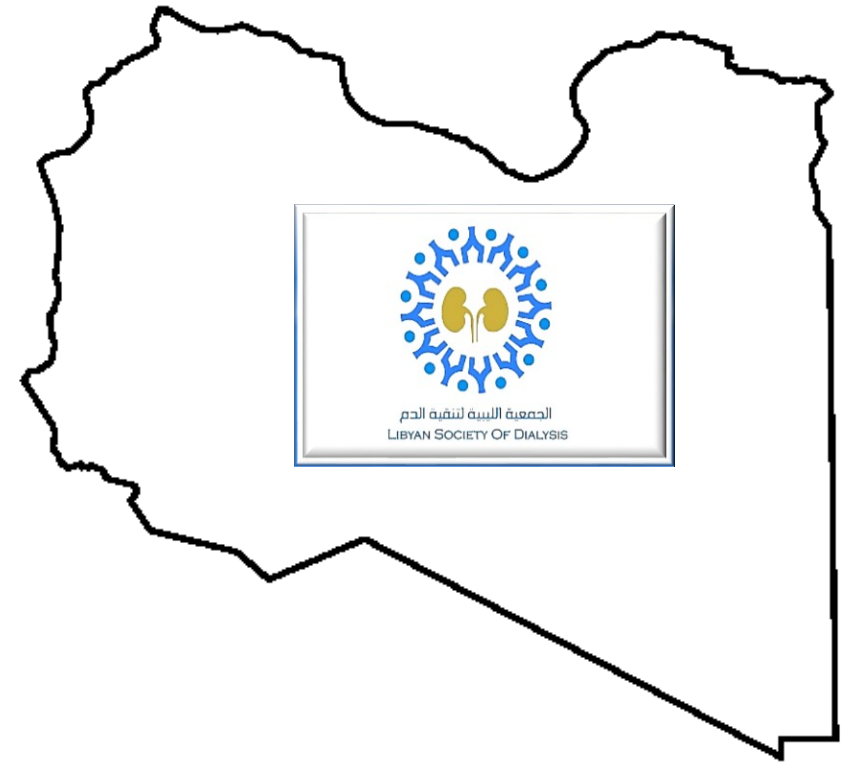


**50 years of dialysis services, where  
we stand now?**

**Khairi Ayad**



# Hemodialysis



- ▶ 1973 in Jomhuriyah hospital Benghazi
- ▶ 1974 in University hosp. Benghazi
- ▶ 1974 in Central hosp. Tripoli
- ▶ 1975 in Tajoura hosp. Tripoli
- ▶ 1978 in Hawari hosp. Benghazi
- ▶ 1980 in Jamil hospital
- ▶ 1983 in Zawia hospital
- ▶ 6000 patients on regular hemodialysis in Libya
- ▶ 76 dialysis centers

# PERITONEAL DIALYSIS



- ▶ 1988 Abudraa et al first used acute PD for pediatric patients with acute renal failure in Tripoli
- ▶ 1989 Alfituri N. et al first used acute PD for adults patients with acute renal failure in Zahra
- ▶ 2005 CAPD started in BENGHAZI, Sabratha & Alshaat center

