Fluid Management During Hemodialysis: "Dispelling the Myths"

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HEMA METRICS™

DISCLOSURE

Director of Clinical Affairs
Hema Metrics

Manufacturer of the Crit-Line
Blood Volume Monitor

<u>Off Label Usage</u>
None

Objectives

- **Review the long-term complications of HD r/ t Fluid volume excess and Fluid volume deficit.**
- **Describe the three compartmental fluid shifts as they relate to Guyton's Curve**
- **Discuss the effects of hypoxemia during dialysis**
- **Identify the main causes and interventions for dialysis induced hypotension**

Goal

Participants will be able to differentiate between

"***Evidence Based Facts and Myths***"

concerning common hemodialysis fluid management beliefs.

Future QIP Clinical Performance Measures

“CMS is currently developing measures in each of the areas specified in section 1881(h)(2)(A) of the Act and is also developing additional measures .. fluid weight management…”

Fact or Myth?

* Achieving “Adequacy of Dialysis” has improved the mortality rate of dialysis patients in the United States.

Fluid Management: The Missing Indicator

- Volume mismanagement is the main cause for cardiac related morbidity and mortality rates
- Not referring to it was a “Serious Omission” that needed to be corrected
- Fluid management cited as the current “Orphan in Quality Assessment”
- It is the “Single Most important indicator” related to morbidity and mortality

Dr Stivelman: CMS Community Forum 12-07

Three out of every four deaths and hospitalizations in dialysis patients can be linked to *sudden death or CHF.*

Left Ventricular in Origin. Glassock

The single largest cause of death is attributed to arrhythmic mechanisms

Risk for CV death highest during the first 120 days vs. 121-365 days

Boston Steering Committee Conclusions 2009

- The model of care since the 1970s is insufficient
- Current CPMs only account for 14% of the measurable differences in facility outcomes (SMRs)
- Current CPMs not “bad”- simply not enough
- Consequently, too many patients are dying, hospitalizations are too high, and cost is enormous

Boston Steering Committee Conclusions 2009

- Yearly mortality rate remains >20%
- CVD / CHF accounts for 50% of deaths
- 70% deceased in 5 Years
- Up to 40% mortality in first year
- Less than 20% rehabilitation
- $20,000 PPPY in hospitalizations
- CVD is a major cause of hospitalizations

Tom Parker ANNA 2010

- ASCVD is apparently not the leading cause of CV death, and all of these years we've been concentrated on hemoglobin, calcium, phosphorus, lipids, and the like – to fix the cardiovascular problems

- We've simply been looking at the wrong outcome measures to improve mortality, hospitalizations, and cost associated with CV disease

Current Practice

- Cardiovascular outcomes have not improved with:

  - Statins
  - ESAs
  - Attaining euvolemia with current TX plans/ traditional assessments
  - Sodium modeling/ UF profiles
  - Probing to a “crash” to attain EDW

Current Practice

- EDW generally incorrect / not re-evaluated regularly
- Patients frequently gain > 5% between TXs
- UFRs exceed recommended 10ml/kg/ hr
- UF Profiles are not individualized for each TX
- Facility Standard Dialysis bath / temperature
- Sodium modeling RX for majority of patients

Causes of CVD

- Hypervolemia vs. Normovolemia (Euvolemia)
  - “Dry Weight “ is an “Evil Doer”

- Inflammation
  - likely caused by hypervolemia
  - CRP levels increase

- Cardiac “Stunning”
  - initiation of TX
  - increases with aggressive UFR

- Hypertension

- LVH

- CHF

CVD

- CHF was found in 40% of ESRD patients
- 60% remain in fluid volume excess post TX
- Pulmonary edema being the most common admitting diagnosis

ESRD Conditions of Coverage

- Quality assessment and performance improvement program
  - Adequacy of dialysis
  - Nutritional status
  - Mineral metabolism and renal bone disease
  - Anemia management
  - Vascular access
  - Infection control
  - Medical injuries and medical error identification
  - Patient satisfaction
  - Hemodialyzer reuse

Conditions of Coverage(CfC) 494.90: Patient Plan of Care

- **Volume control, important to *blood pressure management and cardiac health*, is an essential component of dialysis care that requires ongoing attention from the care team.**

- **Therefore, we are incorporating it into the "dose of dialysis" plan of care element.**

- **"The interdisciplinary team must provide the necessary care and services to manage the patient's volume status"**

Fact or Myth?

* Most hemodialysis patients are discharged "*Stable*" and at their Dry Weights.

USA Dry Weight Definitions

- Estimate of Optimum Total Body Weight
- Weight at Hypotension
- *Weight at End of Dialysis to Maintain Normal BP until next Dialysis*

TREATMENT DEMOGRAPHICS

60%	%	50%
Fluid Overload	Stable?	Hypotension

The Dry Weight Issue

Prevalence of Patients on Antihypertensives

1970	10%
1997	75%
2002	80-90%

Cary, 2002

Hypertension in ESRD

- The use of antihypertensive meds with ESRD pts does not reduce BP
- 90% patients could be normotensive by lowering Dry Weight
- BP decreases 6 weeks after lowering DW
- BP will not increase with increasing Body Mass

Fluid Volume Excess (FVE)

- 57-77% of pts have LVH
- LVH once on dialysis is from FVE
- CVD causes 50% of all deaths
- CHF causes 15% of all deaths

CHF and ESRD Patient Longevity

Congestive Heart Failure (CHF) and Mortality (Harnett, Foley, et al., KI '95)
432 patients were followed until the end of their lives. Study showed in patients who:

- Did not experience CHF: Average ESRD Treatment Life of 62 months
- Had experienced CHF before but had no recurrence: Lost 17 months of life
- Had experienced CHF before and had a recurrence: Lost 33 months

THEREFORE: <u>ANY</u> OCCURRENCE OF CHF = <u>MINIMUM</u> LOSS OF 17 MONTHS

Consequences of LVH

- Fibrous tissue encircles myocytes
- High electrical resistance
- Favors “re-entry” type of atrial and ventricular arrhythmias
- High Hospitalization and Sudden Death

QAPI: Measurement Assessment Tool (MAT)

- V543 Dose of Dialysis:

  Management of volume status

- Value monitored:

  - Euvolemic and Normotensive
  - BP 130/80 (adult)
  - Lower of 90% of normal for age/ht/wt or 130/80 (pediatric)

Boston Steering Committee Conclusions 2009

- Greater emphasis on LV disease / attainment of euvolemia and BP control vs. EDW

- Time on dialysis needs to become a CPM tied to :
  - LV disease
  - Volume status
  - Blood pressure
  - Interdialytic weight gain

Technical Expert Panel

- Rajiv Agarwal
- Nathan Levin
- John Daugirdas
- William Peckham
- Raymond Hakim
- Thomas Parker
- Allen Nissenson

New Initiatives

- Catheter last
- Volume First
- Save the Ventricle
- Euvolemia vs. "Dry Weight"
- Euvolemia on Monday vs. Friday
- Let them Eat Eat Eat
- Reduce Sodium
- Slow UFR
- Longer / Extra TXs
- Emphasis on Incident Patient
- Right start/ Right return
- Scaled up studies on available technologies
- Take quess work out of fluid removal

Fact or Myth?

* Experiencing Intradialytic Morbidities, a "*CRASH*", is expected and considered an acceptable, frequent, temporary side effect of hemodialysis.

Intradialytic Morbidity (IM)

The "*CRASH*":

Hypotension

Nausea / Vomiting

Cramps

Lightheadedness

Any symptom requiring intervention

A symptom of a "***CRASH***" is a symptom of Ischemia

Uncorrected Ischemia leads to Infarct

TREATMENT DEMOGRAPHICS

60%	%	50%
Fluid Overload	Stable?	Hypotension

Complications of Intradialytic Hypotension

- Tissue Ischemia / Hypoxia
- Changes in Mental status / Seizures / Stroke
- Vision changes
- Silent cardiac ischemia / MI
- Ischemia / Infarct to the gut
- Decrease in Residual Renal Function
- Ischemia = decrease in URR
- Recovery time following typical HD >1 day

Occurrence of Intradialytic Morbidities (Ischemic events) during HD :

- Hypotension up to 50%
- Hypoxemia 50%
- Cramping 20%
- Nausea/ vomiting 15%
- Seizures up to 10%
- Angina 5%
- Myocardial Ischemia 22% TXs
- Dysrhythmias 50% of patients
- Cardiac arrest 7/100,000 TX
- Sudden death 25% of all deaths in HD population

CfC: Medical injuries and medical errors: V634(vi)

“ Occurrences such as treatment prescription errors, ***intradialytic morbidities (IDMs)*** ….should be identified, reviewed and trended”

Complications of Intradialytic Hypotension

- Post BP < 110 correlates with a 2.5x increase risk of Death

- 2 or more hypotensive episodes / week increases the Death rate 70%

Martin J. Schreiber, M.D.
Department of Nephology &Hypertension
Cleveland Clinic Foundation

Conditions of Coverage 494.80(a)(2): Patient Assessment

Patients must be assessed for the appropriateness of the dialysis prescription, blood pressure and fluid management which encompasses ***intradialytic symptoms***, such as cramping, as well as dialysis adequacy.

Fact or Myth?

* Once a patient starts dialysis, preserving the remaining renal function does not matter.

Dialysis does not remove the “middle molecules” as efficiently as the kidney.

The presence of Residual Renal Function is protective against mortality.

Specifically, the presence of Residual Renal Function, *even at a low level,* is associated with a lower mortality risk in hemodialysis patients.

Shemin D, Bostom AG, Laliberty P, Dworkin LD.
Residual Renal Function and mortality risk in hemodialysis patients.

