FLUID MANAGEMENT:
WHAT THE NEPHROLOGY TECHNICIAN CAN DO TO HELP?

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BONENT President

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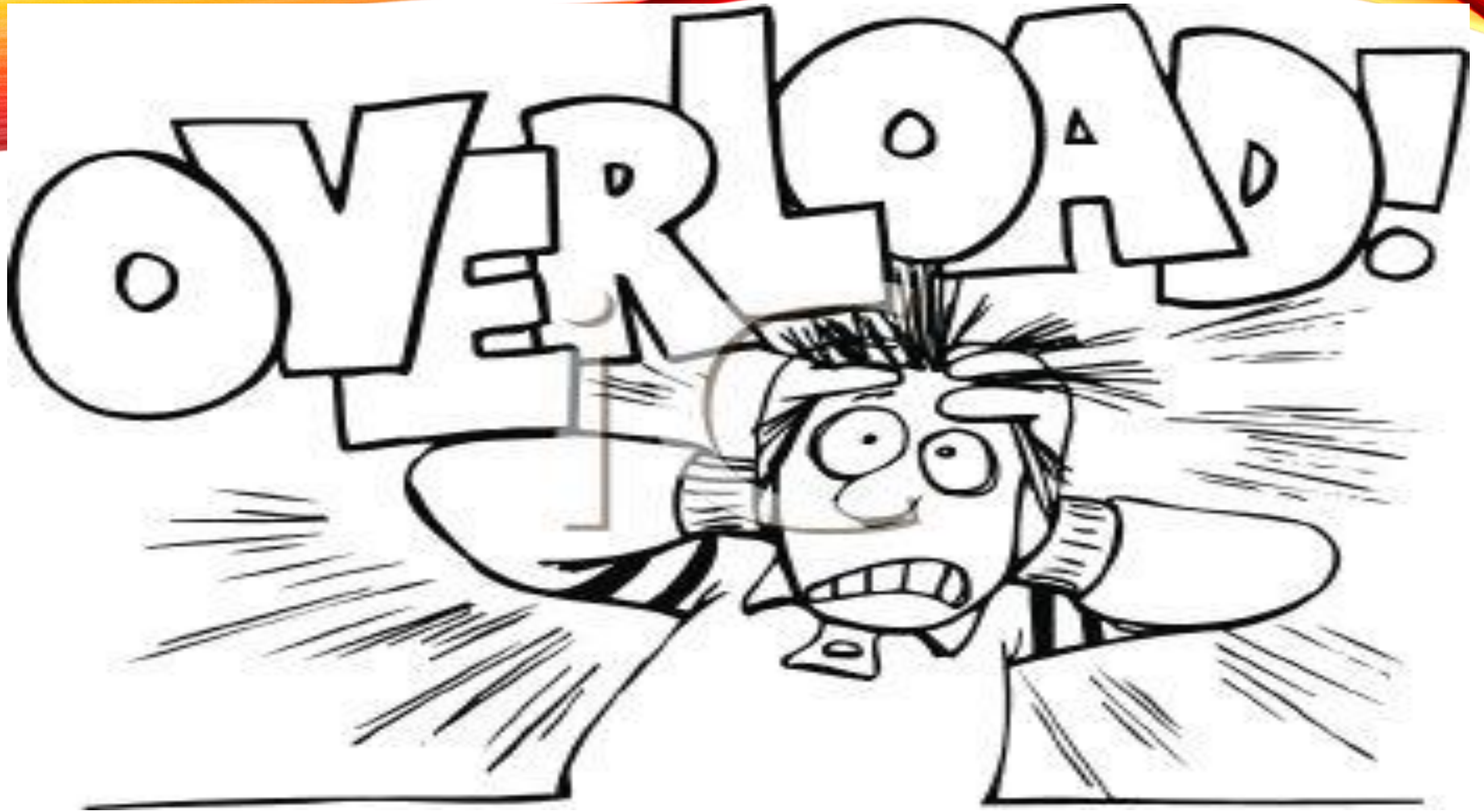
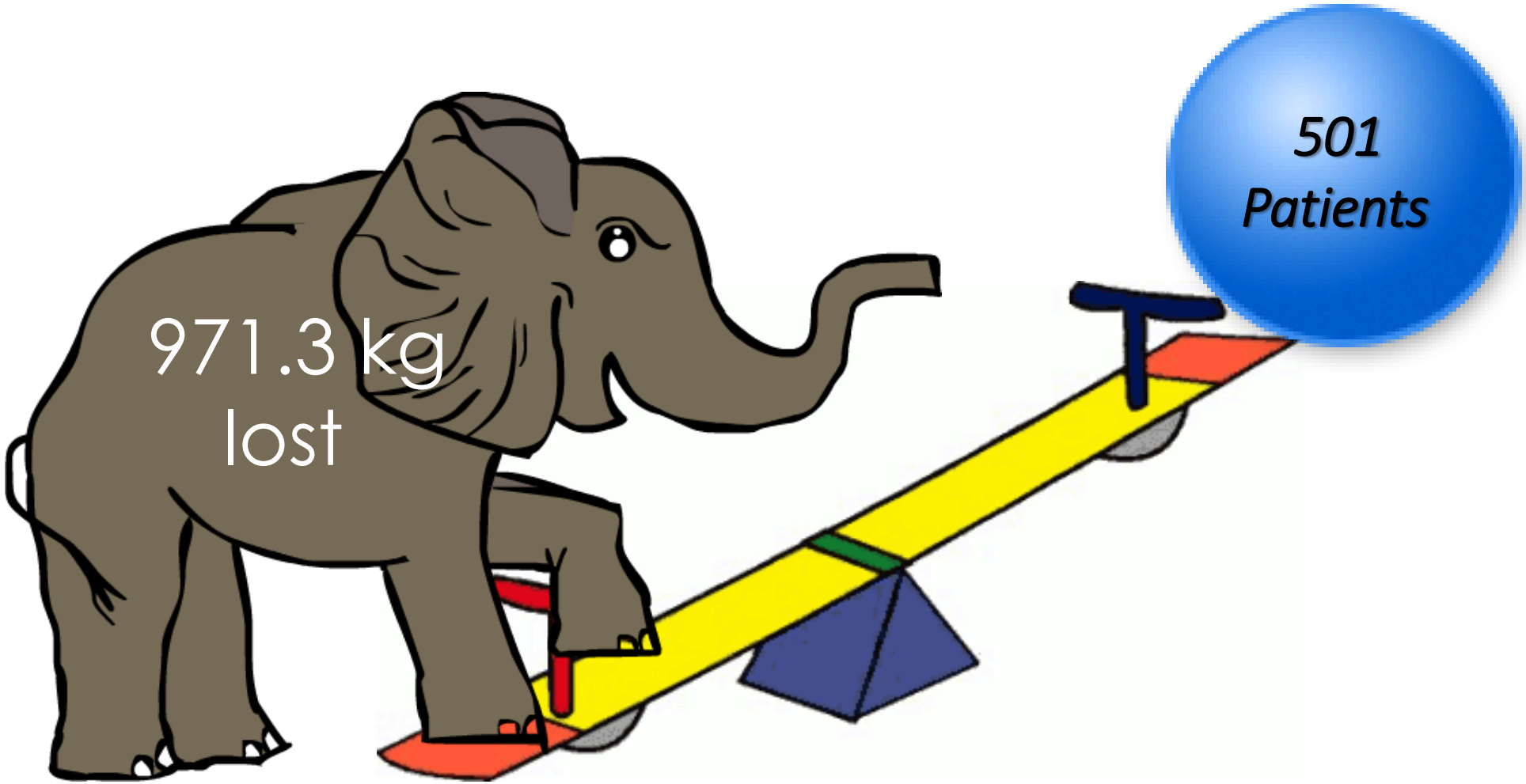
TODAY'S TALK

