Original Study

Ovarian Preservation from Tumors and Torsions in Girls: Prospective Diagnostic Study

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ABSTRACT

Study Objective: To develop a new decision tree system (DTS) for the management of adnexal masses in prepubertal and adolescent girls, aimed to improve the distinction between benign and malignant masses, help preserve affected ovaries during surgery, and reduce the rate of surgical management of uncomplicated functional ovarian cysts.
Design: A prospective diagnostic study using clinical and ultrasound data collected for all patients younger than 19 years of age with adnexal masses managed between 2006 and 2015.
Setting: Mother and Child Health Institute of Serbia 'Dr Vukan Čupić' (Belgrade, Serbia).
Participants: Patients (N = 1499) with adnexal masses, of whom 318 were surgically treated.
Interventions and Main Outcome Measures: Ultrasonographic characteristics (Ueland's Morphology Index [MI] and the ovarian crescent sign [OCS]). Patients were managed expectantly or surgically, in line with 3 rules of the DTS. Rule 1: asymptomatic patients having a mass with MI of 4 or less and OCS present, were managed expectantly. Rule 2 (emergency): malignancy was suspected if the MI was 7 or more and no edema of the OCS was present. Rule 3 (nonemergency): malignancy was suspected if the OCS was absent and MI was 5 or more. The diagnostic accuracy was assessed using sensitivity and specificity ($P < .05$).
Results: No malignancy was found in the group of 1236 patients selected according to the DTS rule 1. Torsion was confirmed in 36% of surgically treated masses (n = 115). The OCS was present in 96% of benign masses in the non-emergency group (n = 149) and in three with microscopic malignancy. In predicting malignancy, the DTS (rules 2 and 3) showed a sensitivity of 93 (95% confidence interval [C.I.]: 82−98); and a specificity of 97 (C.I.: 95−99). Ovarian tissue was preserved from benign (n = 254, 93%) and malignant tumors (n = 3, 7%). Only five (2%) uncomplicated ovarian cysts were surgically treated.
Conclusion: The DTS with 3 rules is a very accurate diagnostic tool in the differentiation between benign and malignant ovarian masses. The DTS rule 1 reduces the number of surgical procedures on functional cysts, rules 2 and 3 are very useful in choosing the optimal treatment of adnexal masses, whether or not they are twisted.
Key Words: Adnexal mass, Benign, Malignant, Ultrasound, Ovarian crescent sign, Laparoscopy

Introduction

In prepubertal and adolescent girls ovarian preservation implies preserving the ovaries affected by tumors and torsions during surgical treatment, to maximize future fertility. Several studies on diagnostic protocols for evaluation of adnexal masses in young patients reported different preservation rates, with a significant number of uncomplicated functional cysts that were managed surgically.[1−4] The Morphology Index (MI), on the basis of tumor volume and structure, was devised by Ueland and coworkers, first for adult women and later, with a different cutoff point of 7 or more on the MI, for girls and adolescents.[5,6] This index assists in distinguishing benign adnexal masses from malignant ones, but also in cases of torsion, although the latter rarely accompanies malignancy.[6−8]

However, it is important to detect whether normal ovarian tissue is present, surrounding the cyst or tumor, indicated by the presence of the so-called "ovarian crescent sign" (OCS) at ultrasonography. The initial reports showed that the presence of this morphological sign, detected using ultrasound, had the potential to become a simple and effective way of excluding an invasive ovarian malignancy in adult patients, although the OCS might be present in neoplasms with borderline malignancy and in ovarian metastases in adults.[9] The value of the OCS in young patients was only reported in a few articles.[10,11]

The aim of our study was to develop a new decision tree system (DTS) for the management of adnexal masses in prepubertal and adolescent girls. When designing our system, we expected it to be helpful: (1) in distinguishing between benign and malignant adnexal masses; (2) in preserving more ovarian tissue during surgery of ovarian tumors and torsions; and (3) in reducing the rate of surgical management of noncomplicated ovarian cysts.

Materials and Methods

This prospective diagnostic observational study included all patients with adnexal pathology referred to the Department of Pediatric and Adolescent Gynecology between January 1, 2006, and December 31, 2015 (Fig. 1). All subjects were younger than 19 years of age at the time of admission. Informed consent was obtained from patients and/or their parents. The study was approved by the Clinical Research Committee of the Mother and Child Health Care Institute of Serbia 'Dr Vukan Čupić.' We followed the guidelines presented in the standards for the reporting of diagnostic accuracy.[12]

