Published in final edited form as:

J Pediatr Adolesc Gynecol. 2011 June ; 24(3): 176–180.

The Approach to Ovarian Dermoids in Adolescents and Young Women

Kathleen E. O'Neill, M.D.¹ and Amber R. Cooper, M.D., M.S.C.I.²

¹Department of Obstetrics and Gynecology, Washington University, Barnes-Jewish Hospital, St. Louis, MO

²Division of Reproductive Endocrinology and Infertility, Department of Obstetrics and Gynecology, Washington University, Barnes-Jewish Hospital, St. Louis, MO

Abstract

Background—Mature cystic teratomas (MCTs) are the most common ovarian neoplastic lesions found in adolescents. MCTs are usually asymptomatic and are often discovered incidentally on exam or imaging. The recurrence rate of MCTs following cystectomy is 3–4% and incidence of malignant transformation is estimated to be 0.17–2%. Given the accuracy with which MCTs can be diagnosed preoperatively, studies suggest that these lesions can be treated surgically using laparoscopic techniques. The management of MCTs in the adolescent population poses unique challenges given the potential impact on sexual development and fertility.

Case—A 17 year-old female was found to have bilateral adnexal masses consistent in appearance with MCTs on computed tomography after a motor vehicle accident. She underwent exploratory laparotomy with pathology confirming the presence of bilateral ovarian MCTs. Three years later she returned to the office with occasional abdominopelvic pain. Ultrasound revealed bilateral complex cysts suggestive of recurrent MCTs. She was expectantly managed with serial ultrasounds and after 24 months, slow but visible growth of the MCTs was confirmed. The patient is now 22 years old and asymptomatic. What is the most appropriate management?

Summary and Conclusion—The risks of expectant management in women like the one presented are small. This suggests that although the traditional treatment for MCTs is laparoscopic ovarian cystectomy, in children and adolescents with MCTs we should consider close follow-up without intervention to preserve ovarian function and future fertility.

Author Correspondence: Amber R. Cooper, MD, MSCI, Washington University, 4444 Forest Park Parkway, Suite 3100, St. Louis, MO 63108, coopera@wustl.edu.

Financial Disclosures:

Amber R. Cooper, MD, MSCI reports past or current research/salary support from 2T32HD040135-07, UL1RR024992, and K12HD063086-01

Publisher's Disclaimer: This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final citable form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

Keywords

dermoid; mature cystic teratoma; ovarian cystectomy; oophorectomy; expectant management; pediatric; adolescent; laparoscopy

Introduction

Mature cystic teratomas (MCTs) or dermoid cysts are the most common ovarian neoplastic lesions found in adolescents. These masses are a benign type of germ cell tumor that arises from totipotent cells in the ovary which develop into fully differentiated ectodermal, mesodermal, and endodermal tissue.¹ MCTs account for approximately 70% of benign ovarian tumors in women under 30 years of age and 50% of pediatric tumors.^{2–4} The exact prevalence of dermoid cysts in the pediatric, adolescent and non-pregnant premenopausal populations is unknown as pelvic imaging is not routinely performed in these groups. One study that examined 335 asymptomatic women aged 25–40 years old using transvaginal ultrasound found one dermoid cyst.⁵

MCTs are usually asymptomatic and in many cases are discovered incidentally on exam or imaging.⁶ A review of 517 cases of MCTs found that 60% of patients were asymptomatic at the time of diagnosis, 11% of patients had their tumors found incidentally at the time of laparotomy for other pathology, and 39% of patients were symptomatic.⁷ If symptoms are present in women with MCTs, abdominal pain is the most common complaint followed rarely by increased abdominal girth, palpable abdominal mass, constipation, nausea, vomiting, and anorexia.⁶

MCTs are indolent tumors with an estimated growth rate of 1.8 mm per year.⁸ It is unclear what signals these lesions to grow. It has been suggested that increasing estrogen and progesterone stimulate the sebaceous gland component of these tumors and in part can explain the increase in size seen in MCTs after puberty and the arrested growth after menopause.^{8–9}

