Uterine adnexal torsion: Pathologic and gray-scale ultrasonographic findings

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Summary

Introduction: Uterine adnexal torsion is a rare and potentially lethal condition that may arise most unexpectedly in women of any age. It may be partial or complete, the later often resulting in necrosis, gangrene and peritonitis if untreated. The purpose of the study was to determine the spectrum of the histologic and gray-scale sonographic pictures in a series of surgically proven cases of uterine adnexal torsion.

Methods: The study population for the pathologic analysis of twisted uterine adnexa included 92 patients with surgical confirmation of torsion of the uterine adnexa; all the patients were treated radically. All the pathology records were reviewed retrospectively over a 10-year period (from 1992 to 2002) by the coding of ovarian, fallopian tube or adnexal torsion. The gray-scale sonographic findings were analysed in 20 patients who underwent sonographic examination before surgery and adnexal torsion was confirmed at surgery.

Results: Neoplasms constituted 46% (42/92) and cysts formed 48% (44/92) of all the twisted uterine adnexa. Normal-sized twisted adnexa were found in five patients (5%) while in one patient simultaneous torsion of both normal fallopian tubes was found (1%). The prevalence of the twisted neoplasms was 16 mature teratomas, nine serous cystadenomas, five mucinous cystadenomas, three serous borderline carcinomas, two fibroma/thecomas, two mucinous borderline carcinomas, two malignant granulosal-stromal cell tumours, one malignant dysgerminoma, one immature teratoma and one clear cell adenocarcinoma. The twisted cysts were 18 serous cysts, 11 paraovarian cysts, nine corpus luteum cysts, three hydrosalpinges, one mucinous cyst and one endometrioma. In one case the torsion of the right ovary was due to hyperstimulation of the ovaries with gonadotropin therapy for IVF treatment. Gray-scale sonographic examination demonstrated cystic lesions in 80% (16/20), solid masses in 5% (1/20) and normal adnexa in 15%; cul-de-sac fluid was present in 55% (11/20). Laparotomy revealed reactive cul-de-sac fluid in ten of these cases (50%) and haemoperitoneum in one (5%).

Conclusion: Adnexal torsion is most commonly associated with benign processes (89%) and usually occurs in patients under 50 years old (80%). The spectrum of sonographic findings varies due to the adnexal pathology, the degree and the duration of adnexal torsion.

Key words: Adnexal uteri; Fallopian tubes; Ovarian neoplasms; Adnexal diseases; Torsion; Pathologic findings; Gray-scale; Ultrasound studies; Sonography.

Introduction

Torsion of the adnexa is an infrequent surgical emergency. The course of the disease may be subacute with initial venous and lymphatic obstruction, which produces oedema and adnexal enlargement. If the torsion becomes complete and untreated then necrosis, gangrene with generalized peritonitis and death may supervene [1, 2]. The clinical presentation of adnexal torsion is variable and depends on whether the torsion is complete, incomplete or intermittent with periods of spontaneous detorsion. The hallmark of the disease is pain. The pain may appear as an acute sharp constant pain, as a colic intermittent pain, or as a gradually increasing pain [3]. Therefore, the diagnosis of adnexal torsion is difficult, as the clinical symptoms are often misleading [4]. Sonography can aid in the preoperative evaluation of adnexal structures in patients with uterine adnexal torsion [1].

The purpose of this study was to determine the spectrum of pathologic and sonographic findings in a series of surgically proven cases of uterine adnexal torsion. The rates of torsion by tumour type in women ≥ 50 years of age were also examined in order to identify neoplasms with increased risk of torsion in these women.

Material and Methods

The study population for the pathologic analysis of twisted uterine adnexa included 92 patients with surgical confirmation of torsion of the uterine adnexa; all the patients underwent surgical intervention and were treated radically. All the pathology records from our departments were reviewed retrospectively over a 10-year period (from 1992 to 2002) by the coding of ovarian, fallopian tube or adnexal torsion. Moreover, the rates of torsion by tumour type in women ≥ 50 years of age were

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examined in order to identify neoplasms with increased risk of torsion in this age of women. Torsion of the previously normal adnexa was pathologically defined as that in which no other adnexal pathology such as cysts or tumours were found in the twisted adnexa.

