Patient vs Labs

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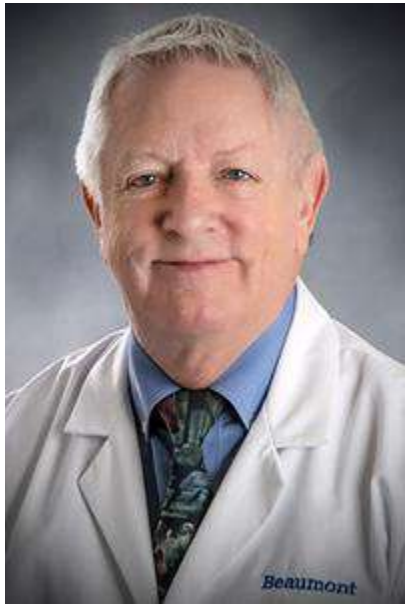
Thank you Jerry for 19 great years 2004-2023
Tests I wished you never ordered



Kidney geeks come from all over the world to be inspired by the Mother Kidney in Chicago

Education Objectives

- Understand the role of properly ordering testing in patients, appropriate testing in the appropriate setting
- Appreciate how to interpret testing results in respect to a patient's presentation
- Discuss the utilization and limitation of BNP testing in patients with end stage kidney disease

Case

- A 61 y.o. dialysis patient presents to the ED complaining of an abrupt onset of fever, chills, and cough productive of mucopurulent sputum.
- He had a 2 ½ year of End Stage Kidney Disease (ESKD) due to Type 2 diabetes and was dialyzed the afternoon prior to this am's presentation and was feeling well throughout the treatment, his post treatment BP was 134/84 mm Hg and his discharge weight was 68 kg, his "dry weight".

Case

- He smokes about 1 PPD (40 pk/yr), but denied any prior fever, chills, nausea, vomiting, diarrhea, arthralgias, rashes, significant travel history, or pets at home.
- PMHx: ESKD, Type-2 DM, HTN, hyperlipidemia, mild COPD, an echocardiographic study 4 months ago demonstrated mild concentric LVH with an ejection fraction of 55% and normal relaxation.
- He was compliant with his treatments, diet, and medications

Case

- In the ED he has some mild dyspnea at rest, relieved by 2L O2 via nasal cannula
- Temperature 39.7 C, pulse 128 regular, BP 92/74 mm Hg O2 saturation 92%, weight 66.5 kg (dry weight 68 kg)

Case

- **Examination:** (as performed by the attending nephrologist in the ED)
  - **HEENT:** moderate bilateral conjunctive injection, no exudates, nares were erythematous, edema and clear exudate noted, ears were normal, posterior pharynx erythematous but no edema or exudates noted.
  - **Neck:** supple, poor skin turgor noted, no cervical adenopathy, thyromegaly, minimal JDV at 0^{o} elevation
  - **Lungs:** some dullness over the right anterior chest, rales and expiratory wheezes noted bilaterally but more pronounced on the right chest.
  - **Heart:** regular but tachycardic, no murmur or rub noted
  - **Abdomen:** normal
  - **Extremities:** pulses 2/4 = no edema or rashes noted.

Lab

HEMATOLOGY		
	CBC	
14,800	WBC	
	RBC (>1 yr)	3.0-5.30*10^{12}/L
	Hgb (M)	13.4-17.4 g/dl
11.7	Hgb (F)	12.3-15.7 g/dl
	Hct (M)	40-54%
36.3	Hct (f)	38-47%
	Platelet Count	150-440*10^{9}/L
84	MCV	81-97 fl
30	MCH	28-32 pg
14	RDW	12-15%

Differential
PNM 80%
Bands 11 %
Lymphs 9%

CHEMISTRIES		
137	SodiU/L	135-145 mmol/L
3.8	PotassiU/L	3.5-5.4 mmol/L
100	Chloride	92-109 mmol.L
23	Bicarbonate	24-31 mEq/l
	Anion Gap	12-Aug

	Arterial Blood Gases	
7.42	pH	7.35-7.45
34	$PaCO_2$	37-43 mmHg
110	PaO2	90 mmHg
24	HCO_3	22-28 Meq/l
96	O_2 saturation, art	97%
	O_2 saturation, vein	60-85%
	BE	0+2 mmol/L
18	A-a gradiant	10 mm Hg

