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Laparoscopy versus laparotomy for benign ovarian tumour (Review)

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[Intervention Review]

Laparoscopy versus laparotomy for benign ovarian tumour

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ABSTRACT

Background

Over the last 10 years laparoscopy and minilaparotomy have become increasingly common approaches for the surgical removal of benign ovarian tumours. However, in the event that a tumour is found to be malignant, laparotomy is the appropriate procedure. Careful preoperative assessment including transvaginal ultrasound with morphological scoring, colour doppler assessment of vascular quality, and serum cancer antigen 125 (CA 125) level is desirable.

Objectives

To determine the benefits, harms, and cost of laparoscopy or minilaparotomy compared with laparotomy in women with benign ovarian tumours.

Search methods

We searched electronic databases, trial registers, and reference lists of published trial reports. Reference lists from trials and review articles were searched.

Selection criteria

All randomised controlled trials comparing either laparoscopy or minilaparotomy with laparotomy for benign ovarian tumours.

Data collection and analysis

Eight review authors independently assessed the eligibility and quality of each study and extracted the data.

Main results

The results of nine randomised controlled trials (N = 482 women) showed that laparoscopic surgery was associated with fewer adverse events of surgery (surgical injury or postoperative complications including fever or infection) (OR 0.3, 95% CI 0.2 to 0.5), less postoperative pain (VAS score WMD -2.4, 95% CI -2.7 to -2.0), greater likelihood of being pain free after two days (OR 7.42, 95% CI 4.86 to 11.33), and fewer days in hospital (WMD -2.88, 95% CI -3.1 to -2.7) than with laparotomy.

In one study that reported costs, laparoscopy was associated with a significant reduction in costs compared to laparotomy (WMD -USD 1045, 95% CI -1348 to -742) in 1993. Very high levels of heterogeneity made it inappropriate to pool data on duration of surgery.

Three RCTs compared laparoscopy versus minilaparotomy and found that laparoscopy was associated with reduced odds of any adverse event (surgical injury or postoperative complications) (OR 0.10, 95% CI 0 to 0.8) and lower VAS scores for pain (WMD -1.0, 95% CI -1.6 to -0.45). Duration of hospital stay ranged between 1 and 2.2 days, with substantial heterogeneity.

Authors' conclusions

In women undergoing surgery for benign ovarian tumours, laparoscopy was associated with a reduction in fever, urinary tract infection, postoperative complications, postoperative pain, number of days in hospital, and total cost. These findings should be interpreted with caution since only a small number of studies were identified. These included a total of only 769 women and not all of the important outcomes were reported in each study.

PLAIN LANGUAGE SUMMARY

Laparoscopic surgery for benign ovarian tumours is associated with less pain, shorter hospital stay, and fewer adverse events than with laparotomy

Laparoscopy is a modern surgical technique in which operations are performed through small incisions (usually 2 to 3 cm long) using a laparoscope. This is a telescopic rod lens system that is usually connected to a video camera. In the 12 controlled studies identified, laparoscopic surgery was associated with reduced risk of any adverse events from surgery, less pain, and fewer days in the hospital when compared to laparotomy, the traditional surgical technique.There was no difference between the procedures with regard to outcomes of fever, postoperative infections, and tumour recurrence.

BACKGROUND

The ovary is a complex embryological, histological, and physiological structure that is capable of developing over 50 types of primary neoplasm variants, from benign to borderline and malignant tumours (Barber 1984). Functional and benign ovarian cysts are the most frequent abnormal gynaecological structural findings in women of reproductive age, and are among the five main causes of hospitalisation for gynaecological disease in the United States and England (Westhoff 1992). Data from the National Hospital Discharge Survey, from 1988 to 1990, showed that the average annual rates of hospitalisation for benign ovarian cysts was 32.7 (95% CI 28.8 to 36.6) per 10,000 women of reproductive age; 68% of these patients were submitted to a surgical procedure (Velebil 1995). Approximately 80% of ovarian tumours can be successfully treated surgically using an endoscopic technique (Canis 1994). Many advantages of laparoscopic gynaecologic surgery have clearly been demonstrated including shorter length of hospital stay, decreased postoperative pain and recovery time, and less adhesion formation (Canis 1994; Lundorff 1991).

Malignant ovarian neoplasms are responsible for 4% of all malignant tumours affecting women. They are the second most common cause of death from gynaecological cancer and the fourth most common cause of death from all types of cancer affecting women (Ekerhovd 2001). The incidence of ovarian tumours progressively increases with age, with 3.2 cases per 100,000 women between the ages of 15 to 39 years and 54 cases per 100,000 women above the age of 70 years (Yancik 1993). The ovary is involved for approximately half of all women with endometriosis

(Jenkins 1986). However, a malignant ovarian tumour has been documented to arise clinically in 0.3% to 0.8% of patients with ovarian endometriosis (Heaps 1990; Hitti 1990). Dermoid cysts are the most prevalent germ cell tumour and account for up to 25% of ovarian neoplasms in premenopausal women. Malignancy occurs in less than 3% and is most frequent in postmenopausal women (Chistopherson 1989; Woodruff 1968). Benign, borderline, and malignant lesions have been identified in the same surgical specimen. The frequency and speed of the evolution from dysplasia into cancer remains unknown (Scully 2000).

When an ovarian tumour is detected, it is necessary to establish whether it is likely to be malignant or benign as this diagnosis will guide decision making on the surgical approach. This cannot be determined with 100% accuracy until inspection of the abdominal cavity, cytological examination of the peritoneal liquid, and histological examination of the surgical specimens (Canis 1994). However, a number of criteria can facilitate preoperative diagnosis. These are as follows.

(1) Transvaginal ultrasonography with the use of a morphological scoring system (internal borders, septations, papillary projections, tissue echogenicity and volume) (Sassone 1991). An ovarian volume of above 20 cm^3 in the reproductive age group and above 10 cm^3 in the postmenopausal group may indicate a need for further investigation (Van Nagell 2000).

(2) Colour Doppler ultrasonography (US) allows vascular quality to be assessed from the vascular resistance index (RI) and the pulsatility index (PI), with cut-off values for malignancy less than 0.4 and 1, respectively (Brown 1994). However for ovarian masses it is still not known if benign and malignant lesions can be differentiated with the use of colour and pulsed Doppler US.

(3) CA 125 may be detected in the serum of up to 86% of patients with ovarian neoplasms, with levels of 35 U/ml or higher being considered suspicious (Chou 1994; Maggino 1987).

In a study of 191 women with ovarian tumours (Timmerman 1999), logistic regression was used to develop an algorithm to preoperatively distinguish between benign and malignant ovarian tumours. The most useful variables in the logistic regression analysis were menopausal status, serum CA 125 level, the presence of one or more papillary growth(s) of greater than 3 mm, and a colour score indicative of tumour vascularity and blood flow. The optimised algorithm had a sensitivity of 95.9% and a specificity of 87.1% in the group studied. A subsequent publication attempting to validate this model and others using a large heterogeneous data set found few models to be robust and generalisable, perhaps due to the subjective nature of some of the component assessments (Van Holsbeke 2007). It is generally accepted that ovarian malignancy can seldom be absolutely excluded prior to surgery.

McDowell reported the first successful removal of an ovarian tumour in 1817 (McDowell 1817). The laparotomy approach was the only option until the end of the 20^{th} century. The first surgical laparoscopic procedure was performed by Semm and Mettler in 1980 (Semm 1980). This approach was thought to be associated with less surgical trauma and lower hospital costs (Canis 2000; Kehlet 1999; Lorenz 1999; Maiman 1991). Approximately 80% of ovarian tumours can be successfully resected using a laparoscopic (endoscopic) technique (Canis 2000). The potential advantages of this approach include: improved magnification that makes the diagnosis of peritoneal metastases more certain; the avoidance of an inappropriate transverse laparotomy incision in cases with a malignant tumour; and, most important, the prevention of unnecessary laparotomies in patients with benign ovarian tumours (Canis 2000). The laparoscopic approach is used in patients whose adnexal mass is less than 10 cm in diameter, whatever the ultrasonographic appearance. Masses of more than 8 cm are managed more cautiously and evaluated by laparoscopy when unilocular or bilocular, or when calcifications are identified) (Canis 1994a; Wong 2000). An alternative minimally invasive procedure for the management of ovarian cysts is minilaparotomy (using a 3 to 7 cm transverse skin incision, 2 to 4 cm above the pubic symphysis) (Panici 2007). For dermoid cysts and endometriomata, special attention is necessary during the procedure to avoid spillage and subsequent chemical peritonitis with increased risk of subsequent postoperative adhesions. In the case of dermoid cysts, there is a risk of granulomatous reactions (Nissole 1994).

Postoperative adhesions are sequelae from ovarian surgery and may result in mechanical infertility in women of reproductive age (Bassil 1994). Laparoscopic ovarian cystectomy is associated with decreased postoperative adhesion formation when compared with laparotomy (Lundorff 1991).

Some endoscopic procedures are performed using carbon dioxide (CO_2) techniques. This is considered by some authors to increase the risk of activating cell enzymes, which may lead to mitosis and an increase in the production of tumour growth factor as has been shown in an animal model (Greene 1995). An increasing rate of trocar-site recurrences and intra-abdominal growth of metastases has been reported after laparoscopic surgery in patients with malignant intra-abdominal tumours (Martinez 1995). For this reason, if a tumour turns out to be malignant during laparoscopy, the procedure should immediately be converted to a laparotomy. In these cases, if laparotomy is delayed for more than eight days, progression from stage Ic to stage II may occur (Kindermann 1995). If a tumour turns out to be malignant during laparoscopy and inadvertent rupture occurs, the procedure should be converted to a laparotomy with a longitudinal medial incision to allow the appropriate, necessary surgical staging and debulking procedures.

As it is not yet established whether laparoscopy, laparotomy or minilaparotomy is the best approach for ovarian tumours assumed to be benign, we have performed a systematic review of all ran-

domised controlled trials in which laparoscopy and laparotomy or minilaparotomy were compared for the treatment of benign ovarian tumours.

OBJECTIVES

To determine the benefits, harms, and costs of laparoscopic surgery compared with laparotomy or minilaparotomy in women with ovarian tumours assumed to be benign.

METHODS

Criteria for considering studies for this review

Types of studies

All randomised controlled trials (RCTs) which compared laparoscopic surgery with laparotomy or minilaparotomy as a treatment for ovarian tumours assumed to be benign.

Types of participants

Inclusion criteria

We considered three groups of women with benign ovarian tumours who were treated surgically by either laparoscopy, minilaparotomy, or laparotomy: those with any type of benign ovarian tumour; those with dermoid cysts; and those with endometriomata. We only included trials where women were investigated in the preoperative setting with transvaginal or transabdominal ultrasonography, or both, for analysis of the morphological scoring (internal borders, septations, papillary projections, echogenicity, and volume) in order to exclude from the trial women with tumours that were likely to be malignant.

We noted whether trials reported:

(1) the use of colour Doppler transvaginal ultrasonography to assess vascular quality from the vascular resistance index (RI) and pulsatility index (PI);

(2) preoperative estimation of serum CA 125 levels, levels greater than 35 U/ml were suggestive of malignancy.

Exclusion criteria

(1) Women with ovarian tumours having features suggestive of malignancy, determined during preoperative assessment.

(2) Women with gynaecological cancer.

(3) Trials where the author did not describe the preoperative assessment that was performed.

Types of interventions

Two surgical approaches used for the management of ovarian tumours assumed to be benign were compared: laparoscopy and laparotomy. Laparotomy was further defined as either 'standard laparotomy' with a Pfannansteil incision or 'minilaparotomy', where the transverse incision was 3 to 7 cm long.

Whenever possible, the results were analysed by type of surgeon: gynaecological versus general surgeon.

Types of outcome measures

The major outcome measures were as follows.

1 *Surgical*

- Mean duration of surgery
- Change of diagnosis from benign to malignant tumour

2 *Adverse events*

Surgical injury of the:

- bladder;
- ureter;
- vasculature;
- small bowel;
- colon.

3 *Postoperative complications*

- Requirement for blood transfusion
- Haematoma
- Fever
- Incision infection
- Urinary tract infection
- Thromboembolism
- Perioperative mortality

4 *Any other adverse event*

- Urinary retention
- Chemical peritonitis
- Intestinal obstruction

5 *Any other adverse events of surgery* (either surgical injury, postoperative complications, or other adverse events of surgery)

6 *Short-term outcomes*

- Pain: VAS scores
- Pain: pain free at 24 to 48 hrs postoperation
- Pain: requirement for analgesia
- Length of hospital stay
- Recurrence rate after 6 to 12 months
- Blood loss determined by haemoglobin level

7 *Economic measure*

- Direct cost of surgical procedures

Search methods for identification of studies

For the update of this review in 2007, we searched the Cochrane Menstrual Disorders and Subfertility Group Trials Register (November 2007), Cochrane Central Register of Controlled Trial (CENTRAL) (*The Cochrane Library*), MEDLINE (1966 to November 2007), EMBASE (1985 to November 2007), CINAHL (1984 to November 2007), SciSearch (1991 to November 2007), and LILACS (1982 to November 2007). See Appendix 1; Appendix 2; Appendix 3; Appendix 4 for the search strategies. The citation lists of relevant publications and included studies, and abstracts of scientific meetings were checked through handsearching for further trials; experts in the field were contacted to identify further reports of trials.

A prospective handsearch of publications (1980 to 2007) on the surgical treatment for benign ovarian tumours was carried out in the following journals: American Journal of Obstetrics and Gynecology; British Journal of Obstetrics and Gynaecology; Gynecologic Oncology; Obstetrics and Gynecology; International Journal of Gynecological Cancer; Gynaecological Endoscopy; The Journal of the American Association of Gynecologic Laparoscopists; European Journal of Obstetrics, Gynecology, and Reproductive Biology; Journal of Reproduction Medicine; Gynecologie et Obstetrique; Fertility and Sterility; Human Reproduction; and Journal of Gynecologic Surgery. Abstracts presented to the following international societies were handsearched: British Society for Gynaecological Endoscopy, European Society for Gynaecological Endoscopy, International Society for Gynecologic Endoscopy, Australian Gynaecological Endoscopy Society, Hong Kong Gynaecological Endoscopy Society, Italian Society for Gynaecological Endoscopy; and American Association of Gynecologic Laparoscopists.

Data collection and analysis

Selection of studies

Studies were assessed according to the inclusion criteria above. Four review authors (LRM, JF, MIR, DDR) worked in pairs; agreement on eligibility was reached. A standard checklist was used to guide this process. No effort was made to blind the names of authors, institutions, or journals. The reason for this was that the review authors were very familiar with the literature on surgical treatment for benign ovarian tumours and would have recognised most studies even if they were blinded. For this update, two review authors (MCB and ATS) independently assessed citations for inclusion. Any discrepancies were resolved by a co-author (RG or SF). When eligibility could not be determined from the published study the authors were contacted for clarification. There were no language restrictions.

Methodological quality and data extraction

Included trials were analysed for the following specific criteria and methodological details. Using a standard checklist to guide this process, the review authors collected information on study design for each trial. Differences in data extraction were resolved by consensus, referring back to the original article. When trials were reported in more than one publication, data were extracted from the most recent article, referring to other articles for methodological details, baseline characteristics, or further outcomes when appropriate.

Data extraction

Data regarding details on the study population, intervention, and outcomes were extracted by one review author (LRM, DDR, or MIR) and checked independently by the other three authors (MCB, JF, ATB) using a data extraction form. This included the following information.

Trial characteristics

(1) Method of randomisation
(2) Presence or absence of blinding to treatment allocation
(3) Quality of allocation concealment
(4) Number of patients randomised, excluded, or lost to follow up
(5) Whether an intention-to -treat analysis was performed
(6) Whether a power calculation was done
(7) Duration, timing, and location of the study

Characteristics of the women participants

(1) Age and any other baseline characteristics of women in the study
(2) Method used to define ovarian cysts in the laparoscopy surgery
(3) Details of the preoperative assessment
(4) Other inclusion criteria
(5) Exclusion criteria
(6) Histological type of ovarian tumour (endometrioma, dermoid cyst, or other)

Interventions used

(1) Laparoscopy: ovarian cystectomy (unilateral and bilateral) or oophorectomy (unilateral and bilateral), number of ports, type of anaesthesia, and histological types (endometriosis, dermoid cysts, and others).
(2) Laparotomy: ovarian cystectomy (unilateral and bilateral) or oophorectomy (unilateral and bilateral), type and length of incision.
(3) Minilaparotomy: where the transverse incision was 3 to 7 cm, ovarian cystectomy (unilateral and bilateral) or oophorectomy (unilateral and bilateral).

Outcomes

The major outcome measures were:
(1) surgical duration;
(2) adverse events - surgical injury;
(3) postoperative complications;
(4) any other adverse events;
(5) any adverse events from surgery (either surgical injury, postoperative complications, or other adverse events);
(6) short-term outcomes;
(7) economic measure.

Assessment of methodological quality of included studies

All assessments of the quality of trials and data extraction were performed independently by five review authors (LRM, DDR, MIR, MCB, ATS) using forms designed by The Cochrane Collaboration. The quality of allocation concealment was assigned for each trial using the following criteria:

- Grade A: adequate concealment;
- Grade B: uncertain concealment;
- Grade C: clearly inadequate concealment.

Trials with quasi-randomisation designs were excluded.

Attrition bias (loss of participants)

We described completeness of follow up for each trial and included reasons for loss of participants, for example withdrawals, dropouts, and protocol deviations, when reported.

Performance bias (blinding of participants, researchers, and outcome assessors)

Blinding of participants, caregivers, and outcome assessors was assessed and described or reported as 'not stated'.

Analysis

Statistical analysis was performed in accordance with the guidelines for statistical analysis developed by the Menstrual Disorders and Subfertility Group. All trials were initially included in the analysis. Subgroup analysis was performed by looking separately at dermoid cysts and endometriomata ovarian cysts.

For categorical outcomes (surgical injuries, change of diagnosis from benign to malignant tumour, postoperative complications, any adverse events of surgery, pain free at 24 to 48 hours, readmission rates) we extracted the numbers reported for each outcome for each group of women. Results for each study were expressed as odds ratios (OR) with 95% confidence intervals (CI) and combined for meta-analysis with the RevMan software using the Peto-modified Mantel-Haenszel method.

Statistical heterogeneity among the results of different studies was examined by inspecting both the scatter points in the graphs and the overlap in their confidence intervals and, more formally, by checking the results of Chi^2 tests. Because there were few studies, a P-value for the Chi^2 tests of less than 0.10 was used to indicate heterogeneity. The outcomes were pooled statistically when no clinical heterogeneity was apparent. However, since clinical and methodological diversity occur in a meta-analysis, statistical heterogeneity is inevitable. An alternative approach that quantifies the effect of heterogeneity is the I^2 statistic, providing a measure of the degree of inconsistency in the results of the studies with 95% uncertainty intervals (Higgins 2003). This describes the percentage of the variability in the effect estimates that is due to heterogeneity rather than sampling error (chance). A value of 0% indicates no observed heterogeneity and a value greater than 50% may be considered as substantial heterogeneity. When it is inappropriate to pool the data due to clinical or statistic heterogeneity a systematic review without meta-analysis is performed.

For continuous outcomes (duration of surgery, length of hospital stay, and direct costs of surgical procedures) we used means and standard deviations to derive a weighted mean difference (WMD) with 95% confidence intervals (CI) using the RevMan software. Difficulties were found with the reporting of continuous outcomes (for example duration of surgery), where the data were skewed and the authors correctly presented them as medians with a range. Whenever possible, original data were obtained from the authors although post-treatment means and standard deviations were not always available or calculable. Where only medians and ranges were available, the median was regarded as being identical to the mean and a crude estimate of the standard deviation (SD) was calculated from the range ((range X 0.95)/4). This method is not ideal for skewed data and was likely to result in an over-estimation of the SD. Therefore, a sensitivity analysis (planned a priori) was performed with inclusion and exclusion of trials with skewed data in the meta-analysis. The distribution of data on duration of surgery is highly likely to be skewed and in these cases the ideal and most appropriate statistical analysis was probably nonparametric rather than inclusion in a meta-analysis assessing a WMD. Where a SD is not reported it can be calculated from either the standard error (SE) or the 95% CIs. A SD can be obtained from the SE of the mean by multiplying with the square-root of the sample size: $SD = SE \times \sqrt{N}$. When making this transformation, SEs must be of means calculated from within an intervention group and not SEs of the difference in means computed between intervention groups.

CIs for means can also be used to calculate SDs. Again, the following applies to CIs for mean values calculated within an intervention group and not for estimates of differences between interventions. Most CIs are 95% CIs. If the sample size is large (say bigger than 100 in each group), the 95% CI is 3.92 SEs wide ($3.92 = 2 \times 1.96$). The SD for each group is obtained by dividing the length of the CI by 3.92 and then multiplying by the square root of the sample size: $SD = \sqrt{N} \times$ (upper limit-lower limit)/3.92 (section 7.7.3.2) (Higgins 2008).

We pooled the effect measure within a random-effects model because the outcomes were heavily influenced by the context of care. Sensitivity analysis was planned a priori to compare the study results for type of intervention (ovarian cystectomy or oophorectomy), histological types (any type of benign ovarian tumour, dermoid cysts, and ovarian endometriomata), and study design and reporting (adequate versus unclear allocation concealment). Both fixed and random-effects model meta-analyses were undertaken to assess the robustness of the results.

RESULTS

Description of studies

Initially 32 studies were identified which compared laparoscopy and laparotomy for benign ovarian tumours (Figure 1). Twenty

of these studies were excluded because they were not randomised (Albini 1994; Bateman 1994; Bulletti 1996; Chapron 1997; Darwisch 2001; Deckardt 1994; Hidlebaugh 1994; Hidlebaugh 1997; Howard 1995; Laberge 2006;Lin 1995; Marana 2004; Mettler 2001a; Papasakelariou 1995; Paredes 1997; Pittaway 1994; Quinlan 1997; Thomas 2006; Yuen 1995; Zanetta 1999). See the 'Characteristics of excluded studies' table.

Twelve randomised controlled trials that were published between 1995 and 2007 met the inclusion criteria for this review (Badawy 2002; Buchweitz 2005; Damiani 1998; Fanfani 2004; Mais 1995; Mais 1996; Mais 2003; Morgante 1998; Nitke 1996; Panici 2007; Panici 2007a; Yuen 1997) (Figure 1).

The six additional primary studies in this update were RCTs (Badawy 2002; Buchweitz 2005; Fanfani 2004; Mais 2003; Panici 2007; Panici 2007a).

Description of Studies

1. *Settings*

Ten studies were of single-centre design and two trials were conducted in two centres. Eight included trials were conducted in Italy (Damiani 1998; Fanfani 2004; Mais 1995; Mais 1996; Mais 2003; Morgante 1998; Panici 2007; Panici 2007a). The other four studies were from Israel (Nitke 1996), Hongkong (Yuen 1997), Germany (Buchweitz 2005), and Egypt (Badawy 2002).

2. *Designs*

Nine studies were randomised comparisons of laparoscopy versus laparotomy for benign ovarian tumours (Badawy 2002; Buchweitz 2005; Damiani 1998; Mais 1995; Mais 1996; Mais 2003; Morgante 1998; Nitke 1996; Yuen 1997). Two studies compared laparoscopy with minilaparotomy (Fanfani 2004; Panici 2007a), and a further study compared laparoscopy with laparoscopic guided minilaparotomy Panici 2007).

3. Participants

All women included in the trials had ovarian tumours and underwent a preliminary workup including transvaginal or transabdominal ultrasonography, or both. In all trials, the type of surgeon (gynaecologists or general surgeons) was not defined. Only one trial reported that surgeons were undergoing training under supervision of an experienced surgeon (Yuen 1997). Eight studies mentioned that all surgical procedures were performed by the same investigators (Badawy 2002; Buchweitz 2005; Damiani 1998; Fanfani 2004, Mais 1995, Mais 1996, Mais 2003; Panici 2007). Six studies recorded the body mass index of the patients (Badawy 2002; Buchweitz 2005; Fanfani 2004; Mais 1995; Panici 2007; Panici 2007a). Eight studies included women with all histopathological types of benign ovarian tumours (Badawy 2002; Buchweitz 2005; Damiani 1998; Fanfani 2004; Mais 1995; Panici 2007; Panici 2007a; Yuen 1997). Three studies defined a subgroup with dermoid cysts (Morgante 1998; Nitke 1996; Mais 2003). Only one randomised trial considered a subgroup of patients with endometriomata ovarian cysts (Mais 1996).

4. *Interventions*

Ovarian cystectomy was performed by laparoscopy or laparotomy in 100% of the cases in five studies (Damiani 1998; Mais 1995; Mais 1996; Morgante 1998; Nitke 1996). Ovarian cystectomy was reported as bilateral in around 20% of cases in two trials, either by laparoscopy or laparotomy (Morgante 1998; Nitke 1996). Oophorectomy was performed by laparoscopy or laparotomy in around 30% of the cases (Yuen 1997) in each group and 100% of the cases in one trial (Buchweitz 2005). Ovarian cystectomy was reported in 87% of cases in the laparoscopy group and 70% of laparotomies (Badawy 2002).

In five studies there were no co-interventions in either group (laparoscopy and laparotomy) (Damiani 1998; Mais 1995; Mais 1996; Morgante 1998; Yuen 1997); in one trial concomitant procedures were performed (Nitke 1996).

No trials compared a surgical approach performed by one surgeon with another surgical approach performed by a second surgeon. Seven trials (Damiani 1998; Fanfani 2004; Mais 1995; Mais 1996; Mais 2003; Panici 2007) reported that a team that was experienced in laparoscopic surgery performed the procedures. Frozen section was referred to in three trials (Buchweitz 2005; Fanfani 2004; Panici 2007).

5. *Outcomes*

For each outcome we considered three groups, according to the ovarian tumour histopathology: all histological types of benign ovarian tumour, dermoid ovarian cysts, and ovarian endometriomata. The four major outcome measures were as follows.

(1) Surgical

- The mean duration of surgery was reported by 10 studies (Badawy 2002; Buchweitz 2005; Damiani 1998; Fanfani 2004; Mais 1995; Mais 1996; Mais 2003; Morgante 1998; Nitke 1996; Yuen 1997). Both studies by Panici reported median operating time together with the interquartile range (Panici 2007; Panici 2007a).

(2) Adverse effects of surgery

- Surgical injury, postoperative complications, and any other adverse events of surgery were described in most studies but four studies stated that no postoperative complications occurred (Mais 1995; Mais 1995; Mais 2003; Nitke 1996); described in all twelve studies.
- In our update three trials described incidence of a suspected malignant ovarian tumour during the procedure by frozen section analysis (Buchweitz 2005; Fanfani 2004; Panici 2007).

(3) Short-term recovery

- Pain (VAS scores) was reported in four studies (Mais 1995; Morgante 1998; Panici 2007a; Yuen 1997)
- Pain free at 24 to 48 hours after surgery was reported in six studies (Badawy 2002; Mais 1995; Mais 2003; Morgante 1998; Panici 2007a; Yuen 1997)
- Requirement for analgesia was reported in four studies (Badawy 2002; Buchweitz 2005; Fanfani 2004, Yuen 1997)
- Mean length of hospital stay was reported in nine studies, median length of stay with the interquartile range was reported

in two studies (Panici 2007; Panici 2007a), and Mais 2003 described numbers discharged within three days of surgery

- Recurrence rates at 6 to 12 months were reported in four studies (Damiani 1998; Mais 1995; Mais 1996; Mais 2003)
- Blood loss measured by decrease in mean haemoglobin level was described by Buchweitz 2005, and Panici 2007 reported the median pre and postoperative haemoglobin levels in each group together with the 25 to 75 percentile range.

(4) Economic measure

- Direct costs of surgical procedures were described in only one study from Italy (Damiani 1998).

