

Partial Resection of the Sternum for Osseous Metastasis of Differentiated Thyroid Cancer: Case Report

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Abstract. *Background:* Due to their resistance to radio-iodine therapy, skeletal metastases from differentiated thyroid cancer (DTC) are difficult to treat. Surgical resection of solitary skeletal metastasis may offer cure with prolonged survival. *Case Report:* A patient with the simultaneous appearance of local recurrence of DTC and skeletal metastasis of the cranial sternum is reported. After radical excision of the tumour recurrence and the lymph nodes, a partial sternal resection was carried out, and the defect in the chest wall was reconstructed with polypropylene mesh. Radio-iodine ablation therapy was carried out 4 times after the operation for locally recurrent disease. At the follow-up, 4½ years after the resection of the sternal metastasis, the patient is free of disease. *Conclusion:* Sternal resection for solitary osseous metastasis of DTC should be performed on selected, individual patients. Reconstruction of the sternum with polypropylene mesh, as a simple and effective method, produces satisfactory functional and cosmetic results and allows a more effective radio-iodine treatment.

Ablation therapy is the therapy of first choice for patients with metastasizing differentiated thyroid cancer (DTC) and can offer the patient several years of palliation. However, for patients with skeletal metastasis from DTC, ablation therapy is not as effective compared to pulmonary or visceral metastasis, and cure has only been reported in a few patients (1). In the case of a solitary osseous metastasis, complete surgical resection is a therapeutic option that offers the chance of cure and prolonged survival (2, 3). This

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Key Words: Metastasizing thyroid cancer, sternal metastasis, resection.

case report describes a patient with sternal metastasis from DTC who was treated by partial sternal resection.

Case Report

Our patient's history commenced 12 years previously. A left-sided total and right-sided subtotal hemithyroidectomy was performed on a 52-year-old woman. The histopathological examination revealed struma nodosa (multinodular goiter) and struma colloidosa (colloid goiter) with regressive changes. Two years after the first resection, a right-sided cervical subcutaneous tumour was detected, and the thyroglobulin level had increased to 3 µg/l. During regular follow-up, the subcutaneous tumour increased in size. Three years after the first operation, a fine-needle cytology revealed atypical follicular adenoma of grade III according to the PAP classification. Three months after the fine-needle cytology, the tumour again showed an increase in size, and the thyroglobulin level had increased to 13 µg/l. For this reason, the tumour was resected and histopathological examination revealed ectopic heterotopic thyroid tissue without suspicion of malignancy.

One year after resection of the tumour, a new subcutaneous tumour was detected by cervical ultrasound, and the thyroglobulin level was 41 µg/l. Again, regular examinations were carried out until the thyroglobulin level reached 119.9 µg/l, 2 years after the second operation. A fine-needle puncture of the tumour did not produce sufficient material for histopathological examination, and 3 months after the aspiration the thyroglobulin level had decreased to 100 µg/l. Four years after the last operation, apart from the subcutaneous manifestation, a new lesion occurred in the jugular space, and the thyroglobulin level measured 416 µg/l. The patient was referred to our unit.

Retrospective histopathological re-examination of the specimens of the two former operations revealed follicular neoplasia as the diagnosis of the first, and differentiated follicular carcinoma as the diagnosis of the second operation. Further diagnosis, including bone scintigraphy

