due to the potential for sudden releases of catecholamines causing significant hemodynamic effects. The cornerstone of perioperative management of pheochromocytoma involves alpha blockade to prevent the potential for hypertensive crisis from unopposed alpha-adrenergic vasoconstriction. Achieving adequate adrenergic blockade is challenging in patients with aortic stenosis due to the risks of decreased afterload precipitating myocardial ischemia and bradycardia leading to diminished cardiac output [1]. It is difficult to determine whether to proceed first with transcatheter aortic valve replacement or pheochromocytoma resection in patients with both conditions. Clinical Case: An 83-year-old woman with a past medical history of type 2 diabetes, essential hypertension, coronary artery disease, and severe aortic stenosis was found to have a left adrenal mass (10.7 cm) on coronary CTA during pre-operative evaluation for transcatheter aortic valve replacement. She had significantly elevated total urine metanephrines of 16,237 ug/24 hr (n 140–785 ug/24 hr); other hormonal workup was unremarkable. A multi-disciplinary team of interventional cardiology, anesthesia, and endocrinology specialists determined the safest management plan involved proceeding with transcatheter aortic valve replacement, after adequate alpha and beta blockade and prior to pheochromocytoma resection, to avoid potential for severe heart failure. Due to the potential for unpredictable catecholamine release intra and peri-operatively, the patient was at high risk for hypertensive crisis and mortality. Her home medications of metoprolol 50 mg twice daily, spironolactone 25 mg daily, and verapamil 120 mg daily were continued. She was started on treatment with phenoxybenzamine 10 mg in morning and 10 mg in evening. The phenoxybenzamine dose was titrated to 10 mg in the morning and 20 mg in the evening to achieve a consistent systolic blood pressure of less than 130 mm Hg. She successfully underwent transcatheter aortic valve replacement and remained hemodynamically stable. She was discharged with plan for surgical resection of pheochromocytoma six weeks after her transcatheter aortic valve replacement. Conclusions: This case describes a successful management strategy for achieving alpha blockade in an elderly patient with pheochromocytoma and severe aortic stenosis. Reference: [1] Saran JS, Moalem J, Schoeniger L, Tzimas K. Perioperative Management of Pheochromocytoma Resection in a Patient With Severe Aortic Stenosis. J Cardiothorac Vasc Anesth. 2018 Dec;32(6):2712–2715.

Adrenal
ADRENAL CASE REPORTS
Metastatic Adrenocortical Carcinoma Co-Secreting Multiple Steroid Hormones
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Background: Adrenocortical carcinoma is a rare disease which may be complicated by co-secretion of multiple steroid hormones.
Clinical Case: A 53-year-old female was discovered to have 1 cm left and 1.7 cm right adrenal nodules by Chest CT scan in 2004. She had a follow-up abdominal CT scan in 2011 revealing enlargement of the left adrenal mass to 5.7 cm and a stable 1.8 cm right adrenal nodule. A laparoscopic left adrenalectomy was performed in 2012 and the surgical pathology diagnosis was benign adrenal hyperplasia. In 5/2016 the patient developed left abdominal pain and a CT scan revealed a 1.7 cm mass in the left adrenalectomy surgical bed, a 1.4 cm nodular density adjacent to the left diaphragm and the stable 1.8 cm right adrenal nodule. 6/2016 lab tests: 24 hr urinary cortisol 15 ug/24 hr (<50 μg/24hr), aldosterone 8.7 ng/dL (<31 ng/dL), renin activity 0.7 ng/ml/hr (0.5–4 ng/ml/hr) and DHEA-S 94 ug/dL (32–240 μg/dL). A re-examination of the 2012 surgical pathology resulted in an addendum diagnosis of an adrenal cortical neoplasm of indeterminate malignant potential. In 1/2018 she underwent an exploratory laparotomy with surgical resection of the 1.7 cm mass in left paracolic gutter and biopsy of numerous small retroperitoneal and multiple liver lesions. Pathology revealed metastatic adrenocortical carcinoma with low grade mitotic activity (3 mitoses per 10 HPF) and intermediate grade Ki-67 (15–25%). 5/2018 lab results: 1. aldosterone 20 ng/dL, 2. renin activity 0.2 ng/mL/hr and 3. testosterone 34 ng/dL (<75 ng/dL). Mitotane was started in 06/2018 but was discontinued in 9/2018 due to side effects. In 3/2020 she was hospitalized for generalized weakness and was discovered to be severely hypokalemic K+ 1.5 mmol/L (3.6–5.2 mmol/L) with an aldosterone of 300 ng/dL and renin activity of 0.1 ng/mL/hr. She was treated with IV KCl to correct her hypokalemia and was discharged on oral KCl 20 meq bid and spironolactone 50 mg bid. She was readmitted to the hospital on 10/12/2020 after a near-syncopal event and lab tests revealed a K+ of 1.4, aldosterone 508 ng/dL, renin activity 0.7 ng/mL/hr, AM cortisol 13.6 μg/dL (5–20 μg/dL), testosterone 161 ng/dL, and DHEA-S 377 μg/dL, indicating co-secretion of multiple steroid hormones. Her hypokalemia was treated with IV KCl and her spironolactone dose was increased to 100 mg bid.

