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PII: S1553-4650(19)31301-9
DOI: https://doi.org/10.1016/j.jmig.2019.09.791
Reference: JMIG 4011

To appear in: *The Journal of Minimally Invasive Gynecology*

Received date: 10 June 2019
Revised date: 17 September 2019
Accepted date: 23 September 2019

Please cite this article as: Sofiane Bendifallah MD PhD , Elie Vesale MD , Emile Daraï MD PhD , Isabelle Thomassin-Neggara MD PhD , Marc Bazot MD PhD , Jean-Jacques Tuech MD PhD , Carole Abo MD , Horace Roman MD PhD , Recurrence after surgery for colorectal endometriosis: systematic review and meta-analysis, *The Journal of Minimally Invasive Gynecology* (2019), doi: https://doi.org/10.1016/j.jmig.2019.09.791

Recurrence after surgery for colorectal endometriosis: systematic review and meta-analysis

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The authors report no funding or conflict of interest

The study is not under review or published in another journal.

The results have not been previously presented at any meeting.

PRECIS: Assessing the risk of recurrence associated with shaving, disc excision and segmental techniques for deep endometriosis with colorectal involvement: an systemic review and meta-analysis

ABSTRACT

Objective

Recurrence after colorectal surgery for endometriosis is up to 50% at 5 years. The aim of the current review and meta-analysis was to assess recurrence associated with shaving, disc excision, and segmental resection for endometriosis with colorectal involvement.

Data sources

A systematic review was performed by searching PubMed, Clinical Trials.gov, Embase, Cochrane Library, and Web of Science for publications through February 28, 2019 that included the terms *colorectal endometriosis* and *recurrence* in the English language. Outcome measure was histologically proven recurrence following one year after index surgery.

Methods of study selection

Studies rated as good or fair by the Study Quality Assessment Tools were included. Two reviewers independently assessed the quality of the studies; discrepancies were discussed and, if consensus was not reached, a third reviewer was consulted.

Tabulation, Integration and results

Of 156 relevant published trials, 41 studies were systematically reviewed and 4 were included in the meta-analysis. The risk of recurrence was higher after rectal shaving compared with both segmental resection (odds ratio (OR) 5.53, 95% confidence interval [CI]: 2.33-13.12, I^2 = 0%,p=0.001) and disc excision for histologically-proven recurrence (OR 3.83 95% CI 1.33-11.05, I^2 = 0%, p= 0.01). This difference was not significant when comparing disc excision and segmental resection (OR 2.63, 95% CI 0.8-8.65, I^2 = 0%, p=0.11).

Conclusion

The current analysis shows a lower risk of recurrence when segmental resection or disc excision are performed compared with rectal shaving, which is important when assigning the most appropriate surgical management.

INTRODUCTION

Colorectal endometriosis affects from 5.3% to 12% of patients with deep infiltrating endometriosis (DIE) [1,2]. Surgical management of DIE is frequently an option when the bowel or urinary tract are involved, as well as in patients with decreased sexual and/or reproductive functions leading to a poor quality of life [3,4].

In this specific setting, two main surgical approaches have been reported [5,6]: (i) a radical procedure allowing complete removal of all implants with segmental resection [7,8]; (ii) conservative surgery based on disc excision and/or rectal shaving.

The main goals of surgical management are to improve quality of life [8]; to optimize fertility outcomes for females wishing to conceive [9,10]; and to delay recurrence for as long as possible [11,12]. The overall recurrence rate is as high as 40–50% at 5 years [13]. However, recurrence rates are not always reported in published studies, and the definition of recurrence may vary [13]. In addition, the likelihood of need for additional surgery for endometriosis within 4 years postoperatively is approximately 27% [14], and need for any type of reintervention occurs in >50% of patients, 25% of whom require ≥3 surgeries [15].

The aim of the current systematic review and meta-analysis was to assess the rates of recurrence associated with shaving, disc excision, and segmental resection for DIE with colorectal involvement.

Methods

This systematic review and meta-analysis were performed in accordance with recommendations from the Cochrane guidelines [16]. The protocol was registered with the International Prospective Register of Systematic Reviews (PROSPERO ID: 126730) before commencing the analysis, and the manuscript follows the Preferred Reported Items for Systematic Reviews and Meta-analyses (PRISMA) guidelines [17].

Sources and literature search

The PubMed, Clinical Trials.gov, Embase, Cochrane Library, and Web of Science databases were searched for relevant studies that were published before February 28, 2019. The search strategy consisted of specific vocabulary and the National Library of Medicine's MeSH (Medical Subject Headings) terms. Major search terms that were used were ("endometriosis" or "deep infiltrating endometriosis" or "colorectal endometriosis") AND ("surgery for endometriosis" or "conservative management" or "colorectal resection" or "shaving" or "full thickness resection") AND "treatment", "outcomes", "long term results", "recurrence" and "persistent". The search was supplemented with a comprehensive evaluation of the references of relevant primary articles and reviews and was not restricted by date but was limited to the English language. A post-hoc decision was implemented to exclude abstracts if authors did not provide adequate information when contacted, as risk of bias assessment was not possible.