Sonographic findings were analyzed in 20 patients who underwent sonographic examination before surgery and adnexal torsion was confirmed at surgery. The sonograms were reviewed retrospectively. The patient's bladder was full for the transabdominal sonography studies. Patients who were examined by transvaginal ultrasonography were instructed to partially void their bladder. In 16 of the 20 patients in whom the sonographic findings were analyzed retrospectively, transabdominal ultrasound examination was performed and in the remaining four patients transvaginal ultrasound examination. Virgins were examined transabdominally. The size, the presence of cul-de-sac fluid, the presence or absence of an underlying mass and the gray-scale characteristics of the mass (cystic, complex or solid) were examined. Complex masses were described when they consisted of solid and cystic components. Cysts were subdivided into (i) simple, (ii) with thick walls, (iii) with diaphragms, (iv) with papillary projections, (v) with internal echoes, and (vi) with mural nodules (dermoid cysts).

Results

The mean age of the 92 patients was 34.8 years (range 13-74 years). In our study the pathologic findings of the twisted uterine adnexa were analyzed in 18 patients over the age of 50 years; their mean age was 60.4 years (range 50-74 years). Adnexal torsion in teenagers occurred in seven patients; their mean age was 15.1 years (range 13-17). All the 92 patients presented with lower abdominal pain. The white blood cell count in our series was highly variable, ranging from normal rates to 24,200/mm^3. Pregnancy at presentation was associated in three patients (3.2%): two pregnancies were at the 8th week of gestation and one at the 15th week; in the last case, torsion of the ovary (right) occurred as a complication of hyperstimulation syndrome after gonadotrophin ovulation induction for IVF therapy. Following surgery the first two pregnancies continued uneventfully to term, ending in delivery of healthy infants; in the other pregnancy, which was complicated by hyperstimulation syndrome, cesarean section was performed at the 30th week of pregnancy because of preterm labor and two male newborns were delivered (weight 1,550 g and 1,560 g, respectively). Coexistence of left adnexal torsion secondary to a serous cyst and appendicitis was found in a 60-year-old patient.

Neoplasms constituted 46% (42/92) and cysts formed 48% (44/92) of all the twisted uterine adnexa. Normal-sized twisted adnexa were found in five patients (5%), while in one patient simultaneous torsion of both normal fallopian tubes was found (1%). The prevalence of the twisted neoplasms was 16 mature teratomas, nine serous cystadenomas, five mucinous cystadenomas, three serous borderline carcinomas, two fibroma/thecomas, two mucinous borderline carcinomas, two malignant granulosal-stromal cell tumours, one malignant dysgerminoma, one immature teratoma and one clear cell adenocarcinoma. The twisted cysts were 18 serous cysts, 11 paraovarian cysts, nine corpus luteum cysts, three hydrosalpinges, one mucinous cyst and one endometrioma. In the case in which the torsion of the right ovary occurred as a complication of hyperstimulation of the ovaries with gonadotropin therapy for IVF treatment, the dimension of the twisted ovary was 8 x 6 x 4.5 cm; it had multiple cysts with maximal diameters fluctuating between 0.5 and 6 cm. In the present report, malignancy was diagnosed in 11% of all the studied cases (10/92) (Table 1). Most patients with either benign or malignant tumours were less than 50 years old (80%, 74/92).

Table 1. — *Histology of malignant tumours in twisted uterine adnexa in relation to the age of the patients.*

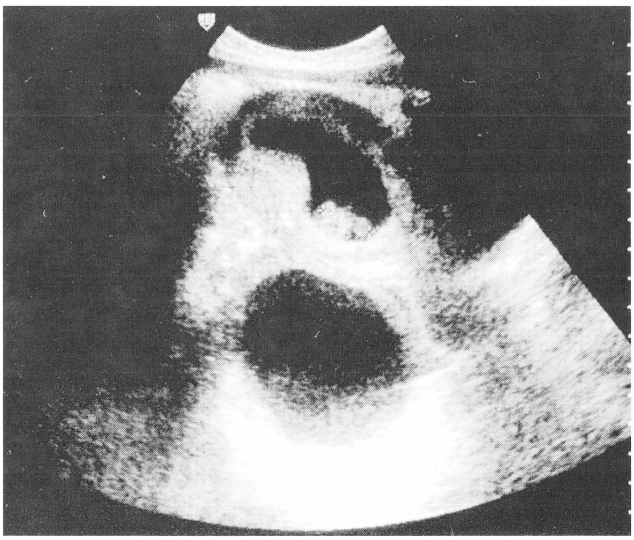
Histology of twisted malignant tumours	Number of patients	Age of patients (years)
Serous Borderline tumours	3	27, 35, 45
Mucinous Borderline tumours	2	36, 71
Granulosal-stromal cell tumours	2	74, 66
Malignant dysgerminoma	1	21
Immature teratoma	1	21
Clear cell carcinoma	1	50