	Total Bilirubin	0.2-1.5 mg/dl
1.1	Direct Bilirubin	0.0-0.3 mg/dl
123	Alkaline Phosp.	25-115 U/L
	LDH	50-240 U/L
	CPK, CK	5-200 U/L
21	AST	10-40 U/L
16	ALT	7-55 U/L
	Total Cholesterol	<200 mg/dl
	LDL Cholesterol	<130 mg/dl
	HDL Cholesterol	>35-40 mg/dl
	Triglycerides	30-135 mg/dl
	Amylase	0-180 U/L
	Lipase	4-25 U/L
	PSA	<4.0 ng/ml
0.6	Lactate	0.5-1.0 mmol/l

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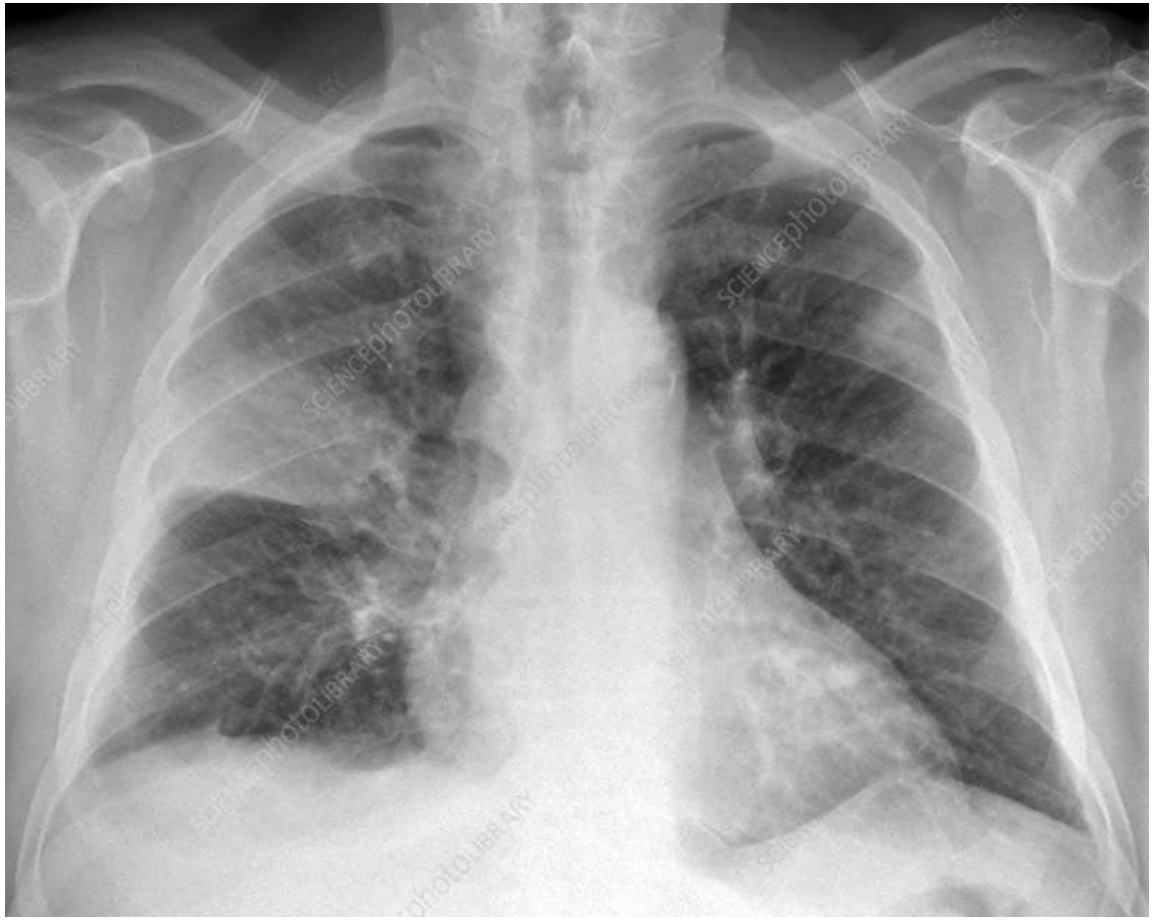
Lab

- And the pro-BNP was 1,460 pg/mL (n <125 pg/mL)

Chest X-Ray



ED Course

- Blood and urine cultures were obtained along with sputum. An intravenous line was placed and a heparin dwell placed after ceftriaxone was given intravenously.
- Nebulized albuterol and ipratropium was given via inhalation
- The nephrologist was contacted by the ED physician

Enter the Nephrologist

- After presenting the case to the nephrologist, the ED stated that the patient needed emergent dialysis due to the patients concomitant CHF.
- When asked for evidence the physician noted that the BNP was 1,460 pg/mL.