# Efficacy of dialysis program



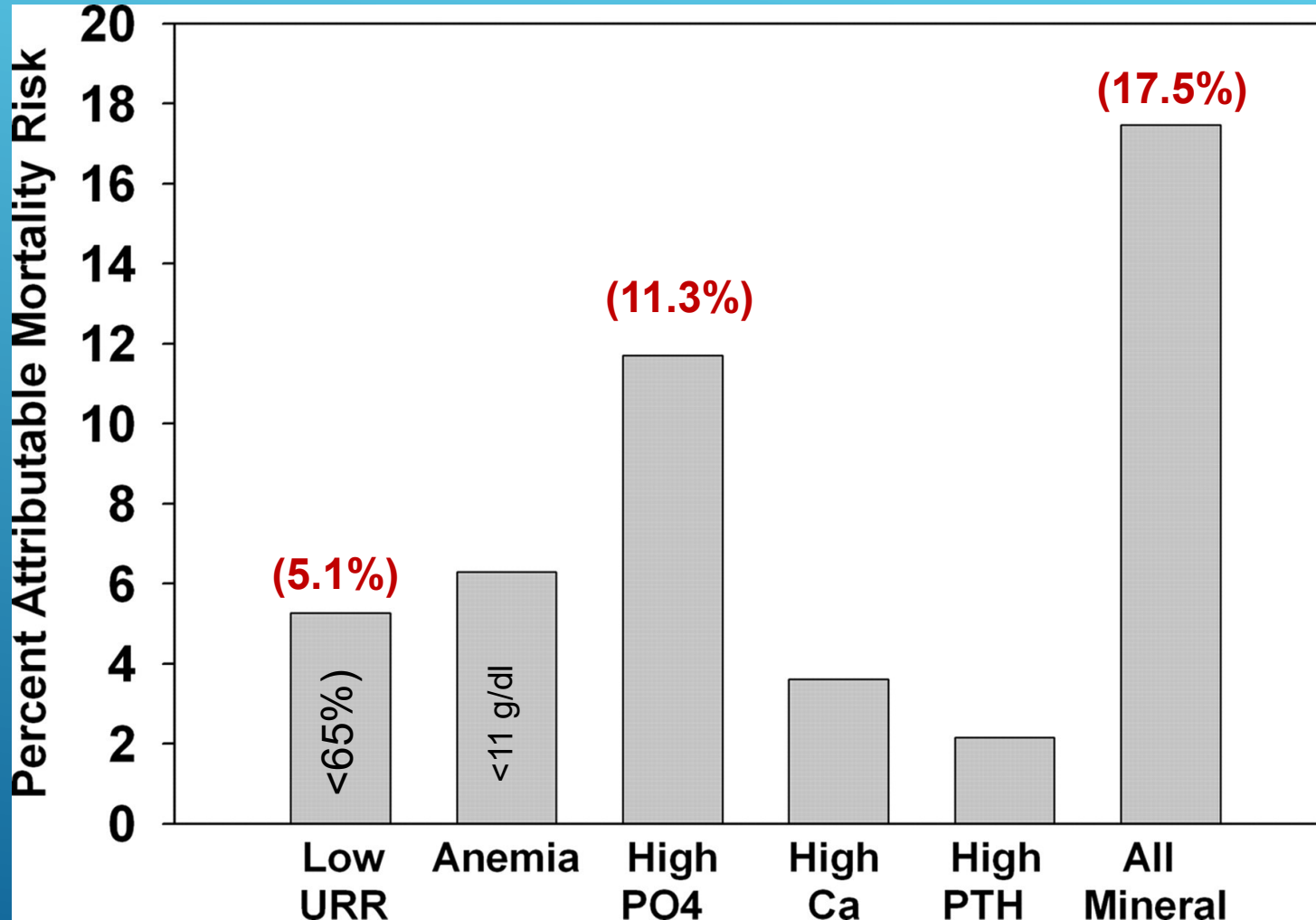
- ▶ Patient's survival
- ▶ Quality of life
- ▶ Biochemical outcome
- ▶ Minimize disease complications and hospitalization

# Efficacy of Dialysis Program



- ▶ Anemia correction
- ▶ MBD
- ▶ Fluid electrolyte homeostasis
- ▶ Good nutrition
- ▶ Biocompatibility
- ▶ Acidosis correction
- ▶ Blood pressure
- ▶ Adequate solute removal