Risk of bias in included studies

See Figure 1; Figure 2. Seven trials were given a score of A based on adequate concealment prior to randomisation; used in conjunction with numbered sealed envelopes where the seal was broken in the anaesthetic room prior to surgery (Badawy 2002; Fanfani 2004; Mais 1995; Mais 1996; Mais 2003; Panici 2007; Yuen 1995). The remaining five trials received an allocation score B since the method of randomisation was not reported in the publication (Buchweitz 2005; Damiani 1998; Morgante 1998; Panici 2007a) (Table 1).

Figure 1. Methodological quality graph: review authors' judgements about each methodological quality item presented as percentages across all included studies.

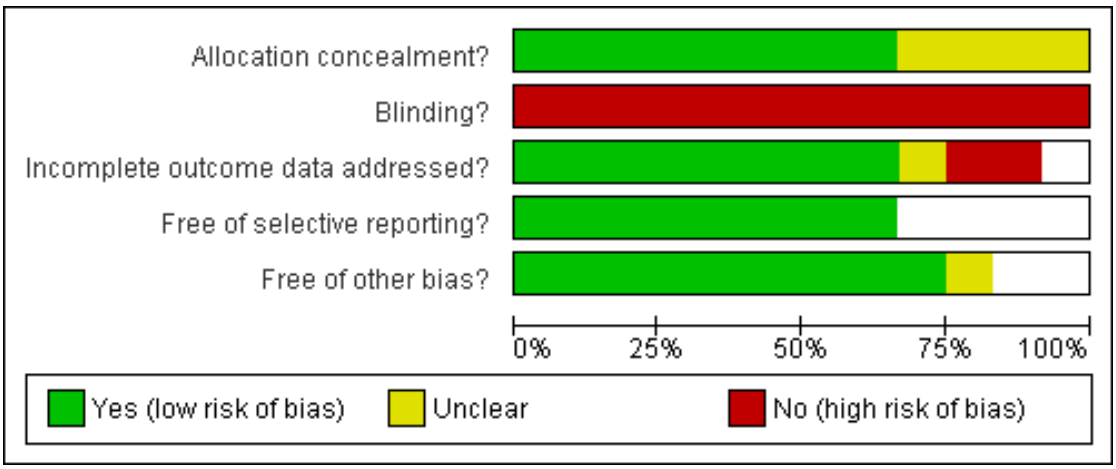
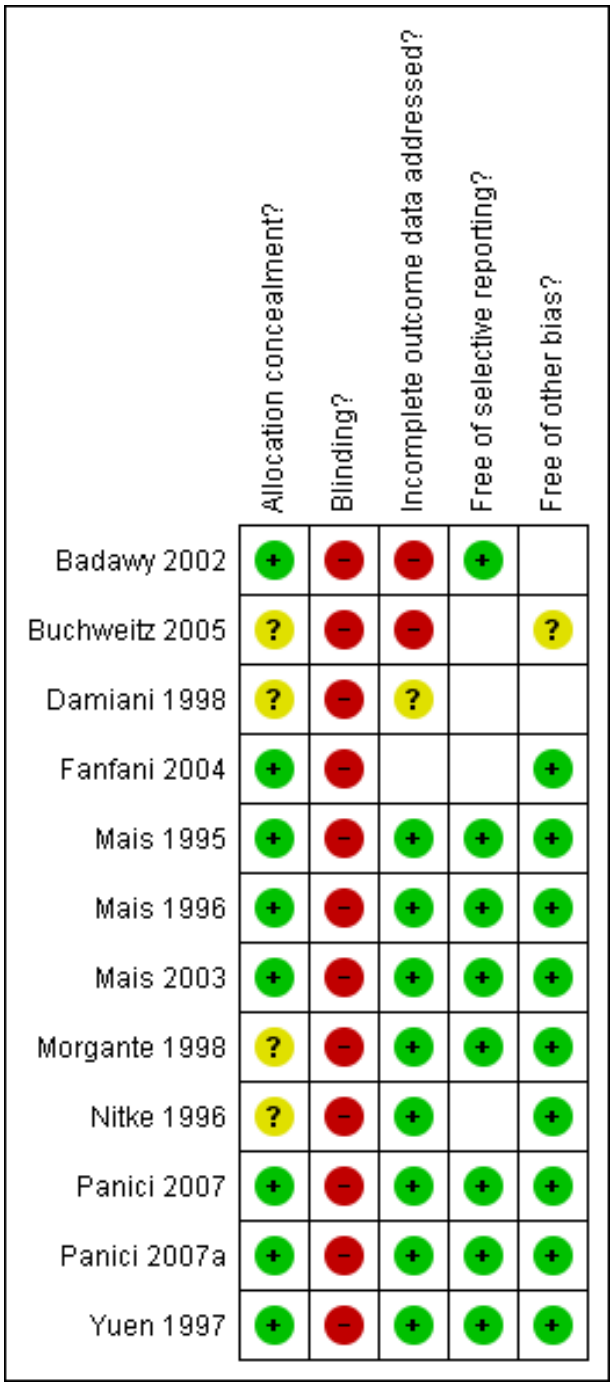


Figure 2. Methodological quality summary: review authors' judgements about each methodological quality item for each included study.



Five trials showed a power calculation for the sample size (Buchweitz 2005; Fanfani 2004; Mais 1995; Mais 1996; Yuen 1997) and only one trial stated that it performed an intention-to-treat analysis (Panici 2007a). One study (Badawy 2002) did not mention randomisation but personal communication with Dr Badawy resulted in confirmation that participants were in fact randomly allocated to treatment groups by the principal investigator, using computerised random tables at the time of admission of the patients to the hospital. Numbers of women included in the trials were generally small, ranging from 10 to 64 per treatment arm.

Two studies reported no loss from follow up six months after surgery (Mais 1995; Mais 1996) and another study reported no losses after two weeks follow up (Morgante 1998). In Nitke 1996, follow up was only until discharge from hospital after the surgery (maximum 4.3 days) and no losses were reported. Damiani and Badawy conducted a follow-up assessment at 12 months after surgery but did not mention any patient losses to follow up (Badawy 2002; Damiani 1998). One study (Yuen 1997) stated that four of the original 110 patients recruited into the study refused randomisation and another four were lost to follow up with the result that a total of eight of the original 110 patients recruited (7.3%) were not assessed at the end of follow up, six weeks after surgery. Mais reported five years of follow up (Mais 2003); Panici 2007 stated that follow up was for three months; and three studies did not specifically state the duration of follow up but it was likely to have been less than three months (Buchweitz 2005; Fanfani 2004; Panici 2007a).

Inter-rater agreement for quality assessment by individual review authors was good (Cohen's kappa = 0.79). Disagreements were resolved through discussion in all cases (MCB, ATS, JF).

Sensitivity analysis by including and excluding the studies of lower quality assessment was performed based on the quality of allocation concealment (A, B, C).

Effects of interventions

Included studies

Twelve studies and 769 patients were included in this review.

Nine studies compared laparoscopy and laparotomy (Badawy 2002; Buchweitz 2005; Damiani 1998; Mais 1995; Mais 1996; Mais 2003; Morgante 1998; Nitke 1996; Yuen 1997). Three studies compared laparoscopy and minilaparotomy (Fanfani 2004; Panici 2007; Panici 2007a).

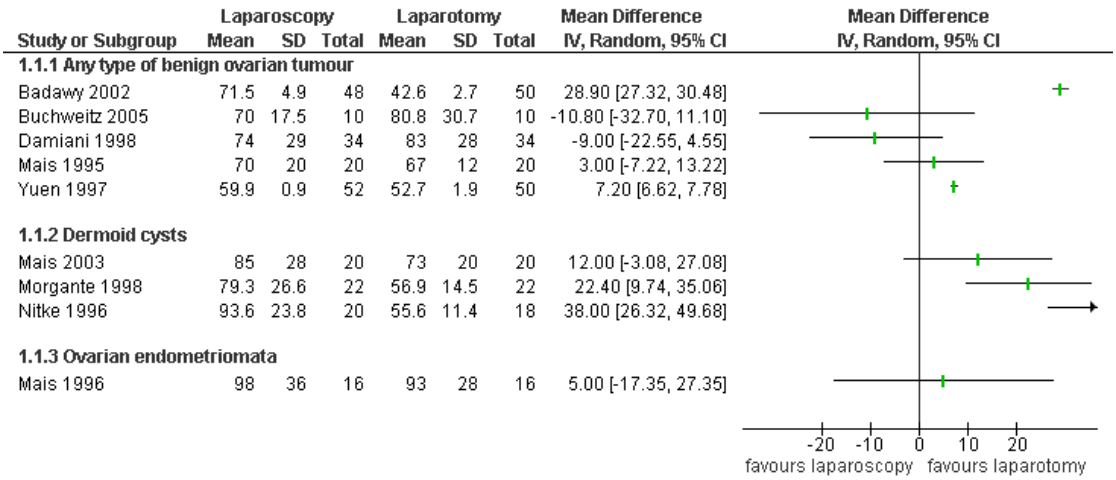
1 Laparoscopy versus laparotomy

1.1 *Surgical outcomes*

(a) *Duration of surgery*

(i) In the studies of any type of benign ovarian tumour (Badawy 2002; Buchweitz 2005; Damiani 1998; Mais 1995; Yuen 1997) there was considerable heterogeneity in the estimates and it was inappropriate to pool the data (Figure 3).

Figure 3. Forest plot of comparison: 1 Laparoscopy versus laparotomy, outcome: 1.1 Surgery - Duration of surgery (min).



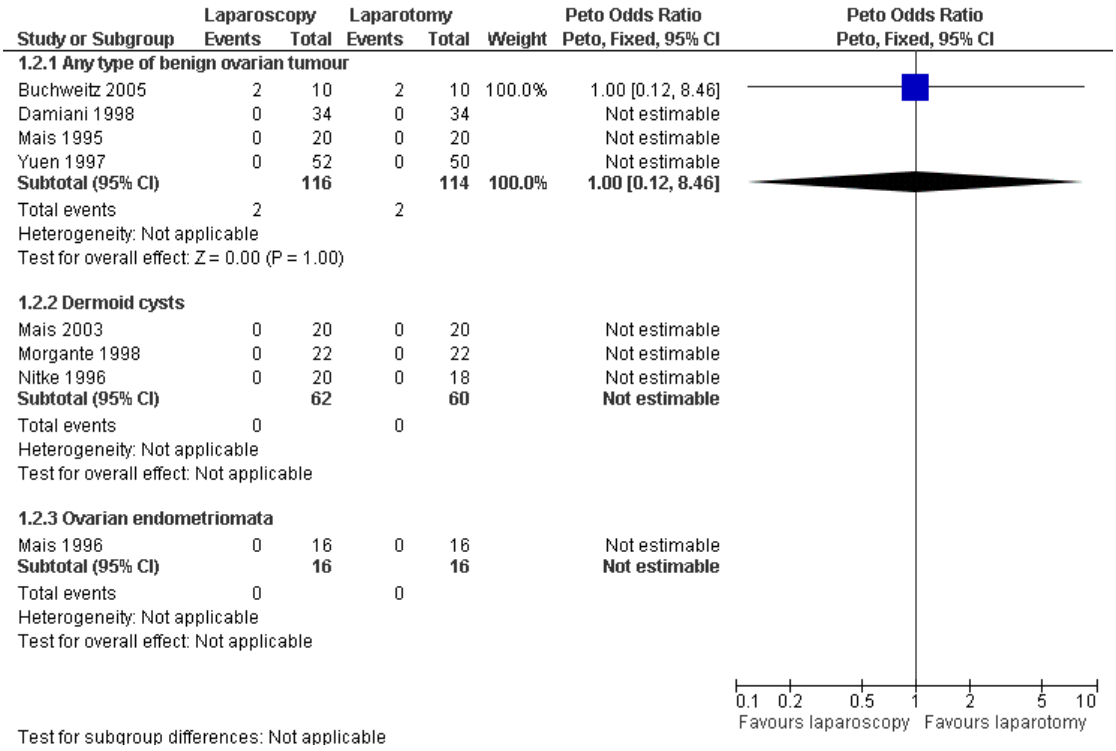
(ii) In the subgroup of dermoid cysts (Mais 2003; Morgante 1998; Nitke 1996) there was substantial inconsistency making it inappropriate to pool the data (Chi^2 = 7.67, P = 0.02, I^2 = 74%) (Figure 2).

(iii) In the subgroup of ovarian endometriomata (Mais 1996) there were no statistically significant differences between treatments arms for duration of surgery (Figure 2).

(b) *Diagnosis of malignant tumour*

In one study, the ovarian tumours in four women were found to be malignant after frozen section was performed during laparoscopy, with subsequent conversion to laparotomy (Buchweitz 2005). Badawy 2002 excluded from the analysis one patient in the laparoscopy group who had significant intracystic lesions which were identified during endocystic evaluation. Biopsy later showed serous cystadenoma with proliferation activity of the epithelial cells and nuclear abnormalities but with no infiltrative destructive growth (low malignant potential) (Badawy 2002) (Figure 4).

Figure 4. Forest plot of comparison: 1 Laparoscopy versus laparotomy, outcome: 1.2 Surgery - Change of diagnosis to malignant tumour.



1.2 Adverse events

(a) Surgical injury

Nine studies provided data for analysis of surgical injuries (Badawy 2002; Buchweitz 2005; Damiani 1998; Mais 1995; Mais 1996; Mais 2003; Morgante 1998; Nitke 1996; Yuen 1997).

(i) In the subgroup of any type of benign ovarian tumour (Badawy 2002; Buchweitz 2005; Damiani 1998; Mais 1995; Yuen 1997) no injuries to the ureter, small bowel, or colon were reported. One study (Yuen 1997) reported a single case of bladder injury in the laparotomy group and two studies (Badawy 2002; Yuen 1997) each reported a single case of vascular injury in the laparoscopy group.

(ii) In the subgroup of dermoid cysts (Morgante 1998; Nitke 1996) no surgical injuries were reported.

(iii) In the subgroup of ovarian endometriomata (Mais 1996) no surgical injuries were reported.

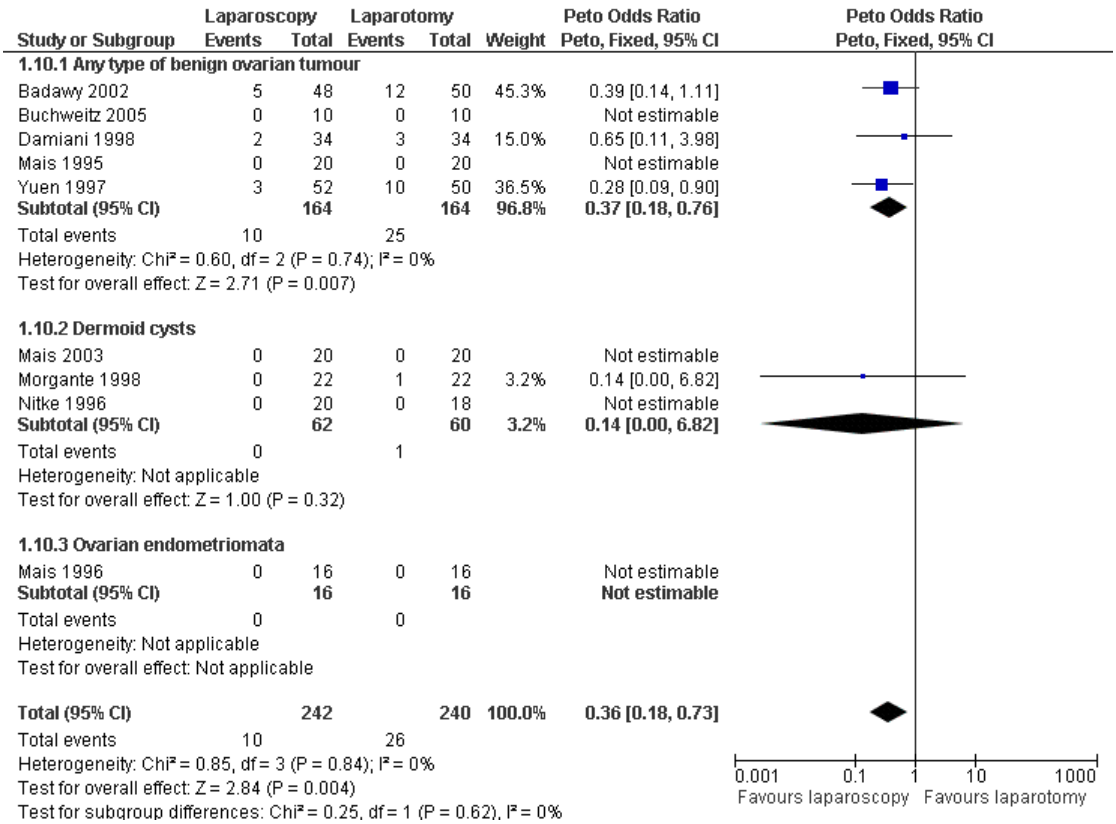
(b) *Postoperative complications*

Postoperative complications were infrequent in all of the included studies. Haematoma, chemical peritonitis, requirement for blood transfusion, and perioperative mortality were not reported in any of the nine included studies. However, febrile morbidity, incision

infection, urinary tract infection, urinary retention, thromboembolism, and intestinal obstruction were reported as uncommon postoperative complications.

(i) In the subgroup of any type of benign ovarian tumour in four studies there was a decreased risk of fever in the laparoscopy group (Peto OR 0.37, 95% CI 0.18 to 0.76) without heterogeneity and with I^2 = 0% (Buchweitz 2005; Damiani 1998; Mais 1995; Yuen 1997) (Figure 5).

Figure 5. Forest plot of comparison: 1 Laparoscopy versus laparotomy, outcome: 1.10 Post operative complications - Febrile morbidity.



There was a non-statistically significant difference between laparoscopy and laparotomy regarding the risk of incision infection (Peto OR 0.18, 95% CI 0.05 to 0.67) and urinary tract infection (Peto OR 0.3, 95% CI 0.08 to 1.16) (Badawy 2002; Yuen 1997) (Figure 6; Figure 7).

Figure 6. Forest plot of comparison: 1 Laparoscopy versus laparotomy, outcome: 1.11 Post operative complications - Incision infection.

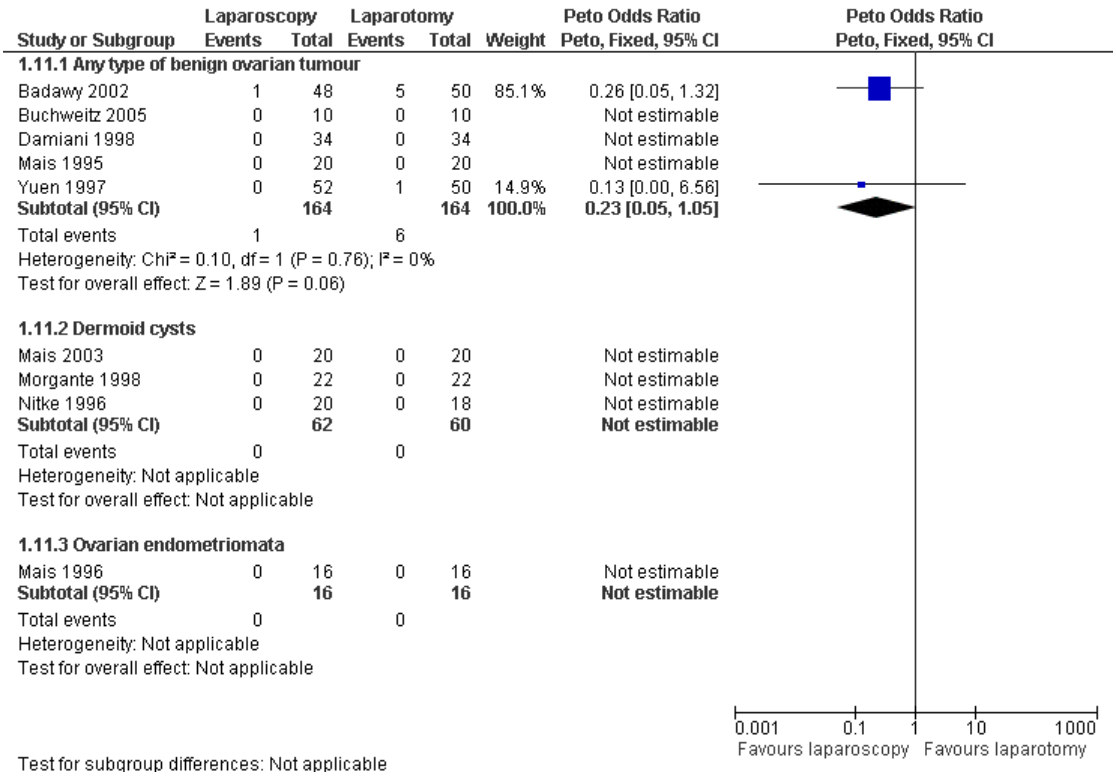
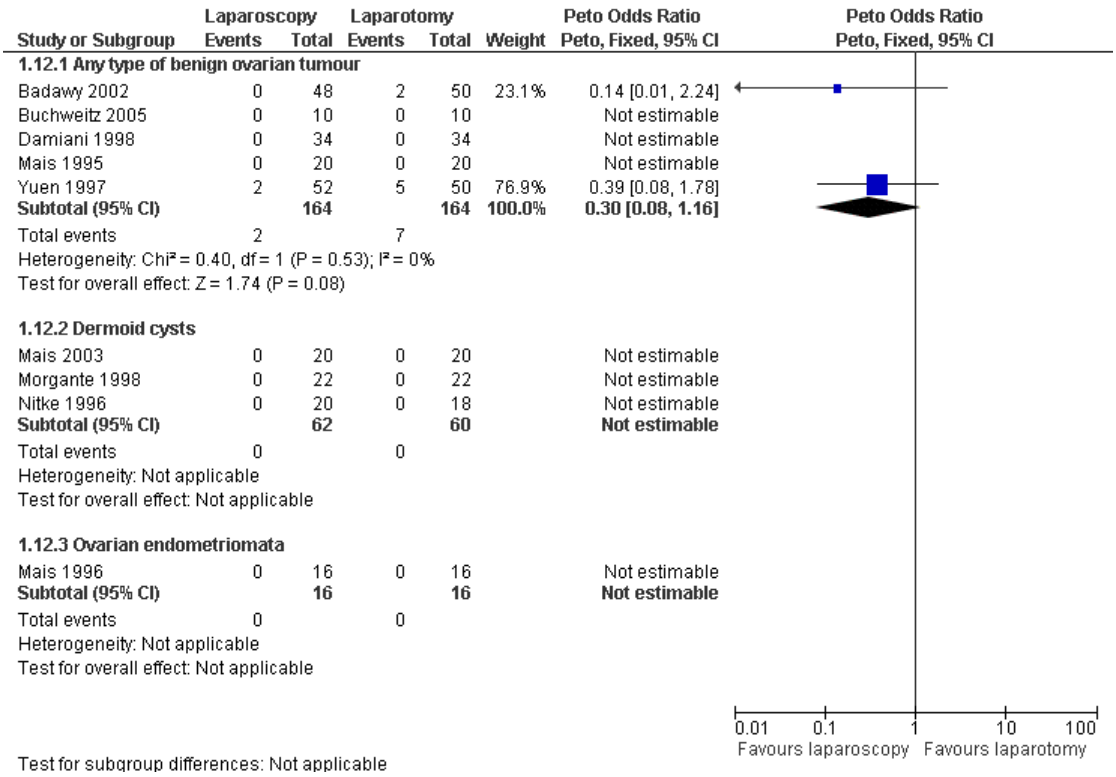


Figure 7. Forest plot of comparison: 1 Laparoscopy versus laparotomy, outcome: 1.12 Post operative complications - Urinary tract infection.



There was also a decreased risk of urinary retention in the laparoscopy group (Peto OR 0.12, 95% CI 0.02 to 0.89) in the one trial that reported this outcome (Yuen 1997) (Figure 8) and blood loss measured by haemoglobin levels (WMD -0.6, 95% CI -1.39 to 0.19) (Buchweitz 2005) (Figure 9).

Figure 8. Forest plot of comparison: 1 Laparoscopy versus laparotomy, outcome: 1.15 Urinary retention.

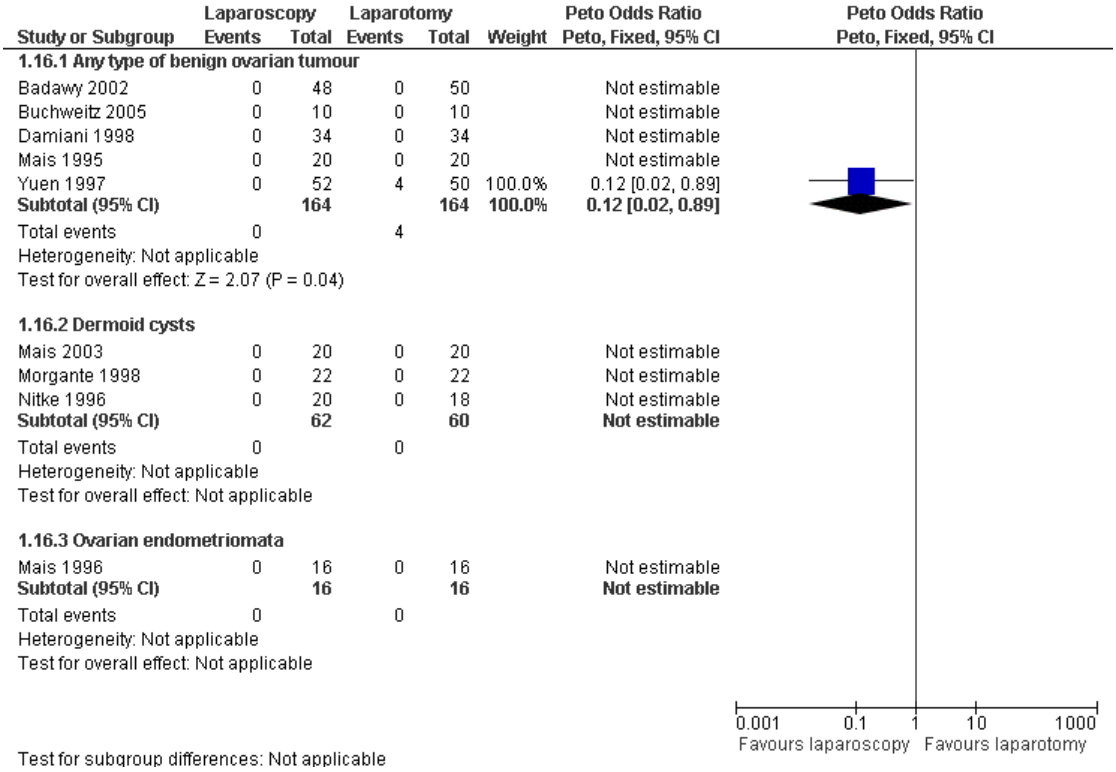
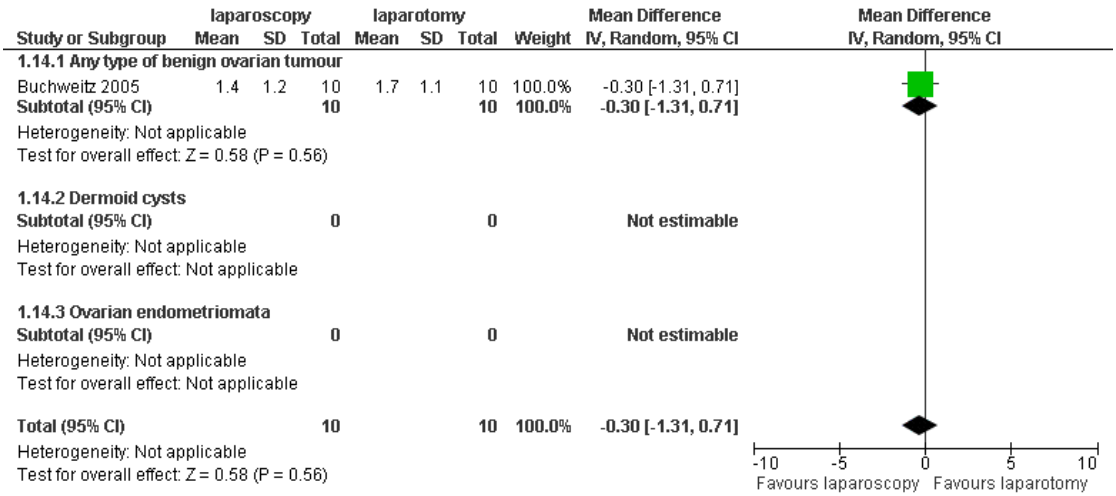


Figure 9. Forest plot of comparison: 1 Laparoscopy versus laparotomy, outcome: 1.18 Blood loss by haemoglobin levels.



