Case Report: Multifocal non-invasive follicular thyroid neoplasm with papillary-like nuclear features presenting in a female child [version 2; peer review: 2 approved]

Asmaa Gaber Abdou, Hayam Aiad, Nancy Asaad

Department of Pathology, Menoufia University, Shebein Elkom, Menoufia, 32511, Egypt

Abstract
Non-invasive follicular thyroid neoplasm with papillary-like nuclear features (NIFTP) was introduced as a separate entity by the World Health Organization in 2017 with strict inclusion and exclusion criteria. Most NIFTP cases have been reported in adults and few cases have been diagnosed in children. Here, we present a classic case of NIFTP affecting a 10-year old female child. We also review previous reports of NIFTP in children regarding size, focality, nodal metastasis, recurrence, type of operation and follow-up data. The present report adds a new case of NIFTP in the paediatric age group characterized by multifocality, absence of nodal invasion and indolent course until last follow-up, recommending less aggressive management.

Keywords
NIFTP, children, multifocality
Introduction
Generally, the diagnosis of papillary thyroid carcinoma (PTC) has increased over the past several decades, partly due to increased recognition of the follicular variant of PTC. The subjectivity in diagnosis of this variant and the indolent behaviour of encapsulated or non-invasive forms, led to revision and follow-up of a large number of these cases by international multidisciplinary collaborative group. Consequently, the encapsulated variant of PTC was reclassified as non-invasive follicular thyroid neoplasm with papillary-like nuclear features (NIFTP), which had strict inclusion and exclusion criteria for this diagnosis. The term NIFTP was then introduced as a separate entity by the World Health Organization in 2017, with a category of follicular tumour of uncertain malignant potential (WHO). The majority of NIFTP reports have been in adults. Here, we present a classic case of NIFTP affecting a 10-year old female child.

Case report
A female patient of 10 years presented to our department with an enlarged thyroid that had been observed by her mother. No previous relevant family history was recorded. Ultrasound revealed two suspicious nodules on the right side of the thyroid lobe. No pathological lymph node enlargement was reported. Ultrasound guided fine needle aspiration cytology was performed and the results showed sheets of follicular epithelial cells, some were elongated with occasional grooved nuclei and inclusions (Figure 1A). This was diagnosed as atypical thyroid lesion indefinite for malignancy (THY3a).

The patient was submitted for total thyroidectomy within one month from her first presentation. On resection, the right thyroid lobe measured 5.5 × 3.5 × 3 cm with two well-defined, firm, grayish white nodules. One nodule measured 2 × 1.5 cm and the other measured 1.5 × 1.5 cm (Figure 1B). The left lobe and isthmus measured 4.5 × 3 cm and 1 × 0.5 cm, respectively.

Histological examination of the two nodules resected from the right thyroid lobe revealed well-circumscribed capsulated nodules formed of microfollicles, lined by follicular epithelial cells with wide-spread nuclear features of papillary thyroid carcinoma (Figure 1C). There was no evidence of capsular or vascular invasion, true papillae, trabeculae or solid arrangement. The patient did not receive any specific medications before surgery and she was followed up for 12 months with no evidence of recurrence or nodal involvement.

Discussion
Most NIFTP cases have been previously reported in adults and data concerning this diagnosis in children is scarce; only 21 cases in children have been reported in the English literature within the last two years (Table 1). Preoperative diagnosis of our case was based on ultrasound data and the cytology was not obviously malignant. The cytologic smears of NIFTP were usually hypercellular showing follicular epithelial cells arranged in microfollicles without papillae formation and they showed subtle features of papillary thyroid carcinoma but with infrequent or absent nuclear inclusions. NIFTP cytology was commonly interpreted as follicular lesion of undetermined significance in 30% (categories III and IV according to Bethesda system), follicular neoplasm in 21%, suspicious for malignancy in 24%, malignant in 8%, benign in 10% and non-diagnostic in 3%. The above findings would suggest lobectomy, our patient was submitted for total thyroidectomy and as has been done in previously reported cases.

On a molecular level, NIFTP shares follicular neoplasm in RAS mutations but it lacks BRAF V600E mutations, which is a common event in papillary thyroid carcinoma. Immunohistochemistry for BRAF V600E mutations is available on paraffin blocks. Nuclear pseudoinclusions are important diagnostic criteria for PTC, which could be highlighted by CK19 immunostaining in comparison to routine hematoxylin and eosin. The latter authors demonstrated absence of CK19 positive nuclear pseudoinclusions in the investigated 7 cases of NIFTP.

The current report demonstrated a classic case of NIFTP affecting a young female child, agreeing with previous reports that there are more cases in women than men (Table 1). Although...
not common, multifocality has been reported previously for NIFTP in adults\(^6\) and in children\(^7\). The size of NIFTP lesion is usually small, rarely exceeding 2 cm in diameter (Table 1).