# Attributable risk for disorders of mineral metabolism.



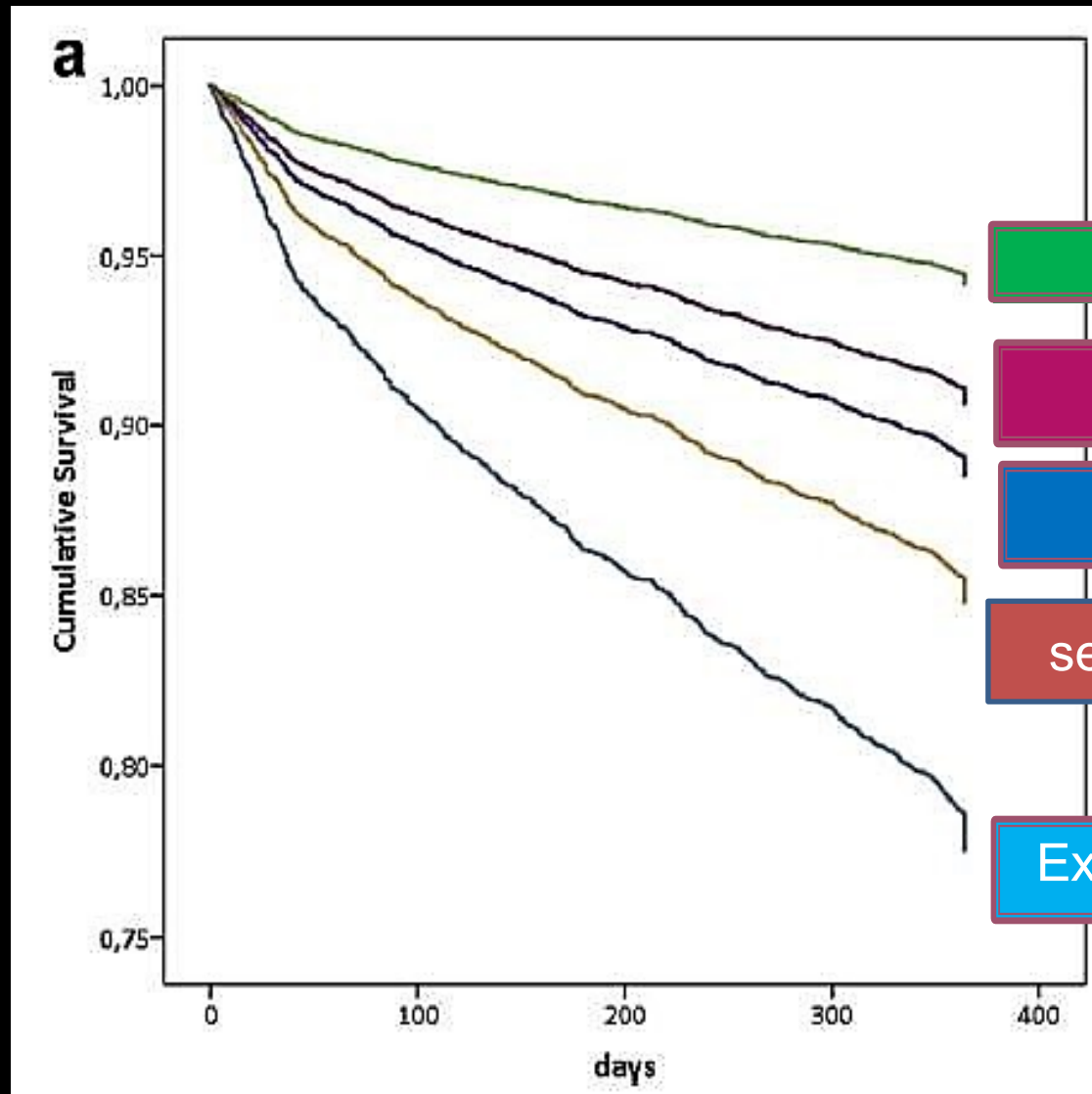
(39,530)

CJASN

# “FO” and “FD” survival



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Normovolemia

Moderate volemia + > 1.1 L

Volume depletion - > 1.1 L

severe hypervolemia + > 2.5 L

Extreme hypervolemia + > 5 L

# MALNUTRITION INFLAMMATION SCORE CUT-OFF PREDICTING MORTALITY IN MAINTENANCE HEMODIALYSIS PATIENTS



**Mariana Clementoni Costa Borges, Barbara Perez Vogt, Luis Cuadrado Martin, Jacqueline Costa Teixeira Caramori**

1 Faculdade de Medicina de Botucatu, UNESP Univ Estadual Paulista, Department of Clinical Medicine, Botucatu, São Paulo, Brazil.

2 Faculdade de Medicina de Botucatu, UNESP Univ Estadual Paulista, Department of Clinical Medicine, Botucatu, São Paulo, Brazil.  
Electronic address: [jteixeir@fmb.unesp.br](mailto:jteixeir@fmb.unesp.br).

## **Conclusion:**

**MIS is an independent predictor of mortality in hemodialysis patients.**



# AFTER 50 YEARS OF DIALYSIS WHERE WE STAND ?



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-  اكثر من 500 مريض
-  اكثر من 300 مريض
-  اكثر من 200 مريض
-  اقل من 100 مريض
-  أيوائي تخصصي

# Extent of Achieving KDOQI Targets For hemodialysis Adequacy in Libyan dialysis patients: A Multicenter Cross-Sectional Study



**Khairi Ayad<sup>1</sup>, Badreddin Shaibani<sup>2</sup>, Zaynab Rahouma<sup>1</sup>, Marwa Elmelowdi<sup>2</sup>, Ibrahim M.Abualqumsaan<sup>3</sup>, Amina Smaida<sup>4</sup>, Faraj A.Tamtum<sup>5</sup>, Huda Salama<sup>6</sup>, Malak M.Alborki<sup>6</sup>, Mohamed Aboalgasem<sup>7</sup>, Asma Mahmoud<sup>8</sup>, Asma S.Alhabry<sup>9</sup>, Najah A Sbak<sup>10</sup>, Hana A. Bobaker<sup>10</sup>**

1 Nephrology Department, Sabratha teaching hospital, Sabratha ;2 Hemodialysis department, AZ zawayah Kidney hospital, Az-zawayah; 3 Dialysis Department, Surman General Hospital, Surman; 4 Hemodialysis department , Agelat Hospital ,Al Agelat ;5Alkhoms Kidney Services Center,Alkhoms;6 Misrata Nephrology Center, Misrata; 7Nephrology Department, Iibn Sina Teaching Hospital, Sirt; 8Hemodialysis Department ,Almagrif Hospital, Ajdabia;9Alhawari Nephrology Center, Benghazi;10Nephrology Department ,Tobrouk Medical Center, Tobrouk

# EXTENT OF ACHIEVING KDOQI TARGETS FOR HEMODIALYSIS ADEQUACY IN LIBYAN DIALYSIS PATIENTS: A MULTICENTER CROSS-SECTIONAL STUDY



This study aimed to evaluate the hemodialysis adequacy and extent of achieving KDOQI targets for dialysis adequacy, hemoglobin level, mineral bone disorders and nutritional status among patients on maintenance hemodialysis.

