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Routine abdominal drainage for uncomplicated open cholecystectomy (Review)

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[Intervention Review]

Routine abdominal drainage for uncomplicated open cholecystectomy

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ABSTRACT

Background

Cholecystectomy is the removal of gallbladder and is performed mainly for symptomatic gallstones. Although laparoscopic cholecystectomy is currently preferred over open cholecystectomy for elective cholecystectomy, reports of randomised clinical trials comparing the choice of cholecystectomy (open or laparoscopic) in acute cholecystitis are still being conducted. Drainage in open cholecystectomy is a matter of considerable debate. Surgeons use drains primarily to prevent subhepatic abscess or bile peritonitis from an undrained bile leak. Critics of drain condemn drain use as it increases wound and chest infection.

Objectives

To assess the benefits and harms of routine abdominal drainage in uncomplicated open cholecystectomy.

Search methods

We searched *The Cochrane Hepato-Biliary Group Controlled Trials Register*, the *Cochrane Central Register of Controlled Trials (CENTRAL)* in *The Cochrane Library*, *MEDLINE*, *EMBASE*, and *Science Citation Index Expanded* until April 2006.

Selection criteria

We included randomised clinical trials comparing 'no drain' versus 'drain' in patients who had undergone uncomplicated open cholecystectomy (irrespective of language, publication status, and the type of drain). Randomised clinical trials comparing one drain with another were also included.

Data collection and analysis

We collected the data on the characteristics and methodological quality of each trial, number of abdominal collections requiring different treatments, bile peritonitis, wound infection, chest complications, and hospital stay from each trial. We analysed the data with both the fixed-effect and the random-effects models using RevMan Analysis. For each outcome, we calculated the odds ratio (OR) with 95% confidence intervals (CI) based on intention-to-treat analysis.

Main results

Twenty eight trials involving 3659 patients were included. There were 20 comparisons of 'no drain' versus 'drain' and 12 comparisons of one drain with another. There was no statistically significant difference in mortality, bile peritonitis, total abdominal collections, abdominal collections requiring different treatments, or infected abdominal collections. 'No drain' group had statistically significant lower wound infection (OR 0.61, 95% CI 0.43 to 0.87) and statistically significant lower chest infection (OR 0.59, 95% CI 0.42 to 0.84) than drain group. We found no significant differences between different types of drains.

Authors' conclusions

Drains increase the harms to the patient without providing any additional benefit for patients undergoing open cholecystectomy and should be avoided in open cholecystectomy.

PLAIN LANGUAGE SUMMARY

Drains increase the harms to patients undergoing open cholecystectomy

Cholecystectomy is the removal of the gallbladder. It is performed mainly in patients having symptomatic gallstones. Drain usage after open cholecystectomy is controversial. The present review includes 28 trials assessing 20 comparisons of 'no drain' versus 'drain' and 12 comparisons of different drain types. The review reports that drains increase the harms to the patient. Drains do not provide any additional benefit for patients undergoing open cholecystectomy and should be avoided in open cholecystectomy. The review found no significant differences between different drain types.

BACKGROUND

About 10% to 15% of the adult population in the United States have gallstones (NIH 1992). Only 1% to 4% of them become symptomatic in a year (NIH 1992). Although laparoscopic cholecystectomy is currently preferred over open cholecystectomy for elective cholecystectomy (NIH 1992; Fullarton 1994; Keus 2006a), reports of randomised clinical trials comparing the choice of cholecystectomy (open or laparoscopic) in acute cholecystitis are still being conducted (Johansson 2005; Rai 2005). Furthermore, a number of laparoscopic cholecystectomies have to be converted into open operations (Keus 2006b).

Drainage in open cholecystectomy is a matter of considerable debate. Surgeons use drains primarily to prevent subhepatic abscess or bile peritonitis from an undrained bile leak (Sarr 1987). Other surgeons do not use drainage routinely because of reports of higher incidence of wound infection (Budd 1982; Monson 1991), chest infections (Budd 1982; Monson 1991), and increase in post-operative temperature (Ronaghan 1986). The possible mechanism of increased chest infections and atelectasis (lung collapse) is decreased ventilation caused by the increased amount of postoperative discomfort related to the use of the drain (Monson 1991). Chest infection and atelectasis may delay hospital discharge. Furthermore, the drains do not perform the function that they are intended to do, like prevent bile peritonitis (Budd 1982) and subhepatic collections (Monson 1991; Irwin 1988), which may require additional interventions such as re-operation. Other studies have found that there is no significant difference in the incidence of wound infection or chest infection (Playforth 1985; Lewis 1990), or hospital stay (Budd 1982).

Surgical drains may either be open or closed. An open drain is when an artificial conduit is left in the wound to allow drainage of fluids to the exterior (eg, corrugated drain; Penrose drain; Yeates drain). Closed drains may either be suction drains (eg, Redon drain) or passive drains (eg, Robinson drain).

We have not been able to identify any meta-analyses or systematic reviews comparing routine abdominal drainage versus no abdominal drainage in uncomplicated open cholecystectomy.

OBJECTIVES

To assess the benefits and harms of routine abdominal drainage in uncomplicated open cholecystectomy.

METHODS

Criteria for considering studies for this review

Types of studies

Only randomised clinical trials (irrespective of language, blinding, or publication status) were considered for this review.

Quasi-randomised studies (where the method of allocating participants to a treatment are not strictly random (eg, date of birth, hospital record number, alternation) and case control studies were not considered for this review.

Types of participants

Patients who have undergone uncomplicated open cholecystectomy.

Types of interventions

We included trials comparing drainage versus no drainage in uncomplicated open cholecystectomy, irrespective of
- the type of the drain;
- type of incision; and
- site of the drain - main wound or stab incision.

Trials comparing two types of drains (open versus closed) or two types of drainage sites (main wound versus stab incision) were also included in this review.

Co-interventions were allowed provided they are used equally in the intervention arms.

Types of outcome measures

Primary outcomes

1. Mortality at maximal follow-up.
2. Additional procedures for subhepatic collection.
   a. Open procedure.
   b. Radiological drainage requiring insertion of drain.
   c. Radiological drainage requiring percutaneous aspiration.
3. Bile peritonitis.

Secondary outcomes

1. Infected wound collections.
2. Wound infection (as reported by authors).
3. Respiratory complications (mainly chest infection and atelectasis).
4. Hospital stay.
5. Pain (measured using any validated scale).

Search methods for identification of studies

We searched *The Cochrane Hepato-Biliary Group Controlled Trials Register*, the *Cochrane Central Register of Controlled Trials (CENTRAL)* in *The Cochrane Library*, *MEDLINE, EMBASE,* and *Science Citation Index Expanded* (Royle 2003). We have given the search strategies with the time span for the searches in Appendix 1 (date of last search April 2006).

We also searched the references of the identified trials to identify further relevant trials.

Data collection and analysis

We followed the instructions given in the *Cochrane Handbook for Systematic Reviews of Intervention* (Higgins 2006) and *the Cochrane Hepato-Biliary Group Module* (Gluud 2006).

Trial selection and extraction of data

We did not apply any language or publication status restrictions. Both of us, independently of each other, identified the trials for inclusion. Both of us extracted independently the data mentioned above. We assessed the methodological quality of the trials independently, without masking of the study names. We intended to obtain any unclear or missing information by contacting the authors of the individual trials. However, since the last trial was published more than 14 years ago, we did not contact any author. We identified whether the trials shared the same patients (completely or partially) by identifying common authors,

centres, inclusion criteria, exclusion criteria, type of drain and other methods of the study such as the policy followed for drain removal. We resolved all differences in opinion through discussion.

Assessment of methodological quality

Due to the risk of overestimation of intervention effects in randomised trials with inadequate methodological quality (Schulz 1995; Moher 1998; Kjaergard 2001), we looked at the influence of methodological quality of the trials on the trial results by evaluating the reported randomisation and follow-up procedures in each trial. We assessed generation of the allocation sequence, allocation concealment, and follow-up.

Generation of the allocation sequence

- Adequate, if the allocation sequence was generated by a computer or random number table. Drawing of lots, tossing of a coin, shuffling of cards, or throwing dice will be considered as adequate if a person who was not otherwise involved in the recruitment of participants performed the procedure.
- Unclear, if the trial was described as randomised, but the method used for the allocation sequence generation was not described.
- Inadequate, if a system involving dates, names, or admittance numbers were used for the allocation of patients. These studies are known as quasi-randomised and will be excluded from the review.

Allocation concealment

- Adequate, if the allocation of patients involved a central independent unit, on-site locked computer, or sealed envelopes.
- Unclear, if the trial was described as randomised, but the method used to conceal the allocation was not described.
- Inadequate, if the allocation sequence was known to the investigators who assigned participants or if the study was quasi-randomised (such studies will be excluded).

Blinding

Blinding was not assessed since we expected that there would be no double-blind trials. However, we recorded whether any of the outcomes were assessed by a blinded observer or assessor blinding.

Follow-up

- Adequate, if the numbers and reasons for dropouts and withdrawals in all intervention groups were described or if it was specified that there were no dropouts or withdrawals.
- Unclear, if the report gave the impression that there had been no dropouts or withdrawals, but this was not specifically stated.
- Inadequate, if the number or reasons for dropouts and withdrawals were not described.

Statistical methods

We performed the meta-analyses according to the recommendations of The Cochrane Collaboration (Higgins 2006).

We used the software package RevMan 4.2 (RevMan 2003). For dichotomous variables, we calculated the odds ratio with 95% confidence interval. For the main comparison ('no drain' versus 'drain'), we have reported the random-effects model (DerSimonian 1986) and the fixed-effect model (DeMets 1987). Heterogeneity was explored by chi-squared test with significance set at P value 0.10, and the quantity of heterogeneity was measured by I^2 (Higgins 2002). For the other comparisons and for sub-group analyses, we have reported the results of the fixed-effect model if the I^2 was less than 25% (ie, low heterogeneity) and the random-effects model if the I^2 was equal to or more than 25% (high heterogeneity).

The analysis was performed on an intention-to-treat basis (Newell 1992). We did not impute any data and performed the analysis on an available-case basis (Higgins 2006). We intended to perform a sensitivity analysis with and without empirical continuity correction factors as suggested by Sweeting et al (Sweeting 2004) in case we were to find 'zero-event' trials in statistically significant outcomes. We have also reported the risk difference.

Subgroup analyses

We performed the following subgroup analyses:
- trials with high methodological quality, ie, low risk of bias. Based on the description of quality components, trials with adequate allocation concealment and adequate follow-up were considered high quality, in spite of very few being with adequate generation of the allocation sequence and none of them blinded.- drainage in emergency cholecystectomy.
- drainage in elective cholecystectomy.
- no drain versus suction drain.
- no drain versus passive closed drain.
- no drain versus passive open drain.
- trials in which routine antibiotic prophylaxis was used.
- trials in which the drain was brought out through a separate wound.
- trials in which the drain was brought out through the main wound.

Bias exploration

We used the funnel plot to explore bias (Egger 1997; Macaskill 2001). Asymmetry in funnel plot of trial size against treatment effect was used to assess bias. We also assessed the funnel plot asymmetry through the linear regression approach described by Egger et al (Egger 1997) by StatsDirect 2.4.

RESULTS

Description of studies

We identified a total of 540 references through electronic searches of *The Cochrane Hepato-Biliary Group Controlled Trials Register* and the *Cochrane Central Register of Controlled Trials (CENTRAL)* in *The Cochrane Library* (n = 89), *MEDLINE* (n = 119), *EMBASE* (n = 239), and *Science Citation Index Expanded* (n = 93). We excluded 173 duplicates and 318 clearly irrelevant references through reading abstracts. Forty-nine references were retrieved for further assessment. No references were identified through scanning reference lists of the identified randomised trials. Of the 49 references, we excluded 18 because of the reasons listed in the table 'Characteristics of excluded studies'. In total, 31 reports of 28 randomised trials fulfilled the inclusion criteria. All the 28 trials were completed trials and could provide data for the analyses. Details of the trials are shown in the table 'Characteristics of included studies'. Four trials had three arms providing data for more than one comparison (Budd 1982; McCormack 1983; Loder 1987; Kriplani 1992). In total, there were 20 comparisons of 'no

drain' versus 'drain' and 12 comparisons of one type of drain versus another.

In total 3659 patients were involved in the trials included for this review. The average age in 18 trials was 51.7 years. Two trials (Locker 1983; Latif 1989) reported the median age. The mean or median age was not stated in other 8 trials (Trowbridge 1982; Playforth 1985; Loder 1987; Chattopadhyay 1990; Lewis 1990; al-Arfaj 1992; Kriplani 1992; Saad 1993). Females constituted 85% of the population studied in 21 trials. The number of females was not stated or was not clear in seven trials (Trowbridge 1982; Fraser 1982; Porati 1984; Chattopadhyay 1990; Brewster 1992; Kriplani 1992; Saad 1993).

Separate data for elective and emergency cholecystectomy were available in two trials (Playforth 1985; Monson 1991). Five trials (van der Linden 1980; Trowbridge 1982; Bartolo 1985; Loder 1987; Sarr 1987) clearly mentioned the inclusion of emergency cholecystectomy. However, separate data were not available for elective and emergency cholecystectomy for any of the outcomes reported in this for any of these five trials. It was not clear whether emergency cholecystectomy was included in five trials (Huguier 1980; McCormack 1983; Salam 1984; al-Arfaj 1992; Saad 1993). In the remaining 16 trials, only elective cholecystectomy was included.

Routine antibiotic prophylaxis was used in six trials (Trowbridge 1982; Playforth 1985; Latif 1989; Chattopadhyay 1990; Monson 1991; Brewster 1992). Routine antibiotic prophylaxis was not used in five trials (van der Linden 1980; Fraser 1982; Porati 1984; Druart 1990; Lewis 1990). In the remaining 17 trials, the prophylactic antibiotic use was not stated or no separate data were available for those who had prophylactic antibiotics and those who did not receive prophylactic antibiotics.

Only one trial reported that the drain was brought out through the main wound (Druart 1990). In three trials (Gordon 1976; van der Linden 1980; Trowbridge 1982), some patients had the drain brought out through main wound and the others had the drain brought out through a separate wound. There are no separate data available for any of the outcomes reported in this review from these three trials. The drain was brought out through a separate wound in 13 trials (Edlund 1979; Huguier 1980; McCormack 1983; Playforth 1985; Sarr 1987; Adloff 1987; Loder 1987; Latif 1989; Monson 1991; al-Arfaj 1992; Forster 1992; Kriplani 1992; Saad 1993). The reports of the remaining 11 trials did not state whether the drain was brought out through the main wound or through a separate wound.

Risk of bias in included studies

The generation of random sequence was adequate in four (Huguier 1980; Bartolo 1985; Playforth 1985; Forster 1992) of the 26 trials (15.4%) in which this was applicable. In two studies (Locker 1983; Sarr 1987), generation of random sequence was not applicable as the randomisation was performed by drawing a card from a deck of playing cards and by drawing lots respectively. Generation of random sequence was not clear in the remaining 22 trials. Seventeen trials (Gordon 1976; Huguier 1980; van der Linden 1980; Budd 1982; Fraser 1982; Trowbridge 1982; Locker 1983; Salam 1984; Playforth 1985; Adloff 1987; Loder 1987; Sarr 1987; Schaupp 1988; Lewis 1990; Kupczyk-Joeris 1991; Monson 1991; Kriplani 1992) of the 28 trials (60.7%) had adequate allocation concealment. These 17 trials also had adequate follow-up and we consider these 17 trials as high-quality trials, ie, trials with low risk of bias. The allocation concealment is not clear in the remaining 11 trials. None of the trials reported blinding of participants or outcome assessors. The follow-up was adequate in all trials except one (Porati 1984), ie, 27 of 28 trials (96.4%). None of the trials reported whether they used intention-to-treat analysis. Three trials (10.7%) (Lewis 1990; Monson 1991; Forster 1992) reported on sample-size calculations.

Effects of interventions

No drain versus drain

The results of the meta-analysis are tabulated in Table 1 and Table 2.

Mortality at maximal follow-up

There was no statistically significant difference in mortality (OR 0.79, 95% CI 0.21 to 2.97). There was no change in the results on adopting the random-effects model, calculating the risk difference, including only trials of high methodological quality or in any of the sub-group analysis.

Abdominal collections requiring re-operation

There were no abdominal collections requiring re-operation in any of the trials that reported on this outcome.

Abdominal collections requiring drain insertion

There was no statistically significant difference in this outcome (OR 6.09, 95% CI 0.24 to 152.24). There was no change in the results on adopting the random-effects model, calculating the risk difference, including only trials of high methodological quality or in any of the sub-group analysis.

Abdominal collections requiring percutaneous drainage

There was no statistically significant difference in this outcome (OR 4.25, 95% CI 0.44 to 41.43). There was no change in the results on adopting the random-effects model, calculating the risk difference, including only trials of high methodological quality or in any of the sub-group analysis.

Total abdominal collections

There was no statistically significant difference in this outcome (OR 1.33, 95% CI 0.93 to 1.89). There was no change in the results on adopting the random-effects model, calculating the risk difference, including only trials of high methodological quality or in any of the sub-group analysis.

Infected abdominal collections

There was no statistically significant difference in this outcome (OR 0.70, 95% CI 0.14 to 3.59). There was no change in the results on adopting the random-effects model, calculating the risk difference, including only trials of high methodological quality or in any of the sub-group analysis.

Bile peritonitis

There was no statistically significant difference in this outcome (OR 1.33, 95% CI 0.22 to 8.01). There was no change in the results on adopting the random-effects model, calculating the risk difference, including only trials of high methodological quality or in any of the sub-group analysis.

Wound infection

The 'no drain' group had a statistically significant lower wound infection rate (3.4%) compared to that of drain group (5.3%) (OR 0.61, 95% CI 0.43 to 0.87). This continued to remain statistically significant on adopting the random-effects model, calculating the risk difference and on including only the trials of high methodological quality. In the subgroup analyses, although the odds of developing the wound infection in the 'no drain' group was lower than that of 'drain' group in all subgroups, this difference was statistically significant only in the subgroup analysis of patients in whom the drain was brought out through a separate wound.

Chest infection

The 'no drain' group had a statistically significant lower chest infection rate (5.4%) compared to that of drain group (8.0%) (OR 0.59, 95% CI 0.42 to 0.84). Although it remained lower in the 'no drain' group than 'drain' group on adopting random-effects model, calculating the risk difference and by including high methodological quality trials only, the difference was not statistically significant. There was also no significant difference in the chest infection rate between the groups in any of the sub-group analyses performed.

Atelectasis

The 'no drain' group had a lower incidence of atelectasis (6.1%) compared to that of drain group (9.3%). However this difference was not statistically significant in the fixed-effects model (OR 0.61, 95% CI 0.35 to 1.08), random-effects model, and by including only high-quality trials. However, there was a statistically significant risk difference (-0.04, 95% CI -0.07 to 0.00) between the groups favouring the 'no drain' group. The subgroup analyses did not reveal any statistically significant difference in the atelectasis incidence between the groups. However, most of the analyses shows a tendency of lower atelectatic rate in 'no drain' group than in the drain group with some analyses approaching statistical significance.

Hospital stay

The hospital stay was statistically significantly lower in the 'no drain' group compared to the 'drain group' (WMD -0.39 days, 95% CI -0.43 to -0.36). This remained significant on adopting the random-effects model, calculating the risk difference, and on including only the trials of high methodological quality. In the sub-group analysis, the hospital stay was statistically significantly lower in the trials that included only elective cholecystectomy and in those in which antibiotic prophylaxis was used routinely and those in which antibiotic prophylaxis was not used routinely. The hospital stay in trials, which reported on this outcome but could not be included in the meta-analysis because of the non-availability or standard deviation or because median stay was reported, is tabulated in the Table 3. As seen from the table, the hospital stay is shorter in the 'no drain' group than 'drain' group in most trials, which reported the hospital stay.

Comparison of different types of drains

The results of the meta-analysis are summarized in the Table 4. The hospital stay in trials, which could not be included for meta-analysis because of the non-availability of standard deviation in the report, is tabulated in table 06.

Suction drain versus passive closed drain

There is no statistically significant difference in the mortality, total abdominal collections, or wound infection between the two groups (OR 1.00, 95% CI 0.06 to 16.23; OR 0.37, 95% CI 0.06 to 2.25, OR 0.87; 95% CI 0.31 to 2.41). There was no change in results in the subgroup analysis.

The chest infection rate was lower in the suction drain group (2.1%) compared to the passive closed drain group (7.5%). However, this difference is not statistically significant (OR 0.43, 95% CI 0.10 to 1.86). When only elective cholecystectomies were taken into consideration, this difference became statistically significant (OR 0.13, 95% CI 0.03 to 0.65).

The pain was statistically lower at the drain site in the suction group than passive closed drain group (OR 0.16, 95% CI 0.04 to 0.61). The only trial, which reported this outcome (Fraser 1982), included only elective cholecystectomy patients and was of high methodological quality.

As noted in Table 5, there was no statistically significant difference in both the trials that reported on hospital stay.

Suction drain versus passive open drain

There was no statistically significant difference in any of the outcomes except hospital stay which was 0.39 days (95% CI 0.3 to 0.48) lower in the passive open drain group than the suction group. All the trials comparing suction drain and passive open drain were of high methodological quality. There was no change in the results when only trials in which all cholecystectomies performed electively were included except for hospital stay. The difference between the groups in hospital stay became statistically insignificant when only trials in which all cholecystectomies performed electively were included.

High-suction versus low-suction drain

There is no statistically significant difference between the two groups in any of the reported outcomes. The results did not change when only the high methodological quality trial (Loder 1987) was included. In both the trials, no separate data were available with regards to elective and emergency cholecystectomy.