Data abstraction and Outcome Measures

We performed a random effects meta-analysis. Two reviewers (CA and EV) independently assessed the quality of each included study, discrepancies were discussed and, if consensus was not reached, a third reviewer was consulted (SB, ED, HR). The data included author, year of publication, number of patients, type of study, number and percentages of recurrences according to colorectal management, definition of recurrence, histological proof of recurrence, and the mean or median follow-up period. The mean, standard deviation, median, interquartile range, and confidence interval of each study was obtained or calculated from existing data [18,19].

The primary outcome that was studied was symptom recurrence following surgical management of colorectal endometriosis. As the recurrence rate varies with the definition of recurrence (subjective feeling of pain or more objective clinical/instrumental measurements),

it was determined to first search for clinical and imaging evidence of recurrence, whether or not it was confirmed histologically during follow-up surgery, and then to analyze histologically proven recurrence. Moreover, as recurrence is closely dependent on the follow-up period, it was decided to evaluate time to recurrence. This allowed for distinguishing between early recurrence (<15 months) that is more likely to be linked to persistent lesions, and late recurrence (≥ 15 months) that probably represents real recurrence of the disease. Moreover, we analyzed the rate of recurrence according to the surgical management of the bowel as this outcome varies greatly between conservative management and colorectal resection.

Risk of Bias

Study Quality Assessment Tools were used to assess the quality of included studies: Quality Assessment of Controlled Intervention Studies and Quality Assessment Tool for Before-After (Pre-Post) Studies With No Control Group (https://www.nhlbi.nih.gov/health-topics/study-quality-assessment-tools - supplemental Figure 1). Studies were rated as "good" when at least 70% of 12 assessment criteria were fulfilled, "fair" when at least 50% were fulfilled, or poor when less than 50% of criteria were fulfilled. Discrepancies regarding study quality were resolved with three authors (SB, ED, HR).

The risk of bias was evaluated by eligibility criteria, sample size, population representation (whether a sampling methodology was used appropriately to produce an estimate representation of the target population), response rate, data collection tool, clarity of questions/statements and definition of outcome, clarity of objective, ethical considerations, and consistency between research question and data reported.

Statistical Analysis

Odd ratios (OR) were derived from each study as primary and secondary endpoints, respectively, and the corresponding 95% confidence intervals (CI) were also extracted. Dichotomous data were reported as ORs, and continuous data were reported as mean

difference, each with corresponding 95% CI. Pooled response means (estimating overall mean difference with 95% CI) are expressed on Forest Plots. A p-value <0.05 was considered significant for pooled response means. Statistical heterogeneity among the studies was determined by Cochran's Q test and I^2 index, in which I^2 <50% or p values of <0.1 indicated that significant heterogeneity did not exist. The fixed-effects model was applied if heterogeneity was not observed among the studies; otherwise, the random-effects model was adopted for pooled estimates. If a study reported no observed events for a given outcome, a 0.001 integer continuity correction was applied. If heterogeneity was high (I^2 >50%), subgroup analyses were completed to explore possible explanations for primary outcome. When sufficient data were available, predefined subgroup analyses according to differing follow-up periods were performed by study design (prospective vs. retrospective) for primary outcome, using the data closest to 12-month follow up. All statistical analysis was performed with Review Manager (RevMan, IOS, version (5.3), Copenhagen: The Nordic Cochrane Centre, The Cochrane Collaboration, 2011).

RESULTS

Study selection

156 studies that fulfilled our electronic search criteria were identified. After screening by title and abstract and removing duplicate papers, 124 full text articles were assessed. Of these, two systemic reviews were excluded. From the 122 remaining papers, 71 were excluded: two articles were not in English, 65 failed to accurately report the rate of recurrence, and four described a new surgical technique. Ten of the 51 remaining papers were ineligible for review: three because the surgical technique was unclear, and 7 reported an overall recurrence rate without specifying the colorectal technique. Among the 41 papers included in the review (Table 1) [11,20–59], 37 were excluded from the meta-analysis according to inclusion criteria: 11 because of follow-up period <12 months, and 26 because of the definition of recurrence (either non-specified or no follow-up surgery with a histologic

proof of recurrence). 41 studies were retained for the systemic review [11,20-59], 4 of which were included (Table 2) [21,25,30,47] for the meta-analysis (Fig. 1).

Study characteristics – Descriptive analysis

Nineteen studies were prospective [24,27,29,30,32,37,38,40-44,48-50,52,55,56,59], two randomized controlled trials (one of which was an extended analysis of a randomized controlled trial) [20,28], and 20 retrospective studies [11,21-23,25,26,31,33,34-36,39,45-47,51,53,54,57], with a total of 4064 patients undergoing surgery for DIE involving the bowel. Surgical techniques were specified for 3845 patients. Among them, 1339/3845 (34.8%) underwent conservative surgery with rectal shaving, 202/3845 (5.3%) disc excision, and 2304/3845 (59.9%) segmental resection. Recurrence was observed in 327/3845 (8%) patients with the following prevalence according to the type of surgery: 108 (8.1%) of 1,339 patients after rectal shaving, 21 (10.4%) of 202 patients after disc excision, and 198 (8.6%) of 2,304 patients after segmental resection. Recurrence was described in 32/39 (82%) studies but proven by surgery in only 13 studies, 4 of which compared at least two colorectal resection groups. In the remaining 19 studies, either recurrence was not defined or was diagnosed on clinical and imaging evidence (Table 1) [11,20–59]. Mean follow-up ranged between 12 and 108 months.

