Voiding Dysfunction after Colorectal Surgery for Endometriosis: A Systematic Review and Meta-analysis

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VOIDING DYSFUNCTION AFTER COLORECTAL SURGERY FOR ENDOMETRIOSIS: A SYSTEMATIC REVIEW AND META-ANALYSIS

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Funding: None

Declaration of interest: None

This manuscript has not been submitted elsewhere.

Disclosure statement: The authors declare that they have no conflicts of interest and nothing to disclose.

Word count : 2807 (<3000)

Precis

In this meta-analysis, we found that, rectal shaving causes less postoperative voiding dysfunction than discoid excision or segmental resection in colorectal surgery for endometriosis.

Abstract

Objective: Surgical management of deep endometriosis is associated with a high incidence of lower urinary tract dysfunction. The aim of the current systematic review and meta-analysis was to assess the rates of voiding dysfunction according to colorectal shaving, discoid excision and segmental resection for deep endometriosis.

Data sources: We performed a systematic review using bibliographic citations from PubMed, Clinical Trials.gov, Embase, Cochrane Library, and Web of Science databases. MeSH terms for colorectal endometriosis and voiding dysfunction were combined and restricted to the French and English languages. The final search was performed on August 28, 2019. The outcome measured was the occurrence of postoperative voiding dysfunction.

Methods of study selection: Study Quality Assessment Tools were used to assess the quality of included studies. Studies rated as good and fair were included. Two reviewers independently assessed the quality of each included study, discrepancies were discussed and, if consensus was not reached, a third reviewer was consulted.

Tabulation, Integration and results: Out of 201 relevant published reports, 51 studies were ultimately reviewed systematically and 13 were included in the meta-analysis. Rectal shaving was statistically less associated with postoperative voiding dysfunction than segmental colorectal resection (OR 0.34, 95% CI 0.18-0.63, I^2= 0%, p=0.0006) or discoid excision (OR 0.22, 95% CI 0.09-0.51, I^2 = 0%, p=0.0004). No significant difference was noted when comparing discoid excision and segmental colorectal resection (OR 0.74, 95% CI 0.32-1.69, I^2= 29%, p=0.47). Similarly, rectal shaving was associated with a lower risk of self-catheterization >1 month compared with segmental colorectal resection (OR 0.3, 95% CI 0.14-0.66, I^2= 0%, p=0.003). This outcome was no longer significant when comparing discoid excision and segmental colorectal resection (OR 0.72, 95% CI 0.4-1.31, I^2 = 63%, p=0.28).

Conclusion: Colorectal surgery for endometriosis has a significant impact on urinary function regardless of the technique. However, rectal shaving causes less postoperative voiding dysfunction than discoid excision or segmental resection.

Key words

Endometriosis; bowel involvement; meta-analysis; voiding dysfunction, gastrointestinal endometriosis.

Introduction

Deep endometriosis (DE) surgery can involve the uterosacral ligaments, rectovaginal septum, vagina, pouch of Douglas, rectum, rectosigmoïd junction, and parametrium. It can induce voiding dysfunction, especially in the context of bowel resection (segmental, discoid resection or shaving).

In this setting, the occurrence of postoperative voiding dysfunction ranges from 0-40% from one study to another (1) and is mainly due to iatrogenic injury of the pelvic anatomic nerves. Indeed, the bladder is innerved by the inferior hypogastric plexus originating for the superior hypogastric plexus (autonomous), the pelvic nerves (parasympathetic) and the hypogastric nerve (sympathetic). The ureter's sphincter is innerved by the pudendal nerve (somatic). The inferior hypogastric plexus can be injured at two different locations during surgery for colo-rectal endometriosis: during the dissection of the utero-sacral ligaments (inferior hypogastric nerve) or during the opening of the para-rectal space (hypogastric nerve). Although it may resolve spontaneously after one to three weeks, it can also persist for months, years or for a lifetime (2). Its occurrence has been reported to affect the quality of life in 20-30% of patients after DE surgery (3)(4) and there are few therapeutic options: mainly intermittent self-catheterization and neuromodulation (5).

For colorectal endometriosis, three main surgical approaches have been reported (6)(7): (i) a radical procedure allowing the complete removal of the endometriosis location by segmental resection (8)(9), and conservative surgery based on (ii) discoid resection or (iii) rectal shaving. Currently, pelvic surgeons agree that a nerve-sparing (NS) technique reduces the risk of persistent urinary retention due to iatrogenic injury of the pelvic autonomic nerves compared with the conventional (non-NS) technique (5). However, despite the NS technique, colorectal endometriosis surgery is still associated with a high rate of voiding dysfunction.

Therefore, the purpose of this systematic review and meta-analysis was to assess the occurrence of voiding dysfunction after surgery for DE with colorectal involvement

according to the surgical approach, i.e. rectal shaving, discoid excision or colorectal segmental resection. The impact of NS techniques were also assessed.

Material and methods

We performed a systematic review and meta-analysis following the recommendations from the Cochrane Collaboration (10) and in accordance with the PRISMA (Preferred Reported Items for Systematic Reviews and Meta-analyses) guidelines (11) . The protocol was approved beforehand (International Prospective Register of Systematic Reviews PROSPERO ID: 3528920).

Electronic search

The following databases were searched: PubMed, Clinical Trials.gov, Embase, Cochrane Library, and Web of Science databases. The major MeSH search terms used were (“endometriosis” or “deep infiltrating endometriosis” or “deep endometriosis” or “deep pelvic endometriosis” or “colorectal endometriosis”) and (“surgery for endometriosis” or “conservative management” or “radical management” or “colorectal resection” or “rectal shaving” or “full thickness resection” or “discoid excision”) AND “treatment”, “outcomes”, “short- and long-term results”, and “voiding dysfunction”. Studies in French or English published before April 1, 2019 were included. Abstracts were excluded if the authors did not provide adequate information when contacted. The final search of each database was performed on August 28, 2019.

Two reviewers (EV and SB) independently assessed the quality of each included study. In case of discrepancies a third reviewer was consulted (ED, HR). The percentages, odd ratios (ORs) and confidence intervals (CIs) of each study were obtained or calculated from existing data (12)(13).

Outcome Measures

The primary outcome was the occurrence of postoperative voiding dysfunction. As the voiding dysfunction rate varies according to the definition, we decided to first analyze the risk of voiding dysfunction regardless its definition and then to take a closer look at the risk of

self-catheterization lasting more than 1 month. Moreover, we analyzed the rate of voiding dysfunction according to the surgical management of the colorectum as this outcome varies greatly depending on conservative management or radical colorectal resection.

Risk of Bias

The risk of bias was assessed using clarity of the statements, the eligibility criteria, size of the population, ethical considerations, representativeness, response rate, data collection, objective, definition of the objective, and consistency between research question and data reported.

The quality of the included studies was evaluated with the Study Quality Assessment Tools(14). Studies were considered as "satisfactory" when at least 70% of 12-14 assessment criteria were met, "fair" when 50% were respected, and “poor” when fewer than 50% of the criteria were fulfilled.

Statistical Analysis

ORs and their CIs were derived from each study as the primary endpoint. Pooled response means, defined as the estimated overall mean difference (with 95% CI), were described using forest plots. For pooled response means, a p-value <0.05 was considered significant. If no observed events was reported by the study for a given outcome, a 0.001 integer continuity correction was determined.

Statistical heterogeneity among the studies was assessed using Cochran’s Q test and the I^2 index. A I^2 <50% or p-values of <0.1 signified that there was no significant heterogeneity. If no heterogeneity was observed, the fixed-effects model was adopted. In case of heterogeneity, the random-effects model was used for pooled estimates. If I^2 > 50% (high heterogeneity), subgroup analyses were carried out when possible. If sufficient data were available, a predefined subgroup analyses for the primary outcome was undertaken.

All statistical analysis was performed on Review Manager (RevMan, IOS, version (5.3), Copenhagen: The Nordic Cochrane Centre, The Cochrane Collaboration, 2011). For the comparison of the nerve sparing techniques, the number of patients and percentages are presented. Comparison was performed using Fisher's exact test (qualitative variable) and $p < 0.05$ was considered statistically significant. For this analysis, statistical analysis was performed using R 3.6.0 software (http://lib.stat.cmu.edu/R/CRAN/).

Results

Study selection

A total of 201 studies fulfilling our electronic search criteria were identified. After screening by title and abstract and removing duplicate papers, 148 full text articles were assessed. Of these, one systemic review was excluded. From the 147 remaining papers, 79 were excluded and among the 68 remaining papers, 17 were not eligible for the review (Figure 1). Among the 51 papers included in the review, 38 were not included in the meta-analysis because these studies did not compare different surgical techniques. The final result for the descriptive analysis included a total of 51 studies, 13 articles for the global meta-analysis (regardless of the definition) and five articles for the meta-analysis of self-catheterization > 1 month (Table 1).

Study characteristics – Descriptive analysis

Twenty-four prospective studies were identified; two randomized controlled trials, one case control study and 24 retrospective studies with a total 5962 patients undergoing surgery for DE involving the colorectum. Among them, 1734 (29.1%) underwent rectal shaving, 573 (9.6%) discoid excision, and 3655 (61.3%) segmental resection. Voiding dysfunction was observed in 452 (7.6%) patients with 41 (2.4%), 43 (7.5%) and 368 (10.1%) in the rectal shaving, the discoid excision and the segmental resection groups, respectively (Table 1).

Eight studies (15)(16)(17)(18)(19)(20)(21)(22) included 1202 patients and defined voiding dysfunction as self-catheterization lasting at least one month after surgery. One (1.2%) patient was included in the shaving group, 0 in the discoid excision group, and 143 (13.6%) in the segmental resection group (Supplementary Table 1).