Fact or Myth?

* Blood Pressure is the best indicator of the patient's Dry Weight

Blood Pressure

BP = Cardiac Output x Peripheral Vascular Resistance
(vasoconstriction)

BP = CO x PVR
(**CO** = Stroke **Volume** X Heart Rate)

BP = Stoke Volume x HR x PVR

BP as a Post-Facto Measurement

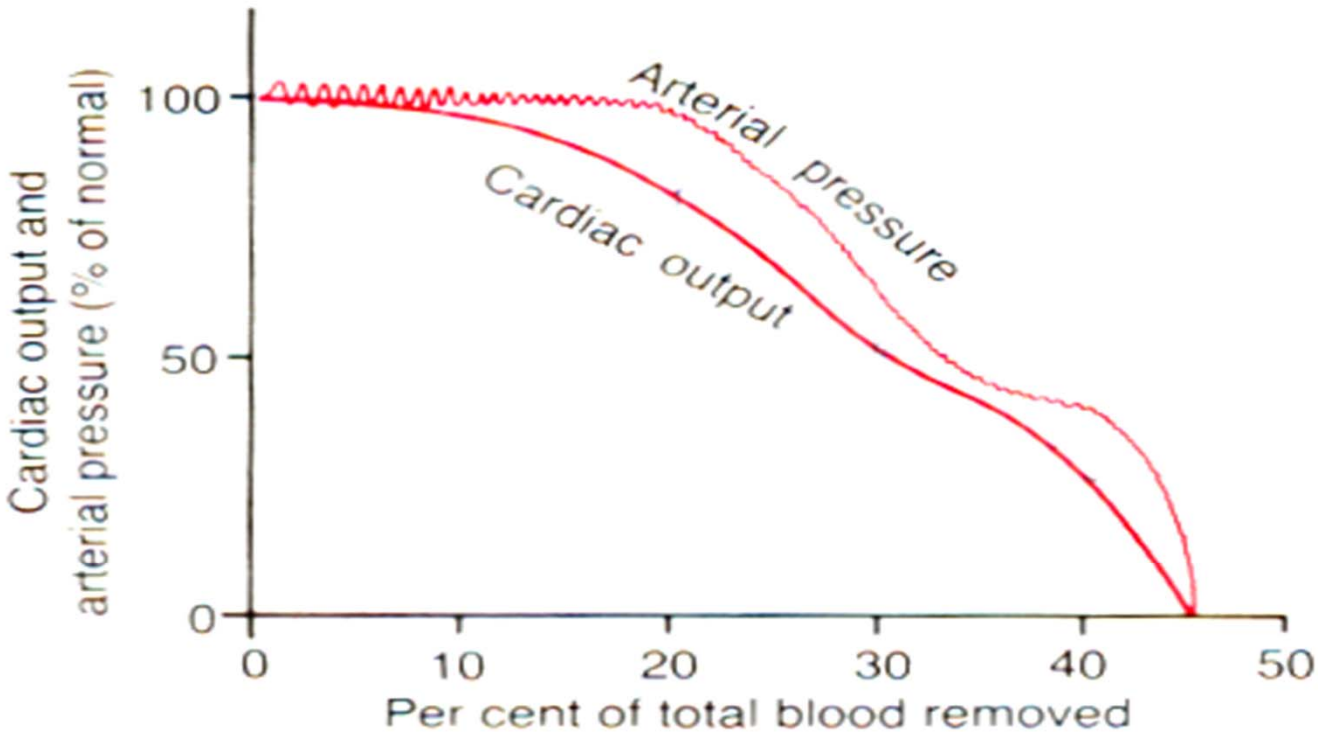


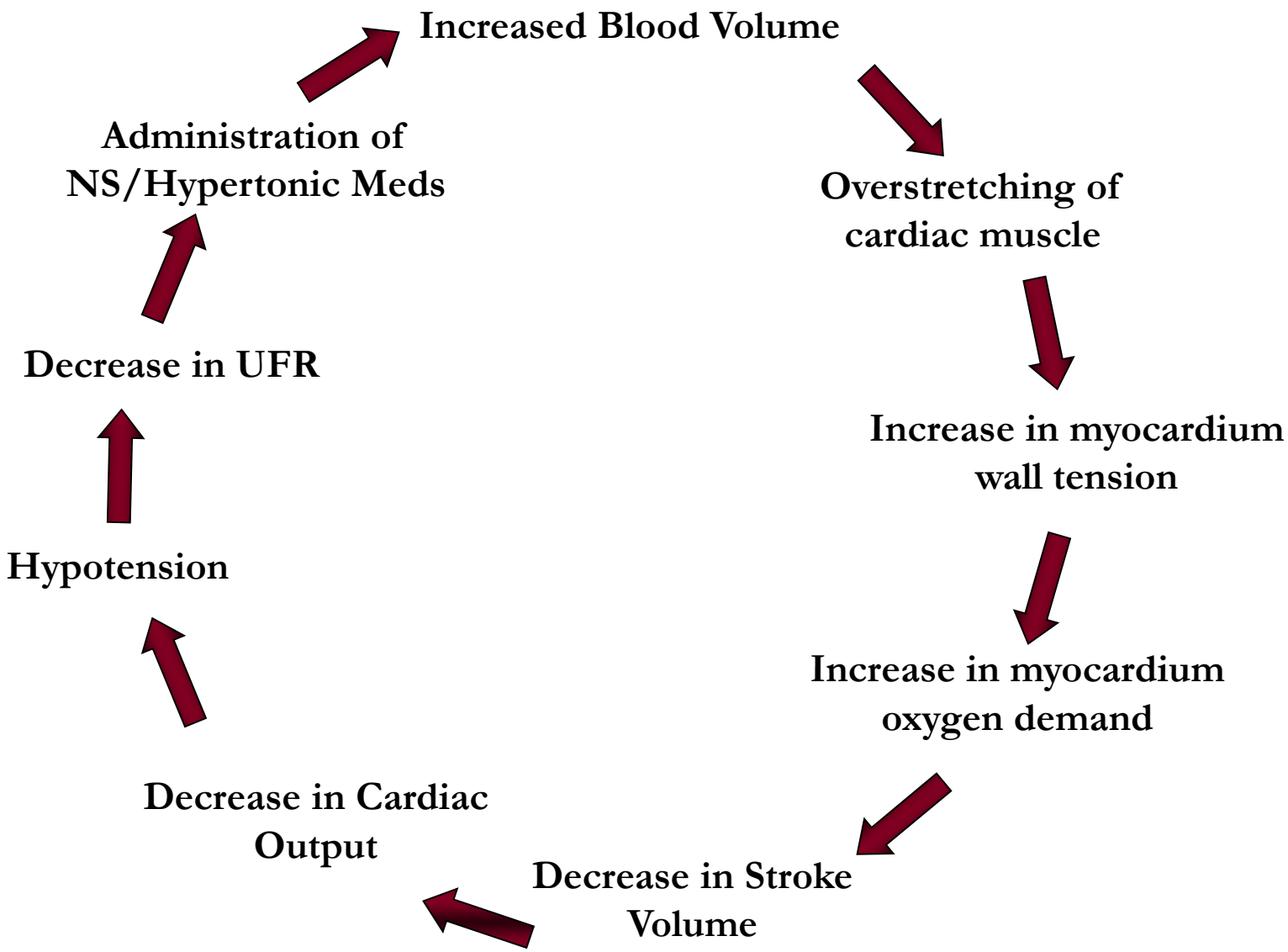
Figure 17 – 7. Effect of hemorrhage on cardiac output and arterial pressure.

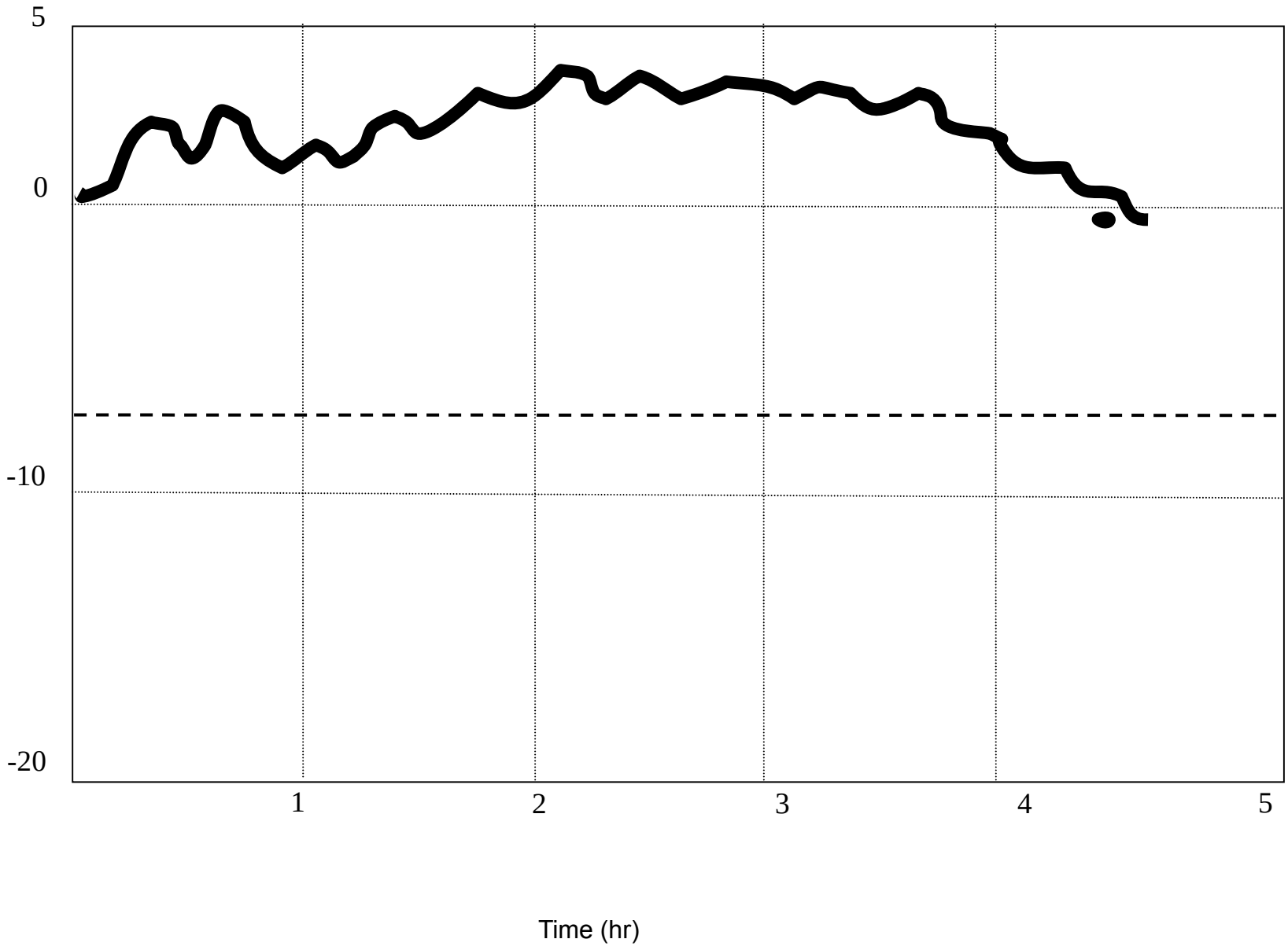
About 10% of the total blood volume can be removed with almost no effect on either arterial pressure or cardiac output, but greater blood loss usually diminishes the cardiac output first, and later the pressure
(Guyton & Hall pg 254)