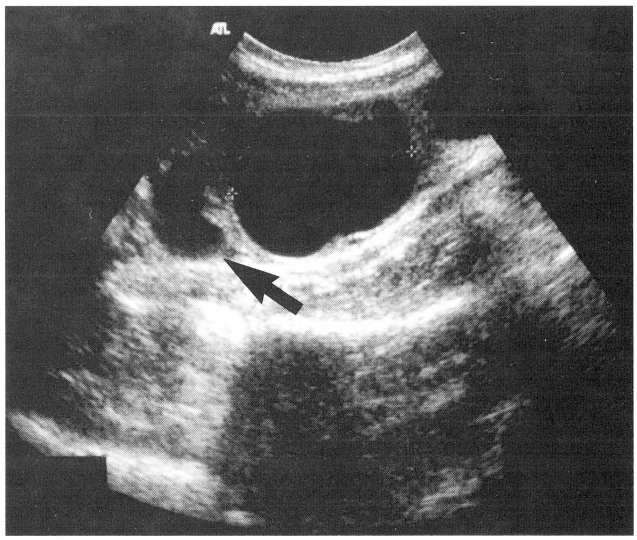
Serous cysts were the most common type that underwent torsion (18/92), followed by mature teratoma (16/92), paraovarian cysts (11/92), serous cystadenoma (9/92), corpus luteum cysts (9/92), mucinous cystadenoma (5/92), normal adnexa (5/92), serous borderline tumours (3/92), hydrosalpinx (3/92), fibroma/thecoma (2/92), mucinous borderline tumours (2/92), malignant granulosal-stromal cell tumours (2/92), mucinous cysts (1/92), endometrioma (1/92), immature teratoma (1/92), malignant dysgerminoma (1/92) and clear cell adenocarcinoma (1/92). As regards the rate of torsion in patients over 50 years of age, serous cysts were the most common type that underwent torsion (7/18), followed by paraovarian cysts (2/18), fibroma/thecoma (2/18), malignant granulosal-stromal cell tumours (2/18), mature teratoma (1/18), mucinous cystadenoma (1/18), borderline mucinous adenocarinoma (1/18) and clear cell adenocarcinoma (1/18). Table 2 presents the histology of twisted uterine adnexa in teenagers.

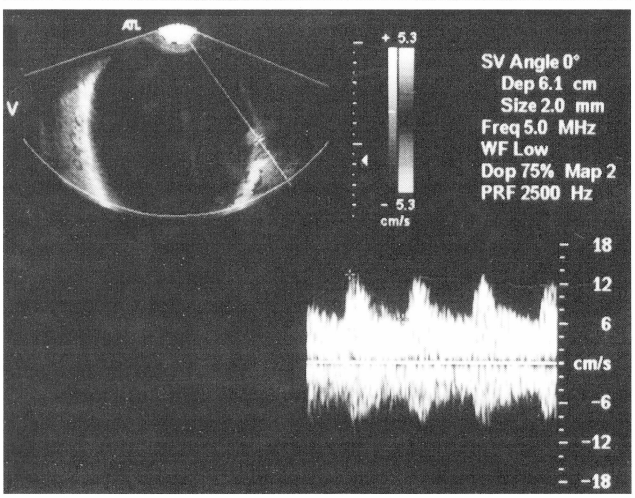
Table 2. — *Histology of twisted uterine adnexa in teenagers.*

