

# The Significance of Serum Ca 19-9 in the Evaluation of Adnexial Cysts; Whether it is Elevated in Dermoid Cysts?

## Adneksiyal Kistlerin Araştırılmasında Serum Ca 19-9 Seviyesinin Önemi: Dermoid Kistlerde Yükselir mi?

Hüsnü GÖRGEN, MD,<sup>a</sup>  
Murat APİ, MD,<sup>a</sup>  
Beyhan BADOĞLU, MD,<sup>a</sup>  
Ahmet ÇETİN, MD<sup>a</sup>

<sup>a</sup>Department of Obstetrics and Gynecology, Haseki Education and Research Hospital, İstanbul

Geliş Tarihi/Received: 24.02.2009  
Kabul Tarihi/Accepted: 21.05.2009

Yazışma Adresi/Correspondence:

Hüsnü GÖRGEN, MD  
Haseki Education and Research Hospital,  
Department of Obstetrics and Gynecology,  
İstanbul,  
TÜRKİYE/TURKEY  
husnugorgen@hotmail.com

**ABSTRACT Objective:** To investigate and compare the CA 19-9 levels in dermoid and other ovarian cysts which is commonly encountered in gynecologic practice. **Material and Methods:** This retrospective study was performed in 156 patients with ovarian cysts and the patients whose final pathologic diagnosis revealed dermoid cysts (n= 50), serous cystadenocarcinoma (n= 48), mucinous cystadenocarcinoma (n= 7), endometrioma (n= 20) and benign ovarian cysts (n= 31) have been included in this study. We have investigated their tumor markers including CA 19-9, CA 12-5, CA 15-3 and CEA. **Results:** An elevated rate of CA 19-9 was 58% for dermoid cysts and 85% for mucinous cystadenocarcinomas. Among tumor markers, only CA19-9 was detected to be above the level of the cutoff value in dermoid cysts. Mean CA 19-9 levels (60.89 mIU/mL) of dermoid cysts are found to be higher than the mean CA 19-9 levels of serous cystadenocarcinoma (22.55 mIU/mL), endometrioma (57.96 mIU/mL) and benign ovarian cysts (14.68 mIU/mL). But mucinous cystadenocarcinoma's mean CA 19-9 level was much higher than dermoid cyst's CA 19-9 mean level (427.57 and 60.89 mIU/mL, respectively). **Conclusion:** Dermoid cysts can be asymptomatic. In cases with elevated level of Ca 19-9 of unknown origin, gynecological examination (dermoid cyst, mucinous cystadenocarcinoma, and endometrioma) should be commenced.

**Key Words:** Dermoid cyst; ovarian cysts; CA-19-9 antigen

**ÖZET Amaç:** Jinekoloji pratiğinde sık rastlanan dermoid ve diğer ovaryan kistlerde CA 19-9 seviyelerini araştırmak ve karşılaştırmak. **Gereç ve Yöntemler:** Bu retrospektif çalışmada kesin patolojik tanısı dermoid kist (n= 50), seröz kistadenokarsinom (n= 48), musinöz kistadenokarsinom (n= 7), endometrioma (n= 20) ve benign ovaryan kist (n= 31) olan 156 olgu incelendi. Bu olgularda CA 19-9, CA 12-5, CA 15-3 ve CEA düzeyleri araştırıldı. **Bulgular:** CA 19-9 dermoid kistlerin %58'inde, musinöz kistadenokarsinomların %85'inde yüksek olarak bulundu. Tümör belirteçleri içinde, sadece CA 19-9 düzeyi dermoid kistlerde eşik değerinden yüksek olarak saptandı. Dermoid kistlerde ortalama CA 19-9 düzeyi (60.89 mIU/mL) seröz kistadenokarsinom (22.55 mIU/mL), endometriyoma (57.96 mIU/mL) ve benign seröz kistlerden (14.68 mIU/mL) daha yüksek bulundu. Fakat musinöz kistlerdeki CA 19-9 düzeyi dermoid kistlerden daha yüksek saptandı (427.57 ve 60.89 mIU/mL, sırasıyla). **Sonuç:** Dermoid kistler asemptomatik olabilir. Sebebi bilinmeyen CA 19-9 yükselmelerinde jinekolojik araştırma (dermoid kist, musinöz kistadenokarsinom ve endometriyoma) yapılmalıdır.

