see it in elderly patients? The 30-year follow-up study of Buckwalter et al. would suggest not, but even longer observation is needed to be certain.

Follicular carcinoma, which has a tendency to spread by blood vessel invasion and less often by regional lymphatics, had a 70% 5-year survival in the experience of Tollefsen and coworkers [2], primarily in adults. The same form of thyroid cancer in childhood is clearly less lethal and appears to behave much like papillary disease. The same is true of mixed papillary-follicular disease as far as anyone can determine.

Prior therapeutic irradiation to the thyroid region is almost certainly a factor that induces malignant changes in the gland of a susceptible host. The latent period is somewhere between 8 and 40 years. However, other factors must be involved since a history of prior irradiation is obtained in less than 40% of patients in most series and in none of the patients in the series that our group reported [3]. Also, the study of Buckwalter et al. indicates that prior irradiation does not induce a more lethal form of cancer in children although multifocal disease that requires more aggressive therapy is more common. Our recommendation for patients with a history of prior irradiation is careful yearly physical examination, including an initial search for substernal thyroid with a chest x-ray. Patients found to have single or multiple lesions are advised to have neck exploration. Those not found to have nodules on examination are subjected to periodic studies and ^{241}Americuim scanning [2]. The latter technique permits repeated evaluation without the introduction of radioactive materials into the body. Since it depends on external excitation of ejection of x-rays from intrathyroidal iodine, it is possible to compare normal thyroid to nodules. A nodular iodine content ratio of less than 0.6 in comparison with normal surrounding thyroid usually indicates malignancy in our experience. We have generally not administered suppressive doses of thyroid hormone to patients with a history of prior irradiation who are being followed up, although others favor this practice.

While information which may come to light in future years from the studies of Buckwalter et al. and others may change our current thinking, our present surgical recommendations are similar to theirs. Most agree that lobectomy and isthmusectomy are sufficient for unilobar disease, and that total or near total thyroidectomy is appropriate for those with multifocal, bilateral disease, for patients with bilateral nodal metastases, or for those with distant metastases. The risk of complications with total thyroidectomy is high enough to restrict its use to situations where the disease cannot be controlled otherwise. Our limited experience would indicate that total thyroidectomy does not protect against recurrence and, even if disease recurs following lobectomy, that patients can be successfully retrieved. While Buckwalter et al. suggest near total thyroidectomy and modified neck dissection for patients with unilateral disease and ipsilateral nodal involvement, we would reserve this approach, or perhaps use total thyroidectomy and modified neck dissection, under these circumstances for patients with follicular carcinoma, which seems to have a slightly higher recurrence rate than papillary carcinoma. Prophylactic neck dissection is not in order. All would agree that postoperative suppression with thyroid hormone is worthwhile and that radioiodine is a helpful adjunct for patients with distant metastases. However, we must all acknowledge that only longitudinal studies such as the one reported here will give us the final answer.

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Invited Commentary

Norman W. Thompson, M.D.

University of Michigan, Ann Arbor, Michigan, U.S.A.

As noted by the authors, primary carcinoma of the thyroid was considered rare in youth and particularly rare in children under 15 years of age before 1950. Although much has been written about the association of thyroid carcinomas and previous low-dose irradiation to the head and neck region, at least $^1/_2$ of all patients with thyroid carcinoma under 20 years of age have not been exposed to therapeutic irradiation for benign conditions. Whether other unidentified initiating factors are responsible for the increased occurrence of this disease in the United States is unclear. Because children with differentiated thyroid cancers usually present with lymph node metastases, it is unlikely that many cases went unrecognized prior to 1950.