# EXTENT OF ACHIEVING KDOQI TARGETS FOR HEMODIALYSIS ADEQUACY IN LIBYAN DIALYSIS PATIENTS: A MULTICENTER CROSS-SECTIONAL STUDY



- ▶ A cross sectional study was carried out on 286 randomly selected regular hemodialysis adult patients
- ▶ from 11 dialysis center (Al agelat , Sabratha, Surman , Az Zawiyah , Alkhoms , Misurata, Sirt, Ajdabiya, Benghazi, Tobruk), study started on September 2019, ended on March 2021
- ▶ All patients subjected to dry body weight and height measurements for BMI calculations, Medical records revised for etiology of ESRD
- ▶ Hemodialysis prescription revised to detect, treatment time, vascular access, dialysis machine, dialyzer membrane properties, ultrafiltration volume, blood flow and dialysate flow.

# Extent of Achieving KDOQI Targets For hemodialysis Adequacy in Libyan dialysis patients: A Multicenter Cross-Sectional Study



- ▶ Kt/V was calculated using the second-generation Daugirdas formula:
- ▶ Single-pool Kt/V =  $-\ln (R - 0.008 \times t) + (4 - 3.5 \times R) \times UF/W$
- ▶ The targets for the measures were based on the KDOQI Clinical Practice Guidelines
  - ▶ Single-pool Kt/V > 1.2, URR ≥ 65% for adequate dialysis dose
  - ▶ Haemoglobin 11.0–12.0 g/dl
  - ▶ iPTH 150 -300 (pg/ml)
  - ▶ Body mass index(BMI) and serum albumin as nutritional markers.

## Extent of Achieving KDOQI Targets For hemodialysis Adequacy in Libyan dialysis patients: A Multicenter Cross-Sectional Study



- ▶ Blood samples collected immediately from arterial fistula needle after insertion without tourniquet before starting haemodialysis for complete blood count, serum albumin, predialysis blood urea, serum creatinine, total serum calcium, serum phosphate, serum alkaline phosphatase, C reactive protein , and serum iPTH levels
- ▶ At the end of dialysis session blood samples for urea according to KDOQI guide line were taken to calculate urea clearance.

Table 1: Summary of all statistical data of patients in study						
%		N	Minimum	Maximum	Mean	Std. Deviation
Age	Years	286	18	86	50.74	14.62
Male	(66.08%)	189	18	86	51.92	14.54
Female	(33.92%)	97	18	75	48.44	14.56
BMI		286	7.21	41.41	25.71	5.46
Cholesterol	g/dl	286	5.00	14.50	9.71	1.745
BUN		286	16.60	47.00	29.22	6.08
Albumin	g/dl	286	2.20	5.70	3.81	0.64
CRP	mg	286	0.00	234.00	25.57	37.44
Calcium	mg/dl	286	5.00	12.40	8.77	1.04
Phosphorus	mg/dl	286	1.10	13.30	5.75	2.07
Urea	mg/dl	286	2.36	1609.00	187.12	193.04
PTH	pg/ml	286	4.81	5500.00	490.08	694.69
Treatment time	min	286	150	270	228.53	20.80
Blood flow	ml/min	286	170	450	269.30	40.31
Dialysate Flow	ml/min	286	250	800	469.93	75.33
Dry body weight	Kg	286	30.00	113.00	70.80	16.04
Urea predialysis	mg/dl	286	36.00	350.00	136.08	52.14
Urea post dialysis	mg/dl	286	12.00	172.00	46.65	24.90
URR		286	0.23	0.88	0.65	0.12
URR ≥ 65%	(56.64%)	162	0.65	0.88	0.73	0.06
URR < 65%	(43.36%)	124	0.26	0.65	0.55	0.09
Kt/V		286	0.35	2.70	1.31	0.40
Kt/V ≥ 1.2	(60.84%)	174	1.20	2.70	1.55	0.31
Kt/V < 1.2	(39.16%)	112	0.35	1.19	0.94	0.20

## EXTENT OF ACHIEVING KDOQI TARGETS FOR HEMODIALYSIS ADEQUACY IN LIBYAN DIALYSIS PATIENTS: A MULTICENTER CROSS-SECTIONAL STUDY