(ii) In the dermoid cyst subgroup one study only reported a single case of fever in the laparotomy group (Morgante 1998) (Peto OR 0.14, 95% CI 0.00 to 6.82). There were no reported cases of incision infection or urinary tract infection in this study but this may be because all patients received prophylactic antibiotics.
(iii) In the subgroup of ovarian endometriomata (Mais 1996): no postoperative complications were reported.
(iv) The pooled estimate for fever, including the subgroups of any type of benign ovarian tumour and dermoid cysts, showed a reduced odds of febrile morbidity associated with laparoscopy (Peto OR 0.31, 95% CI 0.13 to 0.76) with no heterogeneity detected (Figure 5).

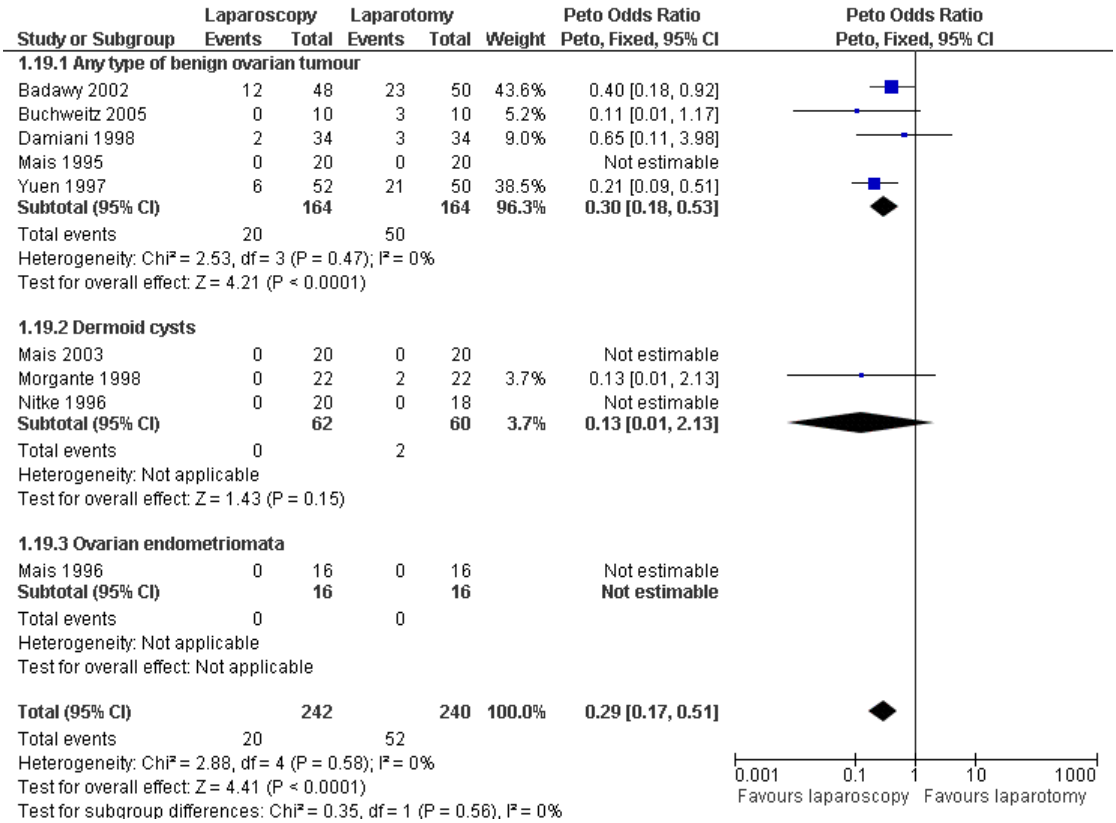
Blood loss assessed by haemoglobin levels

Blood loss was described in two studies (Badawy 2002;Buchweitz 2005). In one study (Buchweitz 2005) there was no statistically significant difference between laparoscopy and laparotomy in mean blood loss as measured by change in haemoglobin levels. In the other study (Badawy 2002) one woman in each group had a blood loss greater than 300 ml.

(c) Any adverse events of surgery (surgical injury, postoperative complications, and any other adverse events of surgery)

(i) In the subgroup for any type of benign ovarian tumour (Badawy 2002; Buchweitz 2005; Damiani 1998; Mais 1995; Yuen 1997) laparoscopic surgery was associated with an overall reduction in odds of any adverse event (Peto OR 0.3, 95% CI 0.18 to 0.52), without heterogeneity and with I^2 = 0% (Figure 10).

Figure 10. Forest plot of comparison: 1 Laparoscopy versus laparotomy, outcome: 1.19 Any adverse effect of surgery (incl surgical injury or post surgery complication or other).



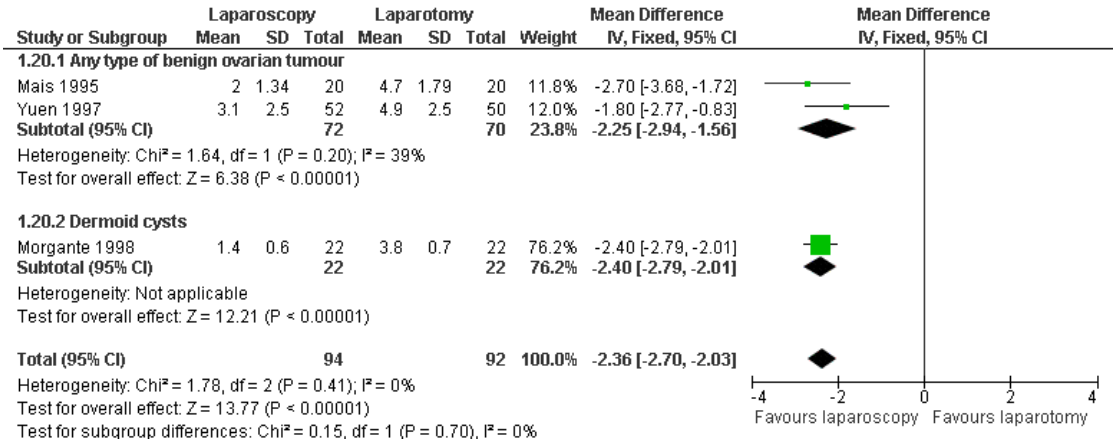
(ii) In the subgroup of dermoid cysts (Morgante 1998; Nitke 1996) there were no statistically significant difference between the two treatments arms regarding the total number of adverse events of surgery (Peto OR 0.14, 95% CI 0.00 to 6.82). Only one case with an adverse event was reported in one trial (Morgante 1998).
(iii) In the subgroup of ovarian endometriomata (Mais 1996) no surgical injuries and no postoperative complications were reported

in the only study analysing this subgroup.
(iv) The pooled estimate for total number of adverse events including the subgroups of any type of benign ovarian tumour or dermoid cysts showed a lower odds for any adverse event with laparoscopy compared to laparotomy (Peto OR 0.29, 95% CI 0.17 to 0.51) and no heterogeneity was detected (Figure 10).

1.3 *Short-term outcomes*

(a) *Postoperative pain (VAS scores, free of pain at 24 to 48 hrs aft her surgery, requirement for analgesia)*
The intensity of postoperative pain was assessed in three ways: visual analogue scores (VAS), the proportion of each group who were pain free 24 to 48 hours after surgery, and the overall requirement for postoperative analgesia in each group.
(i) In the group with any type of ovarian tumour (Mais 1995; Yuen 1997) VAS scores for pain favoured laparoscopy (WMD -2.25, 95% CI -2.94 to -1.56); in the subgroup of dermoid cysts laparoscopy was also associated with lower pain scores (WMD -2.40, 95% CI -2.79 to -2.01) (Morgante 1998).
The pooled estimate for VAS scores including these two groups favoured laparoscopy (WMD -2.36, 95% CI -2.7 to -2.03) and no heterogeneity was detected (Chi^2 = 1.78, P = 0.41, I^2 = 0%) (Figure 11).

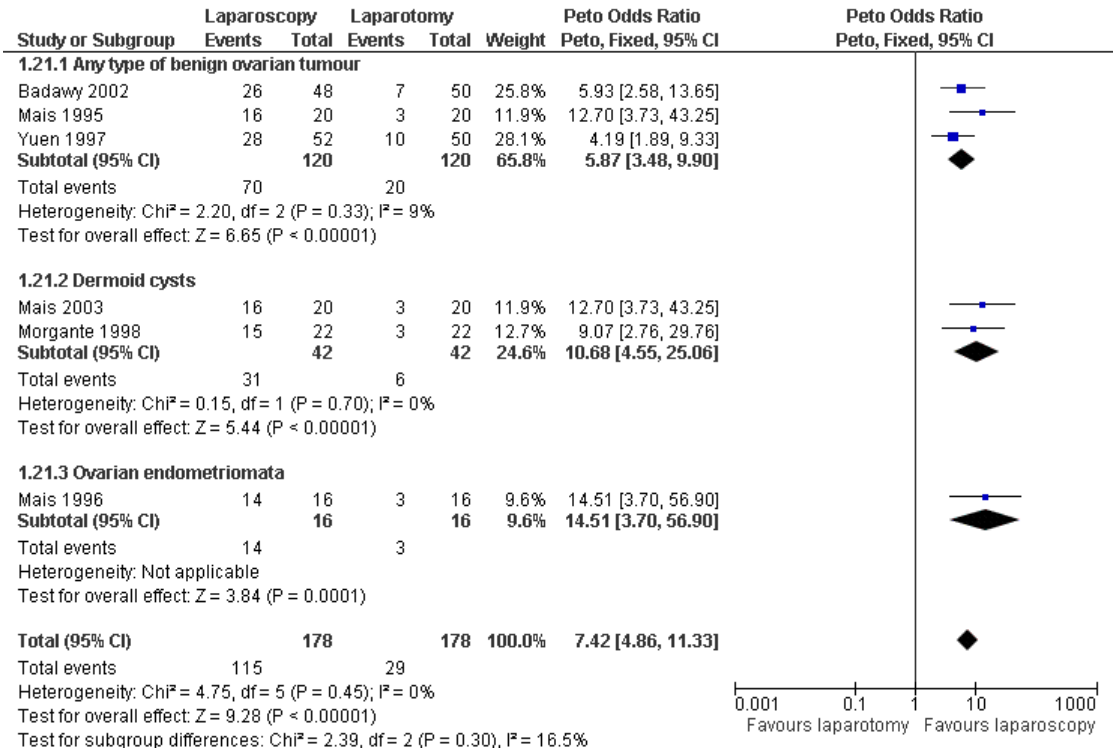
Figure 11. Forest plot of comparison: 1 Laparoscopy versus laparotomy, outcome: 1.20 Short term recovery - pain (VAS).



(ii) The odds for being free of pain were significantly greater for laparoscopy in each of the three subgroups: any type of benign ovarian tumour (Peto OR 5.87, 95% CI 3.48 to 9.9) (Badawy 2002; Mais 1995; Yuen 1997); dermoid cysts (Peto OR 3.7, CI 1.42 to 9.63) (Mais 2003; Morgante 1998); and ovarian endometriomata (Peto OR 14.51, 95% CI 3.7 to 56.9) (Mais 1996). The pooled estimate for all the subgroups was Peto OR 7.42 (95% CI 4.86 to 11.33) with no heterogeneity detected among the 356 participants included in these six studies (Chi^2 = 4.75, P = 0.45) (Figure 12).

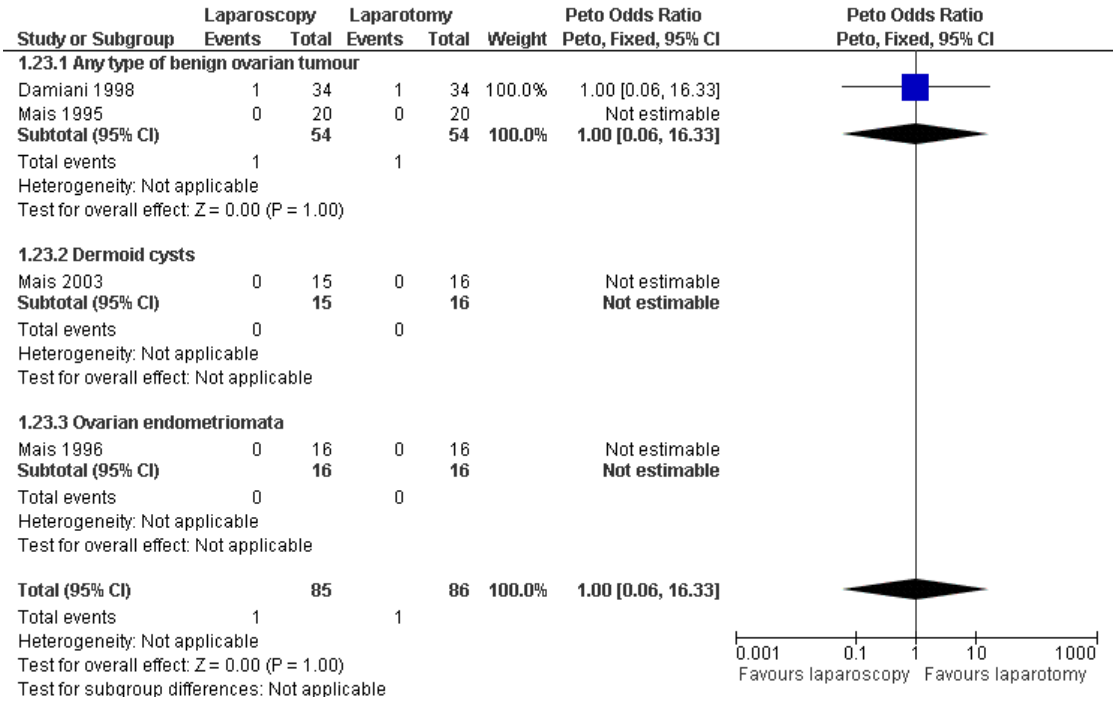
(iii) Two studies reported the mean postoperative consumption of analgesics (Badawy 2002; Buchweitz 2005; Yuen 1997). Only one study (Badawy 2002) found a statistically significant difference between the groups, favouring laparoscopy.

Figure 12. Forest plot of comparison: 1 Laparoscopy versus laparotomy, outcome: 1.21 Short term recovery - pain (pain free 24-48 hours post surgery).



(b) *Recurrence of ovarian tumours six to 12 months after surgery*
Recurrence was mentioned in only two studies with a combined total of 108 participants (Damiani 1998; Mais 1995). Two cases of recurrence (one in each group) occurred in the group with any type of benign ovarian tumour (Damiani 1998) (Figure 13).

Figure 13. Forest plot of comparison: 1 Laparoscopy versus laparotomy, outcome: 1.23 Recurrence at 6-12 months.

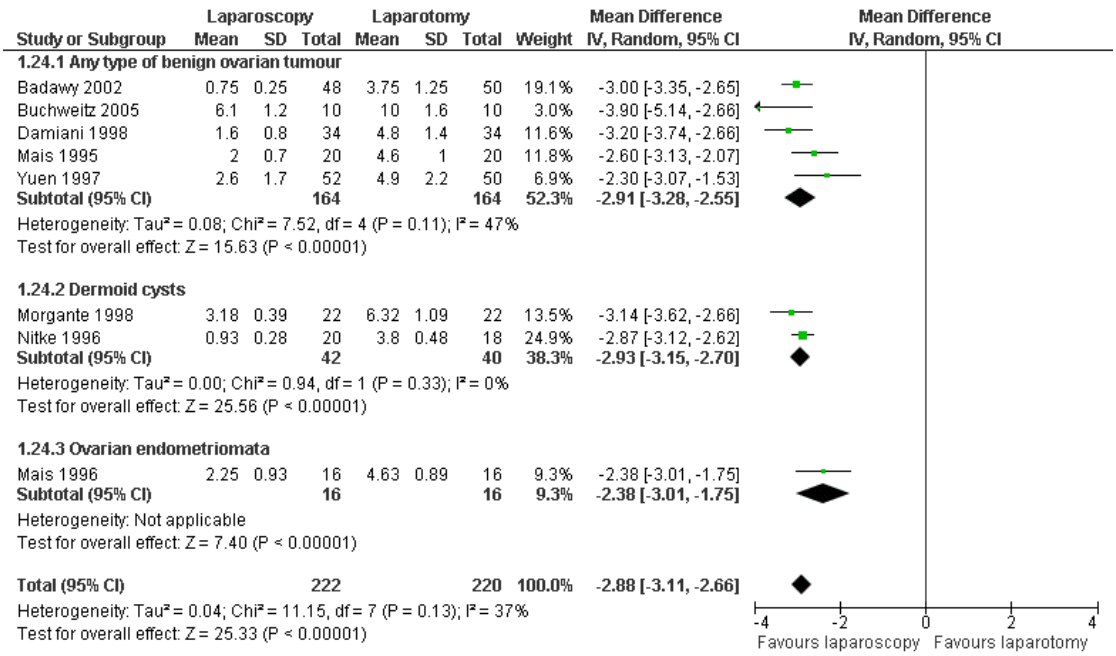


(c) *Length of hospital stay*

Laparoscopy was associated with a reduced number of days in hospital in all the subgroups: any type of benign ovarian tumours (Buchweitz 2005; Damiani 1998; Mais 1995; Yuen 1997) (WMD -2.90, 95% CI -3.28 to -2.52); dermoid cysts (Morgante 1998; Nitke 1996) (WMD -2.93, 95% CI -3.15 to -2.70); and endometriomata (WMD -2.38, 95% CI -3.01 to -1.75).

The pooled estimate for these three subgroups favoured laparoscopy (WMD -2.88, 95% CI -3.10 to -2.65) with heterogeneity (Chi^2 = 11.63, P = 0.11) and inconsistency detected (I^2 = 40%) (Figure 14).

Figure 14. Forest plot of comparison: 1 Laparoscopy versus laparotomy, outcome: 1.24 Length of hospital stay (days).



(d) *Readmission rates*

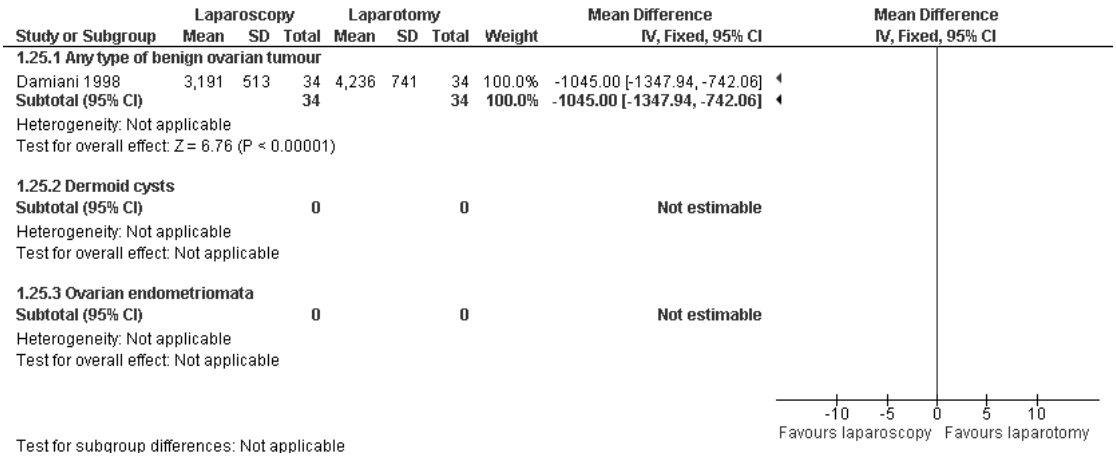
No case of readmission was reported in any of the nine included studies.

1.4. Economic measures

(a) Direct costs of surgical procedures

Only one study of 68 women, undertaken in Rome, Italy, described the cost of interventions (Damiani 1998). Using a cost analysis from a social perspective, the total costs of laparoscopy 1993 USD were significantly lower for laparoscopy when compared to laparotomy (WMD USD1045, 95% CI -1348 to -742) (Figure 15).

Figure 15. Forest plot of comparison: 1 Laparoscopy versus laparotomy, outcome: 1.25 Economic outcomes - total cost (US$1000 1993).



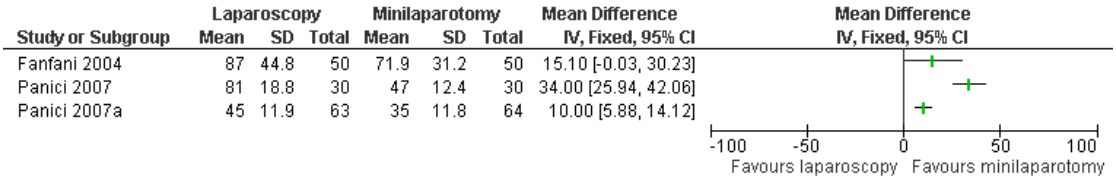
2 Laparoscopy versus minilaparotomy

2.1 *Surgical outcomes*

(a) Duration of surgery

Three trials (Fanfani 2004; Panici 2007; Panici 2007a) reported the outcome of operative time but both the studies by Panici reported medians as the data were skewed. The substantial heterogeneity and inconsistency in these results made it inappropriate to pool these data (Chi^2 = 55.56, P < 0.001) with substantial inconsistency (I^2 = 96.4%) (Figure 16).

Figure 16. Forest plot of comparison: 2 Laparoscopy versus minilaparotomy, outcome: 2.1 Surgery - duration of surgery.

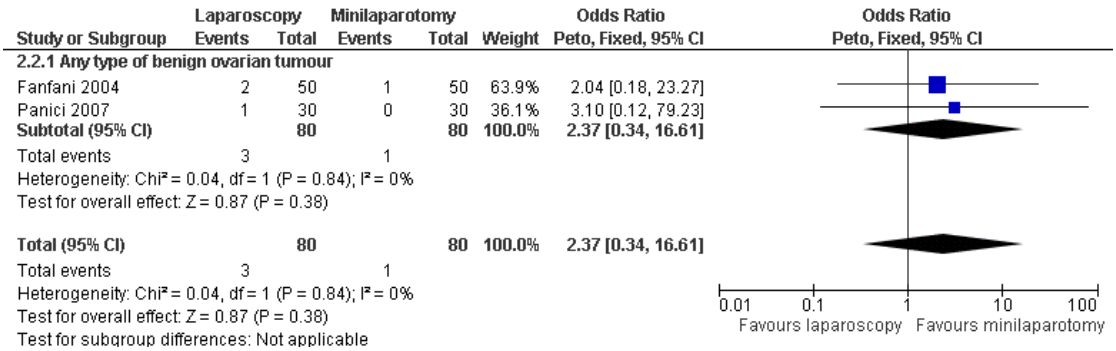


(b) Diagnosis of malignant tumour

One study reported inadvertent treatment by endoscopic surgery for tumours found to be malignant on frozen section analysis during the surgery (Panici 2007). Conversion was carried out through an increase in the transverse cutaneous incision. Fanfani had three cases of unexpected borderline ovarian tumour after intensive surgical staging by laparoscopy (Fanfani 2004).

These studies did not report a complete five-year follow up. We found no statistically significant difference between the two groups (Peto OR 0.95, 95% CI 0.19 to 4.7) and no heterogeneity was detected (Figure 17).

Figure 17. Forest plot of comparison: 2 Laparoscopy versus minilaparotomy, outcome: 2.2 Surgery - change of diagnosis to malignant tumour.



2. 2 *Adverse events*

(a) Surgical injury

No injuries to the ureter, small bowel, colon, bladder or vascular tissue were reported In the three studies (Fanfani 2004; Panici 2007; Panici 2007a).

(b) Postoperative complications

Blood transfusion, haematoma, thromboembolism, chemical peritonitis, intestinal obstruction, and perioperative mortality were not reported in any of the three included studies (Fanfani 2004; Panici 2007, Panici 2007a).

One trial (Panici 2007) reported median pre- and postoperative heamoglobin levels in each group and stated the the difference between groups was not statitically significant.

There was no statistically significant difference between laparoscopy and laparotomy for febrile morbidity in two studies (Fanfani 2004; Panici 2007a) (Peto OR 0.16, 95% CI 0.02 to 1.38) (Figure 18), nor for risk of incision infection (Peto OR 0.14, 95% CI 0.01 to 2.73) in the one trial that reported this outcome (Panici 2007a) (Figure 19).

Figure 18. Forest plot of comparison: 2 Laparoscopy versus minilaparotomy, outcome: 2.10 Post operative complications - Febrile morbidity.

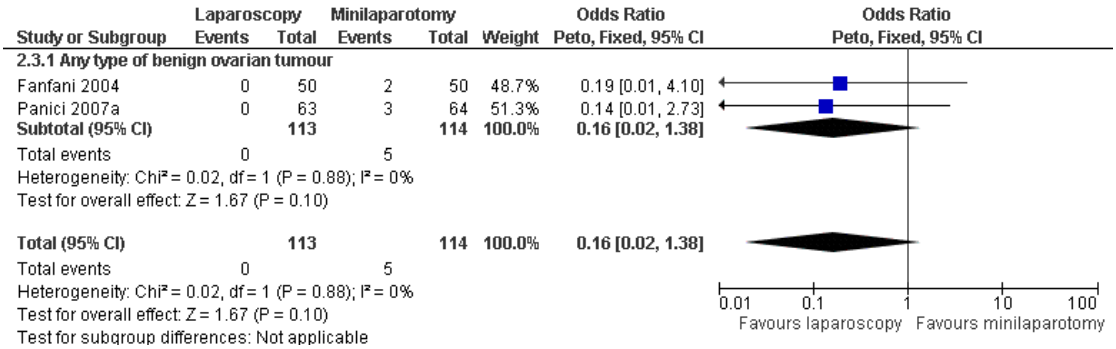
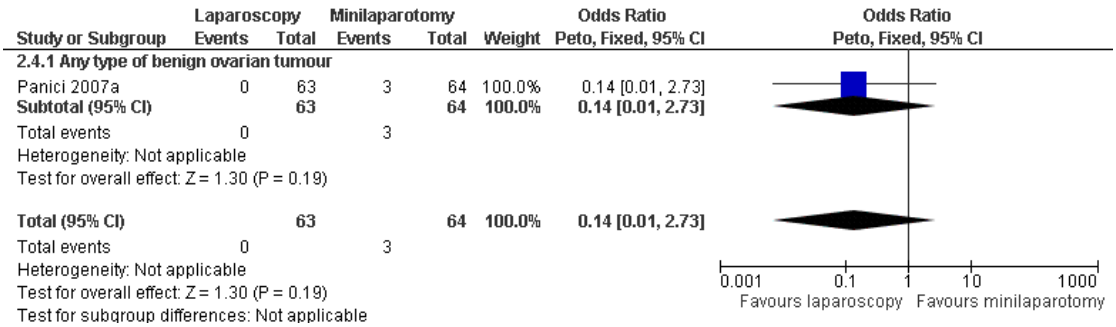


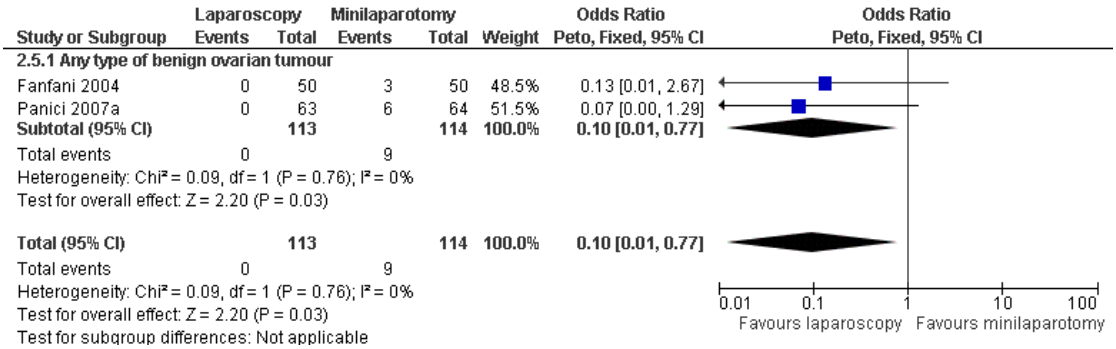
Figure 19. Forest plot of comparison: 2 Laparoscopy versus minilaparotomy, outcome: 2.11 Post operative complications - Incison infection.



