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CASE REPORT

Bilobar Thyroid Agenesis presenting with Adenomatous Isthmus and Hypothyroidism in a 13 year old girl: A Case report

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Abstract:
Agenesis (complete non formation) of human organs or glands is known since antiquity for example asplenia (spleenic agenesis), gall bladder agenesis, renal agenesis and so on. Endocrine glands like adrenals and thyroid are no exception to agenesis. Thyroid is the first endocrine gland to develop and is not uncommonly affected with congenital abnormalities. Commonest is left lobar hemi-agenesis. However, only one case of bilobar thyroid agenesis (BTA) has been reported in the literature. We report a case of BTA with adenomatous Isthmus and sub clinical hypothyroidism in a 13 year old girl who presented with midline thyroid nodule. FNAC was suggestive of colloid nodule with cystic degeneration. Preoperatively hypothyroidism was corrected. At surgery, entire isthmus was found to be replaced by a large cyst and both lobes of the thyroid were absent. So, Isthmusectomy amounting to total thyroidectomy was done and she was put on thyroxine replacement therapy. Preoperative diagnosis of BTA is difficult even if patient develops nodule or becomes symptomatic. Many cases go unnoticed or detected only intra operatively; and they require life long thyroxine replacement therapy.

Keywords: Bilobar Thyroid Agenesis, Adenomatous Isthmus, Hypothyroidism
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Introduction

Agenesis (complete non formation) of human organs or glands is known since antiquity for example asplenia (spleenic agenesis), gall bladder agenesis, renal agenesis and so on. Endocrine glands like adrenals and thyroid are no exception to agenesis. Thyroid is the first endocrine gland to develop in an embryo. Disturbed organogenesis of thyroid leads to several rare anomalies collectively termed as "Thyroid Dysgenesis" which includes ectopia, agenesis and hypoplasia of thyroid gland [1,2]. Thyroid dysgenesis has an incidence of 1 in 3500 live births and accounts for 85% cases of congenital hypothyroidism [3]. Thyroid agenesis may be complete (bilobar agenesis), unilateral

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(hemiagensis) or isthmic agenesis [4]. Hemiagenesis of the left thyroid lobe is the commonest among thyroid agenesis [5]. Hemiagenesis usually presents with lesions in the functioning lobe. Primary hyperthyroidism, toxic multinodular goiter, hyperfunctioning follicular adenoma, colloid goiter, multinodular goiter, lymphocytic thyroiditis, papillary and follicular carcinoma, all have been associated with thyroid hemiagenesis [5-7]. However Bilobar thyroid agenesis (BTA) with intact or diseased isthmus has rarely been reported. Our search of English literature revealed only one case of ‘‘Bilobar Thyroid Agenesis’’ associated with euthyroid adenoma of the isthmus [8]. We report a similar case where bilobar thyroid agenesis presented with adenomatous degeneration of isthmus and hypothyroidism in a 13 year old.

Case Report

A 13 year old pre-menarchal girl presented with a progressively increasing midline neck swelling of 5 months duration. Child was a product of a non-consanguineous marriage with normal birth history. Her growth and mile stones were normal. Her height was 142 cm and weight 41 kg that was appropriate for her age and sex. Clinically there was no hypothyroidism or hyperthyroidism. Cardiovascular and respiratory systems were normal. Local examination revealed a midline neck swelling measuring 5x4 cm, clinically arising from the isthmus (Figure 1).

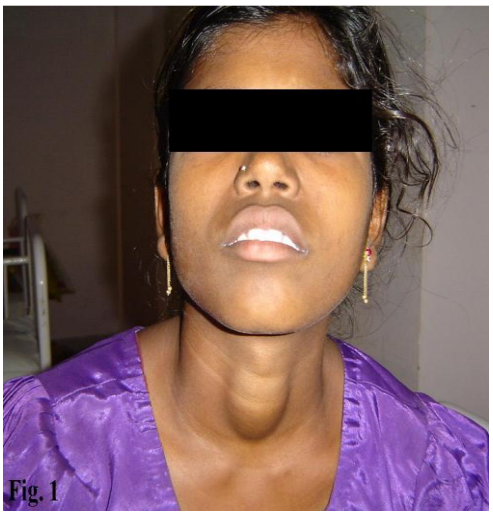

Figure 1. Clinical photograph revealing midline thyroid swelling (Isthmic nodule)