- What's possible with Fluid Management Programs
- Why is a Fluid Initiative important
- How can a Nephrology Technician help lead this kind of patient improvement

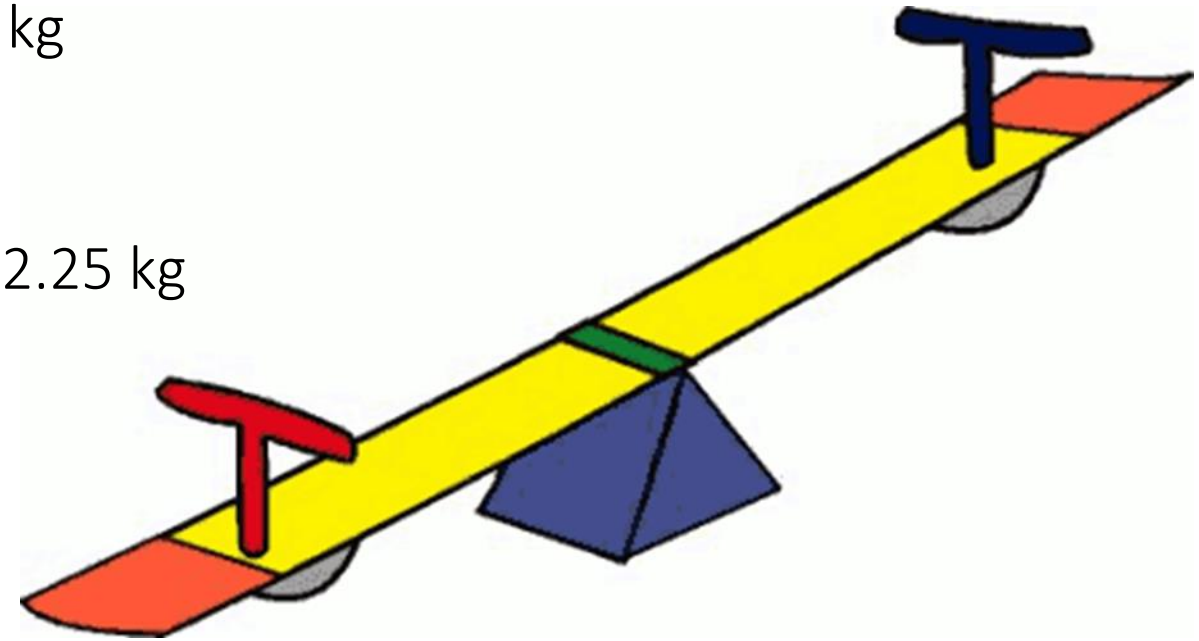

OVERLOAD!

HOW TO LOSE A TON OF WEIGHT

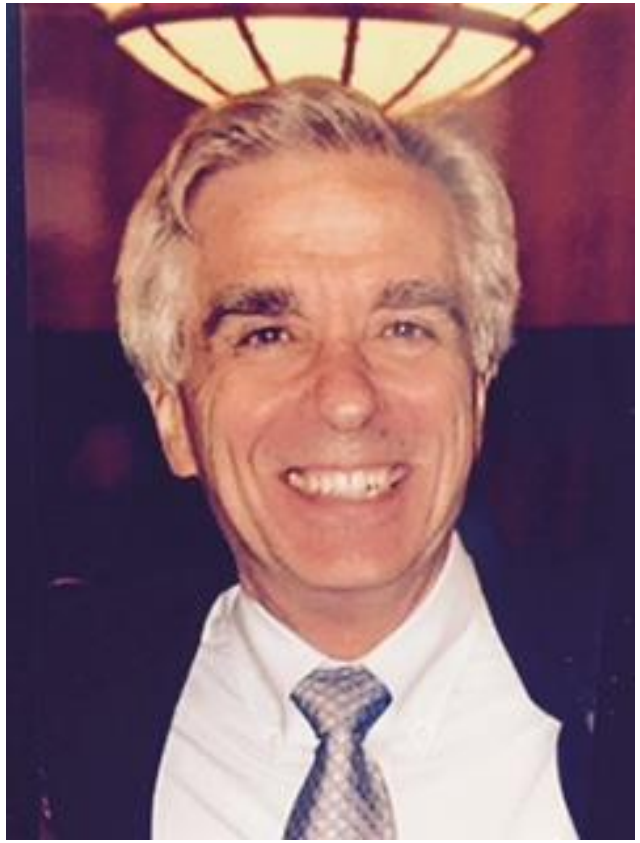


CONFIRMED: DRY WEIGHT IS AN ESTIMATE

- Only 21% patients at Dry Weight
- 62% patients decreased weight
  Average kg/patient lost: 3.14 kg
- 17% patients increased weight
  Average kg/patient increase: 2.25 kg



PIONEER FOR IMPROVED PATIENT CARE



- Leader for Quality & Patient Satisfaction
- Driven by Research
- Utilized Best Practices
- Publications
- Posters
- Continuing Work

FOUNDATIONAL STUDY

Fluid Management with Photoplethysmographic Assisted Probing

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*Centers for Dialysis Care, Shaker Heights, Ohio
#Intelomed, Wexford, Pennsylvania

Introduction. The dialysis prescription must include appropriate time to reach reasonable fluid removal goals without excessive ultrafiltration rates, symptoms, or intra-dialytic hypotension (IDH). Fluid control should be given as much emphasis as is achieving target Kt/V. We sought to develop a protocol that allow the RN's to challenge a patient's "dry weight" over a series of treatments. We used photoplethysmography (PPG) to monitor the patients' tolerance to ultrafiltration and judge the efficacy of interventions to mitigate the impact of UFR.

Methods.

Patients: Convenience sample 8 Trial patients over 18 treatments outcomes compared to their 36 previous treatments (baseline); outcomes compared to16 Control patients over 18 treatments at same time as the trial patients, by same staff in same treatment area (control)

Protocol: reduce target weight by 0.2 kg each treatment. May increase goal 100 ml up to 3x in first half of treatment if no hypotensive trend or alerts from the PPG. Interventions: change chair position, administer oxygen, reduce dialysate temp (base line = 36°), use sequential hemofiltration and dialysis, reductions in UF goal, turn UF off, give NS. BP measured every 15'

Outcome Indicators: % of treatments where post weight (pw) > dry weight + 1 KG; where pw < dw – 1 KG; Pulse pressure; Systolic BP < 90, UFR and weight loss / PW.

Photoplethysmography: Pulse oximeter sensor on forehead (Intelomed, Wexford, PA). Signal analyzed for rate of change from baseline of amplitude (strength PS), rate (PR), regularity (PI) and O_2 saturation (SpO_2). Alert 1 (20% change in PS or PR). Alert 2 (40% decrease PS); Alert 3 (60% decrease in PS or increase PI); Alert 4 (80% decrease PS or sustained PI or SpO_2). Picture shows forehead PPG sensor and display showing the 2nd level alert.

% ∂ PR

% ∂ PS

Pulse wave

Results.