Overall recurrence

When considering all included studies (n=41) [11,20-59], no significant difference in overall recurrence was found between the three surgical groups with OR 1.47 (95% CI 0.89-2.43, I^2 = 72%, p=0.7) (Fig 2A) [21,22,24,25,27,30,47,53], OR 1.08 (95% CI: 0.59-1.98, I^2 = 0%, p=0.95) (Fig 2B) [21,25,35,40,47,53,59] and OR 1.21 (95% CI: 0.62-2.35; I^2=57%, p=0.58) (Fig 2C) [21,25,47,53,59] when comparing recurrence respectively between shaving

and segmental resection, disc excision and segmental resection, and shaving and disc excision (Funnel plots revealed a low risk of publication bias [Supplemental Figure 2]).

Histologically-proven recurrence

When considering histology-proven recurrence in 4 articles [21,25,30,47], a significantly lower recurrence rate was observed in patients with segmental resection compared with rectal shaving (OR 5.53, 95% confidence interval [CI]: 2.33-13.12, I^2 = 0%,p=0.001) (Fig 3A) [21,25,30,47]. This decrease was not significant comparing segmental resection to disc excision (OR 2.63, 95% CI 0.8-8.65, I^2 = 0%, p=0.11) (Fig 3B) [21,25,47]. Finally, disc excision significantly decreased the number of recurrences compared to rectal shaving (OR 3.83 95% CI 1.33-11.05, I^2 = 0%, p= 0.01). (Fig 3C) [21,25,47]. Funnel plots found low risk of publication bias (Supplemental Figure 2). No further tests were applied because fewer than ten studies were included in meta-analysis.

Time to recurrence

Time to recurrence was highly variable, depending on when recurrence was considered to occur. Ten studies mentioned details of the interval up to recurrence (Table 3) [11,20,22,31,33,38,39,42,46,51]: five reported the time between the index surgery and follow-up surgery (22,33,39,42,46), and the remaining five reported the time between the index surgery and reccurrence of clinical symptoms or imaging evidence of endometriosis (11,20,31,38,51). In the former case, time to recurrence ranged between 14 [39] and 90 [33] months and in the latter, between 12 [20] and 94 months [22].

DISCUSSION

No significant differences were found in the three groups when comparing recurrence rate independently with how recurrence was diagnosed. Nevertheless, the risk of recurrence was significantly higher after rectal shaving compared with both segmental resection and

disc excision for histologically-proven recurrences. This difference was not significant when disc excision was compared with segmental resection.

Among the 4,064 patients included in the present review, the rate of surgery for recurrence (after at least 12 months of follow-up), when reported, was 15.3%. The data do not allow for an evidenced-based algorithm concerning the need for reintervention and the ensuing benefits, as surgery for recurrence is often complicated and can result in serious postoperative complications. Roman et al [27], in a retrospective cohort of 77 patients with a follow-up of up to 10 years, reported that four (8%) of 46 patients who underwent colorectal shaving experienced recurrence at the site of a previous bowel nodule, and no patient underwent colorectal resection. Recurrences were successfully treated by shaving in two patients. Conversely, two other patients underwent colorectal resection and experienced postoperative complications that included a rectovaginal and small bowel fistula, respectively. These findings imply that it is crucial to choose the right technique from the onset so as to reduce the risk of recurrence, considering all individual factors which may contribute to increase the risk of recurrence .

According to earlier studies, rectal shaving is associated with lower risk of immediate postoperative complications when compared to disc excision and colorectal resection [60–62]. However, the risk of leaving behind microscopical foci on the bowel seems higher after shaving, which may explain the presumed higher rate of recurrence at mid- and long-term follow up after surgery [11]. This risk may in theory be controlled by simply using postoperative suppressive medical treatment in patients who no longer intend to get pregnant.

For the purpose of this review, we defined postoperative recurrence as histologically-proven endometriosis followed for at least 12 months after initial surgery. Indeed, the main challenge encountered in the present review was that the definition of endometriosis recurrence varied considerably from one study to another. Interestingly, while we did not observe any significant difference between rectal shaving, disc excision, or segmental

resection in terms of recurrence, once the definition was adopted of pathological proof obtained at least 12 months after primary surgery, a significantly lower recurrence was observed for segmental resection compared with rectal shaving. It is thus crucial to clearly define postoperative recurrence to overcome discrepancies in recurrence rates.

