

Cortisol Secreting Pediatric Adrenocortical Adenoma, Managed with Robotic Posterior Retroperitoneoscopic Adrenalectomy: A Case Report with Review of Literature

Wondwossen Amtataw^{1*}, Gyan Chand² and Kumari Madhu²

¹Department of Surgery Yekatit 12 Hospital medical College, Addis Ababa, Ethiopia

²Department of Endocrine and Breast Surgery, SGP GIMS, Lucknow, India

***Corresponding Author:** Wondwossen Amtataw, Department of Surgery Yekatit 12 Hospital medical College, Addis Ababa, Ethiopia.

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Abstract

Endogenous Cushing syndrome (CS) during childhood is rare and mostly due to steroid taken for treatment of other diseases. Due to delayed diagnosis of endogenous Cushing syndrome it results high morbidity and mortality. The incidence of CS is about 2 to 3 cases per million of populations and 10% of them occur in children. Patients with endogenous CS are presented with typical features of facial plethora, weight gain, glucose intolerance, hypertension, osteoporosis, proximal body weakness, fracture opportunistic infections, easily bruising and striae. We are reporting that an 8-year-old boy presented with central body weight gain, facial plethora, hypertension, and delayed weight gain. He was diagnosed to have left suprarenal mass with imaging and corticotrophin-independent Cushing's syndrome from a laboratory profile. Although laparoscopic transperitoneal adrenalectomy is mentioned as the gold standard treatment, with the introduction of surgical robotic systems, surgeons are experiencing different approaches to adrenalectomy. Our patient was operated on with a robotic adrenalectomy through a posterior retroperitoneoscopic approach successfully, and the final histopathology report was adrenocortical adenoma. Corticotrophic-independent CS is more common in young children mostly younger than 7-year old, hence our patient is 8-year old which goes with possible explanation.

Keyword: Cushing's syndrome/disease; ACTH; Robotic surgery

Introduction

Cushing syndrome (CS) occurs usually from prolonged exposure of excess steroid which could be exogenous or endogenous steroid source. Endogenous cause of CS which could be corticotrophic-dependent or corticotrophic-independent are a rare multisystem disorder with overall incidence of about 1 to 2.5 per million people per year and where only 10% occurring in children [1, 2]. Generally corticotrophin overproduction resulting from ACTH-dependent pituitary microadenoma, rarely by macroadenoma, is the most common cause of endogenous CS in both adults and children [1, 3].

Under normal condition cortisol is secreted from cortical cell of the adrenal gland under the control of pituitary produced hormone, adrenocortrophic hormone, controlled by corticotrophic-releasing hormone (CRH) synthesized in the hypothalamus [3, 4].

Autonomous secretion of cortisol from adrenal glands, or ACTH-independent Cushing syndrome contribute for only about 15% of Cushing syndrome in children [1, 4].

Adrenocortical tumors, which are rare in old pediatric age group, common in young children and contribute for about 0.6% of childhood tumors [3]. Majority of patients presenting with CS are malignant and the remaining are unilateral adrenocortical adenomas [2, 3].

The common clinical manifestations of CS are weight gain, growth retardation, obesity, striae, acne, hirsutism and fatigue. However cause Obesity in children is challenging to know whether due to exogenous obesity or Cushing's syndrome [1, 3, 5, 6].

The first step to diagnose CS is confirmation for the presence of excess production of cortisol using confirmatory tests and these confirmatory tests include low dose dexamethassone suppression test, 24-hour urinary cortisol and salivary cortisol measurements. After hypercortisolism diagnosed differentiating ACTH-independent from ACTH-dependent cause has to be settled where plasma ACTH level and high-dose DST with urinary cortisol measurement are done. Contrast enhanced computed tomography (CECT) and magnetic resonance imaging (MRI) are usually used for the purpose of localization of adrenal neoplasm [2, 5-7].