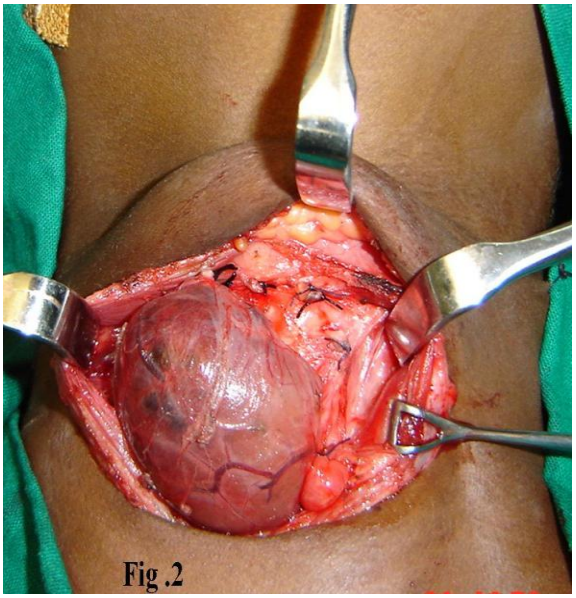

Figure 2. Per-operative photograph showing entire isthmus replaced by a cystic nodule with empty left paratracheal fossa

Ultrasound (USG) neck showed 5.4x1.2x2.5 cm swelling arising from isthmus and extending to the right lobe, however, left lobe was poorly visualized. Thyroid function tests revealed sub-clinical hypothyroidism with TSH of 19.5mIU/L (0.3-4.5) and free T4 of 0.8ng/dl (0.8-2). Aspiration cytology suggested colloid goiter with cystic degeneration. As thyroid scintigraphy is indicated only in hyperthyroid state it was not done preoperatively. Hypothyroidism was controlled with oral thyroxine for 6 weeks, and was taken up for an elective right hemi-thyroidectomy. At surgery, entire isthmus was found to be replaced by a 5x4x3 cm nodule extending slightly on to the right of the trachea (Figure 2), and to our surprise we found that both paratracheal regions were empty and even on thorough exploration both lobes of thyroid were found to be absent (Figure 3). The Adenomatous Isthamus was predominantly supplied by few small vessels on the superior aspect only and the superior and inferior thyroid arteries and their corresponding veins were absent. There was a small nodule (lymph node) on the left paratracheal region (Figure 3). Both parathyroids on either side were morphologically normal but lying close to each other near the entry point of Recurrent

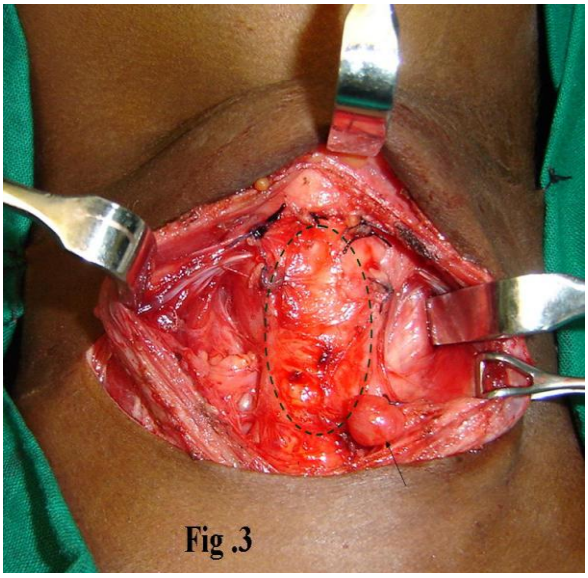

Figure 3. Per-operative photograph showing empty paratracheal fossae on either side (both lobes absent), isthmectomy area marked with black circle, and a small paratracheal lymph node (arrow mark) on left side

Laryngeal Nerve (RLN). Hence isthmusectomy instead of right hemithyroidectomy was performed. Entire isthmic nodule could be dissected out very easily and quickly. The child was put on regular thyroxine replacement therapy. Histopathology of isthmus and paratracheal nodule suggested adenomatous Isthmus and reactive hyperplastic lymph node respectively. Postoperative thyroid scintigraphy did not suggest any ectopic or residual thyroid tissue.