Trial Patients Baseline and Intervention

Index	BL (± sem)	Trial (± sem)
Lo Sys BP	114 ± 1.3	117 ± 2.1
Dry Wt	80.1 ± .7	78.3 ± 1.24
*PW < DW – 1 KG **	*.09 ± .02*	*.34 ± .04*
*PW > DW + 1 KG**	*.24 ± .02*	*.15 ± .04*
If low sys < 90°	*.07 ± .01*	*.01 ± .02*
Pre PP°	*71 ± 1.3*	*66 ± 1.6*
Pst PP°	*68 ± 1.2*	*63 ± 1.6*
∂ PP	2.9 ± 1.4	3.6 ± 2
UFR (cc/kg/hr)°	*5.73 ± .19*	*7.74 ± .32*
Wt Loss/DW°	*.020 ± .001*	*.028 ± .001*

Compared to their Baseline treatments the Trial treatments were more likely to be below their dry weight, less likely to be above their DW, less likely to have a SBP < 90, had a lower PP pre and post HD, tolerated a higher UF and had greater % of their post weight removed during the treatment. Comparisons between groups highlighted in blue p < .05 by paired t.

Trial Patients vs. Control Patients

Index	Control (± sem)	Trial (± sem)
Lo Sys BP	114 ± 1.3	117 ± 2.1
Dry Wt	80.1 ± .7	78.3 ± 1.24
*PW < DW – 1 KG **	*.04 ± .02*	*.34 ± .04*
PW > DW + 1 KG	.12 ± .02	.14 ± .04
If low sys < 90°	*.13 ± .01*	*.02 ± .02*
Pre PP	71 ± 1.6	68 ± 2.2
Pst PP	62 ± 1.4	62 ± 2/1
∂ PP°	*9 ± 1.4*	*6 ± 2.6*
UFR (cc/kg/hr)°	7.61 ± .19	7.54 ± .3
Wt Loss/PW	.03 ± .001	.03 ± .00

Compared to the Control patients, the Trial patients were be under their dry weight, less likely to have a SBP < 90, smaller reduction of their pre to post pulse pressure. Com between groups highlighted in blue p < .05 by One-way

Discussion Over-hydration is associated with excess mortality and cardiovascular morbidity in CKD patients (1). Dialysis patients who are consistently over or under their "dry weight" have a higher hazard for death and hospitalization (2). Over emphasizing urea kinetics as the dominant definition of "adequacy" often leads to treatment times too short to avoid excessive ultrafiltration rates and intra-dialytic hypotension (IDH) (3).

There is no agreement on the the best protocols or assistive devices to guide fluid removal during dialysis treatments (4). Hypotension is a poor endpoint, may give the false impression that the patient is euvolemic, and is associated with myocardial stunning (5).

Currently, changes in relative plasma volume (RPV), continuous bio-impedance analysis (BIA), and changes in the PPG signal have been used to assist patient care staff to guide the rate and amount of fluid removal (6). None has been shown to be safe and effective in randomized controlled trials. The CLIMB (7) trial showed harm to patients randomized to the RPV arm. In the DRIP (8) study, a protocol of consistent challenge of dry weight, while successful in lowering BP as post weight was lowered, was a associated with a 6% serious adverse event rate (hypotension, seizures, and angina).

PPG shows the pulse rate and regularity in addition to SpO_2 and pulse wave amplitude. We and others have been impressed by the incidence of sleep induced hypoxemia, and the incidence of atrial and ventricular arrhythmias identifiable in the pulse tracing.

Our small study supports the hypothesis that a conservative "challenge" protocol assisted by PPG that shows the cardiovascular response to dialysis and ultrafiltration can achieve dry weight reduction without an increase in IDH while safely bringing patients to lower post dialysis weights.

References
1. Tsai YC, et. al.: Association of fluid overload with cardiovascular morbidity and all cause mortality in stage 4 and 5 CKD. *CJASN* 10:39-46, 2015.
2. Flythe JE, et. al.: Associations of post hemodialysis weights above and below target weight with all-cause and cardiovascular mortality. *CJASN* 10:1-9, 2015.

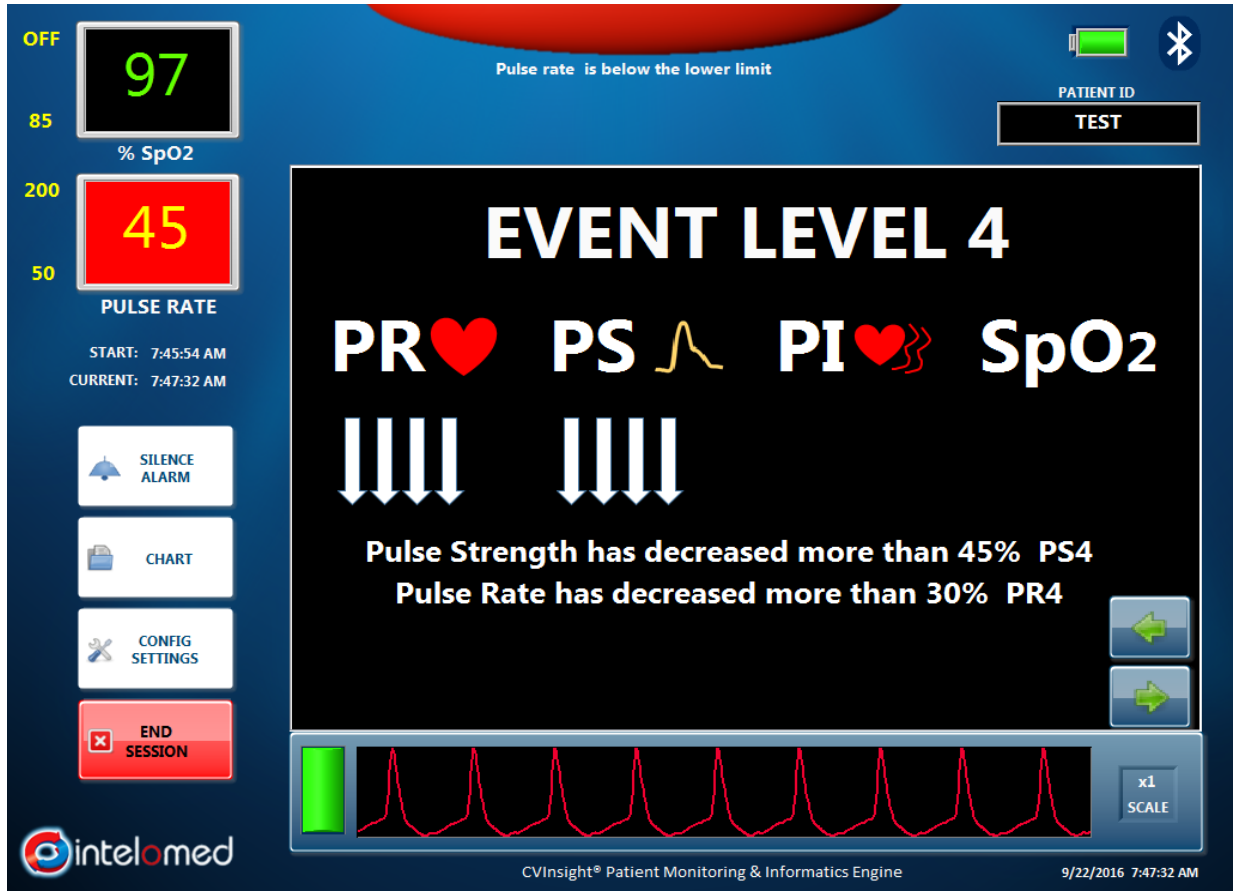
ASN 2015 Poster:

Reducing Rate of hypotensive events during dialysis while lowering DW

The rate of hypotension to 2%

Our small study supports the hypothesis that a conservative "challenge" protocol assisted by PPG that shows the cardiovascular response to dialysis and ultrafiltration can achieve dry weight reduction without an increase in IDH while safely bringing patients to lower post dialysis weights.