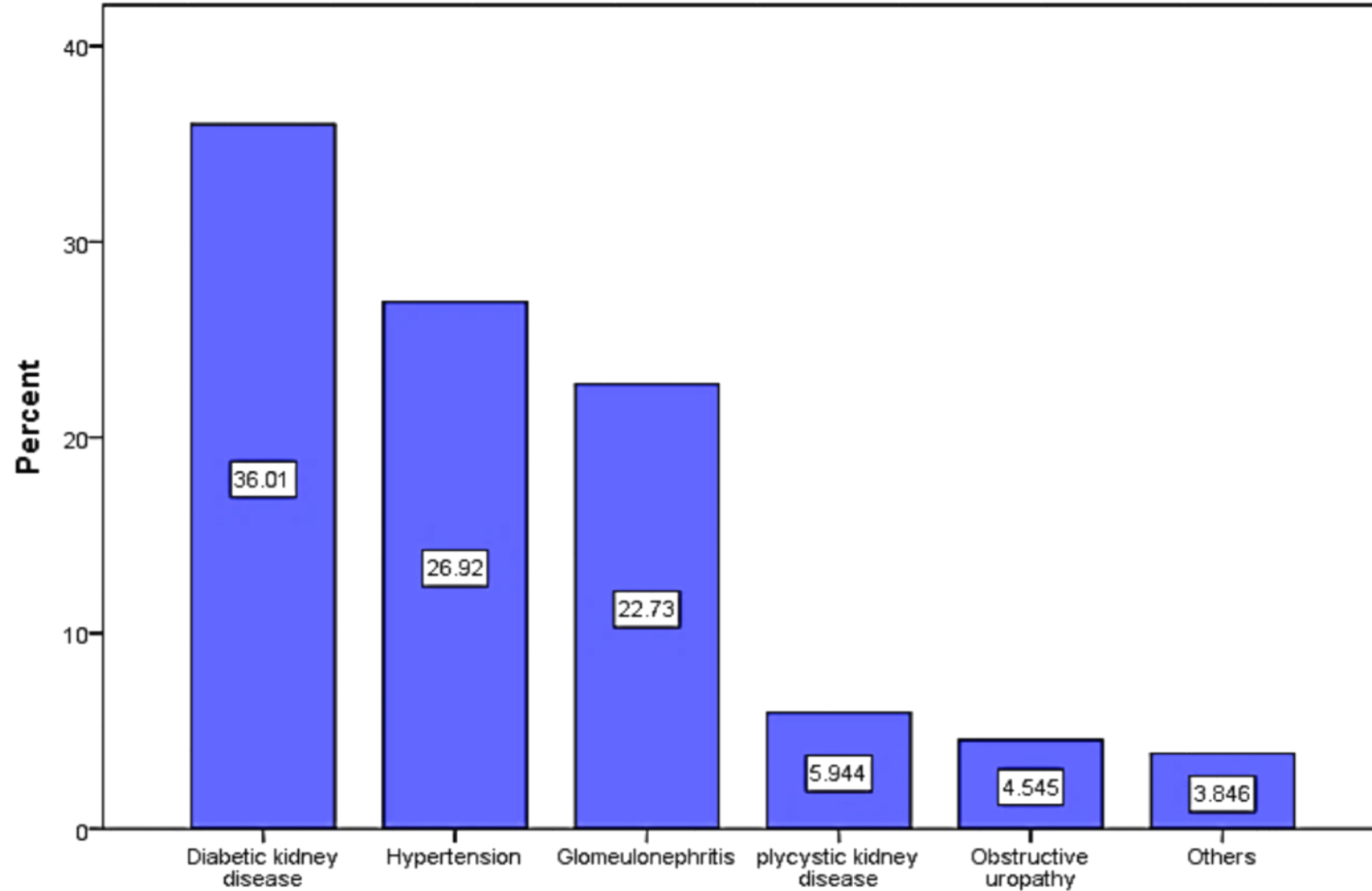
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- ▶ The mean age of the patients was  $50.74 \pm 14.62$  years, similar to the Gulf Cooperation Council countries (GCC)
- ▶ Less than the west European countries where the mean age is more than 60 years.