MCTs are bilateral in approximately 10–20% of cases.^{10–11} Immature teratomas represent <1% of all ovarian teratomas and are also composed of tissue from the three germ cell layers, however unlike MCTs, the cells are not fully differentiated and are arranged in a haphazard manner.¹²

Nonsurgical Diagnostic Tools

MCTs have a characteristic appearance on ultrasound. Ultrasound findings include the presence of a Rokitansky nodule, fat fluid levels, dermoid mesh, and the “tip of the iceberg sign”.¹³ The Rokitansky nodule, or dermoid plug, is a cystic lesion with a densely echogenic tubercle projecting into the cyst lumen. Dermoid mesh is a specific sign that refers to the matrix of echogenic bands made by hair fibers floating within the cyst. The “tip of the iceberg sign” applies to the acoustic shadowing that sebum can have on hair containing lesions. Ultrasound can also be useful in differentiating benign ovarian masses from malignant lesions. Characteristics suggestive of malignancy include ovarian volume of

above 20 cm³ or greater, increased vascular support to a lesion on color Doppler, septations, papillary projections, and heterogeneous tissue echogenicity.^{14–16}

Other modalities used to evaluate adnexal masses include computed tomography (CT) and magnetic resonance imaging (MRI). On CT, findings suggestive of teratomas include large amounts of fat attenuation within an ovarian lesion, with or without calcification in the wall of the cyst. On MRI, the sebaceous component of dermoid cyst parallels the signal intensity of fat on all sequences.¹⁷

Serum markers are useful in differentiating benign ovarian lesions from malignant lesions when markedly abnormal. A commonly drawn marker in cases of adnexal masses, CA-125 may be detected in the serum of up to 86% of patients with ovarian neoplasms, with levels of 35 U/mL or higher being considered suspicious for malignancy.^{18–19} In the pediatric and adolescent population serum markers are an important adjunct given the reported rate of malignancy in ovarian masses in childhood ranging from 16–55%.^{20–22} Tumor markers including β -HCG, alpha-fetoprotein (AFP), lactate dehydrogenase (LDH), inhibin, and testosterone are useful in detecting choriocarcinoma, endodermal sinus tumors, dysgerminomas, granulosa cell tumors and Sertoli-Leydig cell tumors respectively.²³

The Surgical Debate

To Remove or Observe?

Before the advent of modern surgical techniques MCTs were purported to produce some morbidity and mortality secondary to ovarian torsion leading to ovarian infarction, rupture leading to chemical peritonitis, fistulization through pelvic viscera, and malignant degeneration.²⁴ As a result many gynecologists and pediatric surgeons agree that large, symptomatic teratomas warrant surgical intervention. Although debate exists over the threshold and criteria that necessitate surgical management of teratomas, solid masses are generally removed if they are symptomatic, large (often defined as greater than 5 cm in diameter given the propensity for torsion), and if thought to be potentially malignant.⁶

The role of expectant management of dermoid cysts in asymptomatic non-pregnant premenopausal women has been little explored. One prospective study explored the role of expectant management in 86 women with ovarian dermoid cysts under 6 cm in diameter by ultrasound and with a growth rate less than 2cm/year.⁸ The cysts were removed surgically in 24/86 women. No complications such as torsion, infection, malignant transformation or rupture were encountered, however 21/24 women who underwent resection did so secondary to tumor growth rate more than 2 cm/year. Another study of expectant management, though retrospective, followed 93 asymptomatic women with MCTs.²⁵ The mean duration of follow-up was 12.6 months with range of 3 to 73 months. No serious complications were noted in patients during the follow-up period and 24/93 women had surgical intervention. Of the 24 women who had surgical intervention nine became symptomatic and three had ovarian cystectomy during an unrelated operation.

