

Comparison of the Surgical Treatment of Adnexal Masses in Pediatric and Adolescent Patients by Gynecologic Surgeons versus Pediatric Surgeons, a Systematic Review

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Background: Adnexal masses in pediatric patients are an uncommon pathology, and treatment often raises the question of whether Gynecologic surgeons (those graduating OBGYN residencies and associated fellowships) or Pediatric and general surgeons (those graduating general surgery or other non-obgyn residencies and fellowships) are better suited to perform the procedure.

Aim: To compare gynecologic surgeons and pediatric surgeons regarding the surgical management of ovarian lesions, whether through laparotomy or laparoscopic procedures.

Methods: We searched all major databases for relative studies.

Results: We found that gynecologic surgeons had lower complication rates (mean 9.5% vs 14.9%) and recurrence rates (mean 10.7% vs 10.8% for laparoscopic) than pediatric surgeons. Additionally, gynecologic surgeons performed more ovarian-sparing surgeries (90% vs 55%) and had fewer laparoscopies converted to laparotomies (mean 8% vs 48%). Hospital stay was shorter with gynecologic surgeons (mean 1.9 days vs 2.1 days). The incidence of accidental tumor spillage was also higher among pediatric and general surgeons than it was with the gynecologic surgeons.

Conclusion: Gynecologic surgeons may be associated with better outcomes compared to pediatric surgeons in the surgical management of pediatric and adolescent female patients with ovarian masses. Limitations include heterogeneity among studies, small number of included studies, and reliance on observational data.

Keywords: ovarian mass, ovarian-sparing surgery, laparotomy, laparoscopy, pediatric surgeons, gynecologic surgeons

Introduction

The most frequent ovarian masses in a pediatric and adolescent population are benign neoplasms and functional cysts, both of which can be causes for ovarian torsion.¹ Malignancies in this population are usually germ cell tumors, which contrasts the adult population, which are more commonly the result of epithelial cell malignancies.² In the United States, tumors of the female genital tract in adolescents and children are uncommon, with an incidence of 2.6 cases per 100,000 girls annually.³ The majority of ovarian lesions are benign or physiologic, although ovarian malignancy in adolescents and children accounts for 10–20% of all ovarian masses and 1–2% of all pediatric cancers.⁴

Adnexal torsion is an uncommon cause of acute abdominal pain in pediatric and adolescent females, and affects approximately 4.9 out of 100,000 children each year.⁵ Torsion of the ovary and pedicle are gynecologic emergencies.⁶ If left untreated, they have the potential to cause adnexal necrosis, venous congestion and lifelong reduced fertility.⁷

The reduction of arterial and venous blood flow results from the adnexa twisting around the ovarian pedicle, which causes adnexal torsion.⁸ Oophorectomy was the most frequently performed procedure in the past for the management of ovarian torsion.⁹ However, in recent years, the trend has changed toward the preservation of adnexa even in cases where the fallopian tube or ovary does not seem viable during surgery.¹⁰

In children with adnexal masses, acute abdominal pain, persistence of the mass, suspected ovarian torsion, and suspicion of malignancy are among the most common indications for surgical management.¹¹ Except for cases where malignancy is suspected, preservation of as much healthy ovarian tissue as possible after removing the adnexal mass is preferred.¹² Recent years have shown an increasing amount of literature speaking to the viability of ovarian-sparing surgery (OSS) as an effective alternative in a large percent of cases.^{13,14} Although laparoscopy has many advantages over laparotomy, there are no quality data on which is superior for OSS, and laparoscopic OSS has become more and more common in adults, as evidenced by the recent publication of a large case series.¹⁵ Since the first published series in the pediatric literature, a few papers and case series utilizing a comparable laparoscopic technique have appeared in recent years, speaking to the viability of OSS in pediatric and adolescent populations suffering from adnexal masses.^{16,17}

One possible reason for potential differences may be specialized training in obstetrics and gynecology residency programs focused on ovarian preservation. For example, the American College of Obstetricians and Gynecologists (ACOG) strongly promotes preservation of adnexal structures regardless of appearance, unless unavoidable, whereas similar guidelines from pediatric or general surgery organizations are less emphatic.