Figure 1. Pattern of aetiology of renal disease



# EXTENT OF ACHIEVING KDOQI TARGETS FOR HEMODIALYSIS ADEQUACY IN LIBYAN DIALYSIS PATIENTS: A MULTICENTER CROSS-SECTIONAL STUDY



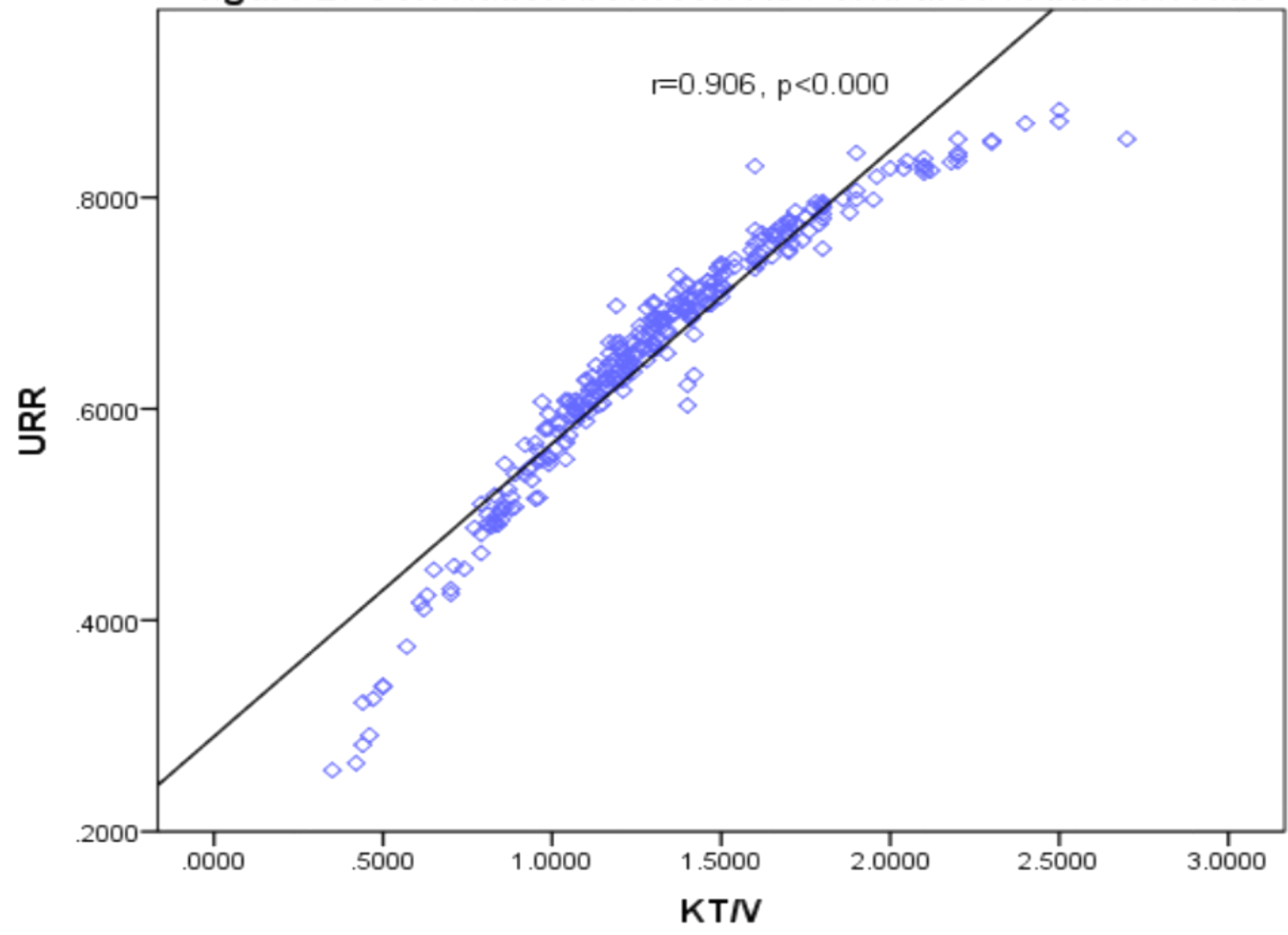
## □ Clearance

- ▶ Mean Kt/V is **1.31±0.40**.
- ▶ Only **60.84%** of the patients achieved the target dose.
- ▶ These results were in agreement with similar findings from Saudi Arabia
- ▶ United States and European (DOPPS) countries (Mean Kt/V is 1.6 and more than 90% of patients reached target dose)
- ▶ Mean treatment time achieved is **228.53±20.8** which is similar to results from united kingdom, Italy and United State

- DOPPS 5 (2012–2015). Saudi J Kidney Dis Transpl 2016;27(6 Suppl 1):S42-S50

- ERA-EDTA Registry Annual Report 2015: a summary. Clinical Kidney Journal, Volume 11, Issue 1, February 2018, Pages 108–12

figure 2: Correlation between Kt/V and urea reduction ratio



# EXTENT OF ACHIEVING KDOQI TARGETS FOR HEMODIALYSIS ADEQUACY IN LIBYAN DIALYSIS PATIENTS: A MULTICENTER CROSS-SECTIONAL STUDY