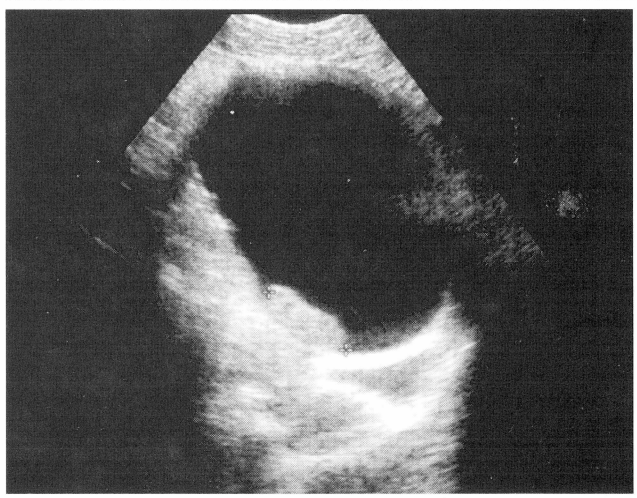
Histology of twisted tumours	Number of patients	Age of patients (years)
Serous cystadenoma	3	14, 15, 16
Paraovarian cysts	2	13, 15
Mucinous cystadenoma	1	17
Malignant dysgerminoma	1	16

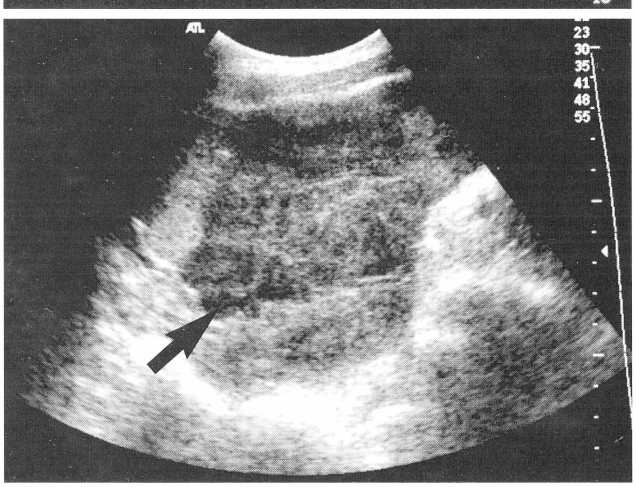
Gray-scale sonography demonstrated preoperatively a pelvic lesion in 85% (17/20), while in three patients no pelvic lesions were detected (15%). Cystic lesions were present in 16 of 20 patients (80%); these included: (i) five simple cysts, (ii) four cysts with mural nodules (dermoid cysts), (iii) three cysts with thick walls, (iv) two cysts with internal echoes, (v) one cyst with a diaphragm, and (vi) one cyst with papillary projections. The pathologic study of these lesions demonstrated the presence of six











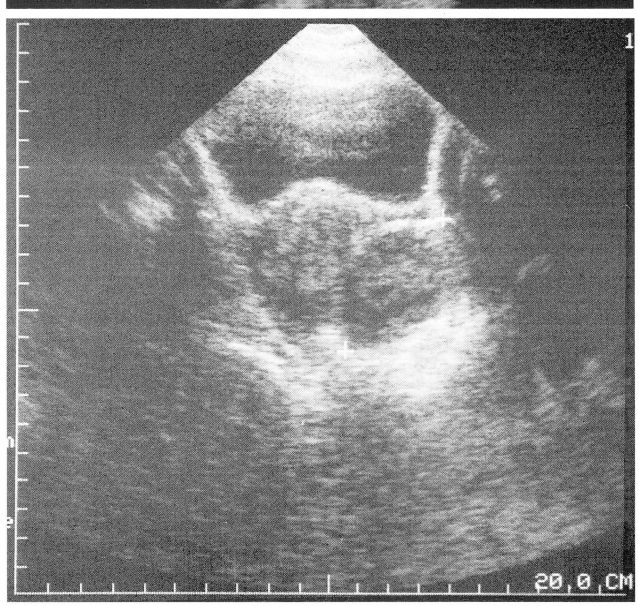


Figure 1. — Transabdominal ultrasonography showing a cyst with thick walls and maximum diameter of 77 mm in a 27-year-old pregnant woman (8th week of gestation). A serous cyst was documented by pathologic examination.

Figure 2. — Transvaginal ultrasonography showing a cyst in the right ovary with papillary projection **(arrow)**. Pathologically, the lesion was a serous cystadenoma.

Figure 3. — Image from a patient with left ovary and fallopian tube torsion: transvaginal ultrasonography showing a simple cyst; color Doppler ultrasonography demonstrating arterial flow in the wall of the cyst (RI = 0.51). A serous cystadenoma was diagnosed.

