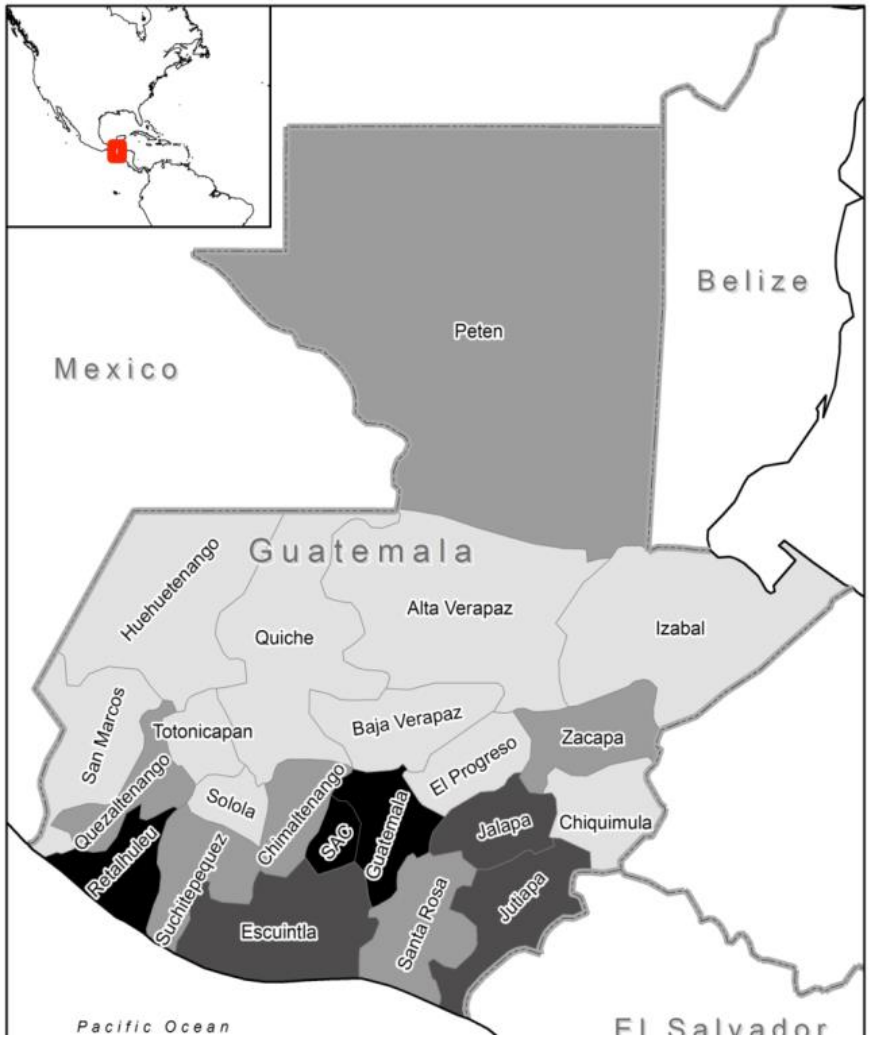
Developing a preparedness plan for the treatment of pediatric AKI and KRT during natural and man-made disasters

SYL Refresher course and Train the Trainers Workshop

Guatemala 2023





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A partnership to deliver care for acute kidney injury in the developing world

- Among the 5 more vulnerable countries
- The country with higher number of volcanoes per square kilometer
- 40% of the population is at risk of suffering 3 disasters at the same time