Fact or Myth?

* Hypotension could be caused by Fluid Volume Excess (FVE).

Inverse Relationship Between Blood Volume and Blood Pressure




5
0
-10
-20
1
2
3
4
5
Time (hr)

KDOQI Guideline #15

- Literature does not support the belief that hypotension is a good indicator of a patient's EDW

- Work Group was especially concerned about the clinical practice of routinely and deliberately provoking hypotension to operationally define a pts EDW

Fact or Myth?

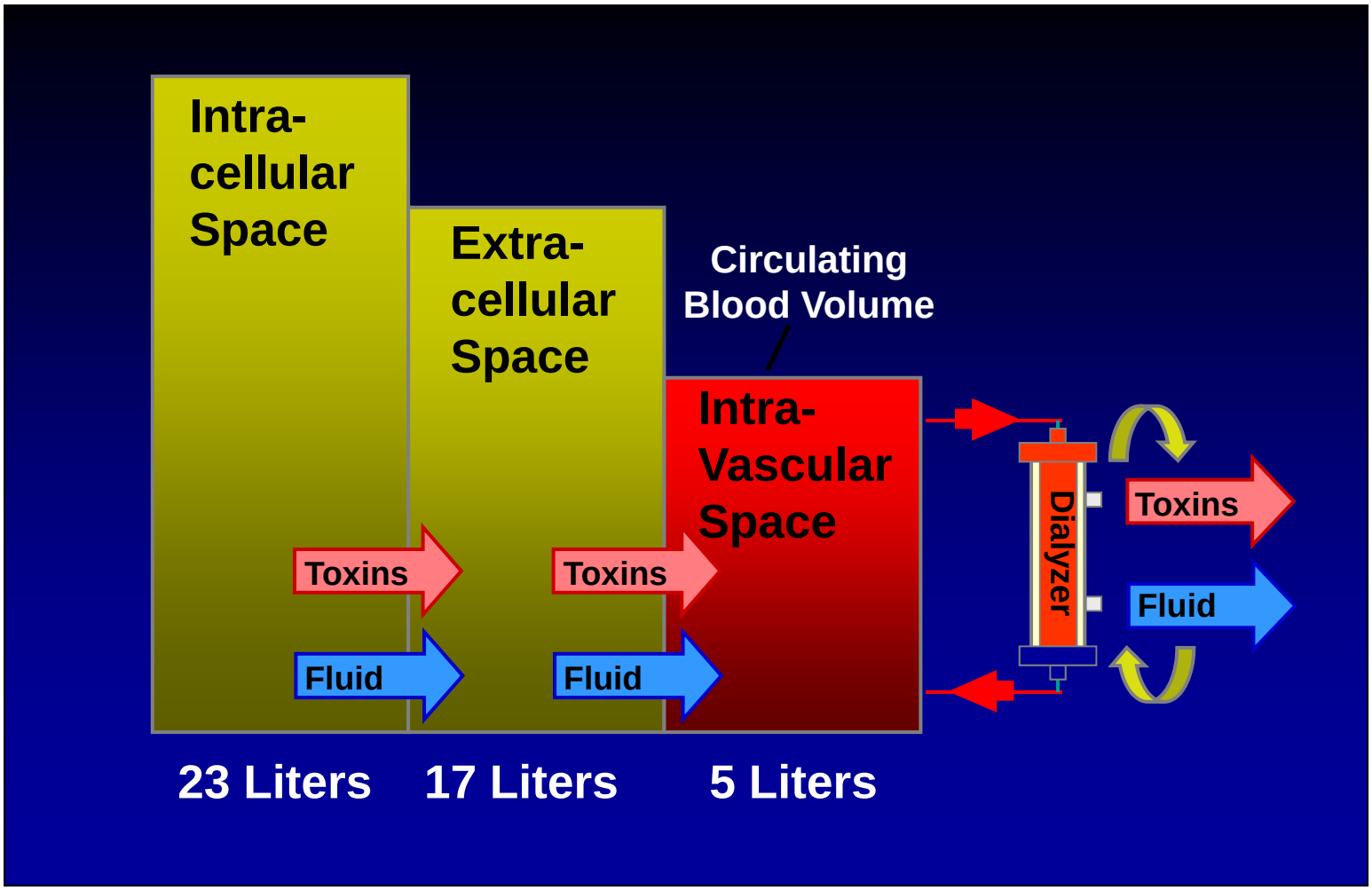
* FVE is easily identified with a thorough physical assessment.

Where is the Evidence for Dry Weights?

- **Even after 50 years of dialysis, the assessment of volume remains a matter of clinical judgment**
  - **Thomson GE, Waterhouse K, McDonald HP Jr, Friedman EA. Hemodialysis for chronic renal failure: clinical observations. *Arch Intern Med*. 1967;120:153–167.**

- **Unfortunately, the clinical examination performs poorly to assess volume.**
  - **Agarwal R, Andersen MJ, Pratt JH. On the importance of pedal edema in hemodialysis patients. *Clin J Am Soc Nephrol*. 2008;3:153–158.**

Three Compartment Model



Fact or Myth?

* When a patient experiences an intradialytic morbidity, a "*CRASH*", they are at their Dry Weight.

Fact or Myth?

*Since Normal Saline is “Isotonic”, it restores needed volume during a “*Crash*” without adding any extra sodium to the patient’s plasma.

Osmolarity of Normal Saline

1 Liter of Normal Saline = 308 osmoles
Plasma = 280 osmoles

- NaCl 0.9%: 154 mEq/L
- Serum sodium: 135-145 mEq/L

Fluid Challenge for Hypotension

NaCl 0.9% stays intravascular X 10” then shifts to interstitial space

↑Serum Sodium > stiffening in microcirculation

Fact or Myth

*The main cause of FVE is

Patient "Non-adherence"

and / or

lack of self-control with fluid restrictions.

- ECV can not be decreased by restricting water- but only by restricting Salt intake.

Where Salt is Water Goes!

Educate on Salt

Investigate Sources

V543 Dose of Dialysis – Management of Volume Status

- Accountability of the team to meet the goals is highlighted- and cannot be solely blamed on the patient.

- *If the expected outcome is not achieved, the interdisciplinary team must adjust the patient's plan of care to achieve the specified goals.*

- *This requirement is not satisfied if the only reason documented for failure to achieve goal(s) is "patient non-compliance" or "non-adherence."*

Fact or Myth?

* It has been proven that Sodium Modeling helps prevent intradialytic morbidities as well as improve patient well being.

- To avoid thirst, fluid gains and hypertension, the NKF-KDOQI Clinical Practice Guidelines state that increasing positive sodium balance by “sodium profiling” or using a high dialysate sodium concentration should be avoided.

- Reviews showed uncertain benefits and possible risks

- Satisfactory experiences with a dialysate sodium of 138 mmol/L have been reported.

Fact or Myth?

* Assessing predialysis sodium levels is irrelevant as it will always be inaccurate related to extra fluid volume.

Sodium Setpoint

1. The mean pre-dialysis plasma sodium varied among the dialysis patients with 98% of patients below dialysate sodium.

2. The frequency of symptomatic hypotension showed no relationship to sodium gradient

M. Keen, F.A. Gotch, 2007

Fact or Myth?

* A 2000 mg daily intake of sodium is the recommended allowance for the dialysis patients.

NKF-KDOQI 20006 Clinical Practice Guidelines state that 1500 mg is the recommended allowance for dialysis patients with hypertension.