Surgical Approach

Given the accuracy with which teratomas can be diagnosed preoperatively, most studies suggest that over 80% of ovarian dermoid cysts can be successfully treated surgically using laparoscopic techniques.²⁶ A minimally invasive approach offers many benefits over open abdominal surgery including less postoperative pain, shorter recovery time, better cosmesis, and improved magnification which makes the diagnosis of peritoneal metastases more certain.²⁷ Disadvantages of laparoscopy include increased operating times, increased cost and other risks of surgery unique to laparoscopy. The surgical approach chosen is in large part dependent on operative experience however, laparotomy is generally preferred with large or bilateral lesions and with masses suspicious for malignancy in the event that surgical staging is required.

In 2009 the use of laparoscopy versus laparotomy for benign ovarian tumors was explored in a Cochrane review. This systematic review included 12 randomized control trials and the results showed that laparoscopic surgery was associated with significantly less postoperative pain, fewer adverse events of surgery, and a shorter length of stay in the hospital.²⁸ Overall, the frequency of inadvertent rupture of the cysts during operation was larger in the laparoscopy group than in the laparotomy group.^{29–30} Despite that finding, in the subgroup of dermoid cysts there was no statistical difference between the two treatment arms regarding total number of adverse events of surgery.^{31–32}

Other issues to consider when weighing the available surgical approaches are the potential for adhesion formation and intraoperative rupture of MCTs. Spillage of the contents of MCTs has been purported to be associated with increased adhesion formation and chemical peritonitis.³³ Postoperative adhesions may result in mechanical infertility in women of reproductive age.³⁴ The risk of spillage is reported to be 40–50% during attempted laparoscopic cystectomy, compared to 10–15% during exploratory laparotomy with cystectomy.^{33, 35–36} Despite this increased risk of rupture, in the adult literature, chemical peritonitis has been found to occur with an estimated incidence of 0.2% following laparoscopic excision of an MCT if spillage is managed by immediate copious lavage.^{37–38} Subsequent series confirmed that spill in children can be managed in the same way as adults with similar expectations for a successful outcome.³⁶ Some studies question if tumor spillage does in fact promote adhesion formation, and found that successful pregnancies did occur in individuals who had experienced intraperitoneal teratoma rupture.³⁹ Additionally, adhesion formation can occur with open abdominal procedures alone regardless of the subsequent interventions and some studies suggest that laparoscopy is actually associated with decreased postoperative adhesion formation when compared with laparotomy.⁴⁰ One important caveat is in patients with unrecognized neoplasms, laparoscopy may be associated with an increase in the rate of intraperitoneal spillage with consequent dissemination of tumor cells and advances in disease stage, which emphasizes the importance of thorough preoperative evaluation of ovarian masses.^{41–43}

In the past, oophorectomy was traditionally performed in children with MCTs due to large cyst size, concern for occult germ cell malignancy, presence of torsion, decreased viability of remaining ovarian tissue, and risk of spillage and/or incomplete removal. However, as surgical techniques have advanced, the use of ovarian cystectomy has been established to be

as safe of a method for tumor removal in the adult and pediatric populations as oophorectomy.^{4,11,21,39,44–46} As a result, many experts now agree that cystectomy should be the first line treatment in lesions that are preoperatively consistent with teratoma.²¹

Given the increased risk of bilateral MCTs some surgeons propose that intraoperative biopsy of the contralateral and seemingly unaffected ovary should be performed. Yet, ovarian wedge biopsy is not without complications including possible hemorrhage, infection, and adhesion formation. In women with unilateral teratomas, histological studies of normal appearing contralateral ovaries led to identification of a teratoma in only 1.1% of cases.^{47–48} Given that ultrasound is a good predictor of MCT presence, preoperative ultrasound in combination with careful inspection of the contralateral ovary at the time of surgery offer a safe alternative to wedge biopsy.⁴⁹

The Threat of Recurrence and Malignancy

In adults, the reported incidence of recurrent MCT following cystectomy is 3–4%⁵⁰ In younger patients with multiple or bilateral MCT there is 2–3% incidence of subsequent development of germ cell tumors.^{50–52} One retrospective multicenter cohort study of ovarian dermoids removed by laparoscopy compared to exploratory laparotomy found significantly more ipsilateral recurrences in the laparoscopy group between 2–24 months postoperatively and calculated the probability of recurrence at two years to be 7.6% by laparoscopy and 0% for laparotomy.⁵³ One could easily wonder whether the increase in ipsilateral recurrent teratomas, especially during laparoscopy, is due to incomplete resection or unrecognized small co-existent MCTs at the time of removal rather than a true recurrence.

