**8 Tumors of the Thymus**


**8.1 Introduction**

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As would be expected from studies of developmental anatomy, the thymus consists of heterogeneous material, which naturally can give rise to various benign and malignant tumors.

A large number of lists of tumors of the thymus have been published. Otto (1984) described 20 different pathoanatomic classifications. While Tesseraux (1953) differentiated between benign and malignant tumors of the thymus, today the tumors are differentiated according to their cell structure, hormone production, and function. This method of differentiation is favored by the fact that it is seldom possible to differentiate between benign and malignant forms of thymoma unless there is invasive growth in the surrounding tissue or metastases are found.

During the past two decades, substantial progress has been made in understanding the biology of the thymus and, therefore, the pathology and clinical behavior of thymic tumors (Levine and Rosai 1978; Janossy et al. 1980; CIBA Foundation Symposium, No. 84, 1984). Such tumors include those arising from thymic epithelial cells (thymomas), neuroendocrine cells (carcinoid tumors of the thymus), lymphoid cells (malignant non-Hodgkin's lymphomas and Hodgkin's disease), and adipose tissue (thymolipomas). All other tumors (myoid and histiocytic) and tumor-like lesions (cysts, hyperplasia) are extremely rare (Rosai and Levine 1976; Otto 1984).

The different tumors of the thymus discussed here reflect the surveys of Otto and Hüsselmann (1978) and Otto (1984), supplemented by recent reports of the more seldom tumors:

1. Epithelial tumors (encapsulated and invasive thymomas, squamous cell carcinoma etc.)
2. Carcinoids
3. Malignant lymphoma and leukemia
4. Mesenchymal tumors (thymolipoma)
5. Germ cell tumors
6. Rare cell tumors (hemangioma, choristoma etc.)
7. Metastases

**References**


Tesseraux H (1953) Physiologie und Pathologie des Thymus unter besonderer Berücksichtigung der pathologischen Morphologie. Barth, Leipzig
8.2 Epithelial Tumors of the Thymus

8.2.1 Pathologic Features

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8.2.1.1 Macroscopic Appearance

8.2.1.1.1 Location

Most thymomas are located in the anterior mediastinum. About 4% of thymomas are located in the lateral cervical region (ROSAI and LEVINE 1976; SALYER and EGGLESTON 1976; GRAY and GUTOWSKY 1979; WICK et al. 1990), which might be a consequence of fetal maldevelopment that led to an undescended thymus (RIDENHOUR et al. 1970). There are, however, some rare locations like the posterior mediastinum (ROSAI and LEVINE 1976), the thyroid gland (ASA et al. 1988), within the pleura, or spread out like a mesothelioma (Fig. 8.1) (ROSAI and LEVINE 1976; HARTMANN and HANKE 1984; HOFMANN et al. 1985b; KUNG et al. 1985; FUKAYAMA et al. 1989).

8.2.1.1.2 Size and Cut Surface

The diameter of thymomas varies considerably within the range of 1 mm in a fortuitously detected lesion (ROSAI and LEVINE 1976) and 20-30 cm (BERNATZ et al. 1961; SALYER and EGGLESTON 1976; LEGOLVAN and ABELL 1977; GRAY and GUTOWSKY 1979). ROSAI and LEVINE (1976) reported a median diameter of 5-10 cm; in our own series of 98 thymomas (HOFMANN et al. 1985b) we found a range from 2 to 20 cm. A diameter of 20 cm seems to be the upper limit since the findings of most authors do not exceed this value (BATATA et al. 1974; SALYER and EGGLESTON 1976; LEGOLVAN and ABELL 1977; GRAY and GUTOWSKY 1979; LEIPNER et al. 1982). This could be due to the fact that tumors of that size are detected by the local symptoms they cause.

The average tumor weight is 120-150 g. GRAY and GUTOWSKY (1979), for example, reported a median weight of 130 g (range, 30-250 g). BERGH and co-workers (1978) found that stage III tumors were heaviest 85-1700 g compared to 20-440 g for stage I tumors.

Most of the thymomas are lobulated by fibrous bands resulting in a nodular surface and in a lobulated cut surface, one of the most characteristic but nevertheless nonspecific gross features of thymomas (Fig. 8.2). The consistency of the tumors varies from soft to very firm. Within the tumors, small areas of necrosis can be found, but these are less common than cysts. Smaller cysts might be filled with a clear fluid, larger ones with a thick, brown, blood-like fluid (Fig. 8.3). Foci of hemorrhage of varying extent occur in about 30% of the tumors (ROSAI and LEVINE 1976; SALYER and EGGLESTON 1976; LEGOLVAN and ABELL 1977; GRAY and GUTOWSKY 1979).

8.2.1.1.3 Encapsulation

One of the most important prognostic parameters of the tumor in situ is whether it is encapsulated or not, as will be discussed below. About 60%-70% of the thymomas are encapsulated; the rest grow into the surrounding fat tissue or organs like pleura and lungs, pericardium, or great vessels (FRIEDMAN 1967; BATATA et al. 1974; SALYER and EGGLESTON 1976; LEGOLVAN and ABELL 1977; BERGH et al. 1978; GRAY and GUTOWSKY 1979; HOFMANN et al. 1985b; VERLEY and HOLLMAN 1985).

ROSAI and LEVINE (1976) observed that the surgeon is usually in a better position than the pathologist to assess the invasive nature of a thymoma from the findings at thoracotomy, but it is sometimes difficult to differentiate macroscopically between fibrous adhesions and invasion by the tumor. In these cases an intraoperative cryostat section or a filament marking of the suspected site would be desirable to enable the pathologist to examine the histology of this site.

8.2.1.2 Histologic Appearance

8.2.1.2.1 The Epithelial Component

The epithelial cells of thymoma can occur as round to oval, large cells with vesicular nuclei and small, inconspicuous or prominent nucleoli. In our series of 98 thymomas, 55.1% were primarily composed of these epitheloid cells (Fig. 8.4). The other feature of epithelial cells is their markedly elongated spindle-shaped and elongated nuclei: 17.4% in our series were primarily composed of that spindle cell type (Fig. 8.5). If a thymoma is a combination of the cell types mentioned above, it is classified as a mixed thymoma. In our series 20.4% were of that type (HOFMANN et al. 1985b).

Most thymomas are of these three types. There are, however, some other rare differentiations of thymoma epithelial cells reported in the literature: