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Adnexal masses in pregnancy: perinatal impact

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Abstract

The incidence of adnexal masses in pregnancy has increased significantly over the last decades and this is mostly because of the widespread use of ultrasound for pregnancy surveillance. Although a clear majority of adnexal masses found in the first trimester are functional cysts, which have a small diameter and disappear spontaneously, those that do persist into the second and third trimester require ultrasound surveillance for proper management. The presence of a large adnexal mass in the third trimester of pregnancy represents solid grounds for delivery *via* Caesarean section (C-section) both because of the risk of dystocia and the advantage of one-step approach of cystectomy/ oophorectomy at the time of C-section. This is a retrospective study of all the third trimester pregnancy related adnexal masses that delivered in our Hospital in the last 10 years *via* C-section where cystectomy was also performed. Our aim was to look at the histological type of ovarian mass and to compare our results to those previously published by other authors. We also wanted to see whether the clinical suspicion based on prenatal ultrasound aspect, where this was available, was similar to the postnatal histology report. Secondary outcomes were gestational age at delivery, fetal weight and Apgar score. We found that dermoid cysts are the most common type of adnexal mass with an incidence of 46%, followed by mucous cysts 27%, serous cysts 18% and endometrioses 9%, which is consistent with the data published by other authors in larger series. In terms of prenatal clinical diagnosis, detailed ultrasound assessment of the ovarian mass was available only in less than half of these cases, but in these, the clinical suspicion was confirmed by histology report. In our series, we had no case that required premature delivery because of adnexal mass-related complications and fetal outcome was very good with normal birth weight and high Apgar score. Although this is a small series of cases, it confirms the incidence previously published of the different histological types of ovarian tumors. It also shows that fetal outcomes are very rarely affected by the presence of ovarian masses and premature iatrogenic delivery for maternal well-being is the only note wordy one of them.

Keywords: adnexal mass, ovarian cyst, ovarian teratoma, pregnancy.

Introduction

Ovarian masses in pregnancy have been the subject of dispute amongst gynecologists for the span of more than 20 years. A turning point in the diagnosis and management of adnexal masses has been the introduction of routine first trimester ultrasound, which enabled early detection of ovarian cysts. The record of size and morphological aspect enabled clinicians to accurately follow-up these lesions both in terms of size growth and changes in shape, content and borders aspect. Also, it is only after the first trimester ultrasound examination has become part of standard protocols in developed countries, that the incidence of adnexal masses has increased reaching 1–4% according to recent data [1, 2]. A recent review of over 10 000 pregnancies found than 5.3% of the population had an ovarian simple cyst measuring more than 3 cm in the first trimester and at follow-up only 1.5% persisted beyond the first trimester of pregnancy [3].

Unfortunately, in our country there are no such national policies as a routine first trimester ultrasound scan. The scarce numbers of women that do get scanned between 11–14 weeks of pregnancy do it in a private setting where record of data is inconsistent and un-reproducible amongst different clinics. Two other main issues arise: one is that most sonographers are not thought to examine the ovaries as part of the routine first trimester scan and often there is no record about their size and appearance; the other is that women are inconsistent in terms of the place and person that does the follow-up scans, thus introducing more inaccuracy in the equation. It is therefore obvious that the incidence of ovarian cysts in pregnancy in our country is much less than what is reported in the literature and a retrospective study of management of adnexal masses is impossible considering that most of these remain undiagnosed throughout the pregnancy and the only management is the natural history of expectant management.

The ultrasound features of ovarian masses can help with the differential diagnosis and whilst most of these masses are simple functional cysts with spontaneous resolution, those that do persist beyond the first trimester could be managed according to their ultrasound aspect and behavior. Ultrasound features that raise the suspicion of a borderline or malignant tumor are: size greater than 7 cm,

irregular borders, rapid growth, papillary like projection, internal septation, bilaterally, solid components or heterogeneous/complex appearance, ascites, increased vascularity. It should be noted that the risk of malignancy in pregnancy is reported as low as 5% [4]. The different adnexal masses during pregnancy include: dermoid (37.4%), endometrioma (14%), *corpus luteum* cysts (12.1%), complex cysts (10.3%), hydrosalpinx (8.4%), and malignant neoplasms (0.9%) [5].

