various factors could affect A1c. The objective of this project is to identify the covariates that affect A1c. The study sample included 9,952 adults (age≥20 years old) from the 2005–2016 NHANES. Subjects with established diabetes were excluded, and we analyzed subject's documented BMI, A1c, FPG, 2hPG, Hemoglobin (Hgb), race/ethnicity, age, education, poverty index, family history of diabetes, and tobacco and alcohol consumption to determine their impact on A1C measurement. Continuous data were expressed as means with standard deviation. Either t-test or ANOVA was used to examine the influence of covariates on continuous variables. We examined the relation of A1c with FPG, 2hPG, and other covariates. With backward regression analysis, we excluded the covariates without significant impact on A1c. All the analyses were conducted in SYSTAT 13, Systat Software, Inc. In the univariate analysis, A1c was significantly corelated with FPG (r=0.5692, P<0.0001) and 2hPG (r=0.5122, P<0.0001). In the backward regression analysis, education, poverty index, and family history of diabetes were excluded for their low impact on A1c. In addition to FPG and 2hPG, gender (r=-0.0527, P<0.0001), age (r=0.1746, P<0.0001), BMI (r=0.0978, P<0.0001), race/ethnicity (r=0.0478, P< 0.0001), current alcohol consumption (r=0.0542, P<0.0001), current smoker (r=-0.0806, P<0.0001), and Hgb (r=-0.1526, P<0.0001) had significant impact on A1c. Due to the significant difference in Hgb between gender, gender-based analyses were performed. In male gender, the impact of other covariates (age, BMI, race/ethnicity, current alcohol consumption, and current smoker) than FPG and 2hPG could be explained at least partially through their impact on Hgb (P<0.0001). Each 1 g/dL decrease of Hgb would falsely decrease A1c by 0.053% (P<0.0001). In female gender, the impact of covariates other than FPG and 2hPG on A1c could be explained by their impact on Hgb (p<0.0001) except for BMI. Each 1 g/dL decrease of Hgb would falsely decrease A1c by 0.047% (P<0.0001). In addition to FPG and 2hPG, A1c could be affected by gender, age, BMI, race/ethnicity, current alcohol consumption, and current smoker through their impact on Hgb, except for BMI in female gender. A1c will be falsely decreased by 0.053% in male gender and 0.047% in female gender for each 1 g/dL decrement of Hgb. Thus, A1c should be interpreted with caution in anemic patients. We propose using the gender specific correction factors for more accurate interpretation of A1c.

Adrenal

ADRENAL CASE REPORTS I

Lifestyle Modifications or Adrenalectomy? Pheochromocytoma Presenting with New Onset Diabetes Mellitus

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SAT-226

Introduction

When clinicians think of pheochromocytomas, diabetes might not be the first thing that comes to mind. Pheochromocytomas elicit deterioration in glucose tolerance in 20% to 40% of affected individuals. Size of the pheochromocytoma could be an independent risk factor for developing diabetes, as larger pheochromocytomas often present with diabetes mellitus in 23% to 33% of patients with symptomatic pheochromocytomas. Evidence suggests that pheochromocytoma proposes a risk for development of diabetes. There is no consensus or recommendations on which patients with new onset diabetes should be screened for pheochromocytoma or how to manage hyperglycemia in these patients.

Clinical Case

42 YO F with PMH of HTN presented to primary care clinic c/o polyuria, fatigue, 25-pound weight loss, epigastric pain and worsening hypertension over 3 months. Initial work up showed a HbA1C of 9%. The patient was diagnosed with type 2 diabetes mellitus and started on Metformin 1g BID with no improvement of glucose levels or symptoms. As part of initial work up for suspicion of pancreatic malignancy patient had an abdominal CT scan showing a 5.6 x 4.8 cm well-circumscribed left adrenal mass. Patient was referred for endocrine evaluation. Initial workup showed negative GAD Ab, normal 1mg Dexamethasone suppression test, normal aldosterone/renin ratio, elevated Free Normetanephrine of 17,921 pg/mL and elevated chromogranin A of 3,427 ng/mL. Based on biochemical evidence of catecholamine excess and left adrenal mass on imaging, patient was diagnosed with Pheochromocytoma. MIBG showed no evidence of metastatic disease. She was started on insulin therapy, Doxazosin 1mg BID which was titrated to 2mg BID and Amlodipine 5mg was increased to 10mg daily. Pt was referred to surgery for adrenalectomy. On pre-op evaluation patient had significant improvement of glucose levels and symptoms. Propranolol 20mg BID was started for BP optimization. A laparoscopic left adrenalectomy was performed without complications. Patient did not require antihypertensive medications or insulin during hospitalization and was discharged on metformin 500mg daily with no antihypertensive medications. At one-month Post-adrenalectomy follow up patient had normal BP of 116/72 mmHg and A1C of 5.4% with normal glucose logs indicating resolution of diabetes and HTN post adrenalectomy.

Conclusion

Diabetes is a multifactorial disease that has direct impact on patient's quality of life, morbidity and mortality. It is important to consider pheochromocytoma as a risk factor for development of diabetes, especially in young patients with atypical presentation, uncontrolled hypertension or without evidence of antibodies or insulin resistance. Screening and early diagnosis of pheochromocytoma could mean significant reduction on long term diabetes complications as diabetes seems to improve or even resolve after adrenalectomy.