More aggressive therapy is recommended for PTC in childhood and adolescence\(^8\) but the indolent behaviour reported for NIFTP necessitates less aggressive management in children, as well as adults. Therefore, completion lobectomy is not recommended for postoperative cases diagnosed as NIFTP.\(^9\) NIFTP in children has a similar outcome as cases reported in adults, suggesting that paediatric NIFTP behaves indolently, as evidenced by the absence of local recurrence and nodal metastases\(^6\).

The present report adds a new case of NIFTP in the paediatric age group characterized by multifocality, absence of nodal invasion and indolent course - until last follow-up, recommending less aggressive management of this disease.

**Consent**

Written informed consent was obtained from the patient’s father for the publication of this case report and any associated images.

**Data availability**

All data underlying the results are available as part of the article and no additional source data are required.

### Table 1. Characteristics of reported non-invasive follicular thyroid neoplasm with papillary-like nuclear features in children.

<table>
<thead>
<tr>
<th>Reference Source</th>
<th>Gender F:M</th>
<th>Size (cm)</th>
<th>Focality</th>
<th>Recurrence</th>
<th>Metastasis</th>
<th>Operation</th>
<th>Follow up (months)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wang et al., 2019 (3 cases)(^3)</td>
<td>2:1</td>
<td>0.4-3.1</td>
<td>Single</td>
<td>No</td>
<td>No</td>
<td>Total thyroidectomy</td>
<td>15–138</td>
</tr>
<tr>
<td>Rosario and Mourão, 2018 (4 cases)(^4)</td>
<td>3:1</td>
<td>1.7-2.4</td>
<td>Single</td>
<td>No</td>
<td>No</td>
<td>Total thyroidectomy</td>
<td>24-108</td>
</tr>
<tr>
<td>Rossi et al., 2018 (2 cases)(^5)</td>
<td>&lt;1:1</td>
<td>&lt;2 &gt; 2</td>
<td>Single</td>
<td>No</td>
<td>No</td>
<td>NA</td>
<td>84</td>
</tr>
<tr>
<td>Mariani et al., 2018 (10 cases)(^6)</td>
<td>14.4</td>
<td>3.5:1</td>
<td>2.1</td>
<td>7 cases single 3 cases multifocal</td>
<td>No</td>
<td>2 cases with lymph node metastases</td>
<td>Total thyroidectomy</td>
</tr>
<tr>
<td>Samuels et al., 2018 (2 cases)(^7)</td>
<td>14</td>
<td>2:1</td>
<td>1.1-4.5</td>
<td>NA</td>
<td>No</td>
<td>No</td>
<td>Total thyroidectomy</td>
</tr>
<tr>
<td>The current case</td>
<td>10</td>
<td>Female</td>
<td>1.5-2</td>
<td>Multifocal</td>
<td>No</td>
<td>No</td>
<td>Total thyroidectomy</td>
</tr>
</tbody>
</table>

F:M, female to male ratio, NA: not available

### References

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Osama Sharaf Eldin
Weston General Hospital, Weston-super-Mare, UK

The case is well written and with full explanation of the diagnostic category. The introduction included the accurate classification of the entity and why the nomenclature changed. The figures and tables are well presented. The references are up to date.

No further comments and I agree for this case report to be indexed without changes.

Is the background of the case's history and progression described in sufficient detail?
Yes

Are enough details provided of any physical examination and diagnostic tests, treatment given and outcomes?
Yes

Is sufficient discussion included of the importance of the findings and their relevance to future understanding of disease processes, diagnosis or treatment?
Yes

Is the case presented with sufficient detail to be useful for other practitioners?
Yes

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Molecular Pathology, Digital Pathology and experimental pathology

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard.
Dear Sir
Thanks for your review and judgment, according to your comments, no changes are required

**Competing Interests:** No competing interests were disclosed.

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**Version 1**

**Reviewer Report 08 September 2020**

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Hanan Alshenawy
Pathology Department, Faculty of Medicine, Tanta University, Tanta, Egypt

This is a case report about a case of NIFTP in thyroid.
- The case is well clinically presented with full clinical data.
- The procedure as FNAC is also presented well with clear figure.
- Histopathology is shortly presented with clear good figure.
- The discussion should be in more details.
- Is there any role for immunohistochemistry?

**Is the background of the case's history and progression described in sufficient detail?**
Yes

**Are enough details provided of any physical examination and diagnostic tests, treatment given and outcomes?**
Yes

**Is sufficient discussion included of the importance of the findings and their relevance to future understanding of disease processes, diagnosis or treatment?**
Partly
Is the case presented with sufficient detail to be useful for other practitioners?
Yes

**Competing Interests:** No competing interests were disclosed.

**Reviewer Expertise:** histopathology

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard.

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