Once the adrenal neoplasm is diagnosed, management option for benign tumors is surgical resection of the tumor either laparoscopically or open procedure through transperitoneal or retroperitoneal approach. Unlike adrenal adenoma, adrenal carcinoma are managed surgically if the tumor are not advanced otherwise chemotherapy may be considered, and if bilateral adrenalectomies are done or the patient develops adrenal insufficiency, glucocorticoid replacement therapy should be considered [1, 2, 6].

Case Summary

We are reporting that an eight-year-old boy presented with increased appetite and weight gain from three years of duration with no increment in height. He recently developed recurrent abdominal pain and constipation for three months. There was no easy fatigability, excessive water intake, or excessive urination; there was no skin change. He has no frequent attacks of infection, a history of slow healing injuries, skin infections, extremity weakness, or bone pain. He has no history of cognitive dysfunction found in his family and no history of mood changes like anxiety or depression. He has no history of any medication use (like a steroid) and no history of headaches, sweating, palpitations, or chest pain.

On examination, he was comfortable, measured weight of 40k.g, height of 125 cm, a BMI of 25.6 (overweight), a BP of 210/150 mmHg (hypertensive for his age), He has a moon face, buffalo hump, and acne with few facial hairs (Figure 1).



Figure 1: Showed physical examination finding of patients with Cushing's syndrome.

Laboratory investigation

WBC -12.9K, PLT - 168K, PT - 13.3se, APTT - 25.2. Serum creatinine -0.56, total calcium - 10 mmol/, Na-132mmol/L, K-3.1mmol/, FSH-1.48u/L, T4-18.75pmol/L, freeT3-6.5pmol/L, serum cortisol -650mmol/L, ACTH - 0.594 mmol/L, and DHEA sulfate -1.74 mmol/L.

Imaging

USG-small sized heterogeneous lesion in the right suprarenal region was revealed. Abdominal CT showed a well-defined, round, heterogeneously enhancing lesion measuring 3.4*3*3.2 cm with few internal non-enhancing areas. On contrast HU-33 and contrast CT scans on the portal venous phase show HU-164 with a 15-minute delayed washout of HU-61Absolute and relative washouts were 78% and 62%, respectively. Anteriorly, the lesion was compressing to the IVC and has focal loss of fat plan with liver supralaterally; it is abutting the diaphragmatic crura medially; the upper pole of the renal cortex inferiorly (Figure 2).

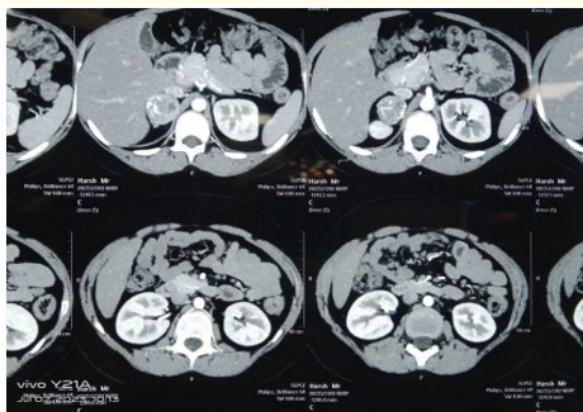


Figure 2: Showed adrenal protocol contrast enhanced CT scan finding of patients with left adrenal tumors.

Management

He was diagnosed with cortisol-secreting right adrenal adenoma with hypertension, which was managed with antihypertensive (spiro lactone 12.5mg bid for 10 days) in the preoperative period and optimization before surgery.

After adequate preoperative preparation, the patient's relatives were counseled, and informed consent was obtained and posted for the robotic posterior retroperitoneoscopic adrenalectomy.

Operative procedure

Under GA, the patient was positioned in the prone partial Jack knife position. Parts were painted and draped. Three 8-mm ports were placed in a straight line level to the 12th rib, lateral to lateral margin of the right para-spinal muscle, and in between the iliac crest and right costal margin.

The first camera port was placed with the open Hassan technique at the tip of the 12th rib, followed by one lateral and one medial port after blunt finger dissection. CO₂ was insufflated and pressure maintained at 15 mmHg. An endoscope was inserted, and retroperitoneal space was inspected. Docking of robotic arms with ports was done. First, the camera was inserted, followed by other instruments (Arm 1: Maryland dissector, Arm 2: camera, and Arm 3: monopolar hook) (Figure 3).



