COLLEGE of AMERICAN PATHOLOGISTS

Educational Questions

2016-B Urine Special Survey (N)

Educational Questions (Ungraded)

	Method	No. Labs	Mean	S.D.	C.V.	Median	Low Value	High Value
N-09	**0.4 L/24 hours**							
	Metanephrine	51	214.3	56.6	26.4	220	42	510
	Normetanephrine	50	524.2	107.1	20.4	532	147	818
	1.04 L/24 hours							
	Metanephrine	51	557.2	147.2	26.4	573	110	1327
	Normetanephrine	50	1349.6	256.2	19.0	1383	382	1747

Educational Questions (Ungraded)

N-09	Metanephrine	Normetanephrine
Assume that this sample was from a 24-hour collection with a total volume of: **0.4 L/24 hours** Calculate the 24-hour metanephrine and normetanephrine using your N-09 results.	010 ☐☐☐☐ . µg/24 hours	020 ☐☐☐☐ . µg/24 hours
Assume that this sample was from a 24-hour collection with a total volume of: **1.04 L/24 hours** Calculate the 24-hour metanephrine and normetanephrine using your N-09 results.	030 ☐☐☐☐ . µg/24 hours	040 ☐☐☐☐ . µg/24 hours

24-hour volumes:

- **A. 0.4 L/24 hours**
- **B. 1.04 L/24 hours**

Clinicians frequently utilize urine metanephrine levels as an initial screening test in patients with suspected catecholamine-secreting tumors. Although significant variability exists between different guidelines and algorithms in such work ups, urine measurements may be particularly useful as an initial biochemical test when clinical suspicion is low to intermediate. In such instances screening by plasma analysis has been shown to yield increased false positive rates.

The aim of the educational questions is to illustrate that accurate reporting of quantitative results (concentrations) in urine is dependent on volume. Although the results from both given 24-hour volumes are generated from the same initial analytical result, the final concentrations for metanephrines calculated from the provided volumes fall within the normal range for volume A, and above the normal range for volume B. Thus, despite the same analytical measurements, the results calculated using volume A suggest a low probability of a catecholamine-secreting tumor, while those using volume B suggest a high probability. Although this educational exercise specifically utilizes metanephrines to illustrate the importance of appropriate calculations prior to final reporting, this point can be generalized to any urine analyte where clinical decisions are guided by a quantitative result.

The majority of participants correctly determined the 24-hour concentrations using the volumes A and B provided (µg/L x 24 hour volume (L) = µg/24 hours). For challenge N-09 the anticipated metanephrine concentration was approximately 545 µg/L. If 0.4 L of urine was excreted in a 24 hour timeframe, the predicted concentration would be about 218 µg/24 hours. If a second patient urinated 1.04 L in 24 hours, then the concentration would be approximately 567 µg/24 hours. Similarly, the anticipated norepinephrine analytic concentration for challenge N-09 was 1,486 µg/L. This calculates to values of 594 µg/24 hours and 1,545 µg/24 hours for urine volumes of 0.4 and 1.04 respectively. These values would be borderline high normal for volume A and elevated for volume B. Most laboratories used the correct formula to calculate 24-hour concentrations, and those laboratories which did not obtain results close to the anticipated 24-hour concentration were outliers in the determination of the analytes.

One should note that volume is not the best way to determine the completeness/accuracy of a 24-hour urine collection. Patients who drink copious amounts of water will produce a large amount of urine; patients who drink less water will produce less urine. Another approach gets around this problem. We each produce a relatively constant amount of creatinine per day, proportional to our muscle mass. In general, women produce about 15 mg/kg body weight; men, about 20 mg/kg body weight. So, if one measures urine creatinine on every 24-hour urine submitted, one can calculate the 24-hour creatinine excretion [urine creatinine (in mg/dL) × urine volume (in dL/24-hour collection)]. In the absence of having the patient's actual weight, one could assume a weight of roughly 70 kg, and the expected excretion would be 1,050 mg/day for women and 1,400 mg/day for men. Values much lower or higher than these would indicate under- or over- collection, regardless of urine volume.

References

1. ARUP Laboratories. Pheochromocytoma. ARUP Consult. https://arupconsult.com/content/pheochromocytoma. Updated August 2016. Accessed August 2016.

2. Mayo Clinic – Mayo Medical Laboratories. Test Catalog: METAF Metanephrines, Fractionated, 24 Hour, Urine. http://www.mayomedicallaboratories.com/test-catalog/Clinical+and+Interpretive/83006. Accessed August 2016.
3. Young WF, Kaplan NM. Clinical presentation and diagnosis of pheochromocytoma. *UpToDate.* 2016. http://www.uptodate.com/contents/clinical-presentation-and-diagnosis-of-pheochromocytoma. Published 2016. Updated February 24, 2016.

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