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Pathognomonic echo patterns of benign cystic teratomas of the ovary: classification, incidence and accuracy rate of sonographic diagnosis

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ABSTRACT

The great variability in the sonographic appearance of ovarian cystic teratomas poses difficulties for their diagnosis and classification. To overcome such difficulties, we have proposed a simplified classification of the pathognomonic echo patterns of ovarian cystic teratomas based on three basic types of echo pattern. In a prospective study of 118 echogenic adnexal masses, with postoperative histological confirmation, this classification enabled the correct diagnosis to be made in 115 cases (accuracy rate, 97.45%). In the three cases misdiagnosed preoperatively as ovarian cystic teratoma, the tumors proved to be benign and included a serous cyst adenoma, a serous cyst adenofibroma and a Brenner tumor. We suggest that, with our proposed classification of the echo patterns of ovarian cystic teratomas, sonography can become a quick and accurate tool in the recognition of this condition .

INTRODUCTION

Ovarian cystic teratomas have a variable appearance on sonography, owing to their heterogeneous histological structure[1]. Because of the virtually limitless combinations of the different tissues in teratomas, their patterns can mimic a number of pathological pelvic masses[2]. Therefore, the interpretation of the sonographic data in terms of tissue characterization and the ascertainment of a particular pattern, as an ovarian cystic teratoma, may sometimes be confusing.

With the refinement of ultrasound technology and increasing experience, sonographic signs characteristic of ovarian cystic teratoma have been recognized, and knowledge about pathognomonic patterns has accumulated. The latter include dermoid plug[3], 'tip of an iceberg'[4], fat–fluid level[5], cysts with pearl gray appearance[6] and, recently, dermoid mesh[7].

The multitude of possible echo pattern combinations in ovarian cystic teratoma has led to the creation of several comprehensive and detailed classifications and diagnostic guidelines[6,8]. However, in some cases sonographers may be overwhelmed by this wealth of data and be deterred from making a conclusive diagnosis. Based on these sonographic signs and on our clinical experience of 10 years, we propose a simpler classification of the pathognomonic echo patterns in ovarian cystic teratoma, and the classification was tested in 105 patients with echogenic adnexal masses. The aim of the present paper is to present this new classification and to ascertain its feasibility in the sonographic detection of ovarian cystic teratoma.

MATERIALS AND METHODS

The study population consisted of 105 women aged 17–73 years (mean 36.8 years), in whom 118 echogenic adnexal masses suspected to be ovarian cystic teratoma were detected sonographically, removed surgically and verified histologically, from 1985 to 1994. The women were selected from the general population of patients referred to our ultrasound unit for gynecological indications, who met our criterion for suspected ovarian cystic teratoma, i.e. the presence of one or more of the basic echo patterns described below. The characteristic echo patterns were classified into three major groups (I–III). The first was further divided into three subgroups (Ia, Ib and Ic), which are distinguished by an echogenic zone that may be totally or partially visible.

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Ia An echogenic mass in which the borders of the tumor (including the one distal to the transducer) are clearly visible (Figure 1).

Ib An echogenic mass in which most of the tumor is visible, except its distal border (Figure 2).

Ic An echogenic mass in which only the border of the tumor proximal to the transducer is seen, producing a 'tip of an iceberg' effect (Figure 3).

II The presence of echogenic particles in a hypoechoic medium, creating a 'mesh-like' appearance within the tumor (Figure 4).

III A cyst with fat–fluid level (Figure 5).

The different types of echo patterns are depicted schematically in Figure 6. Some of the patients were evaluated initially in our ultrasound unit, and others were referred to us for further evaluation. All those suspected of having ovarian cystic teratoma were eventually examined sonographically by one of the authors (B.C.).