US Department of Agriculture Advise

- We get more sodium from processed food than a salt shaker

- Most adults- including those with HTN, African American, the middle aged and elderly- should consume no more than

1500 milligrams of sodium a day

- Others should consume less than 2300mg or less than a teaspoon

Learning from “history”

- Clyde Shields
- First long-term HD patient in the US, March 1960
- Developed malignant HTN within a few months
- Treatment: aggressive ultrafiltration (UF)
- Three times per week HD – 8-10 hours each
- Result: 11 years of dialysis in the 1960s

- ***“The key to treating HTN in dialysis patients is adequate control of the extracellular volume”.*** Scribner BH: AJKD;6:511-519,1990

Fact or Myth

*Reducing the Blood Pump (QB) is an acceptable intervention to treat or prevent a “Crash”?

Fact or Myth

* FVD from hypovolemia is the ***Main*** cause of dialysis induced hypotension and intradialytic morbidity.

Blood Pressure

BP = Cardiac Output x PVR

(**CO** = Stroke Volume X Heart Rate)

BP = Stoke Volume x HR x PVR

PVR

- Withdrawal of ***vasoconstriction*** of the resistance vessels is a significant cx of UF induced hypotension- more so than hypovolemia

Fact or Myth

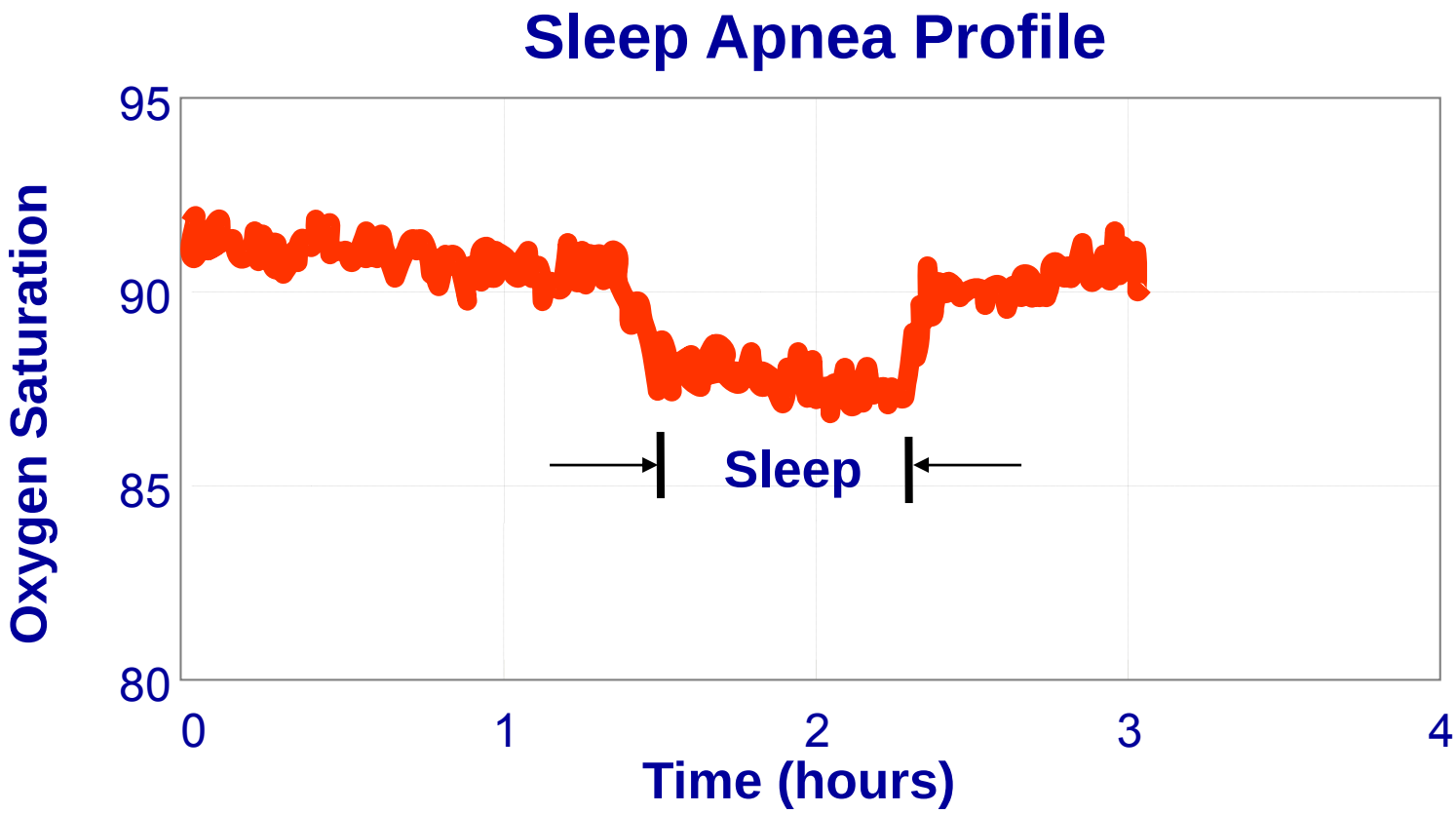
* Hemodialysis patients rarely need Oxygen supplementation since they are mostly "*Chronic Stable*" patients.

Intradialytic Hypoxemia: Incidence

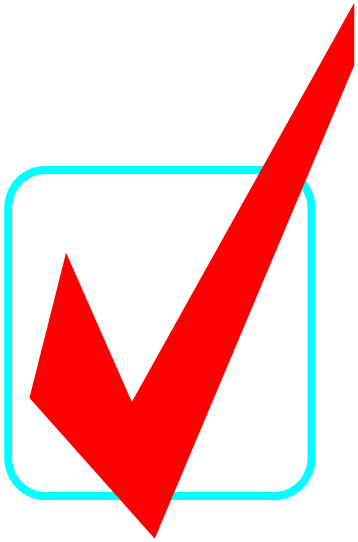
- 26% of patients drop their O_2 sat 2-8% in first hour of dialysis
- Hemodialysis can provoke significant tissue hypoxemia
- 56% of patients experience at least one episode of hypoxemia
- Sleep apnea occurs up to 70% of all Txs

Complimentary Oxygen Delivery Issues

O_2 Delivery → 50+ % of HD patients have intradialytic hypoxemia and up to 70% are sleep apneics.

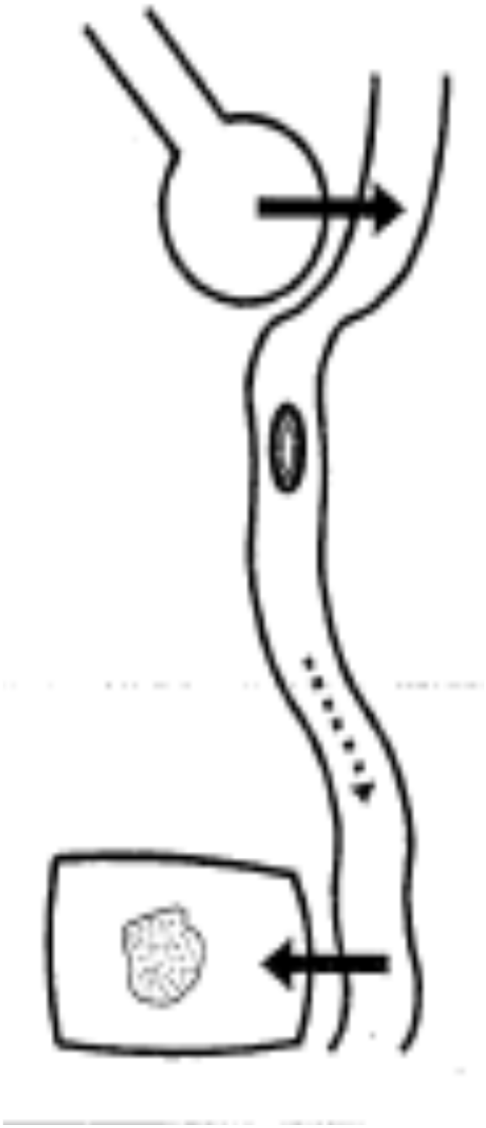


Signs & Symptoms of Hypoxia



- SOB
- Tachypnea
- Tachycardia
- **Hypotension**
- **Cramping**
- **Cyanosis**
- **Dizziness**
- **Nausea / Vomiting**
- **Blurred vision**
- **Confusion**

Types of Hypoxia: Causes in ESRD



• Hypoxemic Hypoxia	Fluid excess COPD; ↓CO2 Sleep Apnea
• Anemic Hypoxia	Anemia (Hgb ≤ 10; Hct ≤ 30)
• Circulatory Hypoxia	Cardiac Dysfunction, arteriosclerosis
• Histotoxic Hypoxia	L shift of saturation curve; alkalosis; ↓CO2; sepsis

Benefits of Oxygen Therapy

Increasing Oxygen:

- Increases Vascular tone
- Increases PVR
- Increases Plasma Refill

Consider Supplemental O2

- Arterial sat <90%
- Venous sat <60%
- Sleep apnea
- Respiratory rate >24
- Pulse <60 or >100
- Systolic BP <100
- Anemia ≤ Hgb 10; Hct ≤ 30
- Symptoms
- Edema
- Cardiac History

Fact or Myth?

* FVE has little impact on Anemia Management

Current EPO Titration Does Not Take Into Account Blood Volume Status

- Hypervolemia dilutes Hct / Hgb values
- Hypervolemia increases inflammation
- Average Hct change during HD TX with UF : 4-5 Hct points

Bundle Metrics: Ability to Manage EPO Dose Will Make or Break Facilities

- The "Bundle" treatment cost is $51.66 which is an average dose of 5740 units at a price of $9.00 per 1000 units.

- Reduce average dose to 5000 units
- Cost is $45 or $6.65 per treatment
- Gain per facility per year = $95,904

- For a facility of 100 patients, a 1% increase or decrease in average dose can result in a $6480 per year savings or additional cost.