Large bore suction drain versus small bore suction drain

The only trial (Salam 1984), which compared the large bore suction drain and small bore suction drain did not find any significant difference in any of the outcomes reported in this review. This trial was of high methodological quality and it is not clear whether patients who underwent emergency cholecystectomies were included in the trial.

Re-usable suction drain versus disposable suction drain

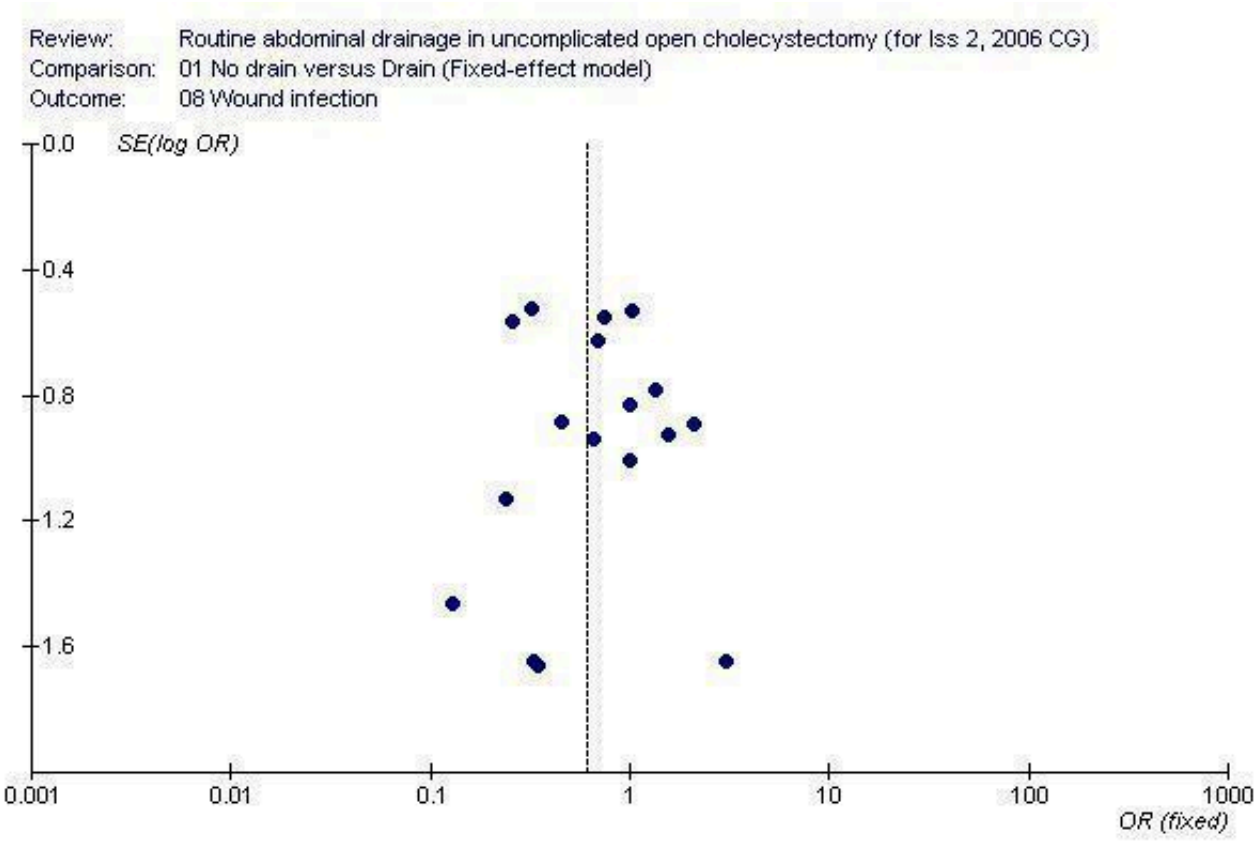
The only trial (Bartolo 1985), which compared the re-usable suction drain and disposable suction drain did not find any significant difference in any of the outcomes reported in this review. This trial was of low methodological quality and no separate data were available with regards to elective and emergency cholecystectomy.

Funnel plot

Visual examination of the funnel plot (Figure 1) does not demonstrate any bias. Statistical examination by Egger's method

(Egger 1997) of bias exploration did not arise any cause for concern of bias (P = 0.75).

Figure 1.



DISCUSSION

This review has shown that routine drain use after open cholecystectomy does not benefit the patient in any way. However, drain increases the rates of wound infection, chest infection, and atelectasis.

Surgeons use drains primarily to prevent subhepatic abscess or bile peritonitis from an undrained bile leak (Sarr 1987). There was no statistically significant difference in the incidence of bile peritonitis between the 'no drain' group and 'drain' group. The total number of abdominal collections, the infected abdominal collections, and the abdominal collections requiring different interventions were not significantly different between the two groups. All the trials, which reported on the re-operation for abdominal collections, reported that there was no patient in either group who needed re-operation. This appears to be a rare event and does not warrant routine drainage.

Critics of the routine drain have used the claim that drain increase wound infection and chest infections (Budd 1982; Monson 1991). In this review, we found that the wound infection rate was statistically significantly higher in the drain group than the 'no drain' group. This was true in spite of adopting various statistical methods like fixed-effect model, random-effects model, and risk difference. Many of the sub-group analyses did not reveal a statistically significant difference. However, the wound infection rate continued to remain lower in the 'no drain' group than 'drain' group. These did not achieve statistical significance, likely because of the smaller number in these sub-group analyses compared to the main analysis.

The chest infection rate also was higher in the drain group than 'no drain' group. This could be possibly due to the pain induced by the drain. Unfortunately, none of the included trials comparing 'no drain' and 'drain' report on the pain (abdominal or chest pain), and hence this hypothesis could not be tested. Whatever the reason, the fixed-effects model revealed statistically higher chest infection rate in the drain group. Even in the random-effects model, trials of high methodological quality, and risk difference, the chest infection rate was higher in the drain group although this was not statistically significant.

The atelectasis rate was also higher in the drain group than the 'no drain' group. The tendency is seen in the fixed-effect model and random-effects model, and becomes statistically significant when the risk difference was calculated. The possible reason for this could be the pain induced by the drain as in the case of chest infection.

Hospital stay was statistically significantly lower in the 'no drain' group. But the difference is only 0.39 days that could have arisen spuriously because of the different ways that authors could have calculated the number of days of hospital stay.

None of the causes of mortality reported in the different trials, ie, perforated gastric ulcer (Edlund 1979), ruptured Berry aneurysm (Locker 1983), myocardial infarction (Playforth 1985; Monson 1991), and pulmonary embolism (Monson 1991) seem to have been related to drain use or drain non-use.

Any systematic review is no better than the trials included in the review. We considered the 61% of the trials as having low risk of bias. However, all trials were conducted without blinded outcome assessment which make the trials prone to bias. We have expected that bias would favour the drain group. In this case, our results may be considered conservative.

To summarize, drains appear to increase the harms to the patient without providing any additional benefit for patients undergoing open cholecystectomy. In this eventuality, we do not attach much importance to the trials comparing different types of drain (which failed to show any significant difference in any of the outcomes measured, except the pain at drain site).

As mentioned previously, although laparoscopic cholecystectomy is currently preferred over open cholecystectomy for elective cholecystectomy (NIH 1992; Fullarton 1994), reports of randomised clinical trials comparing the choice of cholecystectomy (open or laparoscopic) in acute cholecystitis are still being conducted (Johansson 2005; Rai 2005). Thus although the overall results of this review may be of limited value in the high-income countries, the sub-group analysis of 'no drain' versus 'drain' is very important even in high-income countries. Only two of the outcomes reported in this review could be assessed separately for emergency cholecystectomies namely wound infection and chest infection. Both these were lower in the 'no drain' group than 'drain' group (ie, they followed the general trend of results). However, this difference was not statistically significant (possibly due to the small number of patients included). The use of drains in open cholecystectomy performed in acute cholecystitis should be restricted to trials.

AUTHORS' CONCLUSIONS

Implications for practice

Drains increase the harms to the patient without providing any additional benefit for patients undergoing open cholecystectomy and should be avoided in open cholecystectomy. Our data give no argument for recommending any specific type of drain.

Implications for research

The use of drains in open cholecystectomy performed in acute cholecystitis should be assessed by adequately powered high-quality randomised trials. Such trials ought to involve proper randomisation and blinded evaluation of outcome measures and be reported according to the CONSORT statement (www.consort-statement.org).

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* Indicates the major publication for the study

CHARACTERISTICS OF STUDIES

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

Adloff 1987

Methods	Randomised clinical trial Generation of the allocation sequence: unclear. Allocation concealment: adequate. Sealed box. Blinding: none (inadequate). Follow-up: adequate. Intention-to-treat analysis: no. Sample size calculation: no.
Participants	Country: France. Number randomised: 200. Mean age: 49.9 years. Females: 164. Inclusion criteria: Elective cholecystectomy. Exclusion criteria: CBD exploration.
Interventions	Participants were randomly assigned to two groups. Group 1: closed passive drain (n = 100). Group 2: no drain (n = 100). Co-interventions: Drain brought through: separate wound. Antibiotic use: not stated. Duration of drain: not stated.
Outcomes	The main outcome measures were wound infection, chest infection, and hospital stay.

Adloff 1987 *(Continued)*

Notes

Risk of bias

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

al-Arfaj 1992

Methods	Randomised clinical trial Generation of the allocation sequence: unclear. Allocation concealment: unclear. Follow-up: adequate. Blinding: none (inadequate). Intention-to-treat analysis: no. Sample size calculation: no.
Participants	Country: Saudi Arabia. Number randomised: 174. Mean age: not stated. Females: 135. Inclusion criteria: Gallbladder disease requiring cholecystectomy. Exclusion criteria: 1. Obstructive jaundice. 2. Pancreatitis. 3. Empyema. 4. Portal hypertension.
Interventions	Participants were randomly assigned to two groups. Group 1: drain (some suction, some passive at surgeon's discretion) (n = 87). Group 2: no drain (n = 87). Co-interventions: Drain brought through: separate wound. Antibiotic use: surgeon's preference. Duration of drain: 48 to 72 hours.
Outcomes	The main outcome measures were abdominal collections, wound infection, chest infection, atelectasis, and hospital stay.
Notes	

Risk of bias

al-Arfaj 1992 *(Continued)*

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

Bartolo 1985

Methods	Randomised clinical trial Generation of the allocation sequence: adequate. Computer generated . Allocation concealment: unclear. Follow-up: adequate. Blinding: none (inadequate). Intention-to-treat analysis: no. Sample size calculation: no.
Participants	Country: United Kingdom. Number randomised: 51. Mean age: 60 years. Females: 40. Inclusion criteria: Cholecystectomy (includes CBD exploration, emergency cholecystectomy).
Interventions	Participants were randomly assigned to two groups. Group 1: re-usable suction drain (n = 25). Group 2: disposable suction drain (n = 26). Co-interventions: Drain brought through: not stated. Antibiotic use: not stated. Duration of drain: not stated.
Outcomes	The main outcome measures were abdominal collections and wound infection.
Notes	

Risk of bias

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

Brewster 1992

Methods	Randomised clinical trial Generation of the allocation sequence: unclear.

Brewster 1992 *(Continued)*

	Allocation concealment: unclear. Follow-up: adequate. Blinding: none (inadequate). Intention-to-treat analysis: no. Sample size calculation: no.
Participants	Country: United Kingdom. Number randomised: 36. Mean age: 58 years. Females: Not stated. Inclusion criteria: 1. Elective cholecystectomy. 2. Performed on Monday only (so that serial ultrasound could be performed for the rest of the week). Exclusion criteria: 1. Patients requiring operative cholangiography. 2. CBD exploration.
Interventions	Participants were randomly assigned to two groups. Group 1: suction drain (n = 19). Group 2: closed passive drain (n = 17). Co-interventions: Drain brought through: Not stated. Antibiotic use: Yes. Duration of drain: till < 50 ml and not bile stained.
Outcomes	The main outcome measure was abdominal collection.
Notes	

Risk of bias

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

Budd 1982

Methods	Randomised clinical trial Generation of the allocation sequence: unclear. Allocation concealment: adequate. Sealed envelope. Follow-up: adequate. Blinding: none (inadequate). Intention-to-treat analysis: no.

Budd 1982 *(Continued)*

	Sample size calculation: no.
Participants	Country: United States of America. Number randomised: 300. Mean age: 43.5 years. Females: 209. Inclusion criteria: Cholecystectomy. Exclusion criteria: 1. Acute cholecystitis. 2. CBD exploration. 3. Liver biopsy. 4. Appendicectomy. 5. Gastroduodenal surgery.
Interventions	Participants were randomly assigned to three groups. Group 1: suction drain (n = 100). Group 2: passive open drain (n = 100). Group 3: no drain (n = 100). Co-interventions: Drain brought through: not stated. Antibiotic use: not stated. Duration of drain: suction drain: 3rd POD (unless drainage in previous 24 hours > 50 ml). Penrose drain: twisted on 1st POD, advanced 2nd POD and removed on 3rd POD.
Outcomes	The main outcome measures were mortality, bile peritonitis, wound infection, chest infection, atelectasis and hospital stay.
Notes	

Risk of bias

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

Chattopadhyay 1990

Methods	Randomised clinical trial Generation of the allocation sequence: unclear. Allocation concealment: unclear. Follow-up: adequate. Blinding: none (inadequate). Intention-to-treat analysis: no. Sample size calculation: no.

Chattopadhyay 1990 *(Continued)*

Participants	Country: India. Number randomised: 110. Mean age: not stated. Females: not stated. Inclusion criteria: Elective cholecystectomy Exclusion criteria: 1. Acute cholecystitis. 2. Empyema. 3. Gangrene of gall bladder. 4. Sepsis (abscess, cholangitis). 5. Bile leak. 6. Inadequate haemostasis. 7. Simultaneous performance of other intra-abdominal procedures.
Interventions	Participants were randomly assigned to two groups. Group 1: passive closed drain (n = 54). Group 2: no drain (n = 56). Co-interventions: Drain brought through: not stated. Antibiotic use: yes. Duration of drain: when drainage was insignificant (exact quantity not stated).
Outcomes	The main outcome measures were mortality, abdominal collection, wound complications, chest infection, atelectasis, and hospital stay.
Notes	

Risk of bias

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

Druart 1990

Methods	Randomised clinical trial Generation of the allocation sequence: unclear. Allocation concealment: unclear. Follow-up: adequate. Intention-to-treat analysis: no. Blinding: none (inadequate). Sample size calculation: no.
Participants	Country: Belgium.

Druart 1990 *(Continued)*

	Number randomised: 50. Mean age: 58 years. Females: 40. Inclusion criteria: Elective cholecystectomy.
Interventions	Participants were randomly assigned to two groups. Group 1: passive open drain (n = 26). Group 2: no drain (n = 24). Co-interventions: Drain brought through: main wound. Antibiotic use: not used routinely. Duration of drain: < 50 ml usually 4 or 5th POD.
Outcomes	The main outcome measures were mortality, abdominal collection, wound infection and chest complications.
Notes	

Risk of bias

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

Edlund 1979

Methods	Randomised clinical trial Generation of the allocation sequence: unclear. Allocation concealment: adequate. Sealed envelope. Follow-up: adequate. Blinding: none (inadequate). Intention-to-treat analysis: no. Sample size calculation: no.
Participants	Country: Sweden. Number randomised: 100. Mean age: 52.8 years. Females: 64. Inclusion criteria: Elective cholecystectomy. Exclusion criteria: 1. Acute cholecystectomy. 2. Jaundice. 3. CBD exploration.

Edlund 1979 *(Continued)*

Interventions	Participants were randomly assigned to two groups. Group 1: suction drain (n = 50). Group 2: no drain (n = 50). Co-interventions: Drain brought through: separate wound. Antibiotic use: not stated. Duration of drain: < 50 ml usually 4 or 5th POD.
Outcomes	The main outcome measures were mortality, wound infection, chest infection and hospital stay.
Notes	

Risk of bias

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

Forster 1992

Methods	Randomised clinical trial Generation of the allocation sequence: adequate. Computer generated. Allocation concealment: unclear. Blinding: none (inadequate). Follow-up: adequate. Intention-to-treat analysis: no. Sample size calculation: yes.
Participants	Country: Germany. Number randomised: 160. Mean age: 49 years. Females: 121. Inclusion criteria: Elective uncomplicated cholecystectomy. Exclusion criteria: 1. Choledocholithiasis requiring further operative measures. 2. Acute cholecystitis.
Interventions	Participants were randomly assigned to two groups. Group 1: passive open drain (n = 80). Group 2: no drain (n = 80). Co-interventions: Drain brought through: separate wound.

Forster 1992 *(Continued)*

	Antibiotic use: not stated. Duration of drain: not stated.
Outcomes	The main outcome measures were abdominal collections, wound infection, chest infection and hospital stay.
Notes	

Risk of bias

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

Fraser 1982

Methods	Randomised clinical trial Generation of the allocation sequence: unclear. Allocation concealment: adequate. Sealed envelope technique. Blinding: none (inadequate). Follow-up: adequate. Intention-to-treat analysis: no. Sample size calculation: no.
Participants	Country: United Kingdom. Number randomised: 92. Mean age: 48.6 years. Females: not clear. Inclusion criteria: Elective cholecystectomy. Exclusion criteria: 1. CBD exploration. 2. No additional procedure to cholecystectomy.
Interventions	Participants were randomly assigned to two groups. Group 1: suction (n = 50). Group 2: passive closed drain (n = 42). Co-interventions: Drain brought through: not stated. Antibiotic use: no. Duration of drain: not stated.
Outcomes	The main outcome measures were wound infection, chest infection, hospital stay and pain at drain site.

Fraser 1982 *(Continued)*

Notes

Risk of bias

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

Gordon 1976

Methods	Randomised clinical trial Generation of the allocation sequence: unclear. Allocation concealment: adequate (sealed envelope technique). Blinding: none (inadequate). Follow-up: adequate. Intention-to-treat analysis: no. Sample size calculation: no.
Participants	Country: United Kingdom. Number randomised: 100. Mean age: 48 years. Females: 67. Inclusion criteria: Elective cholecystectomy. Exclusion criteria: 1. Exploration of CBD or fear of biliary leakage. 2. Acute cholecystitis. 3. Empyema. 4. Incomplete hemostasis.
Interventions	Participants were randomly assigned to two groups. Group 1: passive open drain (n = 50). Group 2: no drain (n = 50). Co-interventions: Drain brought through: separate wound (right paramedian incision) and main wound (right subcostal incision). Antibiotic use: not stated. Duration of drain: after 48 hours unless continued significant discharge.
Outcomes	The main outcome measures were infected abdominal collections, wound infection, chest infection, atelectasis, and hospital stay.
Notes	

Gordon 1976 *(Continued)*

Risk of bias

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

Huguier 1980

Methods	Randomised clinical trial Generation of the allocation sequence: adequate. Random number table. Allocation concealment: adequate. Sealed envelope technique. Blinding: none (inadequate). Follow-up: adequate. Intention-to-treat analysis: no. Sample size calculation: no.
Participants	Country: France. Number randomised: 100. Mean age: 51.2 years. Females: 70. Inclusion criteria: Simple cholecystectomies where the operative field at end of the operation was clear of bile and bleeding. Exclusion criteria: CBD exploration, empyema gall bladder, other malignancies.
Interventions	Participants were randomly assigned to two groups. Group 1: passive open drain (n = 50). Group 2: no drain (n = 50). Co-interventions: Drain brought through: separate wound. Antibiotic use: not stated. Duration of drain: not stated.
Outcomes	The main outcome measures were mortality, wound infection, and hospital stay.
Notes	

Risk of bias

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

Kriplani 1992

Methods	Randomised clinical trial Generation of the allocation sequence: unclear. Allocation concealment: adequate. Sealed envelope technique. Blinding: none (inadequate). Follow-up: adequate. Intention-to-treat analysis: no. Sample size calculation: no.
Participants	Country: India. Number randomised: 150. Mean age: not stated. Females: not stated. Inclusion criteria: Elective cholecystectomy. Exclusion criteria: 1. CBD exploration. 2. Needle puncture cholangiogram. 3. Acute cholecystitis.
Interventions	Participants were randomly assigned to three groups. Group 1: suction drain (n = 50). Group 2: passive open drain (n = 50). Group 3: no drain (n = 50). Co-interventions: Drain brought through: separate wound. Antibiotic use: In high risk cases such as airway disease, diabetes mellitus, old age. Duration of drain: drain removed in 24 hours unless > 30 ml or more than 2 pads soaked.
Outcomes	The main outcome measures were bile peritonitis, abdominal collections, chest infection, atelectasis, and hospital stay.
Notes	

Risk of bias

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

Kupczyk-Joeris 1991

Methods	Randomised clinical trial Generation of the allocation sequence: unclear.

Kupczyk-Joeris 1991 *(Continued)*

	Allocation concealment: adequate (sealed envelope technique). Blinding: none (inadequate). Follow-up: adequate. Intention-to-treat analysis: no. Sample size calculation: no.
Participants	Country: Germany. Number randomised: 56. Mean age: 52 years. Females: 38. Inclusion criteria: Elective cholecystectomy. Exclusion criteria: 1. Acute cholecystitis. 2. Choledochotomy. 3. Intra-operative complications. 4. Portal hypertension. 5. Coagulation defects.
Interventions	Participants were randomly assigned to two groups. Group 1: passive open drain (n = 26). Group 2: no drain (n = 30). Co-interventions: Drain brought through: not stated. Antibiotic use: not stated. Duration of drain: not stated.
Outcomes	The main outcome measures were mortality, wound complications and hospital stay.
Notes	

Risk of bias

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

Latif 1989

Methods	Randomised clinical trial Generation of the allocation sequence: unclear. Allocation concealment: unclear. Blinding: none (inadequate). Follow-up: adequate.

