BORDERLINE OVARIAN TUMORS AND FERTILITY -PRESERVING SURGERY - A SYSTEMATIC REVIEW

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ABSTRACT

OBJECTIVES

This systematic review evaluates fertility-preserving surgery (FPS) outcomes in borderline ovarian tumours (BOTs), focusing on reproductive success and oncologic safety.

METHODOLOGY

We systematically searched PubMed, MEDLINE, ScienceDirect, Google Scholar, the Cochrane Library, and ResearchGate (through September 14, 2024) using the terms "borderline ovarian tumour," "fertility-preserving surgery," and "reproductive outcome." From 2,288 initial records, we identified 10 high-quality (Newcastle-Ottawa Scale score ≥7) retrospective cohort studies (January 2019- September 2024) that met our eligibility criteria. The included English-language studies evaluated reproductive-aged women (14-49 years) with borderline ovarian tumours undergoing fertility-sparing surgery (cystectomy/USO). After excluding case reports, reviews, non-peer-reviewed articles, and duplicate publications, two reviewers independently extracted data, resolving discrepancies through consensus. We conducted this systematic review in accordance with the PRISMA guidelines, with registration on Prospero (Id: Crd420251042984).

RESULTS

Among 1051 patients, pooled pregnancy rates ranged from 42.1% to 57.1%. Live birth rates varied widely (23-67%). Recurrence rates differed significantly by surgical approach: 24.1–33.3% after cystectomy versus 2.5-7.7% after USO. High-risk subgroups (advanced-stage/micropapillary histology) had recurrence rates up to 70.8%. Complete surgical staging reduced relapse risk by 21%, and ART did not increase recurrence. Bilateral cystectomy and USO + contralateral cystectomy showed comparable fertility outcomes. Malignant transformation was rare (0–20%), with no impact on overall 5-year survival (97–100%).

CONCLUSION

FPS provides reasonable reproductive outcomes but requires careful patient selection due to higher cystectomy-associated recurrence. Complete staging and histologic assessment are crucial. Until stronger evidence exists, USO with complete staging represents the most balanced option. Study limitations include retrospective designs and heterogeneous follow-up. Prospective trials with standardised protocols and long-term monitoring (at least 10 years) are needed.

KEYWORDS: *Reproductive Outcomes, Borderline Ovarian Tumours, Fertility*

INTRODUCTION

Borderline ovarian tumours (BOTs) are intermediate neoplasms accounting for 10-20% of ovarian epithelial tumours, primarily affecting fertility-age women. While generally indolent with >95% 10-year survival (especially in stage I, representing 50-85% of cases), 10-15% demonstrate aggressive behaviour with malignant potential.[1,3] This favourable prognosis supports fertility-preserving approaches for early-stage disease. Diagnosing BOTs preoperatively is difficult since imaging cannot reliably differentiate them from other ovarian tumours. While intraoperative examination may suggest BOTs, histological confirmation remains essential.[4] For fertility-preserving cases, balancing oncologic safety with reproductive potential poses a key clinical challenge. Fertility-preserving surgery (FPS) has emerged as the cornerstone of treatment for young women with BOTs.[5] FPS is defined as the preservation of the uterus and ovarian tissue in one or both ovaries. The two primary surgical approaches are unilateral ovarian cystectomy (with or without contralateral ovarian

biopsy/cystectomy) and unilateral salpingo-oophorectomy (USO). In contrast, radical surgery involves hysterectomy and bilateral salpingo-oophorectomy (BSO). Since ovarian cystectomy removes less ovarian tissue than adnexectomy, it offers a higher likelihood of preserving fertility. However, some studies suggest that bilateral cystectomy may be associated with an increased recurrence rate due to the potential presence of residual tumour cells. A prospective randomised controlled trial by Palomba et al. (2007) found no significant difference in outcomes between bilateral cystectomy and USO with contralateral cystectomy.[6,8] FPS aims to reduce recurrence while optimising pregnancy chances; however, its effects on conception rates and live births remain under investigation.[9] Recurrence risks and their impact on long-term fertility also warrant careful consideration.[10] Over the past decade, advancements in surgical techniques, including laparoscopy and improved perioperative care, have refined FPS approaches for patients with BOT.[11] Concurrently, there has been growing interest in the role of assisted reproductive technologies (ART) in optimising fertility outcomes in this population.[12] Despite these developments, the literature on reproductive outcomes following FPS for BOTs remains heterogeneous, with varying definitions of fertility success and inconsistent long-term follow-up data.[13] Previous systematic reviews have focused on recurrence rates, conservative surgeries, and prognosis.[5,14,26] Subsequently, more recent reviews have addressed updates in laparoscopic surgery, molecular advances, and the role of ultrasound in BOT diagnosis.[17,18,19] However, due to outdated evidence and a lack of ART outcome data, an updated systematic review is warranted to assess the role of FPS in light of evolving surgical and reproductive technologies. This systematic review aims to synthesise recent evidence regarding reproductive outcomes following FPS for BOTs, with a particular focus on pregnancy success, live birth rates, ART utilisation, and oncologic safety, by critically evaluating contemporary data. This paper seeks to provide updated guidance for clinical decision-making and identify key areas for future research in this evolving field.