Fact or Myth?

* It is acceptable to maintain the dialysate temperature between 37-38 C, especially since the dialysis patient's most common complaint is feeling "*cold*" during dialysis.

Thermal Control

- More Extracorporeal cooling is necessary with more ultrafiltration to keep patients at a ***constant*** temperature. (*Isothermic*)
- Dialysate temperatures may need to be decreased for patients with a high ultrafiltration to maintain stability.
- Dialysate temp significantly affected PaO2

- Patients felt more energetic and generally well during and after dialysis, which in turn positively impacted activities of daily living

Nancy Kutner, PhD NKF 2007 Spring Clinical Meeting

Fact or Myth?

* UF Profiling has been proven to improve our patient's fluid management outcomes.

Ultrafiltration Rate

- Too High causes hypovolemia
- Too Low causes hypervolemia

Either can cause:

Hypertension

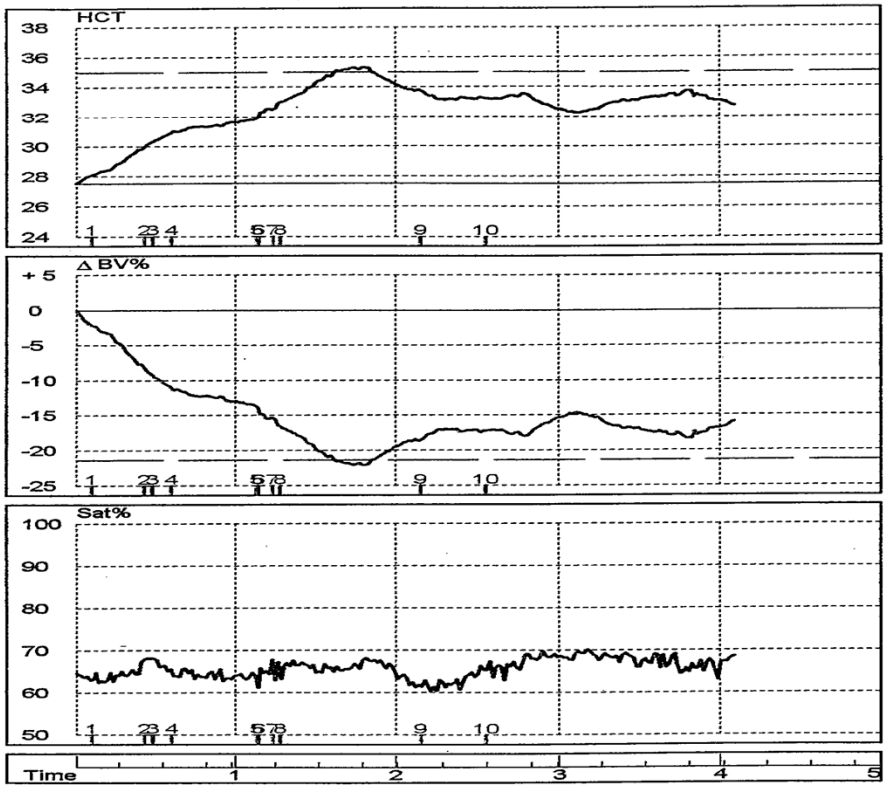
or

Hypotension

UFR too high

Unregistered - In-Line Diagnostics, USA

Patient Name	:
Patient ID	:
Birth-date	:
Attending Doctor	:
Remarks	:



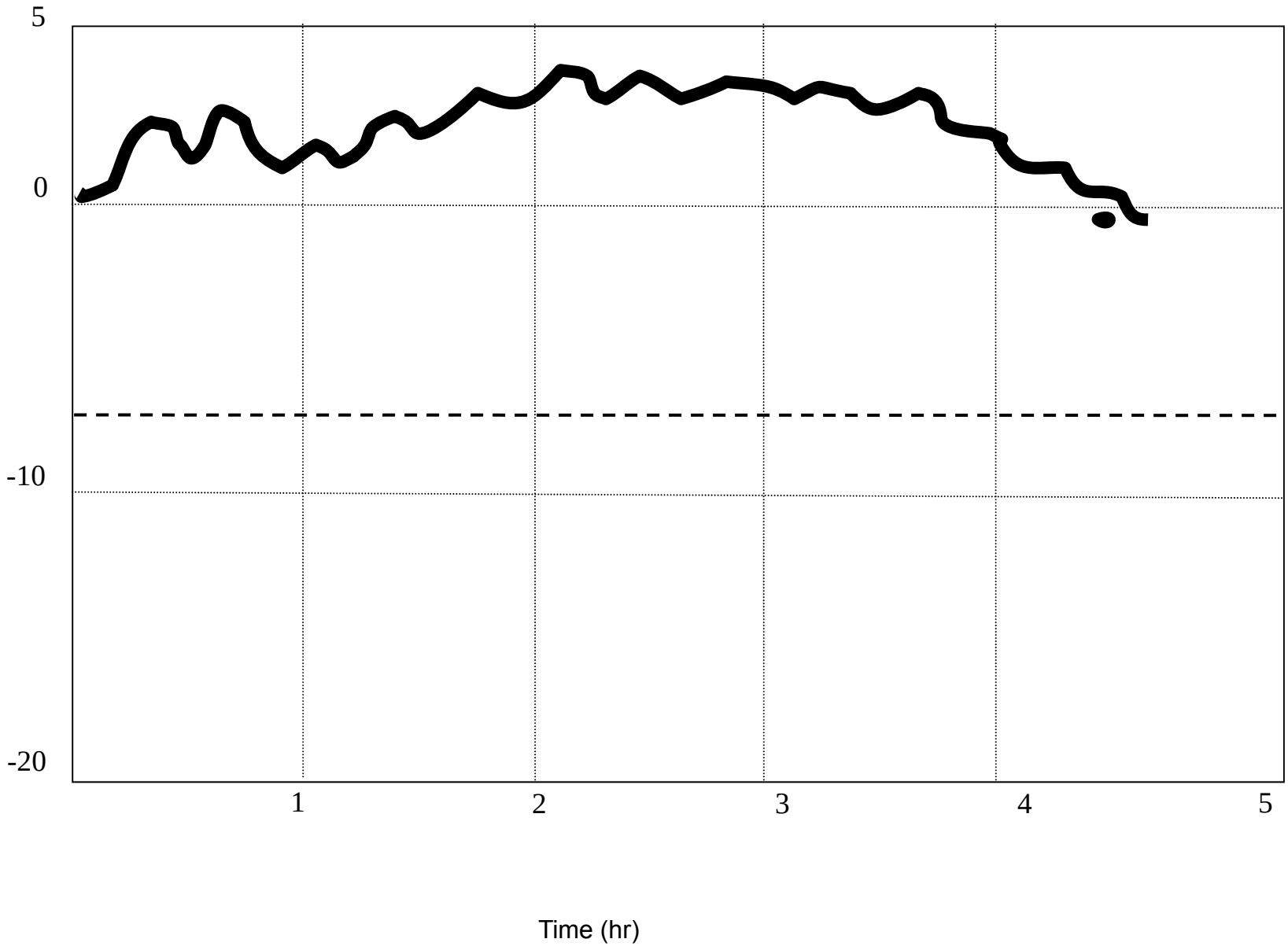
Session date	:
Session Nr.	:
CL - Patient	:
CL-s/n	: 195AM404535
Dialysis System	: System 1
Station ID	: Station 1
Technician/Nurse	:
Dialysis type	: HAEMODIALYSIS
Start	: 08:49:12 End: 12:54:52
Duration	: 4:05:40
Weight at start	: at end:
Dry weight current	:
HCT Start	: 27.5
HCT Max	: 35.4
HCT Limit	: 35
Crash-Crit	:
Saturation Min %	: 60.2%
ABF ml/min.	: ****

No ABF data recorded.

Recirculation	: ****

No (valid) recirculation recorded.

Nr	Time	Puls	Bloodpr	UF/hr	%BV	HCT	Sat	Pos	Symptom	UFtot	Interv./Remark
1	0:06				-2.4	28.2	63.2		CL button		
2	0:26				-8.4	30.0	67.6		CL alarm		Hct Limit high
3	0:29				-9.4	30.4	67.8		CL alarm		Hct Limit high
4	0:36				-11.4	31.0	64.0		CL alarm		Hct Limit high
5	1:08				-14.3	32.1	63.6		CL alarm		Hct Limit high
6	1:09				-15.0	32.4	64.1		CL button		
7	1:14				-15.8	32.7	67.6		CL button		
8	1:17				-16.7	33.0	63.2		CL alarm		Hct Limit high
9	2:09				-18.5	33.8	62.7		CL button		
10	2:33				-17.0	33.1	66.5		CL button		


5
0
-10
-20
1
2
3
4
5
Time (hr)

V543: *Dose of dialysis*

- The ultrafiltration component of the hemodialysis prescription should be optimized with a goal to render the patient euvolemic and normotensive

2006 NKF KDOQI guideline 5.1

UFR

- Observational studies suggest longer time is associated with improved patient outcomes
- National Cooperative Dialysis Study (1983) showed lower risk of hospitalization
- DOPPS study (Kidney Int 2006) showed longer treatments reduced mortality
- DOPPS showed UFR > 10 ml/min/kg associated with higher mortality and intradialytic hypotension
- DOPPS showed for every 30 min longer on HD associated with 7% lower mortality risk
- Tx time < 4 hours associated with poorer outcomes

Co-morbidities / Special Considerations

- *Must always review the clinical assessment and existing medical history before initiating a dialysis treatment*

