

## Adrenal Neoplasms: Review Questions

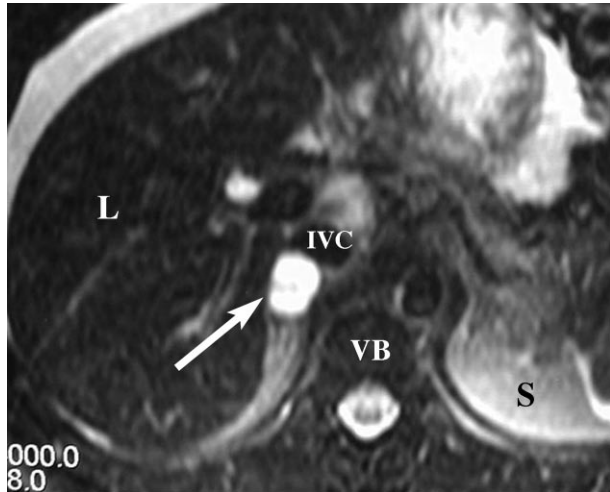
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### QUESTIONS

Choose the single best answer for the question.

1. A 57-year-old woman with a history of hypertension treated with metoprolol and lisinopril presents to her primary care physician with dull right upper quadrant pain. On examination, the patient's blood pressure is 165/92 mm Hg and her heart rate is 94 bpm. Her abdomen is soft and nontender with no palpable masses. Abdominal ultrasonography demonstrates cholelithiasis with no evidence of acute inflammation and a 4.2-cm lesion in or adjacent to the upper pole of the right kidney. Results of laboratory testing demonstrate a serum creatinine level of 1.7 mg/dL, glucosuria, and markedly elevated plasma free metanephrines. What is the most appropriate next step in the evaluation of this patient?  
(A) Computed tomography (CT) scan of the abdomen and pelvis  
(B) Fine-needle biopsy of the lesion  
(C) Magnetic resonance imaging (MRI) of the abdomen and pelvis  
(D) Surgical resection
2. Which autosomal dominant familial syndrome is associated with pheochromocytoma?  
(A) Beckwith-Wiedemann syndrome  
(B) Multiple endocrine neoplasia (MEN) type I  
(C) Neurofibromatosis 2  
(D) von Hippel-Lindau disease
3. A patient with MRI findings shown in the **Figure** undergoes an ultrasound-guided biopsy. During the procedure, the patient complains of a severe headache and has a blood pressure of 240/120 mm Hg.



**Figure.** Unenhanced axial T2-weighted magnetic resonance image of the patient in question 3. IVC = inferior vena cava; L = liver; S = spleen; VB = vertebral body. (Image courtesy of Benjamin Yeh, MD, University of California San Francisco, Department of Radiology.)

**What is the most appropriate pharmacologic intervention to manage this patient's high blood pressure?**

- (A) Metoprolol
- (B) Metyrosine
- (C) Nifedipine
- (D) Phenoxybenzamine
- (E) Sodium nitroprusside

**Questions 4 and 5 refer to the following case.**

A 65-year-old man with a history of diabetes, hypertension, and melanoma resected 3 years ago undergoes CT of the chest, abdomen, and pelvis during a comprehensive physical. CT demonstrates a 3.3-cm enhancing nodule in the right adrenal gland. Results of laboratory studies, including 24-hour urine free cortisol and plasma free metanephrine testing, are normal.

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**4. What is the most appropriate next step in the evaluation of this patient?**

- (A) Fine-needle biopsy of the nodule
- (B) Iodine metaiodobenzylguanidine (MIBG) scan
- (C) MRI of the abdomen and pelvis
- (D) Observation with repeat imaging in 1 year

**5. Surgical resection is subsequently planned for the patient. What is the most appropriate preoperative medication regimen?**

- (A) Propranolol 10 days preoperatively followed by phenoxybenzamine 3 days preoperatively
- (B) Phenoxybenzamine 10 days preoperatively followed by propranolol 3 days preoperatively
- (C) Sodium nitroprusside infusion 1 hour preoperatively
- (D) No pharmacologic intervention is necessary

**6. What is the most common malignant lesion of the adrenal gland?**

- (A) Adrenal adenoma
- (B) Adrenocortical carcinoma
- (C) Malignant pheochromocytoma
- (D) None of the above

**7. All of the following statements are correct regarding the National Institutes of Health consensus statement on the management of adrenal incidentaloma EXCEPT**

- (A) Tumors larger than 6 cm have a high rate of malignancy and should be surgically excised
- (B) All patients with an incidentaloma should have plasma free metanephrines levels checked and a 1-mg dexamethasone suppression test
- (C) Patients with an incidentaloma and a history of hypertension should undergo serum potassium and plasma aldosterone/renin activity ratio
- (D) Both open and laparoscopic adrenalectomy are acceptable approaches to surgical excision
- (E) A homogenous mass with CT enhancement less than 10 Hounsfield units is likely a benign adenoma