Our study aims to compare the success rates and complications for pediatric and general surgeons versus gynecologic surgeons for the surgical management of adnexal masses in pediatric or adolescent populations. Success rates were defined as higher rates of ovarian-sparing surgeries, lower rates of conversion to laparotomy, shorter hospital stays, and lower recurrence rates. Complications included intraoperative issues such as tumor spillage and other surgical adverse events.

Methods

We performed this study based on the PRISMA guidelines and recommendations.¹⁸

A meta-analysis was not performed due to the small number of included studies (n=7), significant heterogeneity in study designs and reporting, and the observational nature of all included studies, which precluded reliable pooling of data. Instead, we conducted a qualitative synthesis to ensure high accuracy in summarizing trends.

Information Sources and Search Strategy

We utilized a strategy for our search by combining these keywords: (“ovarian mass” OR “ovarian tumor” OR “ovarian torsion”) AND (“laparotomy” OR “laparoscopic” OR “ovarian-sparing surgery”). Regarding the sources of data, we searched the Cochrane Library, Medline, Web of Science, PubMed, ClinicalTrials.Gov and SCOPUS databases in the search process. We searched from each database’s inception until March 1st 2024.

Study Selection

We started by screening the titles and abstracts. We then conducted a full-text screening. Finally, we choose the qualifying articles in accordance with the following eligibility requirements:

Case cohort: laparotomy and laparoscopic management of ovarian lesions by surgeons having completed a four year residency in obstetrics and gynecology, with or without any subsequent fellowship or ancillary training.

Control cohort: laparotomy and laparoscopic management of ovarian lesions by pediatric and general surgeons, which consisted of any surgeons who have not completed a four year residency program in obstetrics and gynecology.

Intervention: laparotomy and laparoscopic management of ovarian lesions of pediatric and adolescent females.

Outcome: the duration of hospital stay, the incidence of complications, the recurrence rate of the same condition, the incidence of tumor spillage, the rate of ovarian-sparing surgeries, and the total number of laparoscopies converted to laparotomies.

1. Studies performed in centers located in the United States or Canada.

2. Studies including adolescent and pediatric females with ovarian lesions who underwent surgical management (laparoscopic or laparotomy).
3. Studies that compare pediatric and general surgeons to gynecologic surgeons in surgical treatment of ovarian lesions. For the purposes of this analysis, we considered any surgeons completing an obgyn residency regardless of additional training to be “gynecologic surgeons”, and considered any surgeons not completing an obgyn residency to be “pediatric or general surgeons”.
4. Prospective and retrospective studies were included.

Exclusion Criteria

1. Reviews, surveys, abstracts, and meta-analyses.
2. Studies conducted outside Canada and the United States.
3. Studies that included postmenopausal women with ovarian masses.

Quality Assessment

Since we ultimately involved only observational studies, we used the National Heart, Lung, and Blood Institute (NHLBI), which evaluates 14 categories in each clinical study.¹⁹ Each study got a score from 1 to 14 and the overall average score will be calculated.

Data Extraction

Two different categories of data were taken from the included papers. The first type includes demographic information about the patients involved and the baseline data for our results. The second category was quality assessment data. Microsoft Excel was used to carry out the data collection process.²⁰

Results

Summary of the Included Studies

Our search results are demonstrated in the PRISMA flow chart found in [Figure 1](#). We involved seven studies^{21–27} that met the inclusion criteria of our systematic review. Our study involved 896 pediatric and adolescent female patients with ovarian lesions divided into two cohorts; the laparoscopic cohort which involved 574 patients who underwent laparoscopic surgery and the laparotomy cohort which involved 322 patients who underwent laparotomy surgery. Six hundred and thirteen pediatric and general surgeons were included, as well as 263 gynecologic surgeons who performed the surgical management of these patients. The mean age of the included patients was 12.8 years. [Table 1](#) shows the characteristics of the included studies and the demographics of the included patients.