(c) *Any adverse events of surgery (surgical injury, postoperative complications, or any other adverse events of surgery)*

The pooled estimate for odds of any adverse event favoured laparoscopy (Peto OR 0.10, 95% CI 0.01 to 0.77) with no heterogeneity detected (Fanfani 2004; Panici 2007a) (Figure 20).

Figure 20. Forest plot of comparison: 2 Laparoscopy versus minilaparotomy, outcome: 2.19 Any adverse effect of surgery (incl surgical injury or post surgery complication or other).

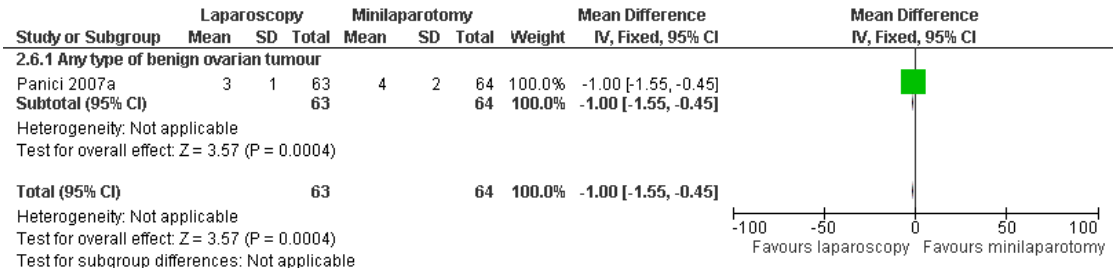


2.3 Short-term outcomes

(a) Postoperative pain (VAS scores, free of pain at 24 to 48 hrs after surgery, requirements for analgesia)

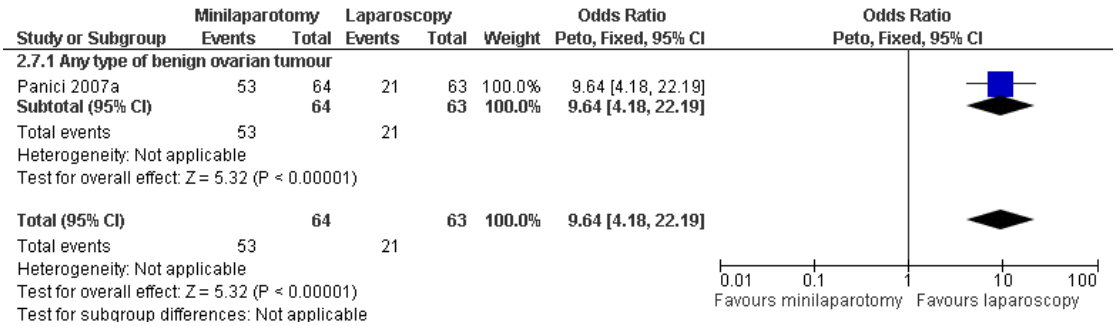
(i) VAS scores for pain were reported in one study (Panici 2007a) which found no statistically significant difference between laparoscopy and minilaparotomy (WMD -1.00, 95% CI -1.55 to -0.45) (Figure 21).

Figure 21. Forest plot of comparison: 2 Laparoscopy versus minilaparotomy, outcome: 2.20 Short term recovery - pain (VAS).



The odds for being free of pain were significantly greater for the laparoscopy group (Peto OR 10.85, 95% CI 4.62 to 25.49) in the one trial that reported this outcome (Panici 2007a) (Figure 22).

Figure 22. Forest plot of comparison: 2 Laparoscopy versus minilaparotomy, outcome: 2.21 Short term recovery - pain (pain free 24-48 hours post surgery).

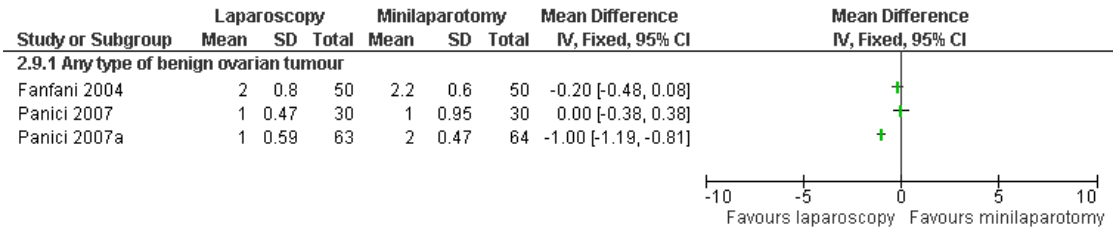


Only one study reported on requirements for analgesia (Fanfani 2004) and found no difference between laparoscopy and laparotomy.

(b) Length of hospital stay

(i) Mean length of stay in hospital ranged between 1 and 2.2 days in the three studies. There was a very high level of heterogenieity and inconsistency (I^2 = 94%) which made it inappropriate to pool these data (Figure 23).

Figure 23. Forest plot of comparison: 2 Laparoscopy versus minilaparotomy, outcome: 2.24 Lenght of hospital stay (days).



SENSITIVITY ANALYSES

Sensitivity analysis was performed to test the robustness of the findings (Egger 2001) in the comparison between laparoscopy and laparotomy. We found that the pooled estimate of treatment effect was similar for studies with adequate and unclear allocation concealment for the following outcomes: length of hospital stay, postoperative pain, and total number of complications.

In the comparison between laparoscopy and minilaparotomy no sensitivity analysis was undertaken due to the small number of studies (Fanfani 2004; Panici 2007; Panici 2007a).

DISCUSSION

This systematic review update has evaluated the benefits, harms, and costs of laparoscopy versus laparotomy for the treatment of benign ovarian tumours. The results of 12 randomised controlled trials (N = 769 women) showed that laparoscopic surgery was associated with significantly less postoperative pain, fewer adverse events of surgery (surgical injury or postoperative complications), and a shorter length of stay in hospital.

The results of this review give no clear information about the operating time for the two procedures. Operating time was very variable, and this was likely due to clinical heterogeneity in the populations included in the trials. Variations in the age and body mass index (BMI) of the women; the number, size, and location (unilateral or bilateral) of the ovarian tumours; and the presence of adhesions due to previous abdominal surgery are all factors likely to influence the duration of surgery. Furthermore, the experience of the surgeon, the requirement to wait for the results of an intraoperative frozen section, and the need to perform concomitant procedures such as oophorectomy also influence the operating time. For example, in one study (Badawy 2002) only 12% of the laparoscopy group underwent oophorectomy whereas 30% in the laparotomy group had this procedure. Many of the studies did not clearly describe the factors which may have accounted for differences in the duration of surgery.

In this systematic review, the quality of allocation concealment was graded as adequate (A) in seven studies (Badawy 2002; Mais 1995; Mais 1996; Mais 2003; Panici 2007; Panici 2007a; Yuen 1997) and five studies were graded as unclear (B) (Buchweitz 2005; Damiani 1998; Fanfani 2004; Morgante 1998; Nitke 1996) (Table 1). The adequacy of the allocation concealment did not affect the outcomes of duration of surgery, postoperative pain, total number of complications, or length of hospital stay.

Although duration of hospital stay was significantly reduced, by nearly three days, after laparoscopy when compared to laparotomy significant heterogeneity was detected. This was likely to be due to differences in the patient populations in the trials - factors such as age and previous surgery may have an influence on length of stay and it would appear that there were differences between hospitals in their policy of postoperative stay. The data from individual trials reported longer hospital stay after laparotomy than would be expected and this suggests that discharge after laparotomy in some trials may have relied more on tradition than on clinical demands.

Cost is another factor that should be taken into consideration when choosing the surgical approach (Barnes 1982; Krahn 1999). The costs of laparoscopy compared to laparotomy were reported by one trial with limited sample size, with only 34 patients in each group (Damiani 1998). This trial, undertaken in Rome, Italy, performed a simple cost analysis from a social perspective. The findings were that the costs of laparoscopy were USD 1000 less per patient when compared to laparotomy (1993 costs) due to the longer hospital stay and the increased requirement for nursing care, medical care, laboratory tests, analgesics, antibiotics, and intravenous infusions in the laparotomy group. However, these data were published many years ago and it is likely that some factors which have an impact on costs of these procedures have changed in the intervening period.

Overall frequency of inadvertent rupture of the cysts during operation was larger in the laparoscopy group that in the minilaparotomy group (Fanfani 2004; Panici 2007). In patients with unrecognised neoplasms, laparoscopy may be associated with an increase in the rate of intraperitoneal spillage with consequent

dissemination of tumour cells and advances in disease stage (Gal 1995). Minilaparotomy has been proposed for the surgical treatment of apparently benign gynecologic conditions as an alternative minimally invasive procedure, in appropriate settings and where patients make an informed choice after careful counselling (Panici 2007).

Since inappropriate treatment of malignant tumours by laparoscopy is associated with risks of tumoral spread in the abdominal cavity, rupture of a malignant ovarian tumour should be avoided during surgery (Volz 1999; Vergote 2004). Only five of the 385 women in this review who were randomised to laparoscopy for treatment of a benign ovarian tumour were subsequently found to have a malignant tumour. In all cases the procedure was converted to laparotomy and successfully completed. Thus, we would suggest that careful preoperative examination, as undertaken in these studies, decreases the risk of a malignancy being identified during a laparoscopy procedure. The standards for management of benign ovarian tumour by laparoscopy include:

(1) careful examination of the external surface of the tumour and sampling of the peritoneal cavity;

(2) avoidance of any tumoral rupture;

(3) protection of the ovarian tumour with an endoscopic bag before removal;

(4) avoidance of any contact between the tumour and the abdominal wall;

(5) frozen-section intraoperative histologic examination; and

(6) conversion to laparotomy when there is a suspicion that the ovarian tumour could be borderline or malignant (Canis 2000; Guglielmina 1997; Mettler 2001a; Nissole 1994).

The diagnostic accuracy of frozen section analysis is high for malignant and benign ovarian tumours, but accuracy is poor in the case of borderline ovarian tumours (Medeiros 2005). However, the incidence of borderline ovarian tumours is relatively low, around 6% compared with benign (71%) and malignant (23%) ovarian tumours (Medeiros 2005).

It should be noted that the follow-up periods in the trials included in this review are generally short. Seven studies had follow periods of three months or less (Buchweitz 2005; Fanfani 2004; Morgante 1998; Nitke 1996; Panici 2007; Panici 2007a; Yuen 1997), two studies followed women for six months (Mais 1995; Mais 1996), two for 12 months (Badawy 2002; Damiani 1998), and only one trial (Mais 2003) followed women (31 of the 40 women randomised) for five years. Consequently we are unable to comment on the long-term benefits or harms of laparoscopy compared to laparotomy for benign ovarian tumours.

This review is limited in its ability to guide surgical practice because of the small number of women randomised in the 12 studies. The small number of randomised studies may be the result of surgeons' resistance to accept this type of study design since only 39% of all treatments validated in surgery are from randomised studies (McLeod 1999; Sauerland 1999).

AUTHORS' CONCLUSIONS

Implications for practice

In this update we have found evidence, based on 12 studies with 769 women, that laparoscopic surgery for women with benign ovarian tumours was associated with reduced pain, fewer adverse events, and reduced time in hospital. In clinical settings where surgical expertise and equipment are available and affordable, and adequate preoperative evaluation is undertaken to exclude malignant tumours, laparoscopic surgery can be recommended. The decision about which surgical approach to choose should follow careful preoperative evaluation and may take into consideration the setting, experience of the surgeon, and the preference of the patient.

Implications for research

There are very few trials in this field. Further trials should carefully address the methods of randomisation as blinding is impractical in surgical studies. Future research should include specific patient subgroups (childbearing and non-childbearing age ranges) and include additional outcomes such as surgical efficacy, tumour recurrence, patient satisfaction, quality of life, and costs, with a longer follow-up period of at least five years. This follow-up period may provide more information on recurrence and the potentially harmful effects of laparoscopy in patients who have an ovarian malignancy diagnosed during the procedure. For evaluation of costs, it would be helpful to report costs separately for the preoperative, intraoperative, and postoperative periods. Comparison of cost effectiveness or cost utility of these procedures would provide further useful information.

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* *Indicates the major publication for the study*

CHARACTERISTICS OF STUDIES

Characteristics of included studies *[ordered by study ID]*

Badawy 2002

Methods	Randomisation: randomly allocated to either treatment group using computerised random tables (personal communication from author) Number of women randomised: 100 Number of women analysed: 98 Number of withdrawals: 2 women in laparoscopic group were excluded after randomisation because one had diagnosis of suspected malignancy and another was excluded from the analysis because patient had thick adhesion Centre: one. The study was carried out between April 1997 and July 2001 in Department of Gynaecology at Mansoura University Hospital in Egypt
Participants	Inclusion: premenopausal women aged < 40 years with ovarian tumour(s) which did not meet sonographic criteria for malignancy. Tumours to be at least 3 cm and less than 15 cm in diameter, and serum CA 125 levels less than 35 U/ml. Colour doppler not mentioned Exclusion: preoperative or interoperative diagnosis of ovarian cancer, and no pathology associated with an indication for hysterectomy Age (years): 32.1 (SD 5.3) in the laparoscopy group, 34.6 (SD 6.2) in the laparotomy group Average cysts dimensions two groups were 12.4 cm (SD 2.3 cm) for laparoscopy and 13. 6 cm (SD 1.8) for laparotomy. The histology of the surgical specimens consisted of 43 endometrioma, 27 dermoid cysts, 24 cystadenoma, 4 paraovarian cysts. 88% (42/48) of the laparoscopy group had cystectomy only and 70% (35/50) of the laparotomy group has cystectomy only, a statistically significant difference
Interventions	Laparoscopy for ovarian cystectomy: 4 trocar technique; enucleation of cysts by traction and countertraction and also fenestration and cyst drainage were performed; the ovary was sutured with Vicryl 4/0 endosuture; bipolar haemostasis; saline solutions were used to lavage the pelvic cavity Laparotomy for ovarian cystectomy: Pfannenstiel incision. A standardised anaesthesia protocol was followed for all the procedures Cystectomy was performed in 87.5% cases in laparoscopy group and 70% in laparotomy group. Frozen section was not mentioned in the trial report.
Outcomes	Operative time, intraoperative blood loss, complications, conversion to laparotomy, postoperative complications, analgesic requirements, hospital stay
Intention to treat analysis	Not mentioned but 98% of women randomised were included in the analysis
Power calculation described	No

Badawy 2002 (*Continued*)

Notes	Follow up: 10, 30, and 365 days after surgery evaluated clinically, and asked to complete a standard questionnaire concerning return to their normal lifestyle or any complications and improvement in their symptoms Conversions to laparotomy: 2 cases.

Risk of bias

Bias	Authors' judgement	Support for judgement
Allocation concealment?	Low risk	A Personal communication from Dr Badawy confirmed that participants in this study were randomly allocated to either treatment group using computerised random tables. Randomisation was done on admission of the patients to the hospital by the principal investigator. However, it was not described in the published trial
Blinding? All outcomes	High risk	
Incomplete outcome data addressed? All outcomes	High risk	2 women in laparoscopy group were excluded after randomisation because one had diagnosis of suspected malignancy and the other was excluded from the analysis because of a thick adhesion
Free of selective reporting?	Low risk	

Buchweitz 2005

Methods	Randomisation: method not stated Blinding: not mentioned Number of women randomised: 23 Number of women analysed:20 Number of withdrawals: 1 woman in each group was excluded after randomisation because the diagnosis changed to malignancy and another was excluded from the analysis because her IL-6 level on admission was very high (an extreme outlier) Centre: one; the study was carried out between January 2001 and August 2002 in Departament of Gynecology at a university hospital in Germany
Participants	Inclusion: consecutive patients older than 60 years with ovarian tumour(s), which did not meet sonographic criteria for malignancy. Tumours to be at least 3 cm and less than 8 cm in diameter, and serum CA 125 levels less than 35 U/ml. Colour doppler not mentioned Exclusion: preoperative or interoperative diagnosis of ovarian cancer, and treatment with 'high doses' of corticoids

	Age (years): 66.5 (SD 5.8) in the laparoscopy group, 68.8 (SD 6.9) in the laparotomy group Average cysts dimensions: two groups were 4.8 cm (SD 1.3) for laparoscopy and 4.0 cm (SD 1.0) for laparotomy. The anatomicopathologic study of surgical specimens identified 11 adenofibroma, 4 serous cystadenoma, 1 mucous cystadenoma, and 4 functional cysts with no differences between the 2 groups
Interventions	Laparoscopy for oophorectomy: 3 trocar technique, the ovarian tumours were placed in a disposable plastic bag and removed via the suprapubic port. All adnexal masses were sent for immediate frozen section and If malignancy was detected the procedure was converted to laparotomy Laparotomy for ovarian cystectomy: Pfannenstiel incision. A standardised anaesthesia protocol was followed for all the procedures Bilateral oophorectomy was performed in 50% cases in laparotomy group and 40% in laparoscopy group Frozen section was mentioned in the trial.
Outcomes	Interleukin 6, C reactive protein levels (objective stress response), operative time, estimated blood loss by haemoglobin drop, postoperative pain duration and requirements for analgesia, hospital stay, convalescence
Intention to treat analysis	No
Power calculation described	It was calculated that 10 women would be required in each group in order to have 90% power, at the 0.05 level of significance, to detect a 30% reduction in serum interleukin-6 (IL-6) levels from the peak
Notes	Follow up was mentioned (3 months).

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Allocation concealment?	Unclear risk	B
Blinding? All outcomes	High risk	No
Incomplete outcome data addressed? All outcomes	High risk	23 women were randomised; 2 women were found to have malignant tumours intraoperatively (1 from each group) and 1 woman was found to have a very high IL-6 level (at some point) so 3 women were excluded from the analysis

Free of other bias?	Unclear risk	3 patients excluded from analysis postrandomisation.

Damiani 1998

Methods	Randomisation: method not stated Blinding: not mentioned Centre: one Number of women randomised: 68 Number of women analysed: 68 The study was carried out between January 1992 and November 1994 in the Endocrinological Gynaecology Department of Catholic University S Cuore in Rome, Italy
Participants	Inclusion: women of reproductive age with ovarian cysts which had persisted for at least 3 months or were noted to have increasing volume on consecutive ultrasound. Cyst diameter less than 10cm, liquid content, thin walls without septa, unilocular cysts without irregular solid parts inside the cyst. CA 125 levels and colour Doppler not mentioned Exclusion: previous pelvic surgical interventions. Age (years): 28.6 (SD 6.2; range 16-38) in the laparoscopy group and 27.3 (SD 6.2; range 18-39) in the laparotomy group Average cyst dimensions: 6.6 cm (SD 1.6; range 3-9 cm) for laparoscopy and 6.6 cm (SD 1.7; range 4-10 cm) for laparotomy. All laparoscopy surgery was performed by a team which had several years experience. Histological findings in laparoscopy group (number of cases): serosal (3); mucinous (4) ; endometriotic (8); functional (12); paraovarian (2); dermoid (5). Histological findings in laparotomy group (number of cases): serosal (5); mucinous (2); endometriotic (10); functional (11); paraovarian (3); dermoid (3)
Interventions	Laparoscopy for ovarian cystectomy: 3 trocar technique; enucleation of cysts by traction and countertraction and also fenestration and cyst drainage were performed; excised tissue were placed in a disposable plastic bag, the ovary was not sutured; bipolar haemostasis; saline solutions were used to lavage the pelvic cavity; all patients received intraoperative prophylactic antibiotic therapy. Laparotomy for ovarian cystectomy: Pfannenstiel incision; all cases ovarian was sutured in two layers; used 0 polyglactin for internal layer and 6-0 polyglactin suture for the external surface; all patients received intraoperative prophylactic antibiotic therapy. Anaesthesia protocol not described. Frozen section was not mentioned in the trial.
Outcomes	Costs of interventions in USD (direct, indirect), operation time, length of stay
Intention to treat analysis	Not stated, but all women appeared to be included in the analysis
Power calculation described	No

Damiani 1998 (*Continued*)

Notes	Follow up for 12 months with one recurrence in each group (one endometrioma and one mucinous cystadenoma). Number of women excluded, number of women withdrawn and lost to follow up not stated. Conversions to laparotomy: unknown

Risk of bias

Bias	Authors' judgement	Support for judgement
Allocation concealment?	Unclear risk	B
Blinding? All outcomes	High risk	
Incomplete outcome data addressed? All outcomes	Unclear risk	No information given.

Fanfani 2004

Methods	Randomisation: centralised and computer based, performed on the day of surgery Blinding: none Centre: one Number of women randomised:100 Number of women analysed:100 This trial was carried out between January and August 2003 at the Department of Gynecologic Oncology, University of the Sacred Heart, Rome, Italy
Participants	100 consecutive women were randomised. Inclusion: adnexal mass, presumed to be benign, requiring surgical treatment Exclusion: BMI greater than 32 kg/m^2, cyst(s) greater than 12 cm in diameter, postmenopausal women with serum CA 125 level greater than 35 IU/ml, requirement for hysterectomy at same time All women underwent standard preoperative assessment including serum markers, an ultrasound scan with colour Doppler evaluation to assess the size and characteristics of the lesions Age (years): 36.3 (SD 12.1) in the laparoscopy group and 37.5 (SD 13.4) in the minilaparotomy group Histopathological diagnosis: endometriotic cysts (n=33), benign ovarian and parasalpingoserous cysts (n=32), dermoid cysts (n=18), benign mucinous cysts (n=16). Only accounts for 99/100
Interventions	All surgical procedures, both laparoscopy and minilaparotomy were performed by one senior surgeon and one fellow. Intraoperative frozen section performed if required Bowel preparation and antithrombotic prophylaxis always performed and second generation cephalosporin administered to all women. General anaesthesia given to all women. Decision on cystectomy versus oophorectomy made based on operative findings and age of patient Laparoscopy: 4 trocar technique, 10 mm transluminal port for the laparoscope and three 5mm ports right, left, and sovrapubic. Enucleation by traction and counter traction and fenestration and cyst drainage were performed. The ovary was not sutured Minilaparotomy: a 4-9 cm transverse incision 1-2 cm below the pubic hair line, end of incision sutured to avoid accidental lengthening. Vertical incision used where patient had previous longitudinal scar. Local anaesthetic also given if operating time exceeded 2 hours Frozen section was mentioned in the trial.

Fanfani 2004 (*Continued*)

Outcomes	Operative time, intraoperative blood loss, complications, conversion to laparotomy, postoperative complications, change of diagnosis to malignant
Intention to treat analysis	Not mentioned but 99 of the 100 women randomised were accounted for in the analysis
Power calculation described	Power stated to be >80% but no details given.
Notes	Follow-up period of 30 days.

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Allocation concealment?	Low risk	A
Blinding? All outcomes	High risk	
Free of other bias?	Low risk	consecutive patients.

Mais 1995

Methods	Randomisation: using random numbers table, with allocation in sealed envelopes. The envelope seal was broken in the anaesthetic room before surgery Blinding: no Centre: one Number of women randomised: 40 Number of women analysed: 40 The study was carried out between January 1993 to June 1994 in the Department of Obstetrics and Gynecology of the University of Cagliari, Cagliari, Italy
Participants	Inclusion: premenopausal (18-40 years) women with ovarian tumours, assumed to be benign, which had persisted for more than 6 months, diameter less than 10 cm. All women were submitted to a preliminary workup, including ultrasonography. CA 125 levels and colour Doppler not mentioned Exclusion: women unfit for general anaesthesia, those with systemic infections, and those unable to give informed consent Age (years): 30.4 (SD 6.1) in the laparoscopy group and 29.8 (SD 6.4) in the laparotomy group Average cyst dimensions: in two groups were 6.7 cm (SD 1.6) for laparoscopy and 6.3 cm (SD 1.7) for laparotomy Histological findings in laparoscopy (number of cases): serous paratubal (8); serous ovarian (10); serous cystadenoma (0); mucinous cystadenoma (2) Histological findings in laparotomy (number of cases): serous paratubal (6); serous ovarian (12); serous cystadenoma (1); mucinous cystadenoma (1) All surgical procedures were performed by the same investigators

Interventions	Laparoscopy for ovarian cystectomy: 3 trocar technique; enucleation of cysts by traction and countertraction and also fenestration and cyst drainage were performed; the ovary was not sutured; saline solution used to lavage the pelvic cavity. Laparotomy for ovarian cystectomy: Pfannenstiel incision. The procedures were performed under general anaesthesia. Frozen section was not mentioned.
Outcomes	Numbers in each group analgesic free at day 2, discharged from hospital within 3 days, and fully recuperated at day 15, difference in mean VAS score for pain, operative time, hospital stay
Intention to treat analysis	Yes
Power calculation described	Calculated that the sample size of 40 (20 in each group) would provide 90% power to detect a difference, at the 5% significance level, in the outcomes of analgesic free at day 2, discharged from hospital within 3 days, and fully recuperated at day 15. Also calculated that sample size of 40 would provide more than 90% power at the 5% significance level to detect a difference of 2cm between group means on the visual analogue scale for pain
Notes	Follow up: 15, 30, 90 and 180 days after surgery (clinical examination and ultrasonographic scan); 83 women were screened, underwent ultrasound evaluation, and 6 months expectant management. After 6 months 32 women whose cysts resolved spontaneously were excluded from surgery. Of the remainder if cyst was still present (n=38) or if cyst size was increased (n=13) surgery was planned. Of these, 2 women were deemed unfit for anaesthesia, 1 had a systemic infection, and 1 had a psychiatric condition which excluded her from study. A further 7 women refused randomisation All cysts were found to be benign.

