Tumor of the Testis: An Attempt of Histological Classification According to WHO Guide Line

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MUKADA, T., ANDOH, N. and SASANO, N. Tumor of the Testis: An Attempt of Histological Classification According to WHO Guide Line. Tohoku J. exp. Med., 1981, 134 (4), 367-373 — Testicular tumor in Japan is one of the evil neoplasms which have increased in incidence rate in recent years. In order to provide the basic data for the clinicopathological and epidemiological studies on testicular tumors, the WHO histological classification was applied to 86 cases in the file of Department of Pathology, Tohoku University School of Medicine, in the years of 1969 through 1980. Of 86 cases, 75 (87%) were germ cell tumors including 37 seminomas, 10 yolk sac tumors, 4 embryonal carcinomas, 9 mature teratomas, and 15 combined forms. The combined forms consisted mainly of embryonal carcinoma and immature teratoma. Malignant lymphoma was encountered in 8 cases. These malignant tumors showed characteristic age preponderance. Non-germ cell benign tumors were recorded in only 3 cases. Briefly mentioned were some histological diagnostic hallmarks of malignant testicular tumors.

epidemiology neoplasm; testis

Annual incidence rate and death rate of Japanese testicular malignancies are generally low but have gradually increased in recent years (Lee et al. 1973). The most up-to-date reported standardized annual incidence rate of malignant testicular tumors in Miyagi Prefecture, Japan, was 0.97 per 100,000 populations per year (Sasano et al. in press). In the epidemiological investigation, satisfactory estimation of the incidence rate or death rate must be based on sophisticated pathological diagnosis as well as a fully developed cancer registry system. Mostofi (1980) stressed that results of research on testicular tumors using the WHO classification from the different parts of the world can be compared.

The present paper concerns histological typing of testicular tumors in our file composed mainly of cases from Miyagi Prefecture according to the WHO classification (Mostofi and Sobin 1977) in order to prepare the basic data for the future clinicopathological and epidemiological studies of this field.

MATERIALS AND METHODS

Materials were histological specimens obtained from 86 surgical cases of testicular and paratesticular tumors excluding tumor-like conditions, mainly from the files of

Received for publication, August 14, 1980.
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Department of Pathology, Tohoku University Hospital and School of Medicine, from 1969 through June, 1980. All were Japanese and a greater part of them were malignant cases from Miyagi Prefecture. Approximately a half of these cases were simultaneously registrated in Miyagi Prefectural Cancer Registry. Histological sections of hematoxylin and eosin stain formerly prepared or presently reprepared from one to four paraffin blocks of representative portion of individual tumors were reviewed. Special stains were prepared in necessity. The age distribution of reviewed cases is shown in Table 1.

**Table 1. Reviewed cases of testicular tumors by age**

<table>
<thead>
<tr>
<th>Age (years)</th>
<th>0-4</th>
<th>5-9</th>
<th>10-19</th>
<th>20-29</th>
<th>30-39</th>
<th>40-49</th>
<th>50-59</th>
<th>60-69</th>
<th>70-</th>
<th>Unknown</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of cases</td>
<td>14</td>
<td>0</td>
<td>3</td>
<td>15</td>
<td>26</td>
<td>18</td>
<td>6</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>86</td>
</tr>
</tbody>
</table>

**Results**

Histological classification of reviewed cases is summarized in Table 2. Of 86 cases, 75 (87%) were germ cell tumors. Of these 75 germ cell tumors, 60 (80%) were pure forms (one histological type) and the remaining 15 (20%) were combined forms (more than one histological type). Seminomas were encountered in 37 cases which accounted for 43% of all neoplasms. All these seminomas were of ordinary type and no spermatocytic seminoma was recorded. Eight malignant lymphomas were consistent with reticulum cell sarcomas. Benign tumors were composed of one adenomatoid tumor, one paracapsular leiomyoma, and one mural papilloma.