The aim of this study was to look at the histopathological (HP) type of ovarian masses found in the third trimester of pregnancy and removed at the time of Caesarean section (C-section). We also want to see whether the clinical suspicion based on prenatal ultrasound aspect of the tumor matched the final HP results. The secondary outcome will be fetal well-being reflected by gestational age (GA) at delivery, fetal weight and Apgar score.

Patients, Materials and Methods

This was a retrospective study conducted at "Polizu" Hospital, "Alessandrescu–Rusescu" National Institute for Healthcare of Mother and Child, Bucharest, Romania. Records of the pregnant patients who were diagnosed with an adnexal mass at the time of C-section were evaluated from ward, operation and delivery records from January 2000 to May 2017. Data collected included age, gravid, GA at delivery, intra-operative aspect, type of surgery, histopathology of tumor and pregnancy outcome. All data were noted and analyzed.

All the excised tumor structures were sent to the laboratory of pathological anatomy for the HP study and diagnosis. The HP aspects were observed on pieces fixed in formalin, included in paraffin and stained with Hematoxylin–Eosin (HE) or with the Goldner–Szekely (GS) green light trichrome.

Results

Between January 2000 and May 2017, in our Hospital there were 58 820 deliveries, out of which 20 736 C-sections. There were 11 cases of adnexal masses, where cystectomy or oophorectomy was performed at the time of C-section (Table 1).

Table 1 – ***Summary of case series***

Histopathology type	Age [years]	Date	Known cyst	Indication for Caesarean section	Intraoperatory findings	Operative technique	Gestational age [weeks]	Birth weight [kg]	Apgar score
Dermoid	27	2008	Yes	Previous CS	RO: mucous cyst, 7/6 cm	Cyst removal	38	3200	9
Dermoid	31	2010	No	Breech	LO: cyst, 4/3 cm	Cyst removal	38	2450	8
Endometrioma	33	2010	No	Placenta praevia	LO: cyst, 3/3 cm, brownish	Adnexectomy	38	3300	8
Mucous cyst	31	2010	No	Previous CS	RO: mucous cyst, 5/5 cm	Cyst removal	38	3550	9
Mucous cyst	31	2011	No	Failure to progress	LO: cyst, 8/6 cm, breaks spontaneously, mucinous	Adnexectomy	39	3500	9
Serous cyst	35	2011	No	Fetal distress; DCDA	RO: cyst, 10/14 cm, clear wall, yellow	Cyst removal	29	850	7
Dermoid	30	2012	Yes	Large ovarian mass: neoplasm suspicion	LO: 20/16 cm, mixed consistency, thick walls	Adnexectomy	37	3000	9
Serous cyst	27	2013	No	Previous CS	LO: cyst, 5/3 cm, clear yellow	Cyst removal	40	3000	7
Dermoid	44	2014	Yes	Fetal distress	RO: cyst, 6/4 cm, thick walls	Adnexectomy	30	850	6
Dermoid	27	2017	Yes	Large ovarian cyst: malpresentation	RO: 8/4 cm, mixed consistency	Adnexectomy	40	3240	8

CS: Caesarean section; RO: Right ovary; LO: Left ovary; DCDA: Dichorionic diamniotic twins.

Maternal ages varied between 27–44 years (mean age 31.3 years). There were only four patients who had been diagnosed antenatal with ovarian masses, 50% of these being in the last year of the study group. The size of the cysts ranged from 3 cm (an endometrioma) to 20 cm (a dermoid cyst), with an average diameter of 12.4 cm. In all cases, inspection of the ovaries was carried out intraoperatively by the main surgeon and the main intention was for cyst removal with immediate HP examination. There was one case with bilateral cysts. In 54% of cases (six out of 11), cystectomy was not feasible and the decision to perform an ovarectomy was taken. The main reasons were large cyst that incorporated the entire ovary leaving no spare healthy tissue for reconstruction, bleeding after cystectomy and adherences. Regarding the HP results, the majority were dermoid cyst (46%), mucous cyst (27%), serous cyst (18%), endometrioma (9%) (Figure 1). We did not have any case of borderline or malignant tumors.