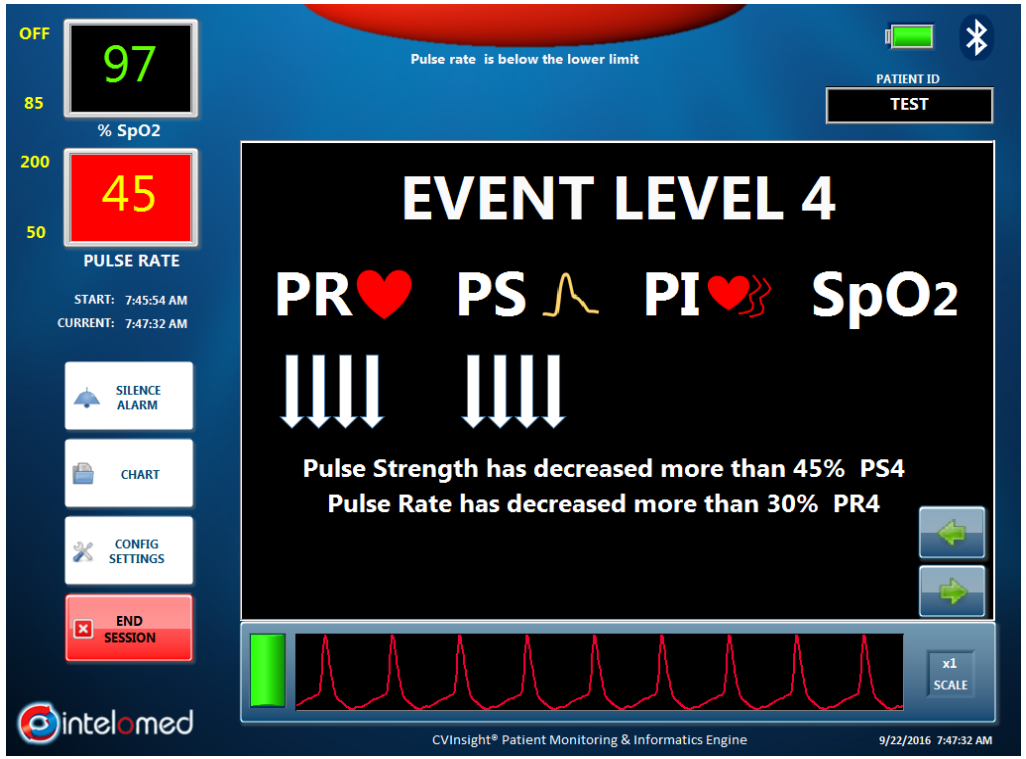
CVINSIGHT® FRAMEWORK FOR DIALYSIS TOLERANCE



Type of Stress

- Pulse Rate
- Pulse Strength
- Pulse Irregularity
- SpO2 Variability

DR. DEOREO DEFINED STRESS LEVELS



Description of Stress (Event) Level

*Based on clinician-set parameters**

0 = No Stress

1 = Compensated Stress

2 = Tolerated Stress

3 = Early Decompensation

4 = Decompensation

* Defined parameters in the DeOreo Dialysis Intervention^{SM} Protocol

DEOREO DIALYSIS INTERVENTION℠ PROTOCOL

Protocol Based On Event Type & Event Level

		Event Type			
		PR	PS	PI	SpO2
	Action Type	Chair Position	UFR	Temp	Oxygen
Event Level	0		Increase by 200		
	1		Increase by 100		
	2	Chair 3	No change		
	3	Chair 3	Decrease by 100	Decrease to 35.5	2L NC
	4	Chair 3	Decrease by 200	Decrease to 35.0	2L NC

Note: If ↓Temp stabilizes, ask for order change.

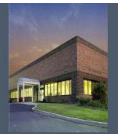
- Classic MD-defined interventions triggered by CVI alerts
- Leverage patient tolerance to increase UFR
- Small reactive steps taken to reduce dialysis stress

PROTOCOLS FOR FLUID MANAGEMENT


CDC Cleveland East

Fluid Management with and without Technology Assistance

RJ Picciano, BA, CHT, OCDT, CHBT; Peter DeOreo, MD
Centers for Dialysis Care, Cleveland OH


CDC Warrensville Heights

INTRODUCTION

The dialysis prescription must include appropriate time to reach fluid removal goals while avoiding excessive ultrafiltration rates, symptoms, or intra-dialytic hypotension (IDH). Fluid control should be given as much emphasis as achieving target Kt/V. We developed a fluid management protocol that allows the patient care team to challenge a patient's "dry weight" over a series of treatments.

We designed a fluid management protocol to challenge patient's current dry weight. The protocol included methods to improve patient tolerance of ultrafiltration (UF). The protocol was approved by the medical staff and ordered for the patient by a physician.

Two methods were used to implement the fluid management protocol; the first was technology assisted and the second was unassisted. The technology assisted method used the CVInsight® Monitoring System pictured below. Staff recommended patients for the technology assisted method when it was expected that the patient would be sensitive to changes in UF. There was no randomization of patients.

CVINSIGHT MONITORING SYSTEM

- A pulse oximeter sensor is placed on the forehead (Intelomed, Wexford, PA). The signal is analyzed for change from baseline rate (PR), amplitude (PS), regularity (PI) and O_2 saturation (SpO_2).
- Alert Levels include: Alert 1 (20% change in PS or PR), Alert 2 (40% decrease PS), Alert 3 (60% decrease in PS or increase PI), and Alert 4 (80% decrease PS or Sustained PI or SpO_2 decreased).


Figure 1. Placement the sensor on the forehead.

Figure 2. Monitor display showing change in pulse rate, pulse strength, pulse irregularity, and oxygen saturation, pulse rate, and an Alert Level 3.

METHODS

- Staff:
  - We created a new Fluid Management Coordinator position as well as fluid champion positions held by RNs to implement our fluid management program.
- Patients:
  - Patients were referred to this project by doctors, case managers, and nurses to participate.
  - Patients were assigned to the fluid management protocol either with or without the CVInsight Monitoring System.
  - Patients with excessive co-morbidities who would be poor candidates for dry weight challenge without monitoring were exclusively assigned to the CVInsight Monitoring group.

Funding for poster creation by Intelomed, Inc.

- Fluid Management Protocol:
  - Reduce the patient target weight by at least 0.2 kg each treatment.
  - Ensure that the UF did not exceed 15cc per kg/per hr (See Table 1).
  - Increase the UF goal by 200 ml up to 3x in the first half of treatment.
  - Utilize alerts from the CVInsight Monitoring System, staff observations of the patient, and periodic blood pressures to determine if UF goal could be increased per above protocol.
- Fluid Management Protocol Chairside Tool (Table 1):

Table 1. UFR Chart.

WT in Kg	10 cc	13cc	15 cc
35	350	455	525
40	400	520	600
45	450	585	675
50	500	650	750
55	550	715	825
60	600	780	900
65	650	845	975
70	700	910	1050
75	750	975	1125
80	800	1040	1200
85	850	1105	1275
90	900	1170	1350
95	950	1235	1425
100	1000	1300	1500
105	1050	1365	1575
110	1100	1430	1650
115	1150	1495	1725
120	1200	1560	1800
125	1250	1625	1875
130	1300	1690	1950
135	1350	1755	2000(max)
140	1400	1820	2000(max)
145	1450	1885	2000(max)

We developed this UFR Chart so that chairside adjustments could be made to UFR without exceeding the 15cc per kg/per hr. limit:

- Green Column (10 cc rage): 200cc increases on UFR are allowed.
- Yellow Column (13 cc range): 100cc increased in UFR are allowed.
- Red Column (15 cc range): No increases in UFR are allowed. Decreases are allowed.