Latif 1989 *(Continued)*

	Intention-to-treat analysis: no. Sample size calculation: no.
Participants	Country: Saudi Arabia. Number randomised: 100. Median age: 36 years. Females: 82. Inclusion criteria: Elective cholecystectomy. Exclusion criteria: 1. Acute cholecystitis. 2. Choledochotomy. 3. Intra-operative complications. 4. Portal hypertension. 5. Coagulation defects.
Interventions	Participants were randomly assigned to two groups. Group 1: Passive open drain (n = 50). Group 2: No drain (n = 50). Co-interventions: Drain brought through: separate wound. Antibiotic use: yes. Duration of drain: within 48 hours.
Outcomes	The main outcome measures were abdominal collections, wound infection, chest infection and hospital stay.
Notes	

Risk of bias

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

Lewis 1990

Methods	Randomised clinical trial Generation of the allocation sequence: unclear. Allocation concealment: adequate (sealed envelope technique). Blinding: none (inadequate). Follow-up: adequate. Intention-to-treat analysis: no. Sample size calculation: yes.

Lewis 1990 *(Continued)*

Participants	Country: Canada. Number randomised: 494. Mean age: not stated. Females: 400. Inclusion criteria: Simple elective cholecystectomy. Exclusion criteria: 1. Acute cholecystitis. 2. Jaundice. 3. CBD exploration. 4. Additional procedure on stomach or colon.
Interventions	Participants were randomly assigned to three groups. Group 1: suction drain (n = 122). Group 2: passive open drain (n = 124). Group 3: no drain (n = 248). Co-interventions: Drain brought through: not stated. Antibiotic use: not used routinely (except for heart valve prophylaxis). Duration of drain: shortened on 1st POD and removed on 2nd POD (unless > 20 ml/eight hours).
Outcomes	The main outcome measures were mortality, abdominal collections requiring re-operation, and hospital stay.
Notes	

Risk of bias

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

Locker 1983

Methods	Randomised clinical trial Generation of the allocation sequence: Not applicable. Allocation concealment: adequate. Drawing a card from a deck of playing cards at the end of cholecystectomy. Blinding: none (inadequate). Follow-up: adequate. Intention-to-treat analysis: no. Sample size calculation: no.
Participants	Country: United States of America. Number randomised: 123.

Locker 1983 *(Continued)*

	Median age: 38. Females: 96. Inclusion criteria: Elective cholecystectomy. Exclusion criteria: 1. CBD exploration. 2. No evidence of abscess or empyema of gall bladder. 3. No evidence of infection.
Interventions	Participants were randomly assigned to two groups. Group 1: drain (n = 60). Group 2: no drain (n = 63). Co-interventions: Drain brought through: not stated. Antibiotic use: not stated. Duration of drain: not stated.
Outcomes	The main outcome measures were mortality, biliary peritonitis, abdominal collections, wound infection, and hospital stay.
Notes	

Risk of bias

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

Loder 1987

Methods	Randomised clinical trial Generation of the allocation sequence: unclear. Allocation concealment: adequate. Sealed envelope technique. Blinding: none (inadequate). Follow-up: adequate. Intention-to-treat analysis: no. Sample size calculation: no.
Participants	Country: Australia. Number randomised: 51. Mean age: not stated. Females: 38. Inclusion criteria: Cholecystectomy.

Loder 1987 *(Continued)*

	Exclusion criteria: 1. Other intra-abdominal procedures performed simultaneously (CBD exploration was included). 2. History of adverse reaction to antibiotic or medications.
Interventions	Participants were randomly assigned to three groups. Group 1: high suction drain (n = 18). Group 2: low suction drain (n = 16). Group 3: passive open drain (n = 17). Co-interventions: Drain brought through: separate wound. Antibiotic use: not stated. Duration of drain: removed on 1st POD. Other co-interventions: gentamycin 80 mg in 100 ml warmed isotonic saline was used to determine the completeness of drainage.
Outcomes	The main outcome measures were wound infection and pain.
Notes	

Risk of bias

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

McCormack 1983

Methods	Randomised clinical trial Generation of the allocation sequence: unclear. Allocation concealment: unclear. Blinding: none (inadequate). Follow-up: adequate. Intention-to-treat analysis: no. Sample size calculation: no.
Participants	Country: United Kingdom. Number randomised: 120. Mean age: 61 years. Females: 86. Inclusion criteria: Cholecystectomy.
Interventions	Participants were randomly assigned to three groups. Group 1: high suction drain (n = 40). Group 2: low suction drain (n = 40).

McCormack 1983 *(Continued)*

	Group 3: passive closed drain (n = 40). Co-interventions: Drain brought through: Separate wound. Antibiotic use: Used in 59 patients, but criteria not stated. Duration of drain: Removed on 3rd POD.
Outcomes	The main outcome measures were wound infection, chest infection and hospital stay.
Notes	

Risk of bias

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

Monson 1991

Methods	Randomised clinical trial Generation of the allocation sequence: unclear. Allocation concealment: adequate. Sealed envelope. Blinding: none (inadequate). Follow-up: adequate. Intention-to-treat analysis: no. Sample size calculation: yes.
Participants	Country: United Kingdom. Number randomised: 479. Mean age: 50.7 years. Females: 369. Inclusion criteria: Elective and emergency cholecystectomy. Exclusion criteria: 1. Perforated gall bladder. 2. Exploration of CBD. 3. Direct needle puncture for operative cholangiogram.
Interventions	Participants were randomly assigned to two groups. Group 1: suction drain (n = 239). Group 2: no drain (n = 240). Co-interventions: Drain brought through: separate wound. Antibiotic use: yes.

Monson 1991 *(Continued)*

	Duration of drain: not stated.
Outcomes	The main outcome measures were mortality, abdominal collections, wound infection, chest infection, and hospital stay.
Notes	

Risk of bias

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

Playforth 1985

Methods	Randomised clinical trial Generation of the allocation sequence: adequate. Random number table. Allocation concealment: adequate. Held by a third party. Blinding: none (inadequate). Follow-up: adequate. Intention-to-treat analysis: no. Sample size calculation: no.
Participants	Country: United Kingdom. Number randomised: 155. Mean age: not stated. Females: 97. Inclusion criteria: Elective and emergency cholecystectomy. Exclusion criteria: 1. CBD exploration. 2. Duodenum opened.
Interventions	Participants were randomly assigned to two groups. Group 1: suction drain (n = 78). Group 2: no drain (n = 77). Co-interventions: Drain brought through: separate wound. Antibiotic use: yes. Duration of drain: 3 to 5 days (criteria not stated).
Outcomes	The main outcome measures were mortality, re-operation, wound infection, chest complications, and hospital stay.
Notes	

Playforth 1985 *(Continued)*

Risk of bias

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

Porati 1984

Methods	Randomised clinical trial Generation of the allocation sequence: unclear. Allocation concealment: unclear. Blinding: none (inadequate). Follow-up: unclear. Intention-to-treat analysis: no. Sample size calculation: no.
Participants	Country: Italy. Number randomised: 155. Mean age: 40.7 years. Females: not stated. Inclusion criteria: 1. Uncomplicated gallstones. 2. Age 30 to 70 years. 3. No fever for 3 days before operation. Exclusion criteria: 1. Acute cholecystitis. 2. Necessity for other interventions.
Interventions	Participants were randomly assigned to two groups. Group 1: passive closed drain (n = 78). Group 2: no drain (n = 77). Co-interventions: Drain brought through: not stated. Antibiotic use: no. Duration of drain: 6 days.
Outcomes	The main outcome measures were mortality, wound infection, chest infection, and hospital stay.
Notes	

Risk of bias

Bias	Authors' judgement	Support for judgement

Porati 1984 *(Continued)*

Allocation concealment?	Unclear risk	B - Unclear

Saad 1993

Methods	Randomised clinical trial Generation of the allocation sequence: unclear. Allocation concealment: unclear. Blinding: none (inadequate). Follow-up: adequate. Intention-to-treat analysis: no. Sample size calculation: no.
Participants	Country: Sudan. Number randomised: 100. Mean age: not stated. Females: not stated. Inclusion criteria: 1. Cholecystectomy. 2. Symptomatic gallstones. Exclusion criteria: 1. Spillage of bile into peritoneal cavity. 2. Excessive ooze of blood from the gallbladder bed. 3. Exploration of CBD.
Interventions	Participants were randomly assigned to two groups. Group 1: passive closed drain (n = 50). Group 2: no drain (n = 50). Co-interventions: Drain brought through: separate wound. Antibiotic use: not stated. Duration of drain: < 30 ml usually 48 to 72 hours.
Outcomes	The main outcome measures were wound infection, septicaemia, and hospital stay.
Notes	

Risk of bias

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

Salam 1984

Methods	Randomised clinical trial Generation of the allocation sequence: unclear. Allocation concealment: adequate. Sealed envelope technique. Blinding: none (inadequate). Follow-up: adequate. Intention-to-treat analysis: no. Sample size calculation: no.
Participants	Country: Ireland. Number randomised: 50. Mean age: 52 years. Females: 36. Inclusion criteria: Simple cholecystectomy.
Interventions	Participants were randomly assigned to two groups. Group 1: large bore suction drain (n = 25). Group 2: small bore suction drain (n = 25). Co-interventions: Drain brought through: not stated. Antibiotic use: not stated. Duration of drain: when the drains stopped draining.
Outcomes	The main outcome measures were abdominal collections and chest infection.
Notes	

Risk of bias

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

Sarr 1987

Methods	Randomised clinical trial Generation of the allocation sequence: not applicable. Allocation concealment: adequate (lots). Blinding: none (inadequate). Follow-up: adequate. Intention-to-treat analysis: no.

Sarr 1987 *(Continued)*

	Sample size calculation: no.
Participants	Country: United States of America. Number randomised: 128. Mean age: 48.6 years. Females: 89. Inclusion criteria: Cholecystectomy for acute or chronic cholecystitis. Exclusion criteria: Undergoing CBD exploration.
Interventions	Participants were randomly assigned to two groups. Group 1: suction drain (n = 67). Group 2: passive open drain (n = 61). Co-interventions: Drain brought through: separate wound. Antibiotic use: according to discretion of surgeon. Duration of drain: not stated.
Outcomes	The main outcome measures were mortality, infected abdominal collection, wound infection, bile peritonitis, and hospital stay.
Notes	

Risk of bias

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

Schaupp 1988

Methods	Randomised clinical trial Generation of the allocation sequence: unclear. Allocation concealment: adequate. Sealed envelope technique. Blinding: none (inadequate). Follow-up: adequate. Intention-to-treat analysis: no. Sample size calculation: no.
Participants	Country: Germany. Number randomised: 200. Mean age: 53.2 years Females: 131. Inclusion criteria: Cholecystectomy.

Schaupp 1988 *(Continued)*

	Exclusion criteria: 1. Acute cholecystitis. 2. Other intra-abdominal surgery.
Interventions	Participants were randomly assigned to two groups. Group 1: drain (type not stated) (n = 100). Group 2: no drain (n = 100). Co-interventions: Drain brought through: not stated. Antibiotic use: not stated. Duration of drain: not stated.
Outcomes	The main outcome measures were mortality, abdominal collections, wound infection, and hospital stay.
Notes	

Risk of bias

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

Trowbridge 1982

Methods	Randomised clinical trial Generation of the allocation sequence: unclear. Allocation concealment: adequate. Sealed envelope technique. Blinding: none (inadequate). Follow-up: adequate. Intention-to-treat analysis: no. Sample size calculation: no.
Participants	Country: United States of America. Number randomised: 100. Mean age: not stated. Females: not stated. Inclusion criteria: 1. Age < 70 years. 2. Cholecystectomy for cholecystitis (chronic or subsiding acute cholecystitis). 3. Rectal temp < 100.6 deg F on day of operation. 4. WBC count < 10,000 on day of operation. 5. Technically satisfying operation. 6. Normal operating cholangiogram.

Trowbridge 1982 *(Continued)*

	Exclusion criteria: Bile spillage.
Interventions	Participants were randomly assigned to two groups. Group 1: passive open drain (n = 50). Group 2: no drain (n = 5 0). Co-interventions: Drain brought through: separate wound (half) and main wound (half). Antibiotic use: yes. Duration of drain: not stated.
Outcomes	The main outcome measures were wound infection and chest infection.
Notes	

Risk of bias

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

van der Linden 1980

Methods	Randomised clinical trial Generation of the allocation sequence: unclear. Allocation concealment: adequate. Sealed envelope technique. Blinding: none (inadequate). Follow-up: adequate. Intention-to-treat analysis: no. Sample size calculation: no.
Participants	Country: Sweden. Number randomised: 184. Mean age: 53.3 years. Females: 125. Inclusion criteria: Patients undergoing cholecystectomy (elective or emergency; with or without CBD exploration).
Interventions	Participants were randomly assigned to two groups. Group 1: suction drain (n = 92). Group 2: passive closed drain (n = 92). Co-interventions: Drain brought through: separate wound (half) and main wound (half). Antibiotic use: no.

van der Linden 1980 *(Continued)*

	Duration of drain: < 25 ml.
Outcomes	The main outcome measures were mortality, re-operation, wound infection and chest infection.
Notes	

Risk of bias

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

No attempts were made to contact any author as all the studies were published 14 years ago.
CBD = common bile duct.
deg F = degrees Fahrenheit.

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

Study	Reason for exclusion
Diez 1990	Allocation concealment - inadequate. Randomisation by clinical records.
Farha 1981	Allocation concealment - inadequate. Allocated by rotation.
Gupta 1978	Not a randomised clinical trial.
Hanna 1970	Not performed in humans.
Irwin 1988	No sample size for the different groups.
Jha 1986	No mention of randomisation.
Kapoor 1993	No separate data available for only those who were randomised.
Maull 1978	Allocation concealment inadequate. Drawing cards arranged in random order. No mention of concealing the randomisation.
Maull 1981	Same as above.
Peer 1993	Allocation concealment not stated. The sentence "non-drainage group included patients with simple cholecystectomy without CBD exploration, no evidence of pericholecystic abscess, empyema of gallbladder, dry liver bed" suggests that this was not a randomised trial.
Ragoonanan 1983	Allocation concealment - inadequate. Randomisation by date of birth.
Rivas 1980	Not a randomised clinical trial.
Salam 1994	Letter to editor with details of an included trial (Salam 1984).
Salles 1992	Not a randomised clinical trial.
Shirazi 1982	Allocation concealment inadequate. Drawing cards arranged in random order. No mention of concealing the randomisation.
Stone 1978	Allocation concealment inadequate. Randomisation by hospital number.

Study	Reason for exclusion
Truedson 1983	Allocation concealment - inadequate. Randomisation by date of birth.
van der Linden 1981	Does not contain any of the outcomes stated in the protocol.

DATA AND ANALYSES

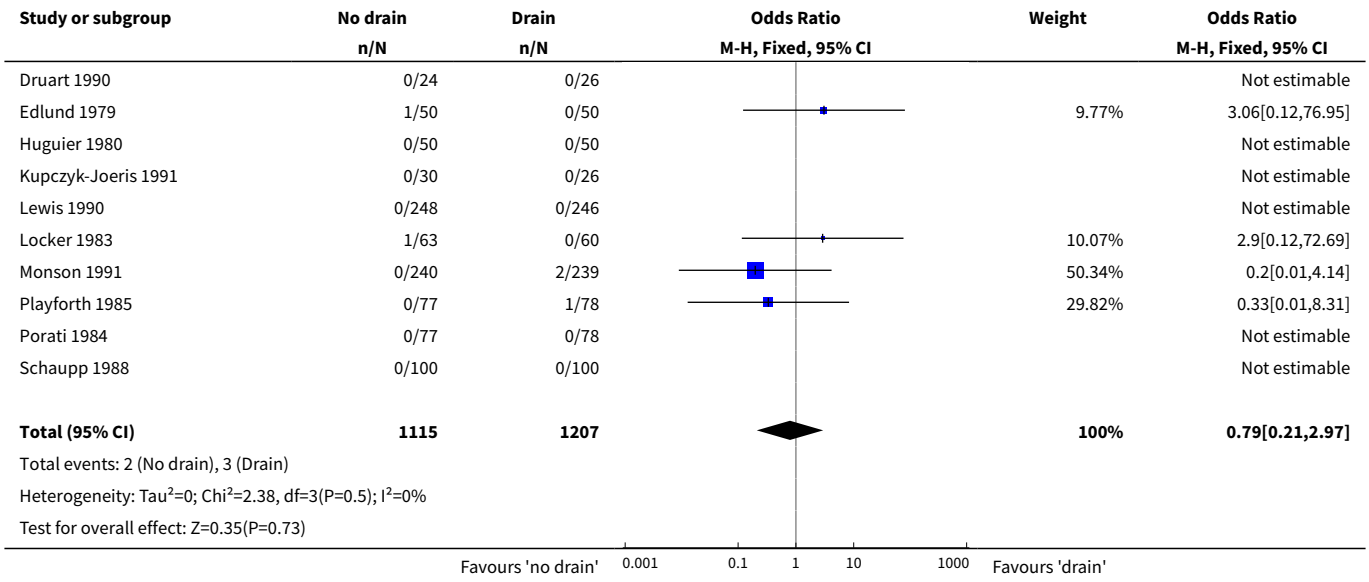
Comparison 1. No drain versus drain

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Mortality	12	2322	Odds Ratio (M-H, Fixed, 95% CI)	0.79 [0.21, 2.97]
2 Abdominal collections requiring re-operation	3	1123	Odds Ratio (M-H, Fixed, 95% CI)	0.0 [0.0, 0.0]
3 Abdominal collections requiring drain insertion	2	629	Odds Ratio (M-H, Fixed, 95% CI)	6.09 [0.24, 152.24]
4 Abdominal collections requiring percutaneous aspiration	3	829	Odds Ratio (M-H, Fixed, 95% CI)	4.25 [0.44, 41.43]
5 Total abdominal collections	5	994	Odds Ratio (M-H, Random, 95% CI)	1.30 [0.67, 2.53]
6 Infected intra-abdominal collections	8	998	Odds Ratio (M-H, Fixed, 95% CI)	0.70 [0.14, 3.59]
7 Bile peritonitis	3	573	Odds Ratio (M-H, Random, 95% CI)	1.47 [0.10, 21.57]
8 Wound infection	17	3090	Odds Ratio (M-H, Fixed, 95% CI)	0.61 [0.43, 0.87]
9 Chest infection	12	2128	Odds Ratio (M-H, Random, 95% CI)	0.84 [0.49, 1.44]
10 Atelectasis	5	774	Odds Ratio (M-H, Fixed, 95% CI)	0.61 [0.35, 1.08]
11 Hospital stay (days)	7	1623	Mean Difference (IV, Random, 95% CI)	-0.50 [-0.90, -0.10]

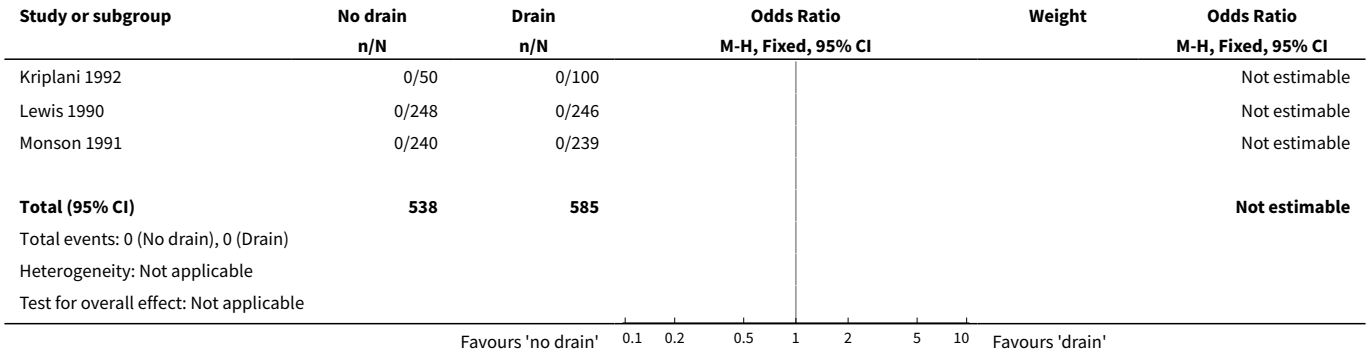
Analysis 1.1. Comparison 1 No drain versus drain, Outcome 1 Mortality.