The indication for C-section was diverse ranging from previous C-section during labor (LCS), breech presentation, fetal distress and failure to progress. Interestingly however is that, out of the four cases that had been diagnosed prenatally, three had an indication for Caesarean delivery

because the location and size of the tumor that impeded normal labor (two cases – Nos. 10 and 11), and one had an ultrasound morphology which raised the suspicion of malignancy. The latter was proved to be a dermoid cyst.

Regarding fetal outcome, the GA at delivery varied between 29–40 weeks (mean GA was 36.8 years) and the fetal weight varied between 850–3550 g (mean birth weight 2694 g). The lowest GA and birth weight was a twin pregnancy complicated by premature rupture of membranes and fetal distress. Additionally, there was another case with severe only onset fetal growth restriction that had iatrogenic preterm delivery because of worsening Dopplers. If these two cases were to be removed from our statistics in terms of fetal outcome, then the mean GA at deliver would become 38.4 weeks and the mean birth weight would be 3104 g, which is consistent with our national average.

In our series, just four cases had prenatal diagnosis of adnexal masses. Three-dimensional (3D) reconstruction was used to render the ovarian mass and also to show the inside aspect of the cyst (Figure 2). One was lost to follow-up because there were no records about the ultrasound aspect of the mass. The case from 2012 identified prenatally was the largest cyst in our series. The records show that the cyst was growing especially in the third trimester and that the borders were thick but uneven and there were intra-cystic solid and mixed echoes. The suspicion of malignancy was raised and this constituted the indication for C-section. The patient was counseled at that time about the risk of malignancy and the need to perform wide pelvic surgery. The remaining two cases were from 2017 and both had large adnexal masses that were impacted in the pouch of Douglas (*tumor praevia*) making normal labor impossible. In both cases, the patients were diagnosed with ovarian cyst prior to pregnancy and were follow-up for growth and ultrasound morphology.

In our cases, the benign cystic teratomas showed areas of skin and its appendages, cerebrum, choroid plexus, respiratory epithelium and fatty tissue (Figures 3–8).

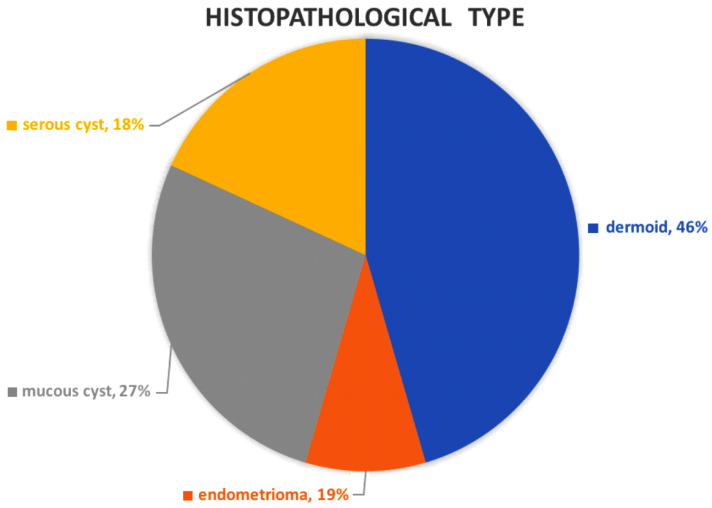

Figure 1 – ***Incidence of histopathological type of ovarian tumors in our case series.***

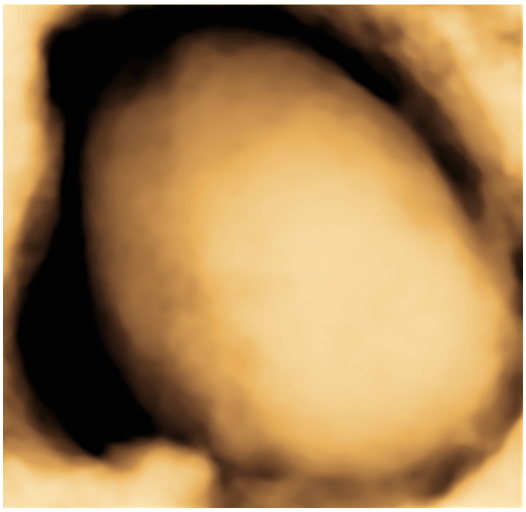

Figure 2 – ***3D inversion rendering of a large adrenal cyst in a 25 weeks pregnancy.***