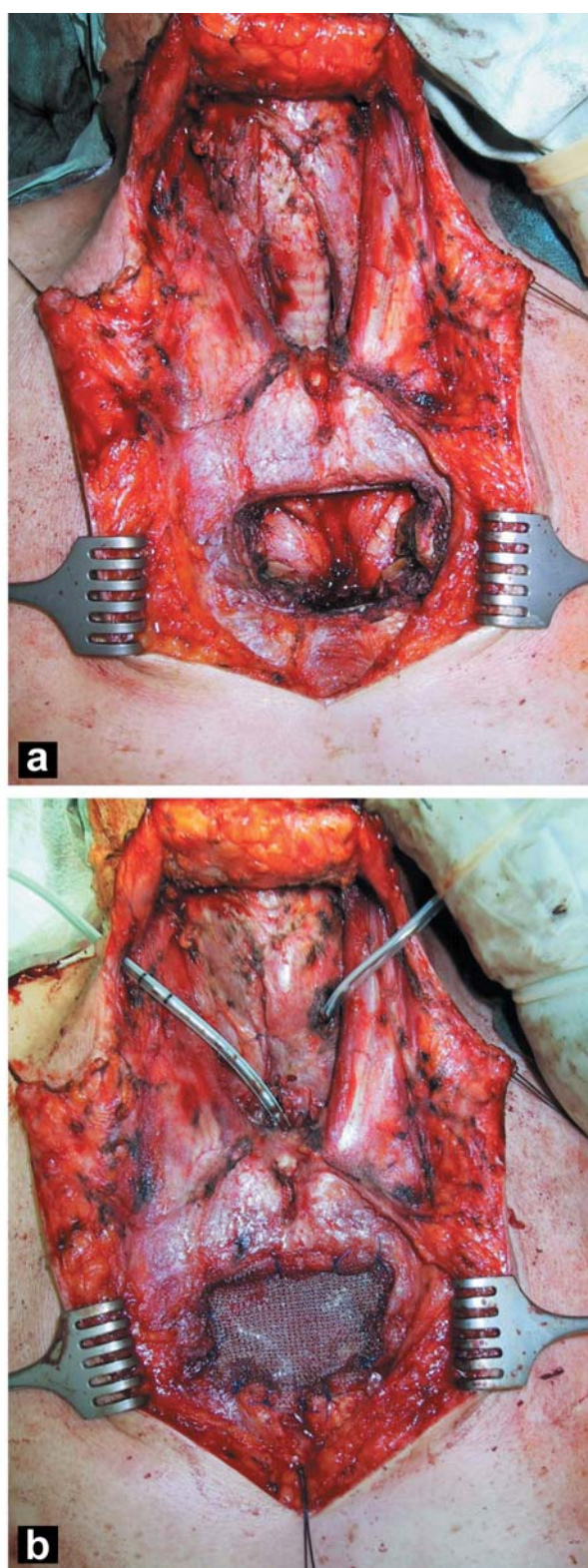


Figure 1. a. Intra-operative photography of the surgical approach used for the resection of the local recurrent tumour, the lymph nodes of the first compartment and of the sternal metastasis. b. Intra-operative situation after the reconstruction of the sternum with polypropylene mesh in two layers.

and thoracic computed tomography, revealed osseous metastasis of the sternum, in addition to the known subcutaneous and jugular lesions. Therefore, a new cervical exploration was carried out with subcutaneous tumour extirpation and lymphadenectomy of the first compartment.

The distance of the osseous metastasis from the jugulum was measured on the thoracic CT as 50 mm. A transverse section of the sternum was performed at a distance of 35 mm and 65 mm from the jugulum and, thereafter, laterally separated from the rib insertions (Figure 1a), in order to remove the metastasis with a good safety margin. The reconstruction was achieved with two layers of polypropylene mesh. The first layer was placed behind the sternum and fixed with several polypropylene sutures. The second layer was positioned in front of the defect and overlapped the defect in all directions. This layer was also stitched tight with non-resorbable suture material (Figure 1b). Above this, the fascia and subcutaneous tissue were sutured by the standard method.

Histopathological examination revealed a recurrent follicular differentiated thyroid carcinoma, the thyroglobulin level decreased to 38 $\mu\text{g/l}$ after the operation. Due to the diagnosis of recurrent and metastasized follicular thyroid carcinoma, a radio-iodine ablation therapy with J^{131} was performed with 11,000 MBq. During further follow-up, the thyroglobulin level decreased to 1 $\mu\text{g/l}$, but 4 months after the ablation therapy the level increased to 21.5 $\mu\text{g/l}$. Scintigraphic examination revealed an accumulation of the tracer on the left neck and in the right lung and, therefore, a second ablation therapy with J^{131} with 11,000 MBq was carried out. Four months after the second ablation therapy, a persistent tumour at the left neck was seen, and the thyroglobulin level was 0.6 $\mu\text{g/l}$. A third ablation therapy with J^{131} with 11,000 MBq was thus carried out.

For the next three years the thyroglobulin levels were constant, ranging from 0.3 to 1.2 $\mu\text{g/l}$ without the appearance of recurrent disease or metastasis. Three years after the last ablation therapy, the thyroglobulin level increased to 13.0 $\mu\text{g/l}$. Clinical re-staging revealed left-sided cervical recurrent disease. A fourth radio iodine ablation therapy was thus performed with J^{131} with 11,000 MBq. At the last follow-up, 12 years after the first operation and 4 ½ years after the resection of the sternal metastasis, the thyroglobulin level was 0.3 $\mu\text{g/l}$ without any suspicion of recurrent disease or metastasis.