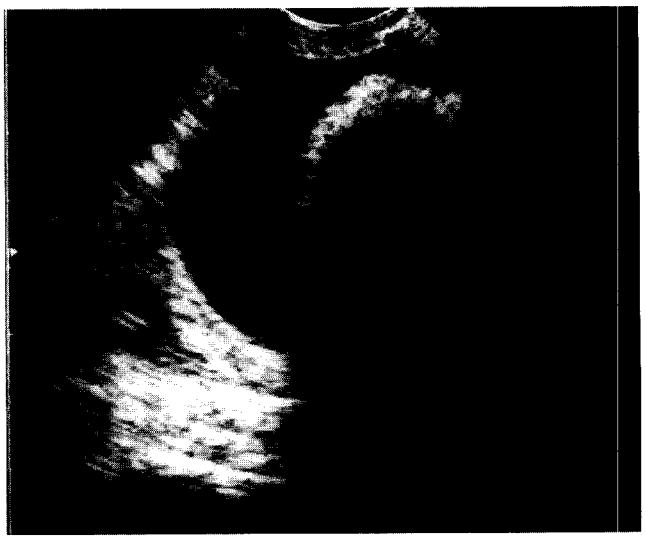

Figure 3 An echogenic lesion producing intense acoustic shadow in a cystic adnexal mass containing low-level echoes. Only the proximal border of the echogenic lesion is seen – 'iceberg effect' (classified as type Ic)

Figure 1 An echogenic lesion in the ovary. Borders are clearly visible (classified as type Ia)

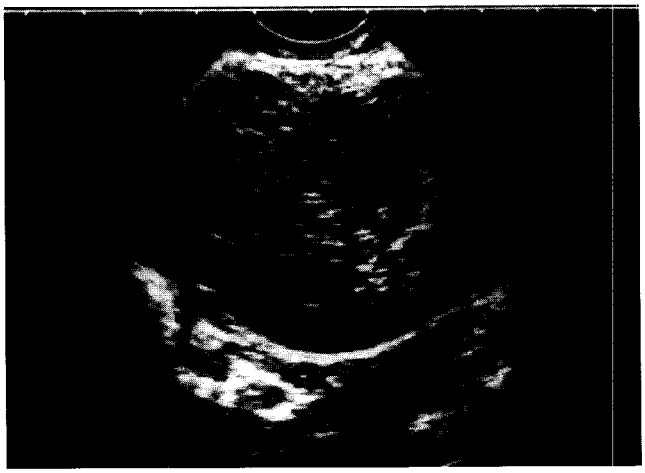

Figure 4 A cystic adnexal mass filled with irregular echogenic lines – 'dermoid mesh' (classified as type II)

Figure 2 An echogenic adnexal mass. Most of the mass is visible, except for its distal border (classified as type Ib)

Figure 5 A cystic adnexal mass with sharp demarcation between highly echogenic phase and fluid containing low-level echoes (classified as type III)

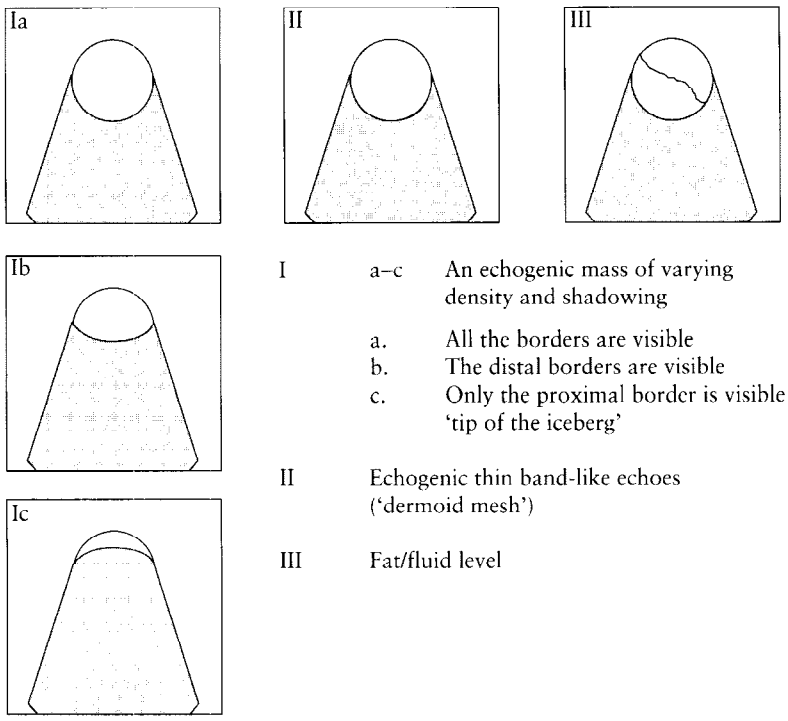

Figure 6 Schematic depiction of the basic pathognomonic echo patterns of ovarian cystic teratoma

The presence of each of the above echo patterns was recorded, as were associated non-echogenic cystic structures (simple cyst) and/or acoustic shadow, produced by the echogenic part of the suspected adnexal mass. A video print of each of the suspicious masses was made at the time of the sonographic examination. The ultrasound machines used were General Electric RT-3000 (abdominal transducer, 3.5 MHz, vaginal transducer, 5 MHz) or Toshiba–Tosbee (abdominal transducer, 3.75 MHz, vaginal transducer, 5 MHz) and ATL Ultramark 4 plus (abdominal transducer, 3.5 MHz, vaginal transducer, 5 MHz).

