CASE REPORT

Thyroglossal duct cyst carcinoma: diagnostic and management considerations in a 15-year-old with a large submental mass

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SUMMARY

A 15-year old boy presented with a 2-year history of a painless slowly enlarging submental neck mass. Head and neck imaging showed a multicystic mass with a central solid component that was closely applied to the hyoid bone. Core needle biopsy under general anaesthesia revealed a papillary thyroid neoplasm. The mass was resected and frozen section histology confirmed papillary carcinoma. Intraoperatively, enlarged cervical lymph nodes were palpable. Bilateral neck dissections and total thyroidectomy with parathyroid reimplantation were performed. On histological examination, the thyroid gland was not involved. The patient recovered uneventfully from the surgery and is planned for radioactive iodine therapy and thyroxine suppression, with subsequent follow-up with serum thyroid-stimulating hormone and thyroglobulin for surveillance. We review the literature and discuss challenges in the diagnosis and surgical management of this rare entity in the paediatric age group.

BACKGROUND

Papillary carcinoma occurring in a thyroglossal cyst is rare, and even more uncommon in the paediatric age group. As such, no formal diagnostic guidelines or management protocols exist, with many of the current regimes extrapolated from that of well-differentiated thyroid carcinoma in adults. Topics of interest in the literature include the use of fine needle aspiration to establish diagnosis, indications for total thyroidectomy—which may be performed concomitantly or subsequent to a Sistrunk procedure—use of intraoperative frozen section, use of radioactive iodine and thyroxine (T4) suppression therapy and follow-up strategies.

Unlike cases in most adult series, concomitant thyroid involvement in children has never been documented. This held true for our patient, despite him having one of the largest tumours described, which may reflect the rarity of cases or underlying differences in aetiology. Accumulating knowledge of this unusual entity via case reports or small case series may be useful in determining best practices and guiding intervention as well as future studies.

CASE PRESENTATION

A 15-year-old Malay boy was referred to our outpatient clinic for a painless submental neck mass that had been gradually enlarging for about 2 years. He did not have symptoms of dysphagia,

odynophagia or shortness of breath. Our patient was obese with a body mass index of 34.9, but was otherwise healthy without any medical issues. Surgical history was significant for a 2 cm dermoid cyst excision over the central sternal region 10 years prior. He had no loss of weight or appetite, and no family history of carcinoma.

On examination, there was a large submental mass that was hard and fixed but not irregular. There were no overlying skin changes and no extension into the oral cavity on bimanual palpation. There were no clinically palpable cervical lymph nodes and cranial nerve examination was unremarkable.

INVESTIGATIONS

Haemoglobin level was 15.6 g/dL. Total white cell count was $10.5 \times 10^9/L$. Serum C reactive protein and procalcitonin levels were normal. Thyroid screen was normal with free T4 at 17.86 pmol/L and thyroid-stimulating hormone (TSH) at 0.975 mIU/L.

Lateral neck X-ray (figure 1) showed a soft tissue mass with multiple small calcific densities at the submandibular level extending to the lower level of C4. MRI of the neck (figures 2 and 3) revealed a $3.4 \times 5.5 \times 5.9$ cm multiloculated cystic mass in the submental region in the midline, which was

Figure 1 Lateral neck X-ray showing a large soft tissue mass in the submandibular level extending to the lower border of C4, with multiple small discrete calcific densities and erosion of the anteroinferior border of the hyoid bone (arrow).

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Figure 2 T1-weighted gadolinium enhanced MRI sagittal view showing a rim enhancing septated cystic mass with a central lobulated solid component.

inseparable from the medial aspects of both submandibular glands. There was rim enhancement of the cyst with a lobulated enhancing $3.8 \times 1.4 \times 3.2$ cm solid component within it. This solid component was in contact with the hyoid bone. Bilateral 1.2 cm cervical lymph nodes were seen posterior to the right and left submandibular glands. The thyroid gland appeared normal. An ultrasound scan (figure 4) was performed to further characterise the mass. This again showed the multiloculated solid-cystic nature of the mass, with thick septations separating the locules as well as arterial vascularity of the solid component.

DIFFERENTIAL DIAGNOSIS

The case was discussed at a multidisciplinary tumour board meeting with surgery, oncology, pathology and radiology representatives. Benign differentials included a lymphangioma, but the central vascularised solid area suggested a possible malignant aetiology such as rhabdomyosarcoma. Under general anaesthesia,

Figure 3 MRI axial view.

Figure 4 Doppler ultrasound of the mass displaying central vascularity.

ultrasound-guided needle aspiration of the cystic component and core needle biopsy of the solid component of the mass were performed. Cytology yielded few atypical papillary clusters while histology showed features of markedly atypical papillary proliferation. Immunohistochemical staining showed strong and diffuse positive nuclear staining for thyroid transcription factor-1, with the MIB-1 stain showing a generally low mitotic index of less than 5%.