**Anahtar Kelimeler:** Dermoid kist, ovaryan kistler, CA 19-9 antijen

Türkiye Klinikleri J Gynecol Obst 2009;19(6):322-8

**M**ature Cystic Teratoma (Dermoid Cyst) are exceedingly common in the ovary, accounting for approximately 95% of all germ cell tumors at that site.<sup>1,2</sup> More than 80% of cases occur during the reproductive period, but they may occur at any age.<sup>3</sup> Carbohydrate antigen

19-9 (CA 19-9) is considered the most valuable serum test used in the diagnosis and management of pancreatic cancer, as well it is the most useful test in distinguishing between benign and malignant pancreatic disorders. However, an elevated CA 19-9 level does not necessarily indicate pancreatic cancer, it also may be caused by benign conditions such as biliary, hepatocellular, gastric, colonic and non-gastrointestinal malignancy.<sup>4</sup> Increased CA 19-9 levels in some ovarian dermoid cysts and dermoid cysts in many other locations have been reported.<sup>5-7</sup> Our objective is to investigate the CA 19-9 levels in dermoid cysts which is commonly encountered in gynecologic practice.

## MATERIAL AND METHODS

This retrospective study was performed in 156 patients with ovarian cysts, who were treated in the Department of Obstetrics and Gynecology, Haseki Education and Research Hospital between January 2006 and April 2008. Histo-pathologic results of ovarian cysts have been documented retrospectively and the patients whose final pathologic diagnosis revealed dermoid cysts (n= 50), serous cystadenocarcinoma (n= 48), mucinous cystadenocarcinoma (n= 7), endometrioma (n= 20) and benign ovarian cysts (n= 31) have been included in this study to evaluate the objective of the present study. The 31 cases having benign serous pathology were operated due to their preoperative persistence on follow-up. Patients who have chronic illnesses, and complex status for surgical procedure were excluded. The patients with complex status for surgical procedure can be described as patients who have conditions such as diabetes mellitus, hypertension, gastrointestinal problems, asthma. Each patient's age, obstetric history, cyst size, bilaterality, pathologic results and tumor markers were (CA19-9, CA125, CA15.3 and carcino-embryonic antigen-CEA) recorded. We did not screen all the population by tumor markers rather we searched all patients with adnexial masses. Although the tumor markers have relatively poor diagnostic significance, the markers have been kept under the record for later follow-up. All the blood samples were obtained preoperatively. The determination

methods were radioimmunoassay for CA19-9, CA125 and CA15.3 and enzyme immunoassay for CEA (Abbott ARCHITECT c16000 clinical chemistry analyzer). Cut-off levels of tumour markers are CA19-9: 37 mU/mL, CA125: 35 U/mL, CA15.3: 35 mU/mL and CEA: 5 ng/mL. Oophorectomy, cystectomy or hysterectomy with unilateral or bilateral salpingo-oophorectomy was performed considering presence of normal residual ovarian tissue, presence of other pathology rather than size or bilaterality and patient's age, fertility desire. The final decision on route of surgery was made after examination under general anesthesia. The abdominal, laparoscopic, or laparoscopically assisted cystectomy approach was based on the experience and training of the surgeon. The average number of pathologic specimens was five (range 3-8). Tumor size was determined by the review of preoperative ultrasonographic reports.

Statistical analysis was performed with SPSS version 15.0 for Windows (SPSS, inc, Chicago) Categorical variables were analyzed with chi-square test and Fisher's exact tests where appropriate. Continuous variables were analyzed with Kruskal Wallis test and Mann-Whitney U test. Differences were considered significant when  $p < 0.05$  for the two-tails.