- *Assess Pt's medical/clinical/cardiac Hx/ residual urine output/ VS/ BP-P*

Fluid Management: The TX Prescription

- Dialysate Temperature
- Conductivity (Na+ level)
- Bicarb level
- K
- Ca
- Glucose in bath
- Dialysis Time
- Treatment schedule
- Ultrafiltration Rate vs. Plasma Refill Rate
- Slope of Blood Volume Curve
- Frequent reassessment of EDW

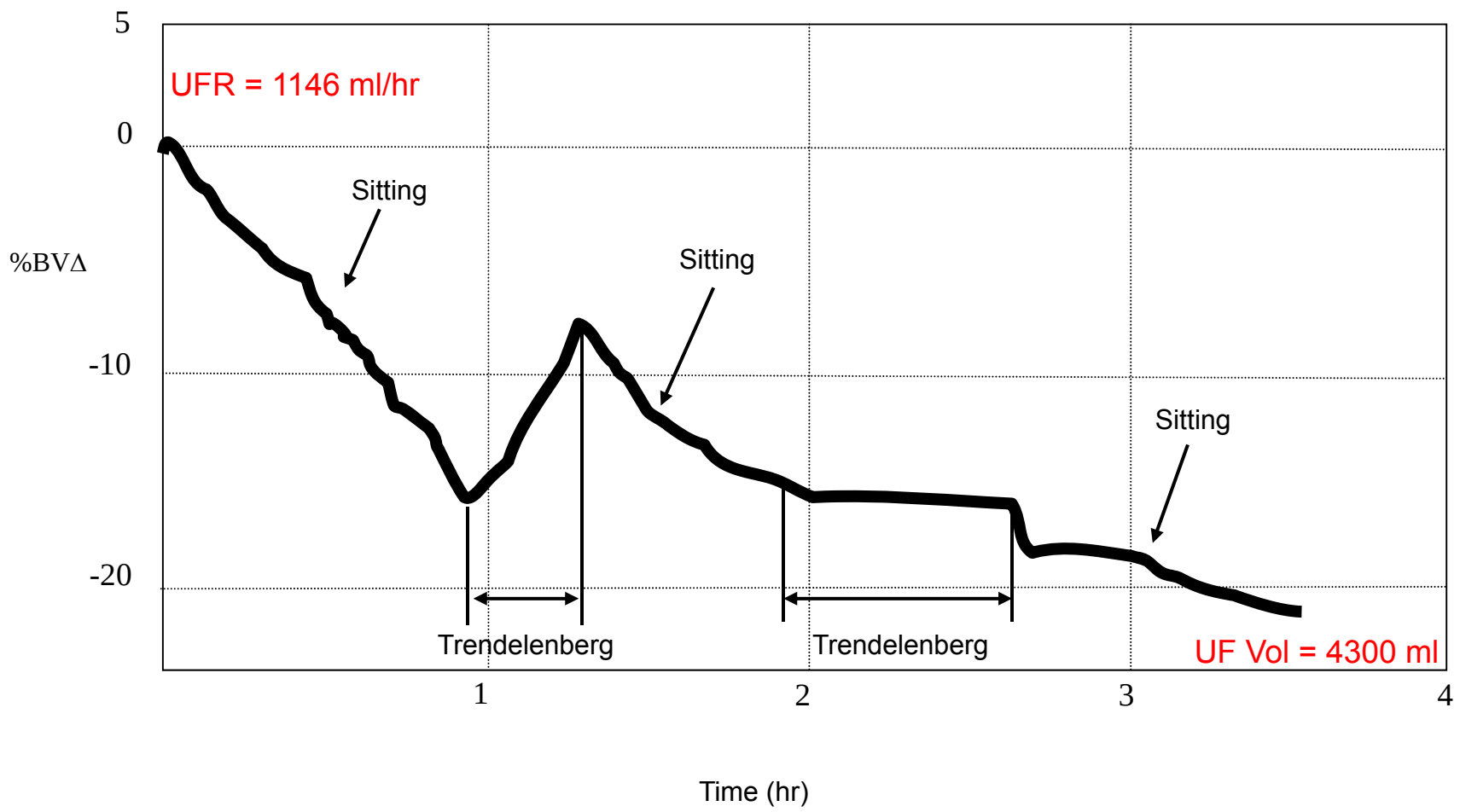
Root Causes of Intradialytic Morbidities

- **Posture**
- **Low O2 saturation**
- **Medications / Antihypertensives**
- **Incorrect Ultrafiltration rate**
- **Hypotonic environment / Hypoalbuminemia**
- **Dialysate at body temperature or warmer: core body heating**
- Splanchnic vasodilatation secondary to food ingestion
- Electrolyte/Acid-Base Imbalance
- Incorrect dialysis bath for individual patient
- Severe anemia (HCT <30) / Occult hemorrhage
- Unstable cardiovascular status / Arrhythmias / Pericardial tamponade / MI
- High Output failure related to high access blood flow rate (QA)
- Residual Urinary Output > 800 ml / day
- Septicemia
- Dialyzer reaction, Hemolysis and Air embolisim

6 Tools of our Trade to Prevent and Treat a “wet crash”

- Position pt with feet off the floor and elevate PRN.
- TX Hypoxemia:
  O2 below 90% for Graft or fistula and below 60% for a CVC
- Assess if the UFR is higher than plasma refill
- Assess if the patient is taking meds that cause vasodilatation.
- Correct a Hypotonic environment: i.e.: low Na+; low albumin
- Thermal Control : keep dialysate 36 C or below

Effects of Posture Changes



Medications

Any Vasodilator such as:

- Antihypertensives
- Pain medications
- Conscious sedation medications
- Antianxiety medications
- Antihistamines (Benadryl)

Heart Blockers such as:

- Beta Blockers:
- Calcium Channel Blockers

- Dose individualized for the HD schedule

Medications

Others such as:

- Steroids
- Over the counter
- Herbal
- Illegal

- Anaphylaxis

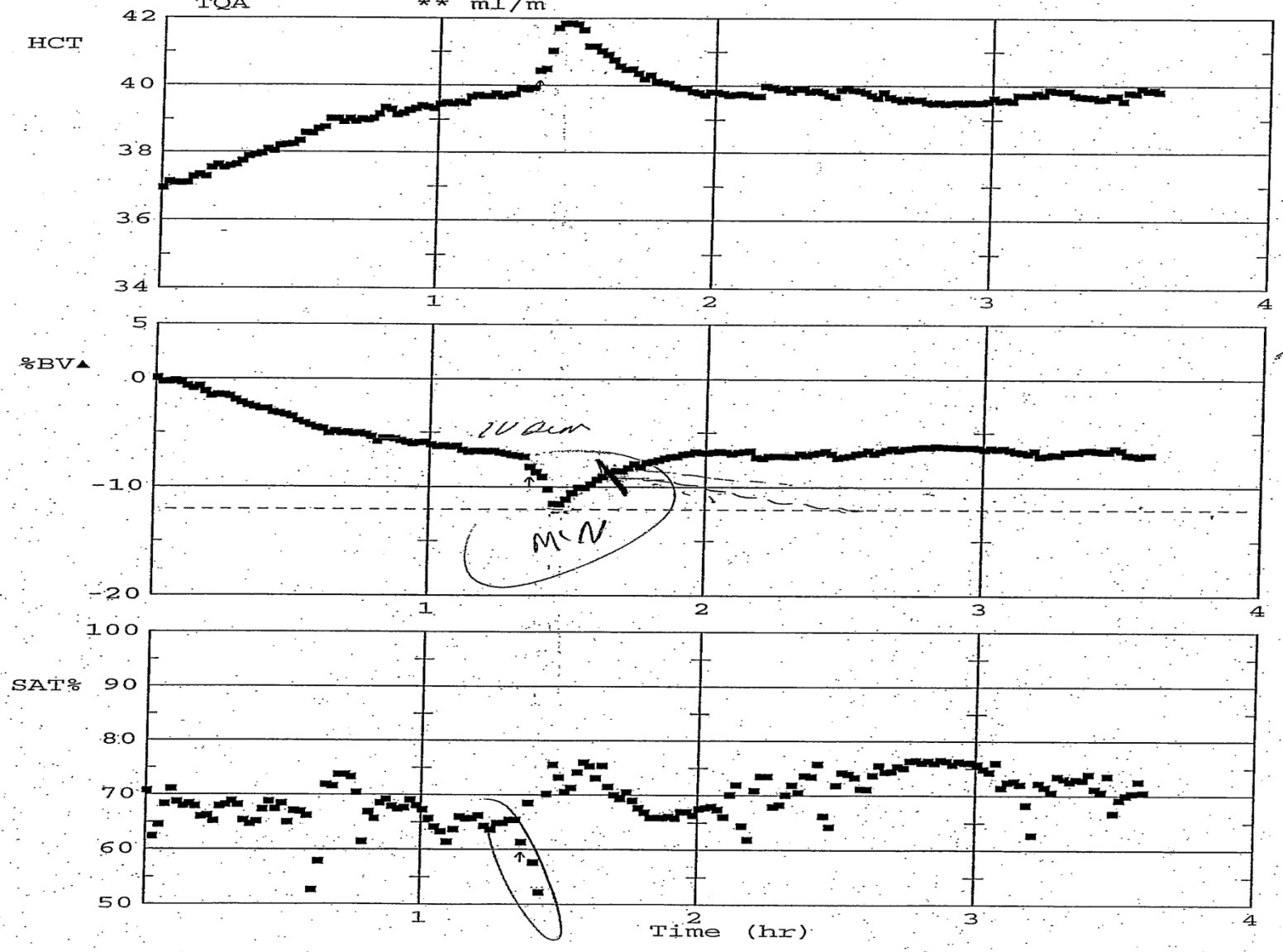
2

HEMA METRICS

CRIT LINE Instrument S/N 195B401054 IDC C3 V8.09

Patient ID. = ...
Hct (start) = 36.9
Hct (max) = 41.8
Hct Limit = 42.
Hgb (start) = 12.2
Sat (min) = 52.0
Recirculation % **
▲H ABF **
TQA ** ml/m

Station ID. = #10
Date 09/13/2005
Start Time 11:37:46
Stop Time 15:13:34
Calibration Date 05/18/2004
Last Verification Date 09/13/2005



DW 90.6
93.6
MAX DRY
W.A.M.

