Case report

Robotic-Assisted Bilateral Cortical Sparing Adrenalectomy in A Case Of Bilateral Familial Pheochromocytoma – A Case Report And Review Of Literature

ABSTRACT

Although bilateral pheochromocytomas are frequently encountered in familial cases, a cortical-sparing approach outweighs the need for total adrenalectomy and its continuing repercussions of lifelong steroid dependency. Hereby highlighting a case of boy with bilateral pheochromocytomas managed with bilateral cortical sparing adrenalectomy. Multi-disciplinary approach and a minimal invasive technique aided the management and toppled the need for life-long steroid supplementation.

Keywords: Familial pheochromocytoma, Bilateral pheochromocytoma, Bilateral adrenalectomy, Cortical sparing adrenalectomy

1. INTRODUCTION

Pheochromocytoma is a rare neuroectodermal tumor arising from catecholamine-producing chromaffin cells of the adrenal medulla [1-2]. It is the underlying pathology in 1.7% of hypertensive children with a mean age of 11-13 years [3-4]. Paraganglioma arises from the extra-adrenal paraganglia of the autonomic nervous system [1]. We report a case of bilateral pheochromocytoma and synchronous paraganglioma associated with a germline VHL mutation in a 14-year-old boy treated successfully by robotic-assisted cortical sparing bilateral adrenalectomy and excision of the paraganglioma.

2. PRESENTATION OF CASE

A 14-year-old boy was noted to have incidental asymptomatic sustained hypertension, with a negative medical or personal history contributing to the same. His mother was diagnosed with bilateral pheochromocytomas at the age of 20 years, and she underwent bilateral total adrenalectomy, hence presently on steroid supplements.

On examination, he had no abnormal physical findings except elevated blood pressure (systolic about 160 mm of Hg and diastolic of 100 mm of Hg). With a preliminary diagnosis of secondary hypertension, a renal artery doppler was conducted; that ruled out renal artery stenosis but showed an incidental lesion in the right supra-adrenal region. CT scan of the abdomen confirmed heterogeneously enhancing bilateral suprarenal masses and suggestive of bilateral pheochromocytoma. Another intensely enhancing lesion was detected in the presacral region at the level of S1 suggestive of extra adrenal pheochromocytoma or paraganglioma.

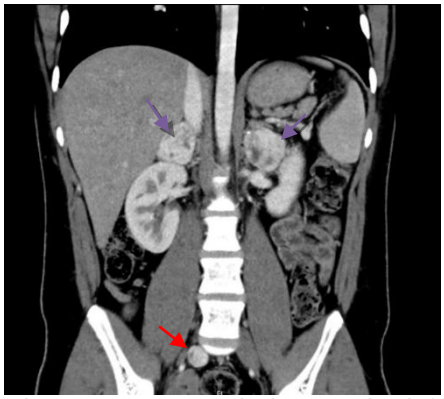

Figure 1: In coronal plane - The left sided mass measuring – 5.3 x 3.7 x 3.7 cm and right sided mass measuring – 6 x 2.9 x 3.5 cm (yellow arrows) s/o bilateral pheochromocytomas. Another intensely enhancing lesion measuring 1.8 x 1.7 cm seen in presacral region at the level of S1 medial to right internal iliac artery s/o extra-adrenal pheochromocytoma/paraganglioma (red arrow).

On biochemical evaluation, his free plasma nor-metanephrine (2220 ug/l) and, 24 hour urinary nor-metanephrine levels (5772 ug) were elevated. 131 MIBG scan confirmed the diagnosis by recording increased MIBG uptake in bilateral suprarenal masses.
With a diagnosis of pheochromocytoma in a young patient and associated family history, genetic testing was advised. Genetic panel was found to be positive for a VHL gene mutation at c.239G>T(p.Ser80Ile).

Pre-operatively he was optimized by giving prazosin 5mg (alpha blocker) 12 hourly, metoprolol 50mg (beta blocker) 12 hourly and nifedipine 10mg once a day for 20 days. His blood pressure was monitored and recorded to be a systolic of 90 mmHg and diastolic of 60 mmHg with a heart rate of 70 per minute on the day of surgery.

Robotic-assisted bilateral cortical sparing adrenalectomy and excision of presacral paraganglioma was performed. Intra-operatively careful dissection was started inferiorly to avoid vascular injury to the adrenal cortex. Bilateral adrenal veins and multiple small adrenal arteries were identified and clipped. Nearing the end of dissection, two surges of blood pressures were noted which pointed towards residual blood supply to the adrenal medulla. Re-evaluation was done, and small arteries supplying the medulla were clipped. Bilateral adrenal medullary specimens were delivered. The diaphragmatic supply to both adrenal cortexes was maintained. Adrenal cortical tissue perfusion was confirmed by indocyanine green fluorescence. A presacral lesion around 2 cm in size was identified right to the right internal iliac artery and delivered.

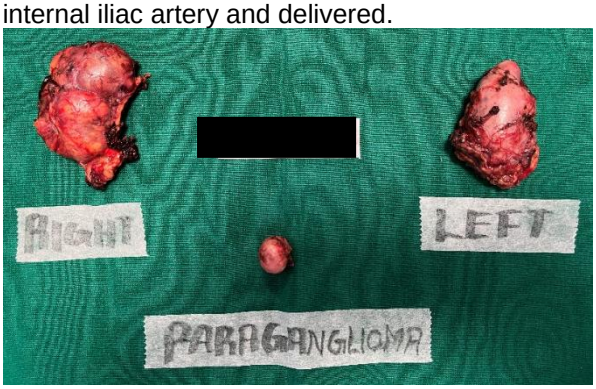

Figure 2: Right and Left pheochromocytoma specimens and Sacral paraganglioma specimen.