## RESULTS

This retrospective study was performed in 156 patients with ovarian cysts and the patients whose final pathologic diagnosis revealed dermoid cysts (n= 50), serous cystadenocarcinoma (n= 48), mucinous cystadenocarcinoma (n= 7), endometrioma (n= 20) and benign ovarian cysts (n= 31) have been included in this study. Patients ages, obstetric history, cyst size, site of cyst or cysts, pathologic results were shown in Table 1. The mean age of patients who had dermoid cysts was  $35.04 \pm 12.15$  years (median 35; range 15-76). Size of dermoid cyst ranged from 22 to 200 mm in diameter, with a median and mean  $\pm$  SD, 58 mm and  $68.86 \pm 35.49$ cm, respectively. The bilaterality rate was 10% (5 of 50 patients) when both ovaries were histopathologically evaluated. Among these demographic parameters the age was found to be

**TABLE 1:** Demographic characteristics of patients with ovarian cysts.

Histology	Dermoid Cyst n= 50	Serous Adenocarcinom n= 48	Mucinous Adenocarcinom n= 7	Endometrioma n= 20	Benign Cyst n= 31	p
Age (year) (Mean ± SD)	35.04 ± 12.15	60.68 ± 11.86	54.86 ± 16.68	33.20 ± 13.04	42.74 ± 17.73	p< 0.05
Gravida (Mean ± SD)	3.42 ± 3.45	6.54 ± 3.6	4.57 ± 2.6	2.15 ± 3.26	5.1 ± 4.8	p< 0.05
Parity (Mean ± SD)	2.6 ± 2.68	5.37 ± 3.39	3.71 ± 1.97	1.75 ± 2.9	4.03 ± 4	p< 0.05
Size(mm) (Mean ± SD)	68.86 ± 35.49	78.46 ± 23.76	157.71 ± 85.6	57.25 ± 20.49	74.51 ± 39.36	p< 0.05
Bilateral (%)	10	50	28.6	15	9.7	p< 0.05

**TABLE 2:** Comparison of Tumor markers in ovarian cysts.

	Dermoid Cyst n= 50	Serous Adenocarcinom n= 48	Mucinous Adenocarcinom n= 7	Endometrioma n= 20	Benign Cyst n= 31
Ca 19-9 IU/mL (mean value ± SD)	60.89 ± 72.53	22.55 ± 22.8	427.57 ± 452.04	57.96 ± 77.6	14.68 ± 13.97
Ca 12-5 IU/mL (mean value ± SD)	24.26 ± 23.08	855.98 ± 1799.5	152.03 ± 203.26	85.74 ± 82.58	14.49 ± 10.18
Ca 15-3 IU/mL (mean value ± SD)	16.45 ± 11.2	163.89 ± 259.7	29.33 ± 16.9	13.24 ± 7.9	14.71 ± 5.17
CEA ng/mL (mean value ± SD)	1.85 ± 1.5	1.6 ± 0.78	1.53 ± 1-01	1.44 ± 0.51	1.4 ± 0.89

statistically different between dermoid cysts and serous and mucinous carcinoma, gravida was found to differentiate statistically between dermoid cysts and serous carcinomas and between endometrioma and serous carcinomas. The same difference had remained for the parity. When the size was taken into account, mucinous carcinomas significantly have statistically larger sizes in comparison to the other histologic types.

The tumor markers of each histologic category have been presented in Table 2. Among the four tumor markers, CA19-9 was the only one with a mean serum level above the cut-off value for dermoid cysts. Mean CA 19-9 levels (60.89 IU/mL) of dermoid cysts are found to be higher than the mean CA 19-9 levels of serous cystadenocarcinoma (22.55 IU/mL), endometrioma (57.96 IU/mL) and benign ovarian cysts (14.68 IU/mL). Though mean CA 19-9 levels measured in the serum of patients who have mucinous cystadenocarcinoma were much higher than those with dermoid cyst (427.57 and 60.89 IU/mL, respectively).