Fact or Myth?

* Eating during dialysis should be encouraged since our patients loose protein during the treatment.

Number 17: Eating

Should Patients Eat During Hemodialysis Treatments?

Katina Kinnel

NEPHROLOGY NURSING JOURNAL ■ September-October 2005 ■ Vol. 32, No. 4

HEMA METRICS
CRIT LINE Instrument S/N 195A-401442 IDC C3 V8.12

Patient ID. = ____
Hct (start) = 42.1
Hct (max) = 49.2
Hct Limit = 50
Hgb (start) = 14.0
Sat (min) = 34.4
Recirculation % **
▲H ABF **
TQA ** ml/m

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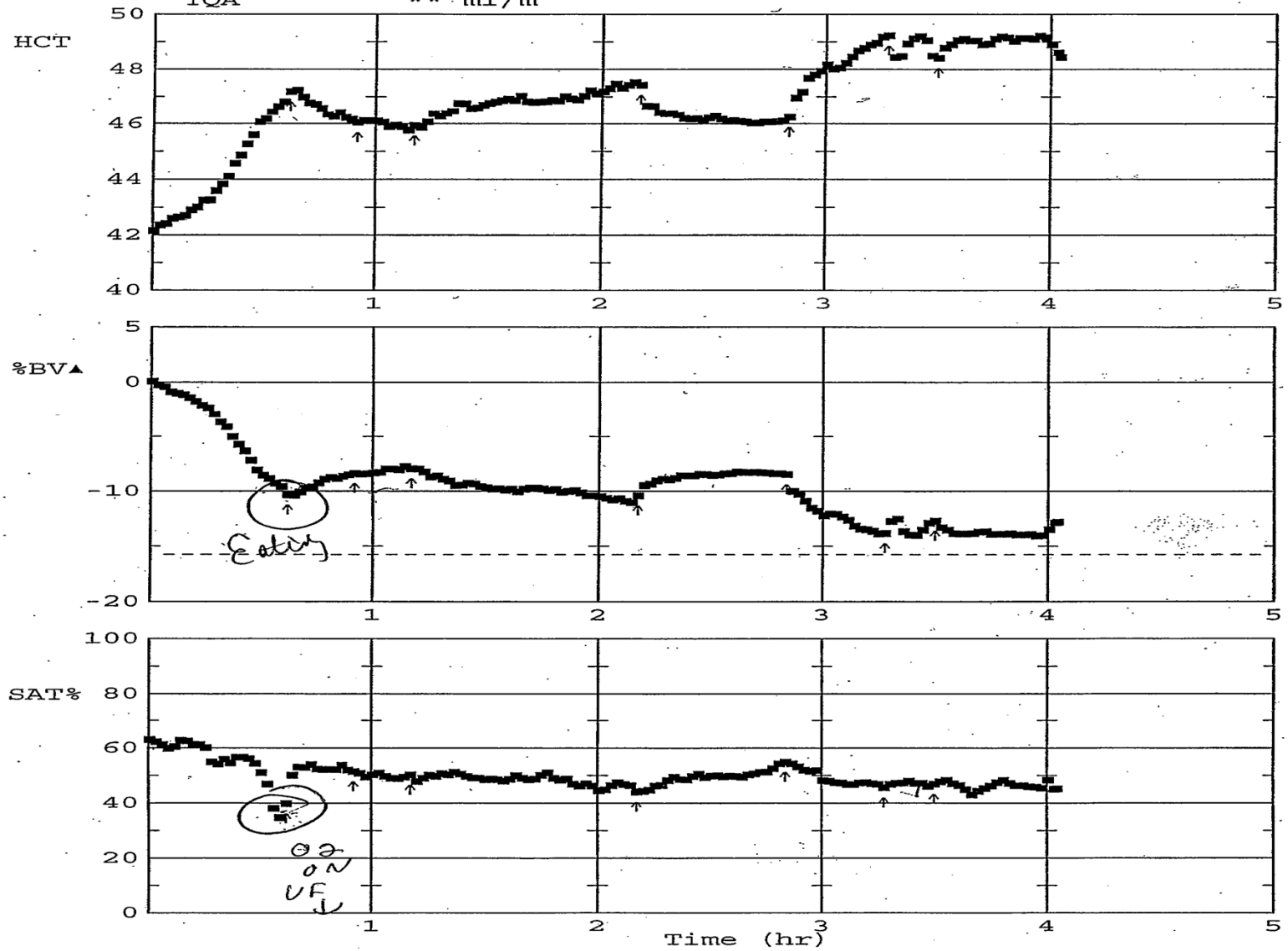

Labs R/T Fluid Management

- Hct/Hgb
- Albumin / Protein level
- Electrolytes (K, Ca, Mg)
- BUN
- Glucose /HgbA1C
- Pre NA levels
- Serum CO2 Level
- ANP/BNP
- Troponin-T

V543
Dose of Dialysis

Evidence of implementation of the plan of care for this aspect would include:

- Treatment records reflecting ***attaining the target weight at the end of each treatment***

or

- Documentation acknowledging the target weight was not attained with an assessment of the reason for not attaining it, and a plan to correct this issue.

Fact or Myth?

* There is no “Real” way to Assess
“Ideal Dry Weight”
versus
“Estimated Dry Weight”?

Kidney International, Vol. 68 (2005), pp. 854–861

Assessment of dry weight by monitoring changes in blood volume during hemodialysis using Crit-Line

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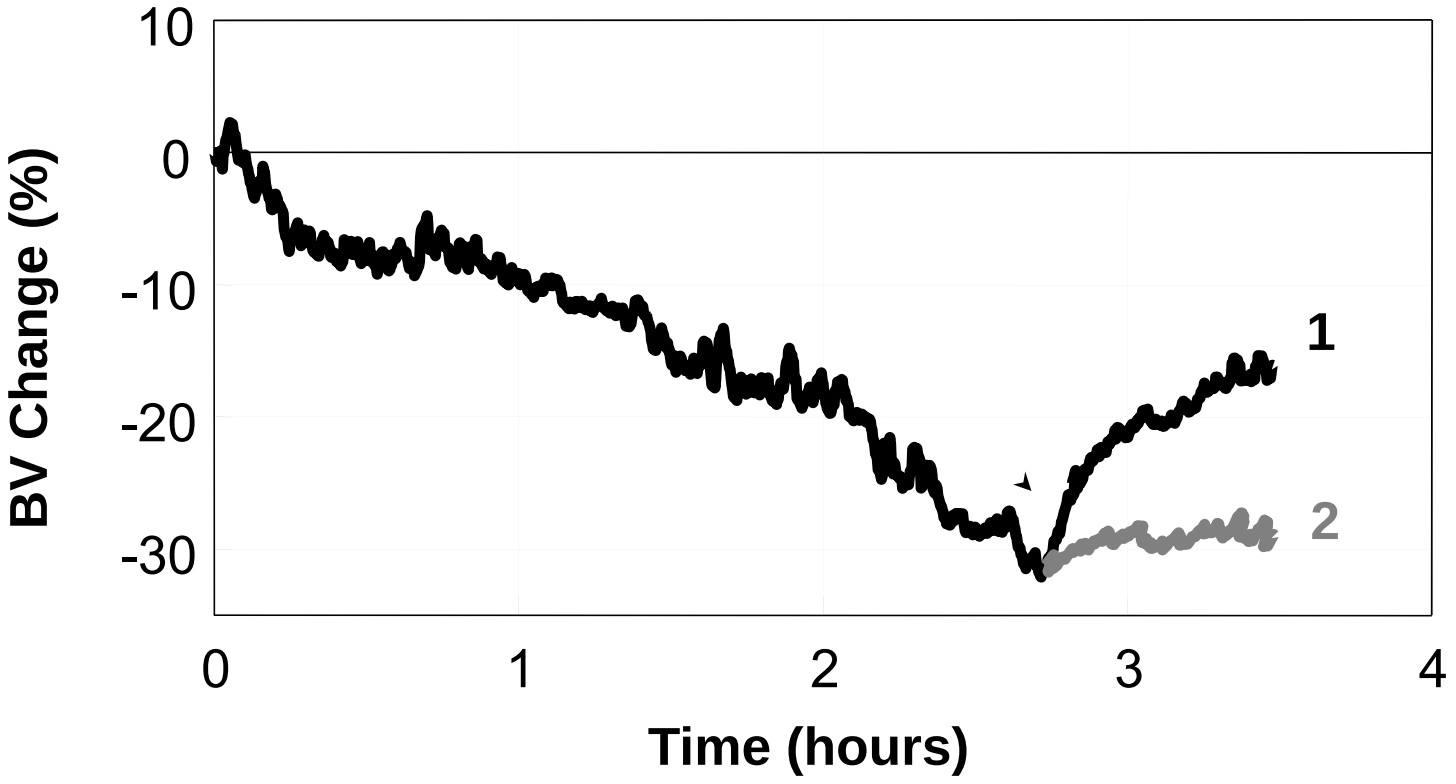
Assessing for Refill: An Indicator of Over-hydration



V504: Blood Pressure and Fluid Management Needs

- Mandated for pediatric patients

..."blood volume monitoring during hemodialysis should be available in order to evaluate body weight changes for gains in muscle weight vs. fluid overload".