Natural Disasters - Our World in Data

2017: Terremoto, San Marcos






2018: Volcán de Fuego

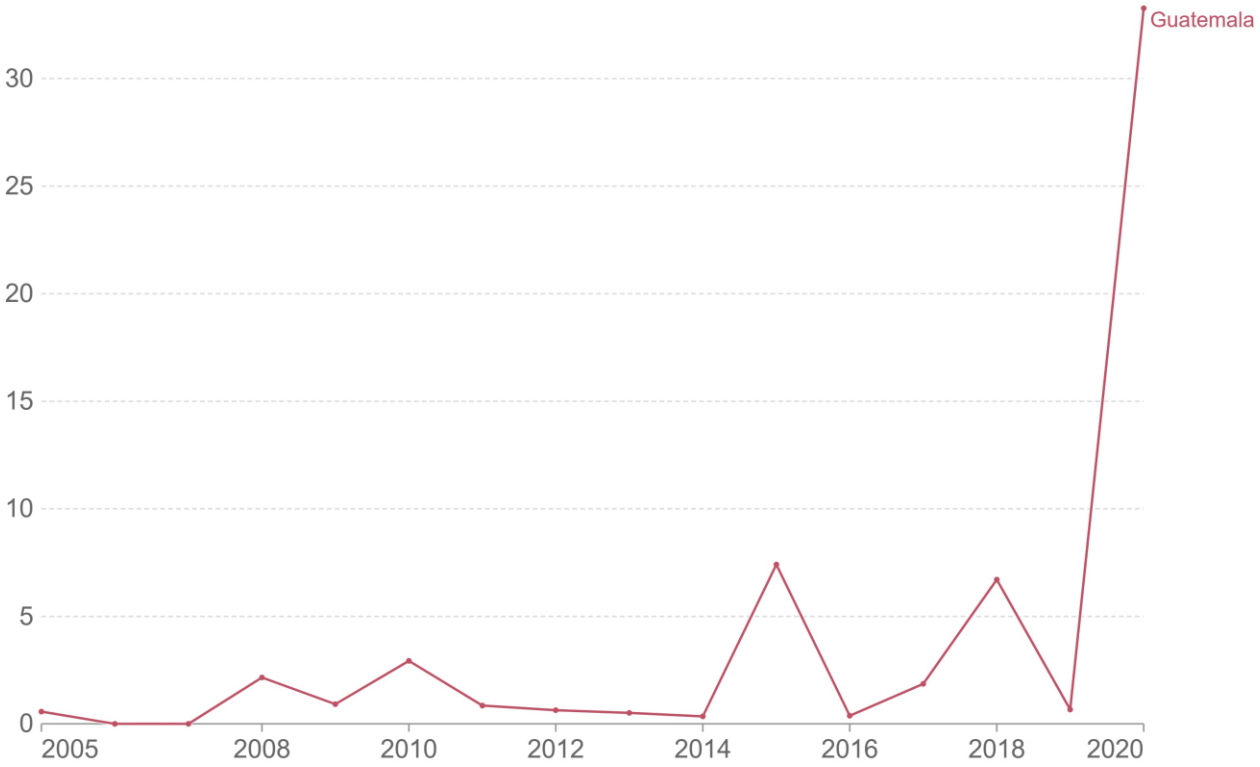
2020: ETA

Conflictos sociales

Rate of deaths and missing persons due to natural disasters, 2005 to 2020

The annual number of deaths and missing persons due to all forms of natural disaster per 100,000 people.