METHODOLOGY

This systematic review followed the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) 2020 guidelines 20 and was prospectively registered in the PROSPERO international prospective register (Registration ID: CRD420251042984). The relevant studies were searched in electronic research literature databases and research engines, including PubMed, PMC, the Medical Literature Analysis and Retrieval System Online (MEDLINE), ScienceDirect, Google Scholar, the Multidisciplinary Digital Publishing Institute (MDPI), the Cochrane Library, and ResearchGate. A combination of keywords: Borderline ovarian tumour, Fertility-preserving surgery, and Reproductive outcome. For MEDLINE, PubMed, and PubMed Central, the integrated Mesh (Medical Subject Headings) approach applied is as follows: ((Borderline ovarian tumour OR borderline ovarian neoplasm OR borderline ovarian cancer OR epithelial ovarian cancer OR borderline serous ovarian cancer OR borderline mucinous ovarian cancer OR ("Ovarian Neoplasms/classification"[Majr] OR "Ovarian Neoplasms/complications"[Majr] OR "Ovarian Neoplasms/surgery"[Majr])) AND (Fertility-preserving surgery OR fertility-preserving surgery OR fertility-conserving surgery OR unilateral salpingo-oophorectomy OR ovarian cystectomy OR "Salpingo-oophorectomy/adverse effects"[Majr])) AND (Reproductive outcome OR fertility outcome OR live birth rate OR pregnancy outcome OR oncofertility OR childbirth OR "Pregnancy Rate/trends"[Majr]). The databases and keywords used, along with the papers retrieved from each database, are presented in Table 1.

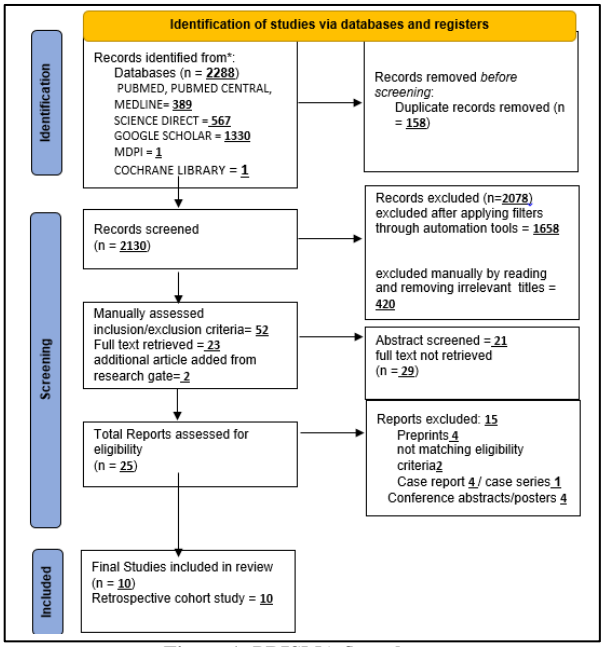

Figure 1: PRISMA flow chart.

PRISMA: Preferred Reporting Items for Systematic Reviews and Meta-Analyses

The included studies involved female patients of reproductive age (14-49 years) with histologically confirmed borderline ovarian tumours who underwent fertility-preserving surgery (either unilateral salpingo-oophorectomy or ovarian cystectomy). The review was limited to English-language publications from January 2019 to September 2024 due to both the need for updated evidence synthesis (as previous systematic

reviews lacked recent studies) and limited resources for professional translation. In this study, mixed-methods observational studies were included; however, no randomised controlled trials or prospective studies that met the criteria were identified during the search period. The excluded papers were the following types of publications to ensure methodological rigour: Review articles, grey literature, and preprints (as these non-peer-reviewed sources typically lack standardised quality control mechanisms essential for reliable evidence synthesis), Case reports and case series (considered lower levels of evidence) and those Articles whose full text could not be retrieved. A comprehensive search was conducted across multiple electronic databases, including PubMed, MDPI, ScienceDirect, the Cochrane Library, and Google Scholar. While Google Scholar was included to maximise search sensitivity for emerging evidence, we restricted final inclusion to peer-reviewed studies meeting our predefined quality criteria, thereby ensuring reliable results while minimising bias. The final search was completed on September 14, 2024. supplemented these database searches with a manual search of Research Gate to identify additional relevant studies. Our search strategy employed Boolean operators (AND/OR) to optimise results. All retrieved records were imported into EndNote software for systematic duplicate removal, followed by manual screening to ensure the complete elimination of redundant publications. To ensure methodological quality and minimise bias, critically appraised all included studies using the Newcastle-Ottawa Scale for retrospective cohort studies.[21] Only medium- and high-quality studies were selected for final analysis. Two independent reviewers conducted study screening, data extraction, and interpretation. Any discrepancies in eligibility judgments or findings were resolved through consensus-based discussion.