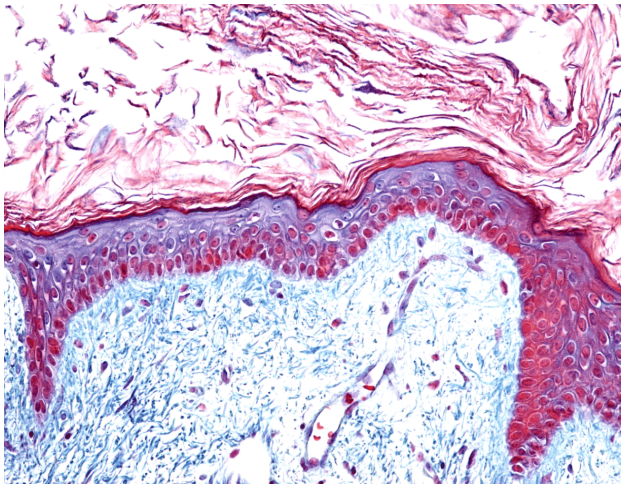

Figure 3 – ***Skin structure in the ovary stroma. There may be observed the presence of a well-structured epidermis, with a heterogeneous corneous layer and a superficial dermis with numerous blood vessels and collagen fibers (GS trichrome staining, ×100).***

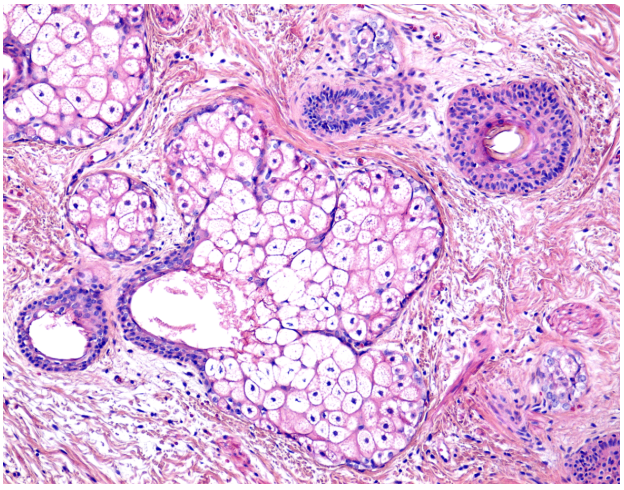

Figure 4 – ***Fibers of hair and sebaceous glands present in the teratoma structure (HE staining, ×100).***

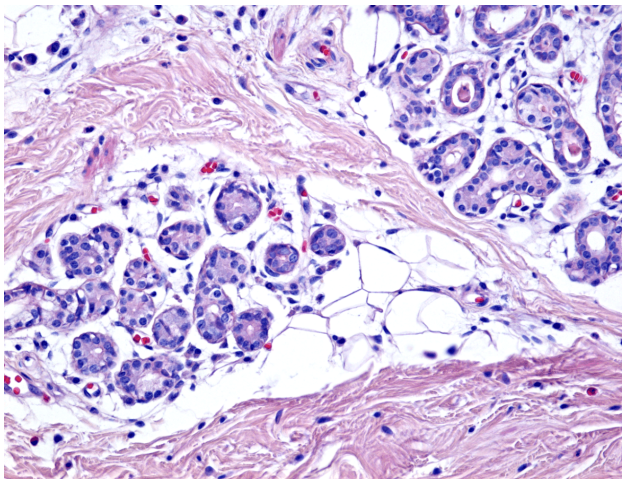

Figure 5 – ***Image of sweat glands, collagen fibers and adipose tissue in the teratoma structure (HE staining, ×200).***