Our World in Data



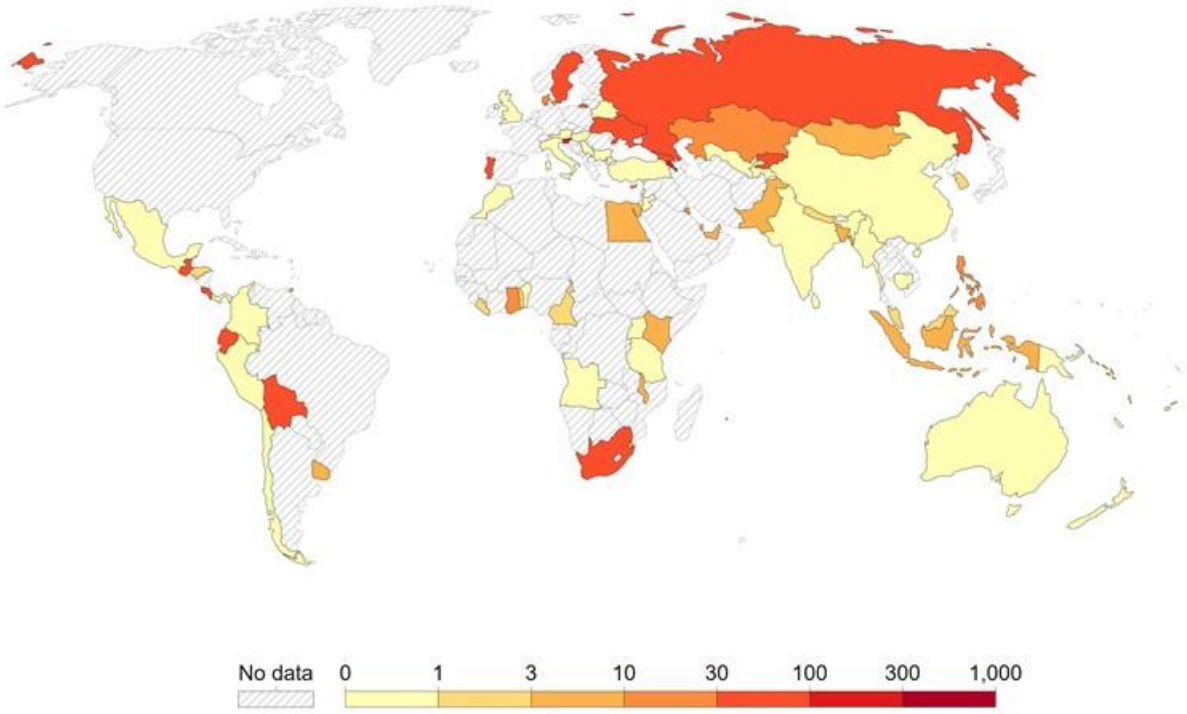
Source: UN Office for Disaster Risk Reduction

OurWorldInData.org/natural-disasters • CC BY

Rate of deaths and missing persons due to natural disasters, 2020

The annual number of deaths and missing persons due to all forms of natural disaster per 100,000 people.

Our World in Data



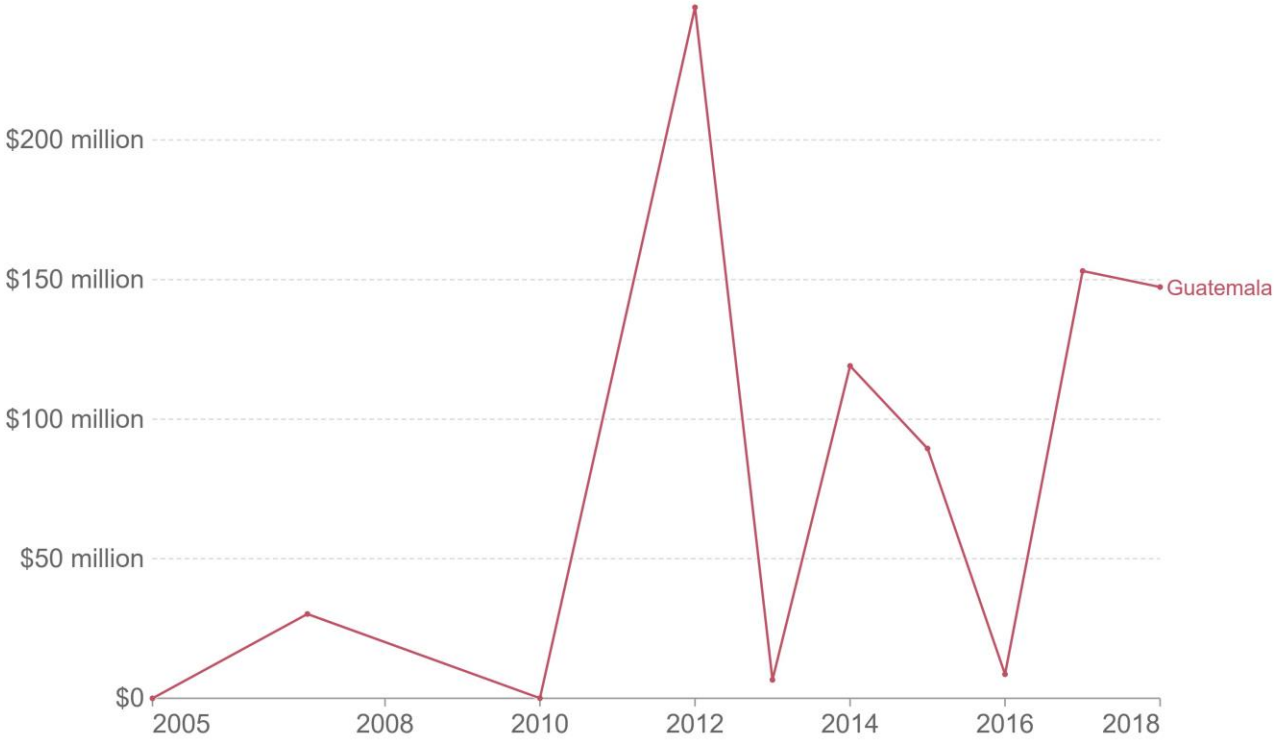
Source: UN Office for Disaster Risk Reduction

