



THE UNIVERSITY OF
CHICAGO
MEDICINE &
BIOLOGICAL
SCIENCES

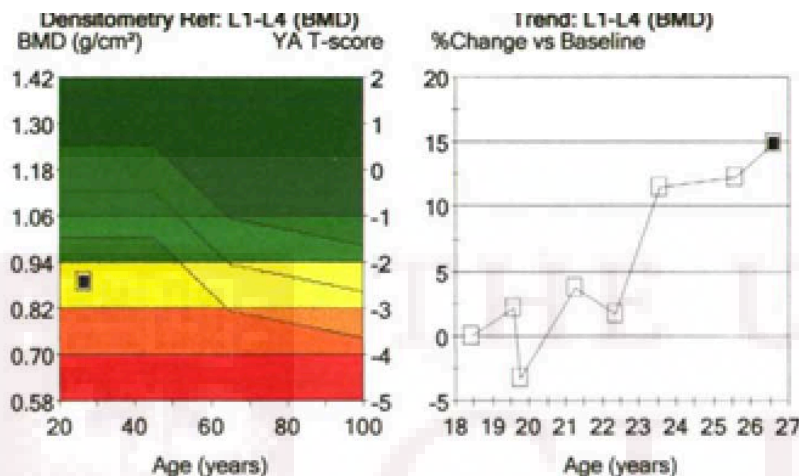
30 y/o woman with anorexia
nervosa and ?Cushing's

Dr. Vokes does not have any relevant financial relationships
with any commercial interests.

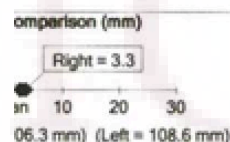
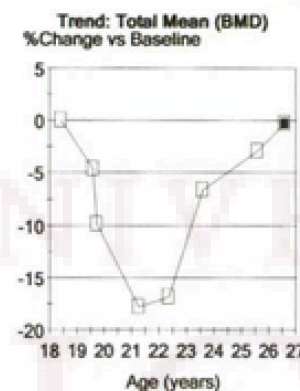
Case history

- Anorexia nervosa since age 14 with primary amenorrhea. Since that time had only one year with menses (5/year). On BCP with normal bleeding 2005-2006. Refused estrogen since.
- Multiple fractures related to running (toes, foot, hip, pubic bone). Treated with teriparatide for 8 ms after hip fracture and risedronate 2007-2008.

Bone density



Region	¹ BMD (g/cm ²)	² Young-Adult T-score	³ Age-Matched Z-score
L1	0.789	-2.8	-2.4
L2	0.898	-2.5	-2.0
L3	0.959	-2.0	-1.5
L4	0.895	-2.5	-2.1
L1-L4	0.888	-2.4	-2.0



Region	¹ BMD (g/cm ²)	^{2,7} Young-Adult T-score	³ Age-Matched Z-score
Neck			
Left	0.806	-1.7	-1.3
Right	0.785	-1.8	-1.5
Mean	0.795	-1.7	-1.4
Difference	0.022	-0.2	-0.2
Total			
Left	0.821	-1.5	-1.1
Right	0.860	-1.2	-0.8
Mean	0.841	-1.3	-1.0
Difference	0.039	0.3	0.3