The most surprising finding in this study is the high incidence of follicular carcinoma, particularly

in patients under 15 years of age. The 68% incidence reported by the authors is in sharp contrast to the 10% occurrence of follicular carcinomas noted by others in studying this age group of patients [1–5]. In our reported series of 58 children 15 years of age or younger, there were only 5 patients with follicular neoplasms [6]. By the current histologic criteria of the American Thyroid Association 3 of these are now considered follicular variants of papillary carcinoma. In my opinion, classification of these neoplasms according to strict criteria is of more than semantic importance. Appropriate classification has implications in selection of therapy, predictability of lymphatic pulmonary or bone metastases, prognosis, and ability to evaluate comparable series. We agree with Frassila that papillary and follicular tumors can and should be specifically identified by strict histologic criteria [7]. We have found in both children and adults that there has been a significant decrease in the occurrence of follicular carcinomas during the past 2 decades. During the same time period, papillary carcinoma has increased in occurrence. Papillary tumors now account for more than 85% of the primary thyroid carcinomas seen at the University of Michigan. To my knowledge there has been only one recent study showing an increasing incidence of follicular carcinomas in patients under 40 years of age [8]. Whether the same histological criteria advocated by Frassila and others were used in that report is not known.

The most significant finding in the study of Buckwalter, Gurll, and Thomas is that nearly all patients under 20 years of age with well-differentiated thyroid carcinomas eventually do well after definitive treatment. Life expectancy for this group of young patients is not significantly altered. Only 1 of their 68 patients followed up for as long as 30 years died from thyroid malignancy. Our results in treating approximately 120 patients in this age group are very similar. In 1973 we reported our experience with 58 children who were 15 years of age or younger. There were 51 children with papillary, 5 with follicular, and 2 with medullary carcinoma of the thyroid. The average follow-up period for those patients is now 23 years. In the 54 patients who had definitive treatment of well-differentiated thyroid carcinoma, there has been only 1 death. This resulted from hepatocellular carcinoma developing in a patient 10 years after treatment of his papillary carcinoma at age 11 years. Two 3-year-old patients died of pulmonary and tracheal involvement before any surgical treatment could be instituted. It is noteworthy that 63% of these children presented with cervical adenopathy due to metastatic papillary carcinoma. The incidence of proven lymphatic metastases was 88%. Local infiltration of tumor occurred in 31% and pulmonary metastases were present in 19%. Twenty-nine of the 54 children treated for differentiated thyroid carcinoma had received previous ionizing radiation to the head and neck. The average interval from exposure to diagnosis was 9.6 years. Definitive treatment in this group of children was total thyroidectomy in all but 3. In addition 48 patients underwent lymph node excisions ranging from lymph node plucking to bilateral modified and radical neck dissections. Radioactive iodine was administered in therapeutic doses to 49 of the 54 patients with differentiated tumors, usually 6 weeks after operation.

The authors of the present paper suggest that the surgical approach should be dictated by "the biological aggressiveness" of the disease. On the basis of our experience, but using their criteria, lobectomy would be rarely indicated in children. Lymph nodes metastases in this age group are almost always present. The high incidence of bilateral metastatic cervical adenopathy (26%), pulmonary metastases (19%) and multifocal cancer would dictate that total or near total thyroidectomy would be recommended in nearly all patients under 15 years of age. In patients between 15 and 20 years of age we have also found a high incidence of metastatic disease at the time of diagnosis. We continue to treat proven follicular carcinoma by total thyroidectomy in order to be able to detect occult metastatic disease in bone or lung. We have not seen any patient under 30 years of age with proven metastatic follicular carcinoma in lymph nodes. In all such designated cases, a careful review of the pathological material resulted in reclassification of the neoplasm as papillary carcinoma. We would agree with the authors that the goals of treatment are the removal of all thyroid carcinoma accessable to the surgeon, as much thyroid as possible without causing permanent hypoparathyroidism, excision of all involved lymph nodes without deforming procedures, and therapeutic radioactive iodine for remote metastases. Despite the high incidence of cervical metastases in young patients, formal radical neck dissection is rarely if ever required for differentiated thyroid carcinomas. Despite the presence of pulmonary metastases, effective treatment with ^{131}I can be instituted after all normal thyroid tissue has been eradicated. In our experience these goals are best accomplished by early total thyroidectomy, preserving all parathyroid glands not involved with neoplasm, regional lymph node excision, and ^{131}I when indicated. Although this approach is also empirical, accomplishment of these goals has resulted in minimal morbidity, avoidance of secondary operations, and excellent long-term results without tumor recurrence.

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