All patients underwent a pelvic ultrasound examination; 2 different ultrasound machines were used in the period from 2006 to 2011: Medison Sonoace 8000 SE and Esaote MyLab 50 X vision; after 2011, only General Electric Voluson E was used; all were equipped with transabdominal or transvaginal probes. Transabdominal ultrasound examination was performed in all patients. In cases for which OCS presence could not be clearly discerned on transabdominal examination, an additional transvaginal ultrasound examination was performed in patients with a history of sexual activity, and transrectal ultrasound in 27 adolescent patients who had no sexual activity. The diameter of each

mass was measured in 3 perpendicular planes, and the mass volume was calculated according to the formula (length $\times$ height $\times$ width $\times$ 0.523).[5] Ovarian volumes greater than 10 cm^3 for premenarchal and greater than 20 cm^3 for postmenarchal patients were considered to be abnormal.[6] Morphological analysis was performed using the index proposed by Ueland.[5,6] Mass volume and structure were each scored from 0 to 5 (Table 1). The sum of the 2 values yielded the MI, with the total number of points ranging from 0 to 10 for each tumor. All ultrasonographers, each with more than 10 years of experience with ovarian masses (Z.B.S., I.M., S.P., and K.S.), were obliged to investigate and report the presence or absence of normal ovarian tissue surrounding the mass—the OCS.

DTS

Rule 1 of the DTS: asymptomatic patients having an adnexal mass with an ultrasound finding of a MI of 4 or less with OCS present, were managed expectantly. At the follow-up examination 4-6 weeks later, if normal ovarian tissue was still present, the patient remained asymptomatic and there was no increase in the volume of the mass, the adnexal mass was classified as benign. Moreover, adnexal masses that resolved spontaneously were classified as being
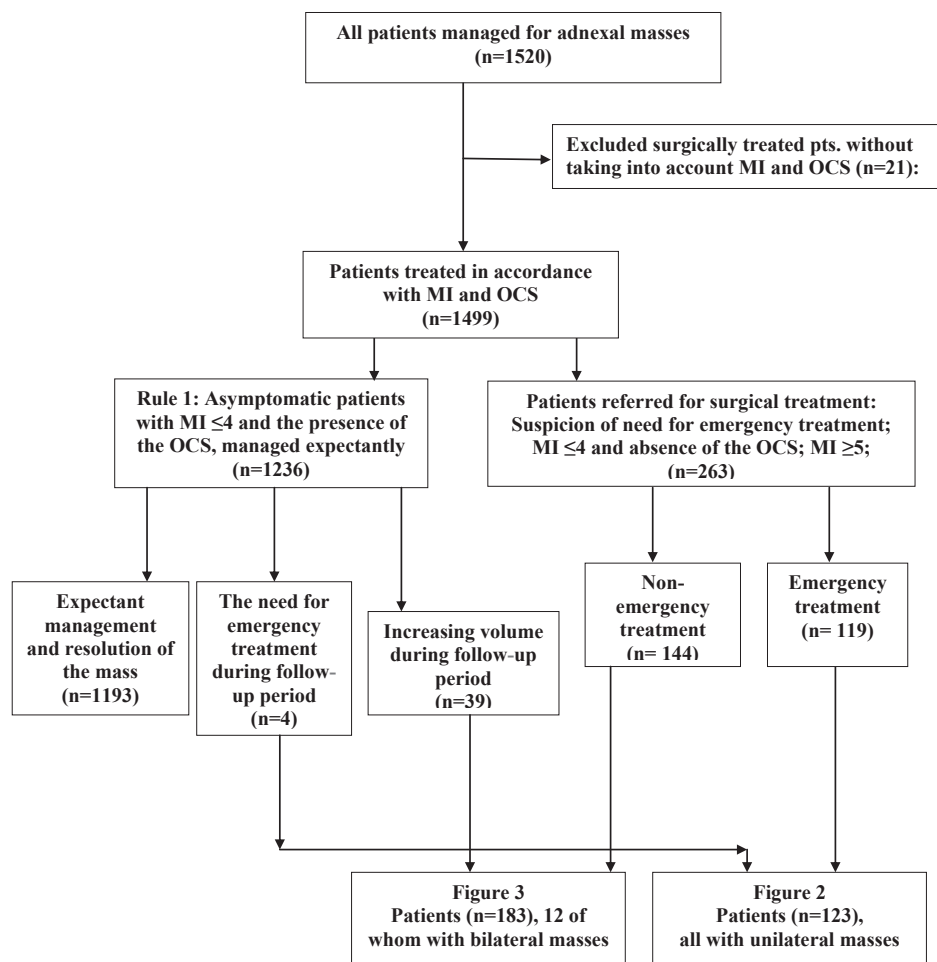

Fig. 1. Flow-diagram of all patients managed. The DTS rule 1: Asyptomatic patients having an adnexal mass with MI ≤ 4 and the presence of the OCS could be managed expectatntly. MI, morphology index; OCS, ovarian crescent sign; pts, patients.