OurWorldInData.org/natural-disasters • CC BY

Direct disaster economic loss, 2005 to 2018

The monetary value of total or partial destruction of physical assets existing in the affected area. Direct economic loss is nearly equivalent to physical damage.

Our World in Data



Source: UN Statistics Division

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INTERNATIONAL SOCIETY FOR PERITONEAL DIALYSIS

ISN
INTERNATIONAL SOCIETY
OF NEPHROLOGY

IPNA

World Kidney Day™

Fundanier
Fundación para el Niño Enfermo Renal

Plan de evacuación desastres FUNDANIER

Reunión con la Municipalidad de Guatemala
Plan de evacuación CONRED
Base de datos del personal
Puestos a desempeñar según personal
Vía de comunicación
Insumos
Capacitación brigadistas






Fundanier

COORDINADORA NACIONAL
PARA LA REDUCCIÓN DE DESASTRES

Plan de Evacuación

Fundación para el Niño Enfermo Renal
FUNDANIER/ Hospital Roosevelt

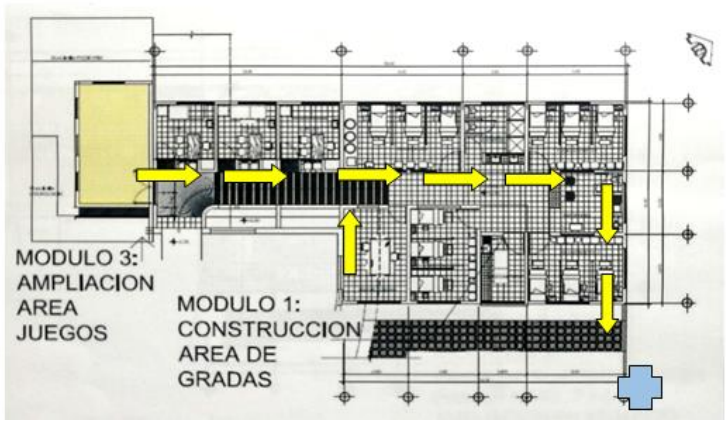
Historial de actualizaciones

Versión	Responsable	Fecha de modificación	Número de páginas
[1. 2. etc.]	Dr. Randall Lou Director Médico	[25/04/2023]	[00]