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Allocation concealment?	Low risk	A
Blinding? All outcomes	High risk	
Incomplete outcome data addressed? All outcomes	Low risk	
Free of selective reporting?	Low risk	
Free of other bias?	Low risk	

Mais 1996

Methods	Randomisation: table of random digits Allocation concealed in numbered sealed envelopes and the seal was broken in the anaesthetic room before surgery Centre: one Number of women randomised: 32 Number of women analysed: 32 The study was carried out between January 1993 and June 1994 in the Department of Obstetrics and Gynecology of the University of Cagliari, Cagliari, Italy
Participants	Inclusion: premenopausal (18-40 years) women without acute pelvic symptoms and with hypoechoic, unilateral, unilocular persistent ovarian cysts, 3-10 cm in diameter, suspected to be endometrioma by transvaginal sonography. CA 125 levels and colour Doppler not mentioned Exclusion: unfit for general anaesthesia, systemic infection, or unable to give informed consent Age (years): 30.1 (SD 5.8) in the laparoscopy group, 31.2 (SD 6.3) in the laparotomy group Average cyst dimensions were: 5.4 cm (SD 2.0) for laparoscopy and 5.5 cm (SD 2.1) for laparotomy Histological findings in laparoscopy and laparotomy group: all cases were endometrioma
Interventions	Laparoscopy for ovarian cystectomy: 3 trocar technique; enucleation of cysts by traction and countertraction and also fenestration and cyst drainage were performed; the ovary was not sutured; saline solution used to lavage the pelvic cavity Laparotomy for ovarian cystectomy: Pfannenstiel incision. All procedures were performed by the same investigators and women were given general anaesthesia Frozen section was not mentioned in the trial report.
Outcomes	Operative time, analgesic requirement, pain (VAS scale), number of women in each group analgesic free at day 2, proportion of women in each group discharged from hospital by day 3
Intention to treat analysis	Not mentioned, but all women randomised appeared to be included in the analysis
Power calculation described	It was calculated that a sample size of 32 would provide a power of 90% to detect a difference, at the 5% significance level, in the proportion of women in each group analgesic free at day 2, discharged from hospital by day 3, and fully recuperated at day 15
Notes	Follow up: 15, 30, 90, and 180 days after surgery (clinical examination and ultrasonographic scan); number of women excluded, number of women withdrawn and lost to follow up. No details given; conversions to laparotomy unknown

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Allocation concealment?	Low risk	A

Mais 1996 (*Continued*)

Blinding? All outcomes	High risk	
Incomplete outcome data addressed? All outcomes	Low risk	All women randomised were included in the analysis.
Free of selective reporting?	Low risk	
Free of other bias?	Low risk	

Mais 2003

Methods	Randomisation by the use of a random digits Allocation concealed in sealed envelopes. The envelope seal was broken in the anaesthetic room before surgery Centre: one Number of women randomised: 40 Number of women analysed: 40 for most outcomes, with 5-year follow up on 31 women The study was carried out between December 1992 and January 1996 in the Department of Obstetrics and Gynecology of the University of Cagliari, Cagliari, Italy
Participants	Inclusion: women without symptoms; of reproductive age (19-43 yrs) with one unilateral persistent ovarian cyst which was suspected to be a dermoid ovarian cyst (teratoma) by ultrasonography, diameter less than 10 cm. CA 125 levels and colour Doppler not mentioned 58 women were screened and underwent abdominal and transvaginal ultrasonography. One woman was deemed unfit for general anaesthetic, two had systemic infections, and one had a psychiatric condition which precluded informed consent, so were excluded. A further 5 women were excluded because their cyst diameter exceeded 10 cm Age (years): 31.4 (SD 6.1) in the laparoscopy group and 30.7 (SD 5.5) in the laparotomy group Average cysts dimensions were: 5.8 cm (SD 1.3 cm) for laparoscopy and 6.1 cm (SD 1. 5 cm) for laparotomy groups
Interventions	Laparotomy: a Pfannestiel incision was always used for laparotomy. Laparoscopy 10 mm port was inserted through the umbilicus to introduce the laparoscope. Two additional 5 mm ports were inserted in the right and left lower abdominal quadrants for introduction of surgical instruments. A fourth 10 mm port was introduced in the midline 4 cm above the symphysis pubis for introduction of endoscopic bag. After the ovary was grasped with atraumatic forceps, a superficial incision of ovarian cortex was made with scissors. The incision was gently enlarged to locate the cleavage plane between the cyst wall and the ovarian cortex. Bipolar coagulation and scissors were used to separate fibrous adhesions. During laparoscopy procedures, the cyst was inserted into an endoscopic bag which was closed by pulling the drawstring. The drawstring and the margins of the bag were removed from the abdominal cavity through the suprapubic port During both laparotomy and laparoscopy careful exploration of the pelvis and the abdomen was performed for evidence of malignancy. During both laparotomy and laparoscopy, the ovary was left open without sutures

	If unintended spillage of the cyst contents occurred, a copious saline solution was used to irrigate the pelvic cavity. Any particulate material was carefully grasped and removed Minimal or mild spillage occurred in nine women (seven laparoscopy and two laparotomies) but the postoperative course was always uneventful Frozen section was not mentioned in the trial report.
Outcomes	Operative time, analgesic requirement, hospital stay, (reported in Mais 1995 and Mais 1993) recurrence rate over 5 years follow up
Intention to treat analysis	Not mentioned, but all women randomised appeared to be included in the primary analysis
Power calculation described	No
Notes	A 5-year follow up of 31 of the 40 women originally randomised. Reasons for loss of data on 9 women were described

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Allocation concealment?	Low risk	A
Blinding? All outcomes	High risk	
Incomplete outcome data addressed? All outcomes	Low risk	In the laparoscopy group 2 women were lost to follow up after 2 years, one lost after 2.5 years, and a further 2 lost after 3 years (2 of these due to pregnancy). In the laparotomy group 2 women were lost to follow up after 2.5 years and a further 2 were lost after 4 years (1 of these due to pregnancy)
Free of selective reporting?	Low risk	
Free of other bias?	Low risk	

Morgante 1998

Methods	Randomisation: random number table RCT: method of randomisation unclear Blinding: not mentioned Centre: one Number of women randomised: 44 Number of women analysed: 44 The study was carried out between January 1992 and 31 December 1996 in the Department of Obstetrics and Gynecology of the University of Siena, Siena, Italy
Participants	Inclusion: women of reproductive age (14-42 yrs) with dermoid ovarian cysts, assumed to be benign, with diameter less than 12 cm. CA 125 levels and colour Doppler not mentioned Age (years): 29.4 (SD 6.8; range 15-40) in the laparoscopy group, 30.3 (SD 8.3; range 14-42) in the laparotomy group The average cyst dimension were: 6.7 cm (range 4-12) for laparoscopy and 6.5 cm (range 4-12) for laparotomy Histological findings were dermoid ovarian cyst but in association with other histological types: functional nature (17.2%), endometriotic (4.5%), serous cystadenomas (5.3%), mucinous cystadenoma (1.2%). Dermoid cysts were bilateral in 7.9% of cases
Interventions	With both procedures the pelvic cavity was examined for signs of malignancy, and all women received prophylactic antibiotics to prevent infection 40 of the 44 women underwent transabdominal and transvaginal ultrasound prior to surgery; 4 who did not were young women who had never had sexual intercourse Laparoscopy for ovarian cystectomy: 4 trocar technique; enucleation of cysts by traction and countertraction; aspiration of the cysts and after the capsule was removed in such a way as to avoid spillage of cyst fluid into the abdominal cavity. Bipolar cautery for haemostasis. When spillage occurred (six cases) saline solution used to lavage the pelvic cavity. Ovary was not sutured. Laparotomy for ovarian cystectomy: details were not given. No details were given concerning anaesthetic protocol. Frozen section was not mentioned in the trial report.
Outcomes	Duration of surgery, mean blood loss, mean length of hospital stay, postoperative complications, pain, requirement for analgesics, return to work
Intention to treat analysis	Not mentioned, but all women randomised appeared to be included in the analysis
Power calculation described	No
Notes	Follow up 2 weeks: no details given; number of women excluded, number of women withdrawn and lost to follow up

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Allocation concealment?	Unclear risk	B

Morgante 1998 (*Continued*)

Blinding? All outcomes	High risk	
Incomplete outcome data addressed? All outcomes	Low risk	
Free of selective reporting?	Low risk	
Free of other bias?	Low risk	

Nitke 1996

Methods	Randomisation: method not stated Blinding: not mentioned Centre: one Number of women randomised: 38 Number of women analysed: 38 The study was carried out between 1992 and 1995 in the Department of Obstetrics and Gynecology of the Rabin Medical Center, Tel Aviv, Israel
Participants	Inclusion: women of reproductive age (16-39 yrs) with dermoid ovarian cysts. All women were submitted to a preliminary workup, including ultrasonography, CA 125, as well as colour Doppler ultrasonography to exclude malignancy Exclusion: women with contraindications to laparoscopy - gross obesity, bowel disease, massive adhesions following previous surgery, a large abdominal mass, and cardiorespiratory disorders Age (years): 27.7 (SD 6.8; range 16-39) in the laparoscopy group and 24.3 (SD 5.2; range 17-38) in the laparotomy group No information provided on average cyst dimensions in each group. Histological findings in laparoscopy and laparotomy group: all cases were dermoid ovarian cyst
Interventions	The procedures were performed under general anaesthesia and the pelvic cavity was thoroughly inspected for signs of malignancy. Laparoscopy for ovarian cystectomy: 3 trocar technique; enucleation of cysts by traction and countertraction; the ovary was not sutured; In 10 cases the cyst was removed intact, and in the remainder the cyst was aspirated to remove fluid and the capsule was removed in such a way as to minimise spillage of cyst fluid into the abdominal cavity; electrocoagulation for haemostasis; Ringers solution was used to lavage the pelvic cavity. Laparotomy for ovarian cystectomy: Pfannenstiel incision (minilaparotomy); in all cases ovarian resection by conservative enucleation followed by suture of the ovary in two layers. When spillage occurred the pelvic cavity was lavaged with ringers solution. Frozen section was not mentioned in the trial.
Outcomes	Operative time; length of stay in hospital, complications; hospital stay
Intention to treat analysis	Not mentioned but all women randomised appeared to be included in the analysis

Nitke 1996 (*Continued*)

Power calculation described	No
Notes	Follow up: no details given. Number of women excluded, number of women withdrawn and lost to follow up: no details given Conversions to laparotomy: unknown. Table 2 gives a list of concomitant procedures performed during laparoscopy which may have influenced duration of operation

Risk of bias

Bias	Authors' judgement	Support for judgement
Allocation concealment?	Unclear risk	B
Blinding? All outcomes	High risk	
Incomplete outcome data addressed? All outcomes	Low risk	
Free of other bias?	Low risk	

Panici 2007

Methods	Randomisation: omputerised randomisation list was independently generated and allocation to treatment arms was recorded in sequentially numbered sealed envelopes by a third party. Envelopes were opened in theatre after initial laparoscopy had been performed Blinding: none Centres: two Number of women randomised: 60 Number of women analysed: 60 (primary endpoint) The study was conducted between January 2005 and September 2006 in the Department of Obstetrics and Gynecology, la Sapienza University, Rome, Italy and Department of Obstetrics and Gynecology, Campus Biomedico University, Rome, Italy
Participants	All patients had a preoperative assessment of transabdominal and transvaginal ultrasound including estimation of cyst size. Colour Doppler not mentioned Inclusion: women aged 18-45 years with large (7-18 cm) apparently benign, non-endometriotic adnexal cysts, serum CA125 in the normal range, BMI less than 29 kg/m^2, American Society of Anaesthesiologists physical status classification 0-2, no known acute or chronic pelvic disease, no previous laparotomies, no requirement for other associated surgical procedures, possibility of placing an intrauterine manipulator, and signed informed consent to the procedure and to traditional surgical staging in case of unexpected malignancy Exclusion: identification of peritoneal signs of malignancy during diagnostic laparoscopy, inadequate surgical field for minilaparotomy Median age (years): 31 (range 24-36) in the laparoscopy group and 29 (range 34-35) in

	the minilaparotomy group Median cyst dimensions were: 8.4 (range 8-12.2) in the laparoscopy group and 8.2 (range 7.9-10.4) in the minilaparotomy group
Interventions	No mechanical bowel preparation was performed and all patients had antithrombotic (low molecular weight heparin) and antibiotic (IV cefalotin) prophylaxis. All women underwent diagnostic open laparoscopy and if the inclusion/exclusion criteria were satisfied a sequentially numbered sealed envelope was opened in theatre to determine which procedure then followed Laparoscopy: 3 additional ports were inserted. Plane of cleavage was located with the aid of grasping forceps and cyst capsule was separated from the ovarian cortex using diverting traction; ancillary port in the sovrapubic region was enlarged to fit a 10 mm trocar for insertion of an endobag. Wherever possible unruptured cyst was placed in bag to contain spillage, or controlled cyst aspiration was carried out under direct view Haemostasis by bipolar coagulation. Peritoneal cavity was copiously rinsed with Ringers solution, and 1000ml was left in cavity for adhesion prevention Minilaparotomy: 3-7 cm transverse incision 1-2 cm below pubic hair line and 2-4 cm above pubic symphysis was made based on the finding of the diagnostic laparoscopy. Where possible the cyst was delivered outside the abdomen through the incision. Alternatively the cyst was aspirated and cyst wall rupture site controlled with a clamp. Excision of the cyst was performed in standard fashion and the ovarian edges approximated with a suture stitch avoiding the ovarian cortex; haemostasis by bipolar coagulation, peritoneal lavage using copious Ringers solution Intraoperative frozen section was routinely performed. Six patients in laparoscopy group were not treated per protocol: three were converted to laparoscopically guided minilaparotomy, one was converted to a Pfannanstiel incision (diagnosis of malignancy), and two a low vertical incision Two patients in minilaparotomy group were not treated as per protocol; in both increase in transverse incision was made due to technical difficulties Frozen section was mentioned in the trial report.
Outcomes	Primary outcome was uncontrolled cyst spillage and/or rupture rate, secondary outcomes surgical difficulty, operative and postoperative results, short and long-term complications, and short-term patient satisfaction
Intention to treat analysis	Yes
Power calculation described	Sample size was calculated to detect with 80% power at the 0.05 alpha level a difference in 40% in rupture rate given a reference rate of 80% for patients treated with operative laparoscopy reported in our previous study
Notes	Relative risk of cyst rupture of laparoscopy group versus laparoscopy guided minilaparotomy was 5.55 (95% CI 1.88 to 16.33). Spillage of cyst contents occurred in 21 and 8 patients respectively. Follow up 3 months

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**

Panici 2007 (*Continued*)

Allocation concealment?	Low risk	
Blinding? All outcomes	High risk	
Incomplete outcome data addressed? All outcomes	Low risk	
Free of selective reporting?	Low risk	
Free of other bias?	Low risk	

Panici 2007a

Methods	Randomisation: allocation to treatment arms was recorded in a blind envelope system; envelopes were opened in theatre after initial laparoscopy had been performed Blinding: none Centres: two Number of women randomised: 127 Number of women analysed: 127 The study was conducted between July 2002 and June 2004 in the Department of Obstetrics and Gynecology, la Sapienza University, Rome, Italy and Department of Obstetrics and Gynecology, Campus Biomedico University, Rome, Italy
Participants	All women underwent preoperative transabdominal and transvaginal ultrasound on the day before surgery. Surgery was performed under general endotracheal anaesthesia. In postmenopausal women bilateral salpingo-oophorectomy was performed Inclusion: women aged more than 16 years and less than 70 years with apparently benign adnexal cysts of less than 10 cm diameter, absence of ultrasonographic evidence of malignancy, serum CA125 in the normal range for postmenopausal women, BMI less than 29 kg/m^2, American Society of Anaesthesiologists physical status classification 0-2, no known acute or chronic pelvic disease, no previous laparotomies, and signed informed consent Exclusion: 127 women were randomised: 63 to laparoscopy group and 64 to minilaparotomy group Median age (years): 30 (range 17-70) in the laparoscopy group and 32 (range 16-65) in the minilaparotomy group Median cyst dimensions were: 5.5 (range 3.5-9.5) in the laparoscopy group and 5.2 (range 3.2-9) in the minilaparotomy group
Interventions	Laparoscopy via 4 ports. Careful exploration of the pelvis and abdomen for visual exclusion of malignancy. Adhesions were lysed and the cyst capsule was separated from the ovarian cortex using diverging tractions. Haemostasis by bipolar coagulation. Ovary left unsutured. Cyst was removed from the abdominal cavity using an endobag; Intraoperative frozen section was always performed Minilaparotomy: 3-7 cm transverse incision, 1-2 cm below pubic hairline and 2-4 cm above the pubic symphysis; laparoscope was introduced through the incision to explore the abdominal cavity; if the size of cyst did not permit its delivery through the incision or

	if the cyst ruptured during mobilisation, cyst content was aspirated, cyst wall rupture site controlled with clamp, and then the cyst was delivered with minimum spillage. Ovaries were left unsutured Intraoperative frozen section was performed.
Outcomes	Operating time, blood loss, pain, time to recovery to regular bowel movements, tolerance of liquid diet, mobility around the ward, duration of postoperative stay. Intraoperative and postoperative complications
Intention to treat analysis	All women randomised were accounted for in the analysis
Power calculation described	No
Notes	Follow up 3 months.

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Allocation concealment?	Low risk	A
Blinding? All outcomes	High risk	
Incomplete outcome data addressed? All outcomes	Low risk	
Free of selective reporting?	Low risk	
Free of other bias?	Low risk	Consecutive patients.

Yuen 1997

Methods	Randomisation: computer-generated numbers were used to assign the surgical approach and were placed in sealed opaque consecutively numbered envelopes Blinding: not mentioned Centre: one Number of women randomised: 102 Number of women analysed: 102 The study was carried out between July 1994 and September 1995 in the Department of Obstetrics and Gynaecology, Prince of Wales Hospital, Hong Kong
Participants	All women had standard preoperative assessment with an ultrasound scan, usually transvaginal. Postmenopausal women had serum CA 125 levels measured. Colour Doppler not mentioned Inclusion: women requiring surgical management of benign ovarian tumours Exclusion: women where ultrasonic scan suggested a malignancy, tumour greater than 10 cm diameter, or requirement for concurrent hysterectomy

	Age (years): 35.1 (SD 10.3) in the laparoscopy group and 34.7 (SD 8.8) in the laparotomy group Average cyst dimensions in two groups were: 5.6cm (SD 1.8 cm) for laparoscopy and 5.7cm (SD 2.1 cm) for laparotomy
Interventions	All procedures were performed under general anaesthesia. All surgical procedures were performed by physicians undergoing training under the supervision of an experienced surgeon. Frozen section was not mentioned in the trial. Laparoscopy: 3 trocar technique; procedures were cystectomy or oophorectomy; excised tissue was placed in a disposable plastic bag; bipolar haemostasis; oophorectomy was performed in 27.6% of cases in the laparoscopy group. Laparotomy: Pfannenstiel incision or subumbilical midline incision; procedures were cystectomy or oophorectomy; not stated whether ovary was sutured. Oophorectomy was performed in 25% of cases in the laparotomy group
Outcomes	Operative time; operative blood loss, postoperative pain, intraoperative complications, postoperative complications, hospital stay, return to work
Intention to treat analysis	Not mentioned but 102 of the 106 women randomised were included in the analysis
Power calculation described	Yes, sample size of 100 women was calculated to provide 90% power at a significance level of 5% to find a difference in operative morbidity
Notes	Follow up: 8 weeks; 4 women excluded because they refused randomisation and 4 women lost to follow up, no details given. All ovarian tumours benign

Risk of bias

Bias	**Authors' judgement**	**Support for judgement**
Allocation concealment?	Low risk	
Blinding? All outcomes	High risk	
Incomplete outcome data addressed? All outcomes	Low risk	
Free of selective reporting?	Low risk	
Free of other bias?	Low risk	

Characteristics of excluded studies *[ordered by study ID]*

Study	Reason for exclusion
Albini 1994	Not randomised
Bateman 1994	Not randomised
Bulletti 1996	Not randomised
Chapron 1997	Not randomised
Darwisch 2001	Not randomised
Deckardt 1994	Not randomised, even though it claimed to be (allocation to different wards by an admitting clerk is NOT a method of randomisation, and it is not likely to result in groups which are equal and balanced with regard to all possible known and unknown confounding factors. This is evidenced by the numerically unbalanced groups which resulted (n=116 versus n=76))
Hidlebaugh 1994	Not randomised
Hidlebaugh 1997	Not randomised
Howard 1995	Not randomised
Laberge 2006	Not randomised
Lin 1995	Not randomised
Marana 2004	Not randomised
Mettler 2001	Not randomised
Papasakelariou 1995	Not randomised
Paredes 1997	Not randomised
Pittaway 1994	Not randomised
Quinlan 1997	Not randomised
Thomas 2006	Not randomised
Yuen 1995	Not randomised
Zanetta 1999	Not randomised

DATA AND ANALYSES

Comparison 1. Laparoscopy versus laparotomy

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Surgery - Duration of surgery (min)	9		Mean Difference (IV, Random, 95% CI)	Totals not selected
1.1 Any type of benign ovarian tumour	5		Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]
1.2 Dermoid cysts	3		Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]
1.3 Ovarian endometriomata	1		Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]
2 Surgery - Change of diagnosis to malignant tumour	8		Peto Odds Ratio (Peto, Fixed, 95% CI)	Subtotals only
2.1 Any type of benign ovarian tumour	4	230	Peto Odds Ratio (Peto, Fixed, 95% CI)	1.0 [0.12, 8.46]
2.2 Dermoid cysts	3	122	Peto Odds Ratio (Peto, Fixed, 95% CI)	0.0 [0.0, 0.0]
2.3 Ovarian endometriomata	1	32	Peto Odds Ratio (Peto, Fixed, 95% CI)	0.0 [0.0, 0.0]
3 Surgical Injury - Bladder	9		Peto Odds Ratio (Peto, Fixed, 95% CI)	Subtotals only
3.1 Any type of benign ovarian tumour	5	328	Peto Odds Ratio (Peto, Fixed, 95% CI)	0.13 [0.00, 6.56]
3.2 Dermoid cysts	3	122	Peto Odds Ratio (Peto, Fixed, 95% CI)	0.0 [0.0, 0.0]
3.3 Ovarian endometriomata	1	32	Peto Odds Ratio (Peto, Fixed, 95% CI)	0.0 [0.0, 0.0]
4 Surgical Injury - Ureter	9		Peto Odds Ratio (Peto, Fixed, 95% CI)	Subtotals only
4.1 Any type of benign ovarian tumour	5	328	Peto Odds Ratio (Peto, Fixed, 95% CI)	0.0 [0.0, 0.0]
4.2 Dermoid cysts	3	118	Peto Odds Ratio (Peto, Fixed, 95% CI)	0.0 [0.0, 0.0]
4.3 Ovarian endometriomata	1	32	Peto Odds Ratio (Peto, Fixed, 95% CI)	0.0 [0.0, 0.0]
5 Surgical Injury - Vascular	9		Peto Odds Ratio (Peto, Fixed, 95% CI)	Subtotals only
5.1 Any type of benign ovarian tumour	5	328	Peto Odds Ratio (Peto, Fixed, 95% CI)	7.40 [0.46, 118.39]
5.2 Dermoid cysts	3	122	Peto Odds Ratio (Peto, Fixed, 95% CI)	0.0 [0.0, 0.0]
5.3 Ovarian endometriomata	1	32	Peto Odds Ratio (Peto, Fixed, 95% CI)	0.0 [0.0, 0.0]
6 Surgical Injury - Small bowel	9		Peto Odds Ratio (Peto, Fixed, 95% CI)	Subtotals only
6.1 Any type of benign ovarian tumour	5	328	Peto Odds Ratio (Peto, Fixed, 95% CI)	0.0 [0.0, 0.0]
6.2 Dermoid cysts	3	122	Peto Odds Ratio (Peto, Fixed, 95% CI)	0.0 [0.0, 0.0]
6.3 Ovarian endometriomata	1	32	Peto Odds Ratio (Peto, Fixed, 95% CI)	0.0 [0.0, 0.0]
7 Surgical Injury - Colon	9		Peto Odds Ratio (Peto, Fixed, 95% CI)	Subtotals only
7.1 Any type of benign ovarian tumour	5	328	Peto Odds Ratio (Peto, Fixed, 95% CI)	0.0 [0.0, 0.0]
7.2 Dermoid cysts	3	122	Peto Odds Ratio (Peto, Fixed, 95% CI)	0.0 [0.0, 0.0]
7.3 Ovarian endometriomata	1	32	Peto Odds Ratio (Peto, Fixed, 95% CI)	0.0 [0.0, 0.0]
8 Post operative complications - Blood transfusion required	9		Peto Odds Ratio (Peto, Fixed, 95% CI)	Subtotals only
8.1 Any type of benign ovarian tumour	5	328	Peto Odds Ratio (Peto, Fixed, 95% CI)	0.0 [0.0, 0.0]
8.2 Dermoid cysts	3	122	Peto Odds Ratio (Peto, Fixed, 95% CI)	0.0 [0.0, 0.0]
8.3 Ovarian endometriomata	1	32	Peto Odds Ratio (Peto, Fixed, 95% CI)	0.0 [0.0, 0.0]

9 Post operative complications - Haematoma	9		Peto Odds Ratio (Peto, Fixed, 95% CI)	Subtotals only
9.1 Any type of benign ovarian tumour	5	328	Peto Odds Ratio (Peto, Fixed, 95% CI)	0.0 [0.0, 0.0]
9.2 Dermoid cysts	3	122	Peto Odds Ratio (Peto, Fixed, 95% CI)	0.0 [0.0, 0.0]
9.3 Ovarian endometriomata	1	32	Peto Odds Ratio (Peto, Fixed, 95% CI)	0.0 [0.0, 0.0]
10 Post operative complications - Febrile morbidity	9	482	Peto Odds Ratio (Peto, Fixed, 95% CI)	0.36 [0.18, 0.73]
10.1 Any type of benign ovarian tumour	5	328	Peto Odds Ratio (Peto, Fixed, 95% CI)	0.37 [0.18, 0.76]
10.2 Dermoid cysts	3	122	Peto Odds Ratio (Peto, Fixed, 95% CI)	0.14 [0.00, 6.82]
10.3 Ovarian endometriomata	1	32	Peto Odds Ratio (Peto, Fixed, 95% CI)	0.0 [0.0, 0.0]
11 Post operative complications - Incision infection	9		Peto Odds Ratio (Peto, Fixed, 95% CI)	Subtotals only
11.1 Any type of benign ovarian tumour	5	328	Peto Odds Ratio (Peto, Fixed, 95% CI)	0.23 [0.05, 1.05]
11.2 Dermoid cysts	3	122	Peto Odds Ratio (Peto, Fixed, 95% CI)	0.0 [0.0, 0.0]
11.3 Ovarian endometriomata	1	32	Peto Odds Ratio (Peto, Fixed, 95% CI)	0.0 [0.0, 0.0]
12 Post operative complications - Urinary tract infection	9		Peto Odds Ratio (Peto, Fixed, 95% CI)	Subtotals only
12.1 Any type of benign ovarian tumour	5	328	Peto Odds Ratio (Peto, Fixed, 95% CI)	0.30 [0.08, 1.16]
12.2 Dermoid cysts	3	122	Peto Odds Ratio (Peto, Fixed, 95% CI)	0.0 [0.0, 0.0]
12.3 Ovarian endometriomata	1	32	Peto Odds Ratio (Peto, Fixed, 95% CI)	0.0 [0.0, 0.0]
13 Post operative complications - Thromboembolism	9		Peto Odds Ratio (Peto, Fixed, 95% CI)	Subtotals only
13.1 Any type of benign ovarian tumour	5	328	Peto Odds Ratio (Peto, Fixed, 95% CI)	0.12 [0.01, 2.09]
13.2 Dermoid cysts	3	122	Peto Odds Ratio (Peto, Fixed, 95% CI)	0.0 [0.0, 0.0]
13.3 Ovarian endometriomata	1	32	Peto Odds Ratio (Peto, Fixed, 95% CI)	0.0 [0.0, 0.0]
14 Blood loss by hemoglobin levels	1	20	Mean Difference (IV, Random, 95% CI)	-0.30 [-1.31, 0.71]
14.1 Any type of benign ovarian tumour	1	20	Mean Difference (IV, Random, 95% CI)	-0.30 [-1.31, 0.71]
14.2 Dermoid cysts	0	0	Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]
14.3 Ovarian endometriomata	0	0	Mean Difference (IV, Random, 95% CI)	0.0 [0.0, 0.0]
15 Perioperative mortality	9		Peto Odds Ratio (Peto, Fixed, 95% CI)	Subtotals only
15.1 Any type of benign ovarian tumour	5	328	Peto Odds Ratio (Peto, Fixed, 95% CI)	0.0 [0.0, 0.0]
15.2 Dermoid cysts	3	122	Peto Odds Ratio (Peto, Fixed, 95% CI)	0.0 [0.0, 0.0]
15.3 Ovarian endometriomata	1	32	Peto Odds Ratio (Peto, Fixed, 95% CI)	0.0 [0.0, 0.0]
16 Urinary retention	9		Peto Odds Ratio (Peto, Fixed, 95% CI)	Subtotals only
16.1 Any type of benign ovarian tumour	5	328	Peto Odds Ratio (Peto, Fixed, 95% CI)	0.12 [0.02, 0.89]
16.2 Dermoid cysts	3	122	Peto Odds Ratio (Peto, Fixed, 95% CI)	0.0 [0.0, 0.0]
16.3 Ovarian endometriomata	1	32	Peto Odds Ratio (Peto, Fixed, 95% CI)	0.0 [0.0, 0.0]
17 Chemical peritonitis	9		Peto Odds Ratio (Peto, Fixed, 95% CI)	Subtotals only
17.1 Any type of benign ovarian tumour	5	328	Peto Odds Ratio (Peto, Fixed, 95% CI)	0.0 [0.0, 0.0]
17.2 Dermoid cysts	3	122	Peto Odds Ratio (Peto, Fixed, 95% CI)	0.0 [0.0, 0.0]
17.3 Ovarian endometriomata	1	32	Peto Odds Ratio (Peto, Fixed, 95% CI)	0.0 [0.0, 0.0]
18 Intestinal obstruction	9		Peto Odds Ratio (Peto, Fixed, 95% CI)	Subtotals only

