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ORIGINAL ARTICLE / *Genito-urinary imaging*

Ovarian tumors in children and adolescents: A series of 41 cases

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Abstract

Objective: Pictorial review with a detailed semiological analysis of ovarian tumors in children and adolescents to provide a relevant diagnostic approach.

Patients and methods: Retrospective study (2001—2011) of 41 patients under the age of 15 who underwent surgery for an ovarian mass with a definite pathological diagnosis.

Results: Sixty-two percent of the lesions were benign, 33% were malignant and 5% were borderline. Germ cell tumors were most frequent (77.5%), followed by sex cord stromal tumors (12.5%) and epithelial tumors (7.5%). Malignant tumors were more frequent in children between 0 and 2 years old. On imaging, calcifications and fat were specific for germ cell tumors; the presence of a mural nodule was predictive of a mature teratoma ($P < 0.001$). Predictive factors for malignancy were clinical, including abdominal distension ($P < 0.01$) or a palpable mass ($P = 0.05$), biological, including increased hCG and/or AFP levels ($P < 0.001$) and radiological, including tumors larger than 12 cm ($P < 0.05$), tumoral hypervascularity ($P < 0.01$) and voluminous ascites ($P < 0.01$).

Conclusion: This semiological analysis confirms the role of imaging in diagnosing the etiology of ovarian lesions in children and adolescents and emphasizes the importance identifying tumoral hypervascularity, which, in addition to classic criteria, is highly predictive of malignancy.

The diagnosis of ovarian tumors in pediatrics is often difficult and delayed because of non-specific symptoms and diverse presentations on imaging.

These rare tumors occur in an estimated 2.6/100,000 girls per year, excluding functional lesions [1,2]. Ten to 20% are malignant [3—6] and they represent 3% of cancers in girls under the age of 15 [7]. The World Health Organization has classified these tumors into three main groups according to whether they develop from epithelial cells, germ cells or sex cord stromal tumors. Primary or secondary locations are possible in leukemias or lymphomas [8,9].

Nevertheless, understanding of ovarian tumors in this age group is limited and the goal of this study was to analyze the diagnostic value of imaging features and suggest a diagnostic approach to ovarian masses in children or adolescents.

Patients and methods

Patients

This retrospective study was performed from April 2001 to September 2011 based on pediatric surgical archives at the Bicêtre Hospital. Inclusion criteria were:
- patients under the age of 15 at diagnosis;
- a definite pathological diagnosis for each lesion;
- initial pre-treatment imaging available for analysis (ultrasound, CT/or MRI).

Data collection

Data were obtained from the medical files of patients in the hospital's digital filing system. The following information was obtained: age at diagnosis, stage of puberty (puberty defined as the presence of a menstrual cycle), medical history, symptoms, adnexal torsion or tumor rupture (surgical data), serum levels of AFP, total hCG, free β-hCG, CA 125, inhibin B and the presence or not of an inflammatory syndrome as well as a pathological diagnosis. Lesions were classified as benign, borderline or malignant.

Imaging results were all reassessed with an evaluation guide (EP). Imaging criteria included:
- the diameter of the mass at its widest axis;
- the cystic features of the lesion (multicompartmental cysts were considered to be pure cysts), solid (no cystic component) or mixed and the proportion of different components (more or less 50%);
- the presence of tumoral calcifications, intratumoral fat, compartments, blood, papillary vegetations (millimetric) or mural nodules (centimetric);
- whether the lesion was vascularized or not;

- associated abnormal endometrial thickening (in pre-pubescent children suggesting an abnormally pubescent uterus, or more than 15 mm thick in post-pubescent patients);
- the presence of ascites (considered to be voluminous if not limited to the pelvis).
- topographic criteria included: the presence of single, multiple or bilateral lesions, and any extra-ovarian extension (peritoneum, lymph nodes).

Three age groups were defined: 0—2 years old, older than 2 and not pubescent and pubescent.

Data analysis

The Chi^2 test was used to compare qualitative variables, with Yates correction for groups of fewer than 5. The Mann Whitney test was used to compare quantitative variables and a ROC curve was obtained. $P \leq 0.05$ was considered to be significant.

Results

Forty-one patients were included in the study. None of the patients were excluded.

Patient characteristics are summarized in Table 1 and the distribution of different types of lesions is summarized in Table 2.

Thirty-nine patients had a single lesion, one patient had a mature bilateral teratoma, and one patient had multiple bilateral sclerosing stromal tumors (0.5—5 cm); only the largest tumor was considered for analysis. Thus, 42 lesions were studied.

The patient with sclerosing stromal tumors had a history of metastatic medulloblastoma with suspected Gorlin syndrome (hereditary disease characterized by a group of developmental anomalies and a predisposition to develop different tumors).

Fig. 1 shows the distribution of the different types and classes of lesions in relation to age and stage of puberty.

Abdominal distension and the presence of a palpable mass were significantly associated with malignancy (Table 3). Fifteen patients (36.5%) presented with the clinical signs of a surgical emergency with nausea and vomiting; the presence of vomiting was significantly associated with ovary torsion ($P < 0.001$). The five cases with fever corresponded to three benign tumors associated with adnexal torsion and partial or total necrosis of the ovary and two malignant tumors with signs of necrosis on histology. One tumor was discovered by chance during an ultrasound for an inguinal hernia. One patient with hemorrhagic shock had a