On the other hand, results must be interpreted according to the appropriate choice of colorectal surgical technique. For instance, rectal shaving of a voluminous rectal nodule (>3 cm) may lead to higher recurrence thus distorting reported rates. When conservative management (shaving or disc excision) is carried out for an inappropriate indication, the recurrence rate of such interventions may be overestimated. This could explain the considerable heterogeneity between included studies. Hence, surgical teams should carefully assess each individual before selecting the surgical technique so as to reduce the risk of recurrence, especially in the case of conservative surgical treatment.

Recently, Meuleman et al [29] classified recurrence according to five levels of evidence. We believe this could be an interesting approach as not only does it standardize recurrence but it also considers the level of proof. However, the study did not include time to recurrence as a parameter [29]. On the other hand, recurrence should be identified via imaging when possible and surgery is not automatically performed, particularly in patients with pain relieved by medical treatment.

The strengths of this review include the use of an extensive search strategy with almost no restrictions. Although some relevant studies may have escaped detection, we are confident that the key publications were included. However, some limitations deserve to be mentioned mainly involving differences in how recurrence is determined. Further, proof of recurrence via clinical and radiological assessment can be mistakenly interpreted as recurrence even by experienced clinicians and radiologists.

CONCLUSION

Recurrence remains one of the major challenges following surgical management for DIE with colorectal involvement. The current analysis shows a lower risk of recurrence when segmental resection or disc excision are performed compared with rectal shaving.

Colorectal surgery for endometriosis is challenging and may lead to several major complications. Thus, the knowledge of risk of recurrence is crucial to determine the most appropriate surgical management. However, more prospective studies are warranted to assess long-term recurrence.

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Figure Legends:

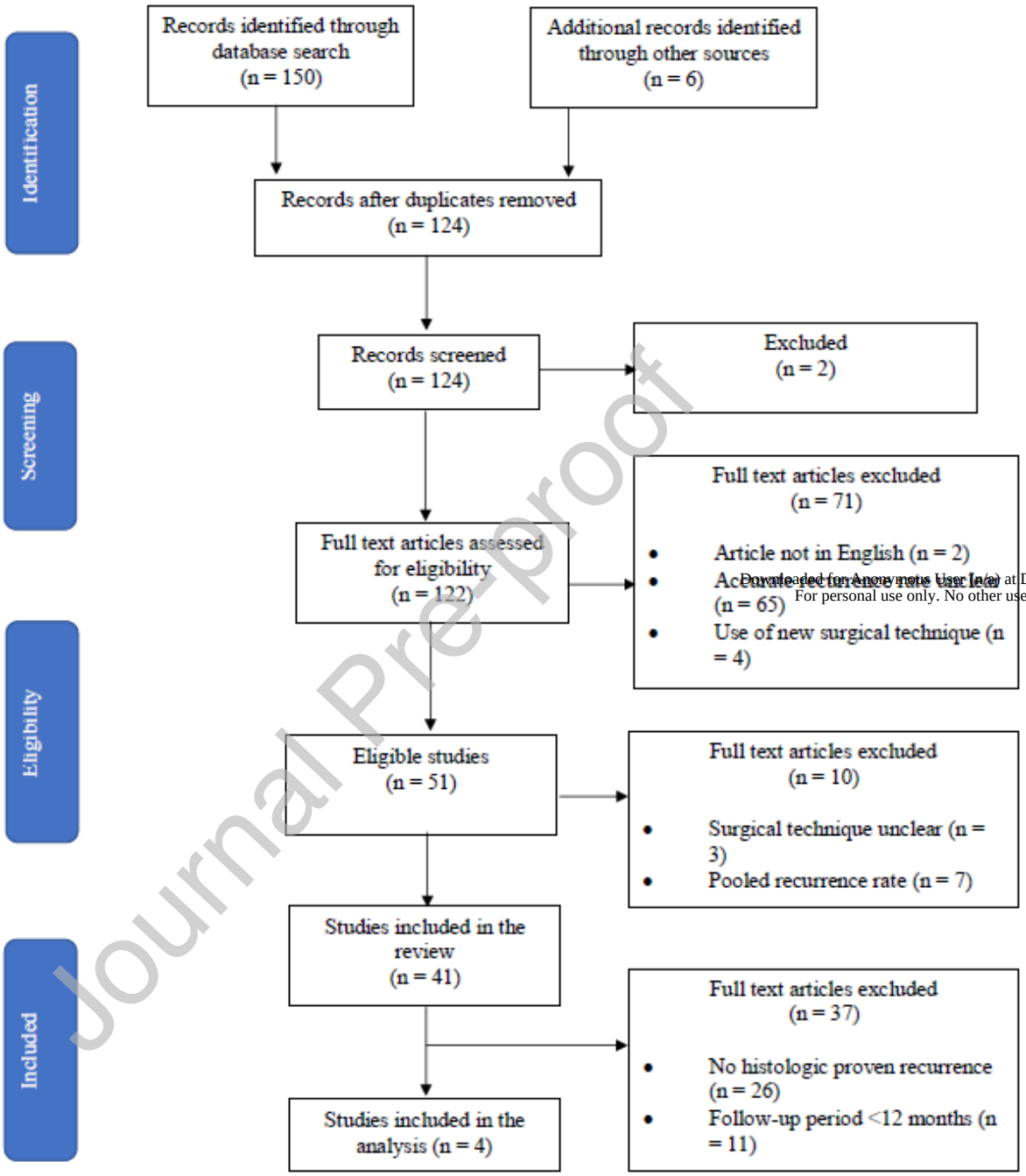

Figure 1: Eligibility of studies for inclusion in the meta-analysis.