- Interventions:
  - Change in chair position, administration of oxygen, reduction of dialysis temp (baseline=35.5°), use of sequential hemofiltration and dialysis, reductions in UF goal, turning off UF, administering saline, review of dialysate Ca++ and K+, measurement of BP measured every 15 mins.
- Outcome Indicators:
  - % of treatments where posted weight (pw) > dry weight (dw) + 1KG; where pw < dw -1KG; Mean Arterial Pressure; Systolic BP <90, UFR and weight Loss/PW

RESULTS

165 patients were referred to the CVInsight monitored cohort (CVI) and 82 were referred to the unmonitored cohort (DWC). Average time on protocol was 36.8 days for CVI and 46.3 days for DWC. There was significant reduction in dry weight in both groups (CVI, 1.73 kg; DWC, 2.13 kg), and this reduction was proportional to the number of days on protocol. Post weight reduction followed this same trend (CVI, 2.4 kg, DWC 2.9 kg). There was no statistical difference in weight loss across facilities, suggesting that this protocol is replicable. (Tables 2 and 3)

Table 2. Results of CVInsight Monitored dry weight challenge from two sites across a total of 165 patients.

Site	Patients (N)	Days	Baseline DW	New DW	Average DWð	Baseline Post Wt	New Post Wt	Average PWð
East	135	40.6	81.9	80.2	1.79	83.2	80.9	2.3
Warr	30	19.4	84.8	83.4	1.45	87.3	84.4	2.9
Overall	**165**	**36.8**	**82.5**	**80.7**	**1.73**	**83.9**	**81.5**	**2.4**

All numbers are averages. All weights are Kg. ð = change from baseline to post challenge.

Table 3. Results of dry weight challenge from two sites across a total of 82 patients.

Site	Patients (N)	Days	Baseline DW	New DW	Average DWð	Baseline Post Wt	New Post Wt	Average PWð
East	48	56.8	82.7	80.8	1.92	84.8	82.1	2.7
Warr	34	31.5	88.4	86.0	2.43	90.0	86.9	3.1
Overall	**82**	**46.3**	**85.1**	**82.9**	**2.13**	**86.9**	**84.1**	**2.9**

All numbers are averages. All weights are Kg. ð = change from baseline to post challenge.

In both cohorts, there were patients with no decrease in dry weight (CVI, 33%, DWC, 25%). Patients on the monitored cohort were slightly less tolerant of increases in UFR as gauged by the increase in IDH events from baseline (CVI, 24% to 31%; DWC, 24% to 26%). Similarly, patients in the CVI cohort experienced a less of an increase of UFR from baseline (CVI, 7.4 to 7.5 cc/kg/hr) than those in the DWC cohort (7.6 to 8.9 cc/kg/hr). These differences between cohorts reflect the fact that patients with cardiac and other clinically significant co-morbidities were referred to CVI. Despite co-morbidities, the CVI cohort experienced a decrease in dry weight similar to the DWC group.

Table 4. Results of dry weight challenge from two sites across a total of 82 patients.

	CVI (Baseline)	CVI (Post)	DWC (Baseline)	DWC (Post)
Mean Art Pressure	102		107	
UFR (mean)	7.4 cc/kg/hr	7.5 cc/kg/hr	7.6 cc/kg/hr	8.9 cc/kg/hr
Post Wt > DW+1 kg	8%	5%	11%	4%
IDH Events	24%	31%	24%	26%
UFR>13 cc/kg/hr	9%	11%	11%	18%
No Change or ↑DW		33%		25%

DISCUSSION

Over-hydration is associated with excess mortality and cardiovascular morbidity in CKD patients (1). Dialysis patients who are consistently over or under their "dry weight" have a higher hazard for death and hospitalization (2). Over emphasizing urea kinetics as the dominant definition of "adequacy" often leads to treatment times too short to avoid excessive ultrafiltration rates and intra-dialytic hypotension (IDH) (3).

There is no agreement on the best protocols or assistive devices to guide fluid removal during dialysis treatments (4). Hypotension is a poor endpoint, may give the false impression that the patient is euvolemic, and is associated with myocardial stunning (5).

Our small study supports the hypothesis that a conservative "challenge" protocol assisted by the CVInsight Monitoring System which shows the patient's tolerance to dialysis can assist with getting challenging patients to their dry weight and then further reducing their dry weight.

Lessons learned from CVInsight monitoring and challenging our more difficult patients with cardiac and additional comorbidities were translated into a protocol for delivering similar care to our remaining population.

References

1. Tsai YC, et. al.: Association of fluid overload with cardiovascular morbidity and all cause mortality in stage 4 and 5 CKD. *CJASN* 10:39-46, 2015.
2. Flythe JE, et. al.: Associations of post hemodialysis weights above and below target weight with all-cause and cardiovascular mortality. *CJASN* 10:1-9, 2015.
3. Flythe JE, et. al.: Rapid fluid removal during dialysis is associated with cardiovascular morbidity and mortality. *Kid Int* 79:250-257, 2009.
4. Sinha AD.: Why assistive technology is needed for probing of dry weight. *Blood Purif*. 31:1-3, 2011.
5. McIntyre CA, et. al. Hemodialysis induced cardiac dysfunction. *CJASN* 3:19-26, 2008.

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NANT 2016 Poster:

DeOreo Dry Weight Challenge Programs:

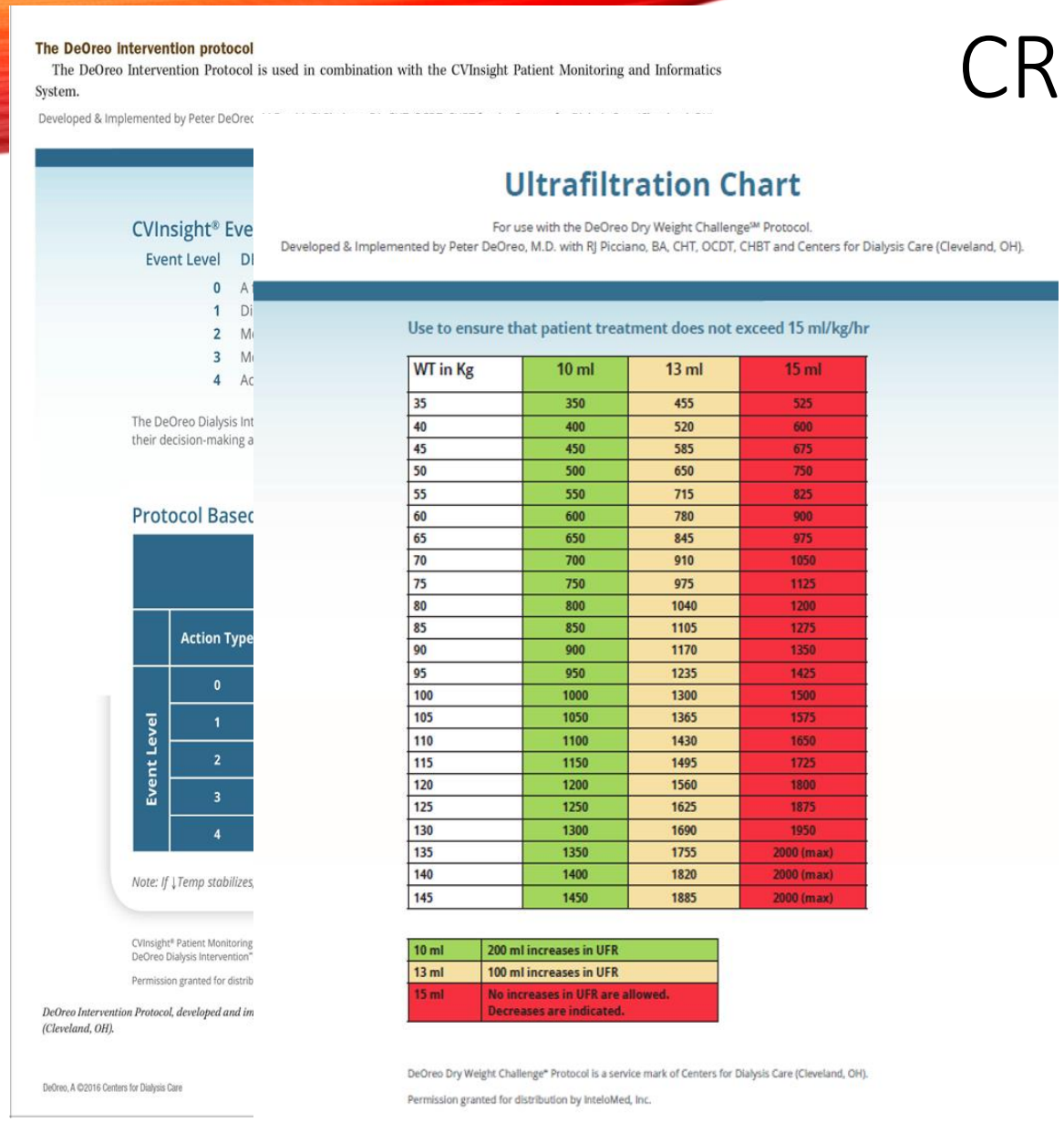
Monitored

Nonmonitored

Avg DW:

2.5Kg/patient

CREATED EASY TO USE TOOLS



The DeOreo Intervention protocol

The DeOreo Intervention Protocol is used in combination with the CVInsight Patient Monitoring and Informatics System.

Developed & Implemented by Peter DeOreo

CVInsight® Eve

Event Level	DI
0	A
1	Di
2	M
3	M
4	Ac

The DeOreo Dialysis Int
their decision-making a

Protocol Based

	Action Type
Event Level	0
	1
	2
	3
	4

Note: If ↓Temp stabilizes,

CVInsight® Patient Monitoring
DeOreo Dialysis Intervention™

Permission granted for distrib

DeOreo Intervention Protocol, developed and im
(Cleveland, OH).

DeOreo, A ©2016 Centers for Dialysis Care

Ultrafiltration Chart

For use with the DeOreo Dry Weight Challenge℠ Protocol.
Developed & Implemented by Peter DeOreo, M.D. with RJ Picciano, BA, CHT, OCDT, CHBT and Centers for Dialysis Care (Cleveland, OH).

Use to ensure that patient treatment does not exceed 15 ml/kg/hr

WT in Kg	10 ml	13 ml	15 ml
35	350	455	525
40	400	520	600
45	450	585	675
50	500	650	750
55	550	715	825
60	600	780	900
65	650	845	975
70	700	910	1050
75	750	975	1125
80	800	1040	1200
85	850	1105	1275
90	900	1170	1350
95	950	1235	1425
100	1000	1300	1500
105	1050	1365	1575
110	1100	1430	1650
115	1150	1495	1725
120	1200	1560	1800
125	1250	1625	1875
130	1300	1690	1950
135	1350	1755	2000 (max)
140	1400	1820	2000 (max)
145	1450	1885	2000 (max)

10 ml	200 ml increases in UFR
13 ml	100 ml increases in UFR
15 ml	No increases in UFR are allowed. Decreases are indicated.

DeOreo Dry Weight Challenge℠ Protocol is a service mark of Centers for Dialysis Care (Cleveland, OH).

Permission granted for distribution by InteloMed, Inc.

- Quick easy assess to make real time decisions
- Ease of Use
- Took away some of the guess work
- Incorporated within current workflow and practices
- Standardized practice
- Gave confidence with decision making

Identifying the value of ... manag...

RJ Picciano, BA, ...

One goal of dialy... remove excess fl... patient to a targe... this is just an esti... weight is a target, ... sis tolerance can v... ual treatment sess... fluid management ...

The dialysis p... include these three...

- appropriate t... removal goals...
- avoid excess... rates, sympt... lytic hypoten...
- give fluid ... emphasis as... Kt/V.

At the Centers ... (Cleveland), we d... management prot... the patient care t... a patient's "dry we... of treatments. The ... methods to impr... ance of ultrafiltrati... tocol was approve... staff and ordered f... nephrologist.

Two methods w... ment the fluid ma... col — one with th... patient monitorin... without. The tec...

Ms. Pi... appoint... of Flu... Center... dialysis... Cleveland. In addition, ... dent of the Board of ...

Dry weight challenge protocol (m...

The goals of the protocol were as f...

- Reduce the patient's target weig... each treatment
- Maintain the ultrafiltration rate ... kg, per hour
- Increase the ultrafiltration goal ... times in the first half of treatme...
- Use alerts from the CVI, staff ... patient, and periodic blood ... to determine if the ultrafiltra... increased

We created a chairside tool to gu... filtration without exceeding the estab... per kg/hr.

Table 1. CDC ultrafiltration chart

WT in Kg	10 cc	13 c...
35	350	45...
40	400	52...
45	450	58...
50	500	65...
55	550	71...
60	600	78...
65	650	84...
70	700	91...
75	750	97...
80	800	104...
85	850	110...
90	900	117...
95	950	123...
100	1000	130...
105	1050	136...
110	1100	143...
115	1150	149...
120	1200	156...
125	1250	162...
130	1300	169...
135	1350	175...
140	1400	182...
145	1450	188...

Green Column (10 cc range): 200cc increases c...
Yellow Column (13 cc range): 100cc increases ...
Red Column (15 cc range): No increases in UFR...
Decreases are indicated

CDC UFR Chart, developed and implemented b... OCDT, CHBT and Centers for Dialysis Care (Cle...

The DeOreo intervention protocol

The I... System.

Develope...

The Dry Weight Challenge Protocol (Monitored)

The DeOreo Intervention Protocol is utilized in conjunct...

Pre-assessment	*RN & PCT will complete the assessment a...* • Last post treatment weight compared to... • gain since last tx • Lowest BP over last tx • Physical assessment (lung sounds, eati... • How well UFG tolerated from previous 3...
Goal establishment	*RN & PCT will jointly establish:* • Volume to be removed this tx: Pre-wt. c... • The overall goal for next week (consider... assessment and response to ultrafiltrati... • The 6 tx goal (what the overall fluid rem... (1.2 kg)
Set up	• Attach CVI tablet to dialysis machine, e... • Connect sensor to tablet via Bluetooth ... • Enter patient ID • Verify perfusion signal and waveform si... • Obtain baseline
Monitoring the treatment	• Set BP for every 15 min • Observe the UFR per hour that results f... • < 10x the dry wt. (10cc/kg/hr.) is genera... • Between 10x and 15x the dry wt. (>10cc... transition to more heart stress and risk ... • >15x the dry wt. (>15cc/kg/hr.) is genera... could result in cardiac stunning
Adjusting goal during treatment	The medical literature suggests that adjus... 30 min of tx the tx stress level is 0-1, the U... • The BP is acceptable and the patient is ... • The new goal is consistent with UF plan... • Check the impact of the UF goal chang... Another 200 ml increase in goal can be ma... • The patient is clinically stable and comf... • The new goal is >10cc/kg/hr. but <15cc/... Ordinarily 200 ml decreases should be ma... Treatment time adjustments: • < 4 hours: No increase after 90 min of t... • > 4 hours: No increased can be made a... Decreases can be made at any time in the ... symptoms, or change in CVI stress
Problem solving to achieve the goal	See DeOreo Intervention Protocol
End of treatment	1. End Session 2. Exit monitoring 3. Remove sensor cap 4. Decontaminate per protocol and return

The Dry Weight Challenge Protocol (monitored), developed and implemente... Centers for Dialysis Care (Cleveland, OH).