Study or subgroup	No drain n/N	Drain n/N	Odds Ratio M-H, Fixed, 95% CI	Weight	Odds Ratio M-H, Fixed, 95% CI
Budd 1982	0/100	0/200			Not estimable
Chattopadhyay 1990	0/56	0/54			Not estimable

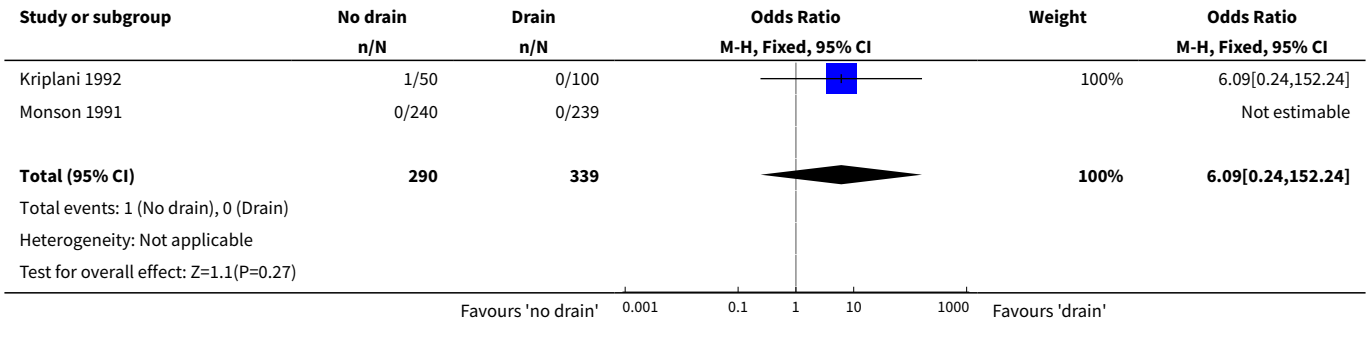
Favours 'no drain' 0.001 0.1 1 10 1000 Favours 'drain'



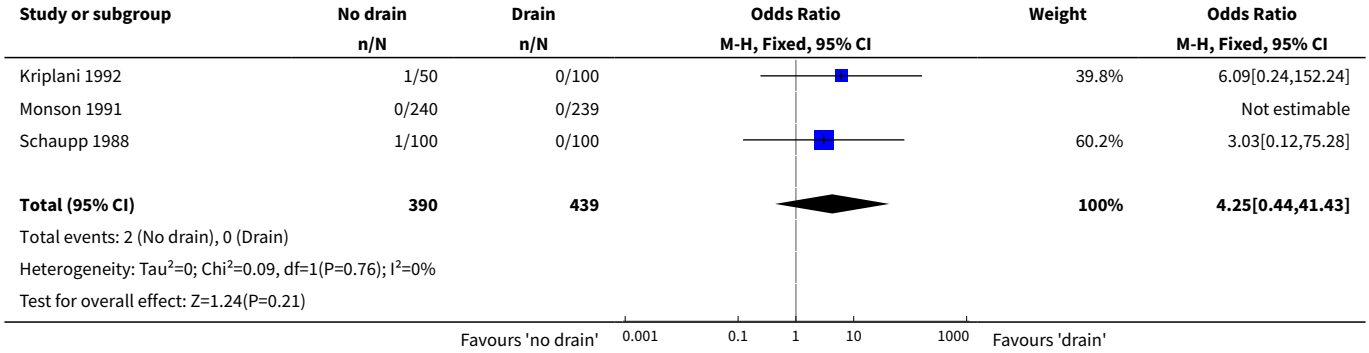
Analysis 1.2. Comparison 1 No drain versus drain, Outcome 2 Abdominal collections requiring re-operation.



Analysis 1.3. Comparison 1 No drain versus drain, Outcome 3 Abdominal collections requiring drain insertion.

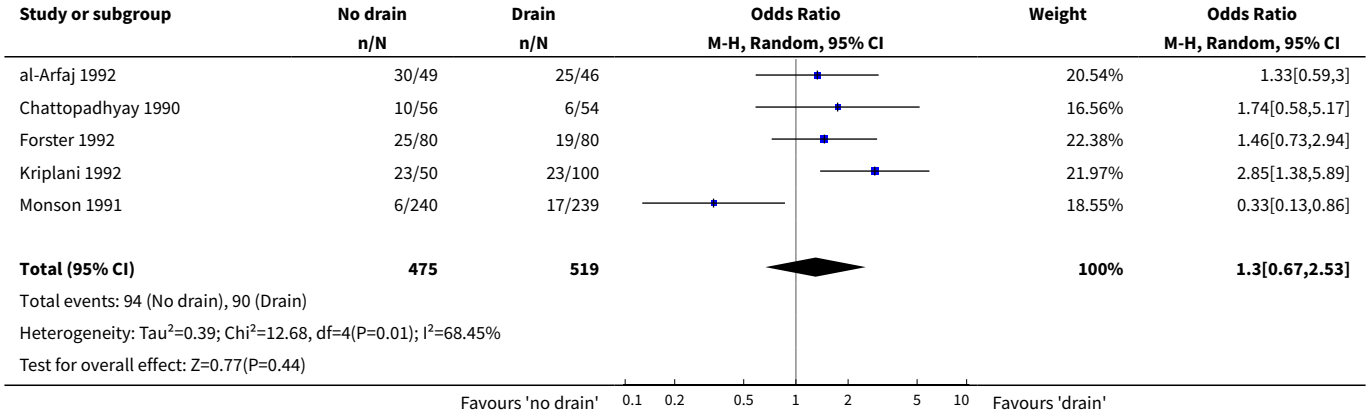


Analysis 1.4. Comparison 1 No drain versus drain, Outcome 4 Abdominal collections requiring percutaneous aspiration.



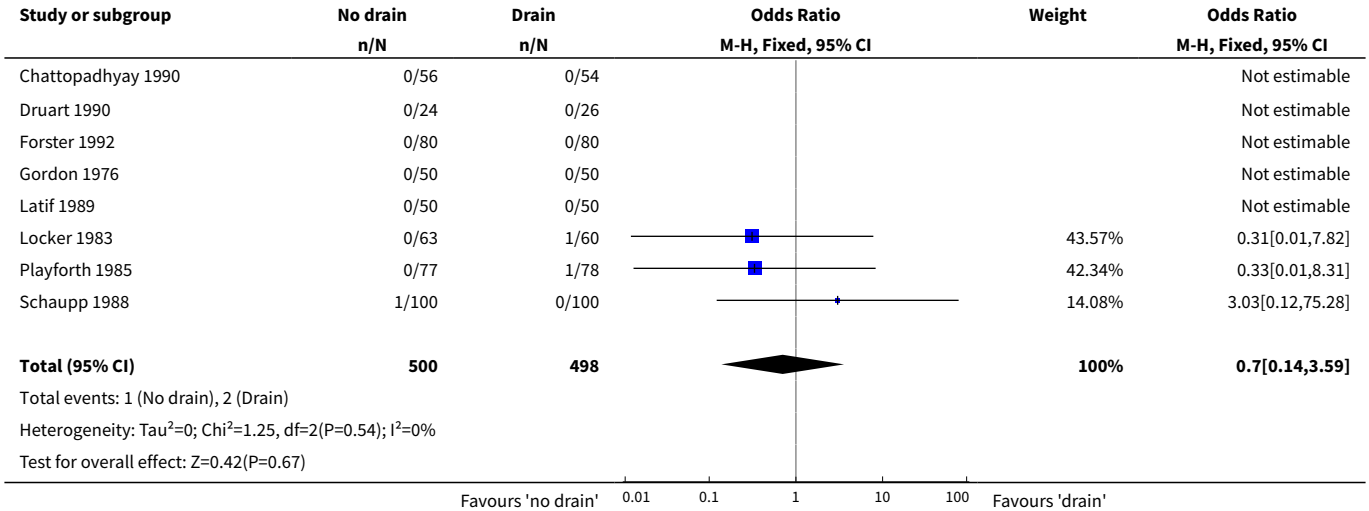
Study or subgroup	No drain n/N	Drain n/N	Odds Ratio M-H, Fixed, 95% CI	Weight	Odds Ratio M-H, Fixed, 95% CI
Kriplani 1992	1/50	0/100		39.8%	6.09[0.24,152.24]
Monson 1991	0/240	0/239			Not estimable
Schaupp 1988	1/100	0/100		60.2%	3.03[0.12,75.28]
Total (95% CI)	**390**	**439**		**100%**	**4.25[0.44,41.43]**
Total events: 2 (No drain), 0 (Drain)					
Heterogeneity: Tau²=0; Chi²=0.09, df=1(P=0.76); I²=0%					
Test for overall effect: Z=1.24(P=0.21)					

Analysis 1.5. Comparison 1 No drain versus drain, Outcome 5 Total abdominal collections.



Study or subgroup	No drain n/N	Drain n/N	Odds Ratio M-H, Random, 95% CI	Weight	Odds Ratio M-H, Random, 95% CI
al-Arfaj 1992	30/49	25/46		20.54%	1.33[0.59,3]
Chattopadhyay 1990	10/56	6/54		16.56%	1.74[0.58,5.17]
Forster 1992	25/80	19/80		22.38%	1.46[0.73,2.94]
Kriplani 1992	23/50	23/100		21.97%	2.85[1.38,5.89]
Monson 1991	6/240	17/239		18.55%	0.33[0.13,0.86]
Total (95% CI)	**475**	**519**		**100%**	**1.3[0.67,2.53]**
Total events: 94 (No drain), 90 (Drain)					
Heterogeneity: Tau²=0.39; Chi²=12.68, df=4(P=0.01); I²=68.45%					
Test for overall effect: Z=0.77(P=0.44)					

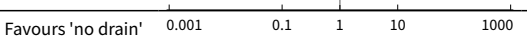
Analysis 1.6. Comparison 1 No drain versus drain, Outcome 6 Infected intra-abdominal collections.



Study or subgroup	No drain n/N	Drain n/N	Odds Ratio M-H, Fixed, 95% CI	Weight	Odds Ratio M-H, Fixed, 95% CI
Chattopadhyay 1990	0/56	0/54			Not estimable
Druart 1990	0/24	0/26			Not estimable
Forster 1992	0/80	0/80			Not estimable
Gordon 1976	0/50	0/50			Not estimable
Latif 1989	0/50	0/50			Not estimable
Locker 1983	0/63	1/60		43.57%	0.31[0.01,7.82]
Playforth 1985	0/77	1/78		42.34%	0.33[0.01,8.31]
Schaupp 1988	1/100	0/100		14.08%	3.03[0.12,75.28]
Total (95% CI)	**500**	**498**		**100%**	**0.7[0.14,3.59]**
Total events: 1 (No drain), 2 (Drain)					
Heterogeneity: Tau²=0; Chi²=1.25, df=2(P=0.54); I²=0%					
Test for overall effect: Z=0.42(P=0.67)					

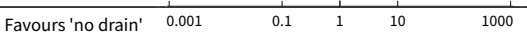
Analysis 1.7. Comparison 1 No drain versus drain, Outcome 7 Bile peritonitis.

Study or subgroup	No drain n/N	Drain n/N	Odds Ratio M-H, Random, 95% CI	Weight	Odds Ratio M-H, Random, 95% CI
Budd 1982	0/100	2/200		51.88%	0.4[0.02,8.31]
Kriplani 1992	1/50	0/100		48.12%	6.09[0.24,152.24]
Locker 1983	0/63	0/60			Not estimable
Total (95% CI)	**213**	**360**		**100%**	**1.47[0.1,21.57]**
Total events: 1 (No drain), 2 (Drain)					
Heterogeneity: Tau²=1.2; Chi²=1.47, df=1(P=0.23); I²=31.93%					
Test for overall effect: Z=0.28(P=0.78)					



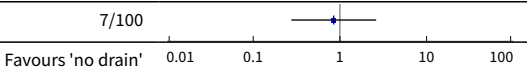
Analysis 1.8. Comparison 1 No drain versus drain, Outcome 8 Wound infection.

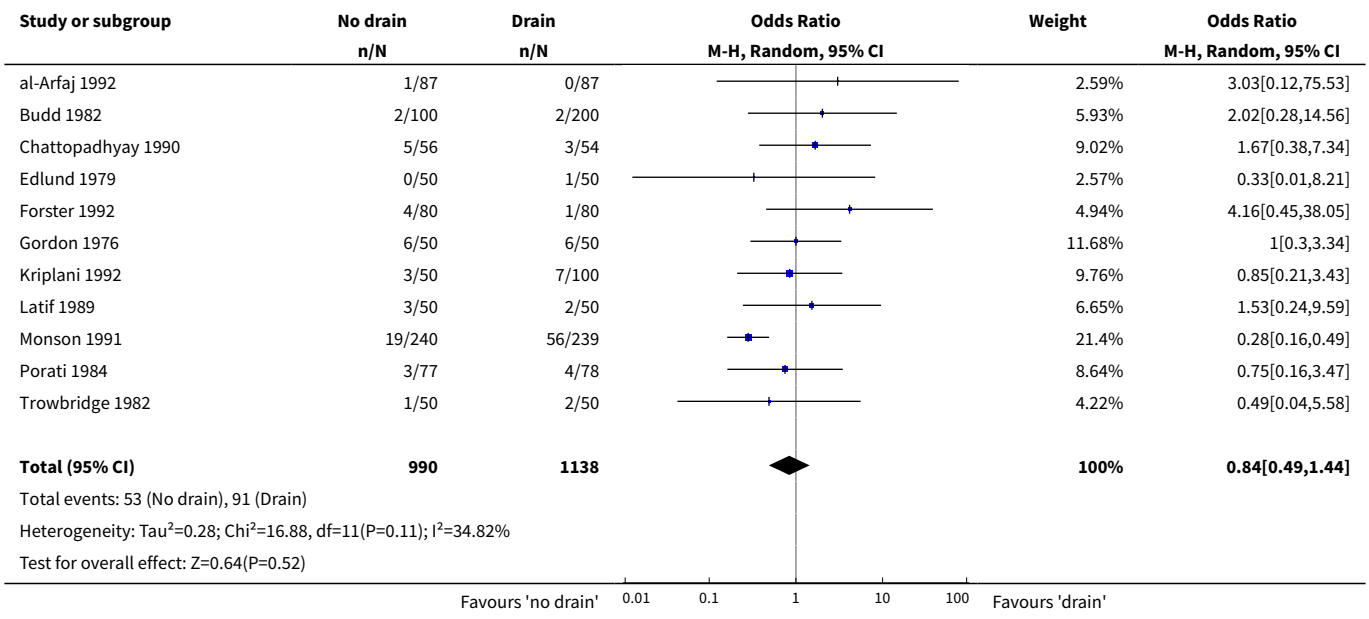
Study or subgroup	No drain n/N	Drain n/N	Odds Ratio M-H, Fixed, 95% CI	Weight	Odds Ratio M-H, Fixed, 95% CI
Adloff 1987	2/100	2/100		2.45%	1[0.14,7.24]
al-Arfaj 1992	4/87	3/87		3.57%	1.35[0.29,6.22]
Budd 1982	0/100	7/200		6.23%	0.13[0.01,2.27]
Druart 1990	0/24	1/26		1.76%	0.35[0.01,8.93]
Edlund 1979	1/50	0/50		0.61%	3.06[0.12,76.95]
Forster 1992	1/80	4/80		4.93%	0.24[0.03,2.2]
Gordon 1976	5/50	7/50		7.86%	0.68[0.2,2.32]
Huguier 1980	2/50	3/50		3.59%	0.65[0.1,4.09]
Latif 1989	4/50	2/50		2.3%	2.09[0.36,11.95]
Lewis 1990	6/248	8/246		9.78%	0.74[0.25,2.16]
Locker 1983	2/63	4/60		4.95%	0.46[0.08,2.6]
Monson 1991	5/240	15/239		18.37%	0.32[0.11,0.89]
Playforth 1985	8/77	8/78		8.89%	1.01[0.36,2.86]
Porati 1984	3/77	2/78		2.38%	1.54[0.25,9.49]
Saad 1993	5/50	15/50		16.85%	0.26[0.09,0.78]
Schaupp 1988	3/100	3/100		3.63%	1[0.2,5.08]
Trowbridge 1982	0/50	1/50		1.85%	0.33[0.01,8.21]
Total (95% CI)	**1496**	**1594**		**100%**	**0.61[0.43,0.87]**
Total events: 51 (No drain), 85 (Drain)					
Heterogeneity: Tau²=0; Chi²=12.62, df=16(P=0.7); I²=0%					
Test for overall effect: Z=2.74(P=0.01)					



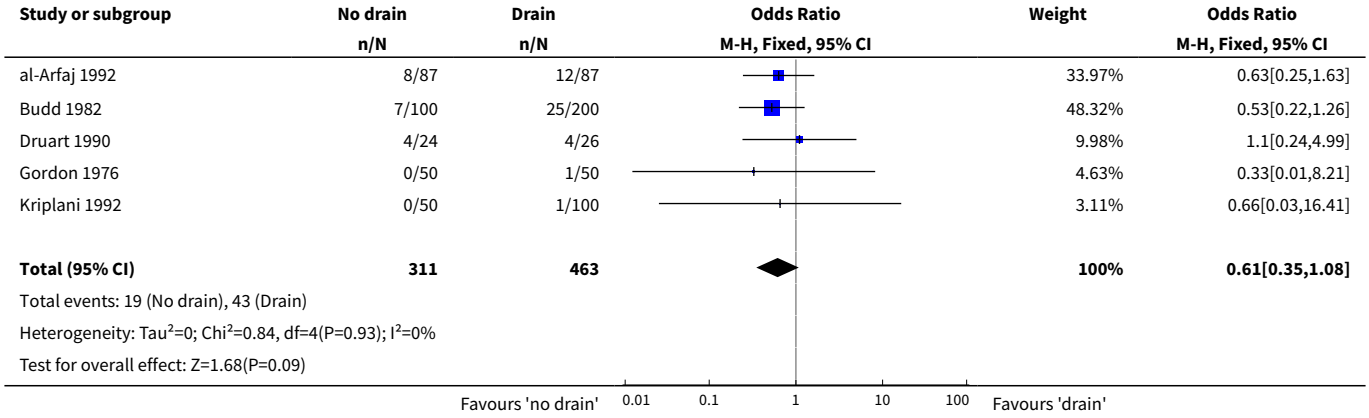
Analysis 1.9. Comparison 1 No drain versus drain, Outcome 9 Chest infection.

Study or subgroup	No drain n/N	Drain n/N	Odds Ratio M-H, Random, 95% CI	Weight	Odds Ratio M-H, Random, 95% CI
Adloff 1987	6/100	7/100		12.6%	0.85[0.27,2.62]

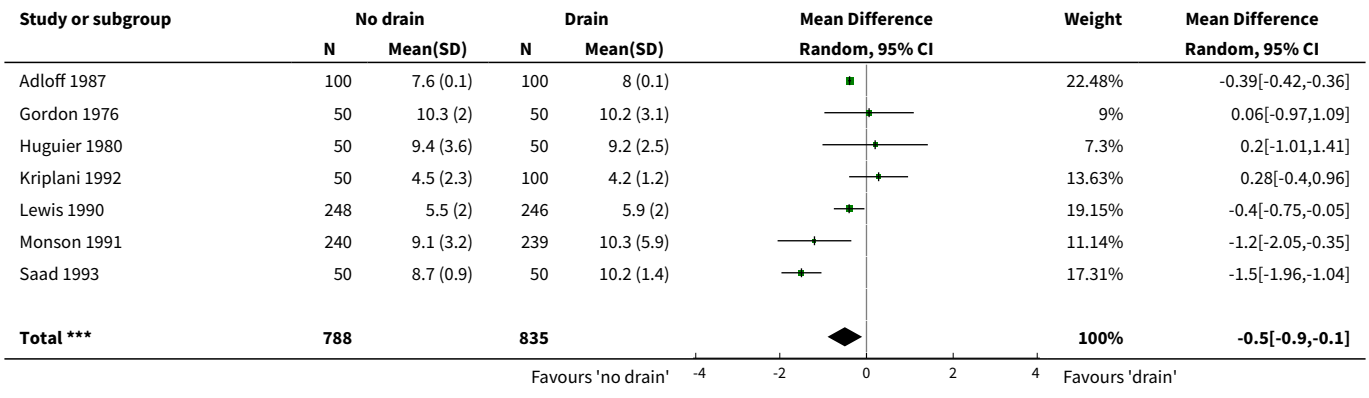




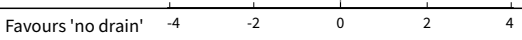
Analysis 1.10. Comparison 1 No drain versus drain, Outcome 10 Atelectasis.



Analysis 1.11. Comparison 1 No drain versus drain, Outcome 11 Hospital stay (days).