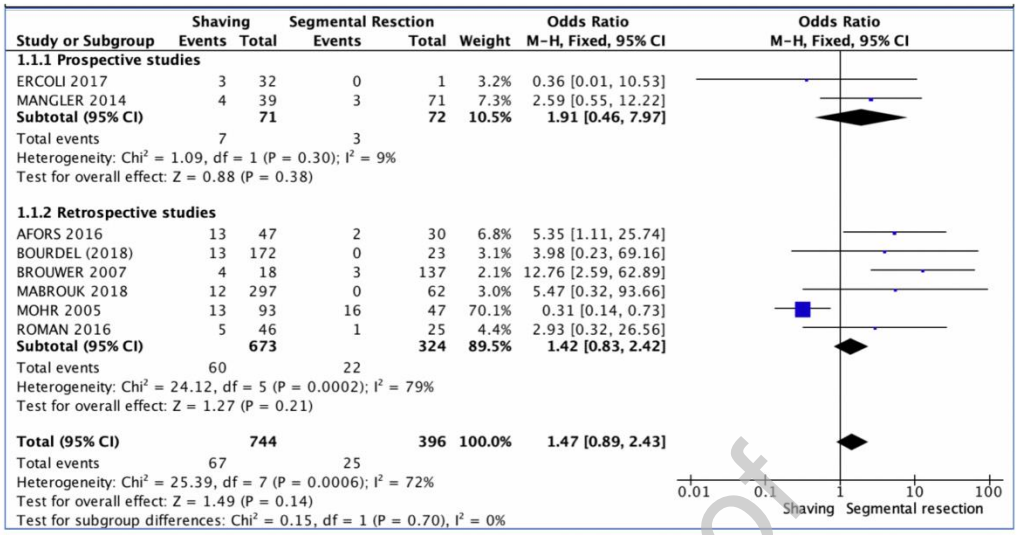

Figure 2A: Comparison of recurrences between the shaving and segmental resection groups whatever the definition of recurrence [21,22,24,25,27,30,47,53].

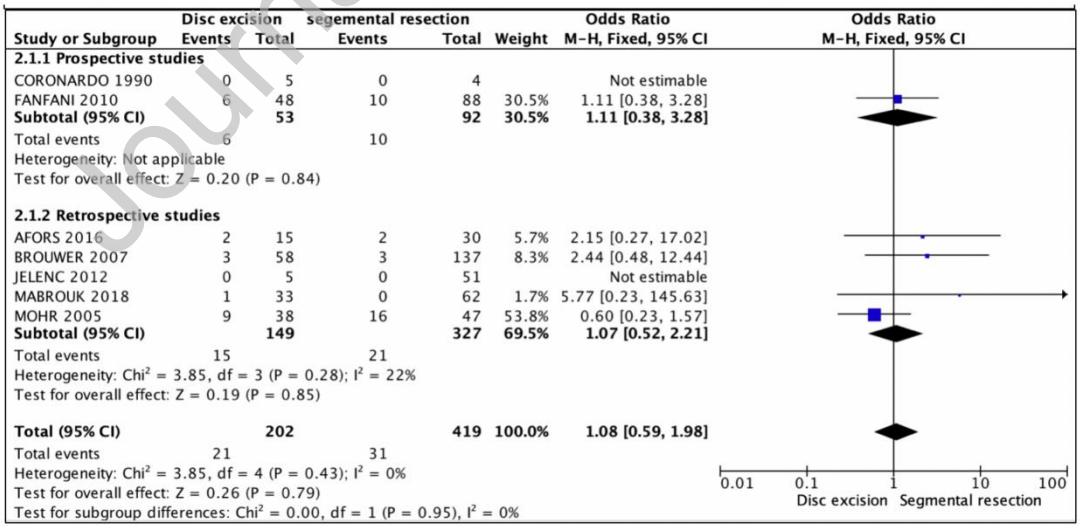

Figure 2B: Comparison of recurrences between the disc excision and segmental resection groups whatever the definition of recurrence [21,25,35,40,47,53,59].

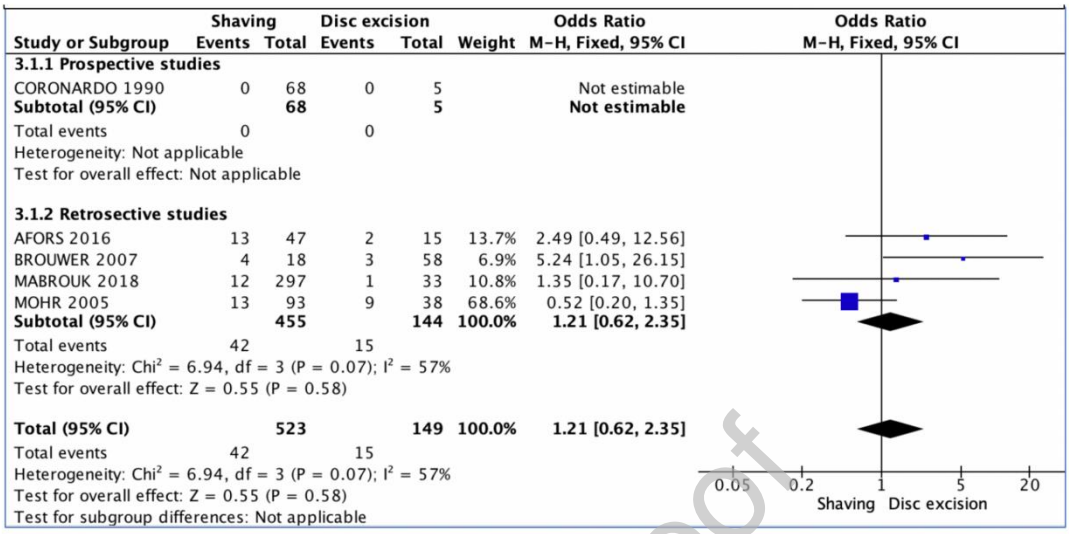

Figure 2C: Comparison of recurrences between the shaving and the disc excision groups whatever the definition of recurrence [21,25,47,53,59].

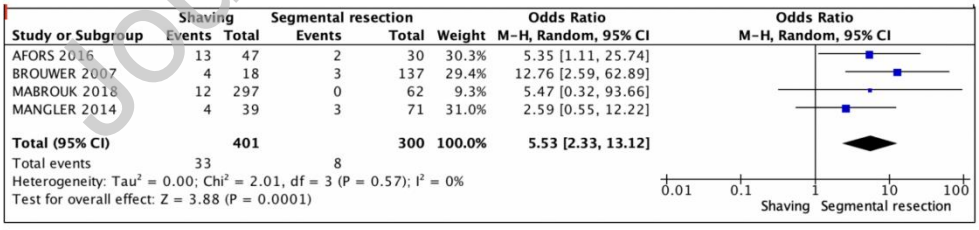

Figure 3A: Comparison of histologically proven recurrences between the shaving and segmental resection groups [21,25,30,47].

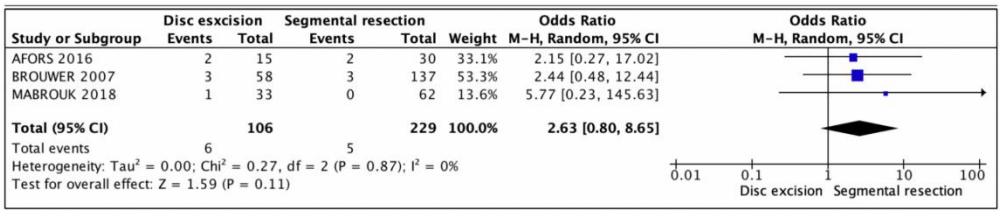

Figure 3B: Comparison of histologically proven recurrences between the disc excision and segmental resection groups [21,25,47].

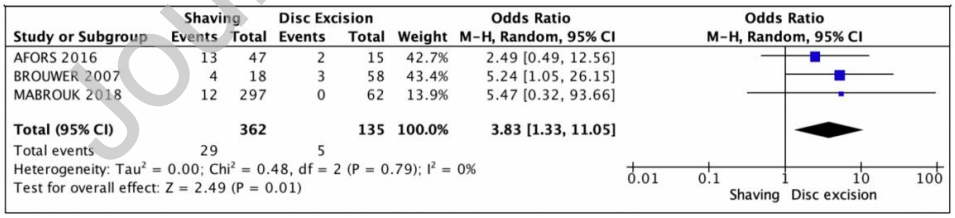

Figure 3C: Comparison of histologically proven recurrences between the shaving and the disc excision groups [21,25,47].

Table 1

Study Author (year)	n analyzed	Type	n shaving	Recurrence Shaving n (%)	N disc excision	Recurrence discoid resection n (%)	N segmental resection	Recurrence segmental resection n (%)	Type of recurrence	Histological proof	Follow-up (mean, median or at preset periods)
ROMAN et al (2018) [20]	60	RCT	27	4/9 (44)	NA	NA	33	8/15 (54)	Clinical	No	At 6, 12, 18 and 24 months
MABROUK et al (2018) [21]	392	Retrospective	297	12 (4)	33	1 (3)	62	0 (0)	Clinical and surgery	Yes	43 months (range, 12–163)
BOURDEL et al (2018) [22]	195	Retrospective	172	13 (7.6)	NA	NA	23	0 (0)	Clinical and surgery	Yes	60±42 months in the shaving group and 67±47 months in the resection group
ERDEM et al (2018) [23]	51	Retrospective	NA	NA	NA	NA	51	3 (5.9)	Clinical and surgery	Yes	86 months (range: 26-168)
ERCOLI et al (2017) [24]	33	Prospective	32	3 (10)	NA	NA	1	0 (0)	Clinical and imaging	NC	27.6 months (range: 10-48)
AFORS et al (2016) [25]	82	Retrospective	47	13 (27.6)	15	2 (13.3)	30	2 (6.6)	Clinical and surgery	Yes	24 months
MALZONI et al (2016) [26]	192	Retrospective	NA	NA	NA	NA	192	44 (22.9)	Imaging and surgery	Yes	At 6 and 12 months
ROMAN et al (2016) [11]	103	Prospective	NC	NC	5 (associated to segmental resection)	NC	103	1 (6.67)	Clinical	No	> 12 months
ROMAN et al (2016) [27]	77	Retrospective	46	5 (10.8)	NA	NA	25	1 (4)	NA	No	80+/-19 months