Conclusion: This case report details the rare occurrence of an adrenocortical carcinoma which was hormonally silent but eventually metastasized and became hormonally active, co-secretting multiple steroid hormones with a predilection of aldosterone. Serial adrenal hormone lab profiles are important for optimal management of patients with this disease.

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ADRENAL CASE REPORTS
Mifepristone (Korlym ®) Use Interferes With Accurate Serum Measurement of Sex Steroids
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Introduction: Mifepristone (MFP) aka RU-486/Korlym is a synthetic steroid analog originally developed in 1980 as an abortifacient that is now used in the management of Cushing’s syndrome (CS). It is both a progesterone (PG) and glucocorticoid (GC) receptor blocker. CS is often associated with reproductive functional anomalies including hypogonadism, menstrual irregularities and infertility. Due to its mode of action, measurement of serum PG and/or cortisol in
patients on MFP are inaccurate indices of systemic PG and/or GC deficiency or excess. However, the potential impact of MFP use on other serum steroid assays has not been widely studied. We report the case of a 55 yr old man on treatment with MFP for adrenal CS found to have striking artefactual changes in serum androgen and estrogen levels. Case Summary: A 55 yr old African American man was referred with poorly controlled type 2 diabetes, hypertension, hyperlipidemia, obesity and untreated hypogonadism. He had a 3.2cm left adrenal incidentaloma associated with adrenal CS and he chose medical management rather than surgery. Upon starting MFP at 300mg QD serum total estrogen (by radio-immunooassay; RIA) and estradiol (by chemiluminescence immunoassay; CIA) were markedly elevated while serum total, free, bioavailable testosterone and dihydrotestosterone were all markedly reduced. His HBA1c, weight and energy levels improved on MFP despite these findings. The serum steroid levels normalized to pre-treatment levels after stopping MFP for ~4 weeks but the changes recurred after restarting therapy. After MFP dose escalation to 300mg BID the serum steroid levels normalized after stopping MFP for ~6 weeks. The artefactual low testosterone levels also occurred with measurement by equilibrium dialysis but “normal accurate” results were obtained when measured by liquid chromatography-Tandem mass spectrometry (LC-TMS). He remains on MFP 300mg BID without need for androgen repletion. Discussion: With increased use of MFP for CS, indices for tracking its clinical and biochemical effects assume great importance. There are few reports of the possible effects of MFP on estrogen and testosterone serum assays despite its touted low cross reactivity with sex steroids. Our case suggests that the significance, extent and prevalence of artefactual changes on serum sex steroid assays may be underestimated and under-appreciated. Conclusions: Our case of wide disparities in serum estrogen and androgen measures in a patient on MFP indicates that caution needs to be exercised in the interpretation of such results in patients on current MFP therapy. Our clinical observations suggest depending on the dose that a wash out period of 4–6 weeks is required to ensure accurate measures. Studies to ascertain the prevalence of this artefactual effect are needed and it appears testosterone measurement by LC-TMS obviates the testosterone assay artefact.