Thirteen studies (23)(24)(25)(15)(26)(16)(27)(28)(19)(29)(30)(31)(32) including 1694 patients (643 rectal shavings, 357 discoid excisions and 728 segmental resections) reported at least two of the three types of colorectal surgery and were thus included in the meta-analysis (Supplementary Table 2). Five studies (23)(15)(16)(28)(19) among them defined voiding dysfunction as self-catheterization > 21 days (Supplementary Table 3).

Postoperative voiding dysfunction regardless of the definition

When analyzing the occurrence of postoperative voiding dysfunction regardless of the definition, rectal shaving was statistically less associated with postoperative voiding dysfunction than segmental colorectal resection (OR 0.34, 95% CI 0.18-0.63, I^2= 0%, p=0.0006) (Figure 2). This difference was no longer significant when comparing discoid excision and segmental colorectal resection (OR 0.74, 95% CI 0.32-1.69, I^2= 29%, p=0.47) (Figure 2). Rectal shaving resulted in less voiding dysfunction than discoid excision (OR 0.22, 95% CI 0.09-0.51, I^2 = 0%, p=0.0004) (Figure 2).

Postoperative voiding dysfunction defined as self-catheterization > 21 days

Rectal shaving was associated with a lower risk of prolonged self-catheterization (i.e. lasting for more than 21 days) compared with segmental colorectal resection (OR 0.3, 95% CI 0.14-0.66, I^2= 0%, p=0.003) (Figure 3). This outcome was no longer significant when comparing discoid excision and segmental colorectal resection (OR 0.72, 95% CI 0.4-1.31, I^2 = 63%, p=0.28) (Figure 3). As no studies included both shaving and discoid excision and defined voiding dysfunction as self-catheterization time >21 days, no comparison was evaluable for these techniques.

Postoperative voiding dysfunction according to conservative versus radical surgery

A comparison between conservative surgery (i.e. rectal shaving and discoid excision) and radical surgery (i.e. segmental colorectal resection) demonstrated that conservative strategy had a lower risk of postoperative voiding dysfunction (Risk Difference -0.04, 95% CI -0.07; -0.02, I^2= 23%, p=0.001). (Figure 4)

Nerve-sparing technique

Twenty-six studies including 3120 patients (1402 conservative and 1718 radical surgeries) clearly reported an NS technique while 25 studies including 2843 patients (1001 conservative and 1842 radical surgeries) did not specifically mention an NS technique (Table 2).

Sixty-two (4.4%) and 18 (1.8%) patients, respectively, had postoperative voiding dysfunction after conservative surgery with an NS and with a non-NS technique (p=0.03). For radical surgery, 222 (12.9%) patients and 208 (11.3%) patients had postoperative voiding dysfunction after an NS and a non-NS technique, respectively (p=0.15).

Duration of postoperative self-catheterization

The mean time of self-catheterization could not be estimated for each group as not all the studies reported the exact catheterization time. The median time of self-catheterization after segmental colorectal resection according to eight studies (33)(34)(35)(36)(37)(21)(38)(39) was 31.5 ± 6.1 days.

Discussion

We report a systematic review and meta-analysis focusing on the occurrence of voiding dysfunction after surgery for deep endometriosis (DE) with colorectal involvement comparing three surgical approaches. The estimated overall rate of voiding dysfunction was 7.6% with a prevalence of 2.4%, 7.5% and 10.1% after rectal shaving, discoid excision and segmental colorectal resection, respectively. Self-catheterization > 1 month mainly occurred after segmental colorectal resection (13.6%). Evaluating urinary function preoperatively is therefore of paramount importance in digestive endometriosis.

The assessment of voiding dysfunction before and after colorectal resection for endometriosis surgery is a major issue in daily practice. However, the current evidence-based literature is marked by a major weakness due to the lack of consensus in the definition used. For instance, voiding dysfunction may correspond to a variety of clinical conditions such as urinary retention, bladder atonia, incomplete urinary bladder emptying requiring intermittent catheterization after postoperative day 7 or with a post-voiding bladder volume of more than 100ml (15)(2)(40). Likewise, some authors define the duration of voiding dysfunction as transient when self-catheterization lasts under 30 days (2) or up to 6 weeks, while others extend this definition to 6 months (33)(41). All these definitions which should be reporting the same outcome render interpretation and comparison of clinical data somewhat difficult and heterogeneous. Moreover, few reports distinguish preoperative from *de novo* voiding dysfunction which can occur in 7.8% of their patients with colorectal endometriosis.To overcome such a limitation, we decided to present the results considering (i) the voiding dysfunction whatever the definition used (tables 2,3,4), (ii) the voiding dysfunction based on the definition of self-catheterization > 1 month, and also (iii) the use of an NS technique.

Regardless of the definition, rectal shaving appears to result in a lower risk of voiding dysfunction than discoid excision (OR 0.22, 95% CI 0.09-0.51, I^2 = 0%, p=0.0004) and segmental colorectal resection (OR 0.34, 95% CI 0.18-0.63, I^2= 0%, p= 0.0006).

Interestingly, this difference was no longer significant when comparing discoid excision and segmental resection, although considerable heterogeneity was observed between the studies (OR 0.74, 95% CI 0.32-1.69, I^2= 29%, p=0.47). Self-catheterization >1 month occurred in 13.6% of the patients and almost only after segmental colorectal resection. Considering this definition, we observed that the risk was significantly lower after rectal shaving compared to segmental resection (OR 0.3, 95% CI 0.14-0.66, I^2= 0%, p=0.003). The difference was not significant when discoid resection was compared to segmental resection although a high heterogeneity among studies was observed (OR 0.72, 95% CI 0.4-1.31, I^2 = 63%, P=0.28). The most frequent type of surgery was segmental resection (61.3% of patients) since this technique was most historical surgical technics and can be proposed no matter the lesion size, the circumference involved and the presence of multifocal lesions.

Colorectal endometriosis is a source of urinary dysfunction in itself due to infiltration of the hypogastric plexus. Urinary function should thus be systematically evaluated preoperatively to distinguish preexisting from *de novo* voiding dysfunction subsequent to surgery (17)(42)(35). Considering the high heterogeneity of the rates of voiding dysfunction reported in the various studies (ranging from 0 to 40%) (Table 1), future studies should include evaluation of preoperative urinary symptoms by urodynamic testing and electrophysiology exam to determine whether intraoperative nerve damage of the pelvic plexus is the cause. In this setting, Ballester et al. conducted a comparative study between a group of patients with DE and a control group (35) based on a validated questionnaire (International Prostate Symptom Score). They showed a significantly higher incidence of preoperative voiding dysfunction in the DE group.

Several authors hypothesized (43) the need of systematic preoperative urodynamic investigation in the context of DE as the rate of preoperative voiding dysfunction can be more than 25%. However, identification of patients who might benefit from preoperative urodynamic testing remain debatable. The majority of published studies in the current

systematic review did not include preoperative assessment of lower urinary tract dysfunction therefore we were unable to refine the assessment of voiding dysfunction rates. Moreover, Bonneau et al reported that half of their patients with preoperative voiding dysfunction had normal urodynamic test values (2).

NS surgery for DE with colorectal involvement has been shown to decrease the incidence of urinary side effects (44)(45). De Resende Junior et al. recently conducted a meta-analysis (41) including four studies that strictly compared NS and non-NS techniques (33)(46)(47)(48). The authors found a common OR of 0.19 [95%CI: 0.03–1.17; (I 21⁄450.20%; P1⁄40.09)] for the need of self-catheterization at discharge in the NS group compared to the conventional non-NS technique.

In the current review, 26 studies clearly mentioned an NS technique compared to 25 studies where it was unclear whether this technique was used. In contrast to De Resende Junior et al.'s review, we found no difference in postoperative voiding dysfunction according to the use of an NS technique. However, the interpretation of these results is compromised because: i) the studies did not aim to compare the techniques; ii) a study which does not mention an NS technique does not necessarily exclude NS surgery; iii) surgery with NS are usually more invasive procedures with a high extent of resection; iv) there is a lack of objective and uniform criteria to define postoperative voiding dysfunction and; v) surgical skills may have improved over time.

Resende et al (41) could not detect significant benefits of NS compared with conventional non-NS surgery in terms of relative risk (RR) of urinary retention at discharge. Nevertheless, they found a statistically significant advantage of NS with respect to RR of persistent urinary retention by the need for self-catheterization for 3 months or more even if no clear criteria (e.g., minimum residual volume) was presented to define the need for self-catheterization after surgery. Although several NS techniques have been reported for delayed functional complications (e.g. urinary retention, constipation, and sexual dysfunction) due to autosomal nerve damage of the bowel, they have not been 100% successful (45). The surgeon should consider both of these complications when choosing

the most appropriate surgical procedure and provide information on functional outcomes to patients treated for colorectal endometriosis (29). Indeed, identifying and sparing the pelvic nerves should be standard practice in 2020 as it is accepted that the more nerves are preserved, the fewer sexual, rectal and bladder disorders you cause (49).

The strengths of this review include the use of an exhaustive search strategy applied to five different databases. In addition, it seems to be the first to report the risk of postoperative voiding dysfunction comparing three surgical approaches for DE with colorectal involvement. Methodological limitations such as differences between criteria used for defining the voiding dysfunction may limit the quality of the available evidence. Furthermore, the absence of taking preoperative voiding dysfunction into account should be mentioned as a limitation. However, most of the articles included in this review lacked data on preoperative voiding dysfunction and we were thus unable to know if the postoperative dysfunction was due to operative damage. In addition, the heterogeneity between some studies may limit the accuracy and the validity of the results. Finally, for the sake of completeness, some comparisons, in particular that of NS procedures, may be rough estimates rather than accurate comparisons because of the lack of studies comparing NS and classical surgery in the context of colorectal resection for DE.