Discussion

Distant metastasis occurs in 10-20% of well-differentiated thyroid carcinoma, mostly in the lung and bones (4). Radio-active iodine therapy is the gold-standard for treatment and remains a primary treatment modality for metastatic thyroid

carcinoma, but poor tumour uptake of the agent can limit its usefulness. Results of ablation therapy are good with lung metastases, but bone metastases cannot be cured with ablation therapy alone. Therefore, the occurrence of osseous metastasis in DTC significantly worsens the prognosis. Treatment options in patients with bone metastases of differentiated thyroid carcinoma are therefore limited and mostly aimed at palliation. Other treatment modalities are surgery or external irradiation. Our case report describes a case of local recurrence of DTC with sternal metastases that was managed successfully by surgery, involving partial excision of the sternum. This demonstrated the effectiveness of surgical resection in the management of isolated skeletal metastasis for metastasizing DTC.

Surgery is indicated as a first-line therapy in individual patients and should be advocated in the case of solitary bone metastasis. This therapeutic approach occasionally remains the only hope of offering a long-term cure with an improved quality of life and prolonged survival, in the case of isolated metastases amenable to resection (2, 3). Furthermore, if multiple metastases or local recurrent disease exist, resection of skeletal metastasis can allow more efficient radio-iodine treatment, making surgical removal of a resectable skeletal metastasis a valuable complement to radio-iodine therapy. Stojadinovic *et al.* proved that solitary distant metastasis of DTC amenable to complete resection are infrequent, but that complete metastasectomy may be associated with improved survival for localized distant disease (5). Zettinig *et al.* identified surgical extirpation of the bone metastases as a significant prognostic factor associated with improved survival in the subgroup of patients with distant metastases limited to the bones. They concluded that, in patients without additional extra-skeletal distant metastases, the radical surgical extirpation of bone metastases may be associated with improved survival (6). Operations for cure of metastases are only justified if the general condition of the patient permits or in the case of patients with a single metastasis who have undergone a radical primary cancer operation.

Various techniques for the closure and coverage of the defect after resection of the cranial sternum have been described. The defect should be covered either by autogenous or artificial substitutes. Autoplastic reconstruction is indicated for smaller defects, whilst larger defects usually require alloplastic materials, especially in the case of chest instability after resection. In our case, reconstruction was performed with two layers of polypropylene mesh. Sternal resection with a polypropylene mesh reconstruction of the chest wall defect allows a rigid setting with a material that can be moulded and easily handled. It is radiolucent, inert and well tolerated with good tissue affinity. In the upper sternum it contributes to the stability of the shoulder girdle and protects the underlying mediastinal structures in a

cosmetically acceptable way. In the few case reports available concerning this special situation, other authors were also able to demonstrate good results with Marlex mesh reconstruction of the chest wall, proving a simple and effective method of reconstruction (7-11). Incarbone *et al.* and Lequaglie *et al.*, with analyses of the outcome of surgical resection for primary and secondary tumours involving the sternum, were also able to show that sternal resection and repair of the defects with prosthetic material is a safe and effective treatment. This method may improve the patient's quality of life and achieve a long-term survival, not only in the case of primary tumours but also with selected secondary malignancies (12-14).

In our case, the resection of the osseous sternal metastasis had a favourable outcome on our patient's prognosis and quality of life. A new local recurrence was first diagnosed 4 years after the previous operation, and this recurrence could be successfully treated with radio-iodine ablation therapy. Today, 4½ years after the resection of the sternal metastasis, the patient is free of disease with a low thyroglobulin level.

In conclusion, considering the radio-iodine insensitivity of bone metastasis, the authors believe that, in the case of solitary osseous metastases from DTC, even in technically demanding localizations, surgical therapy is a good treatment option and should be favoured. In selected and individual cases, surgical resection of skeletal metastases in patients with DTC is recommended because it can be curative and because it provides symptomatic palliation, prolongs overall survival and allows for more effective radio-iodine treatment to pulmonary and visceral metastasis or local recurrence.

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Received May 10, 2005

Accepted July 6, 2005