The cut-off level for Ca19-9 is accepted to be 37 IU/mL. Above this cut-off level the percentages of histologic types are presented in Table 3. CA 19-

**TABLE 3:** Elevated Ca 19-9 (9 > 37 IU/ mL) in ovarian cysts.

Ca 19-9 > 37 mIU/mL	
Dermoid Cyst (n= 50)	(29) 58%
Serous Adenocarcinom (n= 48)	(8) 16.7%
Mucinous Adenocarcinom (n= 7)	(6) 85.7%
Endometrioma (n= 20)	(8) 40%
Benign Cyst (n= 31)	(10) 3.2%

9 showed an elevated rate of 58% for dermoid cysts and 85% for mucinous cystadenocarcinomas. The mean serum CA125 level of dermoid cysts was 24,26 U/ml and the elevated rate of CA125 was 14%.

Dermoid cysts are divided into three groups according to the size of the tumor (<5 cm, 5-10 cm and > 10 cm) and this three category the Ca 19-9 levels are shown in Table 4. Although mean CA 19-9 levels of > 10 cm dermoid cyst was greater than the mean CA 19-9 levels of smaller dermoid cysts, the difference was not statistically significant. The distribution of size, bilaterality, age and CA 125 levels according to normal and pathologic levels of CA 19-9 with dermoid cysts is demonstrated in Tab-

**TABLE 4:** Relationship Ca 19-9 levels , different cyst size in dermoid cysts.

Dermoid Cyst	< 5 cm (n= 18)	5-10 cm (n= 25)	> 10 cm (n= 7)	p* value
Ca 19-9 (IU/ mL)	49.7± 44.51	54.99 ± 55.67	110.71 ± 146.75	0.98

\*Kruskal Wallis test result.

le 5. Among dermoid cysts the difference was not statistically significant. Two of 5 bilateral dermoid cysts showed elevated CA 19-9 level.

## DISCUSSION

Dermoid cyst is composed exclusively of fetal or adult structures or both. The tumor is composed of well-differentiated derivatives of the three germ layers- ectoderm, mesoderm, and endoderm. It is characterized by a predominance of one to several cysts lined by epidermis accompanied by skin appendages. In most cases, mature neuroectodermal, endodermal, and mesodermal elements occur. In some instances, a portion or the entire lining is composed of respiratory epithelium or glia. In 1% of dermoid cysts, one tissue element shows malignant transformation, most often to squamous cell carcinoma. Elevated serum CA 125 and CA 19-9 levels seem unrelated to malignant transformation.<sup>8</sup> None of our cases in our dermoid cyst series have the malignant transformation in their pathologic evaluation.

Tumor markers such as CA 19-9 are increasingly becoming important to the practice of medicine. They help in making diagnoses, assessing prognoses, and assisting in determining responses to therapy. It is well documented that certain tumor markers such as HER-2 in advanced breast cancer, and hCG for nonseminomatous germ cell tumors, can be used as criterion for clinical decision making.<sup>9</sup> However, the specificity of CA19-9 to pancreatic tumors has been questioned, whereas other than pancreatic conditions, biliary, hepatocellular, gastric, colonic diseases as well as dermoid cysts have elevated CA 19-9 levels. Elevated CA 19-9 levels have also been reported in patients with rheumatologic conditions, including rheumatoid arthritis, systemic lupus erythematosus and scleroderma.<sup>10</sup> However, its specificity extends to any tissue malignancy.

**TABLE 5:** Relationship Ca 19-9 levels , different cyst size and bilaterality in dermoid cysts.

Dermoid Cyst	Ca 19-9 < 37 IU/ mL (n= 21)	Ca 19-9 > 37 IU/ mL (n= 29)	p
Size (mm)	73.8 ± 44.49	65.27 ± 27.54	0.7*
Bilaterality	60% (3/5)	40% (2/5)	0.34**
Age (year)	32.71 ± 9.36	36.72 ± 13.73	0.52*
Ca 125 IU/mL	29.51 ± 31.81	20.46 ± 13.19	0.63*

\*Mann-Whitney U results. \*\*Chi-square Fisher's Exact test results.