Conclusion

Bowel surgery for DE has a significant impact on urinary function regardless of the technique and patients should be clearly informed pre-operatively. Rectal shaving causes less postoperative voiding dysfunction than discoid excision or segmental resection. It is therefore essential to detect preoperative urinary symptoms and to define a high-risk group for which urodynamic testing could be helpful. Moreover, a consensual definition of postoperative voiding dysfunction as well as the indication for self-catheterization should be used to develop a predictive tool which would be useful when counseling patients and to determine clinical trial eligibility.

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Tables

Table 1: Studies reporting voiding dysfunction rate after colorectal surgery for deep endometriosis

Table 2: Nerve sparing versus non-nerve sparing technique in colorectal surgery for deep endometriosis

Figure legends

Figure 1: Flow chart of the eligibility of studies for inclusion in the meta-analysis

Figure 2. Meta-analysis of voiding dysfunction, no matter the definition after colorectal surgery for deep endometriosis.

1.1. Shaving versus segmental resection no matter the definition of voiding dysfunction

1.2. Disc excision versus segmental resection no matter the definition of voiding dysfunction

1.3. Shaving versus disc excision no matter the definition of voiding dysfunction

Figure 3. Meta-analysis of voiding dysfunction defined by self-catheterization at 3 weeks after colorectal surgery for deep endometriosis.

2.1. Shaving versus segmental resection

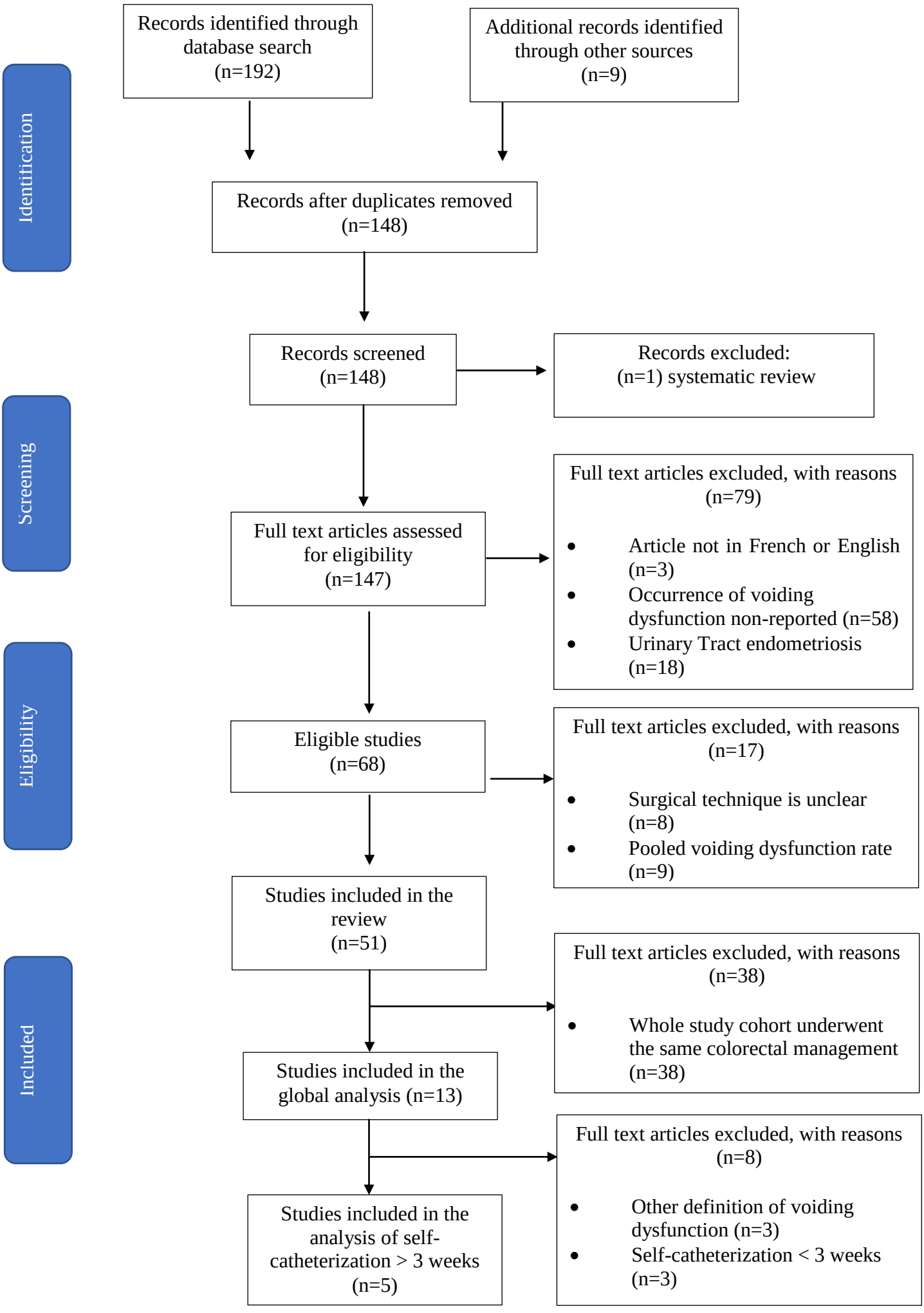
2.2. Disc excision versus segmental resection

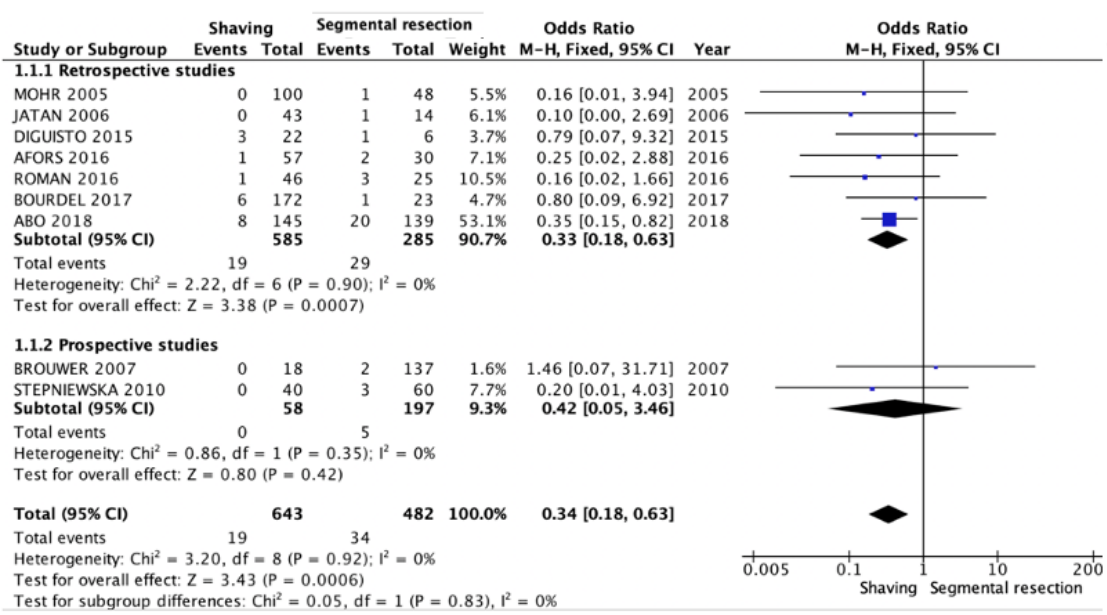
Figure 4. Meta-analysis of voiding dysfunction after radical versus conservative colorectal surgery for deep endometriosis

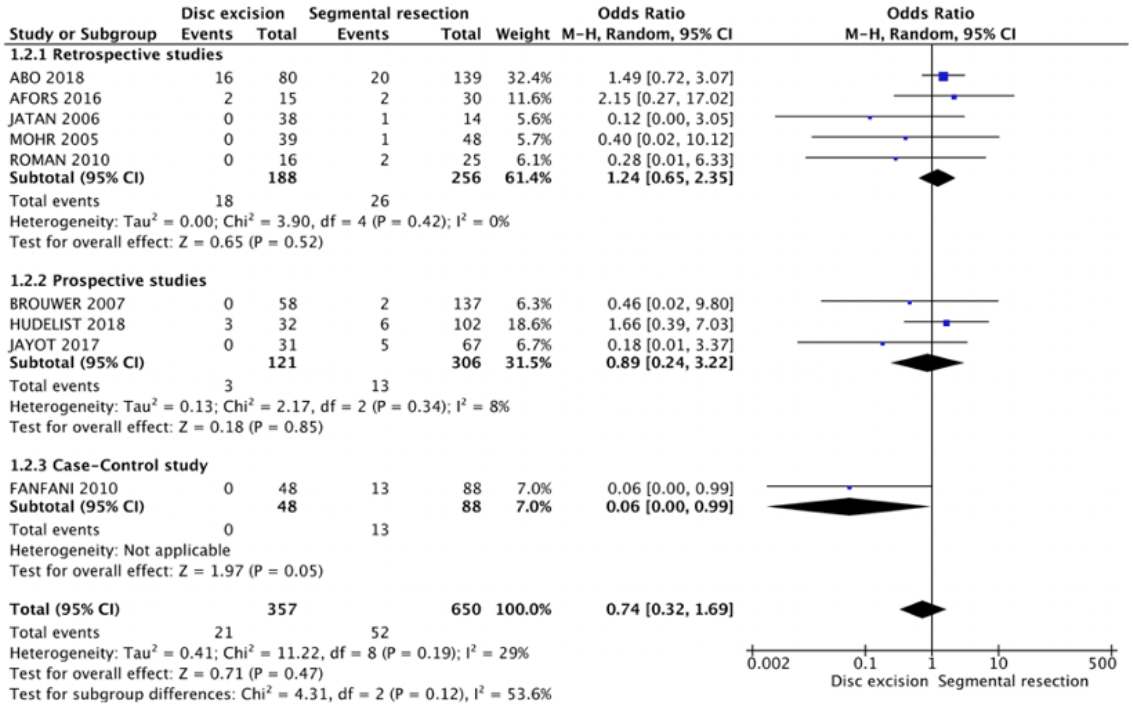
3.1. Voiding dysfunction, no matter the definition