Results of Quality Assessment

Since we included seven observational studies,^{21–27} we assessed their quality using NHLBI. The observational studies' mean score was 10.7 out of 14. [Table 2](#) shows a summary of the quality assessment of the included studies.

Systematic Review Results

[Table 3](#) contains a concise comparison of key outcomes between gynecologic and pediatric/general surgeons.

Length of Hospital Stay

Four included studies assessed the duration of hospital stay; Schenkman et al²¹ and Michelotti et al²⁵ were performed by pediatric surgeons not trained in obstetrics and gynecology, Savasi et al²⁷ was performed by gynecologic surgeons, and Alberto et al²³ was performed by both. Savasi et al²⁷ and Alberto et al²³ reported that the mean duration of hospital stay after laparoscopic surgeries by gynecologic surgeons was 2.5 and 1.3 days, respectively (mean 1.9 days). In contrast, Schenkman et al,²¹ Michelotti et al,²⁵ and Alberto et al²³ reported that the mean duration after laparoscopic surgeries by pediatric and general surgeons was 2.22, 1.85, and 2.3 days, respectively (mean 2.12 days). So, the hospital stay was lower with the gynecologic surgeons than with the pediatric surgeons.

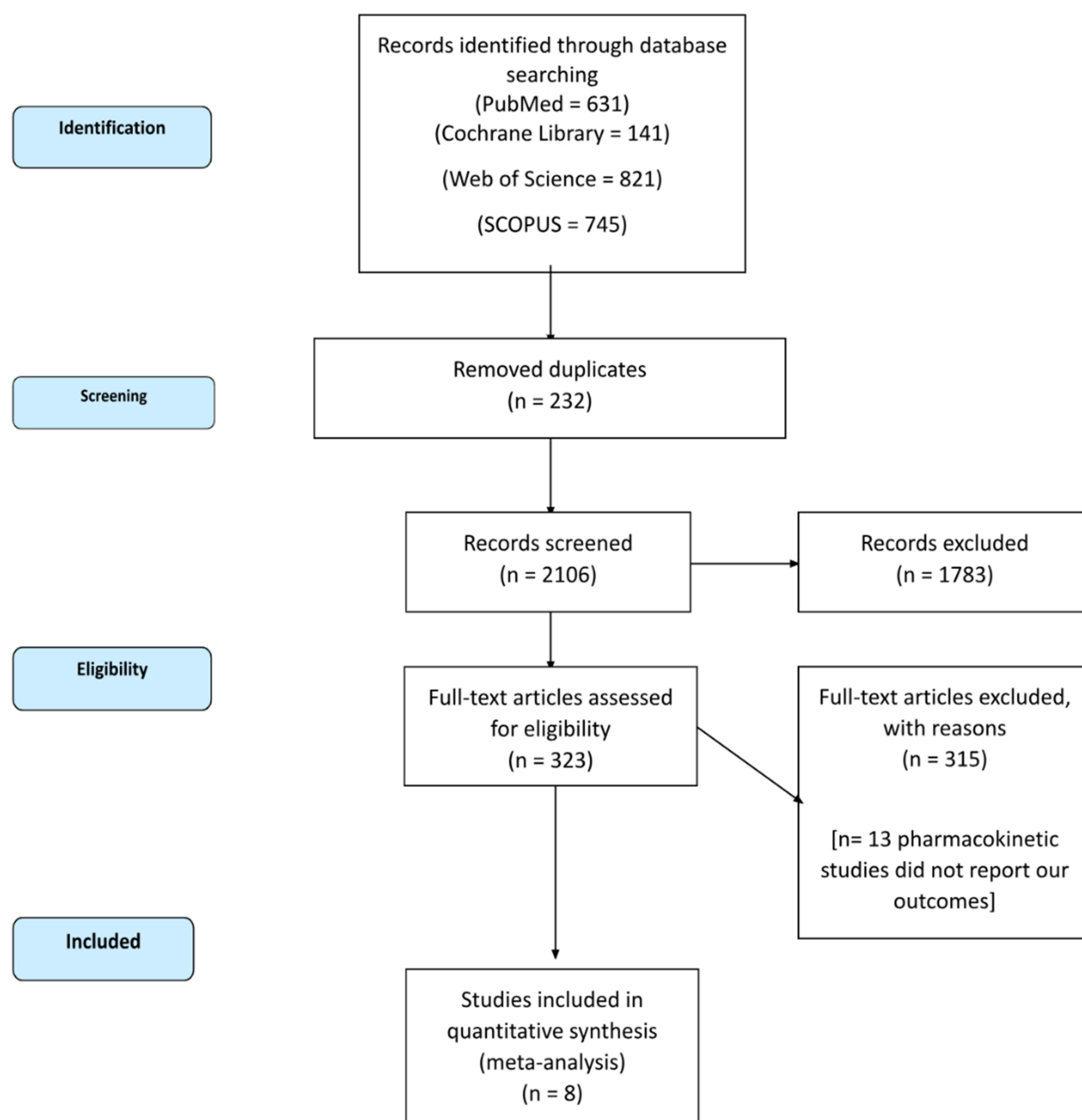


Figure 1 PRISMA flow diagram of our literature search.

Incidence of Intraoperative Complications

Five of the included studies reported the incidence of intraoperative complications. Schenkman et al,²¹ Michelotti et al,²⁵ and Yousef et al²² were performed by pediatric and general surgeons, Savasi et al²⁷ was performed by gynecologic surgeons, and Alberto et al²³ was performed by both. Savasi et al²⁷ and