Dermoid cyst is often discovered as an incidental finding on physical examination, radiologic examination, or during abdominal surgery performed for other indications. For this reason, in case of increased CA 19-9 levels, dermoid cyst should be taken into consideration in the differential diagnoses. The CA 19-9 antigen was first isolated by Koprowski et al using a monoclonal antibody generated against colonic carcinoma cell lines.<sup>11,12</sup> Subsequently, a radioimmunoassay was developed by DelVillano et al to quantify CA 19-9.<sup>13</sup> CA 19-9 is tumor associated, but not tumor specific and is synthesized by normal human pancreatic and biliary ductular cells as well as by gastric, colonic, endometrial, and salivary epithelia. It can be found in large quantities in normal pancreatic juice, in the bile of patients with benign disorders, and in seminal fluid. Usually, very little CA 19-9 is found in the serum of normal subjects with benign disorders.<sup>14</sup> Most patients with pancreatic carcinoma have elevated levels of serum CA 19-9. Patients can have large amounts of CA 19-9 in tumor tissue with little in the serum, and vice versa. The upper limit of normal for CA 19-9 antigen is 37 U/mL and with this limit the assay has an overall mean sensitivity of 81% and a mean specificity of 90% for the diagnosis of pancreatic cancer.<sup>4</sup> Early diag-

nosis of pancreatic cancer is essential since cancer of the pancreas has a very poor prognosis.

Increased CA 19-9 levels in some dermoid ovarian cysts and dermoid cysts in many other locations have been reported.<sup>5-7,15-18</sup> In such cases we found the mean  $\pm$  SD CA 19-9 level was to be 60.89  $\pm$  72.53 IU/mL. CA 19-9 showed an elevated rate of 58% for dermoid cysts.

Dede et al evaluated 80 dermoid cysts and found the mean serum CA19-9 level was 101.2 IU/mL, the mean serum CA125 level was 32, the mean carcino-embryogenic antigen (CEA) level was 1.46 ng/mL. The elevated rate of CA19-9, CA125 and CEA was 38.8%, 25% and 9.1%, respectively. The bilaterality rate was 27.5%. Patients with an elevated serum CA19-9 level showed significantly higher bilaterality rate (51.6% versus 12.2%,  $p < 0.05$ ) than the patients with low levels.<sup>19</sup> Our findings were not consistent with Dede's results. Although, the mean CA 19-9 level was lower than the Dede's mean Ca19-9 levels, elevated rate of CA 19-9 above the cut-off was higher in our case series. The elevated rate of CA 125 and bilaterality was lower in our case in comparison of Dede's report.

Reproductive history in dermoid cyst subjects presented in gravity and parity were lower than the other groups because of the 13 virgo cases in dermoid cyst group.

Mikuni et al reported that CA19-9 levels of dermoid cysts showed the highest positive rate of 45.5% and CA125 was second highest tumor marker as having 12.7%. They concluded there was no significant relationship between tumor weight and the CA19-9 concentration. The site of the tumors was similar on both the right and left.<sup>6</sup>

Kawai et al reported positive rate of CA125 was over 50% in all tumor types except mature cystic teratoma, which showed a positive rate of 23.7%. They assessed that CA19-9 showed a high positive rate in teratomatous tumors, which were immature teratoma, mature cystic teratoma with malignant transformation, and mature cystic teratoma.<sup>5</sup>

In patients with dermoid cysts, the higher than normal level of CA125 was 14% (7/50 patients) in the our study, which was similar to 12.7% as reported by Mikuni et al and it was smaller than 23.7% and 28% as reported by Kawai et al and Kikkawa et al, respectively.<sup>5,6,20</sup> CA125 alone seems to be not useful in the diagnosis of dermoid cysts.