A total of 2,288 articles were identified from the following databases: 389 from PubMed, PubMed Central, and MEDLINE; 567 from Science Direct; 1,330 from Google Scholar; and one article each from MDPI and the Cochrane Library. After removing 158 duplicates, the remaining 2,130 papers were screened. Using automated filters (limiting to English-language articles published within the last five years, human studies, and original research), 1,658 papers were excluded. Manual title screening excluded an additional 420 articles. Of the 52 papers that met the initial eligibility criteria, 21 were excluded as irrelevant after reviewing the abstracts, and the full text could not be retrieved for 29 others. Through manual hand searching, two additional articles were identified and included from ResearchGate. Reapplying the eligibility criteria to the remaining 25 articles resulted in the exclusion of 15 papers: four preprints, four case reports, one case series, four conference presentations or posters, and two that failed to meet the inclusion criteria. Following the PRISMA 2020 guidelines, the final selection comprised 10 retrospective cohort studies, all of which demonstrated strong quality appraisal scores on the Newcastle-Ottawa scale for retrospective cohort studies. The specific scores for each study, as determined by the Newcastle-Ottawa quality assessment scale for retrospective cohort studies, are listed below in Figure 2.

	Kumari S, et al [22]	**Lađević I, et al[23]**	**Ko M-E, et al[24]**	**Cang W, et al[25]**	**Kurt S, et a[26]**	**Jia S-Z, et al[27]**	**Ozenne A, et al[28]**	**Sobiczewski P, et al [29]**	**Johansen G, et al[30]**	**Wang L, et al[31]**
Selection										
Representativeness of the exposed cohort	1	1	1	1	1	1	1	1	1	1
Selection of the non-exposed cohort	0	0	0	0	0	0	0	0	0	0
Ascertainment of exposure	1	1	1	1	1	1	1	1	1	1
Demonstration that outcome of interest was not present at the start of the study	1	1	1	1	1	1	1	1	1	1
Comparability										
Study controls forage	1	1	1	1	1	1	1	1	1	1
The study controls for other factor	1	1	1	1	1	1	1	1	1	1
Outcome										
Assessment of outcome	1	1	1	1	1	1	1	1	1	1
Was follow-up long enough for outcomes to occur	1	1	1	1	1	1	1	1	1	1
Adequacy of follow-up of cohorts	1	1	1	1	1	1	1	1	1	1
Total	8	8	8	8	8	8	8	8	8	8

Figure 2: Quality Appraisal Using the Newcastle Ottawa Scale for Retrospective Cohort Studies

RESULTS

The analysis incorporated 10 retrospective studies with cohort sizes ranging from 32 to 213 patients. The geographic distribution included 6 Asian studies (India, China, Taiwan, and Turkey) and 4 European studies (Serbia, France, Poland, and Sweden). Populations covered early-stage (7 studies), advanced-stage (2 studies), and bilateral/recurrent tumours (3 studies). Key cohorts included Wei Cang's advanced serous BOTs and Wang's second fertility-sparing interventions. Two studies mandated complete staging [14,29], one flagged micropapillary histology as high-risk [29], and the Francogyn multicenter study enhanced generalizability despite most studies being single-centre.

Table 1: Summary of characteristics of each study.

Study (Author, Year)	Country	Sample Size	Age Range (Years)	Type of FPS	Pregnancy Rate	Recurrence Rate	Follow-up Duration
Kumari et al. 2021	India	75	Median: 32	Cystectomy, Oophorectomy	42.1% (8/19)	9.3% (higher with cystectomy: 33.3%)	Median: 36 months
Lađević et al. 2022	Serbia	52	<40	USOE (57.8%), Cystectomy	44.8% (13/29)	7.7% (FPS group only)	Median: 68.5 months
Mu-EnKo et al . 2023	Taiwan	71 (BOT)	18-45	USO (57.8%), Cystectomy	57.1% (20/35)	11.3% (BOT)	Median: 36.3 months
Cang et al. 2023	China	65	≤45	USO + CC (31), Bilatera Cystectomy(25)	48.6% (17/35)	70.8% (advanced-stage SBOT)	Median DFS: 22.8 months
Kurt et al. 2024	Turkey	58 (FSS group)	NR	Cystectomy, USO	36% (21/58: 18 spontaneous, 3 ART)	24.1% (vs. 2.5% in non-FSS)	NR
Jia et al. 2020	China	110	NR	UAC (unilateral adnexectomy + cystectomy), BOC	47% (24 spontaneous, 3 IVF)	65% (highest in UAC: 84%)	Median: 64 months
Ozenne et al. 2022	France	175	NR	NR	67% (majority spontaneous)	20% (higher if age <35,MP component	Median: 29.5 months to recurrence
Sobiczewski et al. 2022	Poland	110	Reproductive age	Laparoscopy/laparotomy.(Cystectomy/adnexectomy)	50.9% (56/110)	PFS: 78.2% at 5 years	NR
Johansen et al. 2021	Sweden	213	Fertile age	USOE (86%), Cystectomy (14%)	23% (50/213; 84% spontaneous)	NR	Mean: 58–76 months
Wang et al. 2022	China	32 (attempted conception)	NR	USO, Oophorocystectomy	46.9% (15/32)	31.9% (vs. 6.5% after RS)	Median: 18 months to pregnancy

