The close proximity of important normal structures makes removal of the thyroid a technically demanding operation in the best of circumstances (Fig. 1). When tumor extends beyond the thyroid gland, cancer removal may require resection of normal structures in a way that is sure to result in permanent functional loss (Weissler 1995; Zarnegar 2003). In our opinion, a gross total tumor resection is such an important goal in thyroid cancer that predictable functional problems should be viewed as expected outcomes rather than unexpected complications in patients with locally advanced disease. The location of the thyroid gland explains the problems that may develop as a result of thyroid cancer surgery (Table 1).

THE RECURRENT LARYNGEAL NERVE

The most common complication of thyroidectomy is damage to the recurrent laryngeal nerve. Temporary weakness in a recurrent laryngeal nerve is common. The chance of permanent damage to the nerve is approximately 2%.

It is easy to damage the recurrent laryngeal nerve during a thyroidectomy because the nerve lies against the posterior surface of the gland and close to the inferior thyroid artery (Fig. 2). The thyroidectomy procedure requires ligation of the inferior thyroid artery, removal of as much thyroid tissue as possible, and separation of the parathyroid glands from the posterior surface of the thyroid. To accomplish these goals the surgeon must dissect the tissues immediately surrounding the thyroid gland to identify the recurrent laryngeal nerve. The nerve is then traced to its distal end where it penetrates the area behind the cricothyroid joint. The gland is then pulled medially away from the nerve.
Retraction injury of the nerve usually causes temporary loss in vocal cord mobility that may take months to resolve. Transection of the nerve or a severe compression injury causes permanent and complete vocal cord paralysis. The literature is still controversial, but it seems that re-aligning the severed ends of the nerve prevents atrophy of the vocalis muscle thereby preserving voice quality.

Loss of function of one recurrent laryngeal nerve results in a breathy voice. In the immediate post-operative period, there may also be a risk of aspiration. Over time, the patient's voice may improve by the compensatory over-rotation of the functional vocal cord. Should this not occur, the paralyzed cord could be physically pushed into place with a second surgery (Thyroplasty or injection augmentation), which generally results in a near-normal voice.

Loss of function of both recurrent laryngeal nerves increases the risk of aspiration even though the vocal cords usually end up opposed to one another. This configuration may easily confuse the clinician as the voice may sound normal due to the juxtaposition of the anterior vocal cords. Unfortunately, this also severely limits the area for respiration,

Figure 1. Axial section through the neck at the level of the C-7. (Redrawn from Eycleshymer AC, Schoemaker DM: A cross-section anatomy. New York, D. Appleton-Century, 1938:55).