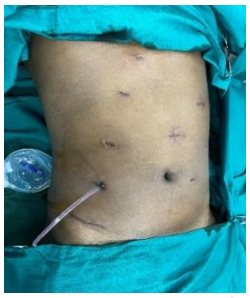

Figure 3: Post-operative picture of the ports placed.

Peri and post-operative recovery were uneventful. Blood pressures became normal from post-operative day one without any medications.
On post-operative day five, serum cortisol levels returned to normal limits (Serum cortisol: 3.09 mcg/dl at 8 am and 8.25 mcg/dl at 6 pm) confirming cortical sparing procedure. Also, CT angiogram of the abdominal aorta was done which confirmed good vascularity of both adrenal cortexes. After 1 week repeat serum and urinary metanephrine levels dropped significantly as compared to their pre-operative levels.

Histopathological examination confirmed the diagnosis and showed an encapsulated tumor composed of medullary cells arranged in nests and trabeculae with no capsular/vascular invasion and no evidence of malignancy.
Patient is in regular follow-up and is maintaining normal levels of cortisol.

3. DISCUSSION

About 80-85% of chromaffin-cell tumors are pheochromocytomas, whereas 15-20% are paragangliomas. Pheochromocytoma is characterized by a classical triad of symptoms - headache, diaphoresis, and tachycardia. The incidence of pheochromocytomas is two to eight per million annually. However, this incidence is underestimated since 50% of pheochromocytomas found on autopsy remain previously undiagnosed [5].

Etiology could be sporadic or familial. The mean age of diagnosis of pheochromocytomas is fourth to fifth decade [2]. Familial tumors are multifocal and present at a younger age as routine surveillance enables early diagnosis. About 25% of diagnosed cases have an underlying susceptible gene. Overall, SDHB, SDHD, RET, VHL, and NF1 germline mutations are often isolated. Studies have shown that pheochromocytomas in hereditary syndromes are bilateral but have a low malignant potential as compared to sporadic cases [6-8].
Medical management is the first step to gain clinical control, followed by definitive surgical management. First described by Gagner et al. in 1997, total adrenalectomy has been adopted globally for optimal disease control [9-10]. Although radical removal absolutes disease control, lifelong steroid supplementation follows. It also has a potential risk of emerging addisonian crisis (10-35%) despite proper steroid replacement [9]. A study conducted by Neumann et al on steroid dependent patients after total adrenalectomy showed that eighteen percent patients developed one adrenal crisis, six percent had two or more adrenal crisis and thirteen percent patients developed symptoms consistent with steroid overreplacement [9].

Hereditary pheochromocytomas tend to be bilateral, with a metachronous or synchronous course. So, in bilateral, familial, and recurrent disease, cortical sparing adrenalectomy is now preferred as the standard of care [11-13]. The plausibility of cortical sparing procedure is

established based on a low risk of malignancy, high chances of maintaining normal cortical functions and ease of routine follow-up. The technical dilemma encountered by surgeons is to ensure complete removal of medullary tissue. Factors that make cortical sparing procedure possible are the dual venous supply of the adrenal gland with segmental arterial anatomy. One third of one gland is the minimum cortical tissue required to obliviate the need for steroid supplementation [14].

Pre-operative cross-sectional imaging help in determining the feasibility of cortical sparing procedure and the quantum of residual cortex.

Cortical sparing adrenalectomy should be performed in a familial unilateral disease whenever possible. This ensures adequate cortical function in case of a contralateral disease later. In case of a bilateral disease at diagnosis, bilateral cortical sparing adrenalectomy should be performed. This enables a total adrenalectomy preserving unilateral cortical function in case of a recurrence.

Normal cortical function and no recurrences are determinants of successful cortical sparing procedure. Recent studies show a need for glucocorticoid supplementation in 43% of patients after partial adrenalectomy as compared to 100% in those undergoing total adrenalectomy [12,15]. A recurrence rate of 0-21% has been reported following partial adrenalectomy. A study by Benhammou et al had a recurrence rate of 11% with a mean follow up period of 9.25 years [13]. This necessitates regular surveillance for recurrent disease. High recurrence rates are associated with factors like younger age, larger tumor, bilateral familial disease, extradrenal and right sided tumors. [15]. Follow-up is aided with proper history, blood pressure measurement and annual biochemical tests – plasma or urinary fractionated metanephrines. If suspicion of recurrence is raised, appropriate imaging is advised. Routine follow-ups should not include imaging to prevent radiation exposure in already vulnerable familial syndromic pathologies.

4. CONCLUSION

Pheochromocytomas require an individualized approach and a multi-disciplinary team. In familial disease, in anticipation of a recurrence and to prevent life-long steroid supplementation, cortical sparing adrenalectomy is considered an optimal procedure. The need for steroid supplementation is less than 50% in cortical sparing procedures. Lifelong surveillance weighs over the risk of late recurrence and delay in the need for steroid supplementation.

8 ABREVIATIONS

MIBG: Metaiodobenzylguanidine
VHL: Von Hippel Lindau
NF1: Neurofibromatosis type 1
SDHD: Succinate Dehydrogenase Complex Subunit D
SDHB: Succinate Dehydrogenase Complex Subunit B
cm: centimeter
mmHg: millimetre of mercury

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