Adipose Tissue, Appetite, and Obesity

ADIPOSE TISSUE BIOLOGY AND OBESITY

Assessment of Thermoregulatory Pathways Induced in Male and Female Mice Lacking Pituitary Adenylate Cyclase Activating Polypeptide (PACAP) in Response to Cold Acclimation

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SAT-583

Pituitary Adenylate Cyclase Activating Polypeptide (PACAP) is a peptide hormone known to regulate energy homeostasis[1]. Mice lacking PACAP are cold sensitive and have impaired adrenergic-induced thermogenesis[2-4]. Interestingly, *Pacap* null mice can survive cold housing if acclimated slowly, similar to what was observed in UCP1 deficient mice[4,5]. We hypothesized that *Pacap*-/- mice employ alternate thermogenic pathways to compensate for impaired adaptive thermogenesis and assessed shivering thermogenesis and UCP1-dependent and UCP1-independent adaptive thermogenesis in male and female *Pacap*-/- and *Pacap*+/+ with cold acclimation (4°C). Assessment of oxidative fibres in skeletal muscles and behavioural observations did not show evidence of prolonged shivering in male or female *Pacap*-/- mice during cold acclimation compared to *Pacap*+/+ mice. We did however observe morphological and molecular differences in adipose tissues of *Pacap*-/- mice compared to *Pacap*+/+ mice that were distinct in males and females. Cold-acclimated, female *Pacap*-/- mice had decreased induction of UCP1 protein in intrascapular brown fat (iBAT), yet had a significantly higher beiging and UCP1 immunoreactivity (ir) in gonadal white fat (gWAT) compared to female *Pacap*+/+ mice. Furthermore, beiging was observed in inguinal white fat (ingWAT) and gWAT of female *Pacap*-/- mice housed at thermoneutrality (30°C), a finding not observed in *Pacap*+/+ control mice. Unlike female mice, we did not observe impaired UCP1 induction in iBAT of male *Pacap*-/- mice compared to *Pacap*+/+ mice, and this was associated with negligible UCP1-ir in male gWAT similar to wildtype controls. Despite previous work that has established impaired adaptive thermogenesis in *Pacap*-/- mice[4], we show here that UCP1 protein can be induced in adipose tissues of *Pacap*-/- mice during cold acclimation, although to a lesser degree or in a different pattern compared to *Pacap*+/+ control mice. Taken together, this work suggests that while PACAP is clearly involved in regulating thermoregulation, it is not required for cold-induced UCP1 expression. In addition, this work highlights sexual dimorphism in adipose tissue remodeling and induction of thermogenesis with cold acclimation. References: (1) Rudecki AP, et al. Trends Endocrinol Metab. 2016;27(9), 620–632. (2) Gray SL, et al. J Mol Endocrinol. 2001;15(10), 1739–1747. (3) Gray SL, et al. J Endocrinol. 2002;143(10), 3946–3954. (4) Diané A, et al. J Endocrinol. 2014;222, 327–339. (5) Golozoubova V, et al. FASEB J. 2001;15, 2048–2050.

Adrenal

ADRENAL - TUMORS

Relationship Between Visceral Fat and the Position of Adrenal Glands in Cranial-Caudal Direction in Patients with Primary Aldosteronism

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SAT-177

Context: Adrenal glands locate at the retroperitoneal space and could be affected their positions by some factors. Adrenal glands being surrounded by visceral adipose tissue (VAT), we have hypothesized that the VAT amount influences the position of adrenal glands in cranial-caudal direction. In patients with primary aldosteronism (PA), comprehending the position of adrenal glands in cranial-caudal direction might be useful to predict the position of adrenal veins before performing adrenal venous sampling.
Objectives: To clarify the influence of VAT amount on the position of adrenal glands, we investigated the correlation of visceral fat parameters with the position difference of adrenal glands in cranial-caudal direction in patients with PA.
Materials and methods: This retrospective observational study included patients with PA according to the guidelines of both the Japan Endocrine Society and the Japan Society of Hypertension. Those with adrenal tumors more than 10 mm in diameter in computed tomography (CT) were excluded. We measured the position difference of the adrenal glands in cranial-caudal direction, from the top of right adrenal gland to the top of left adrenal gland by CT. We correlated visceral fat percentage (VF%), visceral fat area (VFA), and subcutaneous fat area (SCFA) evaluated by CT studies with the position difference of adrenal glands in cranial-caudal direction.
Results: We analyzed 150 patients [male (n = 50), female (n = 100)]. Patients' characteristics: Age was 54.8 ± 11.4, body mass index 24.9 ± 3.8 kg/m^2, plasma aldosterone concentration 133.5 [101–176] pg/ml, plasma renin activity 0.3 [0.2–0.5] ng/ml/h, VF% 25.8 [19.8–33.6] %, VFA 88.3 [60.9–125.0] cm^2, and SCFA was 147.4 [105.6–193.4] cm^2 (mean ± SD, or median [interquartile range]). The position difference of adrenal glands in cranial-caudal direction was 9.7 ± 10.0 mm. In 120 patients (80.0%), left adrenal glands locate at the upper position comparing to right adrenal glands. In 19 patients (12.7%), right adrenal glands were positioned at the upper comparing to left adrenal glands. A positive correlation of VF%, VFA with the position difference of adrenal glands in cranial-caudal direction were shown (r = 0.451, p < 0.001, r = 0.426, p < 0.001, respectively). No significant correlation of SCFA with the position difference of adrenal glands in cranial-caudal direction was shown (r = 0.122, p = 0.139). In patients with more VAT amount, right adrenal glands locate at the upper position comparing to left adrenal glands. In patients with less VAT amount, left adrenal glands locate at the upper position comparing to right adrenal glands.
Conclusions: Regardless of the variation of the position of adrenal gland on each side, the correlation was found between VAT and the position difference of adrenal glands in cranial-caudal direction in PA.

Neuroendocrinology and Pituitary

PITUITARY TUMORS: TRIALS AND STUDIES

Results From the Phase 3, Randomized, Double-Blind, Placebo-Controlled CHIASMA OPTIMAL Study of Oral Octreotide Capsules in Adult Patients with Acromegaly

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