Figure 3: Shows port placement site and patient position.

Intraoperatively

After right adrenal gland is identified it was mobilized and clip was applied to the adrenal vein and divided from IVC. Superior, middle, and inferior parasitic vessels were dissected and divided with bipolar and monopolar electro energy. After Homeostasis achieved, the specimen measuring 3.4 * 3 * 2 cm and weight 16.7 gm was delivered through the first open working port wound, this was closed without drain with an interrupted suture (Figure 4).



Figure 4: Shows intraoperative finding of right suprarenal tumor.

The histopathology report revealed a right adrenalectomy specimen where the outer surface was smooth and encapsulated. The cut surface showed yellow-white areas along two tiny cystic areas, which measured 0.3cm and 0.2 cm, respectively (Figure 5). Normal adrenal parenchyma was not identified, and all parts were embedded. A microscopically thin section of adrenal mass shows a tumor disposed of in sheets and lobules with intervening fibrous septae at places. The tumor cells are round to polygonal, have mildly pleomorphic nuclei which is suggestive of adenoma.

Postoperatively, the patient was on a hydrocortisone infusion, which gradually tapered down and switched off on discharge, and he was also on antihypertensives. Currently, he is on follow-up.

Discussion

Excessive production of glucocorticoid hormone results Cushing syndrome (CS) which happen due to loss of normal hypothalamic-pituitary-adrenal feedback mechanism. Anually there are about 2 to 5 new cases per million of CS in the general population where 10% of them contributed by pediatric age group. Settling the diagnosis of CS is difficult due to non-specific signs, variety severities of clinical manifestations and diagnostic interpretation methods [8-10].

The most common cause of Cushing syndrome is exogenous source of steroids given for treatment of others pediatric disorders which could be long term oral or inhaled and topical corticosteroids used. Once exogenous cause of CS ruled out cause of CS from endogenous causes should be searched which could be from adrenocorticotrophic hormone-secreting pituitary lesions, adrenal lesions, and rarely ectopic ACTH-releasing hormone producing tumors. In pediatric age group older than 5 years-old Cushing's disease is common cause of CS while to the young age groups like infants adrenal disorders like adrenocortical tumors are the most mentioned causes [8, 9].

Children affected by CS in many ways which is different from adults like resulting of impairment of their quality of life even after remission of their excess cortisol. Some studies showed cognitive impairment in children but adults got improvement to their cognitive function after remission the disease. Features of CS like bone mineral density, cognitive dysfunction may got improvement after surgical intervention but do not always true for all patients to be normalized. Quality of life after surgical treatment might be improved otherwise remains below the expected for age and gender matched groups of pediatric population [9, 11].

For suspicious of Cushing disease adequate investigation have to done to reach the correct diagnosis and classify the CS to decide best management of options. The 24-hour urine free cortisol, late night salivary cortisol and LDDS test measurements are the first diagnostic investigation which should be done and for pediatric population midnight plasma cortisol can be considered, and above 4.4mg/dl of midnight plasma cortisol value is diagnostic for hypercortisolism. Once the diagnosis of CS is confirmed plasma ACTH level can be used in 70% of cases to distinguished weather the CS is ACTH-dependent or ACTH-independent where morning plasma level of ACTH greater or equal to 29 pg/ml confirmed ACTH dependent CS. In our case the serum cortisol level was 650 mmol/L and the ACTH level is 0.594 mmol/L which is suggestive of ACTH independent CS.