Although noninvasive imaging can diagnose MCTs with considerable accuracy, tissue examination is necessary to definitively excluding malignancy. Malignant transformation in a mature teratoma is a very rare complication, with a reported incidence of 0.17–2%.^{21,36,54–59} Most of these cases are diagnosed after the age of 40 years and in cysts greater than 10 cm.^{10,60} Approximately 80–85% of malignant transformations have been reported as squamous cell carcinomas.⁵⁵ Whether these malignant neoplasms commence in a malignant fashion rather than being a clear transformation of a benign process will likely remain unknown. Among pediatric and adolescent females 1–2% of teratomas have been found to be malignant on pathology.^{21, 36, 58–61}

Given the slow growth of teratomas, small rate of recurrence and rare risk of malignancy, the most appropriate method of surveillance is an area of great debate. Given the sensitivity of ultrasound in the detection of MCT, annual imaging in prepubertal and young adolescents followed by annual pelvic examinations in older adolescents has been advocated by some.⁵⁹ Alternatively, it could be argued that regular surveillance is not required and young women should have regular follow-up with a physician and no additional imaging/testing unless symptomatic.

The Hope for Fertility Preservation

For benign ovarian disorders in young women, conservative surgery is paramount in development of normal puberty and in optimizing future fertility.³⁶ When dealing with MCTs, cystectomy is almost always preferred to oophorectomy. Contrary to appearances,

the thinned cortical tissue that remains after cystectomy contains numerous viable follicles which can serve for future hormonal production and oocytes for reproduction. Meiorow et al found after laparoscopic ovarian biopsy that in women 11–34 years old each 1 mm² of surface ovarian tissue contained approximately 35 primordial follicles.⁶² Another study in women that underwent laparoscopic ovarian cystectomy demonstrated that 56 of 632 patients had 3 cm³ or greater ovarian volume at 12 months post-operatively on transvaginal ultrasound, and 24 of these patients had no visualized normal ovarian tissue pre-operatively by the same diagnostic measure.⁶³ Furthermore, even in cysts 8 cm or greater in this study, there was an average of 3.7 cm³ functioning ovarian tissue on follow-up transvaginal ultrasound. The amount of ovarian tissue remaining can dramatically impact future fertility and is an important consideration in the management of MCTs in young women.

Discussion

The patient presented in the case had large bilateral teratomas originally managed with exploratory laparotomy and cystectomy. Follow-up revealed recurrence of her bilateral teratomas and expectant management was pursued. Given the small size of the lesions, asymptomatic status, low risk of malignancy, torsion and rupture, continued expectant management is a reasonable approach. Annual surveillance with ultrasound and pelvic exam is appropriate given the proven consistent growth of the cysts. The patient should be counseled that she is at increased risk of ovarian torsion given the multiple and bilateral character of her MCTs. Surgical intervention should be pursued if the patient becomes symptomatic or considered if the individual lesions grow to a diameter of greater than 5 cm. When surgery is performed the ideal approach combines laparoscopy and cystectomy and leaves as much viable ovarian tissue in place in order to preserve the patient's childbearing potential. That being said, it is clear that the current body of research does not show clear benefit of this approach over mini-laparotomy with good surgical technique. Given the lack of prospective randomized trials examining expectant management of MCTs, formulating a management plan involves communication to patients and families regarding the limited knowledge regarding the long term implications of surgery versus expectant management.