BOT:Borderline Ovarian Tumor,FPS: Fertility-Preserving Surgery, RS: Radical Surgery (Hysterectomy + Bilateral Salpingo-oophorectomy), USO/USOE: Unilateral Salpingo-oophorectomy, CC: Contralateral Cystectomy, BOC: Bilateral Ovarian Cystectomy, UAC: Unilateral Adnexectomy + Contralateral Cystectomy

Table 2: Reproductive and Oncologic Outcomes of FPS for BOTs.

Author Year of Study	Reproductive outcome	Oncologic Outcome
Kumari et al. 2021	Pregnancy rate: 42.1% (8/19) - Median time to menses: 1 month	Recurrence rate: 9.3% (higher after cystectomy: 33.3%) - OS: 98.7%
Lađević et al. 2022	- Pregnancy rate: 44.8% (13/29) - 93.7% spontaneous pregnancies	Recurrence rate: 7.7% (FSS only) - OS: 100%
Mu-EnKo et al. 2023	Pregnancy rate (BOT): 57.1% (20/35) - Median time to conception: 39 months	Recurrence rate (BOT): 11.3% - Malignant transformation: 1 case
Cang et al. 2023	Pregnancy rate: 48.6% (17/35) - 5 ART live births	Recurrence rate: 70.8% (advanced-stage SBOT) - 5-yr OS: 97%
Kurt et al. 2024	Pregnancy rate: 36% (21/58) - 12 live births	Recurrence rate: 24.1% (vs. 2.5% in non-FPS) - Higher after cystectomy
Jia et al. 2020	Pregnancy rate: 47% (24 spontaneous + 3 IVF) - 19 live births	Recurrence rate: 65% (highest after UAC: 84%) - Invasive recurrence: 15%
Ozenne et al. 2022	Pregnancy rate: 67% (majority spontaneous) - 51% live births	Recurrence rate: 20% - Risk factors: age <35, MP component, advanced stage
Sobiczewski et al. 2022	Pregnancy rate: 50.9% (56/110) - 83 children born	PFS: 78.2% at 5 yrs - All recurrences borderline (no invasive)
Johansen et al. 2021	Live birth rate: 23% (50/213) - 84% spontaneous	5-yr OS: 98% (FPS) - 3 deaths (mucinous BOT with malignant recurrence)
Wang et al. 2022	Pregnancy rate: 46.9% (15/32) - Live birth rate: 81.3%	Recurrence rate: 31.9% (vs. 6.5% after RS) - USO safer than cystectomy