Varying forms of combined tumors are shown in Fig. 1. Seminomas and yolk sac tumors usually appeared as pure forms. On the contrary, embryonal carcinoma often appeared as a major component of combined tumors. Immature teratomas appeared as single component, major or minor, associated usually with

**Table 2. Histological classification of testicular tumors by WHO guideline (Mostofi and Sobin 1977)**

<table>
<thead>
<tr>
<th>Histology</th>
<th>Number of cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>Germ cell tumors</td>
<td></td>
</tr>
<tr>
<td>Tumors of one histological type</td>
<td></td>
</tr>
<tr>
<td>Seminoma</td>
<td>37</td>
</tr>
<tr>
<td>Embryonal carcinoma</td>
<td>4</td>
</tr>
<tr>
<td>Yolk sac tumor</td>
<td>10</td>
</tr>
<tr>
<td>Teratoma</td>
<td></td>
</tr>
<tr>
<td>mature</td>
<td>9</td>
</tr>
<tr>
<td>immature</td>
<td>0</td>
</tr>
<tr>
<td>Choriocarcinoma</td>
<td>0</td>
</tr>
<tr>
<td>Tumors of more than one histological type</td>
<td></td>
</tr>
<tr>
<td>Embryonal carcinoma and teratoma</td>
<td>7</td>
</tr>
<tr>
<td>Other combinations</td>
<td>8</td>
</tr>
<tr>
<td>Others</td>
<td></td>
</tr>
<tr>
<td>Lymphoma</td>
<td>8</td>
</tr>
<tr>
<td>Benign tumors</td>
<td>3</td>
</tr>
<tr>
<td>Total</td>
<td>86</td>
</tr>
</tbody>
</table>
embryonal carcinoma (teratocarcinoma). Mature teratomas occurred as pure forms or combined forms. Choriocarcinoma appeared not in pure form but in combination with yolk sac tumor and seminoma.

Characteristic age distribution of the testicular tumor was observed in yolk sac tumors, seminomas, and lymphomas (Fig. 2). Pure forms of yolk sac tumors (10 cases) were observed exclusively in infants younger than 5 years of age and most of them (8 cases) belonged to 1 to 2 years. Seminomas were concentrated in the 4th and 5th decades. Embryonal carcinoma and tumors of any combination preferred slightly younger ages to those of seminomas. Mature teratomas (9 cases) were observed in both infancy and adolescence. Lymphomas (8 cases) were evenly distributed throughout the older adulthood from the 4th to the 8th decade.

For the diagnostic aids, a few histological hallmarks of testicular malignancies are shown here as far as repetition of the WHO’s criteria has been avoided (Figs. 3–10). When a tumor shows a solid pattern; embryonal carcinoma, in particular

![Fig. 1. Various combinations of histological types are shown. Lines correspond to individual cases and dots indicate histological types combined. *Number of cases of pure form.](image)

![Fig. 2. Tumor incidence by age. Germ cell tumors (74 cases) and lymphomas (8 cases) are shown. One case of unknown aged seminoma is excluded. A characteristic age distribution is evident in each group.](image)
Fig. 3. Typical seminoma. Closely packed uniform cells with centrally located round nuclei are seen. Cytoplasms are not always clear. Lymphoid infiltration is present not in the stroma but within the tumor cell nests. Hematoxylin and eosin. × 320.

Fig. 4. Seminoma. An area from well fixed tissue near the margin of a tumor mass of otherwise typical seminoma. Note ill-defined cell boundaries and large oval nuclei with a characteristic chromatin pattern simulating those in spermatocytic seminoma. Hematoxylin and eosin. × 320.

Fig. 5. Embryonal carcinoma. Early differentiations of tumor cells to epithelial-like cell clusters and further to a papillary pattern are observed. Cases with predominating solid pattern are sometimes misinterpreted as seminoma. Hematoxylin and eosin. × 200.

Fig. 6. Lymphoma. Tumor cells show dark cytoplasms and nuclei of varying shape. Note less cohesive cells comparable to seminoma. Hematoxylin and eosin. × 320.
being poorly fixed or irradiated, must be differentiated from seminoma. The latter is usually composed of tumor cells with centrally located nuclei showing a prominent nuclear membrane and fine and diffuse chromatin pattern. Both seminoma and embryonal carcinoma may or may not show clear cytoplasm. Cell to cell boundaries are not always clear in seminoma and the opposite is true in

Fig. 7. Seminoma. A poorly fixed area shows a loose cellular arrangement. Yolk sac tumor or embryonal carcinoma must be considered for differentiation. Hematoxylin and eosin. × 200.