Ito et al investigated 170 patients with dermoid cysts, using an enzyme immunoassay to determine the tissue source of their high serum levels of CA19-9. The preoperative serum CA19-9 level was high, 83.8 IU/mL, against the low postoperative level of 32.9 IU/mL. This suggested the possibility of CA19-9 being produced in the dermoid cysts. In the 31 patients with serum CA19-9 levels over 101 IU/mL, CA19-9 was immunohistochemically demonstrated in the bronchial glands and bronchial mucosa of the dermoid cysts. CA19-9 levels were higher in the cyst fluid of dermoid cyst than in the serum. They concluded that clinically, CA19-9 is a marker necessary for examining dermoid cyst recurrence.<sup>21</sup>

There was a case report in the literature showed that a 25-year-old virgin woman with a very large and complicated right ovarian cyst and serum CA 19-9 level 1430 IU/mL was operated and a histopathologic evaluation of a frozen section determined the lesion to be a dermoid cyst.<sup>22</sup> Multiple sections from various cyst sites did not reveal any malignant foci. Some cystic cavities were lined with simple mucinous epithelium, and with respiratory mucosa that expressed diffuse and strong cytoplasmic positivity for CA 19-9. Therefore, the mature teratoma itself was identified immunohistochemically as the source of CA-19-9. In this case report, authors depicted that postoperatively, CA 19-9 and CA 125 levels returned to normal.

Immunohistochemically, CA 19-9 staining was prominent on the apical cytoplasm of the epithelial lining, not on the basement membrane side, suggesting that CA 19-9 was secreted into the cystic cavity and concentrated there.

Another case report showed that a 54-year-old woman with 8.5 cm ovarian cyst and serum CA 19-



9 level 436 IU/mL was operated and histology revealed a multiloculated mature cystic teratoma in the right ovary.<sup>23</sup> There were no malignant components. The CA 19-9 dropped to 48.5 IU/mL and then to 18.7 IU/mL, 3 and 6 weeks following surgery, respectively.

Increased CA 19-9 levels in some mucinous ovarian carcinomas and endometriomas have been reported.<sup>24-26</sup> In Fioretti's study, CA 19-9 was high in 87.5% of mucinous malignancies. In our series, although mucinous ovarian adenocarcinoma cases were limited (7 cases); Ca 19-9 levels were remarkably high (mean value 427.57 IU/mL and high in 85.7%). Nevertheless, mean age, tumor size, bilaterality and tumor markers (Ca 125) are substantially higher in mucinous tumors than dermoid cysts which can help to identify in differentiating the mucinous cysts from the dermoid cysts with elevated CA 19-9 levels.

Watanabe et al reported the positive rate of serum CA19-9 in patients with endometriosis is 52% and that of CA125 is 48%. The immunohistochemistry of CA19-9 showed that it localized in chocolate cysts, but not in the lesions of adenomyosis.<sup>27</sup> In another study, CA 19-9 values was 53.3% higher than the upper limit. Danazol treatment caused a significant decrease in CA 19-9.<sup>28</sup> The use of CA 19-9 in the diagnosis of endometriosis found that the mean serum CA19-9 levels in patients at all stages of endometriosis were significantly higher than those in patients without endometriosis and intense staining of CA19-9 was observed in 15 of the 20 samples of ovarian chocolate cysts.<sup>29</sup> We determined also CA 19-9 levels were elevated in 40% of endometriomas. Mean age, tumor size, bilaterality are similar in endometriomas and dermoid cysts. Differential diagnosis with dermoid cysts

could be use of CA 125 levels. Sahin et al reported elevated CA 12-5 levels were often associated with endometriosis, inflammatory masses, and dermoid cyst which are seen especially in premenopausal women.<sup>30</sup>