RESULTS

A total of 118 echogenic adnexal masses in 105 women were sonographically diagnosed as ovarian cystic teratomas (13 (12.4%) had bilateral lesions). During surgery, 120 lesions were found; bilaterality was undetected by sonography in two patients (1.8%) owing to the juxtaposition of the tumors. The masses ranged in size from 12 to 135 mm (mean, 59 mm). Histological examination confirmed the preoperative sonographic diagnosis based on our criteria in 115 of the 118 lesions (accuracy rate 97.45%). The three lesions misdiagnosed as ovarian cystic teratomas were all benign unilateral tumors: serous cystadenoma, serous cystadenofibroma and Brenner tumor (Figure 7–9, respectively). It is beyond the scope of the present report to describe the detailed histological findings for each lesion.

Figure 10 shows the frequency of each echo pattern among the 115 histologically proven ovarian cystic teratomas. Group Ib, in which most of the echogenic mass is visible except the distal border, had the highest incidence – 69/115 (60%). Group III (fat–fluid level) was the least often noted, appearing in only 4/115 patients (3.4%). Acoustic shadowing, which can accompany all types of echo patterns, was present in 94/115 tumors (81.7%), and associated hypoechogenic cystic components (simple cyst) were present in 37/115 (32.2%).

Table 1 denotes the number of echo patterns found in each mass. In only 58/115 (50.4%) was a single echo pattern observed. In each of the remaining cases, 57/115 (49.6%), more than one echo pattern was found.

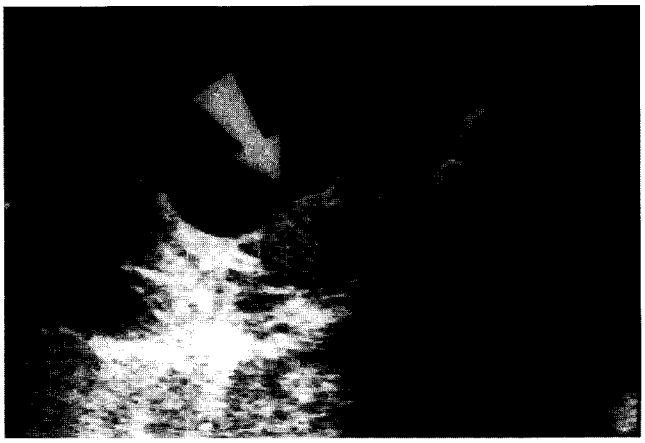

Figure 7 Echogenic adnexal mass diagnosed by sonography as ovarian cystic teratoma type Ia and found to be serous cystadenoma on histology

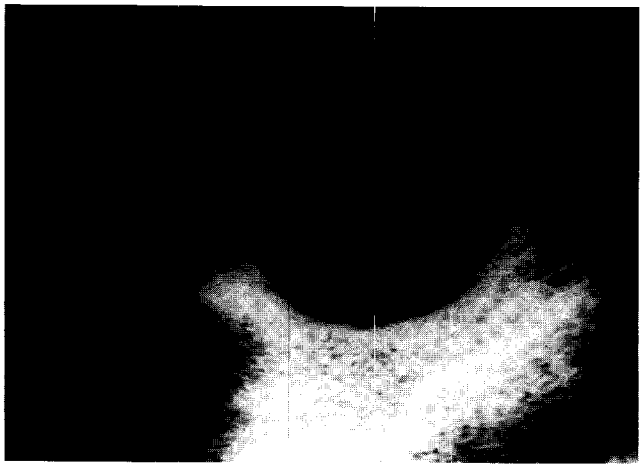

Figure 8 A cystic adnexal mass containing echogenic strands diagnosed as dermoid type II (dermoid mesh). Histology was consistent with a serous cystadenofibroma