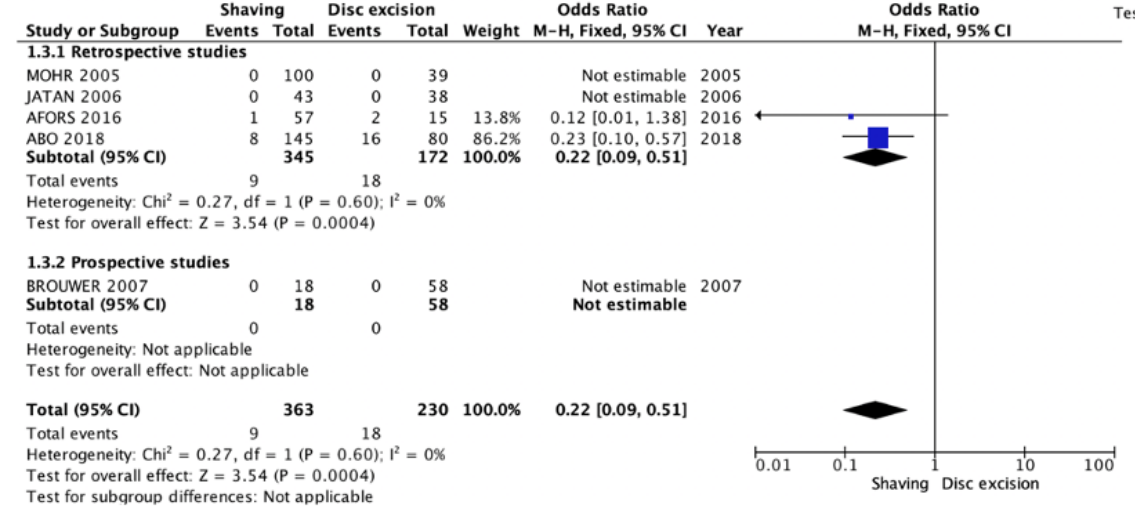
4.1. Voiding dysfunction, defined by self-catheterization at 3 weeks

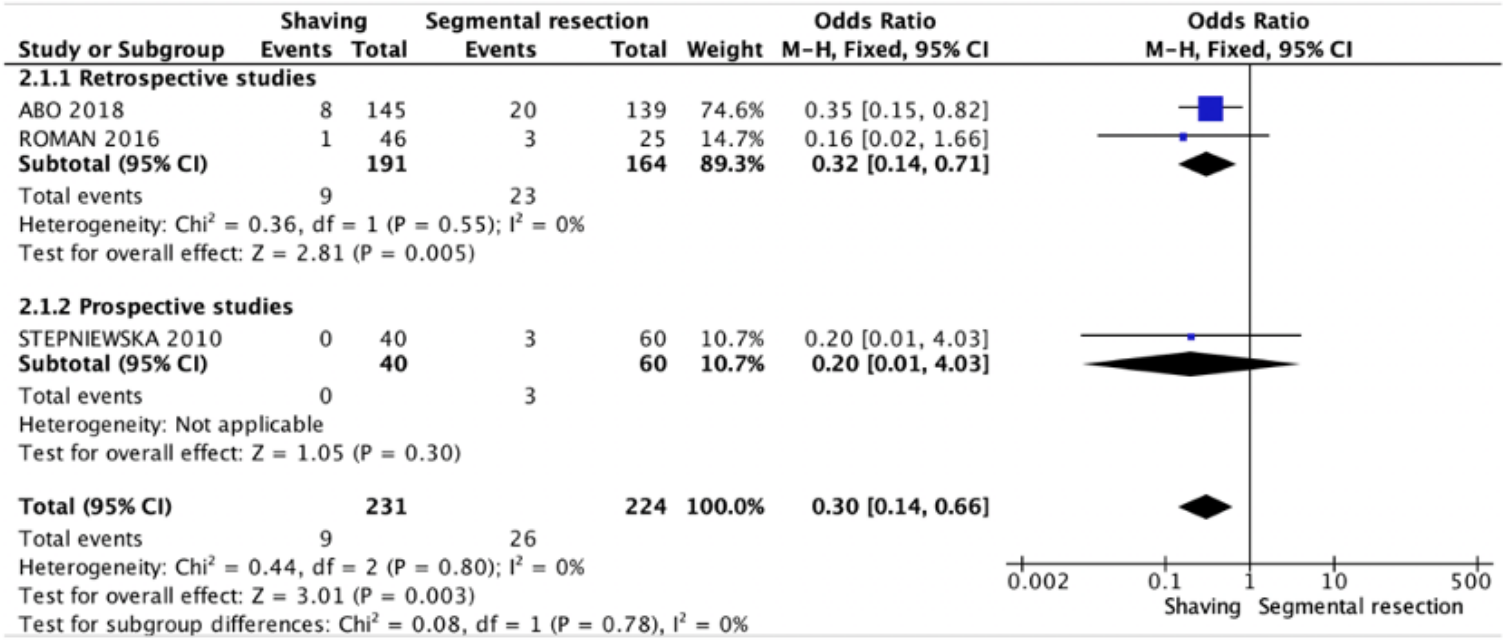
Figure 1: Eligibility of studies for inclusion in the meta-analysis