The management of MCTs in the adolescent population poses unique challenges given the potential impact on a young women's sexual development and future fertility. A fine balance exists between complete excision of symptomatic lesions, prevention of negative sequelae like ovarian torsion, and overly aggressive intervention. Each surgical approach and technique has the potential to significantly impact childbearing potential in unique ways with varying risk/benefit profiles. Many questions still linger. When trying to prevent adhesion formation do we increase the risk of recurrence or incomplete resection by choosing laparoscopy? By avoiding surgery in smaller suspected teratomas do we take too much risk of subsequent morbidity? Could low dose oral contraceptive pills diminish sebaceous gland stimulation and subsequent growth? Much of these questions warrant further investigation. In reality, the risks of expectant management in women like the one presented may be so small that we should consider close follow-up without intervention to preserve ovarian function and future fertility more often.

References

1. Powell J. Benign adnexal masses in the adolescent. *Adolesc Med.* 2004; 15:535–547.
2. Damjanov, I.; Linder, J.; Anderson, W. *Anderson's Pathology*. 10. Damjanov, I.; Linder, J., editors. St. Louis: Mosby; 1996. p. 1-2900.
3. Ayhan A, Bukulmez O, Genc C, et al. Mature cystic teratomas of the ovary: case series from one institution over 34 years. *Eur J Obstet Gynecol Repro Biol.* 2000; 33:153–157.
4. Templeman C, Fallat M, Lam A, et al. Managing mature cystic teratomas of the ovary. *Obstet Gynecol Surv.* 2000; 55:738–745. [PubMed: 11128910]
5. Borgfeldt C, Andolf E. Transvaginal sonographic ovarian findings in a random sample of women 25–40 years old. *Ultrasound Obstet Gynecol.* 1999; 13:345–350. [PubMed: 10380300]
6. Laufer, M.; Goldstein, D. Benign and malignant ovarian masses. In: Emans, S.; Laufer, M.; Goldstein, D., editors. *Pediatric and Adolescent Gynecology*. 5. Philadelphia: Lippincott Williams and Wilkins; 2005. p. 706-710.
7. Comerici J, Licciardi F, Bergh P, et al. Mature cystic teratoma: a clinicopathologic evaluation of 517 cases and review of the literature. *Obstet and Gynecol.* 1994; 84:22–28.
8. Caspi B, Appelman Z, Rabinerson D, et al. The growth pattern of ovarian dermoid cysts: a prospective study in premenopausal and postmenopausal women. *Fertil Steril.* 1997; 68:501–505. [PubMed: 9314922]
9. Blackwell W, Dockerty M, Masson J, et al. Dermoid cysts of the ovary: their clinical and pathologic significance. *Am J Obstet Gynecol.* 1946; 51:151–172. [PubMed: 21012750]
10. Caruso P, Marsh M, Minkowitz S, et al. An intense clinicopathologic study of 305 teratomas of the ovary. *Cancer.* 1971; 27:343–348. [PubMed: 5100397]
11. Shalev E, Bustan M, Romano S, et al. Laparoscopic resection of ovarian benign cystic teratomas: experience with 84 cases. *Hum Reprod.* 1998; 13:1810–1812. [PubMed: 9740429]
12. Outwater E, Siegelman E, Hunt J. Ovarian teratomas: tumor types and imaging characteristics. *Radiographics.* 2001; 21:475–490. [PubMed: 11259710]
13. Quinn S, Erickson S, Black W. Cystic ovarian teratomas: the sonographic appearance of the dermoid plug. *Radiology.* 1985; 155:477–478. [PubMed: 3885313]
14. van Nagell J, DePriest P, Reedy M, et al. The efficacy of transvaginal sonographic screening in asymptomatic women at risk for ovarian cancer. *Gynecol Oncol.* 2000; 77:350–356. [PubMed: 10831341]
15. Brown D, Frates M, Laing F, et al. Ovarian masses: can benign and malignant lesions be differentiated with colour and pulsed Doppler US? *Radiology.* 1994; 190:333–336. [PubMed: 8284377]
16. Sassone A, Timor-Tritsch I, Artner A, et al. Transvaginal sonographic characterization of ovarian disease: evaluation of a new scoring system to predict ovarian malignancy. *Obstet and Gynecol.* 1991; 78:70–76.
17. Choudhary S, Fasih N, Mc Innes M, et al. Imaging of ovarian teratomas: appearances and complications. *J Med Imaging Radiat Oncol.* 2009; 53:480–488. [PubMed: 19788483]
18. Chou C, Chang C, Yao B, et al. Color doppler ultrasonography and serum CA 125 in the differentiation of benign and malignant ovarian tumours. *J Clin Ultrasound.* 1994; 22:491–496. [PubMed: 7814654]
19. Maggino T, Sopracordevole F, Matarese M, et al. CA-125 serum levels in the diagnosis of pelvic masses: comparison with other methods. *Eur J Gynaecol Oncol.* 1987; 8:590–594. [PubMed: 3319631]
20. Morowitz M, Huff D, von Allmen D. Epithelial ovarian tumors in children: a retrospective analysis. *J Pediatr Surg.* 2003; 38:331–335. [PubMed: 12632344]
21. Cass D, Hawkins E, Brandt M, et al. Surgery for ovarian masses in infants, children, and adolescents: 102 consecutive patients treated in a 15-year period. *J Pediatr Surg.* 2001; 36:693–699. [PubMed: 11329568]
22. Lindfors O. Primary ovarian neoplasms in infants and children: a study of 81 cases diagnosed in Finland and Sweden. *An Chir Gynaecol Suppl.* 1971; 177:1–6.

