

# Analysis of the factors determining the type of surgical procedure in mature cystic teratomas

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## ABSTRACT

**Objectives:** It was aimed to evaluate which factors determine the surgical procedure selected by surgeons for cases with mature cystic teratoma (MCT).

**Material and methods:** This study included 50 cases with histopathologically proven MCT between January 2011 and August 2016 at a tertiary reference hospital. Data related to demographic and clinical characteristics were retrieved from medical records. Multivariate logistic regression analysis was conducted to evaluate the independent factors determining the type of surgical procedure to be applied.

**Results:** A higher rate of patients with large cyst size and elevated CA 19-9 was determined in the postmenopausal patients compared to the premenopausal patients ( $p = 0.033$ ,  $p = 0.035$ ). Cystectomy and oophorectomy were applied to 72.55% and 27.5% of the cases respectively. No recurrence in the operated ovary was observed in the 1-year follow-up period in any of the cystectomy cases. The major and only independent variable for the preference of cystectomy over oophorectomy was found to be a younger age ( $\leq 40$  years). There was no independent variable which predicted the selection of laparoscopy or laparotomy by surgeons.

**Conclusions:** Cystectomy was seen to be preferred by surgeons in the majority of MCT patients aged  $\leq 40$  years regardless of the size of the cyst. This is plausible since these patients have greater concerns about future fertility compared to patients  $> 40$  years old. No recurrence was detected in any of the cystectomy cases, which strengthens the feasibility of this procedure. No serious complications developed in laparoscopy which could render it a safe option for undertaking cystectomy/oophorectomy in MCT cases.

**Key words:** cystectomy, mature cystic teratoma, oophorectomy

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## INTRODUCTION

Mature cystic teratoma (MCT) is the most frequently determined benign neoplasm of the ovary with a reported incidence of 1.2–14.2/100.000. It can contain tissues derived from the embryological germ cell layers: ectoderm, endoderm, and/or mesoderm. Although MCT may be seen at any age, the majority are determined in the reproductive years and 20% in the postmenopausal period [1, 2]. Unilateral location is seen in the majority of cases, but it may be bilateral in 10–20%. Even when there are symptoms such as abdominal pain, abdominal distension and menstrual irregularities, most cases of MCT are determined incidentally. Different symptoms may be seen depending on the tissue

content. For example, in cases of struma ovarii, there may be symptoms related to thyroid dysfunction. There is no specific tumour marker for MCT but studies have reported elevated serum CA 19-9 level [2–5].

Cystectomy or oophorectomy can be applied in the treatment of MCT cases to eliminate cyst-related complaints, to prevent potential complications and to discount malignancy. While cystectomy may offer the advantage of preserving ovarian tissue, it may be associated with an increased rate of recurrence in that ovary [2].

In the treatment of MCT in recent years, laparoscopy (LS) has started to be more widely used and in comparison with laparotomy (LT), it has the advantages of shorter hospital

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stay and more rapid recovery. However, there have been concerns regarding the laparoscopic procedure, such as the spillage of the cyst contents intraperitoneally, which may lead to chemical peritonitis or intra-abdominal spread of malignant cells in cases of malignant teratoma [6, 7].

There is still no consensus on the route of access to the cyst (LT vs. LS) or on the extraction method of the cyst (cystectomy or oophorectomy). The aim of this study was to present the clinical characteristics of MCT cases diagnosed in our clinic and to analyse the factors which affect the preference of surgical procedure by surgeons, in cases with MCT.

## MATERIAL AND METHODS

Approval for the study was granted by the Institutional Review Board and Ethics Committee of Kahramanmaraş Sutcu Imam University, where it was conducted. This was a retrospective review of 50 cases with MCT diagnosed and treated in the study center between January 2011 and August 2016.

The data related to patient age, presenting symptoms, laboratory findings, ultrasonography and CT/MRI findings, surgical procedures and pathological diagnosis were obtained from the medical files.

Data analysis was performed with Statistical Package for Social Sciences version 18.0 software (SPSS Inc., Chicago, IL, USA). Continuous variables were expressed as mean  $\pm$  standard deviation (range: minimum-maximum) whereas categorical variables were denoted as number (n) or percentage (%). The distribution of continuous variables was evaluated with the Kolmogorov-Smirnov test. The Mann Whitney test was used for the comparison of quantitative variables while the Fisher's test and  $\chi^2$ -test were utilized for the comparison of qualitative variables. Logistic regression analysis was applied for model failure and odds ratio was estimated with 95% confidence intervals. Two-tailed p values  $< 0.05$  were accepted as statistically significant.

## RESULTS

The study included a total of 50 patients with a mean age of  $34.75 \pm 12.77$  years (range, 14–67 years) and 13.7% of the cases were post-menopausal. The MCT was mean  $7.40 \pm 4.2$  cm (range: 3–20 cm) in size, and location was right-side in 28 cases (54.9%), left-side in 22 (43.1%) and bilateral in 1 (2.0%). The complaints on presentation were pelvic pain in 49.0% of the cases and bleeding irregularity in 27.5%. In the remaining 23.5% of the cases, the diagnosis of the cyst was made incidentally. In 2 cases (4.0%), there was ovarian torsion because of MCT (Tab. 1).