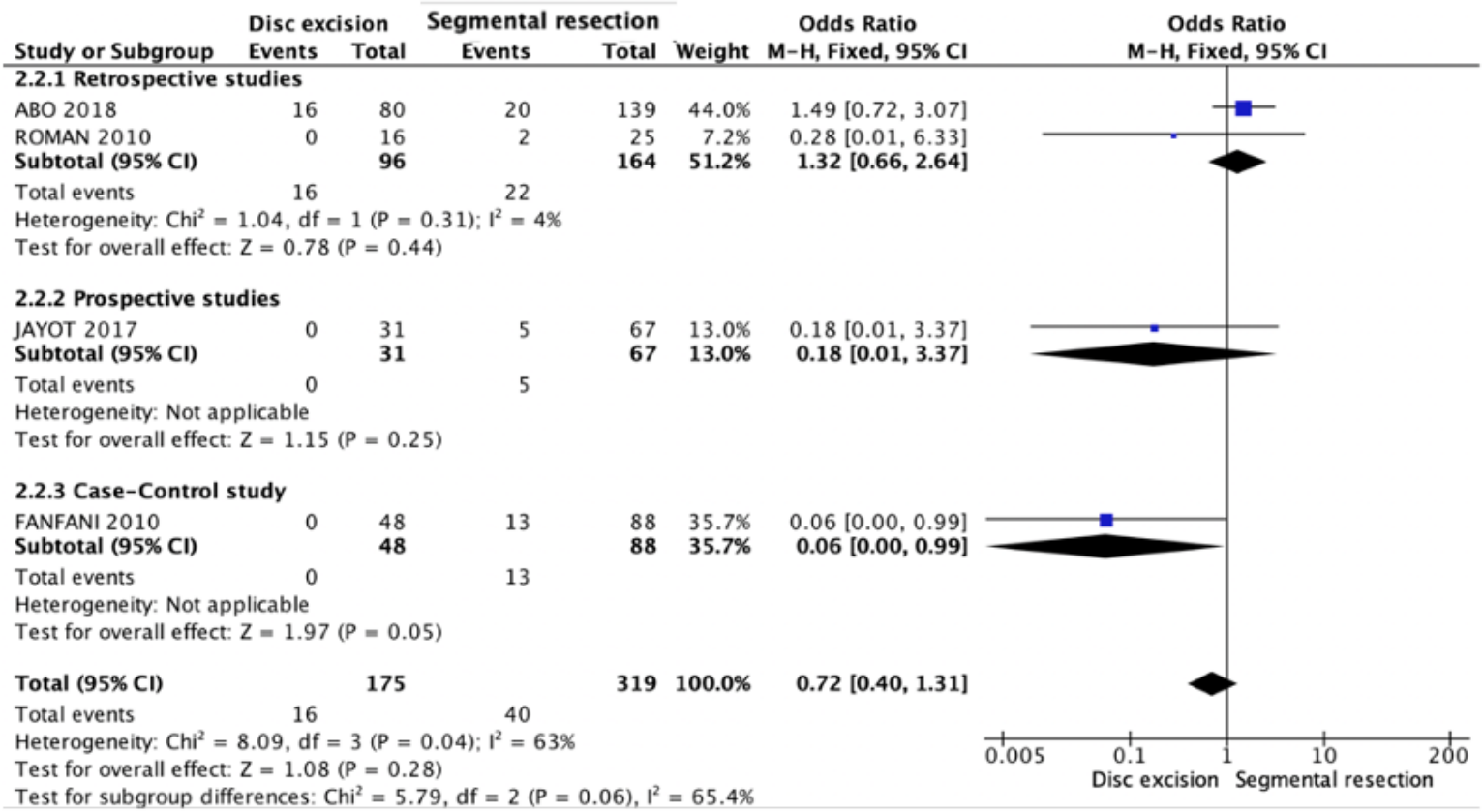


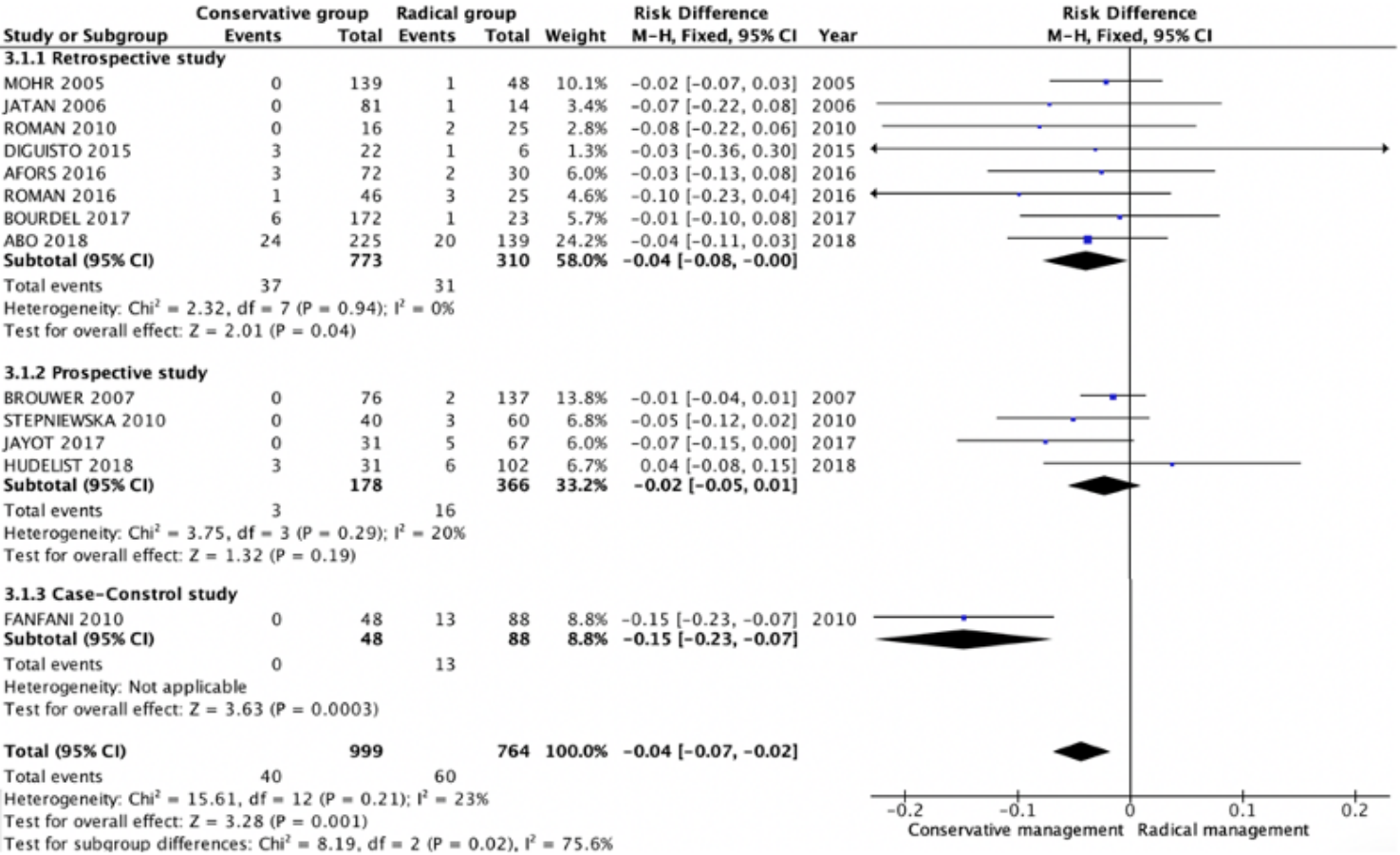

Shaving
Segmental resection
Odds Ratio
Odds Ratio
Study or Subgroup Events Total Events Total Weight M-H, Fixed, 95% CI Year
M-H, Fixed, 95% CI
1.1.1 Retrospective studies
MOHR 2005 0 100 1 48 5.5% 0.16 [0.01, 3.94] 2005
JATAN 2006 0 43 1 14 6.1% 0.10 [0.00, 2.69] 2006
DIGUISTO 2015 3 22 1 6 3.7% 0.79 [0.07, 9.32] 2015
AFORS 2016 1 57 2 30 7.1% 0.25 [0.02, 2.88] 2016
ROMAN 2016 1 46 3 25 10.5% 0.16 [0.02, 1.66] 2016
BOURDEL 2017 6 172 1 23 4.7% 0.80 [0.09, 6.92] 2017
ABO 2018 8 145 20 139 53.1% 0.35 [0.15, 0.82] 2018
Subtotal (95% CI) 585 285 90.7% 0.33 [0.18, 0.63]
Total events 19 29
Heterogeneity: Chi² = 2.22, df = 6 (P = 0.90); I² = 0%
Test for overall effect: Z = 3.38 (P = 0.0007)
1.1.2 Prospective studies
BROUWER 2007 0 18 2 137 1.6% 1.46 [0.07, 31.71] 2007
STEPNIEWSKA 2010 0 40 3 60 7.7% 0.20 [0.01, 4.03] 2010
Subtotal (95% CI) 58 197 9.3% 0.42 [0.05, 3.46]
Total events 0 5
Heterogeneity: Chi² = 0.86, df = 1 (P = 0.35); I² = 0%
Test for overall effect: Z = 0.80 (P = 0.42)
Total (95% CI) 643 482 100.0% 0.34 [0.18, 0.63]
Total events 19 34
Heterogeneity: Chi² = 3.20, df = 8 (P = 0.92); I² = 0%
Test for overall effect: Z = 3.43 (P = 0.0006)
Test for subgroup differences: Chi² = 0.05, df = 1 (P = 0.83), I² = 0%
0.005 0.1 1 10 200
Shaving Segmental resection