Table 3: Summary and comparison of each study

Author and year of study	Study period and country	Age of patients	Sample size	Tumor stage and recurrence	Type of fertility-preserving surgery	Tried for pregnancy	Live birth	Abortion	Use of art
Mu-EnKo et al. 2023	2007 - 2022 Taiwan	19–44 years	Total sample size (244) patients with BOT (71)	IA to IC 11%	Unilateral salpingo-oophorectomy	35	23	3	1
Kumari et al. 2021	2014-2019 India	18–45 years	120 patients	I to III Recurrence rate: 9.3%	Cystectomy, Unilateral salpingo-oophorectomy	42	23	5	3
Cang et al. 2023	1999-2021 china	<_45 years	65	II – III	Unilateral salpingo-oophorectomy and contralateral cystectomy	35	15	1	12
Ozenne et al. 2022	1997-2020 France	>_18 years	BOT 175	I to IV 17.7 %	Unilateral cystectomy, Unilateral ovariectomy, Bilateral cystectomy, Cystectomy + contralateral ovariectomy	45	23	0	5
Sobiczewski et al. 2022	1994-2010 Poland	17 – 40 years	110	Stage I–III; Recurrence rate: Not specified	Cystectomy, Cystectomy + contralateral adnexectomy	83	62	10	20
Wang et al. 2022	2009 – 2020 China	18–45 years	BOT (78)	Stage I–III; Recurrence rate: Not specified	Unilateral salpingo-oophorectomy	32	20	3	6
Jia et al. 2020	1999-2019 China	<_40 years old	BOT 94	I to III Recurrence UAC 84% BOC 67%	Unilateral adnexectomy + contralateral cystectomy (UAC), Bilateral ovarian cystectomy (BOC)	UAC: 31 patients, BOC: 48 patients	UAC: 15 live births, BOC: 28 live births	UAC: 5 abortions, BOC: 14 abortions	UAC: 3 Patients, BOC: 3 Patients used ART
Kurt et al. 2024	2001 – 2020 turkey	18–45 years	80	Stage I–III; Recurrence rate: 24.1%	Cystectomy, Unilateral salpingo-oophorectomy	32	18	4	5
Lađević et al. 2022	2010-2019 Serbia	18-40 years	52 FPS 45	Stage I Recurrence 7.7%	Unilateral salpingooophrectomy	29	16	2	1
Johansen et al. 2021	2008-2015 Sweden	18-40years	277 FPS 213	Stage I-III; Recurrence rate: Not specified	Unilateral salpingo-oophorectomy 183 cystectomy 30	62	40	5	15

DISCUSSION

The systematic review of reproductive outcomes in patients with BOTs undergoing FPS highlights several critical aspects, including oncologic safety, recurrence rates, and reproductive success. The included studies collectively provide a comprehensive overview of the outcomes, enabling a detailed comparison across different populations, surgical approaches, and follow-up durations.

Recurrence Rates:

Recurrence rates in BOTs demonstrate considerable variability, which can be attributed to differences in study design, patient demographics, surgical approaches, and follow-up durations. While some studies report relatively low recurrence rates, others indicate significantly higher risks, particularly in specific subgroups. Kumari et al. (2023) observed a recurrence rate of 9.3%, with a stark contrast between cystectomy (33.3%) and oophorectomy (6.2%).[32] This discrepancy raises important questions about the appropriateness of cystectomy in patients desiring fertility preservation, as the substantially higher recurrence risk may outweigh its benefits. Similarly, Lađević et al. (2022) reported a 7.7% recurrence rate in fertility-preserving surgery (FPS) cases, with no recurrences in radical surgery groups.[23] These findings suggest that while FPS is feasible, it may compromise

long-term oncologic safety, necessitating thorough patient counselling.

However, the most alarming recurrence rates were reported by Cang et al. (2021), with 70.8% in advanced-stage serous BOTs.[25] This exceptionally high rate challenges the conventional perception of BOTs as indolent tumours, particularly in advanced stages. The study underscores the aggressive potential of certain histologic subtypes (e.g., micropapillary patterns) and reinforces the need for tailored surgical strategies in high-risk cases. Kurt et al. (2020) further supported this notion, demonstrating a significantly higher recurrence rate in FPS groups (24.1%) compared to non-FPS groups (2.5%).[27] Collectively, these findings highlight a critical trade-off between fertility preservation and oncologic outcomes, emphasising the necessity of individualised risk assessment.

Several risk factors for recurrence were consistently identified, including younger age (<35 years), nulliparity, advanced FIGO stage, micropapillary histology, and incomplete surgical staging.[23,25,29,32] The study by Ozenne et al. (2021) provided compelling evidence that initial complete peritoneal staging (ICPS) significantly reduces the recurrence risk (25% in the ICPS group vs. 46% in the non-ICPS group).[29] This reinforces the argument that comprehensive surgical staging should be prioritised, even in presumed early-stage disease, to minimise recurrence risk.

Malignant Transformation:

Malignant transformation was rare but clinically significant. While Kumari et al. reported no cases, Cang et al.[32] observed invasive recurrence in 20% of patients (including low-grade serous ovarian carcinoma).[25] Johansen et al. documented three fatal mucinous cancer recurrences post-FPS, underscoring mucinous histology risks.[31] Notably, overall survival rates remained excellent (97-100%) across all studies.[23,25,31,32]

Pregnancy Rates:

Fertility-preserving surgery for borderline ovarian tumours shows variable pregnancy rates (42.1-57.1%) across studies. Kumari et al. reported a pregnancy rate of 42.1%, while Lađević et al. observed a slightly higher rate of 44.8%.[23,32] Ko et al. found that 57.1% of BOT patients achieved pregnancy, with higher rates in those without prior childbirth (82.4%).[24] Cang et al. reported a pregnancy rate of 48.6% in patients with advanced-stage serous BOTs, with 12 patients achieving pregnancy through assisted reproductive technology (ART).[25] Sobiczewski et al. noted a successful pregnancy rate of 50.9%, with the majority of pregnancies occurring spontaneously.[30] While these results are encouraging, they should not be viewed in isolation, as they are subject to significant variability across studies and must be balanced against the elevated recurrence risks associated with micropapillary and advanced-stage disease.