The rate of patients with large cyst size ( $> 10$  cm) and elevated CA19-9 was determined to be higher in the post-menopausal patients compared to the premenopausal patients ( $p = 0.033$ ,  $p = 0.035$  respectively).

**Table 1. Clinical characteristics of MCT cases**

	MCT cases (n = 50)
Mean age (years)*	34.75 $\pm$ 12.77
Menopausal status <sup>†</sup>	
Premenopause	86.3
Postmenopause	13.7
Presenting symptom <sup>†</sup>	
Pain	49.0
Bleeding irregularity	27.5
No symptom	23.5
Laterality <sup>†</sup>	
Right ovary	54.9
Left ovary	43.1
Bilateral	2.0
Diagnostic tool <sup>†</sup>	
USG alone	82.4
USG+CT/MRI	17.6
Cyst diameter [cm]*	7.40 $\pm$ 3.9
Elevated CA 125 level ( $> 35$ U/mL) <sup>†</sup>	9.5
Elevated CA 19-9 level ( $> 37$ U/mL) <sup>†</sup>	35.7
Type of surgery <sup>†</sup>	
Laparoscopy	49.0
Laparotomy	51.0
Surgical treatment <sup>†</sup>	
Cystectomy	72.5
Oophorectomy	27.5

\*Values are given as mean  $\pm$  standard deviation, <sup>†</sup>Values are stated as percentage (%); USG — ultrasonography; CT/MRI — computed tomography/magnetic resonance imaging

Elevated serum CA 125 and CA 19-9 levels were determined in 9.5% and 35.7% of the patients respectively. No correlation was determined between cyst size and CA 19-9 level ( $p = 0.298$ , OR: 0.476, 95% CI 0.052–2.477) (Tab. 1).

A preoperative diagnosis of dermoid cyst was made with gray-scale ultrasonography alone in 82.4% of the cases. In 17.6% of the cases, computed tomography (CT) or magnetic resonance (MR) imaging was applied additional to USG (Tab. 1).

Laparoscopic surgery was applied to 48.0% of cases and laparotomy was applied to 52.0%. Conversion from laparoscopy to laparotomy was applied in 1 patient due to the excessive adhesion of the cyst to surrounding tissues. The mean cyst size, the mean body mass index (BMI), the rate of patients with elevated CA 19-9 level and with a history of previous abdominal surgery was similar in the patients who underwent laparoscopy and laparotomy (Tab. 2).

Cystectomy and oophorectomy were applied to 72.0% and 28.0% of the cases respectively. The cases undergoing cystectomy or oophorectomy were similar in respect of clinical characteristics (Tab. 2). In 1 patient, cystectomy was applied during a caesarean section at 38.4 gestational weeks. In 3 patients, there were adhesions between the ovary where the cyst was located and the intestines. In 1 of

**Table 2. Comparison of cases on the basis of surgical procedures**

	LS (n = 24)	LT (n = 26)	P value	Cystectomy (n = 36)	Oophorectomy (n = 14)	P value
Mean age*	35.3 ± 12.4	34.3 ± 13.8	0.792	29.6 ± 9.8	48.2 ± 10.4	0.000 <sup>‡</sup>
BMI [kg/m <sup>2</sup> ]*	23.5 ± 4.9	24.1 ± 2.6	0.221	24.2 ± 2.7	23.8 ± 3.6	0.179
History of previous abdominal surgery <sup>†</sup>	8.3	11.5	0.453	8.3	14.3	0.771
Cyst diameter*	7.5 ± 3.7	8.1 ± 4.1	0.632	7.3 ± 3.3	9.1 ± 5.0	0.136
Elevated CA 19-9 level (> 37 U/mL) <sup>†</sup>	60.0	36.8	0.179	47.8	45.5	0.601

\*Values are given as mean ± standard deviation, <sup>†</sup>Values are stated as percentage (%), <sup>‡</sup>p < 0.05 was accepted as statistically significant; LS — laparoscopy; LT — laparotomy; BMI — body mass index

**Table 3. A multiple logistic regression model for independent variables determining the type of treatment procedure**

	Cystectomy (n = 36)*	Oophorectomy (n = 14)*	Odds ratio (95% CI)	P value
Age				
≤ 40 years	87.0	18.2	30.0 (4.249–211.814)	0.000 <sup>‡</sup>
> 40 years	13.0	81.8		
CA 19-9 level				
Normal	52.2	54.5	–	–
High	47.8	45.5		
Cyst diameter				
< 10 cm	73.9	63.6	–	–
≥ 10 cm	26.1	36.4		
Type of surgery				
Laparotomy	52.2	63.6	–	–
Laparoscopy	47.8	36.4		

\*Values are stated as percentage (%), <sup>‡</sup>p < 0.05 was accepted as statistically significant; CI — confidence interval

these cases, invasive squamous cell carcinoma was reported as a result of the pathology examination.