**ANSWERS AND EXPLANATIONS**

**1. (C) MRI of the abdomen and pelvis.** Plasma free metanephrine is 99% specific and 89% sensitive in the diagnosis of pheochromocytoma.<sup>1</sup> Once there is strong biochemical evidence of pheochromocytoma, imaging is necessary to define features, such as anatomical relationships, invasion, and multifocality, before surgical intervention can be undertaken. Contrast-enhanced CT and gadolinium-enhanced

MRI demonstrate similar sensitivity (90%–100%) and specificity (70%–80%) for pheochromocytoma.<sup>2</sup> In a patient with renal insufficiency, MRI is the imaging study of choice because iodinated contrast used with CT is nephrotoxic. Pheochromocytoma typically has high signal intensity on T2-weighted MRI. Fine-needle biopsy of a suspected pheochromocytoma is contraindicated and can cause life-threatening changes in blood pressure.

**2. (D) von Hippel-Lindau disease.** von Hippel-Lindau disease is an inherited disorder that affects multiple organs and is characterized by abnormal growth of blood vessels. In addition to pheochromocytoma, patients with von Hippel-Lindau disease have a predisposition to retinal angiomas, central nervous system hemangioblastomas, renal cell carcinomas, islet cell tumors of the pancreas, and cysts of the kidney, pancreas, and epididymis. MEN type II (both IIa and IIb), not MEN type I, is associated with pheochromocytoma. Neurofibromatosis 2 is an autosomal dominant syndrome characterized by multiple schwannomas, meningiomas, and ependymomas. Beckwith-Wiedemann syndrome is a contiguous gene syndrome associated with adrenocortical carcinoma. Patients with hereditary pheochromocytoma are more likely to have multiple bilateral, benign lesions, and these lesions are more likely to be extra-adrenal. MIBG, a compound structurally related to norepinephrine, is taken up by adrenergic tissues and can be used to help localize multiple lesions. MIBG scanning should be strongly considered in patients with suspected hereditary pheochromocytoma.

**3. (E) Sodium nitroprusside.** The Figure shows a right adrenal mass with high signal intensity suspicious for pheochromocytoma. In this case, percutaneous biopsy of the lesion incited a hypertensive crisis. The preferred treatment for a hypertensive crisis from catecholamine release is intravenous sodium nitroprusside. Phenoxybenzamine, an oral nonselective  $\alpha$ -antagonist, is used preoperatively in patients undergoing surgical resection of pheochromocytoma. Intravenous metoprolol may block the vasodilating  $\beta$ -adrenergic receptors on peripheral vasculature and can worsen a hypertensive crisis. Metyrosine inhibits catecholamine synthesis but is not used in the acute setting. Nifedipine is an oral calcium channel blocker. Intravenous antihypertensive medications with a rapid onset of action should be used during a hypertensive emergency. Nicardipine is an intravenous calcium channel blocker that can be

used during hypertensive crisis if sodium nitroprusside is not available. Of note, biochemical testing for pheochromocytoma should be performed on all suspicious adrenal masses before planned procedures.

4. **(A) Fine-needle biopsy of the lesion.** Approximately 15% of all discovered adrenal incidentalomas that are removed are malignant.<sup>3</sup> The risk of malignancy increases with increasing tumor size. Given the patient's history of melanoma, CT results showing an enhanced nodule, and normal biochemical screening profile, fine-needle biopsy is the next best step in the evaluation. MRI would not provide additional information in this case. In the absence of biochemical evidence suggesting pheochromocytoma, MIBG is not likely to be helpful.
5. **(B) Phenoxybenzamine 10 days preoperatively followed by propranolol 3 days preoperatively.** All patients undergoing resection of a pheochromocytoma should receive preoperative pharmacologic therapy, which typically includes initiation of an  $\alpha$ -blocker (eg, phenoxybenzamine) at least 10 days preoperatively. Once  $\alpha$ -blockade is sustained, a  $\beta$ -blocker (eg, propranolol) is typically initiated at least 3 days prior to surgery. In the absence of  $\alpha$ -blockade,  $\beta$ -blockade can exacerbate hypertension. Sodium nitroprusside is not used preoperatively in patients with adrenal incidentaloma in the absence of a hypertensive crisis.
6. **(D) None of the above.** The most common malignant lesion of the adrenal gland is metastatic carcinoma. In a review of all adrenal lesions found on CT in 5 years

at a single institution, over 50% were obvious metastasis.<sup>4</sup> Adrenal adenoma is a common benign lesion of the adrenal gland. Adrenocortical carcinoma and malignant pheochromocytoma of the adrenal gland are far less common than metastatic cancer.

7. **(A) Tumors larger than 6 cm have a high rate of malignancy and should be surgically excised.** The National Institutes of Health consensus statement makes no specific size recommendations for surgical excision. The statement notes that tumors larger than 6 cm are usually excised; however, no recommendations are made regarding surgery versus observation based on size criteria alone.<sup>5</sup>

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