Impact of Surgical Approach

The choice of fertility-preserving procedure significantly affected both oncologic and reproductive outcomes. Consistent with previous findings, cystectomy demonstrated higher recurrence rates than oophorectomy.[27,32] Notably, Jia et al. reported a 67% relapse rate for bilateral ovarian cystectomy (BOC) versus 84% for unilateral adnexectomy with contralateral cystectomy (UAC), though pregnancy rates were similar between approaches.[28] For recurrent cases requiring a second FPS, unilateral salpingo-oophorectomy (USO) has shown superior oncologic safety and fertility preservation compared to oophorocystectomy.[32]

Role of Assisted Reproductive Technology (ART)

ART played a significant role in achieving pregnancy in several studies. Ko et al. reported that only one BOT patient and three EOC patients required assisted reproductive technology (ART), while Cang et al. noted that 12 patients achieved pregnancy through ART.[24,25]. Sobiczewski et al. observed that only one patient achieved pregnancy through ART, suggesting that spontaneous conception is the primary mode of achieving pregnancy after FPS.[30] These findings highlight the potential role of ART in supporting fertility preservation, particularly in patients with persistent infertility.

Long-Term Follow-Up

Studies consistently highlighted late recurrence risks, necessitating long-term follow-up. Kumari et al. reported median recurrence at 35 months (some >5 years), while Lađević et al. found most recurrences within 3 years.[32,23] In contrast, Cang et al. reported a median disease-free survival (DFS) of 22.8 months, with recurrences occurring beyond 3 years.[25] Our review confirms Wang and Fang's findings of lower recurrence rates with salpingo-oophorectomy while adding new ART outcome data (5-20% pregnancy rates) and showing that complete surgical staging reduces relapse by 21%, thereby strengthening the evidence for fertility-preserving approaches.[14]

Clinical Recommendations

Based on this review, we propose the following:

Patient Selection:

FPS is suitable for FIGO I BOTs in fertility-desiring patients (pregnancy rates: 23–67%) and avoids high-risk cases (micropapillary histology, FIGO II–III, mucinous subtypes) due to increased recurrence/malignant transformation

Surgical Approach:

Preferred: USO for unilateral tumours (recurrence: 7.7–24.1%). *Alternative:* Cystectomy if bilateral/conservation needed (higher recurrence: 28.5–84%) and Staging reduces recurrence (7.7% vs 46%)

ART & Recurrence:
ART is safe post-FPS. For recurrences: Repeat FPS achieves 46.9% pregnancy rates (USO preferred)
Follow Up:
Monitor ≥10 years (peak recurrence risk: first 3 years)

LIMITATIONS

No randomised controlled trials were identified on this topic, and the full texts of many potentially relevant articles could not be retrieved, leading to their exclusion. All included studies were retrospective in design, increasing the risk of bias. The potential for self-reporting and publication bias should also not be disregarded. Furthermore, only English-language articles were included. The studies in this review had several limitations, including retrospective designs, small sample sizes, variable follow-up durations, and inconsistent definitions of surgical techniques. These factors may introduce selection bias and limit the generalizability of the findings. Additionally, some studies used marital status as a proxy for pregnancy desire [19,24], which may not accurately reflect patients' actual attempts to conceive. Given these limitations, the results should be interpreted with caution, and further high-quality prospective research is needed.

CONCLUSIONS

This systematic review highlights key trade-offs in FPS for BOTs. While pregnancy rates range from 42.1% to 67%, outcomes vary substantially by approach: unilateral salpingo-oophorectomy (USO) demonstrates lower recurrence rates (7.7-24.1%) compared to cystectomy (28.5-84%), with bilateral cystectomy offering intermediate results. Complete surgical staging halves recurrence risk (7.7% vs 46%), and micropapillary/advanced-stage disease carries particularly high relapse rates (70.8%). Three research priorities emerge: RCTs comparing USO and cystectomy techniques, Long-term (>10-year) reproductive and oncologic registries, and Biomarker studies for recurrence prediction. Until stronger evidence exists, USO with complete staging represents the most balanced option, requiring thorough counselling about residual uncertainties.