Due to intraoperative rupture of the cyst in 9 (17.6%) patients (3 cases during LT, 6 cases during LS), there was spillage of the cyst content into the peritoneal cavity. Post-operative follow-up was uneventful in these patients.

In 1 case (2%), endometrioma was determined in the contralateral ovary and in 1 case (2%), serous cyst adenoma in the contralateral ovary. In the pathology report of 1 case, there was MCT and immature teratoma in an area of approximately 40%. Struma ovarii was determined in 1 case with no findings of hyperthyroidism.

Using multivariate logistic regression analysis, the major and the only independent variable for the preference of cystectomy over oophorectomy was found to be a younger age (≤ 40 years) (OR: 30.0, 95% CI 4.249–211.814, p = 0.000) (Tab. 3). Logistic regression analysis did not reveal any statistically significant independent variable which predicted the selection of laparoscopy or laparotomy by surgeons.

## DISCUSSION

In the current study, the complaint on presentation was determined as abdominal pain in 49% of cases, which was consistent with the findings of previous studies [2]. Although

bilateral MCT has been previously reported at 7–15%, in the current study the rate was determined as 2% [2]. This low rate of bilaterality may be due to the relatively small sample size of the present study. The procedure of wedge resection in the contralateral ovary of normal appearance in MCT cases, started to be abandoned in the 1990s. In unilateral MCT cases, inspection and palpation of the contralateral ovary of normal appearance is recommended [2]. This same approach was applied to the cases in the current study.

It has been reported that 0.8–12.8% of MCTs are determined in pregnancy and in the current study this rate was 2% [2]. The cyst was excised during a caesarean section procedure and this patient did not experience any cyst-related complications.

Torsion, infection, rupture and malignant degeneration are potential complications related to MCT. In the current study, no infection or rupture was determined in any patient. Torsion has been reported to develop more in intermediate-size MCT and the incidence has been reported as 3–16% [8]. In the current study, torsion developed in 2 cases (4%) and the cyst size in these cases was 11 cm and 20 cm.

The rate of elevated CA19-9 in MCT has shown differences in previous studies. Coşkun et al. [5] reported this rate as 86%, Frimer et al. [3] stated it to be 37%, and in the cur-

rent study, it was determined as 35.7%. Although there are studies which have reported that as the size of the tumour increases, so the rate of elevated CA19-9 level increases, in the current study no correlation was determined between tumour size, age and elevated CA19-9 [9, 10].

In the present study, the detection rate of MCT on USG was determined as 82.4%, which was higher than the detection rate of 58% in a study by Ozgur et al. [1]. This difference could be attributed to the recent advances in the resolution of ultrasonographic imaging.

In the current study, cystectomy was applied in the majority of cases aged  $\leq 40$  years. This is possibly related to clinicians preferring to preserve ovarian tissue in young patients. Tumor size or the elevated CA19-9 level were not the factors which determined the decision to perform cystectomy or oophorectomy since they were similar in both treatment groups. One of the concerns regarding cystectomy is the recurrence of MCT in the same ovary. As no recurrence was detected in cystectomy patients during the follow-up period of at least 1 year in our clinic, cystectomy can be suggested as an appropriate surgical procedure in MCT cases regardless of the size of the cyst.

Laparoscopy was applied to 48% of the patients in the current study. In a retrospective study by Ayhan et al. [2], the size of the cyst was reported as the factor determining the decision for laparoscopy or laparotomy. However, in the current study, the laparoscopy and laparotomy groups were found to be similar regarding the baseline characteristics, such as cyst size, and patient age. Therefore, it can be concluded that the selection of type of surgery was at the discretion of the surgeon rather than based on tumor size. During surgery, spillage of the cyst content into the abdomen can cause chemical peritonitis. However, recent studies have claimed that intraperitoneal spillage does not create a very significant problem [6, 7]. In the current study, spillage occurred in 9 patients, none of whom experienced any problems postoperatively, which could be attributed to the vigorous irrigation of the peritoneal cavity using lactated Ringer's solution as recommended by Shawki et al. [7].

## CONCLUSIONS

In conclusion, the results of this study showed that accurate diagnosis could be made with ultrasonography alone in 82% of MCT cases. Surgeons preferred cystectomy in the majority of MCT patients aged  $\leq 40$  years regardless of the size of the cyst and of the elevated CA 19-9 levels. This is plausible as younger patients have greater concerns about future fertility compared to patients  $> 40$  years old. No recurrence was detected in the cystectomy cases which strengthens the feasibility of this procedure. No serious complications developed in laparoscopy which could render it a safe option for undertaking cystectomy/oophorectomy in MCT cases.

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