23. von Allmen D. Malignant lesions of the ovary in childhood. *Semin Pediatr Surg.* 2005; 14:100–105. [PubMed: 15846566]
24. Pantoja E, Noy M, Axtmayer R, et al. Ovarian dermoids and their complications: comprehensive historical review. *Obstet Gynecol Surv.* 1975; 30:1–20. [PubMed: 1089224]
25. Hoo W, Yazbek J, Holland T, et al. Expectant management of ultrasonically diagnosed ovarian dermoid cysts: is it possible to predict the outcome? *Ultrasound Obstet Gyn.* 2010; 36:235–40.
26. Canis M, Mage G, Wattiez A, et al. A simple management program for adnexal masses. *Ref Gynecol Obstet.* 2000; 77:563–5.
27. Canis M, Botchorishvili R, Manhes H, et al. Management of adnexal masses: role and risk of laparoscopy. *Semin Surg Oncol.* 2000; 19:28–35. [PubMed: 10883021]
28. Medeiros L, Rosa D, Bozzetti M, et al. Laparoscopy versus laparotomy for benign ovarian tumor. *The Cochrane Database Syst Rev.* 2009; (4)
29. Fanfani F, Fagotti, Ercoli A, et al. A prospective randomized study of laparoscopy and minilaparotomy in the management of benign adnexal masses. *Hum Reprod.* 2004; 10:2367–71. [PubMed: 15242993]
30. Panici P, Palaia I, Bellati F, et al. Laparoscopy compared with laparoscopically guided minilaparotomy for large adnexal masses: a randomized control trial. *Obstet Gynecol.* 2007; 110:241–8. [PubMed: 17666596]
31. Morgante G, Ditto A, La Marca A, et al. Surgical treatment of ovarian dermoid cyst. *Eur J Obstet Gynecol R Biol.* 1998; 81:47–50.
32. Nitke S, Goldman G, Fisch B, et al. The management of dermoid cysts – a comparative study of laparoscopy and laparotomy. *Isr J Med Sci.* 1996; 32:1177–9. [PubMed: 9007148]
33. Milad M, Olson E. Factors that increase the risk of leakage during surgical removal of benign cystic teratomas. *Hum Reprod.* 1999; 14:2264–67. [PubMed: 10469692]
34. Bassil, S.; Canis, M.; Pouly, J., et al. Fertility following laparoscopic treatment of benign adnexal cysts. In: Donnez, J.; Nissole, M.; DeCherney, A., editors. *An atlas of laser operative laparoscopy and hysteroscopy.* 1. London: Parthenon Publishing Group; 1994. p. 165–74.
35. Milingos S, Protopapas A, Drakakis P, et al. Laparoscopic treatment of ovarian dermoid cysts: ten years' experience. *J Soc Laparosc Surg.* 1999; 3:179–84.
36. Templeman C, Hertweck P, Scheetz J, et al. The management of mature cystic teratomas in children and adolescents: a retrospective analysis. *Hum Reprod.* 2000; 15:2669–72. [PubMed: 11098043]
37. Nezhat C, Kalyoncu S, Nezhat C, et al. Laparoscopic management of ovarian dermoid cysts: ten years' experience. *J Laparoendosc Surg.* 1999; 3:179–184.
38. Zanetta G, Ferrari L, Mignini-Renzini M, et al. Laparoscopic excision of ovarian dermoid cysts with controlled intraoperative spillage. *J Reprod Med.* 1999; 44:815–820. [PubMed: 10509307]
39. Canis M, Bassil S, Wattiez A, et al. Fertility following laparoscopic management of benign adnexal cysts. *Hum Reprod.* 1992; 7:1429–1432. [PubMed: 1291571]
40. Lunderoff P, Hahlin M, Kallfelt B, et al. Adhesion formation after laparoscopy surgery in tubal pregnancy: a randomized trial versus laparotomy. *Fertil Steril.* 1991; 55:911–5. [PubMed: 1827075]
41. Gal D, Lind L, Lovecchio J, et al. Comparative study of laparoscopy vs laparotomy for adnexal surgery: efficacy, safety, and cyst rupture. *J Gynecol Surg.* 1995; 11:153–8. [PubMed: 10172733]
42. Volz J, Koster S, Spacek A, et al. The influence of pneumoperitoneum used in laparoscopic surgery on an intraabdominal tumour growth. *Cancer.* 1999; 86:770–4. [PubMed: 10463974]
43. Vergote I. Role of surgery in ovarian cancer: an update. *Acta Chir Belg.* 2004; 104:246–56. [PubMed: 15285533]
44. Bollen N, Camus M, Tournay H, et al. Laparoscopic removal of benign mature teratoma. *Hum Reprod.* 1992; 7:1429–1432. [PubMed: 1291571]
45. Ding D, Chen S. Conservative laparoscopic management of ovarian teratoma torsion in a young woman. *J Chin Med Assoc.* 2005; 68:37–39. [PubMed: 15742862]
46. Sandoval C, Strom K, Stringel G. Laparoscopy in the management of pediatric intraabdominal tumors. *JSLs.* 2004; 8:115–118. [PubMed: 15119653]