Alberto et al²³ found that 4.3% and 14.7% of the laparoscopic cohort by gynecologic surgeons suffered from intraoperative complications, respectively (mean 9.5%), while Schenkman et al,²¹ Michelotti et al,²⁵ Alberto et al,²³ and Yousef et al²² found that 40%, 2%, 5% and 12.5% of the laparoscopic cohort by pediatric and general surgeons suffered from intraoperative complications, respectively (mean 14.9%). These results suggest that the incidence of complications with the gynecologic surgeons was lower than that with the pediatric and general surgeons.

Table 1 Characteristics of the Included Studies and the Demographics of the Included Patients

Study ID		Alberto 2020	Knaus 2022	Michelotti 2010	Rogers 2014	Savasi 2009	Schenkman 2008	Yousef 2016
Country		US	US	US	Canada	US	US	Canada
Study design		Retrospective study	Retrospective study	Retrospective study	Retrospective study	Retrospective study	Retrospective study	Retrospective study
Study duration		2004-2018	2010-2020	1992-2007	2003-2012	2001-2006	1992-2006	1991-2011
Ovarian lesion		Ovarian torsion	Ovarian dermoids	Benign lesions, germ cell tumor	Ovarian dermoids	Ovarian dermoids	Cyst Torsion	Benign and malignant tumors
Sample size	Laparoscopy	71	279	148	40	23	5	8
	Laparotomy	7	139	73	26	18	8	51
Age, years, (mean, SD)	Laparoscopy	12.5 (4.1)	15	14	12.9	12.6	4.8	13.6
	Laparotomy		14	13		12.5	16.3	
Ovarian mass size (CM)	Laparoscopy	7.3	6.4	NR	8.0 (3.2–16)	7.1	5	14.1
	Laparotomy		11.4			14.4		
Specialty of operating surgeon	Ped/Gen Surg	60	260	221	0	0	13	59
	Gynecology	34	122	0	66	41	0	0
Side of the lesion	Unilateral	NR	NR	NR	59 (89%)	41	19	55
	Bilateral				7 (11%)	0	1	3

Abbreviation: NR, Not Reported.