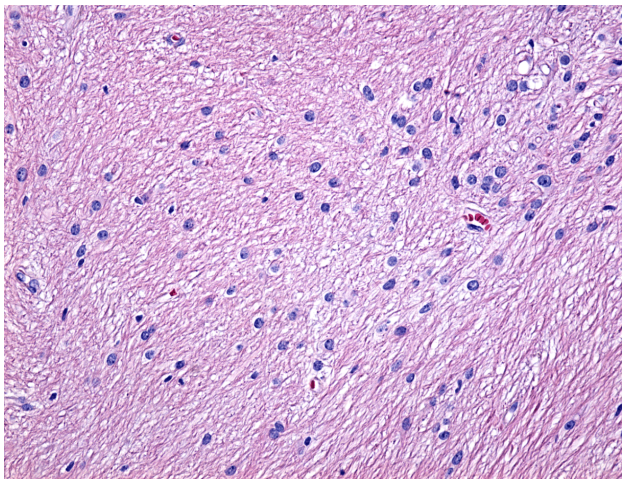

Figure 6 – ***Extended area of mature glial cells (HE staining, ×200).***

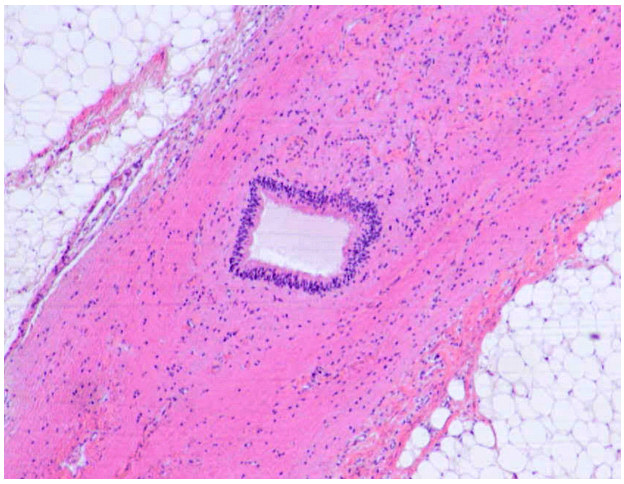

Figure 7 – ***Mature glial tissue with ependymal cells (middle) surrounded by adipose tissue (HE staining, ×40).***

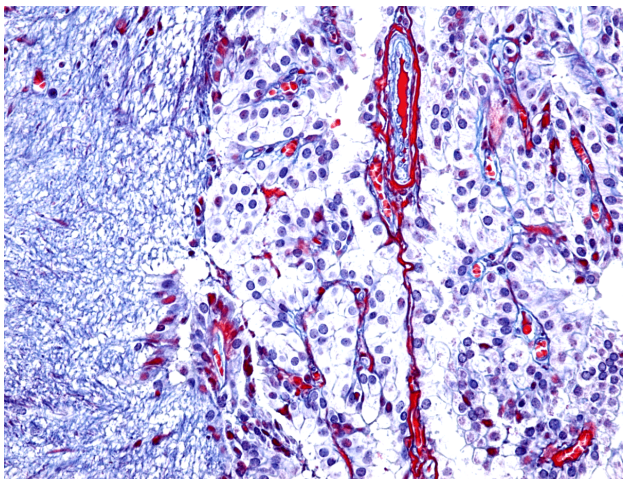

Figure 8 – ***Image of choroid plexus on the surface of a nervous tissue formed of glial cells (GS trichrome staining, ×200).***

Discussions

The most common adnexal masses found in pregnancy are dermoids, followed by cystadenomas. Leiserowitz (2006) found a 0.93% incidence of ovarian malignancy in pregnancy [1]. In this cohort, 51% were epithelial (both malignant and borderline), 39% were germ cell tumors and were primarily dysgerminomas and malignant teratomas. The lower stage and higher proportion of germ cell tumors are in line with the generally younger age of pregnant women [1] (Table 2). Zanetta *et al.* (2003) showed that ultrasound could be used to differentiate between benign and borderline/suspicious of malignancy ovarian masses and that management could be adjusted as such [6]. Similarly, other studies have shown that the more complex a mass is on ultrasound (septations and solid components), the higher the risk of malignancy [7].

The management of asymptomatic ovarian cysts during pregnancy has raised much debate amongst gynecologist: on one hand, the risk of rapid growth of some cysts raises the possibility of rupture or torsion, or development of extragenital complications, most often grade II/III uretero-hydronephrosis, caused by cyst compression [8], and therefore, removal of such cysts by laparoscopy could potentially be beneficial. However, on the other hand, several studies have showed that the incidence of preterm labor and preterm birth was higher in the group of women who underwent surgery compared to the observational group [9]. Whitecar *et al.* (1999) found that adverse pregnancy outcomes, including preterm deliveries and fetal loss were noted in half of the patients who underwent laparotomy during the third trimester [2]. This was significantly less frequent if laparotomy occurred before 23 weeks GA.