Study or subgroup	No drain N	No drain Mean(SD)	Drain N	Drain Mean(SD)	Mean Difference Random, 95% CI	Weight	Mean Difference Random, 95% CI
Heterogeneity: Tau²=0.18; Chi²=31.03, df=6(P<0.0001); I²=80.66%							
Test for overall effect: Z=2.45(P=0.01)							

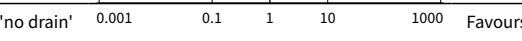


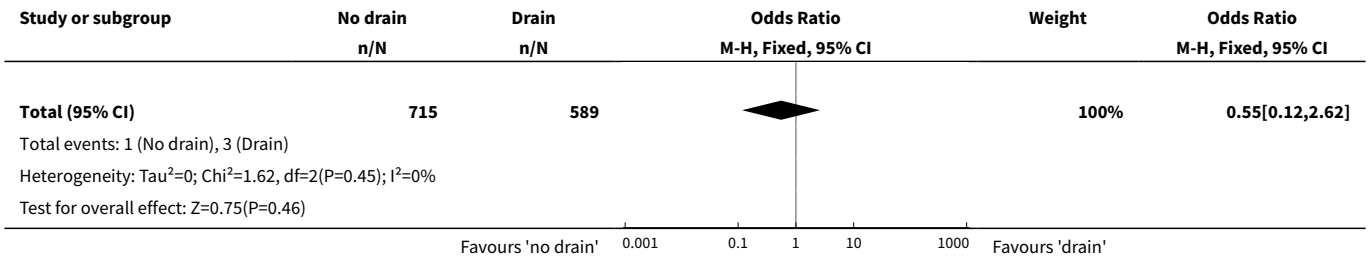
Comparison 2. Subgroup - No drain versus suction drain

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Mortality	5	1304	Odds Ratio (M-H, Fixed, 95% CI)	0.55 [0.12, 2.62]
2 Abdominal collections requiring re-operation	3	949	Odds Ratio (M-H, Fixed, 95% CI)	0.0 [0.0, 0.0]
3 Abdominal collections requiring drain insertion	2	579	Odds Ratio (M-H, Fixed, 95% CI)	3.06 [0.12, 76.95]
4 Abdominal collections requiring percutaneous aspiration	2	579	Odds Ratio (M-H, Fixed, 95% CI)	3.06 [0.12, 76.95]
5 Total abdominal collections	3	702	Odds Ratio (M-H, Random, 95% CI)	0.82 [0.20, 3.39]
6 Infected intra-abdominal collections	1	155	Odds Ratio (M-H, Fixed, 95% CI)	0.33 [0.01, 8.31]
7 Bile peritonitis	2	300	Odds Ratio (M-H, Fixed, 95% CI)	1.0 [0.14, 7.18]
8 Wound infection	5	1073	Odds Ratio (M-H, Random, 95% CI)	0.63 [0.28, 1.44]
9 Chest infection	5	1018	Odds Ratio (M-H, Random, 95% CI)	0.51 [0.20, 1.25]
10 Atelectasis	3	439	Odds Ratio (M-H, Fixed, 95% CI)	0.60 [0.29, 1.21]
11 Hospital stay (days)	2	579	Mean Difference (IV, Random, 95% CI)	-0.46 [-1.89, 0.98]

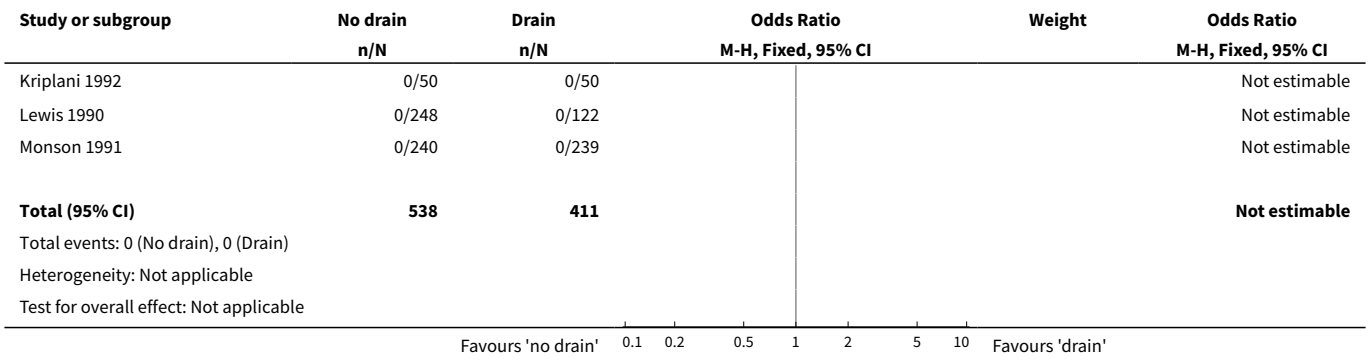
Analysis 2.1. Comparison 2 Subgroup - No drain versus suction drain, Outcome 1 Mortality.

Study or subgroup	No drain n/N	Drain n/N	Odds Ratio M-H, Fixed, 95% CI	Weight	Odds Ratio M-H, Fixed, 95% CI
Budd 1982	0/100	0/100			Not estimable
Edlund 1979	1/50	0/50		10.87%	3.06[0.12,76.95]
Lewis 1990	0/248	0/122			Not estimable
Monson 1991	0/240	2/239		55.98%	0.2[0.01,4.14]
Playforth 1985	0/77	1/78		33.16%	0.33[0.01,8.31]

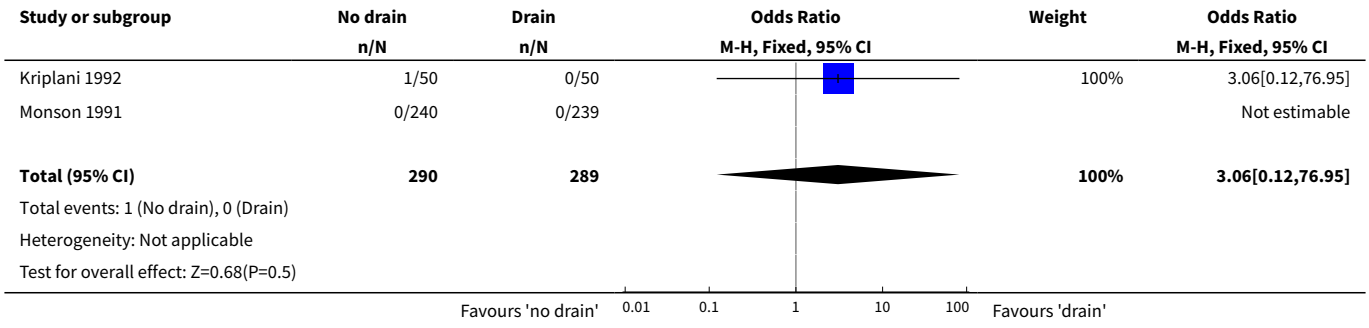




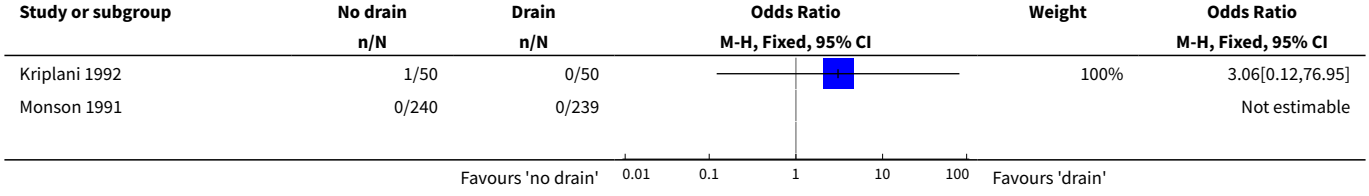
Analysis 2.2. Comparison 2 Subgroup - No drain versus suction drain, Outcome 2 Abdominal collections requiring re-operation.

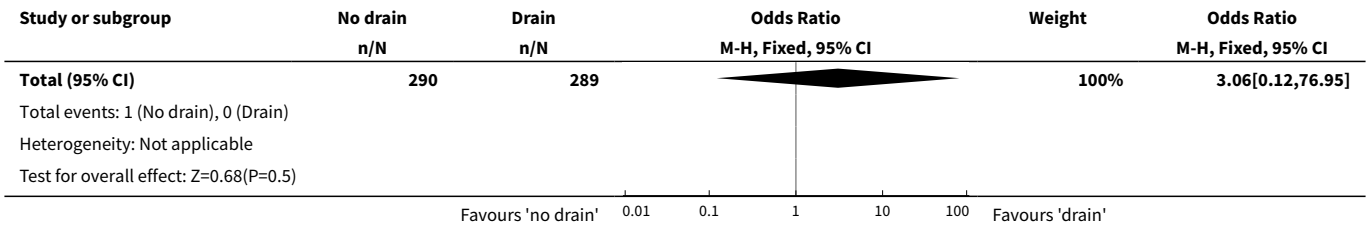


Analysis 2.3. Comparison 2 Subgroup - No drain versus suction drain, Outcome 3 Abdominal collections requiring drain insertion.

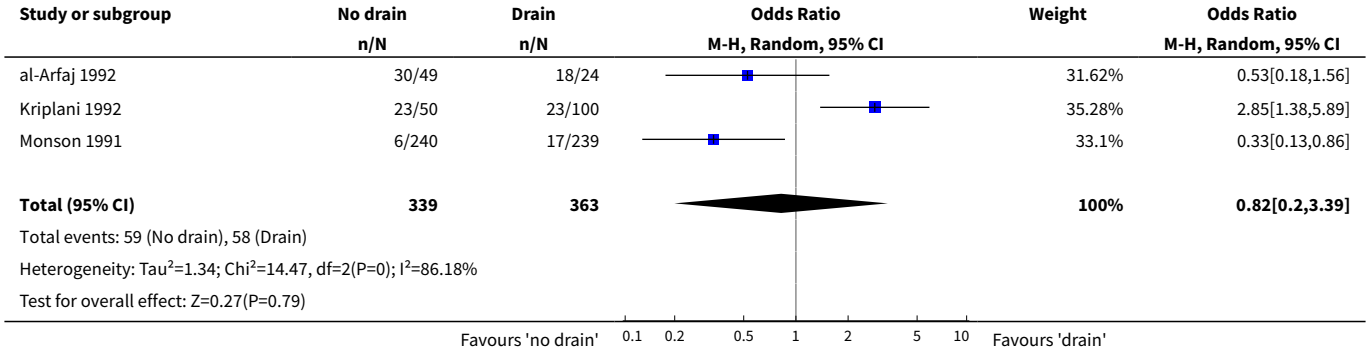


Analysis 2.4. Comparison 2 Subgroup - No drain versus suction drain, Outcome 4 Abdominal collections requiring percutaneous aspiration.

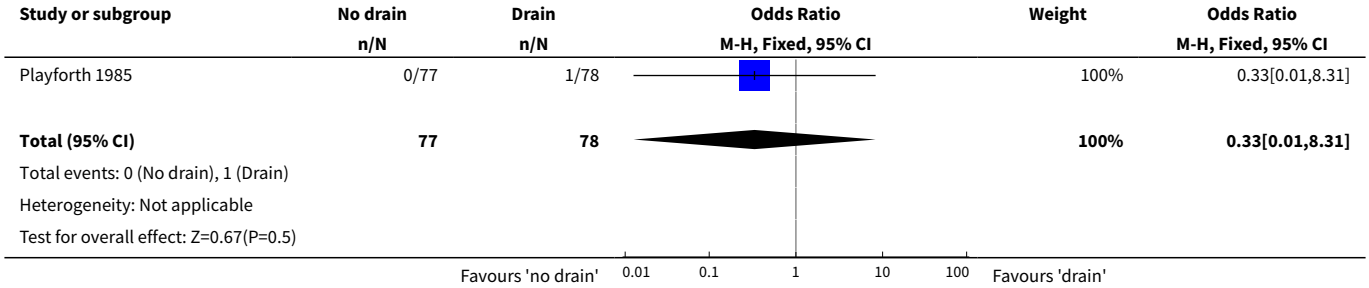




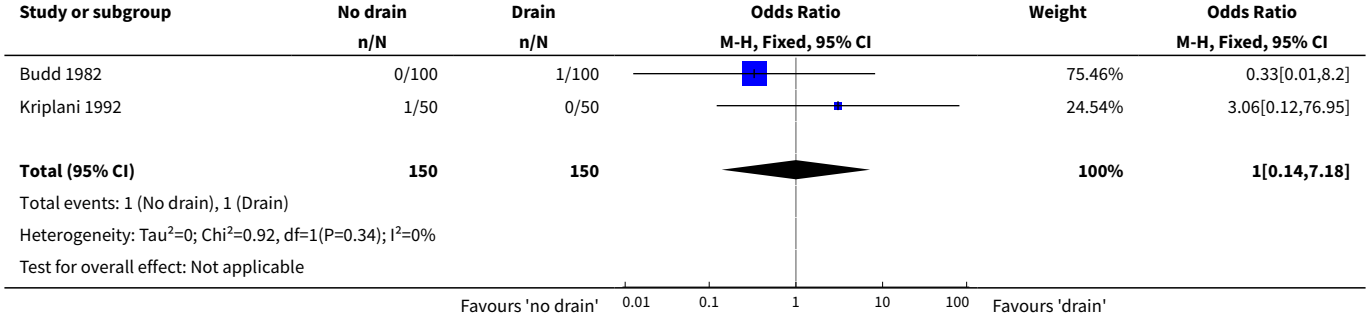
Analysis 2.5. Comparison 2 Subgroup - No drain versus suction drain, Outcome 5 Total abdominal collections.



Analysis 2.6. Comparison 2 Subgroup - No drain versus suction drain, Outcome 6 Infected intra-abdominal collections.



Analysis 2.7. Comparison 2 Subgroup - No drain versus suction drain, Outcome 7 Bile peritonitis.

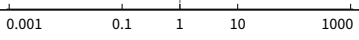


Analysis 2.8. Comparison 2 Subgroup - No drain versus suction drain, Outcome 8 Wound infection.

Study or subgroup	No drain n/N	Drain n/N	Odds Ratio M-H, Random, 95% CI	Weight	Odds Ratio M-H, Random, 95% CI
al-Arfaj 1992	4/87	2/52		17.38%	1.2[0.21,6.82]
Budd 1982	0/100	4/100		7.1%	0.11[0.01,2.01]
Edlund 1979	1/50	0/50		5.98%	3.06[0.12,76.95]
Monson 1991	5/240	15/239		34.88%	0.32[0.11,0.89]
Playforth 1985	8/77	8/78		34.65%	1.01[0.36,2.86]
Total (95% CI)	**554**	**519**		**100%**	**0.63[0.28,1.44]**
Total events: 18 (No drain), 29 (Drain)					
Heterogeneity: Tau^2=0.23; Chi^2=5.44, df=4(P=0.25); I^2=26.41%					
Test for overall effect: Z=1.09(P=0.28)					

Analysis 2.9. Comparison 2 Subgroup - No drain versus suction drain, Outcome 9 Chest infection.

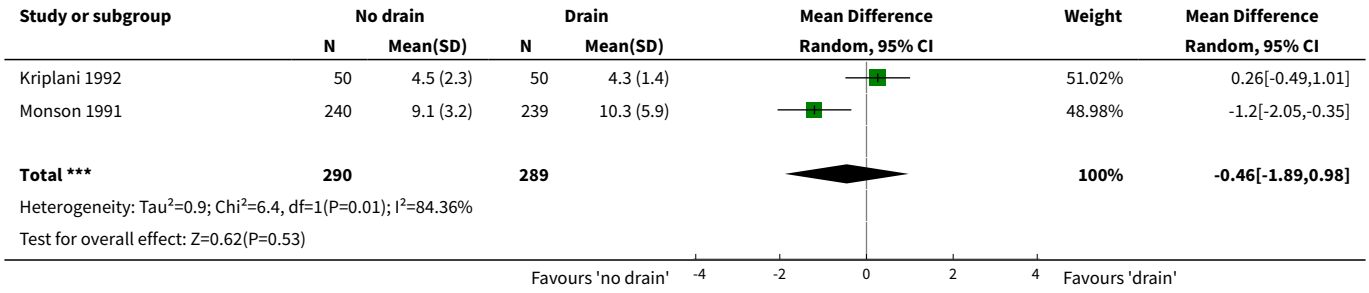
Study or subgroup	No drain n/N	Drain n/N	Odds Ratio M-H, Random, 95% CI	Weight	Odds Ratio M-H, Random, 95% CI
al-Arfaj 1992	1/87	0/52		7.11%	1.82[0.07,45.52]
Budd 1982	2/100	0/100		7.83%	5.1[0.24,107.62]
Edlund 1979	0/50	1/50		7.09%	0.33[0.01,8.21]
Kriplani 1992	3/50	4/50		22.88%	0.73[0.16,3.46]
Monson 1991	19/240	56/239		55.08%	0.28[0.16,0.49]
Total (95% CI)	**527**	**491**		**100%**	**0.51[0.2,1.25]**
Total events: 25 (No drain), 61 (Drain)					
Heterogeneity: Tau^2=0.31; Chi^2=5.48, df=4(P=0.24); I^2=26.97%					
Test for overall effect: Z=1.47(P=0.14)					



Analysis 2.10. Comparison 2 Subgroup - No drain versus suction drain, Outcome 10 Atelectasis.

Study or subgroup	No drain n/N	Drain n/N	Odds Ratio M-H, Fixed, 95% CI	Weight	Odds Ratio M-H, Fixed, 95% CI
al-Arfaj 1992	8/87	8/52		45.74%	0.56[0.2,1.59]
Budd 1982	7/100	10/100		46.78%	0.68[0.25,1.86]
Kriplani 1992	0/50	1/50		7.47%	0.33[0.01,8.21]
Total (95% CI)	**237**	**202**		**100%**	**0.6[0.29,1.21]**
Total events: 15 (No drain), 19 (Drain)					
Heterogeneity: Tau^2=0; Chi^2=0.21, df=2(P=0.9); I^2=0%					
Test for overall effect: Z=1.43(P=0.15)					

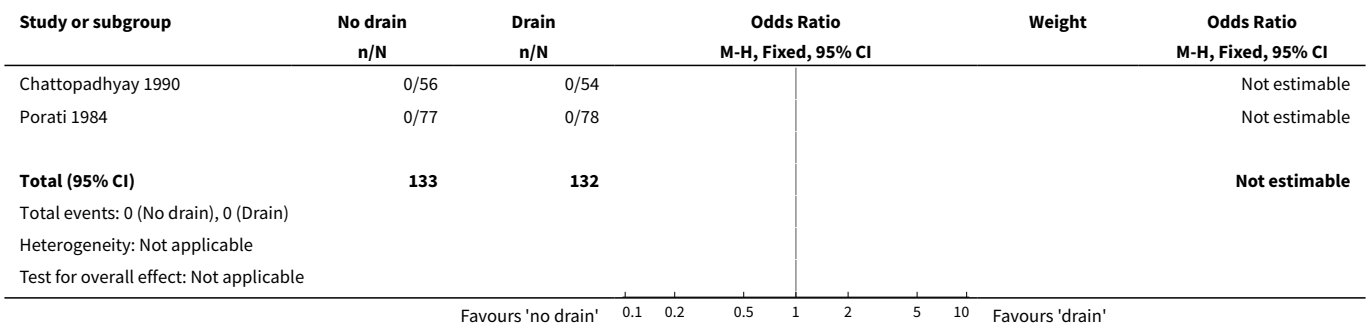
Analysis 2.11. Comparison 2 Subgroup - No drain versus suction drain, Outcome 11 Hospital stay (days).



Comparison 3. Subgroup - No drain versus passive closed drain

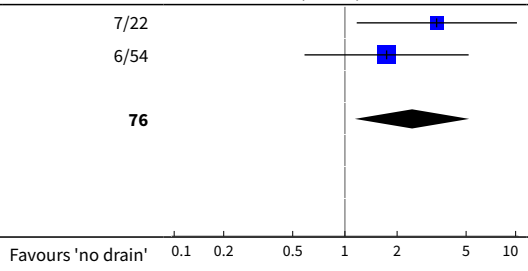
Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Mortality	2	265	Odds Ratio (M-H, Fixed, 95% CI)	0.0 [0.0, 0.0]
2 Total abdominal collections	2	181	Odds Ratio (M-H, Fixed, 95% CI)	2.44 [1.14, 5.21]
3 Infected intra-abdominal collections	1	110	Odds Ratio (M-H, Fixed, 95% CI)	0.0 [0.0, 0.0]
4 Wound infection	4	577	Odds Ratio (M-H, Random, 95% CI)	0.68 [0.25, 1.88]
5 Chest infection	4	587	Odds Ratio (M-H, Fixed, 95% CI)	1.00 [0.48, 2.11]
6 Atelectasis	1	122	Odds Ratio (M-H, Fixed, 95% CI)	0.78 [0.22, 2.79]
7 Hospital stay (days)	2	300	Mean Difference (IV, Random, 95% CI)	-0.92 [-2.01, 0.17]

Analysis 3.1. Comparison 3 Subgroup - No drain versus passive closed drain, Outcome 1 Mortality.



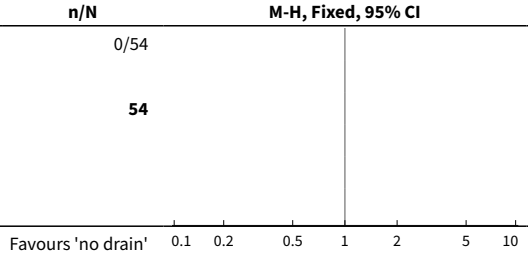
Analysis 3.2. Comparison 3 Subgroup - No drain versus passive closed drain, Outcome 2 Total abdominal collections.

Study or subgroup	No drain n/N	Drain n/N	Odds Ratio M-H, Fixed, 95% CI	Weight	Odds Ratio M-H, Fixed, 95% CI
al-Arfaj 1992	30/49	7/22		42.75%	3.38[1.17,9.82]
Chattopadhyay 1990	10/56	6/54		57.25%	1.74[0.58,5.17]
Total (95% CI)	**105**	**76**		**100%**	**2.44[1.14,5.21]**
Total events: 40 (No drain), 13 (Drain)					
Heterogeneity: Tau^2=0; Chi^2=0.73, df=1(P=0.39); I^2=0%					
Test for overall effect: Z=2.31(P=0.02)					



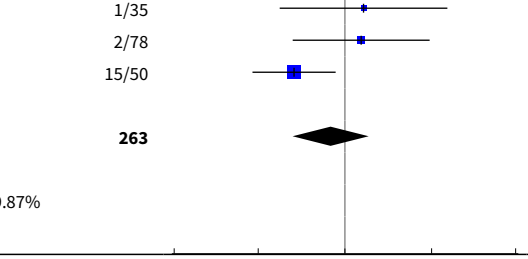
Analysis 3.3. Comparison 3 Subgroup - No drain versus passive closed drain, Outcome 3 Infected intra-abdominal collections.

Study or subgroup	No drain n/N	Drain n/N	Odds Ratio M-H, Fixed, 95% CI	Weight	Odds Ratio M-H, Fixed, 95% CI
Chattopadhyay 1990	0/56	0/54			Not estimable
Total (95% CI)	**56**	**54**			**Not estimable**
Total events: 0 (No drain), 0 (Drain)					
Heterogeneity: Not applicable					
Test for overall effect: Not applicable					



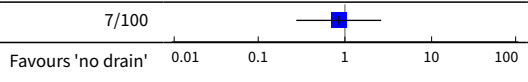
Analysis 3.4. Comparison 3 Subgroup - No drain versus passive closed drain, Outcome 4 Wound infection.