TOUBOUL et al (2015) [28]	**52**	**Extended analysis of RCT**	**NA**	**NA**	**NA**	**NA**	**52**	**0 (0)**	**Clinical**	**No**	**50.7 (13.8) months**
MEULEMAN et al (2014) [29]	**203**	**Prospective**	**NA**	**NA**	**NA**	**NA**	**76**	**2 (3)**	**Surgery**	**Yes**	**20 months (1-45 months)**
MANGLER et al (2014) [30]	**110**	**Prospective**	**39**	**4 (10.3)**	**NA**	**NA**	**71**	**3 (4.3)**	**Surgery**	**Yes**	**64 months**
FLEISCH et al (2014) [31]	**4**	**Retrospective**	**NA**	**NA**	**NA**	**NA**	**4**	**1 (25)**	**Imaging**	**No**	**38.5 months (31–56 months)**
SILVEIRA da Cunha Araujo et al (2014) [32]	**36**	**Prospective**	**NA**	**NA**	**NA**	**NA**	**36**	**2 (5.56)**	**Imaging**	**No**	**12 months**
NIRGIANAKIS et al (2014) [33]	**81**	**Retrospective**	**NA**	**NA**	**NA**	**NA**	**81**	**13 (16)**	**Surgery**	**Yes**	**53 (range 12–120)**
TARJANNE et al (2014) [34]	**112**	**Retrospective**	**NA**	**NA**	**NA**	**NA**	**112**	**11 (7)**	**NA**	**No**	**61 months (range 16–116 months)**
JELENC et al (2012) [35]	**56**	**Retrospective**	**NA**	**NA**	**5**	**0 (0)**	**51**	**0 (0)**	**NC**	**NC**	**6 months and 12 months**
MABROUK et al (2012) [36]	**47**	**Retrospective**	**NA**	**NA**	**NA**	**NA**	**47**	**9 (19)**	**Clinical and imaging**	**Yes**	**18 months (range: 6–35)**
KAVALLARIS et al (2011) [37]	**30**	**Prospective**	**NA**	**NA**	**NA**	**NA**	**30**	**2 (6.6)**	**Clinical and imaging**	**No**	**94 months**
RUFFO et al (2011) [38]	**31**	**Prospective**	**NC**	**NC**	**NC**	**NC**	**31**	**1 (3.2)**	**Clinical and imaging**	**No**	**27 (range, 12–56) months**
MEULEMAN et al (2011) [39]	**45**	**Retrospective**	**NA**	**NA**	**NA**	**NA**	**45 (+ CO_2)**	**2 (4.4)**	**Surgery**	**Yes**	**27 (range: 16 – 40)**
FANFANI et al (2010) [40]	**142**	**Prospective**	**NA**	**NA**	**48**	**6 (13.8)**	**88**	**10 (11.5)**	**Clinical**	**No**	**33 months (16–46 months)**

STEPNIEWSKA et al (2010) [41]	60	Prospective	NA	NA	NA	NA	60	8 (13)	Clinical and surgery	Yes	26.9 months
DOUSSET et al (2010) [42]	100	Prospective	NA	NA	NA	NA	100	2 (2)	Clinical and surgery	Yes	78 +/- 15 months
DONNEZ et al (2010) [43]	500	Prospective	500	40 (8)	NC	NC	NC	NC	Clinical	No	3.1 years (range 2–6 years)
MINELLI et al (2009) [44]	286	Prospective	NA	NA	NA	NA	286	24 (8.4)	Clinical and imaging	No	19.6 (range, 6-48) months
DE JONG et al (2009) [45]	5	Retrospective	NA	NA	NA	NA	5	0 (0)	NC	NC	18–36 months
SHAKIBA et al (2008) [46]	73	Retrospective	NA	NA	NA	NA	73	14 (31.6)	Clinical and surgery	Yes	7.65 years (7 years, 8 months)
BROUWER et al (2007) [47]	213	Retrospective	18	4 (22.2)	58	3 (5.17)	137	3 (2.19)	Surgery	Yes	68 months (7-158)
DARAI et al (2007) [48]	71	Prospective	NA	NA	NA	NA	71	0 (0)	NC	NC	24 +/- 2.2 months
GHEZZI et al (2008) [49]	33	Prospective	NA	NA	NA	NA	33	0 (0)	Clinical	No	13 months (range, 3–27 mo)
SERACCHIOLI et al (2007) [50]	22	Prospective	NA	NA	NA	NA	22	6 (28)	Clinical	No	at 6 12 24 and 36 months
LANGEBREKKE et al (2006) [51]	8	Retrospective	NA	NA	NA	NA	8	1 (20)	NA	No	12 months (range 4 - 15 months)
DARAI et al (2005) [52]	40	Prospective	NA	NA	NA	NA	40	0 (0)	NC	NC	15 months (3-22 months)
MOHR et al (2005) [53]	187	Retrospective	93	13 (6.9)	38	9 (4.8)	47	16 (22)	Clinical	No	28.2 +/- 19.6
FEDELE et al (2004) [54]	36	Retrospective	NA	NA	NA	NA	32	7 (22)	Clinical and imaging	No	37.5 +/- 20,04