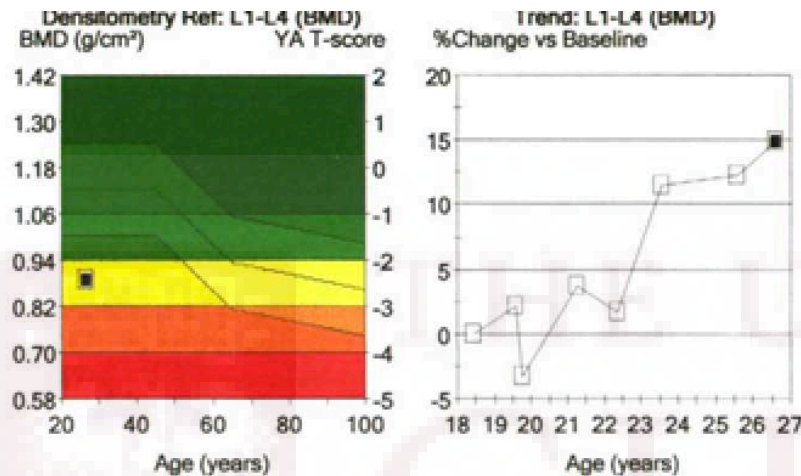
Trend: Total Mean				
Measured Date	Age (years)	¹ BMD (g/cm ²)	Change vs Previous (g/cm ²)	Change vs Previous (%)
6/12/2013	26.5	0.841	0.021	2.6
6/14/2012	25.5	0.820	0.032 *	4.1 *
6/10/2010	23.5	0.788	0.086 *	12.3 *
3/19/2009	22.3	0.702	0.009	1.3
2/20/2008	21.2	0.693	-0.067 *	-8.8 *
...
4/14/2005	18.4	0.844	-	-

Trend: L1-L4				
Measured Date	Age (years)	¹ BMD (g/cm ²)	Change vs Previous (g/cm ²)	Change vs Previous (%)
6/12/2013	26.5	0.888	0.020	2.3
6/14/2012	25.5	0.868	0.007	0.8
6/10/2010	23.5	0.861	0.075 *	9.5 *
3/19/2009	22.3	0.786	-0.016	-2.0
2/20/2008	21.2	0.802	0.055 *	7.4 *
...
4/14/2005	18.4	0.773	-	-

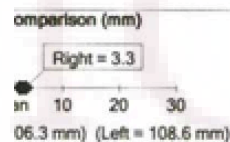
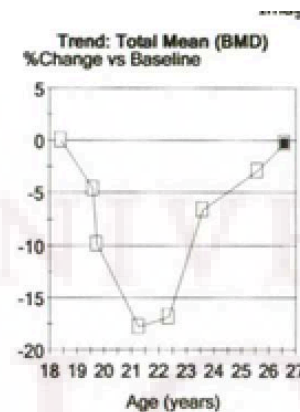
Current concerns

- Presents in October 2016 with concerns about Cushing's
- Gained 5-6 lbs, feels “muscle tired”
- Exercise: biking 40 Mi per day with “group of seniors” 3 days/week, shorter rides other days, no exercise one day/week
- Social Hx: mother had a CVA and pt and father help with care (in suburbs) – high stress
- MD/PhD student – doing well

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...
4/14/2005	18.4	0.844	-	-

2016 BMD scan from Adventist

L1-L4: T-score=-3.5, Z-score=-2.7

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Region	¹ BMD (g/cm ²)	^{2,7} Young-Adult T-score	³ Age-Matched Z-score
Neck			
Left	0.691	-2.5	-1.8
Right	0.727	-2.2	-1.6
Mean	0.709	-2.4	-1.7
Difference	0.037	0.3	0.3
Total			
Left	0.724	-2.3	-1.6
Right	0.745	-2.1	-1.4
Mean	0.734	-2.2	-1.5
Difference	0.021	0.2	0.2

Physical exam

- Cachectic
- Vitals: BP 115/69 Pulse 79 Ht 165.1 cm (5' 5")
Wt 42.2 kg (93 lb) **BMI 15.48 kg/m²**
- No Cushing's stigmata