Discussion

Various theories have been proposed on the thyroid organogenesis. Thyroid develops from median thyroid anlage at approximately 4 weeks of gestation in the region of foramen cecum. Rudimentary thyroid tissue descends and ultimately becomes isthmus and most of each lateral lobe [9]. It has also been proposed that the lateral thyroid lobes derive contributions from caudal pharyngeal endoderm (4th and 5th branchial pouches) [9,10]. They arise later in the development than median component. The median and lateral thyroid components unite by complicated mechanisms. Conversely, recent literature states that thyroid rudiment is derived solely from the median thyroid anlage and it alone expands laterally to form the characteristic bilobar structure [11]. However the exact mechanism of thyroid dysgenesis is largely unknown; and it could be due to descent disturbance, lobulation defect or defects in the interaction between median thyroid anlage and lateral thyroid rest (caudal pharyngeal endoderm). Several genetic mechanisms have been implicated in thyroid dysgenesis as these disorders have been described in monozygotic twins and sibling sisters [12,13]. The control of descent and fusion of thyroid may be influenced by multiple transcription factors such as TTF-1, TTF-2, and Pax-8 [14]. Embryology of BTA can be attributed to either of the two theories; due to the failure of contribution from the caudal pharyngeal endoderm [9,10] or the failure of median thyroid analage to differentiate in to the lateral lobes [11]. Observation in our case supports the later theory as it also explains the other very rare thyroid anomaly the isthmic agenesis where isthmus is absent but both lobes of the thyroid are well developed. Isthmus agenesis results from an early (prior to isthmus formation) and high division of the median thyroid anlage (primitive thyroglossal duct) into two independent thyroid lobes with the absence of isthmus [15]. On the contrary the former theory can explain only bilobar thyroid agenesis but not isthmic agenesis. According to the former theory the median thyroid anlage not only forms isthmus but after formation it also induces contributions from lateral thyroid rest to form lateral thyroid lobes [9,10], in such a case in isthmic agenesis isthmus itself is not formed so it should result in complete agenesis of thyroid rather than only isthmic agenesis. This further supports the later theory that median thyroid anlage alone is responsible for the complete development of thyroid gland and aberrations in its differentiations can lead to rarest of the rare anomalies like isthmic agenesis and bilobar thyroid agenesis. In a study of 24,032 school children based on USG of thyroid the incidence of hemiagenesis, ectopia and agenesis was described as equal however, even in that large study bilobar thyroid agenesis was

not mentioned [2]. BTA is a rare developmental anomaly of the thyroid gland and in the only case reported by Attipou et al, a 27 year old female presented with an euthyroid adenoma of the isthmus where in the final diagnosis of BTA could be established only at cervicotomy as in our case [8].

We feel that the true incidence of BTA is higher because it goes undetected unless a nodule develops or the patient becomes hypo or hyperthyroid. Even in symptomatic patients as well its dignosis requires the knowledge of its occurrence and high degree of intraoperative suspicion or a meticulous autopsy (during routine postmortem examinations) in all cases to find this rare abnormality. However they may manifest during pubertal growth spurt (as in our case) or pregnancy with nodule formation as the body demand for thyroxine increases. As the nodule increases in size it tends to deviate to either side and hence ultrasound or thyroid scintigraphy may not give a correct picture of BTA. Thyroid USG has been reported to be effective in the diagnosis of hemiagenesis [16]. However BTA is usually not suspected by the sonologist because of its rarity and hence the diagnosis is missed. This statement is substantiated by the fact that largest study done using USG has not mentioned any case of BTA [2]. Similarly in the only case of BTA reported, USG failed to diagnose the condition rather misdiagnosed it as right hemiagenesis. As pre-operative thyroid scintigraphy is indicated only in hyperthyroid state [17] it was not done in our case. In addition, on scintigraphy several conditions like autonomously functioning isthmus nodule, bilobar thyroiditis, bilateral cold nodules and infiltrative diseases like amyloidosis can mimic thyroid agenesis hence scintigraphy alone has no or limited diagnostic role in this entity [16]. Similarly in the only case of BTA reported, like USG, scintigraphy also misdiagnosed BTA as right hemiagenesis of thyroid. Thus preoperative diagnosis of this entity is difficult and it may come up as an intraoperative surprise as in our case. Both superior and inferior parathyroid glands on either side were lying very close to each other near the entry point of RLN into the larynx unlike in a normally developed thyroid lobe where they are placed away from each other. During usual thyroidectomy, mobilization and medial rotation of lateral lobes expose the RLN in the tracheoesophageal groove, however when a lobe is absent RLN identification becomes difficult as in our case. We used the superior parathyroid as a guide to identify the RLN at its entry into the larynx. From the surgical point of view absence of named arteries and veins supplying or draining the thyroid and closely lying parathyroids are indirect indicators of BTA, and in such cases the superior approach to identify the RLN using the superior parathyroid as a guide is highly helpful. Isthusmectomy in bilobar thyroid agensis amounts to total thyroidectomy and hence patient requires life long thyroxine replacement therapy and regular follow up.

Conclusion

Bilobar thyroid agenesis is a rare form of thyroid dysgenesis. Preoperative diagnosis is highly difficult even if the patient develops an isthmic nodule or becomes symptomatic. Many cases go unnoticed or detected only intra operatively; that may pose specific problems especially in the identification of RLN. As many cases go unnoticed routine autopsy if performed meticulously can diagnose few of them. These cases require life long thyroxine replacement therapy as isthusmectomy in such cases amounts to total thyroidectomy. Ours is only the second such case to be reported and first of its kind to be reported in a child.

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