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Mixed Corticomedullary Tumors of the Adrenal Gland Harboring Both Medullary and Cortical Properties

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Adrenal cortex and medulla are derived from mesoderm and ectoderm, respectively. Mixed corticomedullary tumors (MCMTs), comprising an intimately admixed population of both adrenal cortical cells and pheochromocytomas in a single adrenal tumor, are extremely rare and its pathogenesis has remained unknown. Here, we report a case of MCMT whose cells co-expressed cortical and medullary antigens in the same tumor cells. Case Summary: A 55 yr old African American man was referred to our hospital for investigating Takotsubo cardiomyopathy following resection of uterine fibroids. An abdominal CT scan depicted a 24 mm tumor on her left adrenal gland. Her basal serum ACTH, cortisol levels and urinary cortisol were 13.8 pg/mL, 9.5 μg/dL, and 26.5 μg/day respectively. The cortisol level was normally suppressed by an administration of 1 mg dexamethasone (1.4 μg/dL). Plasma renin activity, aldosterone levels and urinary aldosterone were 15.0 ng/mL/h, 122 pg/mL, and 5.0 μg/day, respectively (with administration history of azosemide). On the other hand, her plasma adrenaline and noradrenaline levels were elevated as high as 177 pg/mL and 536 pg/mL, and urinary metanephine and normetanephine were 2.12 mg/day and 1.10 mg/day. A 123I-metaiodobenzylguanidine scan revealed high uptake in the tumor. After adequate adrenergic α-receptor blockade, left adrenalectomy was performed. Her postoperative endocrine and clinical findings were normalized without any further complications. [Pathology] Immunohistochemistry (IHC) revealed the presence of MCMT. Cells morphologically consistent with pheochromocytoma and adrenocortical cells were confirmed by immunostaining of chromogranin A and SF-1, respectively. Chromogranin A-positive medullary-derived and SF-1-positive cortical-derived tumor cells were intermixed in the chimeric fashion. In addition, some tumor cells were positive for both proteins, indicating hybrid nature of the cells. Tumor cells of cortical origin expressed CYP11B1, 3β-HSD, p450c21, and p450c17, but not CYP11B2. Non neoplastic adrenal cortex were atrophic, whereas the glomerulosa was hyperplastic positive for CYP11B2, consistent with diffuse hyperplasia and adrenal medullar unremarkable. Conclusion: Our case of wide disparities in serum estrogen and androgen measures in a patient on MFP indicates that caution needs to be exercised in the interpretation of such results in patients on current MFP therapy. Our clinical observations suggest depending on the dose that a wash out period of 4–6 weeks is required to ensure accurate measures. Studies to ascertain the prevalence of this artefactual effect are needed and it appears testosterone measurement by LC-TMS obviates the testosterone assay artefact.

Adrenal

Multifactorial Hyponatremia in a Lung Transplant Recipient: A Case Report of Pseudohyponatremia, SIADH and Secondary Adrenal Insufficiency

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Background: Lung transplant recipients are prone to developing multifactorial hyponatremia from immunosuppressive therapies and posttransplant lymphoproliferative disorders. Clinical Case: A 77-year-old male with a history of lung transplantation in 2017 presented for a 3-month history of confusion, decline in executive function and chronic abdominal pain. Vital signs were BP 137/81 mmHg, HR 81 bpm, RR 14 per minute, SPO2 99% and afebrile. The patient was clinically euvolemic with a presenting sodium