Table 2 Summary of the Quality Assessment of the Included Studies

	Alberto 2020	Knaus 2022	Michelotti 2010	Rogers 2014	Savasi 2009	Schenkman 2008	Yousef 2016
1. Was the research question or objective in this paper clearly stated?	I	I	I	I	I	I	I
2. Was the study population clearly specified and defined?	I	I	I	I	I	I	I
3. Was the participation rate of eligible persons at least 50%?	I	I	I	I	0	I	I
4. Were all the subjects selected or recruited from the same or similar populations (including the same time period)? Were inclusion and exclusion criteria for being in the study prespecified and applied uniformly to all participants?	0	I	I	I	I	I	I
5. Was a sample size justification, power description, or variance and effect estimates	0	0	0	0	0	0	0
6. For the analyses in this paper, were the exposure (s) of interest measured prior to the outcome(s) being measured?	I	I	I	I	I	I	I
7. Was the timeframe sufficient so that one could reasonably expect to see an association between exposure and outcome if it existed?	I	I	I	I	I	I	I
8. For exposures that can vary in amount or level, did the study examine different levels of the exposure as related to the outcome (eg, categories of exposure or exposure measured as a continuous variable)?	I	I	I	I	I	I	I
9. Were the exposure measures (independent variables) clearly defined, valid, reliable, and implemented consistently across all study participants?	I	I	I	I	I	I	I
10. Was the exposure(s) assessed more than once over time?	0	0	I	0	0	0	0
11. Were the outcome measures (dependent variables) clearly defined, valid, reliable, and implemented consistently across all study participants?	I	I	I	I	I	I	I
12. Were the outcome assessors blinded to the exposure status of participants?	N/A	N/A	N/A	N/A	N/A	N/A	N/A
13. Was the loss to follow-up after baseline 20% or less?	I	I	I	I	I	I	I
14. Were key potential confounding variables measured and adjusted statistically for their impact on the relationship between exposure(s) and outcome(s)?	I	0	I	I	I	I	I
Total score (out of 14)	10/14	10/14	12/14	11/14	10/14	11/14	11/14

Abbreviation: N/A, Not Applicable.

Table 3 Comparison of Key Outcomes Between Gynecologic and Pediatric/General Surgeons

Outcome	Gynecologic Surgeons	Pediatric/General Surgeons
Length of Hospital Stay (mean days)	1.9	2.1
Intraoperative Complications (mean %)	9.5	14.9
Postoperative Recurrence Rate - Laparoscopic (mean %)	10.7%	10.8%
Postoperative Recurrence Rate - Laparotomy (mean %)	3.8%	7.8%
Unintended Tumor Spillage	Lower Incidence	Higher Incidence
Ovarian-Sparing Surgeries (%)	90%	55%
Laparoscopies Converted to Laparotomies (mean %)	8%	48%

Postoperative Recurrence of the Same Adnexal Pathology

Rogers et al²⁶ that was performed by gynecologic surgeons, Yousef et al²² that was performed by pediatric and general surgeons, and Alberto et al²³ which was performed by both, reported the recurrence rate of the treated pathology. Regarding the laparoscopic cohort by gynecologic surgeons, Rogers et al²⁶ and Alberto et al²³ reported that 6 (15%) and 2 (6.3%) of the participants showed recurrence of the pathology, respectively (mean 10.65%), while Yousef et al²² and Alberto et al²³ reported 1 (12.5%) and 5 (9.1%) patients with recurrence after surgeries performed by pediatric and general surgeons, respectively (mean 10.8%). Regarding the laparotomy cohort, Rogers et al²⁶ reported that 1 (3.8%) of the participants showed recurrence pathology, while Yousef et al reported 4 (7.8%) patients with recurrence. These findings revealed that the recurrence rate was higher with the pediatric and general surgeons than with the gynecologic surgeons in both laparoscopic and laparotomy cohorts.

Unintended Tumor Spillage (Capsule Rupture)

Knaus et al²⁴ compared laparoscopic surgeries and laparotomy surgeries performed by pediatric or general surgeons and gynecologic surgeons. Their analysis revealed that the incidence of tumor spillage was 14% in laparotomy, 17% in laparoscopy, and 6% in laparoscopy converted to laparotomy, $p = 0.15$. The incidence of tumor spillage showed no significant difference by surgical approach and was higher among pediatric and general surgeons than gynecologic surgeons, though specific rates by surgeon type were not uniformly reported.