KAVALLARIS et al (2003) [55]	**50**	**Prospective**	**NA**	**NA**	**NA**	**NA**	**50**	**2 (4)**	**Clinical**	**No**	**32 months**
PoSSOVER et al (2000) [56]	**34**	**Prospective**	**NA**	**NA**	**NA**	**NA**	**34**	**0 (0)**	**Clinical**	**No**	**16 months**
VERSPYCK et al (1997) [57]	**6**	**Retrospective**	**NC**	**NC**	**NC**	**NC**	**6**	**0 (0)**	**NC**	**NC**	**60 months**
BAILEY et al (1994) [58]	**130**	**Retrospective**	**NC**	**NC**	**NC**	**NC**	**130**	**0 (0)**	**NC**	**NC**	**60 months**
CORONADO et al (1990) [59]	**77**	**Prospective**	**68**	**0 (0)**	**5**	**0(0)**	**4**	**0 (0)**	**NC**	**NC**	**1 to 9 years**
Total	**4064**	**-------**	**1339**	**108 (8.1)**	**202**	**21 (10.4)**	**2304**	**198 (8.6)**	**-------**	**-------**	**-------**

Table 2
Four studies included in the meta-analysis

Study	n	Type	Shaving, n	Recurrence shaving, n (%)	Disc excision, n	Recurrence disc excision, n (%)	Segmental resection, n	Recurrence segmental resection, n (%)	Type of recurrence	Histological proof	Follow up, months
Mabrouk et al (2018) [21]	392	Retrospective	297	12 (4)	33	1 (3)	62	0 (0)	Clinical and surgery	Yes	43 (range, 12–163)
Afors et al (2016) [25]	82	Retrospective	47	13 (27.6)	15	2 (13.3)	30	2 (6.6)	Clinical and surgery	Yes	24
Mangler et al (2014) [30]	110	Prospective	39	4 (10.3)	NA	NA	71	3 (4.3)	Surgery	Yes	64
Brouwer et al (2007) [47]	213	Retrospective	18	4 (22.2)	58	3 (5.17)	137	3 (2.19)	Surgery	Yes	68 (range, 7-158)
Total	797		401	33 (8.3)	106	6 (5.7)	300	8 (2.7)	Surgery	Yes	-------

Table 3
Time to recurrence

STUDY AUTHOR (YEAR)	N	TYPE	HISTOLOGICALLY PROVEN RECURRENCE	TIME TO RECURRENCE
ROMAN ET AL (2018) [20]	n = 60	RCT	No	Recurrence of dysmenorrhea • Conservative management: 12 (5-18) months • Segmental resection: 10 (4-18) months
BOURDEL ET AL (2018) [22]	n = 195	Retrospective	Yes	Data available for the shaving group • Pain: 36 months • Salpingitis: 28 months • Rectovaginal fibrosis: 35 months • Endometrioma and ureteral lesion: 94 months • Endometrioma: 8, 36, 40 and 66 months • Rectovaginal nodule: 46 and 75 months • Vesical endometriosis: 12 and 71 months
ROMAN ET AL (2016) [11]	n = 103	Prospective	No	One patient underwent a second bowel resection 56 months after first surgery
FLEISCH ET AL (2014) [31]	n = 4	Retrospective	No	21 and 33 months
NIRGIANAKIS ET AL (2014) [33]	n = 81	Retrospective	Yes	Most surgeries for recurrence took place 17 to 90 months after segmental bowel resection
RUFFO ET AL (2011) [38]	n = 31	Prospective	No	One patient developed recurrence 2 years after surgery
MEULEMAN ET AL (2011) [39]	n = 45	Retrospective	Yes	Follow-up surgery at 14 and 32 months
DOUSSET ET AL (2010) [42]	n = 100	Prospective	Yes	Mean time to recurrence was 48 ± 21 months (range, 24-102)
SHAKIBA ET AL (2008) [46]	n = 73	Retrospective	Yes	Time to reoperation was different across groups (Ovary preservation vs Oophorectomy)
LANGEBREKKE ET AL (2006) [51]	n = 8	Retrospective	No	DIE recurrence in posterior vaginal fornix was identified in 1 patient after 6 months