Table 2 – ***Major histology types of ovarian tumors***

Benign	Malignant
Corpus luteum	Germ cell tumors
Simple cyst	Epithelial tumors
Hemorrhagic cyst	▪ Low malignant potential ▪ Invasive
Dermoid	
Cystadenoma	Sex cord stromal tumors
Endometrioma	
Pedunculated fibroid	
Ovarian hyperstimulation	
Hydrosalpinx	
Paraovarian/tubal cyst	
Theca lutein cyst	

In the last two decades, the use of high frequency transvaginal probes has allowed a step forward in the accurate definition of cystic masses. Ultrasound not only increases the number of cystic masses detected, but also allows distinguishing with sufficient accuracy those cysts that are simple, those that are unlikely to be malignant and even those that are likely to be of borderline nature and thus may be managed by delayed surgery. In addition, repeat ultrasound examination allows early detection of progressive enlargements and changes in the morphology of the mass, leading to prompt surgical management. Husseinzadeh *et al.* (2012) summarized the main ultrasound morphological aspects of ovarian masses [10], the main aspect being adapted in Table 3.

Table 3 – ***Stratification of malignancy risk of ovarian tumors based on ultrasound appearance***

Low risk	Intermediate risk	High risk
Size ≤5 cm	Size 5–10 cm	Size >10 cm
Cystic	Cystic or complex	Complex or solid
Unilocular	Unilocular or multilocular	Multilocular
Smooth wall	Thick wall without nodularity or papillary projections	Thick wall with nodularity or papillary projections

Small ovarian cysts (<4 cm) diagnosed in the first trimester of pregnancy are usually functional cysts. [11] The consensus amongst gynecologists is expectant management for such masses due to the high spontaneous resolution. Large ovarian cysts (measuring more than 4 cm) are at high risk of complications such as torsion, rupture, infarction and intra-cystic hemorrhage, which could lead to acute abdominal pain and emergency surgery [12]. Traditionally these lesions were managed surgically during the second trimester by laparotomy and more recently laparoscopy. The wide use of ultrasound in pregnancy has increased the detection rate of adnexal masses and together with high-resolution transvaginal scans and color Doppler, the clinician can guide the diagnosis towards a clearer morphological type. Having the advantage of ultrasound surveillance by monitoring mass growth with serial scans and studying the morphology of such lesion has opened the window towards expectant management of ovarian masses, thus reserving surgery only for those lesions that are suspicious.

The risk of rupture and torsion remains debatable in terms of management of ovarian masses. The risk of spontaneous rupture is small and is mostly found in cases of functional cysts or rapidly growing malignancies. Benign ovarian cysts are more likely to rupture following an abdominal trauma. In terms of the risk of torsion in pregnancy, this is also low, considering that the rapidly growing uterus reduces the mobility of the adnexa.

Katz *et al.* (2010) [12] conducted a study between 1988–2007, which comprised a total of 212 114 deliveries, out of which 93 presented with benign ovarian cysts. Most the lesions were benign cystadenoma (41.9%), followed by dermoid cysts (36.7% of cases) and adenofibroma (11.8% of cases), diagnosed primarily during the C-section in 76.3% of cases. In the rest of the cases, the diagnosis was established by ultrasound performed during the regular check-ups (12.9%) or before the pregnancy (10.8%). Dermoid cysts were diagnosed in a great number of cases at a mean diameter of 6.09±3 cm. Ovarian dermoid cysts were significantly associated with fertility treatments [odds ratio (OR) 3.75, 95% confidence interval (CI)]. The presence of the cysts was also evaluated according to the maternal age, revealing that the patients with dermoid cysts were significantly older than those in perfect health. Also, no difference was shown between the group with benign ovarian cysts and the group without any abnormal findings regarding the perinatal outcomes measured through the Apgar score, congenital malformations, growth restriction and perinatal mortality. In what concerns the complications induced by the presence of the benign ovarian masses, which can have an even higher rate during pregnancy due to the increasing size of the uterus, the most common ones observed in the study were torsion, cyst hemorrhage and tumor praevia. However, regardless of these findings the course of treatment in these cases was conservative and consisted of regular ultrasound check-ups during pregnancy [12].