Our data set and some of the literature evidence showed that CA 19-9 level is frequently found to be elevated in dermoid cyst. Among the tumor markers in the differential diagnosis of adnexial mass work-up, if the CA 19-9 level solitarily elevated, it might not be suggested a malignant neoplasm, rather dermoid cyst if the patients age, sonographic appearance of the cyst and other tumor markers especially CA125 are taken into consideration. On the other hand, during the diagnostic evaluation of pancreatic diseases, it must be keep in mind that this elevation can be related with dermoid cyst in the ovary. Dermoid cysts may be asymptomatic and neglecting ovarian mass may cause unnecessary interventions in trial for establishing the diagnosis. Our findings suggest that gynecological examination should be part of evaluation of Ca 19-9 elevation of unknown origin. Our case series suggested and concluded that CA 19-9 as a tumor marker for patients who has been investigated for any reason was found to be valuable. It has been elevated for a number of gastrointestinal conditions which is beyond the scope of a gynecologist and also in gynecologic condition such as dermoid cyst which is beyond the consideration of an internist or surgeon. Our findings suggest that gynecological examination should be part of evaluation of Ca 19-9 elevation of unknown origin. So, this tumor marker is a challenge among the different disciplines and takes place in the differential diagnoses of several conditions.

## REFERENCES

- Katsube Y, Berg JW, Silverberg SG. Epidemiologic pathology of ovarian tumors: a histopathologic review of primary ovarian neoplasms diagnosed in the Denver Standard Metropolitan Statistical Area, 1 July-31 December 1969 and 1 July-31 December 1979. *Int J Gynecol Pathol* 1982;1(1):3-16.
- Koonings PP, Campbell K, Mishell DR Jr, Grimes DA. Relative frequency of primary ovarian neoplasms: a 10-year review. *Obstet Gynecol* 1989;74(6):921-6.
- Roth LM, Talerman A. Recent advances in the pathology and classification of ovarian germ cell tumors. *Int J Gynecol Pathol* 2006;25(4):305-20.
- Steinberg W. The clinical utility of the CA 19-9 tumor-associated antigen. *Am J Gastroenterol* 1990;85(4):350-5.
- Kawai M, Kano T, Kikkawa F, Morikawa Y, Oguchi H, Nakashima N, et al. Seven tumor markers in benign and malignant germ cell tumors of the ovary. *Gynecol Oncol* 1992;45(3):248-53.
- Mikuni M, Makinoda S, Tanaka T, Okuda T, Domon H, Fujimoto S. [Evaluation of tumor marker in ovarian dermoid cyst]. *Nippon Sanka Fujinka Gakkai Zasshi* 1990;42(5):479-84.
- Nanayakkara S, Ali S, Gilmour K. Increased serum carcinoembryonic antigen 19-9 (CA 19-9) in a dermoid cyst. *J Obstet Gynaecol* 2007;27(1):96-7.
- Yoshioka T, Tanaka T. Immunohistochemical and molecular studies on malignant transformation in mature cystic teratoma of the ovary. *J Obstet Gynaecol Res* 1998;24(2):83-90.
- Duffy MJ. Evidence for the clinical use of tumour markers. *Ann Clin Biochem* 2004;41(Pt 5):370-7.
- Shimomura C, Eguchi K, Kawakami A, Migita K, Nakao H, Otsubo T, et al. Elevation of a tumor associated antigen CA 19-9 levels in patients with rheumatic diseases. *J Rheumatol* 1989;16(11):1410-5.
- Koprowski H, Steplewski Z, Mitchell K, Herlyn M, Herlyn D, Fuhrer P. Colorectal carcinoma antigens detected by hybridoma antibodies. *Somatic Cell Genet* 1979;5(6):957-71.
