

Comparison of Emergent and Elective Surgeries of Endometriomas: Is Adnexal Torsion a Concern?

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ABSTRACT: **Background:** When a woman with an endometrioma presents with acute abdominal pain, it is unclear whether ovarian torsion should be suspected.

Objectives: To compare patient characteristics, imaging results, and surgical management of endometriomas in elective versus emergent surgeries.

Methods: This retrospective cohort study included women treated at our institution between 1990 and 2015 who presented with histologically verified endometrioma and who underwent either planned surgery or emergent surgery due to suspected adnexal torsion.

Results: Of 225 surgeries performed, 174 were elective and 51 emergent. Patients in the emergent group were significantly younger (33.9 ± 11.1 vs. 39.01 ± 10.9 years, $P = 0.004$). Abdominal pain was the main complaint of all the emergent surgery patients and the leading complaint in 21% of the elective surgery patients ($P < 0.001$), with right-sided predominance in both groups. Sonographic parameters were similar in both groups. Bilateral ovarian cysts were noted in 11.7% and 11.0% of emergent and elective patients, respectively ($P = 0.87$). Laboratory evaluation was notable for a higher white blood cell count and CA125 levels among emergent patients. All patients in the emergent group and 93% of patients in the elective group were managed laparoscopically. No cases of torsion were noted. The rate of intra-pelvic adhesions was similar in both groups (56.8% vs. 66.6%, $P = 0.19$).

Conclusions: Endometrioma may present with acute abdominal pain. However, adnexal torsion in these patients is rare. These cases can be managed using a minimally invasive approach, assuming an optimal surgical setting.

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Endometriosis is defined as the presence of endometrium-like tissue in areas outside the uterine cavity. The most common symptoms of endometriosis are infertility and abdominal or pelvic pain, including dysmenorrhea [1,2]. Endometriosis can be divided into three different entities: peritoneal endometriosis, ovarian endometriotic cyst (endometrioma), and adenomyotic nodules of the rectovaginal septum [3]. Endometriomas typi-

cally present as a pelvic mass arising from growth of ectopic endometrial tissue within the ovary. The pathogenesis of endometriomas is not currently well understood.

Endometriomas have a typical sonographic appearance of a cyst that contains a homogeneous echo-pattern (i.e., ground-glass appearance) [4]. Although the diagnosis of an endometrioma can be made by ultrasound with a high degree of certainty in most cases [5], the definitive diagnosis is based on surgical findings [6] and histologic evaluation of suspected lesions [7,8].

Endometriomas are often firmly adherent to adjacent structures and therefore appear to be less likely to cause adnexal torsion, although there are not enough data on the rate of torsion in these cysts. Rather, few case reports to date depict isolated fallopian tube torsion secondary to endometriosis [9-12].

Previous research has focused on sonographic evaluation and surgical principles for management of these cysts. However, a limited number of studies have analyzed the management of endometriomas according to surgery type: emergent or elective.

The objective of this study was to compare clinical presentation, laboratory and imaging results, and intra-operative findings in patients with verified endometriomas, according to emergent versus elective management. We aimed to determine the rate of adnexal torsion in emergent cases and to reach a conclusion regarding the optimal management of acute symptoms in the presence of a suspected endometrioma.

PATIENTS AND METHODS

We conducted a retrospective cohort study of patients with histologically proven endometriomas who were treated at the Wolfson Medical Center between January 1990 and August 2015. The study was approved by our institutional review board in agreement with the Helsinki Declaration.

Charts of patients with a diagnosis of an endometrioma according to the institutional pathology database were retrieved and reviewed for the following types of data: patient demographics, gynecological history, clinical presentation, laboratory and sonographic findings at admission, type of surgical procedure, and surgical findings. The elective management group comprised elective surgeries performed at a preset date, in which ovarian cyst material was confirmed histologically as

endometrioma. This group also included surgeries performed for other indications in which ovarian cystic material analyzed after the fact proved to be endometrioma. The emergent group consisted of surgeries performed due to acute abdominal pain that was suspected to be adnexal torsion, where adnexal torsion is defined as the surgically confirmed rotation of the ovary/adnexa of at least 360 degrees.

Data were analyzed with Epi Info, version 7.0 (Centers for Disease Control and Prevention, Atlanta, GA, USA). Continuous variables were calculated as mean \pm standard deviation and compared with Student's *t*-tests. Categorical variables were calculated as rate (%) and compared using the chi-square test or Fisher's exact test as appropriate. $P < 0.05$ was considered statistically significant.

RESULTS

During the study period, 225 surgeries were performed in which an endometrioma was confirmed histologically. Of the total number of surgeries, 174 were performed electively, as previously defined, and 51 were performed emergently.

Patient characteristics and clinical presentation according to surgery type and emergent vs. elective, are presented in Table 1. Patients in the emergent surgery group were significantly younger, with an average age of 33.9 ± 11.1 years, as compared to 39.0 ± 10.9 years in the elective surgery group, $P = 0.004$. The rate of patients with a positive history of previous deliveries was similar in both groups. Five women (2.2%) were pregnant at the time of surgery. All patients who underwent emergent surgery presented with acute abdominal pain, in contrast to 21 patients (2.0%) who underwent elective surgery for chronic abdominal pain ($P < 0.001$).