## Comparison between Kt/V values with respect to treatment time

Treatment time		N	%	N	%	N	%	χ <sup>2</sup> -test	
								χ <sup>2</sup>	P-value
		Group 1		Group 2		total			
	3 hours	5	16.7	25	83.3	30	100	31.66	.000
	3.5 hours	23	52.3	21	47.7	44	100		
	≥4 hours	146	68.9	66	31.1	212	100		
Total		174	60.84	112	39.16	286	100		

Group 1: Kt/V ≥1.2

Group 2 :Kt/v <1.2

# EXTENT OF ACHIEVING KDOQI TARGETS FOR HEMODIALYSIS ADEQUACY IN LIBYAN DIALYSIS PATIENTS: A MULTICENTER CROSS-SECTIONAL STUDY



## Comparison between Kt/V values with respect to Gender

	Group 1		Group 2		Total N	Fischer exact test	P-value
	N	%	N	%			
Male	111	58.7	78	41.3	189	1.037	0.186
Female	63	64.9	34	35.1	97		
Total	174	60.84	112	39.16	286		

Group 1: Kt/V  $\geq 1.2$

Group 2: Kt/v  $< 1.2$

# EXTENT OF ACHIEVING KDOQI TARGETS FOR HEMODIALYSIS ADEQUACY IN LIBYAN DIALYSIS PATIENTS: A MULTICENTER CROSS-SECTIONAL STUDY



## Comparison between Kt/V values with respect to Blood Flow Rate

BFR ml/min	N	%	N	%	N	%	$\chi^2$ -test	
	Group 1		Group 2		Total		$\chi^2$	P-value
< 250	55	43.0	73	57.0	128	100	31.235	.000
250-300	107	75.9	34	24.1	141	100		
> 300	12	70.6	5	29.4	17	100		
Total	174	60.84	112	39.16	286	100		

BFR: Blood flow rate

Group 1: Kt/V  $\geq 1.2$   
 Group 2: Kt/v  $< 1.2$

# EXTENT OF ACHIEVING KDOQI TARGETS FOR HEMODIALYSIS ADEQUACY IN LIBYAN DIALYSIS PATIENTS: A MULTICENTER CROSS-SECTIONAL STUDY



## □ Vascular access and Blood flow

- ▶ **94.05%** of the patients dialyzed from arteriovenous fistula.
- ▶ Mean blood flow is **269.30±40.3** ml/min
- ▶ European DOPPS country (300 – 360 ml/min) and United State ( more than 400ml/min)

# THE PRACTICED PATTERN OF VASCULAR ACCESS USED IN HEMODIALYSIS: A CROSS-SECTIONAL STUDY



Rodaba Ahmed Bitrou<sup>1</sup>, Badreddin Shaibani<sup>1</sup>, Hajir Salih Ahmed<sup>1</sup>, Khairi Ayad<sup>2</sup>

1 Alzawia Kidney Hospital Kidney Hospital, 2 Sabratha Teaching Hospital, Azzawia University, Azzawia, Libya

## □ Timing of arteriovenous fistulas creation

Timing	Percentage
○ Early (preemptive)	0.6 %
○ 1-2 months	45 %
○ 3-4 months	35%



# EXTENT OF ACHIEVING KDOQI TARGETS FOR HEMODIALYSIS ADEQUACY IN LIBYAN DIALYSIS PATIENTS: A MULTICENTER CROSS-SECTIONAL STUDY



## □ Dialyzers

- All dialyzers are high efficient dialyzers (KoA for urea more than 800ml/min) surface area more than 1.4 square meters
- 64% patients were on high flux dialyzer
- 36% patients on low flux dialyzers.

## □ Effect of dialyzer type on adequacy of sessions

- 58.3% of patients who dialyzed with low flux dialyzers achieved target dose ( $Kt/V > 1.2$ )
- 62.3% of patients who dialyzed with high flux dialyzers achieved target dose ( $Kt/V < 1.2$ )
- Percentage differences for  $Kt/V$  values among both dialyzer groups were statistically insignificant ( $P = 0.501$ ).

# EXTENT OF ACHIEVING KDOQI TARGETS FOR HEMODIALYSIS ADEQUACY IN LIBYAN DIALYSIS PATIENTS: A MULTICENTER CROSS-SECTIONAL STUDY



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## □ Hemoglobin

- only **27 %** of studied patients achieved the target range (11.0 to 12.0 g/dl)
- **36%** of patients had hemoglobin level less than 9.0 g/dl

## □ Nutritional status

### ➤ BMI

- **37.1%** of the patients are within the range of body weight
- **14%** of the Patients are underweight

### ➤ Serum albumin

- hypoalbuminemia (<3.5 g/dl) was present in (**27.98%**) of the studied patients.