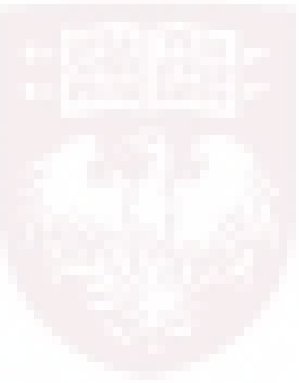
Outside labs

BMP Na 131; K5.0. Cortisol 21.9

TSH 1.482 free T4 1.13






Clinical problems

- Hyponatremia
- Cushing's



Component	Latest Ref Rng	10/14/2016
Glucose Ser/Plasma Interface External	65 - 99 mg/dL	85
BUN Interface External	7 - 25 mg/dL	19
Creatinine Interface External	0.50 - 1.10 mg/dL	0.74
GFR Non-AfrAmer(Calc) Interface External	> OR = 60 mL/min/1.73m2	109
GFR AfrAmer Estimate (Calc) Interface External	> OR = 60 mL/min/1.73m2	127
B/C Ratio Interface External	6 - 22 (calc)	NOT APPLICABLE
Sodium Interface External	135 - 146 mmol/L	127 (L)
Potassium Ser/Plasma Interface External	3.5 - 5.3 mmol/L	4.8
Chloride Interface External	98 - 110 mmol/L	92 (L)
Carbon Dioxide Interface External	20 - 31 mmol/L	30
Calcium Interface External	8.6 - 10.2 mg/dL	9.9
Total Protein Interface External	6.1 - 8.1 g/dL	7.2
Albumin Interface External	3.6 - 5.1 g/dL	4.8
Globulin Calculated Interface External	1.9 - 3.7 g/dL (calc)	2.4
A/G Ratio Interface External	1.0 - 2.5 (calc)	2.0
Bilirubin, Total Interface External	0.2 - 1.2 mg/dL	0.6
Alk Phos Interface External	33 - 115 U/L	48
AST (SGOT) Interface External	10 - 30 U/L	36 (H)
ALT (SGPT) Interface External	6 - 29 U/L	19

Evaluation of hyponatremia

Component	Latest Ref Rng	11/15/2016	10/27/2016 	10/24/2016 	10/17/2016
Glucose, Ser/Plasma	60 - 99 mg/dL	84 		92	
Sodium	134 - 149 mmol/L	137		136	
Potassium, Ser/Plasma	3.5 - 5.0 mmol/L	4.4		4.4	
Chloride	95 - 108 mmol/L	95		95	
Carbon Dioxide	23 - 30 mmol/L	29		29	
Anion Gap	6 - 15 mmol/L	13		12	
BUN	7 - 20 mg/dL	15		14	
Creatinine	0.5 - 1.4 mg/dL	0.6		0.7	
GFR Estimate (Calc)	>59 mL/min/BSA	117 		99 	
Calcium	8.4 - 10.2 mg/dL	9.6		10.0	
Collection Duration	h		24	24	
Volume	mL		4550	11000	
Rate	mL/min		3.160	7.639	
Osmolality, Ser/Plasma	289 - 308 mosm/kg			285 (L)	267 (L)
Urine Osmolality, Random	500 - 800 mosm/kg		513	255 (L)	
Urine Sodium, Timed	40 - 220 mmol/24hr		196	627 (H)	

Evaluation for Cushing's

Component	Latest Ref Rng	11/3/2016	10/27/2016	10/17/2016
Cortisol, Free, Ur	3.5 - 45	172 (H)	164 (H)	This column
Collection Duration		24	24	
Urine Volume		3900	4550	
Collection Duration	h	24	24	
Volume	mL	3900	4550	
Rate	mL/min	2.708	3.160	
Midnight Cortisol	<100 ng/dL			87
Cortisol, A.M. Interface External	mcg/dL			26.3 (H)
Cortisol	ug/dL		23.9	1 mg Dex suppression
ACTH	<52 pg/mL		26.2 random	
Urine Creatinine, Timed	800 - 1800 mg/24hr	858		

	Cortisol
Ref. Range	Latest Units: ug/dL
2/19/2003 0904	11.5 *
6/19/2007 1126	15.3 *
10/27/2016 0942	23.9 *

11/9 – pituitary MRI:
normal

Cushing's evaluation (cont)

Test Name	11/4/2016	In Range	Out Of Range	Reference Range
DEXAMETHASONE		94		ng/dL

Reference Ranges for Dexamethasone:

Baseline: Less than 20 ng/dL

1 mg dexamethasone overnight: 180-550 ng/dL (8:00-10:00 AM)

This test was developed and its analytical performance characteristics have been determined by Quest Diagnostics Nichols Institute San Juan Capistrano. It has not been cleared or approved by FDA. This assay has been validated pursuant to the CLIA regulations and is used for clinical purposes.