Laboratory and imaging evaluation of patients prior to surgery are presented in Table 2. White blood cell (WBC) count was notably higher among emergent surgery patients (9.9 ± 4.4 vs. 8.1 ± 2.0 cells/ μ l, $P < 0.001$). The most common sonographic finding was a homogeneous ovarian cyst with a ground-glass appearance. This finding was exhibited in both groups at a similar rate. Other sonographic cyst descriptions included solid, complex, and clear all of which were equally prevalent in both groups. Average cyst size was 5.6 ± 2.1 cm and 5.3 ± 2.4 cm ($P = 0.5$) in the emergent and elective groups, respectively. Both groups had a similar rate of bilateral cystic findings.

Table 3 shows surgical characteristics and intra-operative findings. All emergent surgeries and 93.6% of elective surgeries were performed laparoscopically ($P = 0.07$). No cases of adnexal torsion were demonstrated in either group. Additional intra-operative findings included pelvic adhesions in 56.8% of emergent surgeries and 66.6% of elective surgeries ($P = 0.19$), and endometriotic foci in 29.4% of emergent surgeries and 34.4% of elective surgeries ($P = 0.49$). Cystectomy was the most common procedure performed in both groups (78.4%

and 67.2%, $P = 0.12$, respectively), followed by unilateral salpingo-oophorectomy. Salpingectomy was performed at a similar rate in both emergent and elective surgeries, while hysterectomy was performed in 15.3% of elective surgeries only. Spillage of cystic contents occurred in over half the surgeries in both groups. Adhesiolysis was additionally performed in 21.5% and 22.4% of emergent and elective surgeries, respectively ($P = 0.89$).

Table 1. Demographic characteristics and surgical indication of study patients

	Emergent surgery n=51	Elective surgery n=174	P value
Age in years, mean \pm standard deviation	33.9 \pm 11.1	39.0 \pm 10.9	0.004
Parous, n (%)	25 (49.0)	92 (52.8)	0.62
Surgical indication			
Abdominal pain, n (%)	51 (100.0)	21 (12.0)	< 0.001
Persistent ovarian cyst, n (%)	0 (0)	140 (80.4)	< 0.001
Infertility, n (%)	0 (0)	2 (1.1)	1.0

Table 2. Laboratory and sonographic presentation of study patients

	Emergent surgery n=51	Elective surgery n=174	P value
WBC ($10^3/\mu$ l), mean \pm SD	9.9 \pm 4.4	8.1 \pm 2.0	< 0.001
CA-125 (U/ml), mean \pm SD	225 \pm 469	70 \pm 69	< 0.001
Sonographic appearance			
Ground glass, n (%)	26 (50.9%)	92 (52.8%)	0.81
Complex/solid, n (%)	12 (23.5%)	40 (23.0%)	0.93
Simple cyst, n (%)	12 (23.5%)	35 (20.1%)	0.59
Not visualized, n (%)	1 (1.9%)	7 (4.02%)	0.68
Cyst size (cm), mean \pm SD	5.6 \pm 2.1	5.3 \pm 2.4	0.50
Unilateral: right, n (%)	23 (45.0%)	72 (41.3%)	0.63
Bilateral, n (%)	6 (11.7%)	19 (11.0%)	0.87

SD = standard deviation, WBC = white blood cell

Table 3. Surgical mode, findings and procedure of study patients

	Emergent surgery n=51	Elective surgery n=174	P value
Laparoscopy, n (%)	51 (100.0)	163 (93.6)	0.07
Surgical findings			
Adnexal torsion, n (%)	0 (0)	0 (0)	1.0
Adhesions, n (%)	29 (56.8)	116 (66.6)	0.19
Endometriosis lesions, n (%)	15 (29.4)	60 (34.4)	0.49
Surgical procedure			
Cystectomy, n (%)	40 (78.4)	117 (67.2)	0.12
USO/BSO, n (%)	9 (17.6)	43 (24.7)	0.29
Salpingectomy, n (%)	2 (3.9%)	14 (8.0%)	0.53
Hysterectomy, n (%)	0 (0%)	12 (15.3%)	0.07
Adhesiolysis, n (%)	11 (21.5%)	39 (22.4%)	0.89
Spillage of cyst, n (%)	29 (56.8%)	96 (55.1%)	0.83

USO = unilateral salpingo-oophorectomy, BSO = bilateral salpingo-oophorectomy

DISCUSSION

Endometriosis is increasingly being diagnosed among reproductive-aged women, and it is estimated to affect 10% of women [13]. In the sub-fertility population, the prevalence of endometriosis reaches 47% [14] and can be as high as 62% [15] among adolescents with dysmenorrhea or pelvic pain. Different etiologies have been suggested, including retrograde menstruation of endometrial cells, metaplasia of celomic epithelium, and peritoneal differentiation of Müllerian remnants [16]. These different suggested pathogeneses point toward some form of genetic linkage [17] but may also be associated with immunological or environmental factors that all share a common final pathway.