Responsable de la elaboración del plan

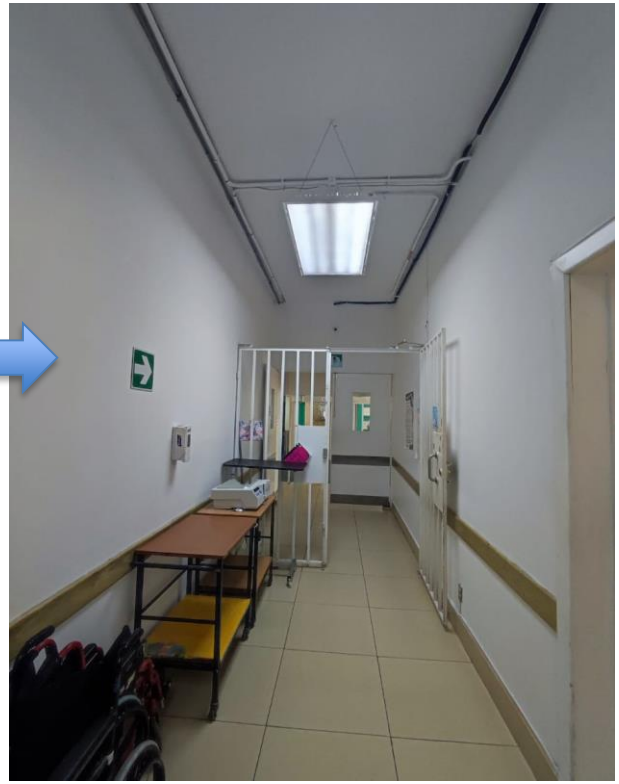
Nombre de la empresa	Nombre de la persona responsable	Teléfono	Correo electrónico
Fundación para el Niño Enfermo Renal	Licda Paola Pérez Asesora	[4675-1656]	Nutri2fundanier@gmail.com

Primer Nivel



Plan de evacuación desastres FUNDANIER

Plan de evacuación desastres



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Capacitación brigadistas

Brigadistas FUNDANIER

Riesgos, Emergencia, Desastre
RED NACIONAL FUNDANIER

Activar alarma

- Avisarnos que recibieron el mensaje de activación
- Contactar a pacientes asignados de acuerdo al plan RED FUNDANIER Nacional
- Enlistar insumos que les hace falta de acuerdo a los pacientes asignados y trasladar el mensaje

cumple

Fundanier
Fundación para el Niño Enfermo Renal

Ejército de Guatemala

CONRED
COORDINADORA NACIONAL PARA LA REDUCCIÓN DE DESASTRES
GUATEMALA, C.A

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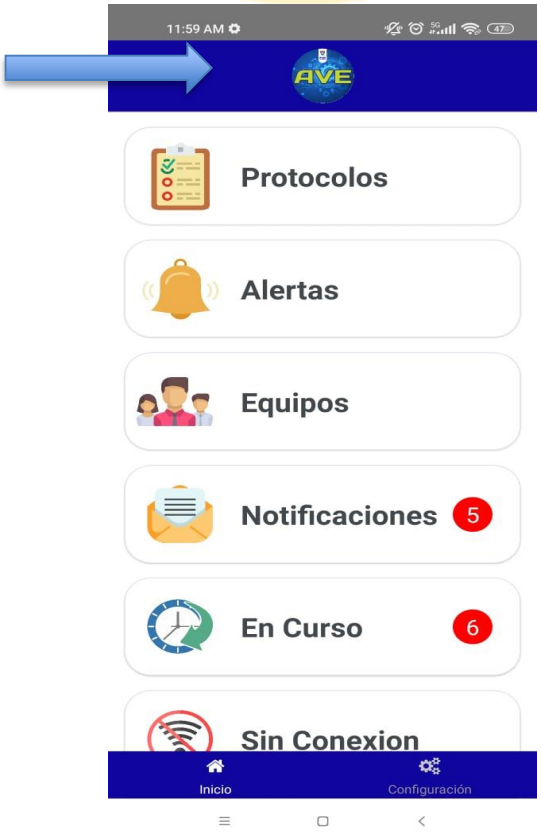
RED NACIONAL FUNDANIER COMUNICADOS

Hospital de Totonicapán	Hospital de Occidente	Hospital de Zacapa	Hospital de Escuintla	FUNDANIER/ Hospital Roosevelt, ciudad de Guatemala
Totonicapán y Huehuetenango	Quiche, San marcos, Quetzaltenango, Sololá	Santa Rosa, Jutiapa, Jalapa, Chiquimula, El progreso, Zacapa, Petén e Izabal. Alta Verapaz y baja Verapaz.	Retalhuleu, Suchitepéquez y Escuintla	Chimaltenango, Sacatepéquez y Guatemala.
(1)	(16 pacientes)	(49 pacientes)	(18 pacientes)	(81 pacientes)

Comunicación

Alerta de emergencia a través de líderes
- Paola Pérez

Suplentes:
- Cristina Zelaya y Mariela Guerra



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GRACIAS