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Osseous metaplasia of thyroid cancer

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Papillary carcinoma is the most frequently occurring thyroid cancer among children and adults.

In ca. half of the cases the carcinoma structure displays psammoma bodies. Their presence in the thyroid gland is a strong indicator for the diagnosis of papillary carcinoma, because their occurrence in other thyroid tumour types is exceptionally rare.

Osteopontin produced by macrophages is assumed to take part in the development of the psammoma bodies.

Squamous metaplasia may be diagnosed in some diffuse sclerosis variants of papillary carcinoma, and osseous metaplasia may sometimes occur. However, bone maturing in the thyroid tumour is a phenomenon that occurs rarely. This study reports such a case.

The patient was 46 years old, not previously diagnosed, and with a positive family history. The patient's mother was diagnosed with thyroid cancer at the age of 68.

Taking into consideration the positive family history, the patient's son decided to undergo a medical examination, whereupon a USG examination revealed a 12 × 12 mm tumour in the left thyroid lobe. The carcinoma was diagnosed as category VI of the Bethesda system, and thyroidectomy was performed. The tumour (22 mm diameter) with significantly increased cohesion was macroscopically diagnosed in the left lobe. Tumour section samples were put into concentrated nitric acid for the analysis of the bone material. After 12-hour incubation in the acid, histological preparations were made, which were stained with HE (Fig. 1).

Thyroid papillary carcinoma was diagnosed, and osseous metaplasia features with the making of mature bones and adipose tissue structure were detected in the tumour tissue. The carcinoma infiltrated and exceeded the thyroid gland. In one out of four dissected lymph nodes small sites of cancer infiltration were detected, limited to the node (pT4aN1aMx). The finding was immunohistochemically confirmed by carrying out CK19 and CD56 antibody staining (Fig. 2).

Cases of squamous metaplasia and adipose tissue metaplasia are less frequently reported. Osseous metaplasia is occasionally observed. Dystrophic calcification is frequently observed in nodular goitre. However, maturation of this calcified tissue to mature bone is exceptionally rare. There are three cases of thyroid lesions with osseous metaplasia features described in the literature. These were women aged 41–72 years. In the sample of thyroid material, numerous nodules with nodular branching characteristics were found, in which osseous metaplasia features were observed [1]. There is a similar case of a 63-year-old woman with incidentally detected thyroid nodule during MRI performed for the assessment of cervical spine joints. Due to the significant calcification level of the nodule, fine-needle aspiration biopsy was unsuccessful. Histopathological examination revealed micro-follicular thyroid adenoma with osseous metaplasia features with mature bone formation [2].

The aetiopathogenesis of the osseous metaplasia is as yet unknown, although various theories have been made. A common theory includes the role of basic fibroblast growth factor (bFGF) and bone morphogenetic protein 2 (BMP-2), signalling factors involved in the proliferation and growth of cells. The pathophysiology of this process is not clearly understood; however, the suggested explanation is increase of BMP-2 level in the calcified tissue of the thyroid gland [2]. Bone morphogenetic protein is a specific morphogenetic factor, which plays a significant role in the bone formation process and induces local osseous process. However, the final stage of the bone formation process is dependent on the presence of the specific calcium and phosphate concentrations [3]. The BMP family has at least 30 members, among which BMP 1–7 originally isolated from the

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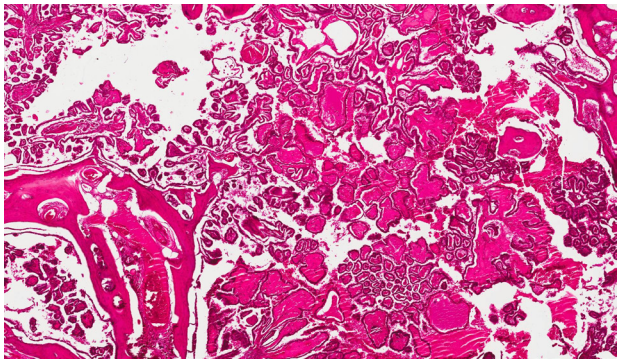

Figure 1. *Papillary thyroid carcinoma with bone formation, haematoxylin and eosin staining*

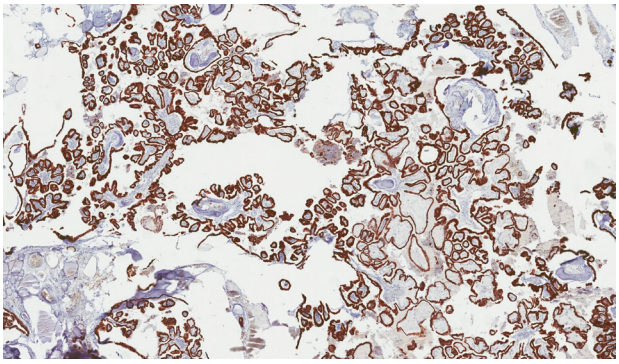

Figure 2. *Papillary thyroid carcinoma with bone formation, immunohistochemical staining CK19*

demineralised bone matrix, are capable of inducing ectopic bone formation. Among the aforementioned BMPs, BMP-1 is a type of metalloproteinase, which is capable of transforming various precursor proteins into mature or active forms taking part in the formation of extra-cellular matrix [4]. Bone morphogenetic protein 1 transforms procollagens type I, II, III, and VII into their mature forms, and it is also the agent in the final transformation of the procollagen homotrimer V. The examinations carried out revealed that thyroid calcified tissue had a significantly higher level of BMP-2 expression in comparison to the regular thyroid tissue [5].

Summarising, osseous metaplasia is described in a few publications only. In the case of the thyroid gland, osseous metaplasia occurs most frequently in the nodular branching and micro-follicular adenomas. This process very rarely refers to the carcinoma site. The pathogenesis of the osseous metaplasia with mature bone formation is currently being discussed; BMP protein is believed to play a significant role in this. However, the issue requires continuous research. Bearing all the aforementioned in mind, the study presents a case of thyroid papillary carcinoma with the osseous metaplasia and mature bone formation that is exceptional and worthy of attention.

Conflict of interest

No financial, personal, or professional competing interests exist.

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