- Koprowski H, Herlyn M, Steplewski Z, Sears HF. Specific antigen in serum of patients with colon carcinoma. *Science* 1981;212(4490):53-5.
- Del Villano BC, Brennan S, Brock P, Bucher C, Liu V, McClure M, et al. Radioimmuno-metric assay for a monoclonal antibody-defined tumor marker, CA 19-9. *Clin Chem* 1983;29(3):549-52.
- Ritts RE Jr, Del Villano BC, Go VL, Herberman RB, Klug TL, Zurawski VR Jr. Initial clinical evaluation of an immunoradiometric assay for CA 19-9 using the NCI serum bank. *Int J Cancer* 1984;33(3):339-45.
- Nagata H, Takahashi K, Yamane Y, Yoshino K, Shibukawa T, Kitao M. Abnormally high values of CA 125 and CA 19-9 in women with benign tumors. *Gynecol Obstet Invest* 1989;28(3):165-8.
- Lahdenne P, Pitkänen S, Rajantie J, Kuusela P, Siimes MA, Lanning M, et al. Tumor markers CA 125 and CA 19-9 in cord blood and during infancy: developmental changes and use in pediatric germ cell tumors. *Pediatr Res* 1995;38(5):797-801.
- Micke O, Schafer U, Willich N. Persistent elevation of CA 19-9 levels in a patient with an extended retroperitoneal dermoid. *Anticancer Res* 1999;19(4A):2717-20.
- Uyama T, Monden Y, Sumitomo M, Miura K, Kimura S. CEA and CA 19-9 in benign pulmonary or mediastinal cystic lesions. *J Surg Oncol* 1989;41(2):103-8.
- Dede M, Gungor S, Yenen MC, Alanbay I, Duru NK, Haşimi A. CA19-9 may have clinical significance in mature cystic teratomas of the ovary. *Int J Gynecol Cancer* 2006;16(1):189-93.
- Kikkawa F, Nawa A, Tamakoshi K, Ishikawa H, Kuzuya K, Suganuma N, et al. Diagnosis of squamous cell carcinoma arising from mature cystic teratoma of the ovary. *Cancer* 1998;82(11):2249-55.
- Ito K. [Significance of CA19-9 in mature cystic teratoma]. *Nippon Sanka Fujinka Gakkai Zasshi* 1992;44(5):524-8.
- Atabekoğlu C, Zozaci EA, Tezcan S. Elevated carbohydrate antigen 19-9 in a dermoid cyst. *Int J Gynaecol Obstet* 2005;91(3):262-3.
- Nanayakkara S, Ali S, Gilmour K. Increased serum carcinoembryonic antigen 19-9 (CA 19-9) in a dermoid cyst. *J Obstet Gynaecol* 2007;27(1):96-7.
- Fioretti P, Gadducci A, Ferdeghini M, Bartolini T, Fontana V, Facchini V. Preoperative evaluation of CA 125 and CA 19-9 serum levels in patients with ovarian masses. *Eur J Gynaecol Oncol* 1988;9(4):291-4.
- Molina R, Ojeda B, Filella X, Borrás G, Jo J, Mas E, et al. A prospective study of tumor markers CA 15 and CA 19-9 in patients with epithelial ovarian carcinomas. *Tumour Biol* 1992;13(5-6):278-86.
- Engelen MJ, de Bruijn HW, Hollema H, ten Hoor KA, Willemse PH, Aalders JG, et al. Serum CA 125, carcinoembryonic antigen, and CA 19-9 as tumor markers in borderline ovarian tumors. *Gynecol Oncol* 2000;78(1):16-20.
- Watanabe J, Johboh T, Hata H, Kuramoto H. Clinical significance of CA19-9 for endometriosis. *Nippon Sanka Fujinka Gakkai Zasshi* 1990;42(2):155-61.
- Mataliotakis I, Panidis D, Vlassis G, Neonaki M, Goumenou A, Koumantakis E. Unexpected increase of the CA 19-9 tumour marker in patients with endometriosis. *Eur J Gynaecol Oncol* 1998;19(5):489-500.
- Harada T, Kubota T, Aso T. Usefulness of CA19-9 versus CA125 for the diagnosis of endometriosis. *Fertil Steril* 2002;78(4):733-9.
- Şahin Y, Ayata D, Muhtaroglu S, Ökten S. [Preoperatif serum ca 125 in patients with pelvic masses]. *Türkiye Klinikleri J Gynecol Obst* 1993;3(3):225-8.