The dry weight challenge protocol (nonmonitored)

The enhancement in patient physiologic insight provided by the CVInsight® allowed us to create a new standard for fluid management for all hemodialysis p...

Pre-assessment	1. The nephrologist (rounding or primary) designates an order t... 2. Each challenge will last for a series of 6 treatments. 3. Establish a target weight for the *current treatment* taking into... a. Pre weight b. Last post weight c. Patient assessment 4. The target weight should be 0.2 kg below either the dry weigh... more obtainable) a. Document the actual target weight and the UF goal in t... b. Starting UF should not exceed 10-13 times the patient ... *(Example: The UFR should not exceed 700-1000 ml/hr. in...* c. However, normotensive patient with obvious fluid overl... the current dry weight if tolerated (refer to CDC UFR chart) 5. Ensure that the dialysate temperature is set at 35.5° C at the ... an order for a lower temperature 6. Do not use UF profile if ordered 7. Confirm that the blood pressure is set to read every 15 minut... 8. For patients requiring normal saline (NS) flushes, add each NS... 9. Document both the NS flush administration and the UF goal a... 10. Refer to treatment alerts for specific parameter pertaining to...
Treatment / Challenge	1. Begin the hemodialysis treatment a. If ordered by the physician, place in isolated ultrafiltrati... the parameters established b. Once isolated ultrafiltration is complete place in conve... treatment time and continue with challenge 2. Ensure that the patient is seated in Chair Position 2 at the be... hemofiltration treatment 3. After 30 minutes, increase goal by 200 ml 4. The goal can be increased by 100 or 200 ml increments at ha... to 3 times and in the first half of the treatment only. (Maximur... new UFR cannot exceed 15x the dry weight. (Refer to CDC U...
Intervention to increase ultrafiltration tolerance	1. Monitor trends in blood pressure (BP) to avoid hypotension (s... 2. All interventions are discussed between the PCT/LPN and the... 3. If the patient is sleeping, check and/or symptomatic check puls... 4. Reduce dialysate temperature to 35°C. Do not go below 35°C...
Interventions for treatment complications	1. If patient is in chair position 2, place patient in chair position ... 2. If UF goal needs to be reduced: a. Reduce UF goal by 100 ml-200 ml per reduction. b. If the patient is still symptomatic, turn the UF to minim... c. If patient symptoms worsen (i.e., blood pressure, cram... 3. In collaboration with the RN, determine the next course of ac... Avoid NS bolus unless directed by an RN 4. Turn UFR back on when symptoms subside
Post treatment considerations	1. After the sixth treatment, either the new dry weight will be est... order will be obtained. Continue to get challenge orders for e... weight is established 2. Review response to the Challenge Dry Weight Protocol in the... 3. Contact primary nephrologist as needed during or after the ta... antihypertensive medication and possible dialysate bath chang... 4. Obtain an order for the newly established dry weight from eit... primary nephrologist 5. Determine the appropriate dialysate temperature (35) and obt... physician or the primary nephrologist

The Dry Weight Challenge Protocol (nonmonitored), developed and implemented by Peter DeOreo, M... Centers for Dialysis Care (Cleveland, OH).

Lessons learned from CVInsight monitoring—and challe... comorbidities—were translated into a protocol for delivering similar care to our remaining population.

DeOreo I... (Cleveland, OH).

> "The long-term objective of the protocol is to observe results achieved by interventions and customize future treatments for each patient. Results observed in the CVI monitored group would be analyzed and used to provide similar care to all patients undergoing unmonitored dialysis"

Results

Patients in both the monitored group and the unmonitored group achieved significant weight loss while on the protocol. Overall, the challenging patients on CVI achieved average dry weight reduction of 2.4 kg. Non-monitored patients achieved 2.9 kg reduction. Both decreases were significant. The results were consistent across multiple facilities. We believe that the protocol is repeatable and could deliver similar achievements in other settings. Based on these results, CDC intends to perform CVI monitored dialysis twice a year and as needed on all patients. With CVI monitoring, we can observe individual responses to treatment and to interventions. We can create an individualized treatment plan for each patient to challenge reductions in dry weight.

Our study supports the hypothesis that a conservative "challenge" protocol assisted by the CVInsight Monitoring System, which shows the patient's tolerance to dialysis, can assist with getting challenging patients to their dry weight and then further reducing their dry weight.

The results were consistent across multiple CDC-managed facilities. We believe that the protocol is repeatable and could deliver similar achievements in other settings

Conclusion

Over hydration is associated with excess mortality and cardiovascular morbidity in CKD patients. [1] Dialysis patients who are consistently over or under their "dry weight" have a higher hazard for death and hospitalization. [2] Over emphasizing urea kinetics as the dominant definition of "adequacy" often leads to treatment times too short to avoid excessive ultrafiltration rates and intra-dialytic hypotension (IDH). [3]

There is no agreement on the best protocols or assistive devices to guide fluid removal during dialysis treatments. [4] Hypotension is a poor endpoint, may give the false impression that the patient is euvolemic, and is associated with myocardial stunning. [5] ***NN&I***

References

1. **Tsai YC, et. al. Association of fluid overload with cardiovascular morbidity and all-cause mortality in stage 4 and 5 CKD. CJASN 10:39-46, 2015.**
2. **Flythe JE, et. al. Associations of post hemodialysis weights above and below target weight with all-cause and cardiovascular mortality. CJASN 10:1-9, 2015.**
3. **Flythe JE, et. al. Rapid fluid removal during dialysis is associated with cardiovascular morbidity and mortality. Kid Int 79:250-257, 2009.**
4. **Sinha AD. Why assistive technology is needed for probing of dry weight. Blood Purif. 31:1-3, 2011.**
5. **McIntyre CA, et. al. Hemodialysis induced cardiac dysfunction. CJASN 3:19-26, 2008.**

CDC

ARE YOU UTILIZING BEST PRACTICES?

Evidenced Based Research

HOW IS DRY WEIGHT DETERMINED?

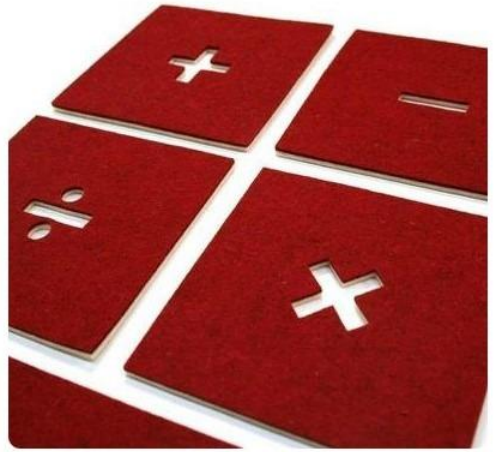
Dry Weight should be considered the post-dialysis weight that results in:

- Least intradialytic hypotension/symptoms
- Shortest post dialysis recovery time
- Fewest hospitalizations
- Fewest Cardiac/Neurological Events

Daugirdas, J: Am J Kidney Dis, 2013

HOW IS GOAL CALCULATED FOR TREATMENT?

How do you determine patient UF Goal?



Look at a series of treatments?

Ask how much they want off?

Standard Calculation:

Pre-weight – Dry Weight + Rinse back/prime* = UF Goal

*Don’t forget to add additional fluids given during treatment (antibiotics/PO, flushes)

HAVE STANDARDS FOR NOT EXCEEDING HIGH UF RATES?