47. Doss N, Forney J, Vellios F, et al. Covert bilaterality of mature cystic teratomas. *Obstet Gynecol.* 1977; 50:651–653. [PubMed: 927754]
48. Ayhan A, Aksu T, Develioglu E, et al. Complications and bilaterality of mature cystic teratomas (clinicopathological evaluation of 286 cases). *Aust NZ J Obstet Gynaecol.* 1991; 31:83–85.
49. Chapron C, Dubuisson J, Samouth N, et al. Treatment of ovarian dermoid cysts. Place and modalities of operative laparoscopy. *Surg Endosc.* 1994; 8:1092–5. [PubMed: 7992183]
50. Anteby E, Ron M, Revel A, et al. Germ cell tumors of the ovary arising after dermoid cyst resections: A long term follow-up study. *Obstet Gynecol.* 1994; 83:605–608. [PubMed: 8134074]
51. Bornstein R, Czernobilsky B, Lancet M. Immature ovarian teratoma—an unusual case. *Int J Gynaecol Obstet.* 1982; 20:159–162. [PubMed: 6125439]
52. Yanai-Inbar I, Scully R. Relation of ovarian dermoid cysts and immature teratomas: An analysis of 350 cases of immature teratoma and 10 cases of dermoid cyst with microscopic foci of immature tissue. *Int J Gynecol Pathol.* 1987; 6:203–212. [PubMed: 3429105]
53. Laberge PY, Levesque S. Short-term morbidity and long-term recurrence rate of ovarian dermoid cysts treated by laparoscopy versus laparotomy. *J Obstet Gynaecol Can.* 2006; 28:789–93. [PubMed: 17022919]
54. Matz M. Benign cystic teratomas of the ovary. A review. *Obstet Gynecol Surv.* 1961; 16:591–605. [PubMed: 14471483]
55. Hirakawa T, Tsuneyoshi M, Enjoji M. Squamous cell carcinoma arising in mature cystic teratoma of the ovary. Clinicopathologic and topographic analysis. *Am J Surg Pathol.* 1989; 13:397–405. [PubMed: 2712191]
56. Christopherson W, Councell R. Malignant degeneration of a mature ovarian teratoma. *Int J Gynaecol Obstet.* 1989; 30:379–84. [PubMed: 2576549]
57. Woodruff J, Protos P, Peterson W. Ovarian teratomas. *Am J Obstet and Gynecol.* 1968; 102:70–115.
58. Young J, Miller R. Incidence of malignant tumors in United States children. *J Pediatr.* 1975; 86:254–7. [PubMed: 1111694]
59. Pippo S, Mustaniemi L, Lendo H, et al. Surgery for ovarian masses during childhood and adolescence: a report of 79 cases. *J Pediatr Adolesc Gynecol.* 1999; 12:223–37. [PubMed: 10584228]
60. Petersen WF. Malignant degeneration of benign cystic teratomas of the ovary: a collective review of the literature. *Obstet Gynecol Surv.* 1957; 12:793–830. [PubMed: 13493921]
61. Mecke H, Savvas V. Laparoscopic surgery of dermoid cysts-intraoperative spillage and complications. *Euro J Obstet Gynecol Repro Biol.* 2001; 96:80–84.
62. Meirrow D, Fasouliotis M, Nugent D, et al. A laparoscopic technique for obtaining ovarian cortical biopsy specimens for fertility conservation in patients with cancer. *Fertil Steril.* 1999; 71:948–951. [PubMed: 10231063]
63. Zupi E, Exacoustos C, Szabolcs, et al. Laparoscopic approach to dermoid cysts: combined surgical technique and ultrasonographic evaluation of residual functioning ovarian tissue. *J Am Assoc Gynecol Laparosc.* 2003; 10:154–8. [PubMed: 12732763]