Enter the Nephrologist

- The nephrologist attempted to explain that this test is frequently elevated in CKD and ESKD patients and is not reliable. In addition, there was significant evidence of volume depletion. Their recommendation was to give the patient 1,000 ml of normal saline intravenously
- This was based on:
  - BP
  - Pulse
  - 1.5 kg under his normal dry weight of 68 kg
  - Skin turgor poor
  - Minimal JVD at 0 degrees
  - CXR consistent with RML pneumonia not CHF

However

- The ED physician stated that the nephologist was wrong and did not feel “comfortable” giving any fluids and once again demanded emergent dialysis.

Hospital Course

- Upon arrival to the floor, the patient was given 1,000 ml of normal saline over 60 minute. About 1 hour later BP was 123/78 mm Hg, pulse was 90 bpm.
- No dialysis was needed

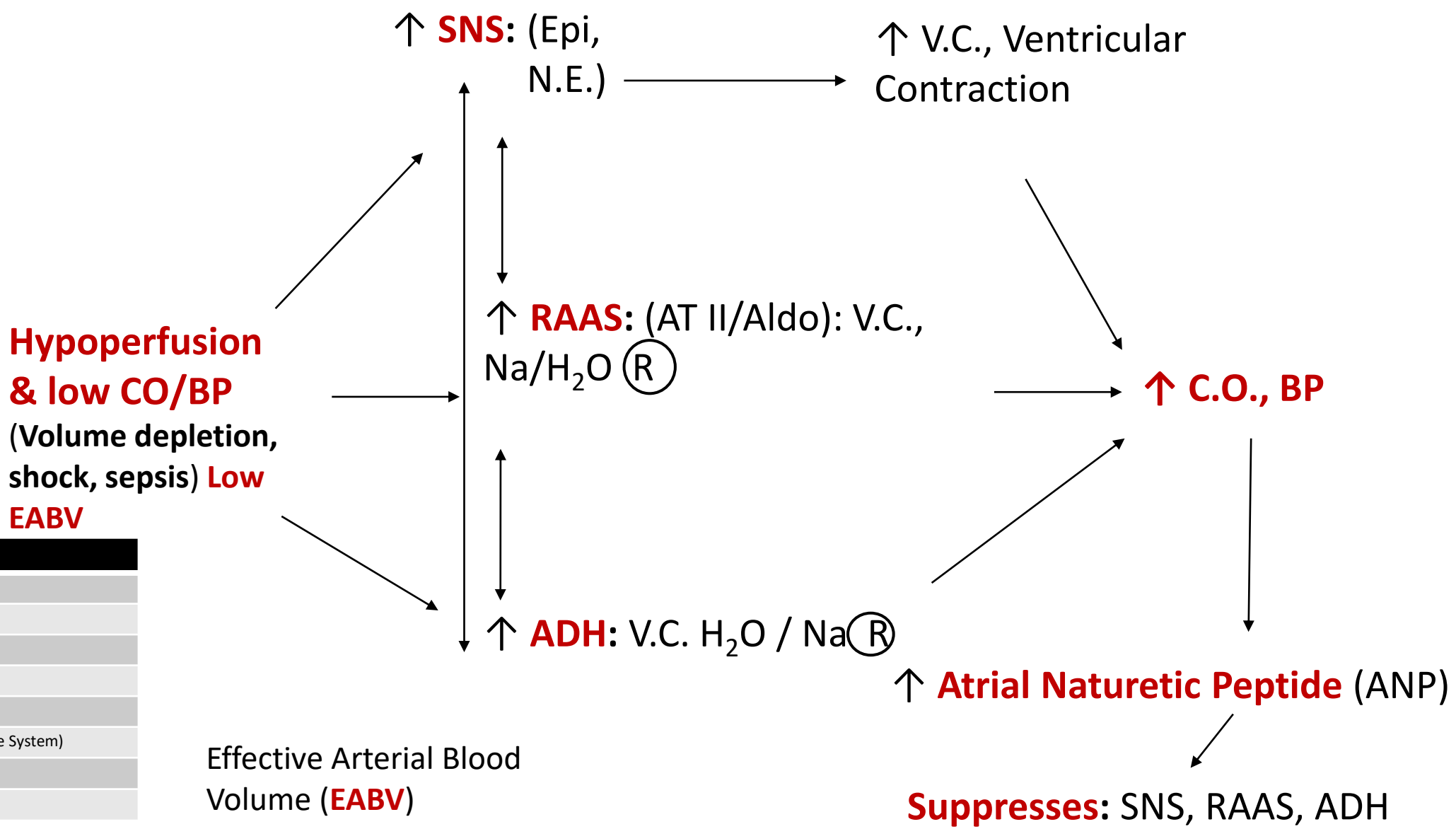
Naturetic Peptides

- **Class of polypeptide hormones:**
  - ANP
  - BNP
  - CNP
- In states of volumes excess, naturetic peptides are released[1]

Naturetic Peptides: Actions

- **Elevated levels**
  - **Increase in GFR:**
    - Decreased Na reabsorption in proximal, distal tubules, and in the collecting duct
    - Collecting duct: Inhibit action of ADH promoting diuresis modest at best
  - **Suppresses activity:**
    - SNS, RASS, ADH, and Endothelin-1 in feedback loop.[1]

How the Body Responds to **Changes in Volume**



Glossary	
SNS	Sympathetic Nervous System
Epi	Epinephrine
N.E.	Norepinephrine
V.C.	Vasoconstriction
R	Reabsorption
RAAS	(Renin Angiotensin Aldosterone System)
ADH	Antidiuretic Hormone
ANP	Atrial Naturetic Peptide

Naturetic Peptides: Uses

- **Diagnostic testing:**
  - Naturetic peptides are used to **differentiate causes** of dyspnea
  - Can use **trending values** to follow course of CHF
  - In various **conditions elevated naturetic peptide levels** correlate with **mortality and morbidity**[1, 2]