Oophorectomy versus Ovarian Sparing Procedures

In total, 117 (45%) of the pediatric and general surgeons performed oophorectomies and 143 (55%) performed ovarian-sparing surgeries, while 12 (10%) of gynecologic surgeons performed oophorectomies and 110 (90%) performed ovarian-sparing surgeries. Alberto et al²³ reported that 96.7% of the gynecologic surgeons performed ovarian-sparing surgeries and 90.5% of pediatric and general surgeons performed ovarian-sparing surgeries.

Conversion from Laparoscopy to Laparotomy

Knaus et al²⁴ and Alberto et al²³ reported the total number of laparoscopies converted to laparotomies. In total 48 conversions occurred in Knaus et al,²⁴ 41 (85.4%) of them were performed by pediatric and general surgeons, and three (6.25%) were performed by gynecologic surgeons. Alberto et al²³ found that the total number of laparoscopies converted to laparotomies was 9. Of these, 6 (10.9%) were performed by pediatric and general surgeons and 3 (9.4%) were performed by gynecologic surgeons. As a result, we found that the gynecologic surgeons cohort was associated with a higher incidence of ovarian sparing surgeries and a lower incidence of conversion of laparoscopy to laparotomy when compared to the pediatric and general surgeons cohort.

Discussion

In recent years, several studies have begun to focus on the surgeries to preserve ovarian function as opposed to oophorectomy for ovarian lesions and ovarian torsion.¹⁶ Many studies have analyzed the long-term consequences, specifically ovarian reserve in benign lesions and survival in tumors that were later found to include malignancy.^{16,28}

Because laparoscopic OSS has the advantages of parenchyma-sparing resections and minimally invasive procedures, it has emerged as the approach of choice for benign ovarian cysts in adult women.²⁹ However, it has been demonstrated that even this conservative approach can diminish the ovarian reserve to some degree. This damage is associated with a number of parameters, including tumor size and laterality, the laparoscopic technique (tissue handling), histology, and use of hemostatic techniques (electrocoagulation). Interestingly, some reports in adult patients have even suggested that laparoscopic OSS may be superior to open surgery in regard to the preservation of healthy ovarian tissue.^{28,29}

Although laparoscopic ovarian-sparing lesion removal has become more common in recent years, there is still no consensus that this is the standard of care for children and adolescents in the US.³⁰ Concern arises about the possibility of tumor rupture, particularly in cases where a malignancy may not be identified prior to surgery.³⁰

In our study, we found that the gynecologic surgeons tended to have a lower incidence of complications and lesion recurrence rates than pediatric and general surgeons.

Additionally, the gynecologic surgeons performed a larger number of ovarian-sparing surgeries and had fewer conversions to laparotomy when beginning from the laparoscopic approach. Also, hospital stay was shorter with the gynecologic surgeons than with the pediatric and general surgeons, while the incidence of tumor spillage was higher with pediatric and general surgeons than it was with the gynecologic surgeons.

One possible cause for these results is more specialized training in obstetrics and gynecology residency programs specific to ovarian preservation. Very strong language appears in the latest committee opinion on this topic published by the American College of Obstetricians and Gynaecologists (ACOG), specifically promoting “preservation of the adnexal structures regardless of the appearance of the ovary”, and that a “surgeon should not remove a torsed ovary unless oophorectomy is unavoidable, such as when a severely necrotic ovary falls apart”.³¹ Our authors were unable to find any similarly strong guidelines published by pediatric or general surgery professional organizations.

Previous studies have reported findings consistent with ours. In 2015, Campbell et al³² conducted a study that included 1322 patients with ovarian torsion. They compared the management of adolescent ovarian torsion by pediatric and general surgeons against gynecologic surgeons and proved that the gynecologic surgeons were much more likely to perform OSS than pediatric surgeons.

Also, they reported that the recurrence rate was similar to pediatric and general surgeons and gynecologic surgeons. Another recent systematic review was performed by Dasgupta et al³³ to find the optimal management of ovarian torsion. Their findings revealed that the incidence of OSS was higher with the gynecologic surgeons than with pediatric and general surgeons.