18.1 Any type of benign ovarian tumour	5	328	Peto Odds Ratio (Peto, Fixed, 95% CI)	0.0 [0.0, 0.0]
18.2 Dermoid cysts	3	122	Peto Odds Ratio (Peto, Fixed, 95% CI)	0.14 [0.00, 6.82]
18.3 Ovarian endometriomata	1	32	Peto Odds Ratio (Peto, Fixed, 95% CI)	0.0 [0.0, 0.0]
19 1.18 Any adverse effect of surgery (incl surgical injury or post surgery complication or other)	9	482	Peto Odds Ratio (Peto, Fixed, 95% CI)	0.29 [0.17, 0.51]
19.1 Any type of benign ovarian tumour	5	328	Peto Odds Ratio (Peto, Fixed, 95% CI)	0.30 [0.18, 0.53]
19.2 Dermoid cysts	3	122	Peto Odds Ratio (Peto, Fixed, 95% CI)	0.13 [0.01, 2.13]
19.3 Ovarian endometriomata	1	32	Peto Odds Ratio (Peto, Fixed, 95% CI)	0.0 [0.0, 0.0]
20 Short term recovery - pain (VAS)	3	186	Mean Difference (IV, Fixed, 95% CI)	-2.36 [-2.70, -2.03]
20.1 Any type of benign ovarian tumour	2	142	Mean Difference (IV, Fixed, 95% CI)	-2.25 [-2.94, -1.56]
20.2 Dermoid cysts	1	44	Mean Difference (IV, Fixed, 95% CI)	-2.4 [-2.79, -2.01]
21 Short term recovery - pain (painfree 24-48 hours post surgery)	6	356	Peto Odds Ratio (Peto, Fixed, 95% CI)	7.42 [4.86, 11.33]
21.1 Any type of benign ovarian tumour	3	240	Peto Odds Ratio (Peto, Fixed, 95% CI)	5.87 [3.48, 9.90]
21.2 Dermoid cysts	2	84	Peto Odds Ratio (Peto, Fixed, 95% CI)	10.68 [4.55, 25.06]
21.3 Ovarian endometriomata	1	32	Peto Odds Ratio (Peto, Fixed, 95% CI)	14.51 [3.70, 56.90]
22 Short term recovery - Pain (requirement for analgesia)			Other data	No numeric data
22.1 any type of benign ovarian tumour			Other data	No numeric data
23 Recurrence at 6-12 months	4	171	Peto Odds Ratio (Peto, Fixed, 95% CI)	1.0 [0.06, 16.33]
23.1 Any type of benign ovarian tumour	2	108	Peto Odds Ratio (Peto, Fixed, 95% CI)	1.0 [0.06, 16.33]
23.2 Dermoid cysts	1	31	Peto Odds Ratio (Peto, Fixed, 95% CI)	0.0 [0.0, 0.0]
23.3 Ovarian endometriomata	1	32	Peto Odds Ratio (Peto, Fixed, 95% CI)	0.0 [0.0, 0.0]
24 Length of hospital stay (days)	8	442	Mean Difference (IV, Random, 95% CI)	-2.88 [-3.11, -2.66]
24.1 Any type of benign ovarian tumour	5	328	Mean Difference (IV, Random, 95% CI)	-2.91 [-3.28, -2.55]
24.2 Dermoid cysts	2	82	Mean Difference (IV, Random, 95% CI)	-2.93 [-3.15, -2.70]
24.3 Ovarian endometriomata	1	32	Mean Difference (IV, Random, 95% CI)	-2.38 [-3.01, -1.75]
25 Economic outcomes - total cost (US$1000 1993)	1		Mean Difference (IV, Fixed, 95% CI)	Subtotals only
25.1 Any type of benign ovarian tumour	1	68	Mean Difference (IV, Fixed, 95% CI)	-1045.0 [-1347.94, -742.06]
25.2 Dermoid cysts	0	0	Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]
25.3 Ovarian endometriomata	0	0	Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]

Comparison 2. Laparoscopy versus minilaparotomy

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Surgery - duration of surgery	3		Mean Difference (IV, Fixed, 95% CI)	Totals not selected
2 Surgery - change of diagnosis to malignant tumour	2	160	Odds Ratio (Peto, Fixed, 95% CI)	2.37 [0.34, 16.61]
2.1 Any type of benign ovarian tumour	2	160	Odds Ratio (Peto, Fixed, 95% CI)	2.37 [0.34, 16.61]
3 Post operative complications - Febrile morbidity	2	227	Odds Ratio (Peto, Fixed, 95% CI)	0.16 [0.02, 1.38]
3.1 Any type of benign ovarian tumour	2	227	Odds Ratio (Peto, Fixed, 95% CI)	0.16 [0.02, 1.38]
4 Post operative complications - Incison infection	1	127	Odds Ratio (Peto, Fixed, 95% CI)	0.14 [0.01, 2.73]
4.1 Any type of benign ovarian tumour	1	127	Odds Ratio (Peto, Fixed, 95% CI)	0.14 [0.01, 2.73]
5 Any adverse effect of surgery (incl surgical injury or post surgery complication or other)	2	227	Odds Ratio (Peto, Fixed, 95% CI)	0.10 [0.01, 0.77]
5.1 Any type of benign ovarian tumour	2	227	Odds Ratio (Peto, Fixed, 95% CI)	0.10 [0.01, 0.77]
6 Short term recovery - pain (VAS)	1	127	Mean Difference (IV, Fixed, 95% CI)	-1.0 [-1.55, -0.45]
6.1 Any type of benign ovarian tumour	1	127	Mean Difference (IV, Fixed, 95% CI)	-1.0 [-1.55, -0.45]
7 Short term recovery - pain (pain free 24-48 hours post surgery)	1	127	Odds Ratio (Peto, Fixed, 95% CI)	9.64 [4.18, 22.19]
7.1 Any type of benign ovarian tumour	1	127	Odds Ratio (Peto, Fixed, 95% CI)	9.64 [4.18, 22.19]
8 Short term recovery - pain (requirement for analgesia)			Other data	No numeric data
8.1 Any type of benign ovarian tumour			Other data	No numeric data
9 Length of hospital stay (days)	3		Mean Difference (IV, Fixed, 95% CI)	Totals not selected
9.1 Any type of benign ovarian tumour	3		Mean Difference (IV, Fixed, 95% CI)	0.0 [0.0, 0.0]

Analysis 1.1. Comparison 1 Laparoscopy versus laparotomy, Outcome 1 Surgery - Duration of surgery (min).

Review: Laparoscopy versus laparotomy for benign ovarian tumour

Comparison: 1 Laparoscopy versus laparotomy

Outcome: 1 Surgery - Duration of surgery (min)

Study or subgroup	Laparoscopy N	Mean(SD)	Laparotomy N	Mean(SD)	Mean Difference IV,Random,95% CI	Mean Difference IV,Random,95% CI
1 Any type of benign ovarian tumour						
Badawy 2002	48	71.5 (4.9)	50	42.6 (2.7)		28.90 [27.32, 30.48]
Buchweitz 2005	10	70 (17.5)	10	80.8 (30.7)		-10.80 [-32.70, 11.10]
Damiani 1998	34	74 (29)	34	83 (28)		-9.00 [-22.55, 4.55]
Mais 1995	20	70 (20)	20	67 (12)		3.00 [-7.22, 13.22]
Yuen 1997	52	59.9 (0.9)	50	52.7 (1.9)		7.20 [6.62, 7.78]
2 Dermoid cysts						
Mais 2003	20	85 (28)	20	73 (20)		12.00 [-3.08, 27.08]
Morgante 1998	22	79.3 (26.6)	22	56.9 (14.5)		22.40 [9.74, 35.06]
Nitke 1996	20	93.6 (23.8)	18	55.6 (11.4)		38.00 [26.32, 49.68]
3 Ovarian endometriomata						
Mais 1996	16	98 (36)	16	93 (28)		5.00 [-17.35, 27.35]

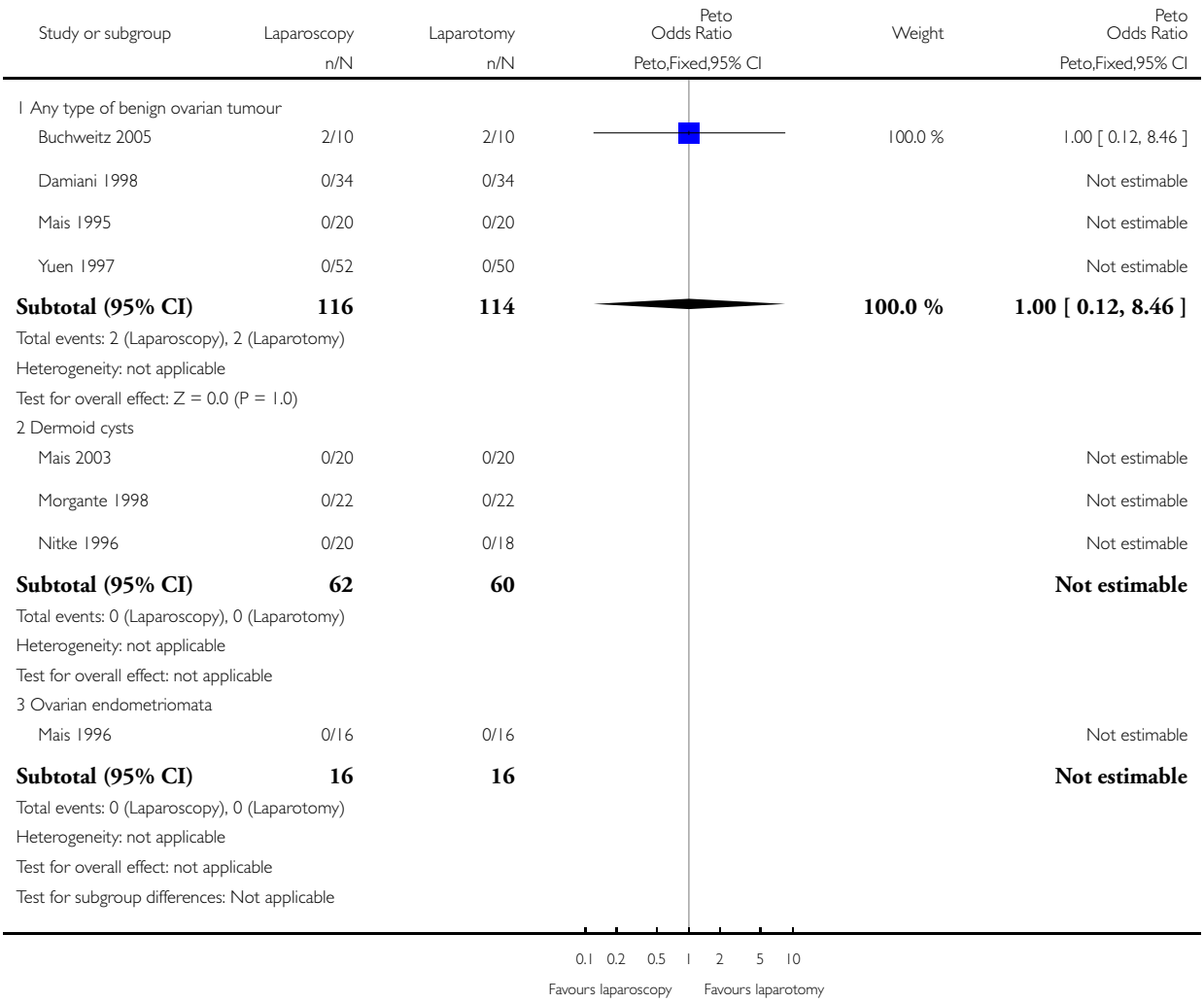
Analysis 1.2. Comparison 1 Laparoscopy versus laparotomy, Outcome 2 Surgery - Change of diagnosis to malignant tumour.

Review: Laparoscopy versus laparotomy for benign ovarian tumour

Comparison: 1 Laparoscopy versus laparotomy

Outcome: 2 Surgery - Change of diagnosis to malignant tumour

Study or subgroup	Laparoscopy n/N	Laparotomy n/N	Peto Odds Ratio Peto,Fixed,95% CI	Weight	Peto Odds Ratio Peto,Fixed,95% CI
1 Any type of benign ovarian tumour					
Buchweitz 2005	2/10	2/10		100.0 %	1.00 [0.12, 8.46]
Damiani 1998	0/34	0/34			Not estimable
Mais 1995	0/20	0/20			Not estimable
Yuen 1997	0/52	0/50			Not estimable
Subtotal (95% CI)	**116**	**114**		**100.0 %**	**1.00 [0.12, 8.46]**
Total events: 2 (Laparoscopy), 2 (Laparotomy)					
Heterogeneity: not applicable					
Test for overall effect: Z = 0.0 (P = 1.0)					
2 Dermoid cysts					
Mais 2003	0/20	0/20			Not estimable
Morgante 1998	0/22	0/22			Not estimable
Nitke 1996	0/20	0/18			Not estimable
Subtotal (95% CI)	**62**	**60**			**Not estimable**
Total events: 0 (Laparoscopy), 0 (Laparotomy)					
Heterogeneity: not applicable					
Test for overall effect: not applicable					
3 Ovarian endometriomata					
Mais 1996	0/16	0/16			Not estimable
Subtotal (95% CI)	**16**	**16**			**Not estimable**
Total events: 0 (Laparoscopy), 0 (Laparotomy)					
Heterogeneity: not applicable					
Test for overall effect: not applicable					
Test for subgroup differences: Not applicable					



Analysis 1.3. Comparison 1 Laparoscopy versus laparotomy, Outcome 3 Surgical Injury - Bladder.

Review: Laparoscopy versus laparotomy for benign ovarian tumour

Comparison: 1 Laparoscopy versus laparotomy

Outcome: 3 Surgical Injury - Bladder

Study or subgroup	Laparoscopy n/N	Laparotomy n/N	Peto Odds Ratio Peto,Fixed,95% CI	Weight	Peto Odds Ratio Peto,Fixed,95% CI
1 Any type of benign ovarian tumour					
Badawy 2002	0/48	0/50			Not estimable
Buchweitz 2005	0/10	0/10			Not estimable
Damiani 1998	0/34	0/34			Not estimable
Mais 1995	0/20	0/20			Not estimable
Yuen 1997	0/52	1/50		100.0 %	0.13 [0.00, 6.56]
Subtotal (95% CI)	**164**	**164**		**100.0 %**	**0.13 [0.00, 6.56]**
Total events: 0 (Laparoscopy), 1 (Laparotomy)					
Heterogeneity: not applicable					
Test for overall effect: Z = 1.02 (P = 0.31)					
2 Dermoid cysts					
Mais 2003	0/20	0/20			Not estimable
Morgante 1998	0/22	0/22			Not estimable
Nitke 1996	0/20	0/18			Not estimable
Subtotal (95% CI)	**62**	**60**			**Not estimable**
Total events: 0 (Laparoscopy), 0 (Laparotomy)					
Heterogeneity: not applicable					
Test for overall effect: not applicable					
3 Ovarian endometriomata					
Mais 1996	0/16	0/16			Not estimable
Subtotal (95% CI)	**16**	**16**			**Not estimable**
Total events: 0 (Laparoscopy), 0 (Laparotomy)					
Heterogeneity: not applicable					
Test for overall effect: not applicable					
Test for subgroup differences: Not applicable					

Analysis 1.4. Comparison 1 Laparoscopy versus laparotomy, Outcome 4 Surgical Injury - Ureter.

Review: Laparoscopy versus laparotomy for benign ovarian tumour

Comparison: 1 Laparoscopy versus laparotomy

Outcome: 4 Surgical Injury - Ureter

Study or subgroup	Laparoscopy n/N	Laparotomy n/N	Peto Odds Ratio Peto,Fixed,95% CI	Weight	Peto Odds Ratio Peto,Fixed,95% CI
1 Any type of benign ovarian tumour					
Badawy 2002	0/48	0/50			Not estimable
Buchweitz 2005	0/10	0/10			Not estimable
Damiani 1998	0/34	0/34			Not estimable
Mais 1995	0/20	0/20			Not estimable
Yuen 1997	0/52	0/50			Not estimable
Subtotal (95% CI)	**164**	**164**			**Not estimable**
Total events: 0 (Laparoscopy), 0 (Laparotomy)					
Heterogeneity: not applicable					
Test for overall effect: not applicable					
2 Dermoid cysts					
Mais 2003	0/20	0/20			Not estimable
Morgante 1998	0/20	0/20			Not estimable
Nitke 1996	0/20	0/18			Not estimable
Subtotal (95% CI)	**60**	**58**			**Not estimable**
Total events: 0 (Laparoscopy), 0 (Laparotomy)					
Heterogeneity: not applicable					
Test for overall effect: not applicable					
3 Ovarian endometriomata					
Mais 1996	0/16	0/16			Not estimable
Subtotal (95% CI)	**16**	**16**			**Not estimable**
Total events: 0 (Laparoscopy), 0 (Laparotomy)					
Heterogeneity: not applicable					
Test for overall effect: not applicable					
Test for subgroup differences: Chi^2 = 0.0, df = -1 (P = 0.0), I^2 =0.0%					

Analysis 1.5. Comparison 1 Laparoscopy versus laparotomy, Outcome 5 Surgical Injury - Vascular.

Review: Laparoscopy versus laparotomy for benign ovarian tumour

Comparison: 1 Laparoscopy versus laparotomy

Outcome: 5 Surgical Injury - Vascular

Study or subgroup	Laparoscopy n/N	Laparotomy n/N	Peto Odds Ratio Peto,Fixed,95% CI	Weight	Peto Odds Ratio Peto,Fixed,95% CI
1 Any type of benign ovarian tumour					
Badawy 2002	1/48	0/50		50.0 %	7.70 [0.15, 388.55]
Buchweitz 2005	0/10	0/10			Not estimable
Damiani 1998	0/34	0/34			Not estimable
Mais 1995	0/20	0/20			Not estimable
Yuen 1997	1/52	0/50		50.0 %	7.11 [0.14, 358.60]
Subtotal (95% CI)	**164**	**164**		**100.0 %**	**7.40 [0.46, 118.39]**
Total events: 2 (Laparoscopy), 0 (Laparotomy)					
Heterogeneity: Chi^2 = 0.00, df = 1 (P = 0.98); I^2 =0.0%					
Test for overall effect: Z = 1.42 (P = 0.16)					
2 Dermoid cysts					
Mais 2003	0/20	0/20			Not estimable
Morgante 1998	0/22	0/22			Not estimable
Nitke 1996	0/20	0/18			Not estimable
Subtotal (95% CI)	**62**	**60**			**Not estimable**
Total events: 0 (Laparoscopy), 0 (Laparotomy)					
Heterogeneity: not applicable					
Test for overall effect: not applicable					
3 Ovarian endometriomata					
Mais 1996	0/16	0/16			Not estimable
Subtotal (95% CI)	**16**	**16**			**Not estimable**
Total events: 0 (Laparoscopy), 0 (Laparotomy)					
Heterogeneity: not applicable					
Test for overall effect: not applicable					
Test for subgroup differences: Not applicable					

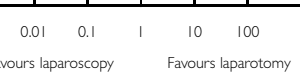
Analysis 1.6. Comparison 1 Laparoscopy versus laparotomy, Outcome 6 Surgical Injury - Small bowel.

Review: Laparoscopy versus laparotomy for benign ovarian tumour

Comparison: 1 Laparoscopy versus laparotomy

Outcome: 6 Surgical Injury - Small bowel

Study or subgroup	Laparoscopy n/N	Laparotomy n/N	Peto Odds Ratio Peto,Fixed,95% CI	Weight	Peto Odds Ratio Peto,Fixed,95% CI
1 Any type of benign ovarian tumour					
Badawy 2002	0/48	0/50			Not estimable
Buchweitz 2005	0/10	0/10			Not estimable
Damiani 1998	0/34	0/34			Not estimable
Mais 1995	0/20	0/20			Not estimable
Yuen 1997	0/52	0/50			Not estimable
Subtotal (95% CI)	**164**	**164**			**Not estimable**
Total events: 0 (Laparoscopy), 0 (Laparotomy)					
Heterogeneity: not applicable					
Test for overall effect: not applicable					
2 Dermoid cysts					
Mais 2003	0/20	0/20			Not estimable
Morgante 1998	0/22	0/22			Not estimable
Nitke 1996	0/20	0/18			Not estimable
Subtotal (95% CI)	**62**	**60**			**Not estimable**
Total events: 0 (Laparoscopy), 0 (Laparotomy)					
Heterogeneity: not applicable					
Test for overall effect: not applicable					
3 Ovarian endometriomata					
Mais 1996	0/16	0/16			Not estimable
Subtotal (95% CI)	**16**	**16**			**Not estimable**
Total events: 0 (Laparoscopy), 0 (Laparotomy)					
Heterogeneity: not applicable					
Test for overall effect: not applicable					
Test for subgroup differences: Chi^2 = 0.0, df = -1 (P = 0.0), I^2 =0.0%					



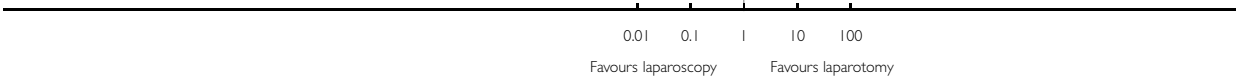
Analysis 1.7. Comparison 1 Laparoscopy versus laparotomy, Outcome 7 Surgical Injury - Colon.

Review: Laparoscopy versus laparotomy for benign ovarian tumour

Comparison: 1 Laparoscopy versus laparotomy

Outcome: 7 Surgical Injury - Colon

Study or subgroup	Laparoscopy n/N	Laparotomy n/N	Peto Odds Ratio Peto,Fixed,95% CI	Weight	Peto Odds Ratio Peto,Fixed,95% CI
1 Any type of benign ovarian tumour					
Badawy 2002	0/48	0/50			Not estimable
Buchweitz 2005	0/10	0/10			Not estimable
Damiani 1998	0/34	0/34			Not estimable
Mais 1995	0/20	0/20			Not estimable
Yuen 1997	0/52	0/50			Not estimable
Subtotal (95% CI)	**164**	**164**			**Not estimable**
Total events: 0 (Laparoscopy), 0 (Laparotomy)					
Heterogeneity: not applicable					
Test for overall effect: not applicable					
2 Dermoid cysts					
Mais 2003	0/20	0/20			Not estimable
Morgante 1998	0/22	0/22			Not estimable
Nitke 1996	0/20	0/18			Not estimable
Subtotal (95% CI)	**62**	**60**			**Not estimable**
Total events: 0 (Laparoscopy), 0 (Laparotomy)					
Heterogeneity: not applicable					
Test for overall effect: not applicable					
3 Ovarian endometriomata					
Mais 1996	0/16	0/16			Not estimable
Subtotal (95% CI)	**16**	**16**			**Not estimable**
Total events: 0 (Laparoscopy), 0 (Laparotomy)					
Heterogeneity: not applicable					
Test for overall effect: not applicable					
Test for subgroup differences: Chi^2 = 0.0, df = -1 (P = 0.0), I^2 =0.0%					



Analysis 1.8. Comparison 1 Laparoscopy versus laparotomy, Outcome 8 Post operative complications - Blood transfusion required.

Review: Laparoscopy versus laparotomy for benign ovarian tumour

Comparison: 1 Laparoscopy versus laparotomy

Outcome: 8 Post operative complications - Blood transfusion required

Study or subgroup	Laparoscopy n/N	Laparotomy n/N	Peto Odds Ratio Peto,Fixed,95% CI	Weight	Peto Odds Ratio Peto,Fixed,95% CI
1 Any type of benign ovarian tumour					
Badawy 2002	0/48	0/50			Not estimable
Buchweitz 2005	0/10	0/10			Not estimable
Damiani 1998	0/34	0/34			Not estimable
Mais 1995	0/20	0/20			Not estimable
Yuen 1997	0/52	0/50			Not estimable
Subtotal (95% CI)	**164**	**164**			**Not estimable**
Total events: 0 (Laparoscopy), 0 (Laparotomy)					
Heterogeneity: not applicable					
Test for overall effect: not applicable					
2 Dermoid cysts					
Mais 2003	0/20	0/20			Not estimable
Morgante 1998	0/22	0/22			Not estimable
Nitke 1996	0/20	0/18			Not estimable
Subtotal (95% CI)	**62**	**60**			**Not estimable**
Total events: 0 (Laparoscopy), 0 (Laparotomy)					
Heterogeneity: not applicable					
Test for overall effect: not applicable					
3 Ovarian endometriomata					
Mais 1996	0/16	0/16			Not estimable
Subtotal (95% CI)	**16**	**16**			**Not estimable**
Total events: 0 (Laparoscopy), 0 (Laparotomy)					
Heterogeneity: not applicable					
Test for overall effect: not applicable					
Test for subgroup differences: Chi^2 = 0.0, df = -1 (P = 0.0), I^2 =0.0%					

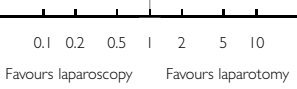
Analysis 1.9. Comparison 1 Laparoscopy versus laparotomy, Outcome 9 Post operative complications - Haematoma.

Review: Laparoscopy versus laparotomy for benign ovarian tumour

Comparison: 1 Laparoscopy versus laparotomy

Outcome: 9 Post operative complications - Haematoma

Study or subgroup	Laparoscopy n/N	Laparotomy n/N	Peto Odds Ratio Peto,Fixed,95% CI	Weight	Peto Odds Ratio Peto,Fixed,95% CI
1 Any type of benign ovarian tumour					
Badawy 2002	0/48	0/50			Not estimable
Buchweitz 2005	0/10	0/10			Not estimable
Damiani 1998	0/34	0/34			Not estimable
Mais 1995	0/20	0/20			Not estimable
Yuen 1997	0/52	0/50			Not estimable
Subtotal (95% CI)	**164**	**164**			**Not estimable**
Total events: 0 (Laparoscopy), 0 (Laparotomy)					
Heterogeneity: not applicable					
Test for overall effect: not applicable					
2 Dermoid cysts					
Mais 2003	0/20	0/20			Not estimable
Morgante 1998	0/22	0/22			Not estimable
Nitke 1996	0/20	0/18			Not estimable
Subtotal (95% CI)	**62**	**60**			**Not estimable**
Total events: 0 (Laparoscopy), 0 (Laparotomy)					
Heterogeneity: not applicable					
Test for overall effect: not applicable					
3 Ovarian endometriomata					
Mais 1996	0/16	0/16			Not estimable
Subtotal (95% CI)	**16**	**16**			**Not estimable**
Total events: 0 (Laparoscopy), 0 (Laparotomy)					
Heterogeneity: not applicable					
Test for overall effect: not applicable					
Test for subgroup differences: Chi^2 = 0.0, df = -1 (P = 0.0), I^2 =0.0%					



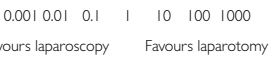
Analysis 1.10. Comparison 1 Laparoscopy versus laparotomy, Outcome 10 Post operative complications - Febrile morbidity.