V543:
Dose of dialysis

Defines EDW- and the inter/ intradialytic measures that will be used to evaluate the outcomes:

- A patient at their EDW should be:
  - asymptomatic and
  - normotensive
  - on minimum blood pressure medications
  - while preserving organ perfusion and
  - maintaining existing residual renal function

V504: Blood Pressure and Fluid Management Needs

The comprehensive assessment should include evaluation of the patient's:

- Plan of Care
- Medications
- Pre/intra/post and interdialytic blood pressures
- Interdialytic weight gains
- Target Weight vs. Ideal Dry Weight
- Related intradialytic symptoms
- Residual urine output
- Along with analysis for potential root causes
- Plasma refill checks / BV slope if available

New Approaches To Fluid Management:

Individualized Dialysate

Daily vs. Nocturnal Dialysis (5 days a week vs. 3 days)

Serial ECHO

Home Blood Pressure Monitoring

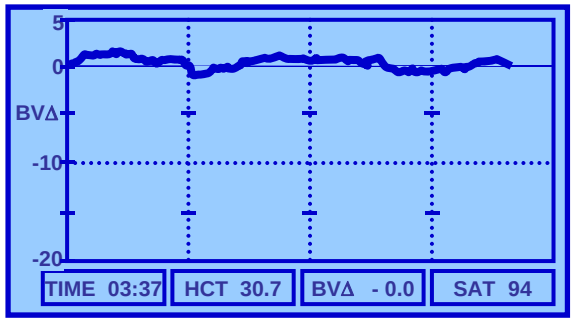
BNP / ANP/ Troponin-T

Continuous NIVM/RPV Monitoring

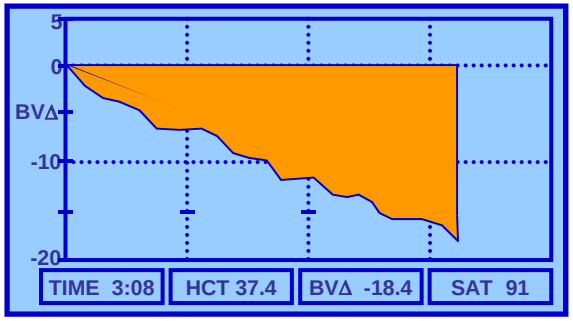
Bioimpedence

Dr Agarwal's Findings: RPV slopes provide prognostic value above and beyond UFR

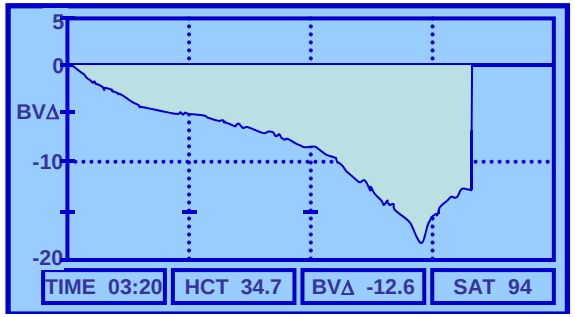
BV Profile A



BV Profile B



BV Profile C



Set 920.
PMVD 650
23 or

HEMA METRICS

CRIT LINE Instrument S/N 195BM405288 IDC C3 V8.12

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Hct (max) = 39.1
Hct Limit = 40
~Hgb (start) = 12.7
Sat (min) = 89.7
Recirculation % **
▲H ABF **
TQA ** ml/m

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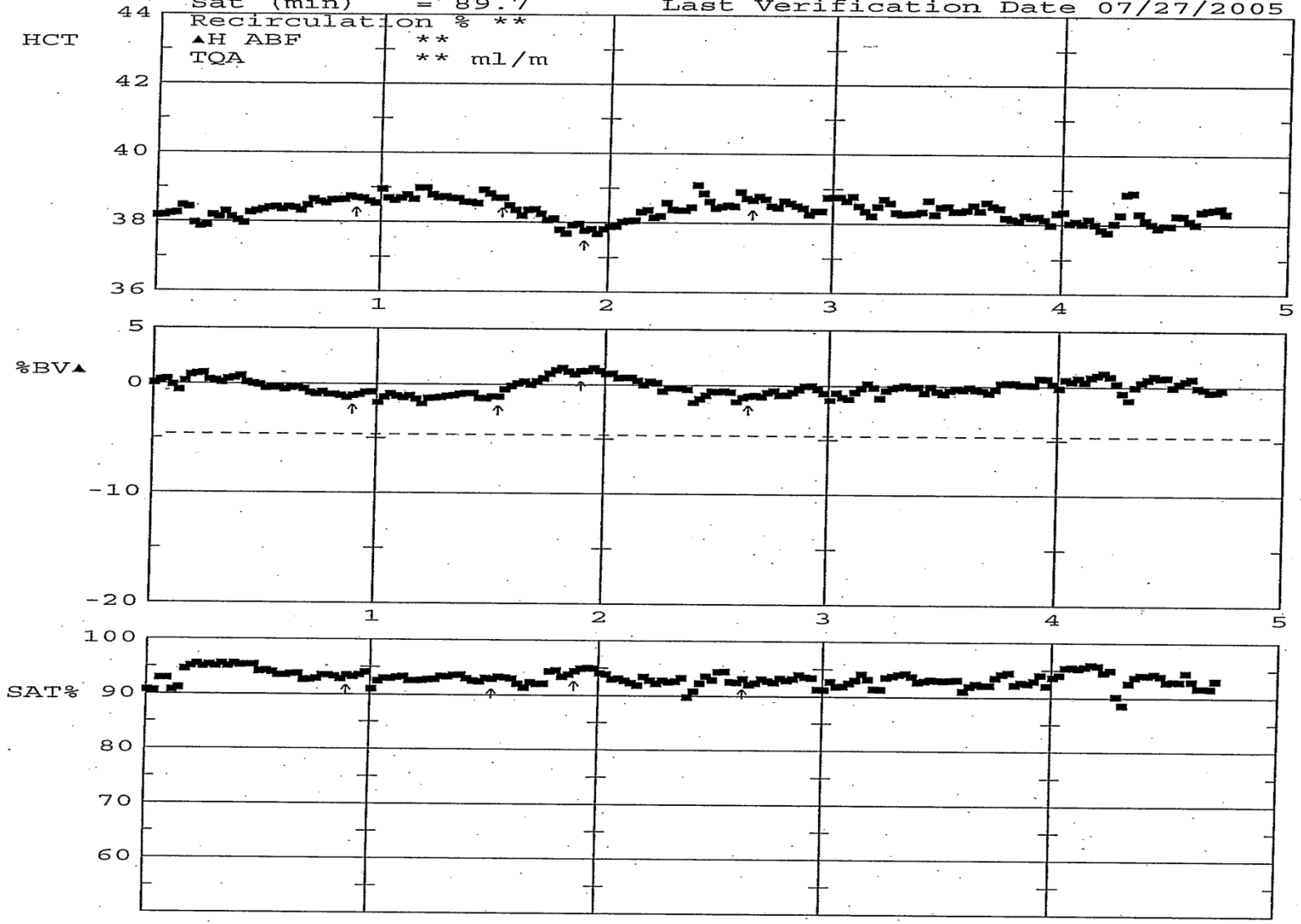
Last Verification Date 07/27/2005



Non Invasive Vascular Monitoring: Bioelectrical Impedance Analysis (BIA) : Bioimpedance

- Not as accurate with edema- looses signal as leads slip off
- Single vs. multiple frequencies
- Some types more difficult to interpret
- Some more expensive than others
- Some suitable for occasional vs. routine use
- Used in Europe for several years
- Scientific Validity still debated

- Practices under Scrutiny
- Unintended Consequences of Current Practices
- Evidence - Based Practices

Next Step

- Incorporate competency based fluid management training in orientation and annual in-service
- Use available technology to its full potential
- Round / Review patient data and tracking tools with staff
- Assess Medications on ongoing basis
- Educate patient/ families on fluid management principles

Patient Education

- Meaning of “Dry Weight”
- Fluid Allowances- What and how much
- How fluids shift during dialysis
- Potential causes of symptoms
- Effects of Eating / Acceptable meals before/ during/after TX

– Medications
- Relationship of BP to fluid gains
- When to take / to hold BP meds
- Reporting changes

Self -Care

- Weigh self daily

- BP cuff

- Reading labels:
  * Especially for Sodium content

Next Step

- Reassess dry weight post treatments
- Track/ Trend/ Analyze Root causes of IDM with staff
- Reassess protocols for Sodium Modeling, Eating, Oxygen and Thermal Control
- Review hospitalization diagnosis for accuracy
- Add Fluid Management into the facility QAPI program

8/17/10 Clinical and Data TEP Quality Measure Recommendations

1. Dietary Sodium Reduction advice during last 90 days by RD

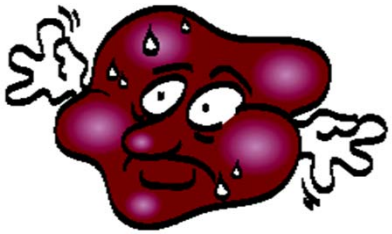
2. #Pts not on Sodium profiling

3. #Pts prescribed < 138 mEq/L

4. # Pts new to dialysis prescribed at least 240 min

5. # Pts receiving new post dialysis weight from nephrologist in reported month

6. # Pts with UFR <15ml/kg/hr



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www.hemametrics.com

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