Characteristics	BNP	NT-proBNP
Amino acids	32	76
Physiologic activity	Biologically active	Biologically inactive
Half life	20-22 minutes	~120 minutes
Metabolism	Neutral endopeptidases, NPR-C	Renal
Normal Values	< 100 pg/mL	< 300 pg/mL

Naturetic Peptides: Uses

- **Pharmacological:**
  - ANP derivative have been investigated for a number of potential uses
  - **Neprilysin inhibition (sacubitril/valsartan):** endopeptidase which cleaves polypeptides, including naturetics
    - Prolong actions of ANP, BNP
    - Limited efficacy in advanced (NYHA IV) HFrEF
  - Combined with valsartan for heart failure[2, 3]

Naturetic Peptides: Limitations

- **Obesity**: lower naturetic peptide levels in ADHF[4, 5]
- **Advanced age**: increased baseline level d/t age related decline in GFR, HTN, changes in production and metabolism[5, 6]
- **Females**: level higher in females vs males ? To estrogen[7, 8]
- **High CO**: naturetic peptides elevated in high cardiac output states[9, 10, 11]
- **HFpEF vs HFrEF**:
  - Diastolic (HFpEF) naturetic peptides are elevated but lower than in systolic HFrEF[12]

Naturetic Peptides: Limitations

- **Advanced CKD/ESKD:**
  - **Levels are elevated due to:**
    - NT-pro BNP is **metabolized in the kidney**, in advanced disease, slower metabolism contribute to elevated levels
    - **Large AV fistulas** can lead to **High CO. Naturetic peptides elevated** in high cardiac output states[9, 10, 11]
    - Chronically **overt clinical or subclinical volume excess elevate levels**[1]
    - **Values may not reflect actual volume status**
    - **But can be readily apparent on examination**

Always ask:
How does this result match up with my patient?

In Memory

Pedro Espat D.O., FACOI

When All Else Fails:

Examine the Patient

May the Flow be with You

Thank you

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