Fig. 8. Yolk sac tumor. Two patterns show an intimately related mosaic arrangement. Cuboidal to columnar cells may differentiate to a papillary or tubular pattern of yolk sac tumor. Hematoxylin and eosin. × 200.

Fig. 9. Yolk sac tumor. The typical endodermal sinus pattern of Teilum (1965) comprising perivascular formations and surrounding reticular areas. Tumor cells vary in size and shape. Hematoxylin and eosin. × 200.

Fig. 10. Embryonal carcinoma. A few perivascular structures of varying size and shape are observed adjacent to a necrotic area. Hematoxylin and eosin. × 130.
embryonal carcinoma. Differentiation subtly to epithelial-like cells or definitely
to two or more cell types, as is typically seen in embryoid bodies, characterizes
embryonal carcinoma. Lymphoid stroma may appear in embryonal carcinoma as
well as in seminoma. Lymphoma cells, less cohesive than cells of embryonal
carcinoma, provide rather polymorphic and usually vesicular nuclei.

When a tumor shows a reticular pattern or loose cellular arrangement; yolk
sac tumors consist of fairly polymorphic tumor cells, while seminomas and
embryonal carcinomas fairly uniform cells. A perivascular structure often said to
characterize the yolk sac tumor may appear in embryonal carcinoma (Mukada and
Aida 1975). Seminomas may show incidental cell cords, simulating reticular and
tubular patterns of embryonal carcinoma or yolk sac tumor, but they may
usually be observed in limited areas in the former. A vasoformative structure may

In summary, specimens of optimal fixation and sections obtained from as
many lesions of a tumor as possible are necessary for the correct diagnosis of
individual testicular neoplasms.

**DISCUSSION**

Mostofi and Sobin (1977) introduced the standard WHO histological typing of
testicular tumors based on morphological standpoint. This seems to be fairly
easy to apply, therefore practical. In the testis, circumstance is quite different from
the ovary with regard to the neoplasms they develop (Scully 1970). In males
germin cell tumors are dominant testicular lesions with characteristic age pre-
ponderance (Young et al. 1970). Suitable diagnosis will be obtainable if some
diagnostic hallmarks are considered. Our studies, although based on the
observation of a fairly limited number of cases, some characteristic aspects of the
testicular tumor were elucidated. Embryonal carcinomas are undifferentiated,
with or without subtle differentiation to immature teratoma, and may appear in
young adult usually as combined forms. On the other hand, yolk sac tumors with
“one-sided differentiation to extraembryonic tissue” (Teilum 1965) may appear in
adults (3 cases) as combined forms. Talerman (1975) emphasized that yolk sac
tumor elements in testicular tumors of adults were found admixed with other
germin cell elements and tumors composed entirely of yolk sac tumor were not en-
countered. However, most of yolk sac tumors in infants (10 cases) were pure
forms. Prognosis of yolk sac tumors is worse in elder children and adults (Young
et al. 1970). Mature teratoma may appear as a pure form, but immature
teratoma usually as a single component, major or minor, in varying combinations
with e.g., embryonal carcinoma, yolk sac tumor or mature teratoma.

Lymphomas and leukemia may involve the testis, primarily or secondarily.
According to Paladugu et al. (1980), the definition of malignant lymphoma with
primary manifestation in the testis requires that there be no clinical evidence of
lymphnode involvement at the time of diagnosis and that the minimum follow-up
time for the living patients be six months. Our 8 cases showed the main tumor
mass in the testis without apparent lymphnode involvement. But follow-up observations were not satisfactory.

When a given case of testicular tumor is concerned, the patient's age seems to be quite important for the histological diagnosis: In infancy and childhood, yolk sac tumor must be considered first; in young adult, embryonal carcinoma of pure or combined form and other combined tumors must be ruled out; in middle ages (the 4th and 5th decade), seminoma is most liable; and in old ages lymphoma may be the single candidate. In conclusion, infants and their "fathers" are prone to develop most serious testicular lesions.

References