Case Presentation

During computed tomography evaluation after a motor vehicle accident, a 17 year-old female was noted to have incidental bilateral adnexal masses. Further ultrasound evaluation revealed a 6–7 cm right and multiple 2–3 cm left ovarian complex cysts consistent in appearance with mature cystic teratomas. She reported slightly irregular menses but was otherwise asymptomatic. The subsequent month she underwent exploratory laparotomy and bilateral ovarian cystectomies with pathologic specimens consistent with the diagnosis. Post-operative recovery was uneventful; she initiated oral contraceptives and returned to her usual activities. She returned to the office three years later when she moved back to the area for routine follow-up with the complaint of occasional vague abdominopelvic pain. Pelvic ultrasound revealed bilateral complex cysts (0.7 cm right and 1.7 cm left) with echogenic patterns suggestive of recurrent dermoids. After six months of expectant management ultrasound findings confirmed slow growth (1.3 cm right, 1.7 left) and one newly identified 1.7 cm left ovarian lesion. Subsequent imaging at 12, 18 and 24 months of expectant management demonstrated slow but visible growth; the last sonogram found 2.1 and 1.9 cm right and 3.6, 2.1 and 1.2 cm hyperechoic cysts on the left all suggestive of dermoids. The patient is now 22 years old, without pain or current desire for pregnancy, and wonders what she should do.