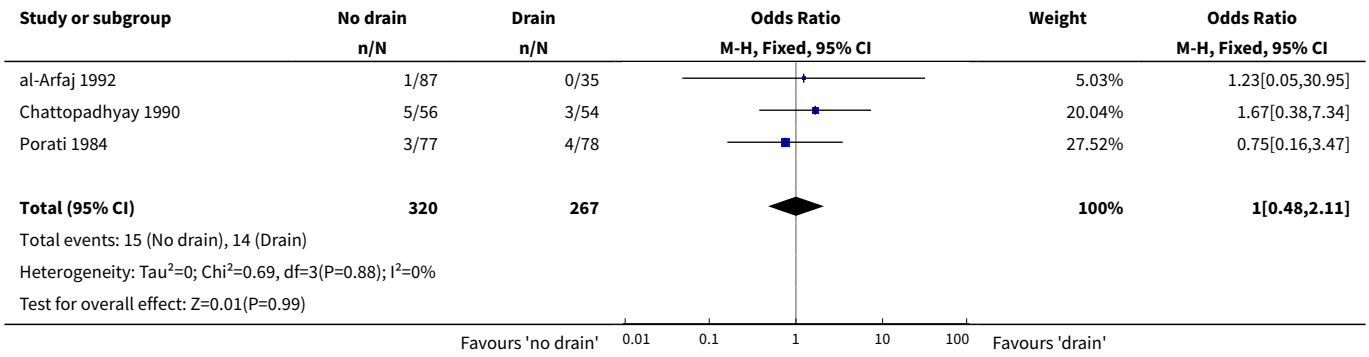
Study or subgroup	No drain n/N	Drain n/N	Odds Ratio M-H, Random, 95% CI	Weight	Odds Ratio M-H, Random, 95% CI
Adloff 1987	2/100	2/100		19.74%	1[0.14,7.24]
al-Arfaj 1992	4/87	1/35		16.43%	1.64[0.18,15.2]
Porati 1984	3/77	2/78		22.42%	1.54[0.25,9.49]
Saad 1993	5/50	15/50		41.4%	0.26[0.09,0.78]
Total (95% CI)	**314**	**263**		**100%**	**0.68[0.25,1.88]**
Total events: 14 (No drain), 20 (Drain)					
Heterogeneity: Tau^2=0.32; Chi^2=4.28, df=3(P=0.23); I^2=29.87%					
Test for overall effect: Z=0.74(P=0.46)					



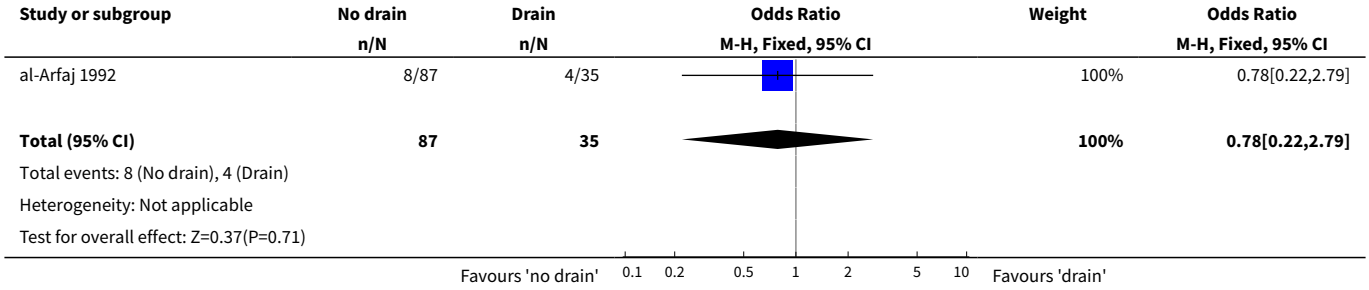
Analysis 3.5. Comparison 3 Subgroup - No drain versus passive closed drain, Outcome 5 Chest infection.

Study or subgroup	No drain n/N	Drain n/N	Odds Ratio M-H, Fixed, 95% CI	Weight	Odds Ratio M-H, Fixed, 95% CI
Adloff 1987	6/100	7/100		47.41%	0.85[0.27,2.62]

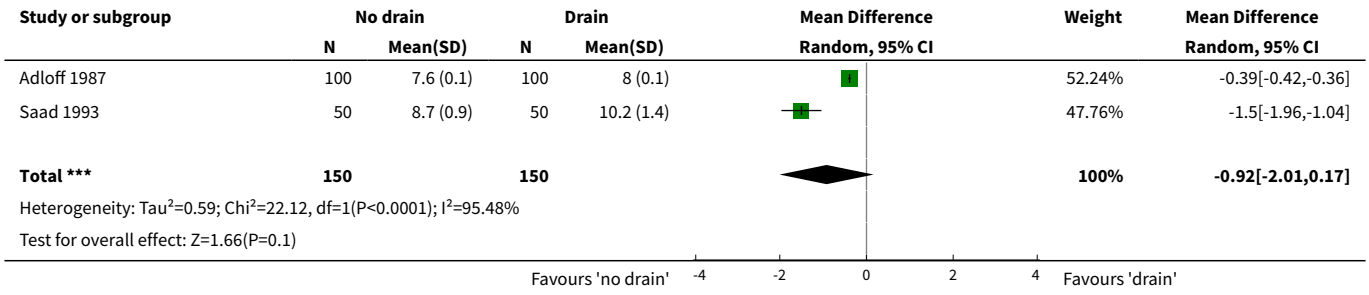




Analysis 3.6. Comparison 3 Subgroup - No drain versus passive closed drain, Outcome 6 Atelectasis.



Analysis 3.7. Comparison 3 Subgroup - No drain versus passive closed drain, Outcome 7 Hospital stay (days).



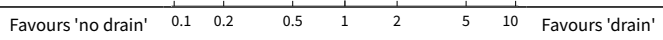
Comparison 4. Subgroup - No drain versus passive open drain

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Mortality	5	778	Odds Ratio (M-H, Fixed, 95% CI)	0.0 [0.0, 0.0]
2 Abdominal collections requiring re-operation	2	472	Odds Ratio (M-H, Fixed, 95% CI)	0.0 [0.0, 0.0]
3 Abdominal collections requiring drain insertion	1	100	Odds Ratio (M-H, Fixed, 95% CI)	3.06 [0.12, 76.95]

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
4 Abdominal collections requiring percutaneous aspiration	1	100	Odds Ratio (M-H, Fixed, 95% CI)	3.06 [0.12, 76.95]
5 Total abdominal collections	2	260	Odds Ratio (M-H, Fixed, 95% CI)	1.80 [1.05, 3.07]
6 Infected intra-abdominal collections	4	410	Odds Ratio (M-H, Fixed, 95% CI)	0.0 [0.0, 0.0]
7 Bile peritonitis	2	300	Odds Ratio (M-H, Fixed, 95% CI)	1.0 [0.14, 7.18]
8 Wound infection	7	810	Odds Ratio (M-H, Fixed, 95% CI)	0.58 [0.29, 1.17]
9 Chest infection	6	760	Odds Ratio (M-H, Fixed, 95% CI)	1.20 [0.60, 2.39]
10 Atelectasis	4	450	Odds Ratio (M-H, Fixed, 95% CI)	0.53 [0.25, 1.15]
11 Hospital stay (days)	3	350	Mean Difference (IV, Fixed, 95% CI)	0.22 [-0.28, 0.73]

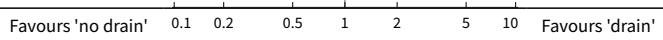
Analysis 4.1. Comparison 4 Subgroup - No drain versus passive open drain, Outcome 1 Mortality.

Study or subgroup	No drain n/N	Drain n/N	Odds Ratio M-H, Fixed, 95% CI	Weight	Odds Ratio M-H, Fixed, 95% CI
Budd 1982	0/100	0/100			Not estimable
Druart 1990	0/24	0/26			Not estimable
Huguier 1980	0/50	0/50			Not estimable
Kupczyk-Joeris 1991	0/30	0/26			Not estimable
Lewis 1990	0/248	0/124			Not estimable
Total (95% CI)	**452**	**326**			**Not estimable**
Total events: 0 (No drain), 0 (Drain)					
Heterogeneity: Not applicable					
Test for overall effect: Not applicable					

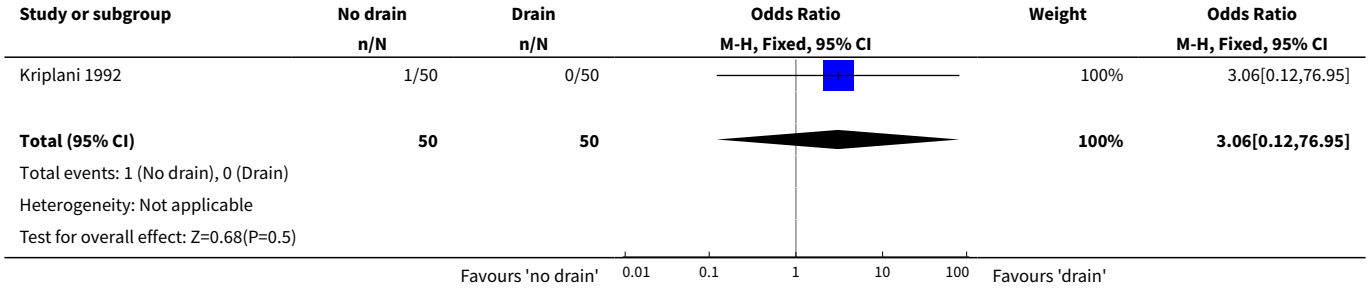


Analysis 4.2. Comparison 4 Subgroup - No drain versus passive open drain, Outcome 2 Abdominal collections requiring re-operation.

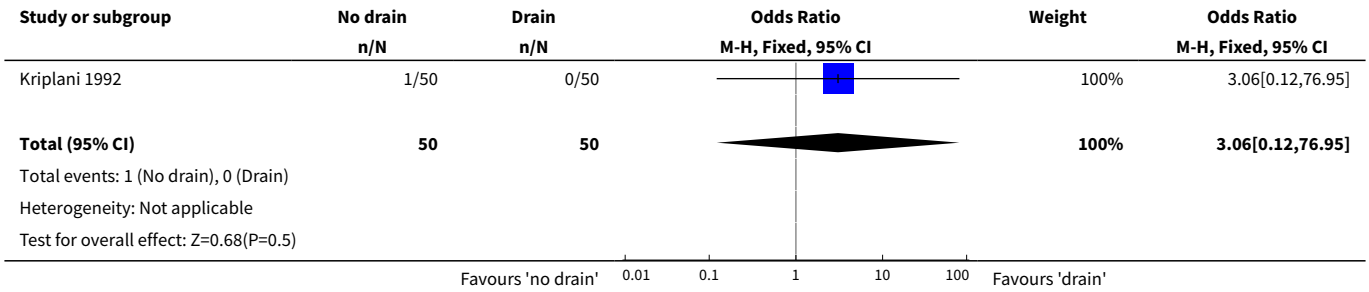
Study or subgroup	No drain n/N	Drain n/N	Odds Ratio M-H, Fixed, 95% CI	Weight	Odds Ratio M-H, Fixed, 95% CI
Kriplani 1992	0/50	0/50			Not estimable
Lewis 1990	0/248	0/124			Not estimable
Total (95% CI)	**298**	**174**			**Not estimable**
Total events: 0 (No drain), 0 (Drain)					
Heterogeneity: Not applicable					
Test for overall effect: Not applicable					



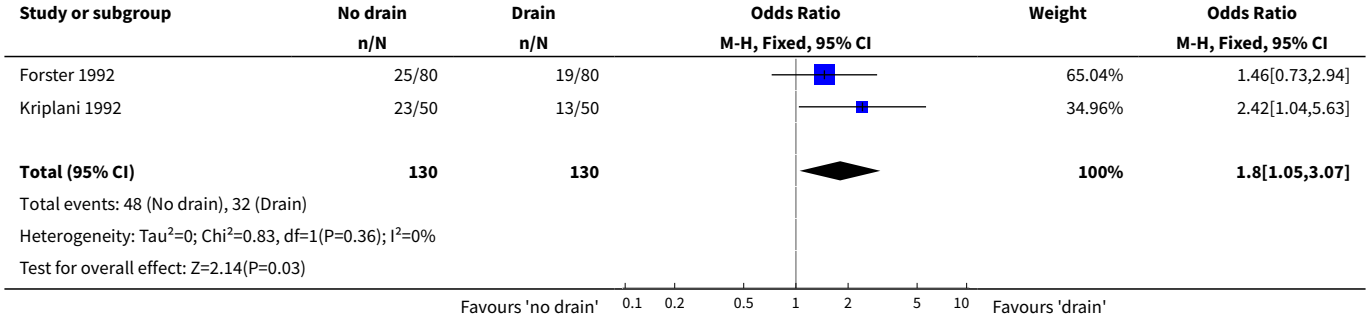
Analysis 4.3. Comparison 4 Subgroup - No drain versus passive open drain, Outcome 3 Abdominal collections requiring drain insertion.



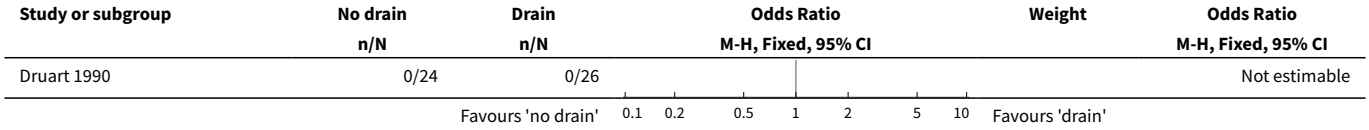
Analysis 4.4. Comparison 4 Subgroup - No drain versus passive open drain, Outcome 4 Abdominal collections requiring percutaneous aspiration.

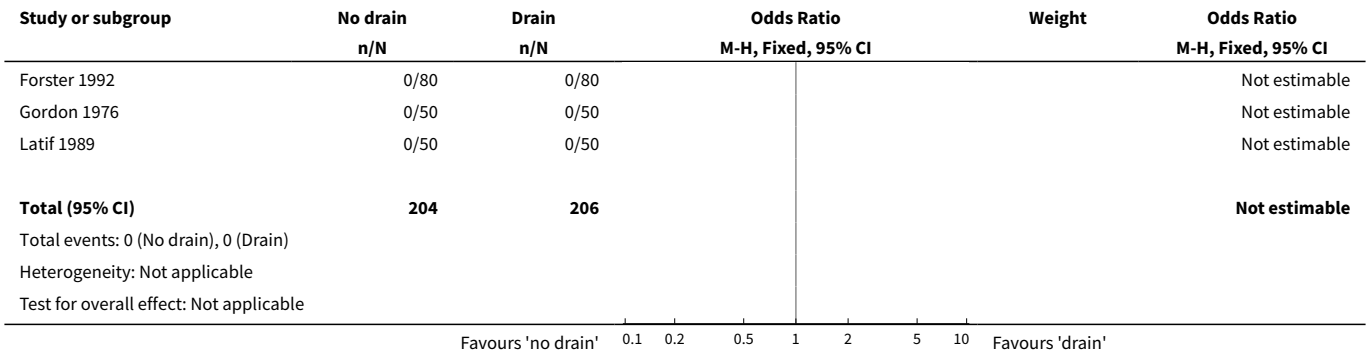


Analysis 4.5. Comparison 4 Subgroup - No drain versus passive open drain, Outcome 5 Total abdominal collections.



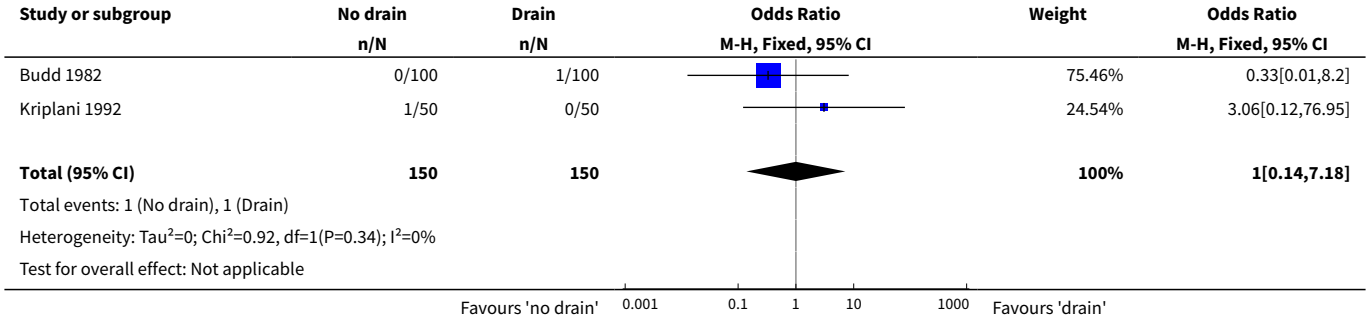
Analysis 4.6. Comparison 4 Subgroup - No drain versus passive open drain, Outcome 6 Infected intra-abdominal collections.





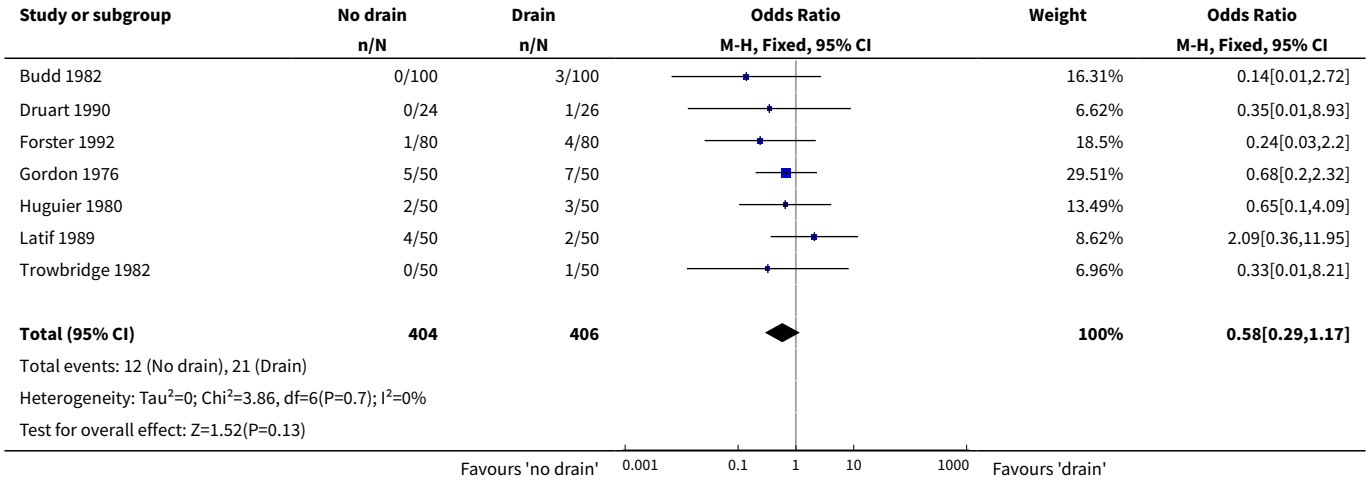
Study or subgroup	No drain n/N	Drain n/N	Odds Ratio M-H, Fixed, 95% CI	Weight	Odds Ratio M-H, Fixed, 95% CI
Forster 1992	0/80	0/80			Not estimable
Gordon 1976	0/50	0/50			Not estimable
Latif 1989	0/50	0/50			Not estimable
Total (95% CI)	**204**	**206**			**Not estimable**
Total events: 0 (No drain), 0 (Drain)					
Heterogeneity: Not applicable					
Test for overall effect: Not applicable					

Analysis 4.7. Comparison 4 Subgroup - No drain versus passive open drain, Outcome 7 Bile peritonitis.



Study or subgroup	No drain n/N	Drain n/N	Odds Ratio M-H, Fixed, 95% CI	Weight	Odds Ratio M-H, Fixed, 95% CI
Budd 1982	0/100	1/100		75.46%	0.33[0.01,8.2]
Kriplani 1992	1/50	0/50		24.54%	3.06[0.12,76.95]
Total (95% CI)	**150**	**150**		**100%**	**1[0.14,7.18]**
Total events: 1 (No drain), 1 (Drain)					
Heterogeneity: Tau^2=0; Chi^2=0.92, df=1(P=0.34); I^2=0%					
Test for overall effect: Not applicable					

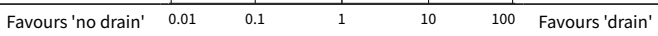
Analysis 4.8. Comparison 4 Subgroup - No drain versus passive open drain, Outcome 8 Wound infection.



Study or subgroup	No drain n/N	Drain n/N	Odds Ratio M-H, Fixed, 95% CI	Weight	Odds Ratio M-H, Fixed, 95% CI
Budd 1982	0/100	3/100		16.31%	0.14[0.01,2.72]
Druart 1990	0/24	1/26		6.62%	0.35[0.01,8.93]
Forster 1992	1/80	4/80		18.5%	0.24[0.03,2.2]
Gordon 1976	5/50	7/50		29.51%	0.68[0.2,2.32]
Huguier 1980	2/50	3/50		13.49%	0.65[0.1,4.09]
Latif 1989	4/50	2/50		8.62%	2.09[0.36,11.95]
Trowbridge 1982	0/50	1/50		6.96%	0.33[0.01,8.21]
Total (95% CI)	**404**	**406**		**100%**	**0.58[0.29,1.17]**
Total events: 12 (No drain), 21 (Drain)					
Heterogeneity: Tau^2=0; Chi^2=3.86, df=6(P=0.7); I^2=0%					
Test for overall effect: Z=1.52(P=0.13)					

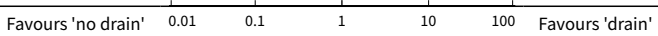
Analysis 4.9. Comparison 4 Subgroup - No drain versus passive open drain, Outcome 9 Chest infection.