TREATMENT

The patient underwent resection of the tumour after all possible surgical options had been discussed. A transverse submental skin crease incision was made overlying the mass, which was found to be densely adherent to the mylohyoid muscle and left submandibular gland. A Sistrunk operation was first performed with en bloc resection of the mass, mid-section of the hyoid bone and adherent left submandibular gland (figures 5 and 6). No tract to the foramen caecum was found. Frozen section of the mass confirmed papillary carcinoma. Grossly enlarged cervical lymph nodes were found bilaterally.

The decision was made to proceed to total thyroidectomy with bilateral radical neck dissection. This was performed by bilateral extension of the neck incision caudally in an inverted

Figure 5 Sistrunk procedure with specimen following hyoid osteotomy (arrow), attached to the residual mylohyoid fibres (arrowhead).

Figure 6 Resected specimen with mid-portion of hyoid bone attached.

'U' shape. Levels I-IV cervical lymph node clearance was performed bilaterally as was level V and the tracheoesophageal groove on the right. Frozen section of the thyroidectomy specimen showed no evidence of carcinoma. Three parathyroid glands were identified and reimplanted into the belly of the left sternocleidomastoid after histological confirmation by frozen section. The vagus, lingual, accessory, hypoglossal and recurrent laryngeal nerves were identified and preserved bilaterally.

OUTCOME AND FOLLOW-UP

The patient had an unremarkable recovery period and was discharged well on postoperative day 7, with thyroid hormone replacement and oral calcium supplementation. Histology of the submental mass confirmed papillary thyroid carcinoma (figures 7 and 8) with 8.5 cm maximal dimension and clear resection margins. Ten of 123 excised level I, III and IV lymph nodes were positive, including the Delphian node. There was no extracapsular spread seen in any of the lymph nodes.

¹³¹I radioactive iodine scan 1 month postsurgery showed two small areas of tracer avidity around the neck but no evidence of distant metastases. Treatment with ablative doses of RAI was completed to remove any remaining thyroidal tissue. The patient has been started on lifelong TSH suppression with T4 and is planned for surveillance of recurrence with regular clinical examination and serum thyroglobulin levels.

Figure 7 Papillary tumour with sclerotic cores and microcalcifications (H&E stain, $\times 100$ magnification).

Figure 8 The papillae are covered by cuboidal to columnar cells with optically clear cytoplasm and frequent nuclear grooves (H&E stain, $\times 400$ magnification).

DISCUSSION

Thyroglossal duct cysts (TGDC) occur in 7% of the population and are the most common neck mass in the paediatric age group.¹ They arise due to persistence of the embryonic tract along the line of normal thyroid descent from the foramen caecum at the base of the tongue to the anterior cervical position. TGDC carcinoma is a rare entity, occurring in up to 1% of cases, with the most common histological subtype being papillary (75–85%), followed by mixed papillary/follicular (7%) and squamous cell (5%).¹ The median age of diagnosis of TGDC carcinoma is 40 years,² with only about 30 children and adolescent patients reported in the literature since 1930.³ In our patient, the involvement of the hyoid bone and midline position of the mass was consistent with a TGDC origin, despite the lack of connection to the foramen caecum and an epithelial lining of the cyst.

There is debate on whether well-differentiated TGDC carcinoma arises *de novo* or metastasises from an occult thyroid primary. In a study by Patel *et al*,² half of 62 patients had undergone a total thyroidectomy, with synchronous thyroid carcinoma occurring in 25% of these patients. However, the authors pointed out that this was comparable to the incidence of occult thyroid carcinoma in autopsy studies. Recent evidence comparing morphological and molecular characteristics of thyroid and thyroglossal tumours also suggests a *de novo* pathogenesis of TGDC carcinoma.⁴

Ultrasonography was helpful in our setting, with calcifications and an internal solid component within the cyst suggestive of carcinoma.¹ Vascularity ascertained on Doppler study may also indicate malignancy. The thyroid gland should be carefully evaluated for synchronous neoplasia as well as to rule out an ectopic thyroid as the only functional thyroid tissue.³ CT is rarely warranted. Ultrasound and CT may not show suspicious radiological features even in malignancy.¹ When malignancy is present, fine needle aspiration cytology (FNAC) has a high false negative rate due to cellular dilution.⁵ Under ultrasound guidance, FNAC permits appropriate sampling of the solid part of the lesion, decreasing the false negative rate. In our patient, we opted for ultrasound-guided core needle biopsy due to the highly suspicious radiological and clinical features of the mass, which allowed for better informed preoperative patient and family counselling as well as surgical planning.