Figure 4. — Transabdominal ultrasound scan of a cyst with a small dermoid plug - dermoid cyst.

Figure 5. — Transabdominal ultrasound scan showing a heterogenic, predominantly solid mass **(arrow)**. On pathologic examimation a malignant dysgerminoma was found.

Figure 6. — Transabdominal ultrasound scan showing an enlarged left ovary due to massive ovarian oedema secondary to its torsion. No other adnexal pathology such as cyst or tumour was found in the twisted adnexa (torsion of a previously normal adnexa).

cystadenomas, four mature teratomas, three serous cysts, one paraovarian cyst, one immature teratoma and one borderline serous adenocarcinoma. Complex masses were not found. A solid mass was detected in one case (5%); this was a malignant dysgerminoma. Cul-de-sac fluid was present in 11 of 20 patients (55%). During laparotomy, in ten cases the fluid, which was detected ultrasonographically in the cul-de-sac, was found to be reactive (50%), while in one case it was haemoperitomeum secondary to rupture of a superficial tumoural vessel in the twisted malignant dysgerminoma. Ultrasonographic examination showed that the maximum diameter of the cysts fluctuated from 4.1 cm to 25 cm. In one case the maximum diameter was ≤ 5 cm (4.1 cm), in ten cases > 5 and < 10 cm, in two cases ≥ 10 cm and < 15 cm and in three cases ≥ 15 cm. The size of the solid mass was 12 x 6.48 cm. Figures 1-6 illustrate the spectrum of gray-scale ultrasonographic findings in this entity.

Discussion

Adnexal torsion is the fifth most common gynaecologic surgical emergency, with a prevalence of 2.7% [5]. It may result from a pre-existing tubal/ovarian pathology or as a consequence of hyperstimulation during ovulation induction [6, 7]. Moreover, torsion of previously normal uterine adnexa has been described [8]. Adnexal torsion may involve twisting of the ovary, the fallopian tube or both structures. Concurrent bilateral adnexal torsion is infrequently described [9]. Torsion of the uterine adnexa is most commonly encountered during the first three decades of life. Indeed, in our study adnexal torsion was found more commonly when the patients were less than 50 years of age; it was observed at the rate of 80%. It is theorized that adnexa in the young age group are especially mobile, allowing torsion at the mesosalpinx with changes in patient position or intra-abdominal pressure. Adnexal masses may also act as a fulcrum to potentiate torsion of the ovary and tube. Torsion of both the fallopian tube and the ovary occurs more often than that of either structure alone, because the broad ligament acts as a fulcrum [1]. The right side has been reported to be the most commonly involved side in ovarian torsion [5]. The propensity for right-sided involvement has been thought to be due to the decreased space on the left side of the lower abdomen and pelvis, which is occupied by the sigmoid colon [1]. Kanbour *et al.*, theorized that the differences in venous drainage of the two ovaries may also be a factor in the propensity for right-sided torsion [10].

The spectrum of reported ultrasonographic findings of adnexal torsion has varied in part because of the adnexal pathology and the degree and the duration of adnexal torsion. In cases where torsion is incomplete, a massive ovarian oedema may result. This develops when the torsion is insufficient to cause ischemic necrosis but sufficient enough to elevate capillary hydrostatic pressure and to interfere with lymphatic drainage [4]. In the study by Albayram and Hamper, gray-scale sonographic abnormalities included complex masses in 73%, cystic masses in 20% and solid masses in 7%; cul-de-sac fluid was found in 87% [4]. The cul-de-sac fluid is possibly a transudate from the ovarian capsule secondary to obstructed veins and lymphatic vessels [4]. In our study gray-scale ultrasonographic abnormalities included cystic lesions in 80%, solid masses in 5% and normal adnexa in 15%. Cul-de-sac fluid was found in 55%. Color Doppler sonography has been suggested as a way to detect the absence of blood flow to a twisted ovary, thereby aiding in the diagnosis and early treatment of ovarian torsion. The theory behind Doppler ultrasonography of the adnexal vessels in suspected ovarian torsion is that Doppler ultrasonography will show a lack of blood flow in these vessels resulting from the mechanical torsion of the ovarian vessels [11, 12]. Thus, the absence of color Doppler flow to the ipsilateral side indicates the possibility of complete ovarian torsion [12, 13]. Peña *et al.* assessed the predictive value of Doppler ultrasonography in the diagnosis of ovarian torsion in ten patients who were managed surgically. The authors found that Doppler ultrasonographic findings were normal in 60%, whereas 20% revealed decreased Doppler flow (decrease in vascular flow to the ovary) and 20% revealed absent of Doppler flow (absence of vascular flow to the ovary), suggestive of torsion. In this study, Doppler ultrasonography missed the diagnosis 60% of the time [12]. This is in agreement with the findings of Lee *et al.* in which the presence of normal arterial and venous flow was confirmed in 57% of cases of surgically confined adnexal torsion (16 out of 28) [13].