Study or subgroup	No drain n/N	Drain n/N	Odds Ratio M-H, Fixed, 95% CI	Weight	Odds Ratio M-H, Fixed, 95% CI
Budd 1982	2/100	2/100		13.2%	1[0.14,7.24]
Forster 1992	4/80	1/80		6.4%	4.16[0.45,38.05]
Gordon 1976	6/50	6/50		35.56%	1[0.3,3.34]
Kriplani 1992	3/50	3/50		18.99%	1[0.19,5.21]
Latif 1989	3/50	2/50		12.66%	1.53[0.24,9.59]
Trowbridge 1982	1/50	2/50		13.2%	0.49[0.04,5.58]
Total (95% CI)	**380**	**380**		**100%**	**1.2[0.6,2.39]**
Total events: 19 (No drain), 16 (Drain)					
Heterogeneity: Tau²=0; Chi²=1.97, df=5(P=0.85); I²=0%					
Test for overall effect: Z=0.52(P=0.6)					



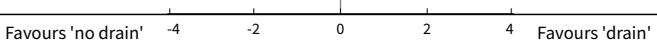
Analysis 4.10. Comparison 4 Subgroup - No drain versus passive open drain, Outcome 10 Atelectasis.

Study or subgroup	No drain n/N	Drain n/N	Odds Ratio M-H, Fixed, 95% CI	Weight	Odds Ratio M-H, Fixed, 95% CI
Budd 1982	7/100	15/100		74.86%	0.43[0.17,1.1]
Druart 1990	4/24	4/26		17.17%	1.1[0.24,4.99]
Gordon 1976	0/50	1/50		7.97%	0.33[0.01,8.21]
Kriplani 1992	0/50	0/50			Not estimable
Total (95% CI)	**224**	**226**		**100%**	**0.53[0.25,1.15]**
Total events: 11 (No drain), 20 (Drain)					
Heterogeneity: Tau²=0; Chi²=1.18, df=2(P=0.55); I²=0%					
Test for overall effect: Z=1.61(P=0.11)					



Analysis 4.11. Comparison 4 Subgroup - No drain versus passive open drain, Outcome 11 Hospital stay (days).

Study or subgroup	No drain N	No drain Mean(SD)	Drain N	Drain Mean(SD)	Mean Difference Fixed, 95% CI	Weight	Mean Difference Fixed, 95% CI
Gordon 1976	50	10.3 (2)	50	10.2 (3.1)		24.33%	0.06[-0.97,1.09]
Huguier 1980	50	9.4 (3.6)	50	9.2 (2.5)		17.53%	0.2[-1.01,1.41]
Kriplani 1992	50	4.5 (2.3)	100	4.2 (1)		58.14%	0.3[-0.37,0.97]
Total ***	**150**		**200**			**100%**	**0.22[-0.28,0.73]**
Heterogeneity: Tau²=0; Chi²=0.15, df=2(P=0.93); I²=0%							
Test for overall effect: Z=0.86(P=0.39)							

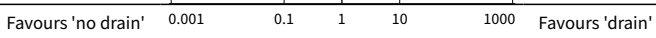


Comparison 5. Subgroup - High methodological quality: no drain versus drain

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Mortality	8	1907	Odds Ratio (M-H, Fixed, 95% CI)	0.54 [0.11, 2.58]
2 Abdominal collections requiring re-operation	3	1123	Odds Ratio (M-H, Fixed, 95% CI)	0.0 [0.0, 0.0]
3 Abdominal collections requiring drain insertion	2	629	Odds Ratio (M-H, Fixed, 95% CI)	6.09 [0.24, 152.24]
4 Abdominal collections requiring percutaneous aspiration	3	829	Odds Ratio (M-H, Fixed, 95% CI)	4.25 [0.44, 41.43]
5 Total abdominal collections	2	629	Odds Ratio (M-H, Random, 95% CI)	1.00 [0.12, 8.23]
6 Infected intra-abdominal collections	4	578	Odds Ratio (M-H, Fixed, 95% CI)	0.70 [0.14, 3.59]
7 Bile peritonitis	3	573	Odds Ratio (M-H, Fixed, 95% CI)	1.33 [0.22, 8.00]
8 Wound infection	10	2251	Odds Ratio (M-H, Fixed, 95% CI)	0.58 [0.38, 0.91]
9 Chest infection	6	1329	Odds Ratio (M-H, Random, 95% CI)	0.63 [0.33, 1.23]
10 Atelectasis	3	550	Odds Ratio (M-H, Fixed, 95% CI)	0.52 [0.23, 1.17]
11 Hospital stay (days)	6	1523	Mean Difference (IV, Random, 95% CI)	-0.33 [-0.59, -0.07]

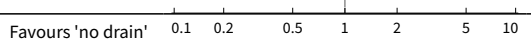
Analysis 5.1. Comparison 5 Subgroup - High methodological quality: no drain versus drain, Outcome 1 Mortality.

Study or subgroup	No drain n/N	Drain n/N	Odds Ratio M-H, Fixed, 95% CI	Weight	Odds Ratio M-H, Fixed, 95% CI
Budd 1982	0/100	0/200			Not estimable
Huguier 1980	0/50	0/50			Not estimable
Kupczyk-Joeris 1991	0/30	0/26			Not estimable
Lewis 1990	0/248	0/246			Not estimable
Locker 1983	1/63	0/60		11.16%	2.9[0.12,72.69]
Monson 1991	0/240	2/239		55.79%	0.2[0.01,4.14]
Playforth 1985	0/77	1/78		33.05%	0.33[0.01,8.31]
Schaupp 1988	0/100	0/100			Not estimable
Total (95% CI)	**908**	**999**		**100%**	**0.54[0.11,2.58]**
Total events: 1 (No drain), 3 (Drain)					
Heterogeneity: Tau^2=0; Chi^2=1.55, df=2(P=0.46); I^2=0%					
Test for overall effect: Z=0.77(P=0.44)					



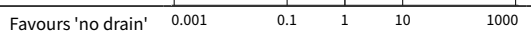
Analysis 5.2. Comparison 5 Subgroup - High methodological quality: no drain versus drain, Outcome 2 Abdominal collections requiring re-operation.

Study or subgroup	No drain n/N	Drain n/N	Odds Ratio M-H, Fixed, 95% CI	Weight	Odds Ratio M-H, Fixed, 95% CI
Kriplani 1992	0/50	0/100			Not estimable
Lewis 1990	0/248	0/246			Not estimable
Monson 1991	0/240	0/239			Not estimable
Total (95% CI)	**538**	**585**			**Not estimable**
Total events: 0 (No drain), 0 (Drain)					
Heterogeneity: Not applicable					
Test for overall effect: Not applicable					



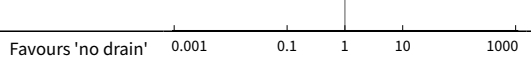
Analysis 5.3. Comparison 5 Subgroup - High methodological quality: no drain versus drain, Outcome 3 Abdominal collections requiring drain insertion.

Study or subgroup	No drain n/N	Drain n/N	Odds Ratio M-H, Fixed, 95% CI	Weight	Odds Ratio M-H, Fixed, 95% CI
Kriplani 1992	1/50	0/100		100%	6.09[0.24,152.24]
Monson 1991	0/240	0/239			Not estimable
Total (95% CI)	**290**	**339**		**100%**	**6.09[0.24,152.24]**
Total events: 1 (No drain), 0 (Drain)					
Heterogeneity: Not applicable					
Test for overall effect: Z=1.1(P=0.27)					



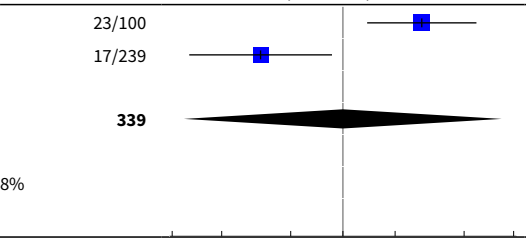
Analysis 5.4. Comparison 5 Subgroup - High methodological quality: no drain versus drain, Outcome 4 Abdominal collections requiring percutaneous aspiration.

Study or subgroup	No drain n/N	Drain n/N	Odds Ratio M-H, Fixed, 95% CI	Weight	Odds Ratio M-H, Fixed, 95% CI
Kriplani 1992	1/50	0/100		39.8%	6.09[0.24,152.24]
Monson 1991	0/240	0/239			Not estimable
Schaupp 1988	1/100	0/100		60.2%	3.03[0.12,75.28]
Total (95% CI)	**390**	**439**		**100%**	**4.25[0.44,41.43]**
Total events: 2 (No drain), 0 (Drain)					
Heterogeneity: Tau^2=0; Chi^2=0.09, df=1(P=0.76); I^2=0%					
Test for overall effect: Z=1.24(P=0.21)					



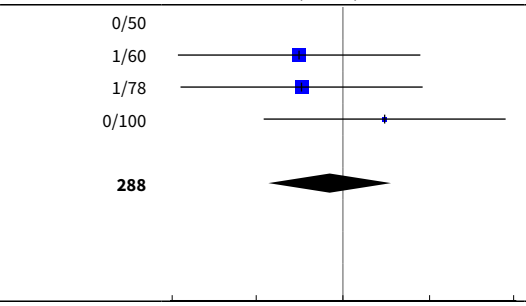
Analysis 5.5. Comparison 5 Subgroup - High methodological quality: no drain versus drain, Outcome 5 Total abdominal collections.

Study or subgroup	No drain n/N	Drain n/N	Odds Ratio M-H, Random, 95% CI	Weight	Odds Ratio M-H, Random, 95% CI
Kriplani 1992	23/50	23/100		51.05%	2.85[1.38,5.89]
Monson 1991	6/240	17/239		48.95%	0.33[0.13,0.86]
Total (95% CI)	**290**	**339**		**100%**	**1[0.12,8.23]**
Total events: 29 (No drain), 40 (Drain)					
Heterogeneity: Tau^2=2.13; Chi^2=12.47, df=1(P=0); I^2=91.98%					
Test for overall effect: Z=0(P=1)					



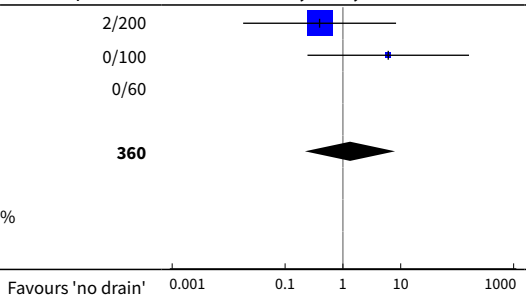
Analysis 5.6. Comparison 5 Subgroup - High methodological quality: no drain versus drain, Outcome 6 Infected intra-abdominal collections.

Study or subgroup	No drain n/N	Drain n/N	Odds Ratio M-H, Fixed, 95% CI	Weight	Odds Ratio M-H, Fixed, 95% CI
Gordon 1976	0/50	0/50			Not estimable
Locker 1983	0/63	1/60		43.57%	0.31[0.01,7.82]
Playforth 1985	0/77	1/78		42.34%	0.33[0.01,8.31]
Schaupp 1988	1/100	0/100		14.08%	3.03[0.12,75.28]
Total (95% CI)	**290**	**288**		**100%**	**0.7[0.14,3.59]**
Total events: 1 (No drain), 2 (Drain)					
Heterogeneity: Tau^2=0; Chi^2=1.25, df=2(P=0.54); I^2=0%					
Test for overall effect: Z=0.42(P=0.67)					



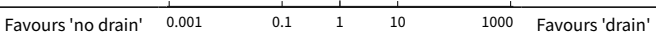
Analysis 5.7. Comparison 5 Subgroup - High methodological quality: no drain versus drain, Outcome 7 Bile peritonitis.

Study or subgroup	No drain n/N	Drain n/N	Odds Ratio M-H, Fixed, 95% CI	Weight	Odds Ratio M-H, Fixed, 95% CI
Budd 1982	0/100	2/200		83.63%	0.4[0.02,8.31]
Kriplani 1992	1/50	0/100		16.37%	6.09[0.24,152.24]
Locker 1983	0/63	0/60			Not estimable
Total (95% CI)	**213**	**360**		**100%**	**1.33[0.22,8]**
Total events: 1 (No drain), 2 (Drain)					
Heterogeneity: Tau^2=0; Chi^2=1.47, df=1(P=0.23); I^2=31.93%					
Test for overall effect: Z=0.31(P=0.76)					



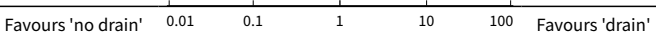
Analysis 5.8. Comparison 5 Subgroup - High methodological quality: no drain versus drain, Outcome 8 Wound infection.

Study or subgroup	No drain n/N	Drain n/N	Odds Ratio M-H, Fixed, 95% CI	Weight	Odds Ratio M-H, Fixed, 95% CI
Adloff 1987	2/100	2/100		3.62%	1[0.14,7.24]
Budd 1982	0/100	7/200		9.21%	0.13[0.01,2.27]
Gordon 1976	5/50	7/50		11.63%	0.68[0.2,2.32]
Huguier 1980	2/50	3/50		5.32%	0.65[0.1,4.09]
Lewis 1990	6/248	8/246		14.47%	0.74[0.25,2.16]
Locker 1983	2/63	4/60		7.32%	0.46[0.08,2.6]
Monson 1991	5/240	15/239		27.17%	0.32[0.11,0.89]
Playforth 1985	8/77	8/78		13.15%	1.01[0.36,2.86]
Schaupp 1988	3/100	3/100		5.37%	1[0.2,5.08]
Trowbridge 1982	0/50	1/50		2.74%	0.33[0.01,8.21]
Total (95% CI)	**1078**	**1173**		**100%**	**0.58[0.38,0.91]**
Total events: 33 (No drain), 58 (Drain)					
Heterogeneity: Tau^2=0; Chi^2=4.67, df=9(P=0.86); I^2=0%					
Test for overall effect: Z=2.4(P=0.02)					



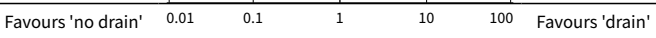
Analysis 5.9. Comparison 5 Subgroup - High methodological quality: no drain versus drain, Outcome 9 Chest infection.

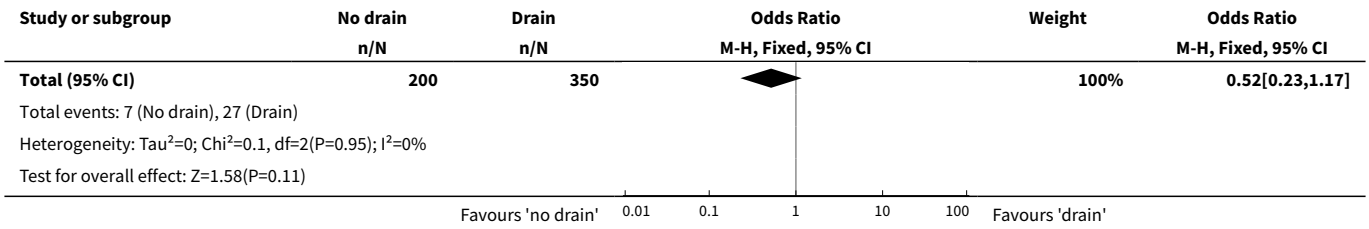
Study or subgroup	No drain n/N	Drain n/N	Odds Ratio M-H, Random, 95% CI	Weight	Odds Ratio M-H, Random, 95% CI
Adloff 1987	6/100	7/100		19.18%	0.85[0.27,2.62]
Budd 1982	2/100	2/200		8.95%	2.02[0.28,14.56]
Gordon 1976	6/50	6/50		17.76%	1[0.3,3.34]
Kriplani 1992	3/50	7/100		14.8%	0.85[0.21,3.43]
Monson 1991	19/240	56/239		32.96%	0.28[0.16,0.49]
Trowbridge 1982	1/50	2/50		6.35%	0.49[0.04,5.58]
Total (95% CI)	**590**	**739**		**100%**	**0.63[0.33,1.23]**
Total events: 37 (No drain), 80 (Drain)					
Heterogeneity: Tau^2=0.27; Chi^2=8.64, df=5(P=0.12); I^2=42.13%					
Test for overall effect: Z=1.35(P=0.18)					



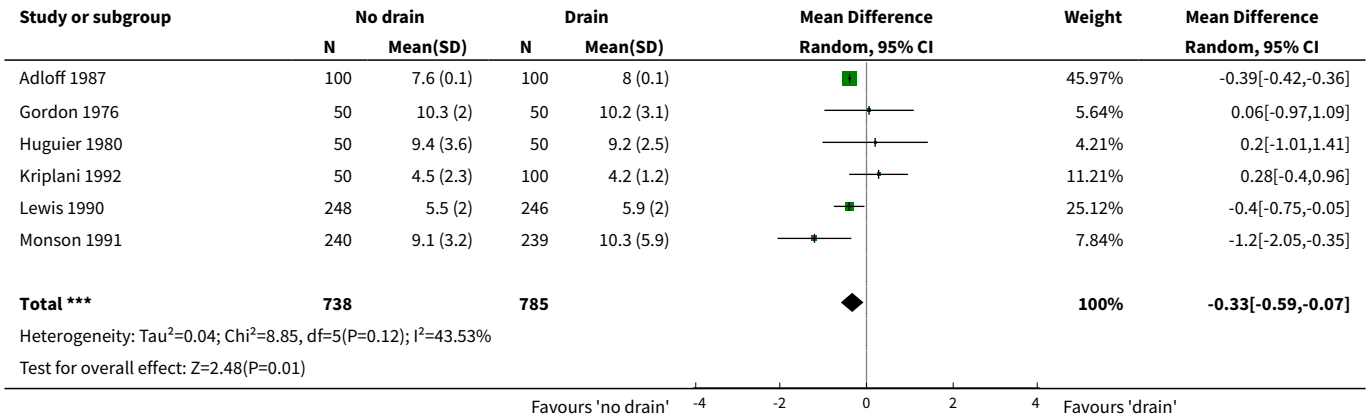
Analysis 5.10. Comparison 5 Subgroup - High methodological quality: no drain versus drain, Outcome 10 Atelectasis.

Study or subgroup	No drain n/N	Drain n/N	Odds Ratio M-H, Fixed, 95% CI	Weight	Odds Ratio M-H, Fixed, 95% CI
Budd 1982	7/100	25/200		86.2%	0.53[0.22,1.26]
Gordon 1976	0/50	1/50		8.26%	0.33[0.01,8.21]
Kriplani 1992	0/50	1/100		5.54%	0.66[0.03,16.41]





Analysis 5.11. Comparison 5 Subgroup - High methodological quality: no drain versus drain, Outcome 11 Hospital stay (days).



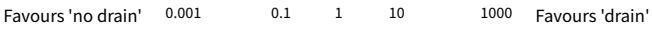
Comparison 6. Subgroup - Routine anitbiotic prophylaxis: no drain versus drain

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Mortality	3	744	Odds Ratio (M-H, Fixed, 95% CI)	0.25 [0.03, 2.23]
2 Abdominal collections requiring re-operation	1	479	Odds Ratio (M-H, Fixed, 95% CI)	0.0 [0.0, 0.0]
3 Abdominal collections requiring drain insertion	1	479	Odds Ratio (M-H, Fixed, 95% CI)	0.0 [0.0, 0.0]
4 Abdominal collections requiring percutaneous aspiration	1	479	Odds Ratio (M-H, Fixed, 95% CI)	0.0 [0.0, 0.0]
5 Total abdominal collections	2	589	Odds Ratio (M-H, Random, 95% CI)	0.75 [0.15, 3.75]
6 Infected intra-abdominal collections	3	365	Odds Ratio (M-H, Fixed, 95% CI)	0.33 [0.01, 8.31]
7 Wound infection	4	834	Odds Ratio (M-H, Random, 95% CI)	0.70 [0.29, 1.67]

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
8 Chest infection	4	789	Odds Ratio (M-H, Random, 95% CI)	0.67 [0.22, 2.01]
9 Hospital stay (days)	1	479	Mean Difference (IV, Fixed, 95% CI)	-1.20 [-2.05, -0.35]

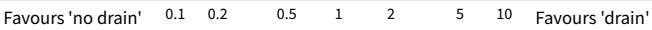
Analysis 6.1. Comparison 6 Subgroup - Routine anitbiotic prophylaxis: no drain versus drain, Outcome 1 Mortality.

Study or subgroup	No drain n/N	Drain n/N	Odds Ratio M-H, Fixed, 95% CI	Weight	Odds Ratio M-H, Fixed, 95% CI
Chattopadhyay 1990	0/56	0/54			Not estimable
Monson 1991	0/240	2/239		62.8%	0.2[0.01,4.14]
Playforth 1985	0/77	1/78		37.2%	0.33[0.01,8.31]
Total (95% CI)	**373**	**371**		**100%**	**0.25[0.03,2.23]**
Total events: 0 (No drain), 3 (Drain)					
Heterogeneity: Tau^2=0; Chi^2=0.05, df=1(P=0.82); I^2=0%					
Test for overall effect: Z=1.24(P=0.21)					



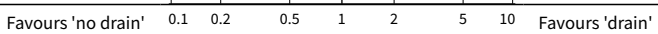
Analysis 6.2. Comparison 6 Subgroup - Routine anitbiotic prophylaxis: no drain versus drain, Outcome 2 Abdominal collections requiring re-operation.

Study or subgroup	No drain n/N	Drain n/N	Odds Ratio M-H, Fixed, 95% CI	Weight	Odds Ratio M-H, Fixed, 95% CI
Monson 1991	0/240	0/239			Not estimable
Total (95% CI)	**240**	**239**			**Not estimable**
Total events: 0 (No drain), 0 (Drain)					
Heterogeneity: Not applicable					
Test for overall effect: Not applicable					



Analysis 6.3. Comparison 6 Subgroup - Routine anitbiotic prophylaxis: no drain versus drain, Outcome 3 Abdominal collections requiring drain insertion.