Currently widely use of cross-sectional imaging for different diseases conditions increasing detection of adrenal masses, and adrenal masses less than 4cm by CT or MRI are likely to be benign adrenal condition. Adrenal protocol of CT imaging enable to differentiate benign from malignant condition of the adrenal masses and for this three phase as protocol used which are non-contrast phase, early contrast uptake and delayed wash out phase. Benign adrenal masses have low attenuation(<10HU) with non-contrast CT scan due to lipid reach cells where 70% of them contain significant intracellular lipid, and they also showed early uptake and early wash out which helps differentiating from malignant lesion with a sensitivity of 71% and specificity of 98% [12-14]. In our case we use adrenal protocol abdominal CT scan and on a non-contrast CT showed a well-defined, round, heterogeneously enhancing lesion measuring 3.4*3*3.2 cm with few internal non-enhancing areas without macro calcifications with HU-33. Contrast CT scans on the portal venous phase showed HU-164 with a 15-minute delayed washout of HU-61. Absolute and relative washouts were 78% and 62%, respectively. Interiorly, the lesion was compressing to the IVC and has focal loss of fat plan with liver supralaterally; it is abutting the diaphragmatic crura medially; the upper pole of the renal cortex inferiorly. Since mass size is less 4 cm and both AWP and RWP are greater than 60% and 40 % respectively the benign adrenal mass is high likely.

Chemical shift imaging of MRI is best modality of investigation which can identify intracellular lipid content used to distinguish adenoma from malignant masses of adrenal tissue with sensitivity of 85-100% with specificity of 95-100%. Usually metastasis and carcinoma have more fluid than adenoma and appears bright on T2-weighted images [12, 15].

Functional imaging like positron emission tomography can be done for incidental adrenal masses where CT or MRI showed suspicion for malignancy, so benign adrenal lesion can be differentiated from malignant adrenal tumors using 18-FDG/PET scan with sensitivity of 85-100% and specificity of 80-100% and also PET/CT can be used with better sensitivity and specificity of 98.5% and 93%

respectively for lipid-poor adenomas and 98.5% and 93% for all adenoma from malignant lesions [16-18].

Management of CS due to adrenal lesion depends on the accurate diagnosis and classification and benign adrenal tumors are best treated with minimally invasive adrenalectomy (MIA) or open surgical approach. Bilateral adrenalectomy may also be considered for bilateral adrenal diseases if there is no medical management option so these patients have to be on exogenous steroid replacement to avoid adrenal insufficiency. Adrenalectomy may be also considered for ACTH-dependent Cushing's syndrome [3, 4, 19].

Currently MIA becomes the standard of treatment for small benign adrenal tumors with advantage of reduction in postoperative pain, risk of intestinal obstruction and surgical wound scars. Due to risk of tumor rupture and spillage physicians usually hesitate doing MIS for malignant lesions. Transperitoneal lateral approach (TLA) which allows for large gravity of organs for self-retraction it is the most widely used approach, but prone retroperitoneoscopy (PRA) is the best approach for small or bilateral adrenalectomy. Studies showed that PRA has advantages over LTA having less blood loss, shorter oral feeding duration, less operative time and shorter hospital stay [20-25].

Robotic adrenalectomy is one of the MIA approach which is safe and effective for most benign adrenal tumors where the PRA provides direct access to the adrenal gland without mobilization of the liver or spleen and also has advantage over lateral approach for patients having bilateral tumors as well as patients with a history of extensive abdominal procedures [26-28]. So in our case we also used the posterior retroperitoneal approach (PRA) and surgery was completed successfully.

Conclusion

Cortisol-secreting adrenal adenoma is rare in pediatric population. Currently MIA is become the standard of care for relatively small benign adrenal lesions of which robotic adrenalectomy is the most safe and effective surgical approach. The PRA is preferred approach which enables direct access to the adrenal gland without mobilization of the liver or spleen and also has less pain, speedy recovery and early return to normal.

Consent

A well informed verbal consent was obtained from the patient family (from both his mother and father) for publication of this case report.

Competing interest

We, the authors, declare there is no conflict of interest.

Abbreviations

ACTH-Adrenocorticotropin hormone.

CRH-Corticotropin-releasing hormone.

CS-Cushing's' syndrome.

CD-Cushing's disease.

DST-dexamethasone stimulation test.

CECT-contrast enhanced computed tomography.

HU-Hounsfield units.

Minimal invasive adrenalectomy.

P/E-physical examination.

PRA-prone retroperitoneal adrenalectomy.

TLA-transperitoneal lateral adrenalectomy.

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