Some families have a germline risk for developing thyroid and other cancers. An understanding of the genomic alterations that occur in these tumors will help to explain the diverse clinical characteristics of thyroid tumors, provide diagnostic information, and direct therapy. This article reviews the classification, genetics, and risks and management of hereditary cancer syndromes, as well as the somatic gene variants found in thyroid epithelial tumors, with clinical implications.

AT A GLANCE

- The identification of benign tumors and clinically insignificant thyroid tumors is important because it can prevent partial or complete removal of the thyroid and lymph node dissection with radiation therapy.
- Identifying individuals at risk for hereditary thyroid cancer syndromes, referring them for germline evaluation, and ensuring follow-up, complete with prevention and early detection recommendations, are responsibilities of the oncology nurse.
- Oncology nurses can provide support and education to patients and families to help them manage their diagnosis and understand how genomic testing of the germline tissue and tumor guides treatment.

KEYWORDS
thyroid cancer; variant; hereditary cancer syndromes; personalized medicine

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Thyroid Cancer

Implications of genomics for care and practice

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The hallmark of thyroid cancer is a palpable lump or nodule in the thyroid or neck. Thyroid nodules are relatively common, occurring in about 65% of the population (Elsayed et al., 2017; Jackson, 2018), and are thought to be related to routine use of diagnostic imaging for conditions not associated with the thyroid. Pathologically, the majority of thyroid nodules are benign, are unlikely to become malignant, and can be managed with surveillance. The primary goal of the initial evaluation and long-term follow-up is identification of the small subgroup of nodules that require further surveillance and treatment. These include those with a clinically significant cancer (10%), those leading to compressive symptoms (5%), or those that progress to functional disease (5%) (Wong et al., 2018).

There are four main types of thyroid cancer: papillary, follicular, medullary, and anaplastic (American Cancer Society, 2020). The incidence of thyroid cancer has increased from 4.9 to 15.8 per 100,000 people since 1975, and the incidence of papillary thyroid cancer has increased from 3.4 to 12.5 per 100,000 people in that same period (Howlader et al., 2016). About 2% of thyroid cancer cases occur in children and teenagers (American Society of Clinical Oncology, 2020); thyroid cancer can occur at any age, but risk peaks for women aged 40–50 years and for men aged 60–70 years (Goodarzi et al., 2019). The thyroid cancer mortality rate has remained stable since 1975, at an estimated 0.5 deaths per 100,000 people (Davies & Welch, 2014).

Radiation exposure is an established environmental risk factor for thyroid cancer, with sources including medical treatment and radiation fallout from power plant accidents or nuclear weapons. Head or neck radiation therapy in childhood increases thyroid cancer risk; this increase begins within 5 years of radiation exposure, with new nodules developing at a rate of about 2% annually and reaching a peak incidence within 30 years of radiation exposure (Schneider et al., 1997). In addition, follicular thyroid cancers are more common in geographic regions where diets are low in iodine; conversely, a diet high in iodine is associated with an increased risk of developing papillary thyroid cancer (Limaiem et al., 2020). Having a family history of thyroid cancer and being overweight or obese are other risk factors (Lauby-Secretan et al., 2016).

Genomic testing informs care for individuals with thyroid cancer. Those with germline variants have a hereditary risk of developing cancer. Tumor testing can detect pathogenic alterations that provide information about prognosis and the treatments that are most likely to be effective.

Hereditary Thyroid Cancer Syndromes

There are several hereditary thyroid cancer syndromes that result from germline pathogenic variants. The clinical presentation and management depend on the syndrome. Table 1 reviews these syndromes and the complexity of care that is needed when a germline variant is detected in a family. Unlike many other hereditary cancer syndromes, several hereditary thyroid cancers have implications