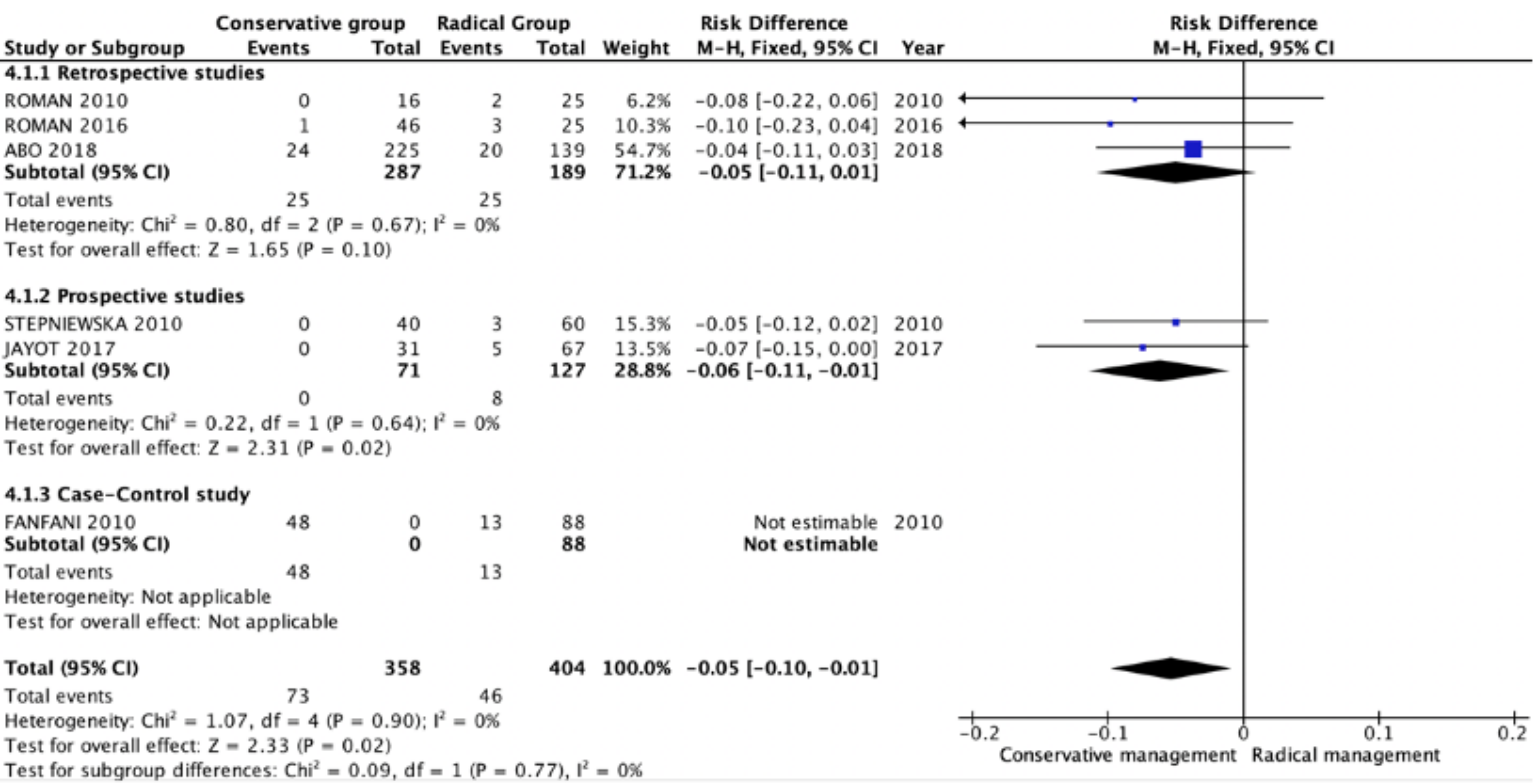

Disc excision
Segmental resection
Odds Ratio
Odds Ratio
Study or Subgroup Events Total Events Total Weight M-H, Random, 95% CI
M-H, Random, 95% CI
1.2.1 Retrospective studies
ABO 2018 16 80 20 139 32.4% 1.49 [0.72, 3.07]
AFORS 2016 2 15 2 30 11.6% 2.15 [0.27, 17.02]
JATAN 2006 0 38 1 14 5.6% 0.12 [0.00, 3.05]
MOHR 2005 0 39 1 48 5.7% 0.40 [0.02, 10.12]
ROMAN 2010 0 16 2 25 6.1% 0.28 [0.01, 6.33]
Subtotal (95% CI) 188 256 61.4% 1.24 [0.65, 2.35]
Total events 18 26
Heterogeneity: Tau² = 0.00; Chi² = 3.90, df = 4 (P = 0.42); I² = 0%
Test for overall effect: Z = 0.65 (P = 0.52)
1.2.2 Prospective studies
BROUWER 2007 0 58 2 137 6.3% 0.46 [0.02, 9.80]
HUDELIST 2018 3 32 6 102 18.6% 1.66 [0.39, 7.03]
JAYOT 2017 0 31 5 67 6.7% 0.18 [0.01, 3.37]
Subtotal (95% CI) 121 306 31.5% 0.89 [0.24, 3.22]
Total events 3 13
Heterogeneity: Tau² = 0.13; Chi² = 2.17, df = 2 (P = 0.34); I² = 8%
Test for overall effect: Z = 0.18 (P = 0.85)
1.2.3 Case-Control study
FANFANI 2010 0 48 13 88 7.0% 0.06 [0.00, 0.99]
Subtotal (95% CI) 48 88 7.0% 0.06 [0.00, 0.99]
Total events 0 13
Heterogeneity: Not applicable
Test for overall effect: Z = 1.97 (P = 0.05)
Total (95% CI) 357 650 100.0% 0.74 [0.32, 1.69]
Total events 21 52
Heterogeneity: Tau² = 0.41; Chi² = 11.22, df = 8 (P = 0.19); I² = 29%
Test for overall effect: Z = 0.71 (P = 0.47)
Test for subgroup differences: Chi² = 4.31, df = 2 (P = 0.12), I² = 53.6%
0.002 0.1 1 10 500
Disc excision Segmental resection


Shaving
Disc excision
Odds Ratio
Odds Ratio
Study or Subgroup Events Total Events Total Weight M-H, Fixed, 95% CI Year
M-H, Fixed, 95% CI
1.3.1 Retrospective studies
MOHR 2005 0 100 0 39 Not estimable 2005
JATAN 2006 0 43 0 38 Not estimable 2006
AFORS 2016 1 57 2 15 13.8% 0.12 [0.01, 1.38] 2016
ABO 2018 8 145 16 80 86.2% 0.23 [0.10, 0.57] 2018
Subtotal (95% CI) 345 172 100.0% 0.22 [0.09, 0.51]
Total events 9 18
Heterogeneity: Chi² = 0.27, df = 1 (P = 0.60); I² = 0%
Test for overall effect: Z = 3.54 (P = 0.0004)
1.3.2 Prospective studies
BROUWER 2007 0 18 0 58 Not estimable 2007
Subtotal (95% CI) 18 58 Not estimable
Total events 0 0
Heterogeneity: Not applicable
Test for overall effect: Not applicable
Total (95% CI) 363 230 100.0% 0.22 [0.09, 0.51]
Total events 9 18
Heterogeneity: Chi² = 0.27, df = 1 (P = 0.60); I² = 0%
Test for overall effect: Z = 3.54 (P = 0.0004)
Test for subgroup differences: Not applicable
0.01 0.1 1 10 100
Shaving Disc excision


Shaving
Segmental resection
Odds Ratio
Odds Ratio
Study or Subgroup Events Total Events Total Weight M-H, Fixed, 95% CI
M-H, Fixed, 95% CI
2.1.1 Retrospective studies
ABO 2018 8 145 20 139 74.6% 0.35 [0.15, 0.82]
ROMAN 2016 1 46 3 25 14.7% 0.16 [0.02, 1.66]
Subtotal (95% CI) 191 164 89.3% 0.32 [0.14, 0.71]
Total events 9 23
Heterogeneity: Chi² = 0.36, df = 1 (P = 0.55); I² = 0%
Test for overall effect: Z = 2.81 (P = 0.005)
2.1.2 Prospective studies
STEPNIEWSKA 2010 0 40 3 60 10.7% 0.20 [0.01, 4.03]
Subtotal (95% CI) 40 60 10.7% 0.20 [0.01, 4.03]
Total events 0 3
Heterogeneity: Not applicable
Test for overall effect: Z = 1.05 (P = 0.30)
Total (95% CI) 231 224 100.0% 0.30 [0.14, 0.66]
Total events 9 26
Heterogeneity: Chi² = 0.44, df = 2 (P = 0.80); I² = 0%
Test for overall effect: Z = 3.01 (P = 0.003)
Test for subgroup differences: Chi² = 0.08, df = 1 (P = 0.78), I² = 0%
0.002
0.1
1
10
500
Shaving
Segmental resection


Disc excision
Segmental resection
Odds Ratio
Odds Ratio
Study or Subgroup Events Total Events Total Weight M-H, Fixed, 95% CI
M-H, Fixed, 95% CI
2.2.1 Retrospective studies
ABO 2018 16 80 20 139 44.0% 1.49 [0.72, 3.07]
ROMAN 2010 0 16 2 25 7.2% 0.28 [0.01, 6.33]
Subtotal (95% CI) 96 164 51.2% 1.32 [0.66, 2.64]
Total events 16 22
Heterogeneity: Chi² = 1.04, df = 1 (P = 0.31); I² = 4%
Test for overall effect: Z = 0.78 (P = 0.44)
2.2.2 Prospective studies
JAYOT 2017 0 31 5 67 13.0% 0.18 [0.01, 3.37]
Subtotal (95% CI) 31 67 13.0% 0.18 [0.01, 3.37]
Total events 0 5
Heterogeneity: Not applicable
Test for overall effect: Z = 1.15 (P = 0.25)
2.2.3 Case-Control study
FANFANI 2010 0 48 13 88 35.7% 0.06 [0.00, 0.99]
Subtotal (95% CI) 48 88 35.7% 0.06 [0.00, 0.99]
Total events 0 13
Heterogeneity: Not applicable
Test for overall effect: Z = 1.97 (P = 0.05)
Total (95% CI) 175 319 100.0% 0.72 [0.40, 1.31]
Total events 16 40
Heterogeneity: Chi² = 8.09, df = 3 (P = 0.04); I² = 63%
Test for overall effect: Z = 1.08 (P = 0.28)
Test for subgroup differences: Chi² = 5.79, df = 2 (P = 0.06), I² = 65.4%
0.005
0.1
1
10
200
Disc excision
Segmental resection


Conservative group
Radical group
Risk Difference
Risk Difference
Study or Subgroup Events Total Events Total Weight M-H, Fixed, 95% CI Year
M-H, Fixed, 95% CI
3.1.1 Retrospective study
MOHR 2005 0 139 1 48 10.1% -0.02 [-0.07, 0.03] 2005
JATAN 2006 0 81 1 14 3.4% -0.07 [-0.22, 0.08] 2006
ROMAN 2010 0 16 2 25 2.8% -0.08 [-0.22, 0.06] 2010
DIGUISTO 2015 3 22 1 6 1.3% -0.03 [-0.36, 0.30] 2015
AFORS 2016 3 72 2 30 6.0% -0.03 [-0.13, 0.08] 2016
ROMAN 2016 1 46 3 25 4.6% -0.10 [-0.23, 0.04] 2016
BOURDEL 2017 6 172 1 23 5.7% -0.01 [-0.10, 0.08] 2017
ABO 2018 24 225 20 139 24.2% -0.04 [-0.11, 0.03] 2018
Subtotal (95% CI) 773 310 58.0% -0.04 [-0.08, -0.00]
Total events 37 31
Heterogeneity: Chi² = 2.32, df = 7 (P = 0.94); I² = 0%
Test for overall effect: Z = 2.01 (P = 0.04)
3.1.2 Prospective study
BROUWER 2007 0 76 2 137 13.8% -0.01 [-0.04, 0.01] 2007
STEPNIEWSKA 2010 0 40 3 60 6.8% -0.05 [-0.12, 0.02] 2010
JAYOT 2017 0 31 5 67 6.0% -0.07 [-0.15, 0.00] 2017
HUDELIST 2018 3 31 6 102 6.7% 0.04 [-0.08, 0.15] 2018
Subtotal (95% CI) 178 366 33.2% -0.02 [-0.05, 0.01]
Total events 3 16
Heterogeneity: Chi² = 3.75, df = 3 (P = 0.29); I² = 20%
Test for overall effect: Z = 1.32 (P = 0.19)
3.1.3 Case-Control study
FANFANI 2010 0 48 13 88 8.8% -0.15 [-0.23, -0.07] 2010
Subtotal (95% CI) 48 88 8.8% -0.15 [-0.23, -0.07]
Total events 0 13
Heterogeneity: Not applicable
Test for overall effect: Z = 3.63 (P = 0.0003)
Total (95% CI) 999 764 100.0% -0.04 [-0.07, -0.02]
Total events 40 60
Heterogeneity: Chi² = 15.61, df = 12 (P = 0.21); I² = 23%
Test for overall effect: Z = 3.28 (P = 0.001)
Test for subgroup differences: Chi² = 8.19, df = 2 (P = 0.02), I² = 75.6%
-0.2
-0.1
0
0.1
0.2
Conservative management
Radical management