Review: Laparoscopy versus laparotomy for benign ovarian tumour

Comparison: 1 Laparoscopy versus laparotomy

Outcome: 10 Post operative complications - Febrile morbidity

Study or subgroup	Laparoscopy n/N	Laparotomy n/N	Peto Odds Ratio Peto,Fixed,95% CI	Weight	Peto Odds Ratio Peto,Fixed,95% CI
1 Any type of benign ovarian tumour					
Badawy 2002	5/48	12/50		45.3 %	0.39 [0.14, 1.11]
Buchweitz 2005	0/10	0/10			Not estimable
Damiani 1998	2/34	3/34		15.0 %	0.65 [0.11, 3.98]
Mais 1995	0/20	0/20			Not estimable
Yuen 1997	3/52	10/50		36.5 %	0.28 [0.09, 0.90]
Subtotal (95% CI)	**164**	**164**		**96.8 %**	**0.37 [0.18, 0.76]**
Total events: 10 (Laparoscopy), 25 (Laparotomy)					
Heterogeneity: Chi^2 = 0.60, df = 2 (P = 0.74); I^2 =0.0%					
Test for overall effect: Z = 2.71 (P = 0.0068)					
2 Dermoid cysts					
Mais 2003	0/20	0/20			Not estimable
Morgante 1998	0/22	1/22		3.2 %	0.14 [0.00, 6.82]
Nitke 1996	0/20	0/18			Not estimable
Subtotal (95% CI)	**62**	**60**		**3.2 %**	**0.14 [0.00, 6.82]**
Total events: 0 (Laparoscopy), 1 (Laparotomy)					
Heterogeneity: not applicable					
Test for overall effect: Z = 1.00 (P = 0.32)					
3 Ovarian endometriomata					
Mais 1996	0/16	0/16			Not estimable
Subtotal (95% CI)	**16**	**16**			**Not estimable**
Total events: 0 (Laparoscopy), 0 (Laparotomy)					
Heterogeneity: not applicable					
Test for overall effect: not applicable					
Total (95% CI)	**242**	**240**		**100.0 %**	**0.36 [0.18, 0.73]**
Total events: 10 (Laparoscopy), 26 (Laparotomy)					
Heterogeneity: Chi^2 = 0.85, df = 3 (P = 0.84); I^2 =0.0%					
Test for overall effect: Z = 2.84 (P = 0.0045)					
Test for subgroup differences: Chi^2 = 0.25, df = 1 (P = 0.62), I^2 =0.0%					



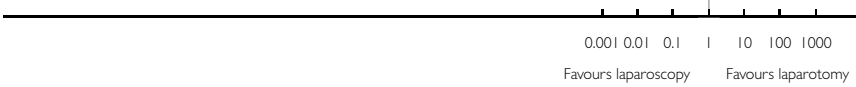
Analysis 1.11. Comparison 1 Laparoscopy versus laparotomy, Outcome 11 Post operative complications - Incision infection.

Review: Laparoscopy versus laparotomy for benign ovarian tumour

Comparison: 1 Laparoscopy versus laparotomy

Outcome: 11 Post operative complications - Incision infection

Study or subgroup	Laparoscopy n/N	Laparotomy n/N	Peto Odds Ratio Peto,Fixed,95% CI	Weight	Peto Odds Ratio Peto,Fixed,95% CI
1 Any type of benign ovarian tumour					
Badawy 2002	1/48	5/50		85.1 %	0.26 [0.05, 1.32]
Buchweitz 2005	0/10	0/10			Not estimable
Damiani 1998	0/34	0/34			Not estimable
Mais 1995	0/20	0/20			Not estimable
Yuen 1997	0/52	1/50		14.9 %	0.13 [0.00, 6.56]
Subtotal (95% CI)	**164**	**164**		**100.0 %**	**0.23 [0.05, 1.05]**
Total events: 1 (Laparoscopy), 6 (Laparotomy)					
Heterogeneity: Chi^2 = 0.10, df = 1 (P = 0.76); I^2 =0.0%					
Test for overall effect: Z = 1.89 (P = 0.058)					
2 Dermoid cysts					
Mais 2003	0/20	0/20			Not estimable
Morgante 1998	0/22	0/22			Not estimable
Nitke 1996	0/20	0/18			Not estimable
Subtotal (95% CI)	**62**	**60**			**Not estimable**
Total events: 0 (Laparoscopy), 0 (Laparotomy)					
Heterogeneity: not applicable					
Test for overall effect: not applicable					
3 Ovarian endometriomata					
Mais 1996	0/16	0/16			Not estimable
Subtotal (95% CI)	**16**	**16**			**Not estimable**
Total events: 0 (Laparoscopy), 0 (Laparotomy)					
Heterogeneity: not applicable					
Test for overall effect: not applicable					
Test for subgroup differences: Not applicable					



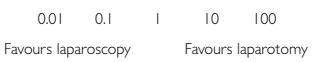
Analysis 1.12. Comparison 1 Laparoscopy versus laparotomy, Outcome 12 Post operative complications - Urinary tract infection.

Review: Laparoscopy versus laparotomy for benign ovarian tumour

Comparison: 1 Laparoscopy versus laparotomy

Outcome: 12 Post operative complications - Urinary tract infection

Study or subgroup	Laparoscopy n/N	Laparotomy n/N	Peto Odds Ratio Peto,Fixed,95% CI	Weight	Peto Odds Ratio Peto,Fixed,95% CI
1 Any type of benign ovarian tumour					
Badawy 2002	0/48	2/50		23.1 %	0.14 [0.01, 2.24]
Buchweitz 2005	0/10	0/10			Not estimable
Damiani 1998	0/34	0/34			Not estimable
Mais 1995	0/20	0/20			Not estimable
Yuen 1997	2/52	5/50		76.9 %	0.39 [0.08, 1.78]
Subtotal (95% CI)	**164**	**164**		**100.0 %**	**0.30 [0.08, 1.16]**
Total events: 2 (Laparoscopy), 7 (Laparotomy)					
Heterogeneity: Chi^2 = 0.40, df = 1 (P = 0.53); I^2 =0.0%					
Test for overall effect: Z = 1.74 (P = 0.082)					
2 Dermoid cysts					
Mais 2003	0/20	0/20			Not estimable
Morgante 1998	0/22	0/22			Not estimable
Nitke 1996	0/20	0/18			Not estimable
Subtotal (95% CI)	**62**	**60**			**Not estimable**
Total events: 0 (Laparoscopy), 0 (Laparotomy)					
Heterogeneity: not applicable					
Test for overall effect: not applicable					
3 Ovarian endometriomata					
Mais 1996	0/16	0/16			Not estimable
Subtotal (95% CI)	**16**	**16**			**Not estimable**
Total events: 0 (Laparoscopy), 0 (Laparotomy)					
Heterogeneity: not applicable					
Test for overall effect: not applicable					
Test for subgroup differences: Not applicable					



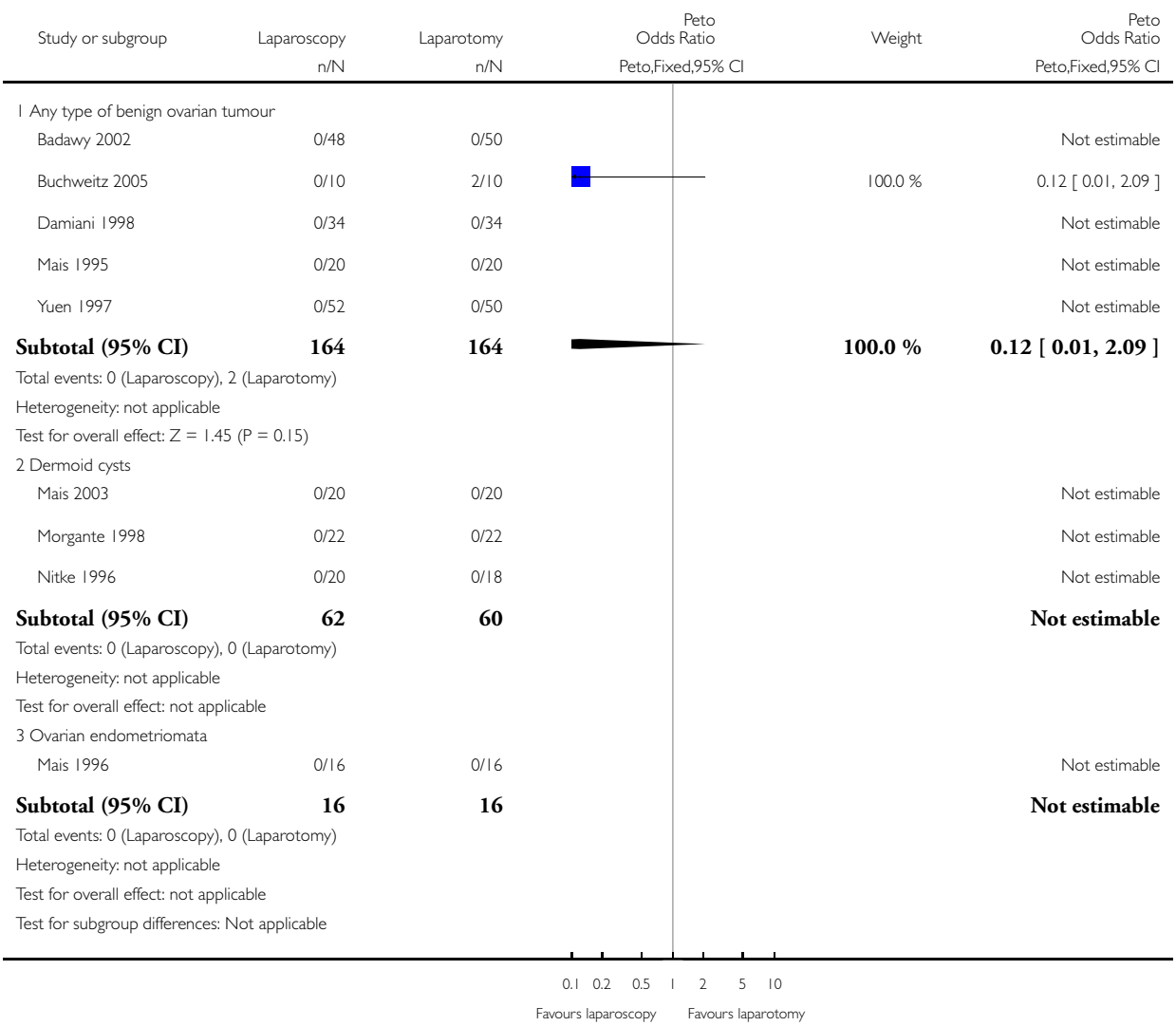
Analysis 1.13. Comparison 1 Laparoscopy versus laparotomy, Outcome 13 Post operative complications - Thromboembolism.

Review: Laparoscopy versus laparotomy for benign ovarian tumour

Comparison: 1 Laparoscopy versus laparotomy

Outcome: 13 Post operative complications - Thromboembolism

Study or subgroup	Laparoscopy n/N	Laparotomy n/N	Peto Odds Ratio Peto,Fixed,95% CI	Weight	Peto Odds Ratio Peto,Fixed,95% CI
1 Any type of benign ovarian tumour					
Badawy 2002	0/48	0/50			Not estimable
Buchweitz 2005	0/10	2/10		100.0 %	0.12 [0.01, 2.09]
Damiani 1998	0/34	0/34			Not estimable
Mais 1995	0/20	0/20			Not estimable
Yuen 1997	0/52	0/50			Not estimable
Subtotal (95% CI)	**164**	**164**		**100.0 %**	**0.12 [0.01, 2.09]**
Total events: 0 (Laparoscopy), 2 (Laparotomy)					
Heterogeneity: not applicable					
Test for overall effect: Z = 1.45 (P = 0.15)					
2 Dermoid cysts					
Mais 2003	0/20	0/20			Not estimable
Morgante 1998	0/22	0/22			Not estimable
Nitke 1996	0/20	0/18			Not estimable
Subtotal (95% CI)	**62**	**60**			**Not estimable**
Total events: 0 (Laparoscopy), 0 (Laparotomy)					
Heterogeneity: not applicable					
Test for overall effect: not applicable					
3 Ovarian endometriomata					
Mais 1996	0/16	0/16			Not estimable
Subtotal (95% CI)	**16**	**16**			**Not estimable**
Total events: 0 (Laparoscopy), 0 (Laparotomy)					
Heterogeneity: not applicable					
Test for overall effect: not applicable					
Test for subgroup differences: Not applicable					

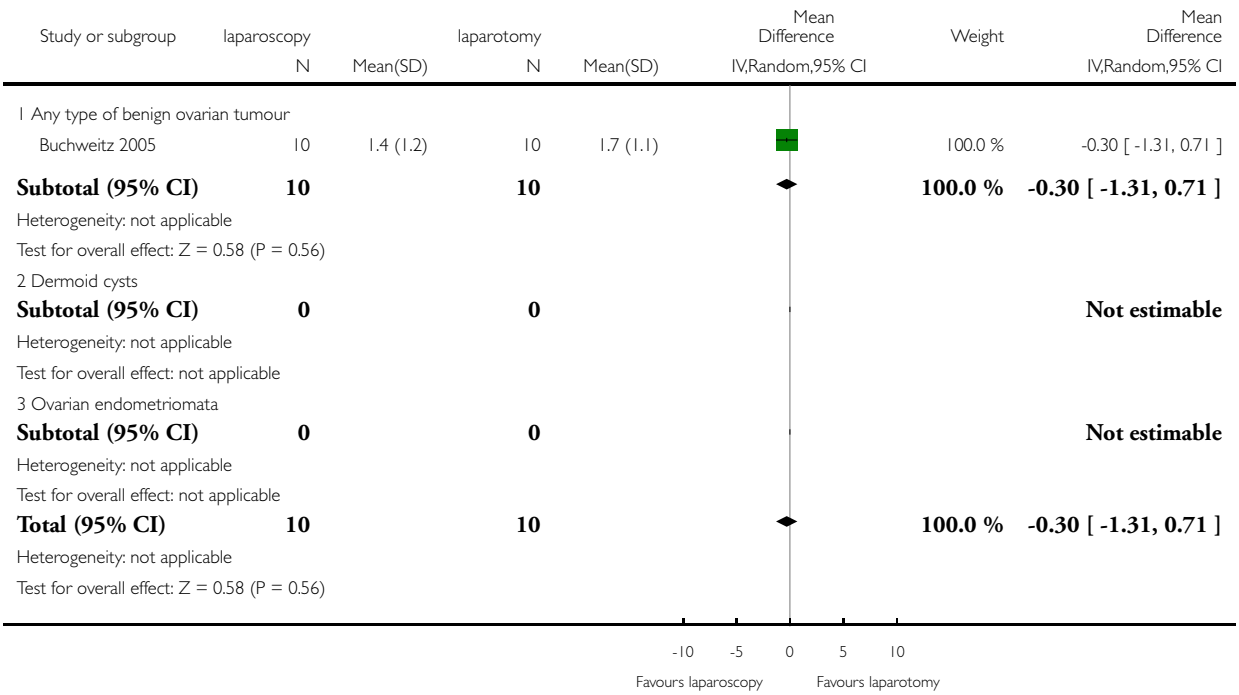


Analysis 1.14. Comparison 1 Laparoscopy versus laparotomy, Outcome 14 Blood loss by hemoglobin levels.

Review: Laparoscopy versus laparotomy for benign ovarian tumour

Comparison: 1 Laparoscopy versus laparotomy

Outcome: 14 Blood loss by hemoglobin levels



Analysis 1.15. Comparison 1 Laparoscopy versus laparotomy, Outcome 15 Perioperative mortality.

Review: Laparoscopy versus laparotomy for benign ovarian tumour

Comparison: 1 Laparoscopy versus laparotomy

Outcome: 15 Perioperative mortality

Study or subgroup	Laparoscopy n/N	Laparotomy n/N	Peto Odds Ratio Peto,Fixed,95% CI	Weight	Peto Odds Ratio Peto,Fixed,95% CI
1 Any type of benign ovarian tumour					
Badawy 2002	0/48	0/50			Not estimable
Buchweitz 2005	0/10	0/10			Not estimable
Damiani 1998	0/34	0/34			Not estimable
Mais 1995	0/20	0/20			Not estimable
Yuen 1997	0/52	0/50			Not estimable
Subtotal (95% CI)	**164**	**164**			**Not estimable**
Total events: 0 (Laparoscopy), 0 (Laparotomy)					
Heterogeneity: not applicable					
Test for overall effect: not applicable					
2 Dermoid cysts					
Mais 2003	0/20	0/20			Not estimable
Morgante 1998	0/22	0/22			Not estimable
Nitke 1996	0/20	0/18			Not estimable
Subtotal (95% CI)	**62**	**60**			**Not estimable**
Total events: 0 (Laparoscopy), 0 (Laparotomy)					
Heterogeneity: not applicable					
Test for overall effect: not applicable					
3 Ovarian endometriomata					
Mais 1996	0/16	0/16			Not estimable
Subtotal (95% CI)	**16**	**16**			**Not estimable**
Total events: 0 (Laparoscopy), 0 (Laparotomy)					
Heterogeneity: not applicable					
Test for overall effect: not applicable					
Test for subgroup differences: Chi^2 = 0.0, df = -1 (P = 0.0), I^2 =0.0%					

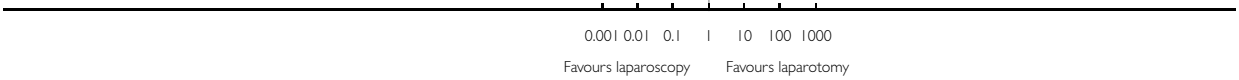
Analysis 1.16. Comparison 1 Laparoscopy versus laparotomy, Outcome 16 Urinary retention.

Review: Laparoscopy versus laparotomy for benign ovarian tumour

Comparison: 1 Laparoscopy versus laparotomy

Outcome: 16 Urinary retention

Study or subgroup	Laparoscopy n/N	Laparotomy n/N	Peto Odds Ratio Peto,Fixed,95% CI	Weight	Peto Odds Ratio Peto,Fixed,95% CI
1 Any type of benign ovarian tumour					
Badawy 2002	0/48	0/50			Not estimable
Buchweitz 2005	0/10	0/10			Not estimable
Damiani 1998	0/34	0/34			Not estimable
Mais 1995	0/20	0/20			Not estimable
Yuen 1997	0/52	4/50		100.0 %	0.12 [0.02, 0.89]
Subtotal (95% CI)	**164**	**164**		**100.0 %**	**0.12 [0.02, 0.89]**
Total events: 0 (Laparoscopy), 4 (Laparotomy)					
Heterogeneity: not applicable					
Test for overall effect: Z = 2.07 (P = 0.038)					
2 Dermoid cysts					
Mais 2003	0/20	0/20			Not estimable
Morgante 1998	0/22	0/22			Not estimable
Nitke 1996	0/20	0/18			Not estimable
Subtotal (95% CI)	**62**	**60**			**Not estimable**
Total events: 0 (Laparoscopy), 0 (Laparotomy)					
Heterogeneity: not applicable					
Test for overall effect: not applicable					
3 Ovarian endometriomata					
Mais 1996	0/16	0/16			Not estimable
Subtotal (95% CI)	**16**	**16**			**Not estimable**
Total events: 0 (Laparoscopy), 0 (Laparotomy)					
Heterogeneity: not applicable					
Test for overall effect: not applicable					
Test for subgroup differences: Not applicable					



Analysis 1.17. Comparison 1 Laparoscopy versus laparotomy, Outcome 17 Chemical peritonitis.

Review: Laparoscopy versus laparotomy for benign ovarian tumour

Comparison: 1 Laparoscopy versus laparotomy

Outcome: 17 Chemical peritonitis

Study or subgroup	Laparoscopy n/N	Laparotomy n/N	Peto Odds Ratio Peto,Fixed,95% CI	Weight	Peto Odds Ratio Peto,Fixed,95% CI
1 Any type of benign ovarian tumour					
Badawy 2002	0/48	0/50			Not estimable
Buchweitz 2005	0/10	0/10			Not estimable
Damiani 1998	0/34	0/34			Not estimable
Mais 1995	0/20	0/20			Not estimable
Yuen 1997	0/52	0/50			Not estimable
Subtotal (95% CI)	**164**	**164**			**Not estimable**
Total events: 0 (Laparoscopy), 0 (Laparotomy)					
Heterogeneity: not applicable					
Test for overall effect: not applicable					
2 Dermoid cysts					
Mais 2003	0/20	0/20			Not estimable
Morgante 1998	0/22	0/22			Not estimable
Nitke 1996	0/20	0/18			Not estimable
Subtotal (95% CI)	**62**	**60**			**Not estimable**
Total events: 0 (Laparoscopy), 0 (Laparotomy)					
Heterogeneity: not applicable					
Test for overall effect: not applicable					
3 Ovarian endometriomata					
Mais 1996	0/16	0/16			Not estimable
Subtotal (95% CI)	**16**	**16**			**Not estimable**
Total events: 0 (Laparoscopy), 0 (Laparotomy)					
Heterogeneity: not applicable					
Test for overall effect: not applicable					
Test for subgroup differences: Chi^2 = 0.0, df = -1 (P = 0.0), I^2 =0.0%					

Analysis 1.18. Comparison 1 Laparoscopy versus laparotomy, Outcome 18 Intestinal obstruction.

Review: Laparoscopy versus laparotomy for benign ovarian tumour

Comparison: 1 Laparoscopy versus laparotomy

Outcome: 18 Intestinal obstruction

Study or subgroup	Laparoscopy n/N	Laparotomy n/N	Peto Odds Ratio Peto,Fixed,95% CI	Weight	Peto Odds Ratio Peto,Fixed,95% CI
1 Any type of benign ovarian tumour					
Badawy 2002	0/48	0/50			Not estimable
Buchweitz 2005	0/10	0/10			Not estimable
Damiani 1998	0/34	0/34			Not estimable
Mais 1995	0/20	0/20			Not estimable
Yuen 1997	0/52	0/50			Not estimable
Subtotal (95% CI)	**164**	**164**			**Not estimable**
Total events: 0 (Laparoscopy), 0 (Laparotomy)					
Heterogeneity: not applicable					
Test for overall effect: not applicable					
2 Dermoid cysts					
Mais 2003	0/20	0/20			Not estimable
Morgante 1998	0/22	1/22		100.0 %	0.14 [0.00, 6.82]
Nitke 1996	0/20	0/18			Not estimable
Subtotal (95% CI)	**62**	**60**		**100.0 %**	**0.14 [0.00, 6.82]**
Total events: 0 (Laparoscopy), 1 (Laparotomy)					
Heterogeneity: not applicable					
Test for overall effect: Z = 1.00 (P = 0.32)					
3 Ovarian endometriomata					
Mais 1996	0/16	0/16			Not estimable
Subtotal (95% CI)	**16**	**16**			**Not estimable**
Total events: 0 (Laparoscopy), 0 (Laparotomy)					
Heterogeneity: not applicable					
Test for overall effect: not applicable					
Test for subgroup differences: Not applicable					

Analysis 1.19. Comparison 1 Laparoscopy versus laparotomy, Outcome 19 1.18 Any adverse effect of surgery (incl surgical injury or post surgery complication or other).

Review: Laparoscopy versus laparotomy for benign ovarian tumour

Comparison: 1 Laparoscopy versus laparotomy

Outcome: 19 1.18 Any adverse effect of surgery (incl surgical injury or post surgery complication or other)

Study or subgroup	Laparoscopy n/N	Laparotomy n/N	Peto Odds Ratio Peto,Fixed,95% CI	Weight	Peto Odds Ratio Peto,Fixed,95% CI
1 Any type of benign ovarian tumour					
Badawy 2002	12/48	23/50		43.6 %	0.40 [0.18, 0.92]
Buchweitz 2005	0/10	3/10		5.2 %	0.11 [0.01, 1.17]
Damiani 1998	2/34	3/34		9.0 %	0.65 [0.11, 3.98]
Mais 1995	0/20	0/20			Not estimable
Yuen 1997	6/52	21/50		38.5 %	0.21 [0.09, 0.51]
Subtotal (95% CI)	**164**	**164**		**96.3 %**	**0.30 [0.18, 0.53]**
Total events: 20 (Laparoscopy), 50 (Laparotomy)					
Heterogeneity: Chi² = 2.53, df = 3 (P = 0.47); I² =0.0%					
Test for overall effect: Z = 4.21 (P = 0.000026)					
2 Dermoid cysts					
Mais 2003	0/20	0/20			Not estimable
Morgante 1998	0/22	2/22		3.7 %	0.13 [0.01, 2.13]
Nitke 1996	0/20	0/18			Not estimable
Subtotal (95% CI)	**62**	**60**		**3.7 %**	**0.13 [0.01, 2.13]**
Total events: 0 (Laparoscopy), 2 (Laparotomy)					
Heterogeneity: not applicable					
Test for overall effect: Z = 1.43 (P = 0.15)					
3 Ovarian endometriomata					
Mais 1996	0/16	0/16			Not estimable
Subtotal (95% CI)	**16**	**16**			**Not estimable**
Total events: 0 (Laparoscopy), 0 (Laparotomy)					
Heterogeneity: not applicable					
Test for overall effect: not applicable					
Total (95% CI)	**242**	**240**		**100.0 %**	**0.29 [0.17, 0.51]**
Total events: 20 (Laparoscopy), 52 (Laparotomy)					
Heterogeneity: Chi² = 2.88, df = 4 (P = 0.58); I² =0.0%					
Test for overall effect: Z = 4.41 (P = 0.000010)					
Test for subgroup differences: Chi² = 0.35, df = 1 (P = 0.56), I² =0.0%					

Analysis 1.20. Comparison 1 Laparoscopy versus laparotomy, Outcome 20 Short term recovery - pain (VAS).

Review: Laparoscopy versus laparotomy for benign ovarian tumour

Comparison: 1 Laparoscopy versus laparotomy

Outcome: 20 Short term recovery - pain (VAS)

Study or subgroup	Laparoscopy N	Mean(SD)	Laparotomy N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Weight	Mean Difference IV,Fixed,95% CI
1 Any type of benign ovarian tumour							
Mais 1995	20	2 (1.34)	20	4.7 (1.79)		11.8 %	-2.70 [-3.68, -1.72]
Yuen 1997	52	3.1 (2.5)	50	4.9 (2.5)		12.0 %	-1.80 [-2.77, -0.83]
Subtotal (95% CI)	**72**		**70**			**23.8 %**	**-2.25 [-2.94, -1.56]**
Heterogeneity: Chi^2 = 1.64, df = 1 (P = 0.20); I^2 =39%							
Test for overall effect: Z = 6.38 (P < 0.00001)							
2 Dermoid cysts							
Morgante 1998	22	1.4 (0.6)	22	3.8 (0.7)		76.2 %	-2.40 [-2.79, -2.01]
Subtotal (95% CI)	**22**		**22**			**76.2 %**	**-2.40 [-2.79, -2.01]**
Heterogeneity: not applicable							
Test for overall effect: Z = 12.21 (P < 0.00001)							
Total (95% CI)	**94**		**92**			**100.0 %**	**-2.36 [-2.70, -2.03]**
Heterogeneity: Chi^2 = 1.78, df = 2 (P = 0.41); I^2 =0.0%							
Test for overall effect: Z = 13.77 (P < 0.00001)							
Test for subgroup differences: Chi^2 = 0.15, df = 1 (P = 0.70), I^2 =0.0%							

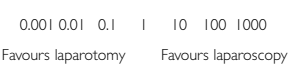
Analysis 1.21. Comparison 1 Laparoscopy versus laparotomy, Outcome 21 Short term recovery - pain (painfree 24-48 hours post surgery).