CORTISOL, A.M.	21.3	mcg/dL
Reference Range		
8 a.m. (7-9 a.m.) Specimen:	4.0-22.0	

COMMENTS: COLLECTION 12/5/16 @2348

Test Name	Results	
CORTISOL, LC/MS/MS, SALIVA	0.29	mcg/dL

8-10 AM: 0.04-0.56 mcg/dL

noon-2 PM: < OR = 0.21 mcg/dL

4-6 PM: < OR = 0.15 mcg/dL

10 PM-1 AM: < OR = 0.09 mcg/dL

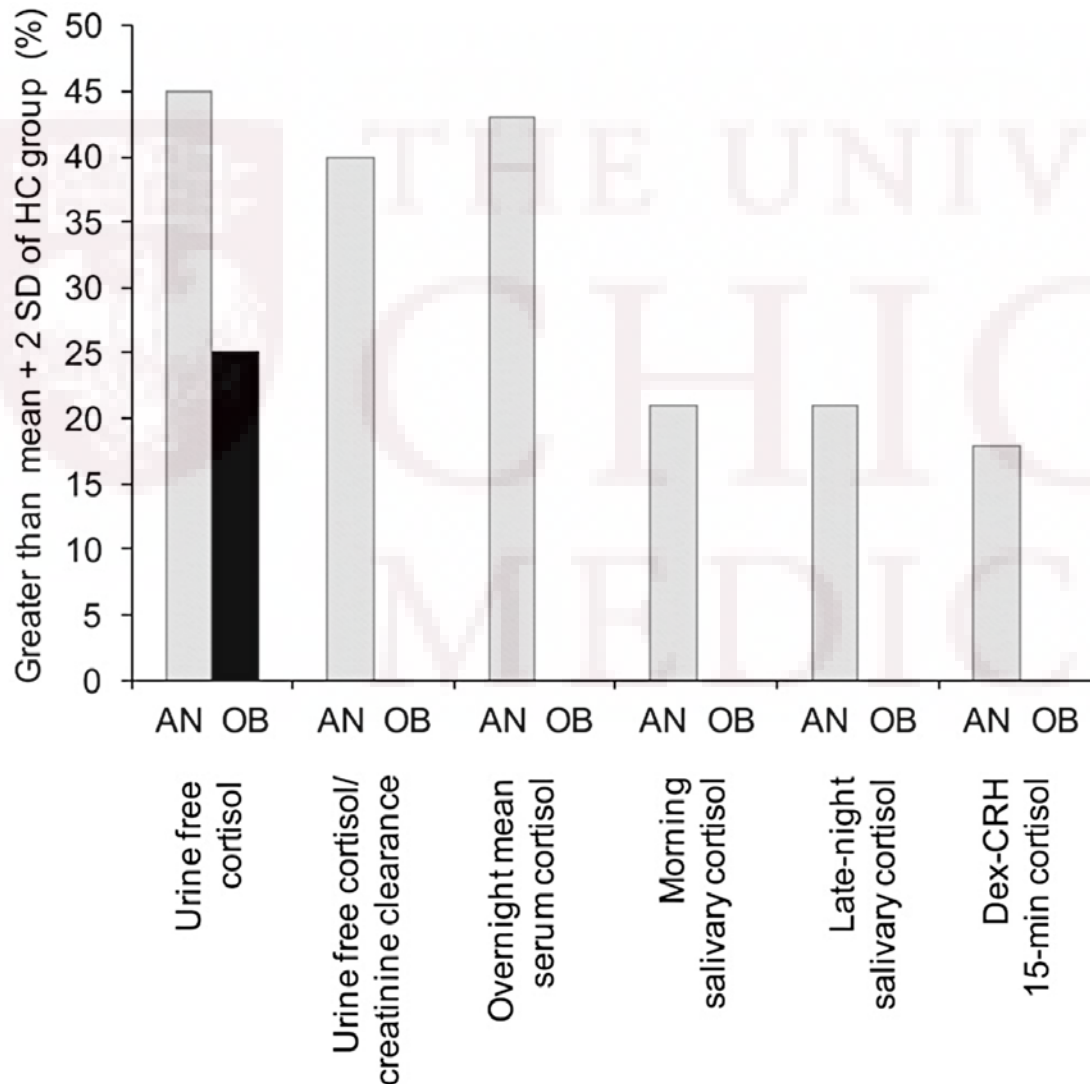
Evaluation for Cushing's summary

- Elevated urinary free cortisol – twice
- Did not suppress serum cortisol with Dex (twice)
- Midnight salivary cortisol normal once and elevated the second time
- Normal pituitary MRI

Abnormal cortisol in AN and obesity

Subject Characteristics	AN (n = 18)	HC (n = 21)	OB (n = 21)
Age, y	26 ± 6	27 ± 7	30 ± 8
BMI, kg/m ²	18.2 ± 1.0	22.3 ± 1.4	31.2 ± 4.3
Visceral adipose tissue, g	90 ± 39	215 ± 85	481 ± 185
Total fat mass, kg	9.3 ± 2.3	16.9 ± 3.6	32.5 ± 9.1
Lean body mass, kg	40.7 ± 3.6	43.4 ± 4.8	51.7 ± 7.3
Cortisol measures			
UFC, $\mu\text{g/d}$ (13.5–88.7) ^a	82.0 ± 42.3	51.1 ± 18.8	67.0 ± 35.2
UFC/CrCl, $\mu\text{g} \cdot \text{kg/mg} \cdot \text{d}$ (0.15–1.23) ^a	1.16 ± 0.52	0.69 ± 0.27	0.61 ± 0.25
