

Well-Differentiated Thyroid Cancer

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Well-differentiated thyroid carcinoma (WDTC) is a slow-growing cancer with a good prognosis, but may show extraglandular progression involving the invasion of tumor-adjacent tissues, such as the trachea, esophagus, and recurrent laryngeal nerve. Tracheal invasion by WDTC is infrequent. Since this condition is rare, relevant high-level evidence about it is lacking. Tracheal invasion by a WDTC has a negative impact on survival, with intraluminal tumor development constituting a worse prognostic factor than superficial tracheal invasion. In WDTC, curative resection is often feasible with a small safety margin, and complete resection can ensure a good prognosis. Despite its resectability, accurate knowledge of the tracheal and peritracheal anatomy and proper selection of surgical techniques are essential for complete resection. However, there is no standard guideline on surgical indications and the recommended procedure in trachea-invading WDTC. This review discusses the indications for radical resection and the three currently available major resection methods: shaving, window resection, and sleeve resection with end-to-end anastomosis.

Keywords: Well-Differentiated Thyroid Cancer ; Tracheal invasion

1. Introduction

Well-differentiated thyroid carcinoma (WDTC) is a slow-growing cancer that has a good prognosis. The trachea has posterior anatomical proximity to the thyroid gland and is affected by extraglandular extension of thyroid cancer. Tracheal invasion by WDTC is infrequent, exemplified by a rate of 3.4–13% [1][2][3][4][5]. Since this condition is rare, relevant high-level evidence about it is lacking. In tracheal invasion by thyroid cancer, the symptoms range from none to fatal, such as airway obstruction and bleeding. McCarty et al. [6] reported that 22% of 40 patients with obvious tracheal invasion had hoarseness, 11% had hemoptysis, and 5% had respiratory distress. In general, tracheal tumor invasion indicates higher biological tumor aggressiveness compared to tumors limited to the thyroid gland [7]. McCaffrey et al. [8] and Ito et al. [9] found that invasion of the aerodigestive tract was an important negative prognostic factor. Thus, data indicate that tracheal invasion decreases long-term survival; intraluminal tumor development constitutes a worse prognostic factor than superficial tracheal invasion [10][11]. However, in WDTC, even with tracheal invasion, curative resection is often possible with a large margin of safety, and complete resection can ensure a good prognosis. Despite tracheal invasion, WDTC has an excellent prognosis, with more than 90% of patients surviving to 10 years after complete resection [12][13][14]. A far advanced or rapidly progressing tumor may be unresectable, and only tracheostomy or stenting can be undertaken. Even in resectable WDTC, accurate knowledge of the anatomy of the trachea and its adjacent tissues, as well as the proper selection of surgical techniques, is necessary for complete resection. Current guidelines do not provide specific guidance on the resection of tracheal invasion by WDTC. The 2015 American Thyroid Association Management Guidelines for Adult Patients with Thyroid Nodules and Differentiated Thyroid Cancer indicated that the decision for surgical treatment should be based on the feasibility of complete resection and the resultant functional impairment following resection; however, the surgical indications and the recommended procedure in trachea-invasive WDTC were not specified [15].

On a case-by-case basis, the possibility of resection, expected postoperative functional disability, and patient's background (e.g., general condition and expected prognosis) should be considered before deciding on surgical intervention. This review discusses the indications for radical resection and the three major resection methods currently available: shaving, window resection, and sleeve resection with end-to-end anastomosis (Table 1).

Table 1. Features of the surgical method.

Techniques	Advantage	Disadvantage
Shaving	Maintaining the tracheal lumen Low morbidity	Risk of local recurrence
Window resection	Microscopic resection Postoperative maintenance of airway	The need for multiple surgeries

Techniques	Advantage	Disadvantage
Sleeve resection with end-to-end anastomosis	More radical resection Lumen is covered with tracheal mucosa	Risk of fatal complications

2. Surgical Management of Tracheal Invasion by Well-Differentiated Thyroid Cancer

There is a general consensus that the order of curability of radical surgical treatment for tracheal invasion is sleeve > window > shaving resection. However, shaving is the least invasive surgery. In the case of superficial invasion of the trachea up to the perichondrium or cartilage, there is consensus that shaving is generally sufficient if the preoperative evaluation is accurate, although it is sometimes difficult to determine the degree of invasion. In a much deeper invasion, many reports indicate that shaving may increase the risk of local recurrence because of microscopic tumor remnants; therefore, shaving may not be sufficient. Moreover, there is consensus that a full-laminar resection is necessary if the disease extends into the lumen or tracheal mucosa. In such cases, there are two possible resection methods: window resection and circumferential resection. Notably, the perioperative risk of sleeve resection is higher than that of window resection, and window resection is not less invasive due to the need for another surgery to close the tracheocutaneous fistula and the possibility of stenosis. However, apart from these complications, window resection is relatively safe, which is a great advantage. Nonetheless, the evidence is inconclusive and requires prospective review. The decision will be based on the patient's general condition, tumor status, expected duration of prognosis, and the facility's strengths and weaknesses (Figure 1). In cases of advanced disease or poor patient condition that makes radical resection intolerable, a less invasive approach should be provided. For this reason, accurate preoperative workup is necessary for choosing the suitable surgical procedure for patients with suspected tracheal invasion. CT, US, and bronchoscopy are essential tests for preoperative evaluation. In addition, MRI and EBUS should be considered depending on the situation (Figure 1).



Figure 1. A schema depicting the surgical strategy for tracheal invasion of well-differentiated thyroid cancer according to the extent of invasion.

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