Excluding those that were included in this review, when examining original studies that have delved into OSS and conversion to laparotomy, there are several notable findings. First, Delehay et al,³⁴ found that pediatric and general surgeons overall performed 142 (41%) total oophorectomies and 208 (59%) ovarian-sparing surgery. When looking at retrospective studies, Szymon et al¹¹ evaluated the surgical management of ovarian teratomas by gynecologic surgeons and demonstrated that 88% of the included females had ovarian-sparing tumorectomy and only 2% experienced recurrence of the teratoma. Liu et al¹⁷ reported that 1.7% of all laparoscopic procedures performed by gynecologic surgeons were converted to laparotomies. Wang et al,³⁵ in 2016, included 203 patients who underwent laparoscopic management of adnexal masses by gynecologic surgeons. They found that only 10% of the included patients had oophorectomies, and the duration of the postoperative hospital stay was 3 days.³⁵ For prospective analyses, Karasu et al³⁶ conducted a clinical trial to determine the best surgical option for the management of benign adnexal masses. All surgeries were done by gynecologic surgeons and their analysis revealed that 9% of the patients had oophorectomies, 0% of laparoscopic operations converted to laparotomies, 0% of the patients suffered from intra or postoperative complications, and the length of hospital stay was 2.3 days. Another trial was conducted and reported that 0% of the cases converted from laparoscopy to laparotomy and only 3% of the cases suffered from post-operative complications such as

delayed ovarian bleeding and paralytic ileus after surgical management by gynecologic surgeons.³⁷ Additionally, Park et al³⁸ evaluated the laparoscopic management of ovarian endometrioma by gynecologic surgeons. They demonstrated that 0% of the cases required conversion to laparotomies, only 3 patients of the 343 included patients suffered from complications, and the duration of hospital stay was 2.3 days.

These results must be interpreted cautiously due to limitations such as study heterogeneity, potential selection bias in surgeon assignment, and the lack of randomized data. Practically, these findings suggest considering referral to gynecologic surgeons for pediatric adnexal masses to potentially optimize fertility preservation and reduce complications.

Limitations

Our systematic review has several limitations such as the presence of heterogeneity between the included articles, the small number of the involved studies, and the inclusion of only observational studies as our study did not include any randomized clinical trial. In addition, because of the lack of a consistent definition of “pediatric surgeons” we were forced to use a definition of pediatric and general surgeons that included all surgeons not completing a residency in obgyn. The results may have been different if we were able to directly compare gynecologic surgeons also completing fellowship in minimally invasive gynecologic surgery with general surgeons completing fellowship in pediatric surgery. Lastly, most of the included studies did not make direct comparisons directly between the pediatric and general surgeons and the gynecologic surgeons.

Conclusion

In conclusion, gynecologic surgeons may be associated with better surgical outcomes with a higher incidence of fertility preservation than pediatric surgeons in the surgical management of pediatric and adolescent female patients with ovarian masses. Gynecologic surgeons showed lower rates of complications, oophorectomies, conversion to laparotomies, and higher rates of OSS. Consideration must be given that these results cannot judge any specific surgeon or clinical scenario, and did take into consideration specific fellowships or board certifications. Future studies, including randomized controlled trials or comparisons of fellowship-trained surgeons, are needed to solidify these findings and may consider direct comparisons between pediatric and general surgeons and gynecologic surgeons, with attention to board certifications and specific training. Practically, these results support considering gynecologic surgeons for managing pediatric adnexal masses to potentially improve fertility preservation and reduce complications.

Prospero Prospective Registration Number

CRD42024529360

Ethics Approval and Consent to Participate

This manuscript has been reviewed by the institutional IRB board at Marchand Institute and was found to be exempt from IRB review (January 2024). Data used was exempt from consent to participate or publish secondary to the nature of the study being a systematic review, retrospectively looking at previously published data.

Consent to Publish

Data used was exempt from consent to participate or publish secondary to the nature of the study being a systematic review, retrospectively looking at previously published data.

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Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

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The authors declare no competing interests in this work.

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