Sonographic imaging of pediatric thyroid disorders in childhood. Experiences and report in 150 cases

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Sonographic technique.

- Use of high frequency linear array transducer.
- Assessment of structural changes and the echogenicity.
- Measurement of all three dimensions of the right and left lobes separately.
- Measuring of AP diameter of thyroid isthmus.
- Look for ectopic thyroid tissue cephalocaudal on midline.
- Look for vascularity by Doppler imaging.
Sonographic anatomy of thyroid gland.

- Homogeneous bilobed.
- Structure slightly hyperechoic relation to neighboring neck muscles.
- Small cystic areas as colloid follicles.
- Incidentally within the cysts echogenic material representing inspired colloid.
- Imaging of superior and inferior thyroid arteries on both sides by colour Doppler technique.
Average volume of normal thyroid gland in infancy and childhood.

<table>
<thead>
<tr>
<th>Length</th>
<th>Thyroid volume in cc</th>
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<tbody>
<tr>
<td>All neonates</td>
<td>0.96 ± 0.24</td>
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<tr>
<td>Children &lt; 100 cm</td>
<td>2.3 ± 0.7</td>
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<tr>
<td>Children 100 – 109 cm</td>
<td>3.3 ± 1.0</td>
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<tr>
<td>Children 110 – 119 cm</td>
<td>4.1 ± 1.1</td>
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<tr>
<td>Children 120 – 129 cm</td>
<td>4.9 ± 1.1</td>
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<tr>
<td>Children 130 – 139 cm</td>
<td>6.3 ± 2.0</td>
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<tr>
<td>Children 140 – 149 cm</td>
<td>7.4 ± 2.2</td>
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<tr>
<td>Children 150 – 159 cm</td>
<td>8.5 ± 2.3</td>
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<tr>
<td>Children &gt; 159 cm</td>
<td>10.9 ± 2.5</td>
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<tr>
<td>14 – 29 years of age</td>
<td>16.5 ± 4.4</td>
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27 cases of normal functioning thyroid disorders.

I. Homogenic and normal sized gland. 12

II. Multinodular goiter. 8

III. Thyroid cancer or conditions with tendency to malignancy. 7
94 cases with a hypothyroidism.

I. Congenital abnormalities, athyroidea and functional disorders included 45

II. Acquired conditions with known and unknown etiology. 10

III. Hashimoto thyroiditis. 32

IV. Not sonographically evaluated cases. 7
20 cases with hyperthyroidism.

I. M. Graves (Thyrotoxicosis). 9
II. Autonome and non-autonome adenomas. 7
III. Maternal hyperthyroidism. 2
IV. Thyroiditis type de Quervain. 1
V. Multinodular goiter without thyreotrope antibody receptor. 1
An example of euthyroid gland with an colloid follicle cyst with insipated colloid.
Homogenic structure with a normal volume.
Euthyroid nodular goiter (8).

Example of a nodular goiter in a girl.

Laboratory: F T4: 19,5 pmol/l. TSH: 0,9 mU/l

Sonography: inhomogeneous with whimsical aspect.

Hemistrumectomy: hyperplastic nodus without malignancy.
Thyroid carcinoma.

- Papillary thyroid carcinoma is the most common type.
- Medullary carcinoma is a familial disease.
- Association with multiple endocrine neoplasms (MEN type A and B).
- US: mostly hyperechoic. The margins are irregular surrounded with a halo sign.
14-year-old boy with a papillary carcinoma.

Note the hypoechogenic inhomogenic large nodules left-sided with halo sign.

Note the right normal thyroid.
A case of MEN type IIb.

Dubble sided totally destructed thyroid, the tumor is hypogenic with punctate calcification.

Histology: medullary carcinoma.
Neonatal thyroid dysgenesis with hypothyroidism (36 cases)

I. Aplasia 10

II. Hypoplasia. 11

III. Ectopia. 3

IV. Dyshormonogenesis. 9

V. Secondary or tertiary congenital hypothyroidism. 3
Female neonate with athyroidea with an empty thyroidlodge.

Laboratory screening: FT4: 15,4 pmol/l; totalT4: 81nmol/l; TSH 351 mU/l
Ectopia
Dyshormonogenensis (9 cases)

A male neonate with hypothyroidism (organification defect).

Laboratory findings: FT4: 14,8 pmol/l; T4: 90 nmol/l; TSH: 98 mU/l.

Sonography: homogenous large thyroid (4,4 cc), isthmus 5 mm
Thyroid hypoplasia (11 cases).

One-sided developed uni-lobed left-sided thyroid.

Laboratory findings: Monday.

Sonography: small thyroid tissue, only on the right side. Empty thyroid lodge on the left side.
Hashimoto thyroiditis.

• Most common thyroiditis in children.
• Most common cause of acquired hypothyroidism.
• Familiar history of thyroid disease common.
• US findings mostly enlarged hypoechogenic gland with a coarse heterogeneous echo texture.
• Frequently enlarged lymphoma in neck.
Hashimoto thyroiditis (32 cases)
10 year old girl with Hashimoto thyroiditis.

Laboratory finding: FT4: 9 pmol/l; T4: 40 nmol/l; TSH: 248 mU/l. Antibody thyroid: 3522; T3: 1.8 pmol/l

TSH reseptor anti body increased.
Multinodular goiter.
Adenomas (7 cases).

Non-autonomic adenoma of thyroid with hypoechoic halo around the lesion.

Note the hypervascularity of the adenomas.
A case of adenoma surrounded by anechoic mass (fluid).
Autonome toxic adenoma.

TSH < 0,00 mU/l, FT4: 28 pmol/l.

Cystic adenoma with a volume of ± 10 cc.
Scintigraphic images of a non-autonomic adenoma (A) with an autonomic toxic adenoma (B).

No intake of isotope in the remaining part of thyroid in cases of autonomic toxic adenoma.
Graves disease.

- Caused by auto-immune disorder most frequent in girls.
- Manifestation: nervousness, weightloss, sweating palpitations.
- Sonography: diffusely enlarged thyroid mostly marked parenchyma hypervascularity.
Graves disease.

Wordt vervolgd.
Cysts.

• Simple cysts cause:
  – Cystic degeneration of follicular adenoma.
  – Anechoic with smooth wall.
  – Avascular.

• Hemorrhagic cysts cause:
  – Traumatisation spontaneously.
  – Hyperechoic or complex mass pattern.
  – Hypoechoic with septation.
Two cases of thyroid cysts.
Conclusion I

• Sonography as a noninvasive modality contributes largely in screening and follow up of different thyroid disorders.

• Sonography is sufficiently sensitive to delineate the anatomy of thyroid and its disease.

• Colour Doppler should be routinely used in diagnosis of thyroid diseases.

• Laboratory data are needed to differentiate the sonoanatomic changes for diagnosis of thyroid diseases.

• Sonography is less accurate than scintigrapy in detection of an ectopic thyroid tissue.
Conclusion II

- Laboratory screening is the first step in diagnosis of neonatal athyroidae, sonography is the modality for choice to confirm the diagnosis.
- Scintigraphy is the modality of choice in diagnosis of autonome toxic adenoma, however the anatomy of the affected thyroid gland can be studied additionally by sonography.
- Hypervascularity is a characteristic finding in both Hashimoto and Graves diseases.
- Calcification of thyroid is rarely found in multinodular goiter but more frequently in thyroid cancer.
- Sonography guided fineneedle aspiration biopsy of nodule is useful in diagnosis of malignancy.