No clear guidelines exist concerning optimal surgical management of TGDC carcinoma. A Sistrunk procedure including removal of the body of the hyoid bone is necessary for adequate

resection of the cyst. Removal of a clinically and radiologically normal thyroid gland remains a controversial issue despite the established multicentric nature of papillary thyroid carcinoma. Patel *et al*² recommended that 'low risk' patients, defined as those less than 45 years old, with a well-differentiated TGDC tumour smaller than 4 cm without soft tissue extension, nodal or distant metastases, should not be subjected to a total thyroidectomy. Plaza *et al*⁶ revised this criteria to patients less than 45 years old, who have tumours smaller than 1.5 cm confined to the cyst, with a normal thyroid and neck ultrasound. Although the rate of synchronous TGDC and thyroid carcinoma may be up to 66% in small case series involving adult patients,⁷ no concomitant histological thyroid involvement has been documented in paediatric TGDC carcinoma so far.^{3 8 9} This trend continues with our patient, who also had a normal thyroid gland, despite a large tumour and multiple involved nodes. Decreased radiation exposure in children, and molecular differences between tumours in adults and children, have been suggested as reasons to account for this disparity.⁹ Further study is warranted to establish the true need for total thyroidectomy in paediatric patients with TGDC. We opted for a total thyroidectomy as it: (1) reliably removes the risk of multicentric papillary carcinoma, (2) avoids the surgical morbidity of a reoperation, (3) allows the use of RAI to detect distant metastatic foci and ablate residual tissue, and (4) permits surveillance with serum thyroglobulin.

Intraoperative frozen section should be mandatory, especially if the diagnosis of malignancy is suspected but has not yet been clearly established, so as to allow for the decision of concomitant thyroidectomy at the same sitting rather than at a separate session. Unfortunately, the finding of TGDC is usually incidental;² a higher degree of suspicion is required for histological confirmation in patients with smaller cysts without an obvious solid component.

The significance of nodal spread in TGDC carcinoma in children is uncertain. Cervical node metastases from papillary TGDC carcinoma occur in about 10–25% of cases,^{1 2} which appears much lower than the incidence of lymph node involvement in adults (20–50%) and children (40–90%) with differentiated thyroid carcinoma.¹⁰ Patel *et al*² deemed routine neck dissection unnecessary but recommended that suspicious nodes be removed. In our case, 8% of lymph nodes were positive for metastatic carcinoma, in keeping with the low incidence of nodal spread seen in TGDC carcinoma.

No specific RAI guidelines exist for TGDC. It should be used according to current protocols for differentiated thyroid cancer, with special considerations in children.¹⁰ T4 suppression therapy should be used to keep TSH levels between 0.1 and 0.5 mIU/L.⁶ Serum thyroglobulin is not a reliable marker of recurrence for patients with residual normal thyroid tissue and is not indicated in the follow-up of patients who were treated with a Sistrunk procedure without thyroidectomy.⁶

Prognosis of TGDC carcinoma is excellent, with 5 and 10-year overall survival rates at 100% and 95.6%, respectively.² No disease related death has occurred in paediatric patients so far. A postoperative death from cerebral oedema has been reported in a 9-year-old girl with papillary TGDC carcinoma 8 h after a left neck dissection, which was performed 13 months after an initial Sistrunk procedure and right neck dissection. In this case, autopsy revealed lung and liver metastases.¹¹ Rare instances of metachronous papillary carcinoma have been reported to develop in the thyroid gland many years after a Sistrunk procedure.^{7 12} Long-term follow-up has been recommended for all patients regardless of whether a total

thyroidectomy was performed.¹ This should include an annual clinical examination, ultrasonography and serum TSH as well as thyroglobulin in the appropriate patients.

Learning points

- ▶ Thyroglossal duct cysts (TGDC) carcinoma is a rare entity, especially in children, but should be considered among the differentials in an enlarging midline neck mass.
- ▶ Ultrasound-guided fine needle aspiration cytology or core needle biopsy are minimally invasive and highly accurate preoperative investigational tools.
- ▶ Suspicious features such as a solid component within the TGDC, or enlarged nodes, should warrant intraoperative frozen section even if preoperative investigations did not detect malignancy.
- ▶ Risks and benefits of a total thyroidectomy should be discussed with the patient and family in the presence of a clinically normal thyroid gland, particularly as no case of concomitant thyroid involvement has been reported to date.
- ▶ As thyroid involvement has been described years after TGDC carcinoma excision, long-term follow-up is mandatory after primary Sistrunk procedure without total thyroidectomy.

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Contributors IS-E performed the literature review, wrote the draft manuscript and participated in the perioperative care of the patient. AHPL and SAN performed the surgery and critically reviewed the manuscript. DWQL provided the histopathological analyses of the specimens.

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