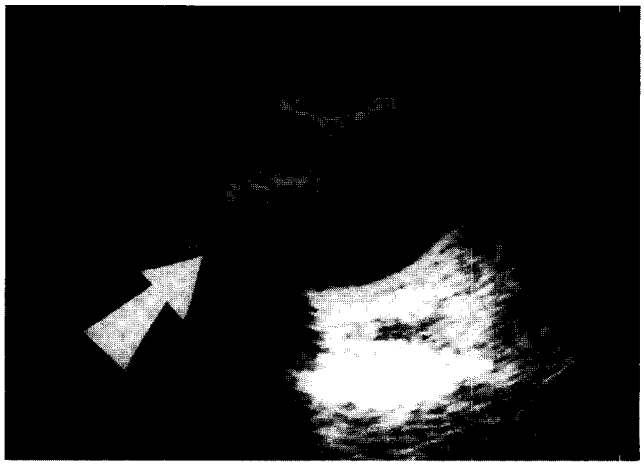

Figure 9 A cystic adnexal mass containing an echogenic lesion with strong acoustic shadow (arrow) diagnosed as dermoid type Ib. Histology was consistent with a Brenner tumor

Echo-pattern	Type I a	Type I b	Type I c	Type II	Type III
Number of cases	56	69	31	24	4
Accompanying (a) acoustic shadow	A total of 94 cases				
Accompanying (a) cystic structure	A total of 37 cases				

(a) can be associated with all of the above types or any of their combinations.

Figure 10 The distribution of echo patterns in 115 cases of ovarian cystic teratoma. As more than one pathognomonic echo pattern can be encountered in each case, the total number exceeds the 115 cases that had postoperative verification

Table 1 The number of pathognomonic echo patterns in each of the 115 cysts

	Number of echo patterns				
	1	*2*	*3*	*4*	*Total*
Number of cysts	58	46	10	1	115

DISCUSSION

Ovarian cystic teratoma is a common tumor[6,9], accounting for up to 25% of all ovarian neoplasms. It is known to have a variable appearance because of the variety of tissues contained within it and this complicates the preoperative ultrasonographic diagnosis[9].

Based on the different criteria for ultrasonographic identification[3–7], the reported accuracy rate of sonography in the preoperative diagnosis ranges between 50 and 85%[10,11]. Since the full spectrum of sonographic appearances of ovarian cystic teratoma has only gradually become known, early publications claimed an accuracy rate of as low as 50%[10]. With instrumental refinement and increasing experience in the last decade, preoperative diagnostic accuracy has greatly improved, to the point that Bronshtein and colleagues[9] were able correctly to diagnose 25 of 25 patients with the tumor.

In our study, using a larger sample of 118 cases, the preoperative diagnostic accuracy rate was 97.45%. Although ovarian cystic teratoma manifests multiple sonographic appearances, the features most characteristic are bright echoes and shadowing[12]. Our findings demonstrated a single echo pattern in 50.4% of cases, and more than one in the remainder. Acoustic shadowing, which can accompany all types of echo pattern, was observed in 81.7% of cases. Non-pathognomonic hypoechoic cystic structures (simple cyst) were present in 32.2%. It is not surprising, therefore, that the sonographic appearances of ovarian cystic teratoma have been described as 'virtually limitless combinations' of different echo patterns[2]. Based on our

experience, our classification seems to be simple (fewer components) and presents a clearer definition of the components (basic elements rather than a descriptive combination of echo patterns) compared to previously proposed classifications[6,8]. We suggest that the pathognomonic features of ovarian cystic teratoma can be broken down to three basic, simple and clearly defined echo patterns, all of which have been described separately in the literature[3–7]. The presence of an acoustic shadow, when concomitantly present with one of these typical echo patterns, should further strengthen the sonographic diagnosis of ovarian cystic teratoma.

In light of the generally benign nature of this tumor[6], we did not, in contrast to earlier studies[9,11], address its malignant potential. Doppler studies were not performed on the women suspected of having ovarian cystic teratoma by sonography, mainly because until recently we did not have the necessary equipment. Doppler studies were, however, added to the evaluation in the last few cases and, in all, the Doppler resistance index was within normal limits (> 0.4[12]). Our goal in this study was to assess the accuracy of our classification system in sonographically, and hence preoperatively, predicting the presence of ovarian cystic teratoma. For this purpose, the correlation between the preoperative sonographic diagnosis and the eventual postoperative histological findings was examined. The advantages of this classification are its simplicity and accuracy (97.45%). No malignancy was found, even in the three cases in which the sonographic diagnosis of ovarian cystic teratoma was false.

In conclusion, we suggest a new simple classification of the pathognomonic echo patterns of ovarian cystic teratoma. It seems to resolve the confusion regarding the variable sonographic presentation of this tumor and demonstrates a high diagnostic accuracy rate.

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