# EXTENT OF ACHIEVING KDOQI TARGETS FOR HEMODIALYSIS ADEQUACY IN LIBYAN DIALYSIS PATIENTS: A MULTICENTER CROSS-SECTIONAL STUDY



## ❑ Mineral Bone Disorders

- ❖ **19.2%** of patients are within target range according to KDOQI guidelines (PTH 150 -300pgm)
- ❖ **80.8%** of the patients had metabolic bone disorders
  - 30.8% low bone turnover
  - 50% high bone turnover
- ❖ Hypocalcaemia **37.4%**
- ❖ Hyperphosphatemia **72.7%**

## ❑ Distribution of the studied patients according to Laboratory mineral bone disorder indicators

	N	%
<b>PTH (pg/ml)</b>		
<150	88	30.8
150-300	55	19.2
>300	143	50.0
<b>Ca (mg/dl)</b>		
<8.5	107	37.4
8.5 -9.5	125	43.7
>9.5	54	18.9
<b>Pi (mg/dl)</b>		
<2.5	18	6.30
2.5 -4.5	60	21.0
>4.5	208	72.7

Ca, calcium; Pi, inorganic phosphate; PTH, Parathyroid hormone.

# AFTER 50 YEARS OF DIALYSIS , WHERE WE STAND ?



	Dialysis Machine	Dialyzers
Fresenius	5008s , Multifiltrate pro	Low flux, High flux, HDF filters , CRRT
Baxter	Ak98 , Artis , Prisma flex	Low flux , High flux , HDF filters , HDx , CRRT
B Braun	Dialog+, OMNI	Low flux , high flux, HDF filters , CRRT
Nipro	Surdial X	Low flux , High flux , HDF filters
Dialife	DIANOVA X2	Low flux , High flux , HDF filters

# AFTER 50 YEARS OF DIALYSIS , WHERE WE STAND ?



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## ❑ Online HDF

- 1.5 – 2 % of hemodialysis
- Efficiency of online HDF .... No data

## ❑ HDX

- Still in its beginning

## ❑ Online HDF and HDX Limitation:

**Water Quality For  
Hemodialysis**

# WATER QUALITY FOR HEMODIALYSIS



Maximum allowable levels for total viable microbial count (TVC) and endotoxins in dialysis water, in standard and ultrapure dialysis fluid (dialysate) and online-prepared substitution fluid

Fluid category	Application	TVC (CFU/mL)	Endotoxin (EU/mL)
Dialysis water	Basis for all fluid preparation	<100 (action level 50)	<0.25 (action level 0.125)
Standard dialysis fluid	Minimum acceptable quality for routine HD	<100 (action level 50)	<0.5 (action level 0.25)
Ultrapure dialysis fluid	Recommended for routine HD/high-flux HD	<0.1	<0.03
Online-prepared substitution fluid	HF and HDF, priming solution, bolus administration	Sterile	Non-pyrogenic

HD: hemodialysis, HF: hemofiltration, HDF: hemodiafiltration, CFU: colony-forming unit, EU: endotoxin unit.

Based on the AAMI Dialysis Standards Collection, 2013.<sup>56</sup>

# ENDOTOXIN RETENTION FILTERS



- ▶ Pore size
- ▶ Adsorptive properties of the membrane
- ▶ All manufactures advise to change these filters basing on No of session or time elapsed
- ▶ Adsorption capacity depends on concentration or load of endotoxins
- ▶ With high load or concentration of endotoxins , **saturation point ??**

Table 2. Bacterium-derived pyrogens and their detection

Bacterium Cell Wall	Molecular Weight (Da)
Components	
LPS	>100,000
lipid A	2000 to 4000
other LPS fragments	<8000
peptidoglycans	1000 to 20,000
muramilpeptides	400 to 1000
others	
Other cellular components	
bacteria DNA	Variable
Secreted toxins	
exotoxin A	71,000
exotoxin A fragment	<1000
other exotoxins	20,000 to 50,000

# BACK FILTRATION AND REPLACEMENT



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- ▶ **High flux** HD 4- 5 L/4hours ( back filtration)
- ▶ **Online HDF** 21 -24 L/4hours ( Replacement)
- ▶ **HDX** 12 -14L /4 hours ( back filtration)
- **In our study**
  - Mean CRP level  $25.57 \pm 37.44$
  - 52.3% of patients had CRP level  $> 10$

Cardiovascular disease is reported as the leading cause of death (COD) among dialysis patients, followed by (sepsis/infection/ chronic inflammations)



# AFTER 50 YEARS OF DIALYSIS , WHERE WE STAND ?



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## Summary

- Despite the advanced and high dialysis technology , the gab is still huge between our HD results and international standards.
- Mortality rate ?????
- Online HDF
  - Is < 2% of dialysis in Libya
  - No data available about.
- Water quality is still a big issue and is a major limitation for online HDF and HDX in Libya