Due to its increasing prevalence in the population of reproductive-age patients, management of endometriosis should ideally palliate symptoms to alleviate medical problems and optimize fertility in a minimally invasive fashion. These criteria are not always trivial in cases of an endometrioma, which may itself be a sign of more extensive endometriosis [18] and inherent sub-fertility [19]. A surgical plane for cystectomy is often difficult to achieve, and therefore, these surgeries commonly result in ovarian compromise, at least to some extent. Numerous studies have attempted to quantify ovarian outcome by assessing ovarian reserve markers, such as anti-Müllerian hormone and sonographic parameters [20,21]. Current research considers ovarian cystectomy to be preferable to ablation in terms of symptom control, fecundability, and recurrence rates [22]. Nevertheless, the optimal surgical procedure to maintain ovarian reserve is still undetermined, although bipolar coagulation is probably best avoided [23].

Elective surgery allows for proper patient evaluation, including proper imaging and ovarian reserve assessment. It may offer an advantage, especially with regard to endometrioma. We assessed differences in patient characteristics and surgical outcomes between elective and emergent surgeries of endometrioma, as well as the need for emergent surgery for suspected adnexal torsion. It is not surprising that we found none, considering the adhesive nature of endometriomas compared to other ovarian cysts (typically mature cystic teratoma), in which adnexal torsion is commonly confirmed in emergent surgeries for acute abdominal pain [24]. We found that the risk of adnexal torsion is low in a symptomatic patient with acute abdominal pain and suspected endometrioma, and consideration should be given to medical symptomatic relief until proper patient evaluation performed and an optimal surgical setting can be organized.

The most common surgical mode in our study was laparoscopy, which has been proven to achieve equivalent and even superior results to laparotomy [25]. In our study, 11 elective surgeries were laparotomies (6.3%). All such cases were performed early in the study period and involved patients aged 43 to 61 years, eight of whom underwent hysterectomy. Of these

12 cases of elective surgeries, which included hysterectomy, all were performed in peri-menopausal or postmenopausal patients, most probably reflecting treatment of additional uterine pathologies (i.e., leiomyomas) or a less conservative management in patients who completed their childbearing plans.

LIMITATIONS

Due to the study's retrospective nature, not all parameters of interest, such a hormonal and sonographic post-operative follow-up, were available for analysis. Even parameters that we could evaluate, such as sonographic assessment, may have been subjected to inter-observer variability. Furthermore, the inclusion of patients with surgically verified endometriomas may constitute a selection bias. These cases likely represent examples of failed medical management or a suspicion for malignancy, and as such may constitute greater surgical challenge. Finally, the study included surgeries performed over a 26-year period. The possibility of a learning curve must be acknowledged, as well as changing surgical trends with a preference for minimally invasive procedures.

In spite of the limitations, to the best of our knowledge this is the first study to assess the clinical characteristics and surgical outcomes of endometrioma surgeries according to the type of surgical setting, whether emergent or elective. The study also has the added advantage of including only histologically verified cases.

CONCLUSIONS

Endometriomas are a common entity in reproductive-age patients and require special planning and experience for optimal management. Our retrospective study suggests that in the setting of a high suspicion for an endometrioma, acute symptoms most probably do not suggest adnexal torsion and thus may allow for proper surgical planning if medical treatment achieves relief. The preferred management is minimally invasive surgery performed by skilled and experienced surgeons, with more extensive surgery reserved for individualized cases based on need.

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Capsule

How flu homes in on the nucleus

Influenza A virus (IAV) causes human epidemics annually and poses an ongoing threat for pandemics. The IAV genome is packaged in the viral capsid and, for successful infection, must be released into the cytosol and then imported into the nucleus for replication. **Miyake** et al. studied the process by which incoming viral ribonucleoproteins (vRNPs) that carry the viral genome are unpackaged during cell infection and find their way to the nucleus. They found that transportin 1 (TNPO1) associates with incoming capsids by binding to a

TNPO1-specific nuclear localization signal in the influenza matrix protein (M1). TNPO1 promotes the removal of M1 from the surface of bundled vRNPs, which leads to bundle disassembly. The dissociated vRNPs then interact with the nuclear import machinery, which delivers them via the nuclear pore complex into the nucleus.

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Capsule

Engaging monocytes to battle Chikungunya

Antibody-binding receptors, including Fc receptors and complement receptors, play a central role in mediating antibody-dependent immune activation. **Fox** et al. examined the role of Fcγ receptors and complement component 1q (C1q) in mediating the therapeutic effects of monoclonal immunoglobulin G antibodies targeting Chikungunya virus. They used antibody engineering in conjunction with mouse strains

lacking C1q or Fcγ receptors to show that the therapeutic effects of these antibodies are dependent on expression of Fcγ receptors. Furthermore, depleting distinct immune cell types revealed that engagement of Fc receptors on monocytes is central in driving antibody-dependent viral clearance.

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