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REFERENCES

1. Ewald-Riegler N, du Bois O, Fisseler-Eckhoff A, Kommoss F, Harter P, Traut A, et al. Borderline tumors of the ovary: clinical course and prognostic factors. Oncol Res Treat. 2012;35(1-2):28-33. https://doi.org/10.1159/000336140. PMID: 22301955.
2. Tropé CG, Kaern J, Davidson B. Borderline ovarian tumours. Best Pract Res Clin Obstet Gynaecol. 2012;26(3):325-36. . https://doi.org/10.1016/j.bpobgyn.2011.12.006. PMID: 22265237.
3. Palomba S, Falbo A, Del Negro S, Rocca M, Russo T, Cariati F, et al. Ultra-conservative fertility-sparing strategy for bilateral borderline ovarian tumours: an 11-year follow-up. Hum Reprod. 2010;25(8):1966-72. https://doi.org/10.1093/humrep/deq159. PMID: 20573679.
4. Abascal-Saiz A, Sotillo-Mallo L, De Santiago J, Zapardiel I. Management of borderline ovarian tumours: a comprehensive review of the literature. Ecancermedicalscience. 2014;8:403. https://doi.org/10.3332/ecancer.2014.403. PMID: 24567796.
5. Vasconcelos I, de Sousa Mendes M. Conservative surgery in ovarian borderline tumours: a meta-analysis with emphasis on recurrence risk. Eur J Cancer. 2015;51(5):620-31. https://doi.org/10.1016/j.ejca.2015.01.004. PMID: 25661104.
6. Alvarez RM, Vazquez-Vicente D. Fertility sparing treatment in borderline ovarian tumours. Ecancermedicalscience. 2015;9:507. https://doi.org/10.3332/ecancer.2015.507. PMID: 25729420.
7. Lim-Tan SK, Cajigas HE, Scully RE. Ovarian cystectomy for serous borderline tumors: a follow-up study of 35 cases. Obstet Gynecol. 1988;72(5):775-81. PMID: 3173929.
8. Palomba S, Zupi E, Russo T, Falbo A, Del Negro S, Manguso F, et al. Comparison of two fertility-sparing approaches for bilateral borderline ovarian tumours: a randomised controlled study. Hum Reprod. 2007;22(2):578-85. https://doi.org/10.1093/humrep/del381. PMID: 17050549.
9. Plett H, Harter P, Ataseven B, Heitz F, Prader S, Schneider S, et al. Fertility-sparing surgery and reproductive outcomes in patients with borderline ovarian tumors. Gynecol Oncol. 2020;157(2):411-7https://doi.org/10.1016/j.ygyno.2020.02.007. PMID: 32115229.
10. Fauvet R, Boccara J, Dufournet C, Poncelet C, Darai E. Laparoscopic management of borderline ovarian tumors: results of a French multicenter study. Ann Oncol. 2005;16(3):403-10. https://doi.org/10.1093/annonc/mdi083. PMID: 15653700.
11. Park JY, Kim DY, Kim JH, Kim YM, Kim YT, Nam JH. Surgical management of borderline ovarian tumors: the role of fertility-sparing surgery. Gynecol Oncol. 2009;113(1):75-82. https://doi.org/10.1016/j.ygyno.2008.12.034. PMID: 19217169.
12. Fortin A, Morice P, Thoury A, Camatte S, Dhainaut C, Madelenat P. Impact of infertility drugs after treatment of borderline ovarian tumors: results of a retrospective multicenter study. Fertil Steril. 2007;87(3):591-6. https://doi.org/10.1016/j.fertnstert.2006.07.1503. PMID: 17113086.
13. Shim SH, Kim SN, Jung PS, Dong M, Kim JE, Lee SJ. Impact of surgical staging on prognosis in patients with borderline ovarian tumours: a meta-analysis. Eur J Cancer. 2016;54:84-95. https://doi.org/10.1016/j.ejca.2015.11.005. PMID: 26686988.
14. Wang P, Fang L. Salpingo-oophorectomy versus cystectomy in patients with borderline ovarian tumors: a systemic review and meta-analysis on postoperative recurrence and fertility. World J Surg Oncol. 2021;19:1-8. https://doi.org/10.1186/s12957-021-02241-2. PMID: 33882931.
15. Daraï E, Fauvet R, Uzan C, Gouy S, Duvillard P, Morice P. Fertility and borderline ovarian tumor: a systematic review of conservative management, risk of recurrence and alternative options. Hum Reprod Update. 2013;19(2):151-66. https://doi.org/10.1093/humupd/dms047. PMID: 23255517.
16. Jiao X, Hu J, Zhu L. Prognostic factors for recurrence after fertility-preserving surgery in patients with borderline ovarian tumors: a systematic review and meta-analysis of observational studies. Int J Gynecol Cancer. 2017;27(9):1833-41. https://doi.org/10.1097/IGC.0000000000001092. PMID: 29095774.