Conservative group
Radical Group
Risk Difference
Risk Difference
Study or Subgroup Events Total Events Total Weight M-H, Fixed, 95% CI Year
M-H, Fixed, 95% CI
4.1.1 Retrospective studies
ROMAN 2010 0 16 2 25 6.2% -0.08 [-0.22, 0.06] 2010
ROMAN 2016 1 46 3 25 10.3% -0.10 [-0.23, 0.04] 2016
ABO 2018 24 225 20 139 54.7% -0.04 [-0.11, 0.03] 2018
Subtotal (95% CI) 287 189 71.2% -0.05 [-0.11, 0.01]
Total events 25 25
Heterogeneity: Chi² = 0.80, df = 2 (P = 0.67); I² = 0%
Test for overall effect: Z = 1.65 (P = 0.10)
4.1.2 Prospective studies
STEPNIEWSKA 2010 0 40 3 60 15.3% -0.05 [-0.12, 0.02] 2010
JAYOT 2017 0 31 5 67 13.5% -0.07 [-0.15, 0.00] 2017
Subtotal (95% CI) 71 127 28.8% -0.06 [-0.11, -0.01]
Total events 0 8
Heterogeneity: Chi² = 0.22, df = 1 (P = 0.64); I² = 0%
Test for overall effect: Z = 2.31 (P = 0.02)
4.1.3 Case-Control study
FANFANI 2010 48 0 13 88 Not estimable 2010
Subtotal (95% CI) 0 88 Not estimable
Total events 48 13
Heterogeneity: Not applicable
Test for overall effect: Not applicable
Total (95% CI) 358 404 100.0% -0.05 [-0.10, -0.01]
Total events 73 46
Heterogeneity: Chi² = 1.07, df = 4 (P = 0.90); I² = 0%
Test for overall effect: Z = 2.33 (P = 0.02)
Test for subgroup differences: Chi² = 0.09, df = 1 (P = 0.77), I² = 0%
-0.2
-0.1
0
0.1
0.2
Conservative management
Radical management

Study Author (year)	Type	n analyzed	n Shaving	Voiding dysfunction if shaving n(%)	n Disc excision	Voiding dysfunction if disc excision n(%)	n conservative surgery	Voiding dysfunction if conservative surgery excision n(%)	n Segmental resection	Voiding dysfunction if segmental resection n(%)	Definition of voiding dysfunction	Self-catherization time	Inclusion period	Nerve sparing surgery
ABO 2018 * 29307394	Retrospective	364	145	8 (5.5)	80	16(20)	225	24(10.7)	139	20(4.3)	Transitory bladder atony requiring auto-catheterization	3 weeks to 6 months	June 2009 - December 2015	Yes
ERDEM 2018 29664797	Retrospective	51	NC	NC	NC	NC	NC	NC	51	2(3)	Transient urinary retention	NR	June 2002 – May 2011	Yes
HUDELIST 2018 * 30080244	Prospective	134	NC	NC	32	3 (9.4)	32	3(9.4)	102	6(5.9)	urinary retention	NR	March 2011 - August 2016	Yes
BOURDEL 2017* 29143306	Retrospective	195	172	6(3.5)	NC	NC	172	6(3.5)	23	1(4.3)	urinary retention	NR	January 2000 - June 2013	NR
JAYOT 2017 * 28987649	Prospective	98	NC	NC	31	0(0)	31	0(0)	31	7(22)	persistent voiding dysfunction	>30 days	January 2015 - September 2016	Yes
RENNER 2017 28374101	Retrospective	113	NC	NC	NC	NC	NC	NC	112	15(15.3)	Postoperative residual urine >100 mL	NR	2001–2010	NR
ROMAN 2017 28139235	Prospective	111	NC	NC	111	10(9)	111	10(9)	NC	NC	Transitory bladder atony requiring auto-catheterization	21 to 180 days	June 2009 - June 2016	NR
MILLOCHAU 2017 28893658	Retrospective	20	NC	NC	20	4(19)	20	4(19)	NC	NC	Transitory bladder atony requiring self-catheterization	>7 days	March 2011 - December 2016	Yes
MARTY 2017 28673871	Retrospective	110	110	2(1.8)	NC	NC	110	2(1.8)	NC	NC	bladder atony requiring daily self-catheterization	>3 weeks	December 2012 - December 2016	NR
AFORS 2016 * 27544881	Retrospective	92	57	1(1.75)	15	2(13.3)	72	3(4.2)	30	2(6.6)	urinary retention which resolved spontaneously within 15 days	NC	January 2010 - September 2012	Yes
ROMAN 2016 * 27393269	Retrospective	70	46	1(2.2)	NC	NC	46	1(2.2)	25	3(12)	Bladder atony requiring daily catheterization	> 1 month	January 2005 - January 2010	Yes
ROMAN 2016 26474734	Prospective	103	NC	NC	NC	NC	NC	NC	103	5(4.9)	transitory urinary dysfunction requiring systematic daily catheterization	NR	June 2009 - November 2014	Yes
ROMAN 2016 27565263	Retrospective	122	122	8(6.6)	NC	NC	122	8(6.6)	NC	NC	bladder postvoiding volume >100 mL on	6 +/- 4 weeks	June 2009 - September 2014	Yes

											the day of discharge from the hospital			
AKLADIOS 2015 25109779	Retrospective	41	NC	NC	NC	NC	NC	NC	41	4(9.7)	transient urinary retention requiring self-catheterization	NR	2004 – 2011	Yes
DIGUISTO 2015 * 25813434	Retrospective	28	22	3 (13.6)	NC	NC	22	3 (13.6)	6	1(16.7)	Self-catheterization at discharge from the hospital	NR	December 2011 - June 2014	NR
ROMAN 2015 26347968	Prospective	50	NC	NC	50	8(16)	50	8(16)	NC	NC	Bladder atony requiring self-catheterization	3 weeks to 6 months	June 2009 - November 2014	Yes
MEULEMAN 2014 23579578	Prospective	76	NC	NC	NC	NC	NC	NC	76	2(2.6)	bladder atony	NR	September 2006 - October 2008	NR
FLEISCH 2014 24407554	Retrospective	4	NC	NC	NC	NC	NC	NC	4	2(50)	transient postoperative urinary retention	NR	2008 – 2010	Yes
RUFFO 2014 24877097	Retrospective	900	NC	NC	NC	NC	NC	NC	900	114(14.7)	Dysuria	NR	January 2002 - December 2010	NR
BALLESTER 2014 24858943	Prospective	227	NC	NC	NC	NC	NC	NC	227	45(22)	Voiding dysfunction requiring self-catherization	>1 month	2001-2011	Yes
Che 2014 24576484	Prospective	21	NC	NC	NC	NC	NC	NC	21	9(4.3)	patient requiring self-catheterization postoperatively	56 days (range: 25 days to eight months)	September 2010 - July 2012	Yes
MANGLER 2014 24726619	Prospective	71	NC	NC	NC	NC	NC	NC	71	2(2.8)	residual urine at discharge	NR	September 2004 - December 2012	Yes
BOILEAU 2012 22071018	Retrospective	23	NC	NC	NC	NC	NC	NC	23	2(8.9)	De novo dysuria requiring self-catheterization	15 days	2005 – 2011	NR
MEULEMAN 2011 22729087	Retrospective	45	NC	NC	NC	NC	NC	NC	45	1(2.2)	Atonic neurogenic urinary bladder necessitating intermittent urethral catheterization	first 10 weeks after the operation	September 2004 - September 2006	Yes
WOLTHUIS 2011 21427115	Prospective	21	NC	NC	NC	NC	NC	NC	21	1(4.8)	atonic neurogenic urinary bladder necessitating intermittent urethral catheterization	NR	September 2009 - September 2010	NR
BALLESTER 2011 21256472	RCT	52	NC	NC	NC	NC	NC	NC	52	15(29)	Self-catheterization or Dysuria	3 months	January 2006 - December 2008	Yes
DONNEZ 2010 20547557	Prospective	500	500	4(0.8)	NC	NC	500	4(0.8)	NC	NC	urinary retention	NR	2004-2008	Yes
FANFANI 2010 * 19394600	Case-control	136	NC	NC	48	0(0)	48	0(0	88	13(14.7)	Urinary retention after 30 days	NR	January 2003 - December 2007	NR