Caspi *et al.* (2000) [9] evaluated the adequacy of conservative management of ovarian cystic teratoma during pregnancy and labor through studying a cohort of 49 patients with dermoid cysts. In this group of patients, 68 pregnancies were diagnosed out of which four were miscarriages, one ended electively and the rest were carried to term. The clear majority of pregnancies ended in vaginal delivery (n=55), while the rest (n=8) were delivered by C-section. None of the complications usually attributed to ovarian dermoid cysts were noted in the patients included in the study. Another important finding was that the dimension of the ovarian teratomas did not increase during pregnancy, this leading to the valuable conclusion that ovarian dermoid cysts with a diameter of less than 6 cm are not expected to grow during pregnancy nor to endanger the pregnancy and labor. In cases with large dermoid cysts (>6 cm), the traditional course of treatment is exploratory laparotomy between 16 and 20 weeks of gestation, which enables the resection of the tumor. The major concern in these cases is ovarian malignancy followed by torsion, bleeding and obstruction of the birth canal [12]. Immunohistochemistry is useful in the difficult differential diagnosis of bilateral ovarian masses associated or not with pregnancy.

From the pathologist's perspective, mature cystic teratoma is often discovered as an incidental finding on imaging studies [13], or during abdominal surgery performed for other indications. Some tumors can be discovered at the time of C-section [14]. The gross pathological features of a teratoma are variable size – from very small (0.5 cm) to large (40 cm), more than 90% measuring less than 15 cm [13] –, usually cystic, typically unilocular but occasionally with two or more cysts [14]. The tumor is round, or globular, with a smooth and glistening external surface [13]. The cut surface of the tumor reveals a cavity filled with a mixture of hair and oily brown sebaceous material [14], and one or more round, solid nodule (Rokitansky's protuberances) composed predominantly of fat [14–16], surrounded by a firm capsule of varying thickness [13]. Macroscopically recognizable and well-formed teeth can be seen in one-third of the cases [13, 14]. Rarely, the tumors are predominantly solid with interspersed cysts [16].

Microscopically, the tumor is composed exclusively of mature tissues derived from the germ layers [16] (ectoderm, mesoderm and endoderm), with ectodermal elements predominating [13]. The outer side of the cyst

wall is composed of ovarian stroma [13], the inner side is lined mainly by keratinized epidermis with adnexal structures (hair follicles, sebaceous and sweat glands) [17]. Glial and peripheral nervous tissue, cerebrum, cerebellum, retina and choroid plexus, may also be encountered [15]. Mesodermal tissue is represented by bone, cartilage, smooth muscle, and fibrous and fatty tissue [13, 16]. Less common, the cyst wall may be lined by endodermal derivatives such as bronchial or gastrointestinal epithelium or can contain thyroid tissues and salivary glands [16]. A study of 100 cases of mature cystic teratomas showed that ectodermal structures were found in 100%, mesodermal in 93%, and endodermal in 71% of cases [18]. Frequently, a foreign body-type granulomatous reaction can be seen in association with hair or the epithelial contents of the cyst [19].

Conclusions

Our study results were similar to those previously published in terms of diagnosis, management options and fetal outcome in pregnancies complicated by adnexal masses. The nature of the cyst can be suspected based on its ultrasound characteristics, keeping in mind those features that are suggestive of malignancy: solid parts, irregular capsule, presence of ascites, rapid growth. The risk of malignancy is low and most of the tumors are borderline tumors or early stage carcinomas. In terms of fetal outcome, this study also showed that there is no difference in terms of fetal outcome in the group of women that had adnexal masses, when compared to the normal population. In conclusion, we agree with other authors that expectant management based on the clinical course of the cystic mass together with the wise use of ultrasound for the study of size and morphology is not only feasible but in fact is the best management in these cases.

Conflict of interests

The authors declare that they have no conflict of interests.

Author contribution

Nuți Daniela Oprescu and Crîngu Antoniu Ionescu equally contributed to the manuscript.

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