17. Rotondella I, Scarpelli E, Martignon G, Scebba D, Monfardini L, Gaiano M, et al. Update of laparoscopic surgery in borderline ovarian tumor: systematic review. Clin Exp Obstet Gynecol. 2023;50(12). https://doi.org/10.31083/j.ceog5012277.
18. Sadlecki P, Walentowicz-Sadlecka M. Molecular landscape of borderline ovarian tumours: A systematic review. Open Med (Wars). 2024;19(1):20240976. https://doi.org/10.1515/med-2024-0976.
19. Otify M, Laios A, Elshamy T, D'Angelo A, Amso NN. A systematic review and meta-analysis of the use of ultrasound to diagnose borderline ovarian tumours. Eur J Obstet Gynecol Reprod Biol. 2020;244:120-7. https://doi.org/10.1016/j.ejogrb.2019.11.016. PMID: 31864984.
20. Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. BMJ. 2021;372:n71. https://doi.org/10.1136/bmj.n71. PMID: 33782057.
21. Wells GA, Shea B, O'Connell D, Peterson J, Welch V, Losos M, et al. The Newcastle-Ottawa Scale (NOS) for assessing the quality of nonrandomised studies in meta-analyses. Ottawa Hospital Research Institute; 2014. PMID: [Not available].
22. Kumari S, Kumar S, Bhatla N, Mathur S, Thulkar S, Kumar L. Oncologic and reproductive outcomes of borderline ovarian tumors in Indian population. Gynecol Oncol Rep. 2021;36:100756. https://doi.org/10.1016/j.gore.2021.100756. PMID: 33816962.
23. Likić-Lađević I, Nešić D, Stefanović A, Kadija S, Vilendečić Z, Pilić I, et al. Oncologic and reproductive outcomes of fertility-sparing surgery for borderline ovarian tumors: first presentation of 10-year experience from a Serbian referral center. Arch Biol Sci. 2022;74(3):283-90. https://doi.org/10.2298/ABS220722027L. PMID: [Not available].
24. Ko ME, Lin YH, Huang KJ, Chang WC, Sheu BC. Fertility and Pregnancy Outcomes after Fertility-Sparing Surgery for Early-Stage Borderline Ovarian Tumors and Epithelial Ovarian Cancer: A Single-Center Study. Cancers (Basel). 2023;15(22):5327. https://doi.org/10.3390/cancers15225327. PMID: 38005379.
25. Cang W, Liang C, Wang D, Xue X, Cao D, Yang J, et al. Oncological and reproductive outcomes after fertility-sparing surgery in patients with advanced-stage serous borderline ovarian tumor: A single-center retrospective study. J Clin Med. 2023;12(18):5827. https://doi.org/10.3390/jcm12185827. PMID: 37763874.
26. Jia SZ, Xiang Y, Yang JJ, Shi JH, Jia CW, Leng JH. Oncofertility outcomes after fertility-sparing treatment of bilateral serous borderline ovarian tumors: results of a large retrospective study. Hum Reprod. 2020 Feb;35(2):328–339. https://doi.org/10.1093/humrep/dez307. PMID: 32048711.
27. Ozenne A, De Berti M, Body G, Carcopino X, Graesslin O, Kerbage Y, Akladios C, Huchon C, Bricou A, Mimoun C, Raimond É, et al. Risk factors for recurrence of borderline ovarian tumours after conservative surgery and impact on fertility: a multicentre study by the Francogyn group. J Clin Med. 2022 June 23;11(13):3645. https://doi.org/10.3390/jcm11133645. PMID: 35806930.
28. Sobiczewski P, Piatek S, Michalski W, Kupryjańczyk J, Maciejewski T, Ołtarzewski M, Bidzinski M. Obstetric outcomes after conservative management of ovarian borderline tumors in women of reproductive age: a single center experience. Eur J Obstet Gynecol Reprod Biol. 2022 Feb;269:126–131. https://doi.org/10.1016/j.ejogrb.2021.12.029. PMID: 34998079.
29. Johansen G, Dahm-Kähler P, Staf C, Rådestad AF, Rodriguez-Wallberg KA. Reproductive and obstetrical outcomes with the overall survival of fertile-age women treated with fertility-sparing surgery for borderline ovarian tumors in Sweden: a prospective nationwide population-based study. Fertil Steril. 2021 Jan;115(1):157–163. https://doi.org/10.1016/j.fertnstert.2020.07.043. PMID: 33036817.
30. Wang L, Zhong Q, Tang Q, Wang H. Second fertility-sparing surgery and fertility-outcomes in patients with recurrent borderline ovarian tumors. Arch Gynecol Obstet. 2022 Oct;306(4):1177–1183. https://doi.org/10.1007/s00404-022-06431-5. PMID: 35396974.

AUTHORS CONTRIBUTION

Sadia Shoukat - *Concept & Design; Data Acquisition; Data Analysis/Interpretation; Drafting Manuscript; Critical Revision; Supervision; Final Approval*
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The authors accept responsibility for all aspects of the work and will ensure that any concerns regarding the accuracy or integrity of any part are properly investigated and resolved.

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