Malignant ovarian neoplasms are less likely than benign ovarian neoplasms to undergo adnexal torsion [5, 15]. Lee and Welch found malignant adnexal tumours in association with adnexal torsion in 15% of cases [16], while Hibbard found it in 2% [5]. Moreover, Koonings *et al.* reported that when a surgeon discovers an adnexal tumour with torsion in women over the age of 50, then the risk of malignancy is very low [17]. Sommerville *et al.* found that benign ovarian neoplasms had a 12.9-fold increased risk of undergoing adnexal torsion when compared with malignant ovarian neoplasms ($p < 0.001$) [18]. In our study, we diagnosed malignant tumours in 11%; four tumours were diagnosed in women ≥ 50 years of age (40%). Because malignant ovarian neoplasms are less common than benign ovarian neoplasms, this discrepancy in relative frequency could account for this difference [17, 18]. Moreover, the low incidence of malignancy may be explained by the fact that most patients with uterine adnexal torsion are premenopausal [5]. Alternatively, the low probability of malignant ovarian neoplasms undergoing torsion may be explained by their ability to adhere to local structures. This may be caused by inflammation, adhesions or local invasion [18]. In the international literature very few studies have assessed the pathology of twisted adnexa in women ≥ 50 years of age [5, 17]. In our study we determined that the most common type of adnexal lesion that underwent torsion in patients over the age of 50 years was serous cystadenoma, which was found at the rate of 39%.

Uterine adnexal torsion is caused by complete or partial rotation of the ovarian pedicle on its long axis. Clinical findings are nonspecific including severe pelvic pain, anorexia, nausea, and vomiting. The pain associated with adnexal torsion is usually intense and localized to either adnexal region. It may be intermittent. This can be attributed to intermittent episodes of incomplete torsion [4]. In children, torsion is the most common complication of ovarian tumours, with an incidence that ranges from 3% to 16%. The most common tumours in children are germ cell tumours; teratomas are the most common germ cell tumours overall and the vast majority of teratomas are benign, while ovarian dysgerminomas are the most common malignant ovarian tumours. In general, in this age of patients, solid ovarian masses are much more likely to be malignant as compared with either complex or simple cysts [19]. In our study the histology of the twisted adnexa in the teenagers included three serous cystadenomas, two paraovarian cysts, one mucinous cystadenoma and one malignant dysgerminoma. In pregnant patients, the diagnosis of adnexal torsion is stated to be similar between early pregnancy and non-pregnancy; it is more difficult when the pregnancy is advanced because of the difficulties in abdominal palpation. Nausea and vomiting, which may occur in both conditions, can further complicate the diagnosis of adnexal torsion [20]. In our study adnexal torsion and pregnancy was found in 3.2%.

Management of adnexal torsion is a controversial topic. Historically, torsion of the adnexa has been managed by excision of the affected structure with extra care taken to avoid untwisting the pedicle, in order to avoid the release of an embolus from the twisted pedicle [2, 9]. However, in 1946, Way initially advocated the conservative management of adnexal torsion by the technique of untwisting the adnexa followed by ovarian cystectomy. He described a series of 15 women treated in this manner without complications [21]. This conservative approach has not been widely accepted and there are only a few reports in the English literature of untwisting tortuous adnexal pedicles. In these reports there was no evidence of thrombosis or embolic sequelae [6, 9, 20, 22-24]. In our study, all the patients were managed radically, in order to avoid release of an embolus from the twisted pedicle.

In conclusion, adnexal torsion is most commonly associated with benign processes (89%) and usually occurs in patients under 50 years of age (80%). Its diagnosis remains challenging. The observation of adnexal abnormalities in gray-scale ultrasound scans, the presence of cul-de-sac fluid and the clinical findings are helpful for a correct diagnosis.

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