Overnight serum cortisol, $\mu\text{g/dL}$ (4.0–11.2) ^a	11.6 ± 3.3	7.6 ± 1.8	6.2 ± 1.7
Overnight serum unbound cortisol, ng/mL (3.7–12.7) ^a	14.2 ± 6.7	8.2 ± 2.3	6.8 ± 2.3
Morning serum cortisol, $\mu\text{g/dL}$ (4.1–39.7) ^a	26.9 ± 8.1	21.9 ± 8.9	18.3 ± 6.8
Morning serum unbound cortisol, ng/mL (0–98.0) ^a	51.0 ± 21.1	44.7 ± 26.7	34.9 ± 21.6
LNSC, $\mu\text{g/dL}$ (0.01–0.09) ^a	0.06 ± 0.03	0.05 ± 0.02	0.04 ± 0.01
Morning salivary cortisol, $\mu\text{g/dL}$ (0–1.01) ^a	0.71 ± 0.43	0.43 ± 0.29	0.29 ± 0.15
CBG, $\mu\text{g/mL}$ (11.7–31.7) ^a	24.4 ± 3.9	21.7 ± 5.0	20.2 ± 3.0
Dex-CRH 0-min cortisol, $\mu\text{g/dL}$ (0.05–0.73) ^a	1.86 ± 3.85	0.39 ± 0.17	0.34 ± 0.22
Dex-CRH 15-min cortisol, $\mu\text{g/dL}$ (0–1.4) ^a	2.05 ± 4.22	0.61 ± 0.41	0.46 ± 0.21
Dex level prior to CRH stimulation, ng/dL (237–857) ^a	386 ± 99	547 ± 155	554 ± 204

Abnormal cortisol in AN and obesity



Cortisol levels in
18 AN, 21 obese
(OB) and 21
healthy controls
(HC)

M. Schorr et al. JCEM 2015;
100: 3313