Ultrafiltration Rates:

HEMO Study data: Data from 1846 patients

- Compared by UF rates:

  up to 10 ml/h/kg

  10–13 ml/h/kg: Higher risk of CHF without increased risk of death

  over 13 ml/h/kg: Increased risk of death

Jennifer E Flythe, et al. Rapid Fluid Removal During Dialysis is Associated With Cardiovascular Morbidity and Mortality. Kidney Int. 2011;79(2):250-257

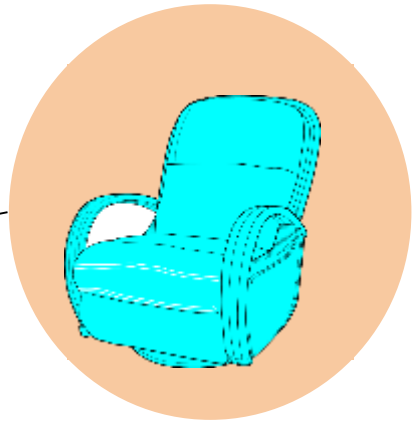
USING INTERVENTION WHICH OPTIMIZE FLUID REMOVAL

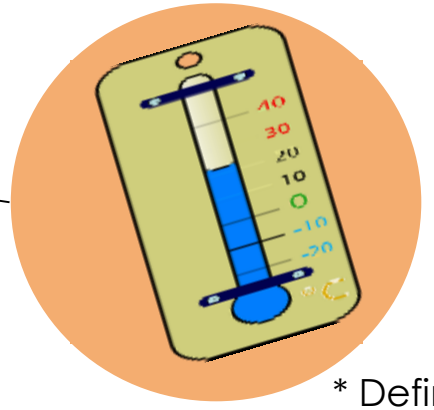
Interventions

COMMONLY USED INTERVENTION

Interventions:

- Chair Position
- Oxygen
- Dialysate Temperature





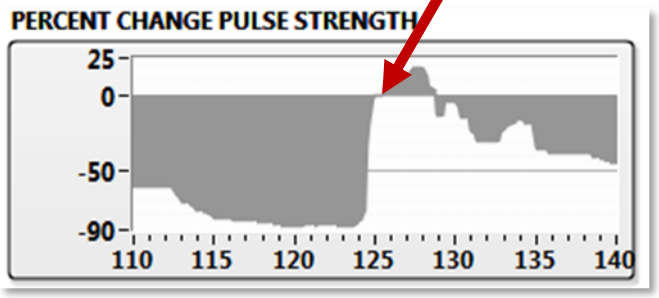
* Defined parameters in the DeOreo Dialysis Intervention℠ Protocol

CHAIR POSITION

Avoid Trendelenburg

Chair 3: Feet above hips

Adjustment of chair position



Similar result as seen with Saline Bolus

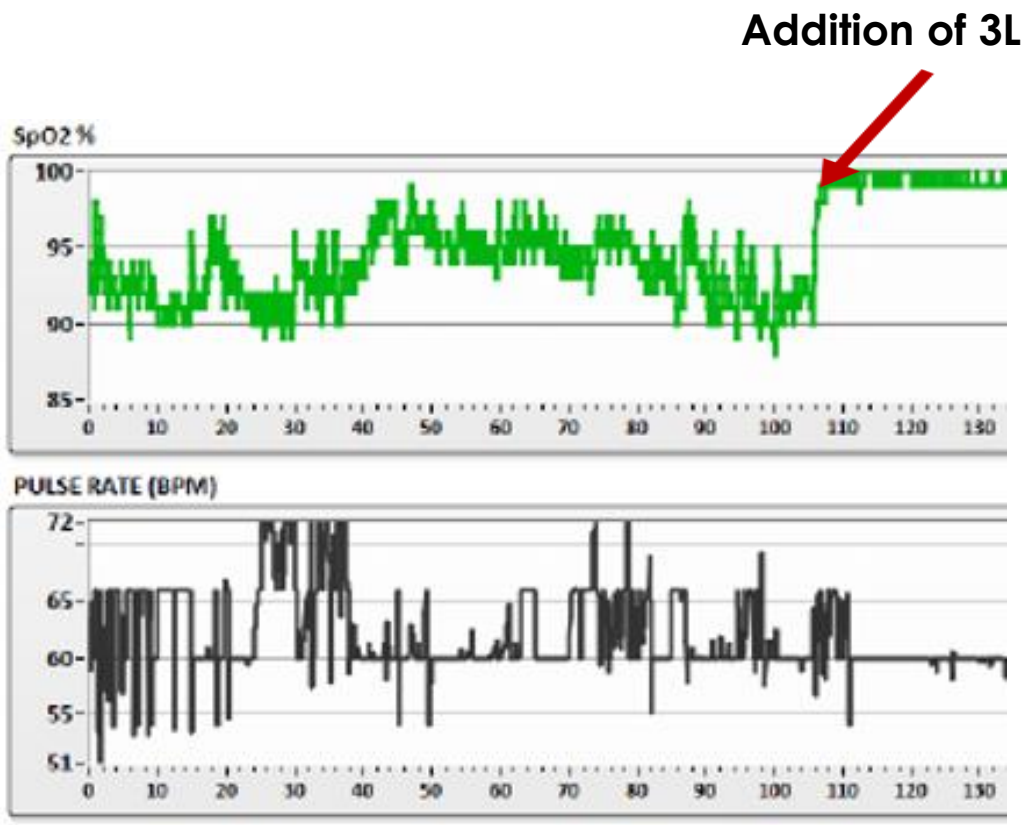
OXYGEN

Helps with disturbed breathing patterns:

SpO2 variability

Delivers more O2 to the heart &
can help with cardiac irritability:

Pulses Irregularities



DIALYSATE TEMPERATURE

Improves cardiac contractility and increases venous tone.[1]:

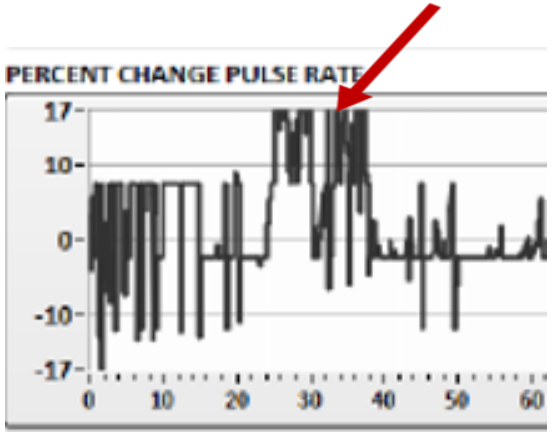
Pulse Irregularities

Causes peripheral vasoconstriction to improve BP

- Lowers the incidence of hypotension without reducing the adequacy of dialysis.[2]
- Helps in achieving higher ultrafiltration while maintaining hemodynamic stability during and after dialysis.[3]

Pulse Strength

Temp decreased to 35.5C



1- Adapted from : http://www.uninet.edu/cin2001-old/conf/schneditz/schneditz.html
2- Adapted from: https://www.ncbi.nlm.nih.gov/pubmedhealth/PMH0023722/
3- Azar AT. Effect of dialysate temperature on hemodynamic stability among hemodialysis patients. Saudi J Kidney Dis Transpl 2009;20:596-603

WHAT CAN YOU DO?

Changing Practice

GET INVOLVED

Participate in committee meetings within your organization

- Quality
- Patient Education
- Staff Education
- Training

Memberships with professional organization: Both local and national

- Boards, Committees, sub committees

ADVANCE YOUR KNOWLEDGE

- Certifications: promotes a high level of competency in the renal community
- Subscriptions to professional journals
- Conferences: Local, Regional & National
- Become a clinical expert or resource
- Become familiar with legislation in your state

OPPORTUNITIES

- Fluid Managers
- Technical Experts/Consultants
- Educators
- Professional Organizations boards/committee members
- Research
- Publications

QUESTIONS?