DOUSSET 2010 20395847	Prospective	100	NC	NC	NC	NC	NC	NC	100	16(16)	A transient peripheral neurogenic bladder defined when intermittent self-catheterization was required after hospital discharge within 15 days	6 weeks (range: 3–18 weeks)	1995-2003	Yes
RUFFO 2010 19466489	Retrospective	436	NC	NC	NC	NC	NC	NC	436	71(19.9)	urinary retention with need for self-catheterization at 1 month	>1 month	January 2002 - March 2008	Yes
STEPNIEWSKA 2010 * 19836731	Prospective	100	40	0(0)	NC	NC	40	0(0)	60	3(5)	urine retention for >1 month	>1 month	2000 – 2005	Yes
ROMAN 2010 * 20106836	Retrospective	41	NC	NC	16	0(0)	16	0(0)	25	2(8)	Bladder dysfunction requiring systematic or occasional catheterization .12 months after surgery	NR	January 2005 - June 2008	Yes
FERRERO 2009 18684451	Prospective	46	NC	NC	NC	NC	NC	NC	46	2(4.3)	Urinary retention after 30 d from surgery	>1 month	May 1999 - May 2006	Yes
LANDI 2008 18656048	Retrospective	35	NC	NC	35	0(0	35	0(0)	NC	NC	NR	NC	January 2003 - September 2006	Yes
BENBARA 2008 19019719	Retrospective	50	NC	NC	NC	NC	NC	NC	50	10(30.4)	Post-operative dysuria spontaneously disappeared between 8 days and 1 year	NR	1998 – 2005	No
DUBERNAND 2008 18313000	Retrospective	52	NC	NC	NC	NC	NC	NC	52	12(23)	acute retention requiring self-catheterization of bladder	85 days (range: 10–420)	April 2001 - April 2004	No
KOSSI 2008 19438891	Retrospective	31	NC	NC	NC	NC	NC	NC	31	2(6.4)	Urinary retention	NR	January 2004 - May 2007	No
BROUWER 2007 * 17610695	Prospective	163	18	0(0)	58	0(0)	76	0(0)	137	2(1.46)	urinary symptoms requiring an indwelling catheter in the postoperative period	NR	1995 - 2005	No
SLACK 2007 17877680	Retrospective	128	128	5(1.4)	NC	NC	128	5(1.4)	NC	NC	urinary catheterization	<7 days	May 1999 - September 2006	No
GHEZZI 2007 18163992	Prospective	33	NC	NC	NC	NC	NC	NC	33	3(9.1)	urinary retention that required intermittent self-catheterization	>1 month	October 2005 - June 2007	No
MEREU 2007 17630164	Prospective	192	NC	NC	NC	NC	NC	NC	192	9(4.7)	Urinary retention after 30 days	>1 month	January 2003 - December 2005	Yes
SERACHIOLLI 2007 17501958	Prospective	22	NC	NC	NC	NC	NC	NC	22	5(22.7)	Transient urinary retention requiring	2-12 weeks	January 2001 - January 2003	No

											self-catheterization			
JATAN 2006 * 16322961	Retrospective	95	43	0(0)	38	0(0)	81	0(0)	14	1(7.1)	urinary retention	NR	April 1996 - August 2004	No
MOHR2005 * 15791964	Retrospective	178	100	0(0)	39	0(0)	139	0(0)	48	1(2)	urinary retention	NR	March 1990 - March 1997	No
DARAI2005 15695977	Prospective	40	NC	NC	NC	NC	NC	NC	40	7(17.5)	Urinary retention required bladder catherization	2 weeks (range: 2-4 weeks)	March 2001 - March 2003	No
LANDI2005 16449312	Prospective	65	NC	NC	NC	NC	NC	NC	65	4(6.2)	bladder self-catheterization for >50 days	>50 days	December 2003 - September 2004	No
TOUBOUL2005 25294552	RCT	40	NC	NC	NC	NC	NC	NC	40	5(12.5)	self-catheterization more than 6 months	>6 months	January 2006 - December 2008	No
CAMPAGNACCI 2005 15759190	Prospective	7	NC	NC	NC	NC	NC	NC	7	1(14)	temporary urinary retention	NR	March 1995 - March 2003	No
MARPEAU2004 15550878	Prospective	32	NC	NC	NC	NC	NC	NC	32	6(18.8)	self-catheterization	3 weeks	From March 2001 - March 2003	No
PASSOVER 2000 10960302	Prospective	34	NC	NC	NC	NC	NC	NC	34	0(0)	NR	NC	NR	No
DONNEZ 1995 7782444	Prospective	231	231	3(1.3)	NC	NC	231	3(1.3)	NC	NC	urinary retention	NR	NR	No
Total		5962	1734	41(2.4)	573	43(7.5)	2307	84(3.6)	3655	368(10.1)				

NC= non-concerned NR= non-reported

ep endometriosis

*Studies reporting at least two groups of colorectal surgery.

Nerve sparing technique	Inclusion period	n conservati-ve surgery	Voiding dysfunction if conservative surgery n(%)	n Radical surgery	Voiding dysfunction if radical surgery n(%)	Non-Nerve sparing or not clearly reported	Inclusion period	n conservati-ve surgery	Voiding dysfunction if conservative surgery n(%)	n Radical surgery	Voiding dysfunction if radical surgery n(%)
ABO 2018 29307394	June 2009 - December 2015	225	24(10.7)	139	20(4.3)	**BOURDEL 2017 29143306**	January 2000 - June 2013	172	6(3.5)	23	1(4.3)
ERDEM 2018 29664797	June 2002 – May 2011	NC	NC	51	2(3)	**RENNER 2017 28374101**	2001–2010	NC	NC	112	15(15.3)
HUDELIST 2018 30080244	March 2011 - August 2016	172	6(3.5)	23	1(4.3)	**MARTY 2017 28673871**	December 2012 - December 2016	110	2(1.8)	NC	NC
JAYOT 2017 28987649	January 2015 - September 2016	31	0(0)	31	7(22)	**DIGUISTO 2015 25813434**	December 2011 - June 2014	22	3 (13.6)	6	1(16.7)
ROMAN 2017 28139235	June 2009 - June 2016	111	10(9)	NC	NC	**MEULEMAN 2014 23579578**	September 2006 - October 2008	NC	NC	76	2(2.6)
MILLOCHAU 2017 28893658	March 2011 - December 2016	20	4(19)	NC	NC	**RUFFO 2014 24877097**	January 2002 - December 2010	NC	NC	900	114(14.7)
AFORS 2016 27544881	January 2010 - September 2012	72	3(4.2)	30	2(6.6)	**BOILEAU 2012 22071018**	2005 – 2011	NC	NC	23	2(8.9)
ROMAN 2016 27393269	January 2005 - January 2010	46	1(2.2)	25	3(12)	**WOLTHUIS 2011 21427115**	September 2009 - September 2010	NC	NC	21	1(4.8)
ROMAN 2016 26474734	June 2009 - November 2014	NC	NC	103	5(4.9)	**FANFANI 2010 19394600**	January 2003 - December 2007	48	0(0	88	13(14.7)
ROMAN 2016 27565263	June 2009 - September 2014	122	8(6.6)	NC	NC	**BENBARA 2008 19019719**	1998 – 2005	NC	NC	50	10(30.4)
AKLADIOS 2015 25109779	2004 – 2011	NC	NC	41	4(9.7)	**DUBERNAND 2008 18313000**	April 2001 - April 2004	NC	NC	52	12(23)
ROMAN 2015 26347968	June 2009 - November 2014	22	3 (13.6)	6	1(16.7)	**KOSSI 2008 19438891**	January 2004 - May 2007	NC	NC	31	2(6.4)
FLEISCH 2014 24407554	2008 – 2010	NC	NC	4	2(50)	**BROUWER 2007 17610695**	1995 - 2005	76	0(0)	137	2(1.46)
BALLESTER 2014 24858943	2001-2011	NC	NC	227	45(22)	**SLACK 2007 17877680**	May 1999 - September 2006	128	5(1.4)	NC	NC
Che 2014 24576484	September 2010 - July 2012	NC	NC	21	9(4.3)	**GHEZZI 2007**	October 2005 - June 2007	NC	NC	33	3(9.1)

						18163992					
MANGLER 2014 24726619	September 2004 - December 2012	NC	NC	71	2(2.8)	**SERACHIOLLI 2007 17501958**	January 2001 - January 2003	NC	NC	22	5(22.7)
MEULEMAN 2011 22729087	September 2004 - September 2006	NC	NC	45	1(2.2)	**JATAN2006 16322961**	April 1996 - August 2004	81	0(0)	14	1(7.1)
BALLESTER 2011 21256472	January 2006 - December 2008	NC	NC	52	15(29)	**MOHR2005 15791964**	March 1990 - March 1997	139	0(0)	48	1(2)
DONNEZ 2010 20547557	2004-2008	500	4(0.8)	NC	NC	**DARAI2005 15695977**	March 2001 -March 2003	NC	NC	40	7(17.5)
DOUSSET 2010 20395847	1995-2003	NC	NC	100	16(16)	**LANDI2005 16449312**	December 2003 - September 2004	NC	NC	65	4(6.2)
RUFFO 2010 19466489	January 2002 - March 2008	NC	NC	436	71(19.9)	**TOUBOUL 2005 25294552**	January 2006 - December 2008	NC	NC	40	5(12.5)
STEPNIEWSKA 2010 19836731	2000 – 2005	40	0(0)	60	3(5)	**CAMPAGNACCI 2005 15759190**	March 1995 - March 2003	NC	NC	7	1(14)
ROMAN 2010 20106836	January 2005 - June 2008	16	0(0)	25	2(8)	**MARPEAU 2004 15550878**	From March 2001 - March 2003	NC	NC	32	6(18.8)
FERRERO 2009 18684451	May 1999 - May 2006	NC	NC	46	2(4.3)	**PASSOVER 2000 10960302**	NR	NC	NC	34	0(0)
LANDI 2008 18656048	January 2003 - September 2006	35	0(0)	NC	NC	**DONNEZ 1995 7782444**	NR	231	3(1.3)	NC	NC
MEREU 2007 17630164	January 2003 - December 2005	NC	NC	192	9(4.7)						
26 studies	1999 - 2016	1402	62(4.4)	1718	222(12.9)	**25 studies**	1995-2013	1001	18(1.8)	1842	208(11.3)

Table 2: Nerve sparing versus non-nerve sparing technique in colo-rectal surgery for deep endometriosis