Review: Laparoscopy versus laparotomy for benign ovarian tumour

Comparison: 1 Laparoscopy versus laparotomy

Outcome: 21 Short term recovery - pain (painfree 24-48 hours post surgery)

Study or subgroup	Laparoscopy n/N	Laparotomy n/N	Peto Odds Ratio Peto,Fixed,95% CI	Weight	Peto Odds Ratio Peto,Fixed,95% CI
1 Any type of benign ovarian tumour					
Badawy 2002	26/48	7/50		25.8 %	5.93 [2.58, 13.65]
Mais 1995	16/20	3/20		11.9 %	12.70 [3.73, 43.25]
Yuen 1997	28/52	10/50		28.1 %	4.19 [1.89, 9.33]
Subtotal (95% CI)	**120**	**120**		**65.8 %**	**5.87 [3.48, 9.90]**
Total events: 70 (Laparoscopy), 20 (Laparotomy)					
Heterogeneity: Chi^2 = 2.20, df = 2 (P = 0.33); I^2 =9%					
Test for overall effect: Z = 6.65 (P < 0.00001)					
2 Dermoid cysts					
Mais 2003	16/20	3/20		11.9 %	12.70 [3.73, 43.25]
Morgante 1998	15/22	3/22		12.7 %	9.07 [2.76, 29.76]
Subtotal (95% CI)	**42**	**42**		**24.6 %**	**10.68 [4.55, 25.06]**
Total events: 31 (Laparoscopy), 6 (Laparotomy)					
Heterogeneity: Chi^2 = 0.15, df = 1 (P = 0.70); I^2 =0.0%					
Test for overall effect: Z = 5.44 (P < 0.00001)					
3 Ovarian endometriomata					
Mais 1996	14/16	3/16		9.6 %	14.51 [3.70, 56.90]
Subtotal (95% CI)	**16**	**16**		**9.6 %**	**14.51 [3.70, 56.90]**
Total events: 14 (Laparoscopy), 3 (Laparotomy)					
Heterogeneity: not applicable					
Test for overall effect: Z = 3.84 (P = 0.00013)					
Total (95% CI)	**178**	**178**		**100.0 %**	**7.42 [4.86, 11.33]**
Total events: 115 (Laparoscopy), 29 (Laparotomy)					
Heterogeneity: Chi^2 = 4.75, df = 5 (P = 0.45); I^2 =0.0%					
Test for overall effect: Z = 9.28 (P < 0.00001)					
Test for subgroup differences: Chi^2 = 2.39, df = 2 (P = 0.30), I^2 =16%					



Analysis 1.22. Comparison 1 Laparoscopy versus laparotomy, Outcome 22 Short term recovery - Pain (requirement for analgesia).

Short term recovery - Pain (requirement for analgesia)

Study	Drug	mean (SD) laparoscop	mean (SD) laparot	difference
any type of benign ovarian tumour				
Badawy 2002	Diclofenac sodium 75 mg	2.9 (1.2) doses	4.6 (3.9) doses	p=0.003, significant difference between the two groups
Badawy 2002				
Buchweitz 2005	Piritramine	3.8 (1.2) doses	4.4 (1.5) doses	
Buchweitz 2005				
Yuen 1997	Dologesic	1.1 (0.9) doses	1.3 (0.9) doses	NS
Yuen 1997	Morphine	0.5 (0.8) doses	0.8 (0.8) doses	NS

Analysis 1.23. Comparison 1 Laparoscopy versus laparotomy, Outcome 23 Recurrence at 6-12 months.

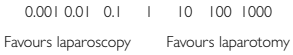
Review: Laparoscopy versus laparotomy for benign ovarian tumour
Comparison: 1 Laparoscopy versus laparotomy
Outcome: 23 Recurrence at 6-12 months

Study or subgroup	Laparoscopy n/N	Laparotomy n/N	Peto Odds Ratio Peto,Fixed,95% CI	Weight	Peto Odds Ratio Peto,Fixed,95% CI
1 Any type of benign ovarian tumour					
Damiani 1998	1/34	1/34		100.0 %	1.00 [0.06, 16.33]
Mais 1995	0/20	0/20			Not estimable
Subtotal (95% CI)	**54**	**54**		**100.0 %**	**1.00 [0.06, 16.33]**
Total events: 1 (Laparoscopy), 1 (Laparotomy)					
Heterogeneity: not applicable					
Test for overall effect: Z = 0.0 (P = 1.0)					
2 Dermoid cysts					
Mais 2003	0/15	0/16			Not estimable

(*Continued* . . .)

(. . . *Continued*)

Study or subgroup	Laparoscopy n/N	Laparotomy n/N	Peto Odds Ratio Peto,Fixed,95% CI	Weight	Peto Odds Ratio Peto,Fixed,95% CI
Subtotal (95% CI)	**15**	**16**			**Not estimable**
Total events: 0 (Laparoscopy), 0 (Laparotomy)					
Heterogeneity: not applicable					
Test for overall effect: not applicable					
3 Ovarian endometriomata					
Mais 1996	0/16	0/16			Not estimable
Subtotal (95% CI)	**16**	**16**			**Not estimable**
Total events: 0 (Laparoscopy), 0 (Laparotomy)					
Heterogeneity: not applicable					
Test for overall effect: not applicable					
Total (95% CI)	**85**	**86**		**100.0 %**	**1.00 [0.06, 16.33]**
Total events: 1 (Laparoscopy), 1 (Laparotomy)					
Heterogeneity: not applicable					
Test for overall effect: Z = 0.0 (P = 1.0)					
Test for subgroup differences: Not applicable					



Analysis 1.24. Comparison 1 Laparoscopy versus laparotomy, Outcome 24 Length of hospital stay (days).

Review: Laparoscopy versus laparotomy for benign ovarian tumour

Comparison: 1 Laparoscopy versus laparotomy

Outcome: 24 Length of hospital stay (days)

Study or subgroup	Laparoscopy N	Mean(SD)	Laparotomy N	Mean(SD)	Mean Difference IV,Random,95% CI	Weight	Mean Difference IV,Random,95% CI
1 Any type of benign ovarian tumour							
Badawy 2002	48	0.75 (0.25)	50	3.75 (1.25)		19.1 %	-3.00 [-3.35, -2.65]
Buchweitz 2005	10	6.1 (1.2)	10	10 (1.6)		3.0 %	-3.90 [-5.14, -2.66]
Damiani 1998	34	1.6 (0.8)	34	4.8 (1.4)		11.6 %	-3.20 [-3.74, -2.66]
Mais 1995	20	2 (0.7)	20	4.6 (1)		11.8 %	-2.60 [-3.13, -2.07]
Yuen 1997	52	2.6 (1.7)	50	4.9 (2.2)		6.9 %	-2.30 [-3.07, -1.53]
Subtotal (95% CI)	**164**		**164**			**52.3 %**	**-2.91 [-3.28, -2.55]**
Heterogeneity: Tau^2 = 0.08; Chi^2 = 7.52, df = 4 (P = 0.11); I^2 =47%							
Test for overall effect: Z = 15.63 (P < 0.00001)							
2 Dermoid cysts							
Morgante 1998	22	3.18 (0.39)	22	6.32 (1.09)		13.5 %	-3.14 [-3.62, -2.66]
Nitke 1996	20	0.93 (0.28)	18	3.8 (0.48)		24.9 %	-2.87 [-3.12, -2.62]
Subtotal (95% CI)	**42**		**40**			**38.3 %**	**-2.93 [-3.15, -2.70]**
Heterogeneity: Tau^2 = 0.0; Chi^2 = 0.94, df = 1 (P = 0.33); I^2 =0.0%							
Test for overall effect: Z = 25.56 (P < 0.00001)							
3 Ovarian endometriomata							
Mais 1996	16	2.25 (0.93)	16	4.63 (0.89)		9.3 %	-2.38 [-3.01, -1.75]
Subtotal (95% CI)	**16**		**16**			**9.3 %**	**-2.38 [-3.01, -1.75]**
Heterogeneity: not applicable							
Test for overall effect: Z = 7.40 (P < 0.00001)							
Total (95% CI)	**222**		**220**			**100.0 %**	**-2.88 [-3.11, -2.66]**
Heterogeneity: Tau^2 = 0.04; Chi^2 = 11.15, df = 7 (P = 0.13); I^2 =37%							
Test for overall effect: Z = 25.33 (P < 0.00001)							

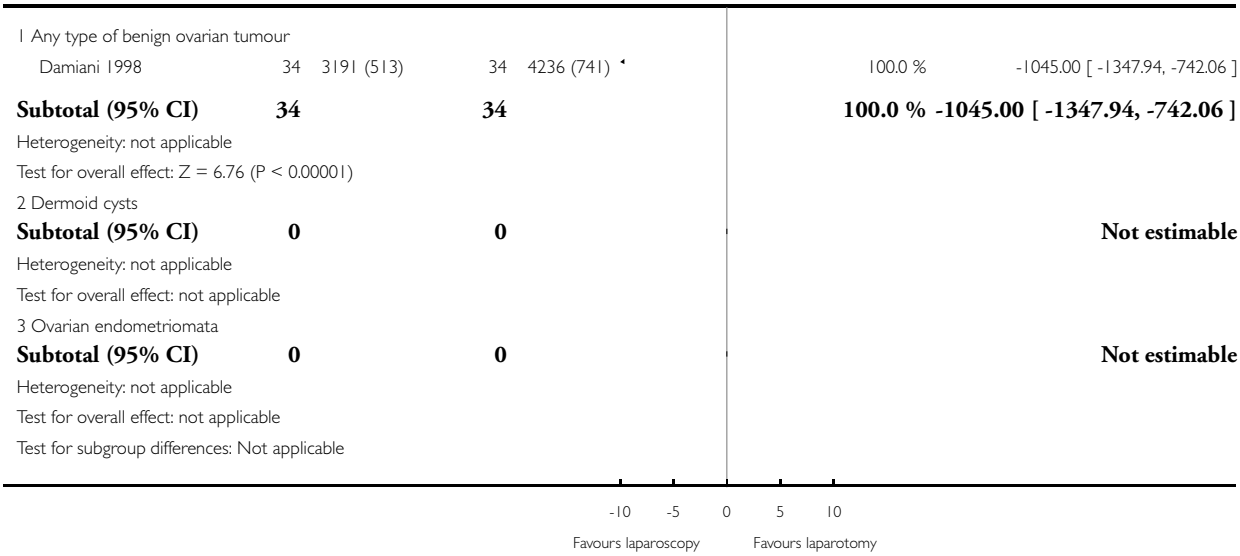
Analysis 1.25. Comparison 1 Laparoscopy versus laparotomy, Outcome 25 Economic outcomes - total cost (US$1000 1993).

Review: Laparoscopy versus laparotomy for benign ovarian tumour

Comparison: 1 Laparoscopy versus laparotomy

Outcome: 25 Economic outcomes - total cost (US$1000 1993)

Study or subgroup	Laparoscopy N	Mean(SD)	Laparotomy N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Weight	Mean Difference IV,Fixed,95% CI
1 Any type of benign ovarian tumour							
Damiani 1998	34	3191 (513)	34	4236 (741)		100.0 %	-1045.00 [-1347.94, -742.06]
Subtotal (95% CI)	**34**		**34**			**100.0 %**	**-1045.00 [-1347.94, -742.06]**
Heterogeneity: not applicable							
Test for overall effect: Z = 6.76 (P < 0.00001)							
2 Dermoid cysts							
Subtotal (95% CI)	**0**		**0**				**Not estimable**
Heterogeneity: not applicable							
Test for overall effect: not applicable							
3 Ovarian endometriomata							
Subtotal (95% CI)	**0**		**0**				**Not estimable**
Heterogeneity: not applicable							
Test for overall effect: not applicable							
Test for subgroup differences: Not applicable							



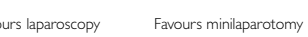
Analysis 2.1. Comparison 2 Laparoscopy versus minilaparotomy, Outcome 1 Surgery - duration of surgery.

Review: Laparoscopy versus laparotomy for benign ovarian tumour

Comparison: 2 Laparoscopy versus minilaparotomy

Outcome: 1 Surgery - duration of surgery

Study or subgroup	Laparoscopy N	Mean(SD)	Minilaparotomy N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Mean Difference IV,Fixed,95% CI
Fanfani 2004	50	87 (44.8)	50	71.9 (31.2)		15.10 [-0.03, 30.23]
Panici 2007	30	81 (18.8)	30	47 (12.4)		34.00 [25.94, 42.06]
Panici 2007a	63	45 (11.9)	64	35 (11.8)		10.00 [5.88, 14.12]



Analysis 2.2. Comparison 2 Laparoscopy versus minilaparotomy, Outcome 2 Surgery - change of diagnosis to malignant tumour.

Review: Laparoscopy versus laparotomy for benign ovarian tumour

Comparison: 2 Laparoscopy versus minilaparotomy

Outcome: 2 Surgery - change of diagnosis to malignant tumour

Study or subgroup	Laparoscopy n/N	Minilaparotomy n/N	Odds Ratio Peto,Fixed,95% CI	Weight	Odds Ratio Peto,Fixed,95% CI
1 Any type of benign ovarian tumour					
Fanfani 2004	2/50	1/50		63.9 %	2.04 [0.18, 23.27]
Panici 2007	1/30	0/30		36.1 %	3.10 [0.12, 79.23]
Total (95% CI)	**80**	**80**		**100.0 %**	**2.37 [0.34, 16.61]**
Total events: 3 (Laparoscopy), 1 (Minilaparotomy)					
Heterogeneity: Chi^2 = 0.04, df = 1 (P = 0.84); I^2 =0.0%					
Test for overall effect: Z = 0.87 (P = 0.38)					
Test for subgroup differences: Not applicable					

Analysis 2.3. Comparison 2 Laparoscopy versus minilaparotomy, Outcome 3 Post operative complications - Febrile morbidity.

Review: Laparoscopy versus laparotomy for benign ovarian tumour

Comparison: 2 Laparoscopy versus minilaparotomy

Outcome: 3 Post operative complications - Febrile morbidity

Study or subgroup	Laparoscopy n/N	Minilaparotomy n/N	Odds Ratio Peto,Fixed,95% CI	Weight	Odds Ratio Peto,Fixed,95% CI
1 Any type of benign ovarian tumour					
Fanfani 2004	0/50	2/50		48.7 %	0.19 [0.01, 4.10]
Panici 2007a	0/63	3/64		51.3 %	0.14 [0.01, 2.73]
Total (95% CI)	**113**	**114**		**100.0 %**	**0.16 [0.02, 1.38]**

Total events: 0 (Laparoscopy), 5 (Minilaparotomy)

Heterogeneity: $Chi^2 = 0.02$, df = 1 (P = 0.88); $I^2 = 0.0\%$

Test for overall effect: Z = 1.67 (P = 0.095)

Test for subgroup differences: Not applicable

Analysis 2.4. Comparison 2 Laparoscopy versus minilaparotomy, Outcome 4 Post operative complications - Incison infection.

Review: Laparoscopy versus laparotomy for benign ovarian tumour

Comparison: 2 Laparoscopy versus minilaparotomy

Outcome: 4 Post operative complications - Incison infection

Study or subgroup	Laparoscopy n/N	Minilaparotomy n/N	Odds Ratio Peto,Fixed,95% CI	Weight	Odds Ratio Peto,Fixed,95% CI
1 Any type of benign ovarian tumour					
Panici 2007a	0/63	3/64		100.0 %	0.14 [0.01, 2.73]
Total (95% CI)	**63**	**64**		**100.0 %**	**0.14 [0.01, 2.73]**

Total events: 0 (Laparoscopy), 3 (Minilaparotomy)

Heterogeneity: not applicable

Test for overall effect: Z = 1.30 (P = 0.19)

Test for subgroup differences: Not applicable

Analysis 2.5. Comparison 2 Laparoscopy versus minilaparotomy, Outcome 5 Any adverse effect of surgery (incl surgical injury or post surgery complication or other).

Review: Laparoscopy versus laparotomy for benign ovarian tumour

Comparison: 2 Laparoscopy versus minilaparotomy

Outcome: 5 Any adverse effect of surgery (incl surgical injury or post surgery complication or other)

Study or subgroup	Laparoscopy n/N	Minilaparotomy n/N	Odds Ratio Peto,Fixed,95% CI	Weight	Odds Ratio Peto,Fixed,95% CI
1 Any type of benign ovarian tumour					
Fanfani 2004	0/50	3/50		48.5 %	0.13 [0.01, 2.67]
Panici 2007a	0/63	6/64		51.5 %	0.07 [0.00, 1.29]
Total (95% CI)	**113**	**114**		**100.0 %**	**0.10 [0.01, 0.77]**

Total events: 0 (Laparoscopy), 9 (Minilaparotomy)

Heterogeneity: Chi² = 0.09, df = 1 (P = 0.76); I² =0.0%

Test for overall effect: Z = 2.20 (P = 0.028)

Test for subgroup differences: Not applicable

Analysis 2.6. Comparison 2 Laparoscopy versus minilaparotomy, Outcome 6 Short term recovery - pain (VAS).

Review: Laparoscopy versus laparotomy for benign ovarian tumour

Comparison: 2 Laparoscopy versus minilaparotomy

Outcome: 6 Short term recovery - pain (VAS)

Study or subgroup	Laparoscopy N	Mean(SD)	Minilaparotomy N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Weight	Mean Difference IV,Fixed,95% CI
1 Any type of benign ovarian tumour							
Panici 2007a	63	3 (1)	64	4 (2)		100.0 %	-1.00 [-1.55, -0.45]
Total (95% CI)	**63**		**64**			**100.0 %**	**-1.00 [-1.55, -0.45]**

Heterogeneity: not applicable

Test for overall effect: Z = 3.57 (P = 0.00035)

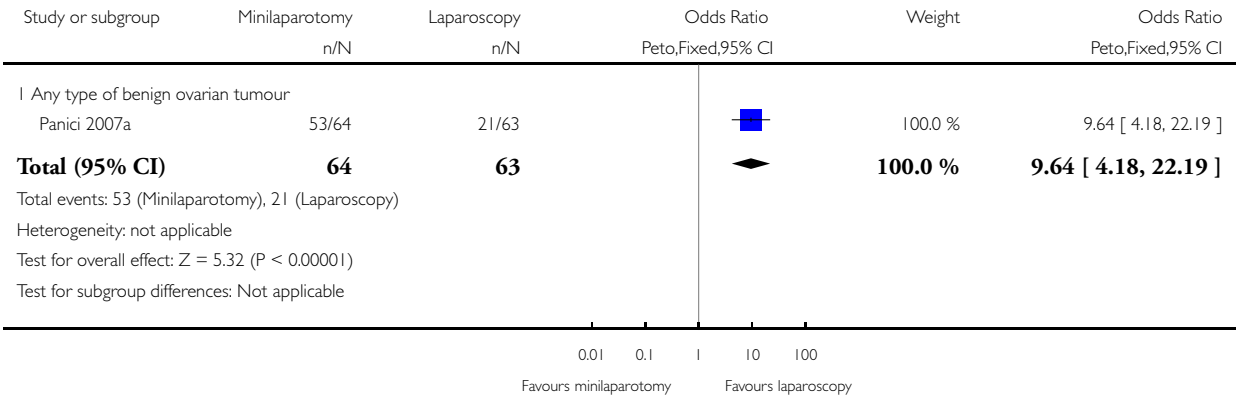
Test for subgroup differences: Not applicable

Analysis 2.7. Comparison 2 Laparoscopy versus minilaparotomy, Outcome 7 Short term recovery - pain (pain free 24-48 hours post surgery).

Review: Laparoscopy versus laparotomy for benign ovarian tumour

Comparison: 2 Laparoscopy versus minilaparotomy

Outcome: 7 Short term recovery - pain (pain free 24-48 hours post surgery)



Analysis 2.8. Comparison 2 Laparoscopy versus minilaparotomy, Outcome 8 Short term recovery - pain (requirement for analgesia).

Short term recovery - pain (requirement for analgesia)

Study	Drug	mean (SD) laparoscopy	mean (SD) laparotomy	difference
Any type of benign ovarian tumour				
Fanfani 2004	morphine chloridate/ ketoralac	1.3 (0.5) doses	1.2 (0.6) doses	NS

Analysis 2.9. Comparison 2 Laparoscopy versus minilaparotomy, Outcome 9 Length of hospital stay (days).

Review: Laparoscopy versus laparotomy for benign ovarian tumour

Comparison: 2 Laparoscopy versus minilaparotomy

Outcome: 9 Length of hospital stay (days)

Study or subgroup	Laparoscopy N	Mean(SD)	Minilaparotomy N	Mean(SD)	Mean Difference IV,Fixed,95% CI	Mean Difference IV,Fixed,95% CI
1 Any type of benign ovarian tumour						
Fanfani 2004	50	2 (0.8)	50	2.2 (0.6)		-0.20 [-0.48, 0.08]
Panici 2007	30	1 (0.47)	30	1 (0.95)		0.0 [-0.38, 0.38]
Panici 2007a	63	1 (0.59)	64	2 (0.47)		-1.00 [-1.19, -0.81]

APPENDICES

Appendix 1. MEDLINE

MEDLINE was searched using the following strategy:
1. Randomized controlled trial. pt.
2. Controlled clinical trial. pt.
3. Randomised controlled trials/
4. random allocation/
5. double -blind method/
6. single-blind method/
7. or/1-6
8. clinical trial. pt
9. Exp clinical trials/
10. (clin$ adj25 trial$).ti,ab,sh.
11. ((singl$ or doubl$ or tripl$ or trebl$) adj25 (blind$ or masks$)).ti,ab,sh.
12. placebos/
13. placebo$.ti,ab,sh
14. random$.ti,ab,sh.
15. Research design/
16. or/8-15
17. animal/ not (human/ and animal/)
18. 7 or 16
19.18 not 17
20. Exp Ovarian Cysts/
21. Exp ENDOMETRIOSIS/

22. (ovar$ adj5 tumo?r).tw
23.exp Adnexal Diseases/
24.exp Ovarian Neoplasms/
25. or/20-24
26. exp SURGERY/
27. surg$.tw.
28. exp OVARIECTOMY/
29. oophorect$.tw.
30. exp Surgical procedures, Operative/
31.or/26-30
32. 25 and 31
33. 19 and 32
34. laparo$.tw.
35. gynaecol$.tw
36. gynecol$.tw
37. general surgeon/
38. surgeon/

Appendix 2. CINHAL

CINAHL - Cumulative Index to nursing & Allied Health Literature was searched using the following strategy
1.ovarian cyst/
2. laparotomy/
3. laparoto$.tw
4 laparoscopy/
5.ovarian surgery/
6.(ovar$ adj5 tumor?r).tw.
7.ovar$ adj5 neoplasm$).tw.
8.exp surgery/
9.exp OVARIECTOMY/
10.surg$.tw.
11.or/1-10
13 exp clinical trials/
14.clinical trial.pt
15. Clinical trial.pt
16. (clinic$ adj trial$).tw
17.((singl$ or doubl$ or trebl$ or trip$) adj (blind$3 or mask$3)).tw.
18 randomi?ed control$ trial$.tw
19. Random assignment/
20. Random$ allocat$.tw
21. Placebo$.tw
22. Placebos/
23. or/13-22
24. 11 AND 23

Appendix 3. EMBASE

EMBASE was searched using the following strategy:
1. Controlled study/or Randomized Controlled trial/
2. double blind procedure/
3. single blind procedure/
4. crossover procedure/
5. drug comparison/
6. placebo/
7. random$.ti,ab,hw,tn,mf.
8. latin square.ti,ab,hw,tn,mf.
9. crossover.ti,ab,hw,tn,mf.
10.cross-over.ti,ab,hw,tn,mf.
11. placebo$.ti,ab,hw,tn,mf.
12.((doubl$ or singl$ or tripl$ or trebl$) adj5 (blind$ or mask$)).ti,ab,hw,tn,mf.
13. (comparative adj5 trial$).ti,ab,hw,tn,mf.
14. (clinical adj5 trial$).ti,ab,hw,tn,mf.
15. or/ 1-14
16. nonhuman/
17. animal/ not (human/and animal/)
18. or/16-17
19. 15 not 18
20. exp Ovary Cyst/
21. exp ENDOMETRIOSIS/
22. (ovar$ adj5 tumor?r).tw.
23. exp Adnexa Disease/
24. (ovar$ adj5 neoplasm$).tw.
25. or/20-24
26. exp surgery/
27. surg$.tw.
28. exp OVARIECTOMY/
29. oophorect$.tw.
30. exp Surgical Technique/
31. or/26-30
32. 25 and 31
33.19 and 32
34. gynaecol$.tw
35. gynecol$.tw
36. general surgeon/
37. surgeon/

Appendix 4. CENTRAL

(3) The Cochrane Central Register of Controlled Trials (CENTRAL)
1.ovarian cyst/
2. laparotomy/
3. laparoto$.tw
4 laparoscopy/
5.ovarian surgery/
6.(ovar$ adj5 tumor?r).tw.
7.ovar$ adj5 neoplasm$).tw.
8.exp surgery/
9.exp OVARIECTOMY/

10.surg$.tw.
11 or/1-10
12 randomized controlled trial/
13.controlled trial/
14.randon allocation/
15. double-blind method/
16 single-blind method/
17.or/12-16
18. 11 and 17

WHAT'S NEW

Last assessed as up-to-date: 9 November 2007.

Date	Event	Description
20 September 2010	Amended	Contact details updated.

HISTORY

Protocol first published: Issue 2, 2004

Review first published: Issue 3, 2005

Date	Event	Description
11 February 2009	New citation required but conclusions have not changed	Review updated October 2008
27 October 2008	New search has been performed	This review was updated in October 2008 and six additional studies were included
15 April 2008	Amended	Converted to new review format.
10 November 2007	New citation required and conclusions have changed	Substantive amendment

CONTRIBUTIONS OF AUTHORS

Lidia Medeiros: took the lead in writing the protocol, developed background, initial objectives, selection criteria, methods and search strategy; assessed eligibility of trials, performed statistical analysis, described results and wrote discussion.

Airton Stein: contributed to background section, selection criteria, initial objectives, methods and search strategy; assessed eligibility of trial, performed statistical analysis, described results and wrote discussion.

Jandyra Fachel: contributed to initial objectives, selection criteria and methods; assessed eligibility of trial, performed statistical analysis, described results and wrote discussion.

Mary Clarrisse Bozzetti: contributed to background section, selection criteria, initial objectives, methods and search strategy; assessed eligibility of trial, performed statistical analysis, described results and wrote discussion.

Maria Ines da Rosa: contributed to background section, selection criteria, initial objectives, methods and search strategy; assessed eligibility of trial, performed statistical analysis, described results and wrote discussion.

Daniela Dorneles Rosa: contributed to background section, selection criteria, initial objectives, methods and search strategy; assessed eligibility of trial, performed statistical analysis, described results and wrote discussion.

Ray Garry: initiated and conceptualised the protocol, comment on drafts.

Sue Furness: contributed to objectives, methods, data extraction, statistical analysis, results and discussion sections.

DECLARATIONS OF INTEREST

None known

SOURCES OF SUPPORT

Internal sources

- UNIVERSIDADE FEDERAL DO RIO GRANDE DO SUL, Brazil.

External sources

- UNIVERSIDADE FEDERAL DO RIO GRANDE DO SUL, Brazil.

INDEX TERMS

Medical Subject Headings (MeSH)

*Laparoscopy [adverse effects; economics]; *Laparotomy [adverse effects; economics]; Ovarian Neoplasms [*surgery]; Randomized Controlled Trials as Topic

MeSH check words

Female; Humans