Study or subgroup	No drain n/N	Drain n/N	Odds Ratio M-H, Fixed, 95% CI	Weight	Odds Ratio M-H, Fixed, 95% CI
Monson 1991	0/240	0/239			Not estimable
Total (95% CI)	**240**	**239**			**Not estimable**
Total events: 0 (No drain), 0 (Drain)					
Heterogeneity: Not applicable					
Test for overall effect: Not applicable					



Analysis 6.4. Comparison 6 Subgroup - Routine anitbiotic prophylaxis: no drain versus drain, Outcome 4 Abdominal collections requiring percutaneous aspiration.

Study or subgroup	No drain n/N	Drain n/N	Odds Ratio M-H, Fixed, 95% CI	Weight	Odds Ratio M-H, Fixed, 95% CI
Monson 1991	0/240	0/239			Not estimable
Total (95% CI)	**240**	**239**			**Not estimable**
Total events: 0 (No drain), 0 (Drain)					
Heterogeneity: Not applicable					
Test for overall effect: Not applicable					

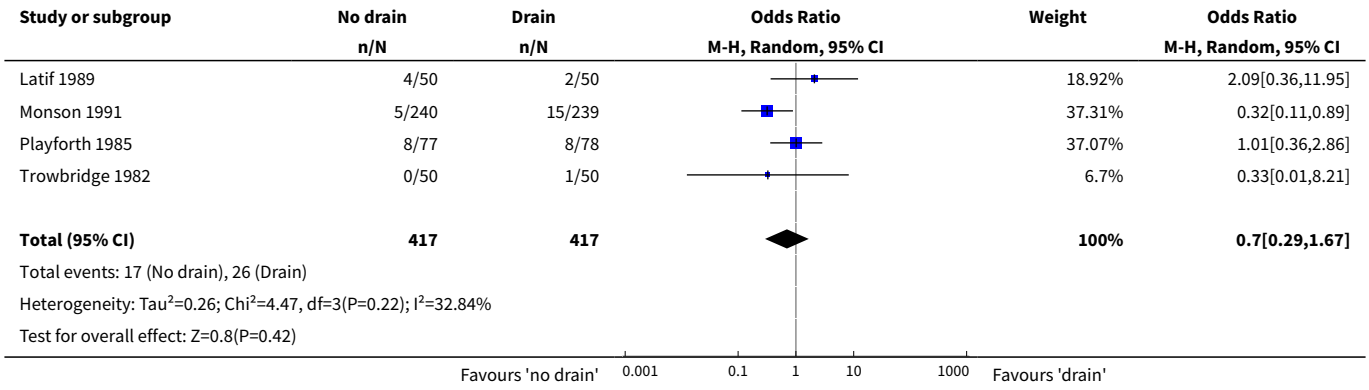
Analysis 6.5. Comparison 6 Subgroup - Routine anitbiotic prophylaxis: no drain versus drain, Outcome 5 Total abdominal collections.

Study or subgroup	No drain n/N	Drain n/N	Odds Ratio M-H, Random, 95% CI	Weight	Odds Ratio M-H, Random, 95% CI
Chattopadhyay 1990	10/56	6/54		48.62%	1.74[0.58,5.17]
Monson 1991	6/240	17/239		51.38%	0.33[0.13,0.86]
Total (95% CI)	**296**	**293**		**100%**	**0.75[0.15,3.75]**
Total events: 16 (No drain), 23 (Drain)					
Heterogeneity: Tau^2=1.09; Chi^2=5, df=1(P=0.03); I^2=80%					
Test for overall effect: Z=0.36(P=0.72)					

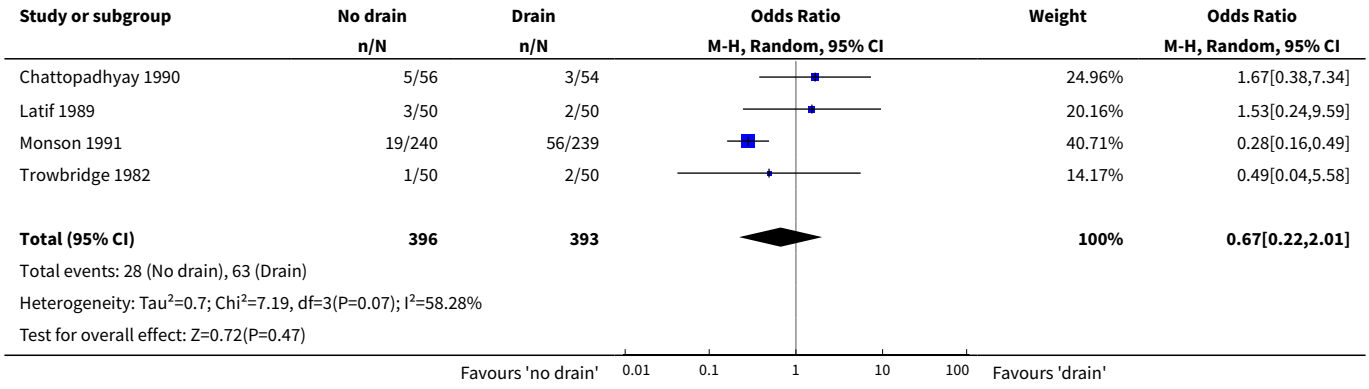
Analysis 6.6. Comparison 6 Subgroup - Routine anitbiotic prophylaxis: no drain versus drain, Outcome 6 Infected intra-abdominal collections.

Study or subgroup	No drain n/N	Drain n/N	Odds Ratio M-H, Fixed, 95% CI	Weight	Odds Ratio M-H, Fixed, 95% CI
Chattopadhyay 1990	0/56	0/54			Not estimable
Latif 1989	0/50	0/50			Not estimable
Playforth 1985	0/77	1/78		100%	0.33[0.01,8.31]
Total (95% CI)	**183**	**182**		**100%**	**0.33[0.01,8.31]**
Total events: 0 (No drain), 1 (Drain)					
Heterogeneity: Not applicable					
Test for overall effect: Z=0.67(P=0.5)					

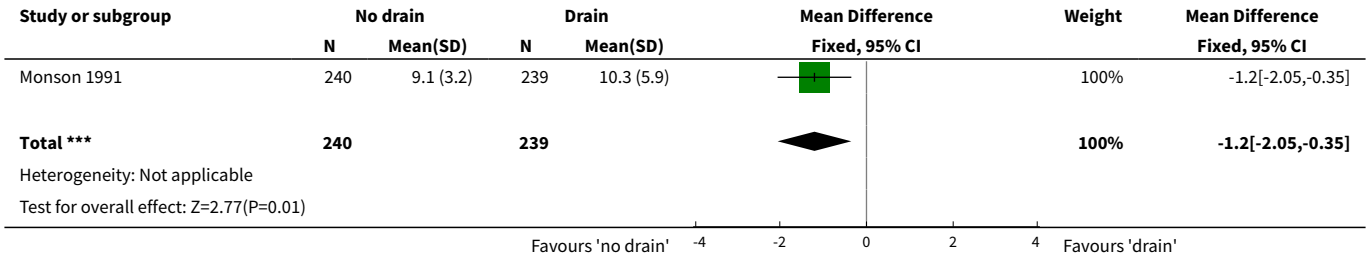
Analysis 6.7. Comparison 6 Subgroup - Routine anitbiotic prophylaxis: no drain versus drain, Outcome 7 Wound infection.



Analysis 6.8. Comparison 6 Subgroup - Routine anitbiotic prophylaxis: no drain versus drain, Outcome 8 Chest infection.



Analysis 6.9. Comparison 6 Subgroup - Routine anitbiotic prophylaxis: no drain versus drain, Outcome 9 Hospital stay (days).

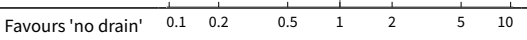


Comparison 7. Subgroup - No routine anitbiotic prophylaxis: no drain versus drain

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Mortality	3	699	Odds Ratio (M-H, Fixed, 95% CI)	0.0 [0.0, 0.0]
2 Abdominal collections requiring re-operation	1	494	Odds Ratio (M-H, Fixed, 95% CI)	0.0 [0.0, 0.0]
3 Infected intra-abdominal collections	2	205	Odds Ratio (M-H, Fixed, 95% CI)	0.33 [0.01, 8.31]
4 Wound infection	3	699	Odds Ratio (M-H, Fixed, 95% CI)	0.83 [0.35, 1.97]
5 Chest infection	1	155	Odds Ratio (M-H, Fixed, 95% CI)	0.75 [0.16, 3.47]
6 Atelectasis	1	50	Odds Ratio (M-H, Fixed, 95% CI)	1.1 [0.24, 4.99]
7 Hospital stay (days)	1	494	Mean Difference (IV, Fixed, 95% CI)	-0.40 [-0.75, -0.05]

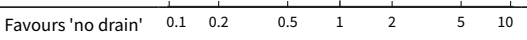
Analysis 7.1. Comparison 7 Subgroup - No routine anitbiotic prophylaxis: no drain versus drain, Outcome 1 Mortality.

Study or subgroup	No drain n/N	Drain n/N	Odds Ratio M-H, Fixed, 95% CI	Weight	Odds Ratio M-H, Fixed, 95% CI
Druart 1990	0/24	0/26			Not estimable
Lewis 1990	0/248	0/246			Not estimable
Porati 1984	0/77	0/78			Not estimable
Total (95% CI)	**349**	**350**			**Not estimable**
Total events: 0 (No drain), 0 (Drain)					
Heterogeneity: Not applicable					
Test for overall effect: Not applicable					



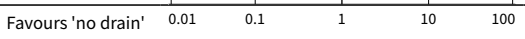
Analysis 7.2. Comparison 7 Subgroup - No routine anitbiotic prophylaxis: no drain versus drain, Outcome 2 Abdominal collections requiring re-operation.

Study or subgroup	No drain n/N	Drain n/N	Odds Ratio M-H, Fixed, 95% CI	Weight	Odds Ratio M-H, Fixed, 95% CI
Lewis 1990	0/248	0/246			Not estimable
Total (95% CI)	**248**	**246**			**Not estimable**
Total events: 0 (No drain), 0 (Drain)					
Heterogeneity: Not applicable					
Test for overall effect: Not applicable					



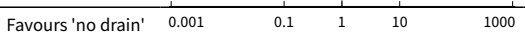
Analysis 7.3. Comparison 7 Subgroup - No routine anitbiotic prophylaxis: no drain versus drain, Outcome 3 Infected intra-abdominal collections.

Study or subgroup	No drain n/N	Drain n/N	Odds Ratio M-H, Fixed, 95% CI	Weight	Odds Ratio M-H, Fixed, 95% CI
Druart 1990	0/24	0/26			Not estimable
Playforth 1985	0/77	1/78		100%	0.33[0.01,8.31]
Total (95% CI)	**101**	**104**		**100%**	**0.33[0.01,8.31]**
Total events: 0 (No drain), 1 (Drain)					
Heterogeneity: Not applicable					
Test for overall effect: Z=0.67(P=0.5)					



Analysis 7.4. Comparison 7 Subgroup - No routine anitbiotic prophylaxis: no drain versus drain, Outcome 4 Wound infection.

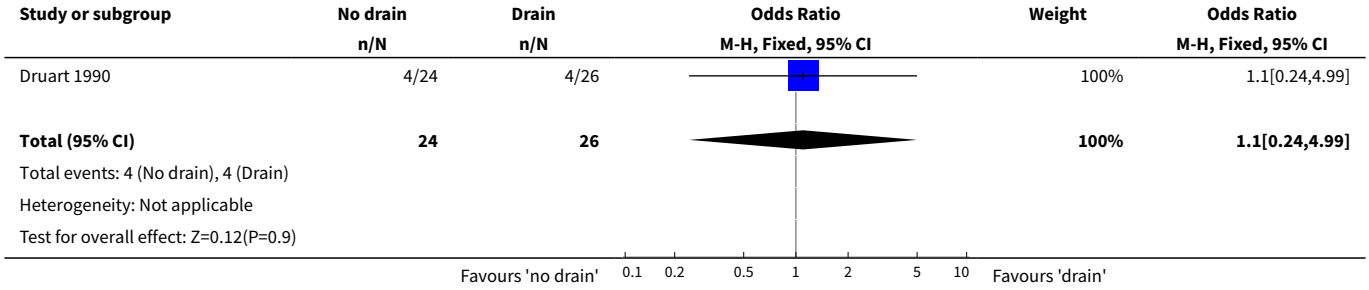
Study or subgroup	No drain n/N	Drain n/N	Odds Ratio M-H, Fixed, 95% CI	Weight	Odds Ratio M-H, Fixed, 95% CI
Druart 1990	0/24	1/26		12.66%	0.35[0.01,8.93]
Lewis 1990	6/248	8/246		70.23%	0.74[0.25,2.16]
Porati 1984	3/77	2/78		17.11%	1.54[0.25,9.49]
Total (95% CI)	**349**	**350**		**100%**	**0.83[0.35,1.97]**
Total events: 9 (No drain), 11 (Drain)					
Heterogeneity: Tau^2=0; Chi^2=0.77, df=2(P=0.68); I^2=0%					
Test for overall effect: Z=0.43(P=0.67)					



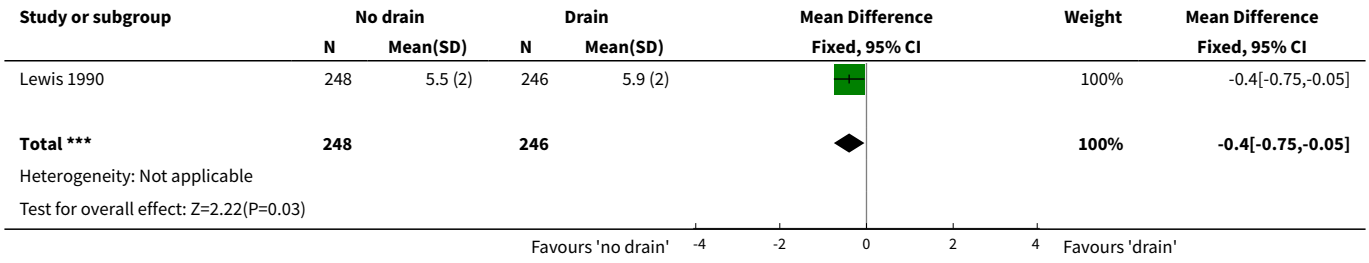
Analysis 7.5. Comparison 7 Subgroup - No routine anitbiotic prophylaxis: no drain versus drain, Outcome 5 Chest infection.

Study or subgroup	No drain n/N	Drain n/N	Odds Ratio M-H, Fixed, 95% CI	Weight	Odds Ratio M-H, Fixed, 95% CI
Porati 1984	3/77	4/78		100%	0.75[0.16,3.47]
Total (95% CI)	**77**	**78**		**100%**	**0.75[0.16,3.47]**
Total events: 3 (No drain), 4 (Drain)					
Heterogeneity: Tau^2=0; Chi^2=0, df=0(P<0.0001); I^2=100%					
Test for overall effect: Z=0.37(P=0.71)					

Analysis 7.6. Comparison 7 Subgroup - No routine anitbiotic prophylaxis: no drain versus drain, Outcome 6 Atelectasis.



Analysis 7.7. Comparison 7 Subgroup - No routine anitbiotic prophylaxis: no drain versus drain, Outcome 7 Hospital stay (days).



Comparison 8. Subgroup - Brought out through separate wound: no drain versus drain

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Mortality	4	834	Odds Ratio (M-H, Fixed, 95% CI)	0.55 [0.12, 2.62]
2 Abdominal collections requiring re-operation	2	629	Odds Ratio (M-H, Fixed, 95% CI)	0.0 [0.0, 0.0]
3 Abdominal collections requiring drain insertion	2	629	Odds Ratio (M-H, Fixed, 95% CI)	6.09 [0.24, 152.24]
4 Abdominal collections requiring percutaneous aspiration	2	629	Odds Ratio (M-H, Fixed, 95% CI)	6.09 [0.24, 152.24]
5 Total abdominal collections	4	884	Odds Ratio (M-H, Random, 95% CI)	1.22 [0.54, 2.72]
6 Infected intra-abdominal collections	3	415	Odds Ratio (M-H, Fixed, 95% CI)	0.33 [0.01, 8.31]
7 Bile peritonitis	1	150	Odds Ratio (M-H, Fixed, 95% CI)	6.09 [0.24, 152.24]
8 Wound infection	9	1568	Odds Ratio (M-H, Fixed, 95% CI)	0.60 [0.38, 0.94]

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
9 Chest infection	7	1363	Odds Ratio (M-H, Random, 95% CI)	0.78 [0.35, 1.75]
10 Atelectasis	2	324	Odds Ratio (M-H, Fixed, 95% CI)	0.63 [0.26, 1.58]
11 Hospital stay (days)	5	1029	Mean Difference (IV, Random, 95% CI)	-0.58 [-1.20, 0.05]

Analysis 8.1. Comparison 8 Subgroup - Brought out through separate wound: no drain versus drain, Outcome 1 Mortality.

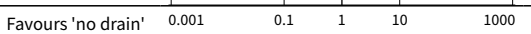
Study or subgroup	No drain n/N	Drain n/N	Odds Ratio M-H, Fixed, 95% CI	Weight	Odds Ratio M-H, Fixed, 95% CI
Edlund 1979	1/50	0/50		10.87%	3.06[0.12,76.95]
Huguier 1980	0/50	0/50			Not estimable
Monson 1991	0/240	2/239		55.98%	0.2[0.01,4.14]
Playforth 1985	0/77	1/78		33.16%	0.33[0.01,8.31]
Total (95% CI)	**417**	**417**		**100%**	**0.55[0.12,2.62]**
Total events: 1 (No drain), 3 (Drain)					
Heterogeneity: Tau^2=0; Chi^2=1.62, df=2(P=0.45); I^2=0%					
Test for overall effect: Z=0.75(P=0.46)					

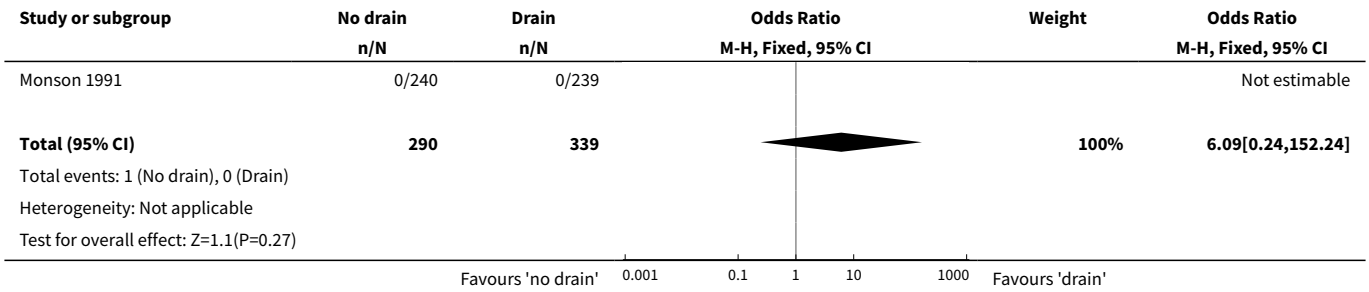
Analysis 8.2. Comparison 8 Subgroup - Brought out through separate wound: no drain versus drain, Outcome 2 Abdominal collections requiring re-operation.

Study or subgroup	No drain n/N	Drain n/N	Odds Ratio M-H, Fixed, 95% CI	Weight	Odds Ratio M-H, Fixed, 95% CI
Kriplani 1992	0/50	0/100			Not estimable
Monson 1991	0/240	0/239			Not estimable
Total (95% CI)	**290**	**339**			**Not estimable**
Total events: 0 (No drain), 0 (Drain)					
Heterogeneity: Not applicable					
Test for overall effect: Not applicable					

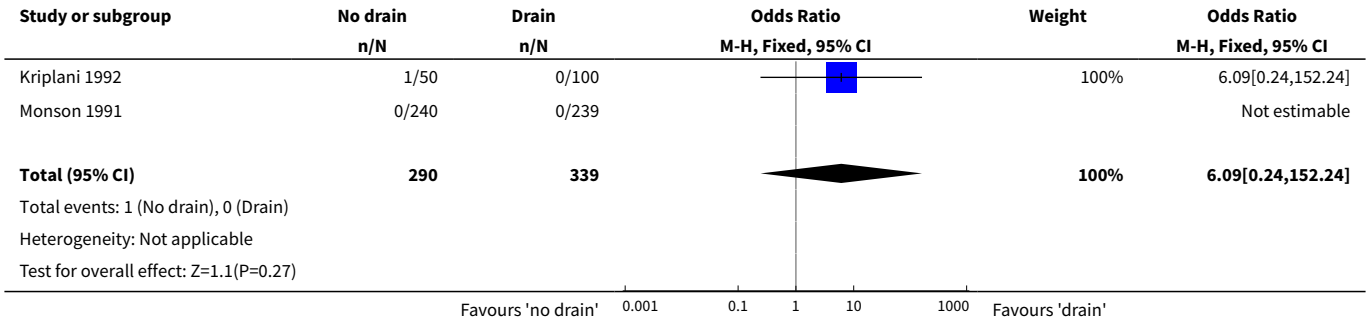
Analysis 8.3. Comparison 8 Subgroup - Brought out through separate wound: no drain versus drain, Outcome 3 Abdominal collections requiring drain insertion.

Study or subgroup	No drain n/N	Drain n/N	Odds Ratio M-H, Fixed, 95% CI	Weight	Odds Ratio M-H, Fixed, 95% CI
Kriplani 1992	1/50	0/100		100%	6.09[0.24,152.24]

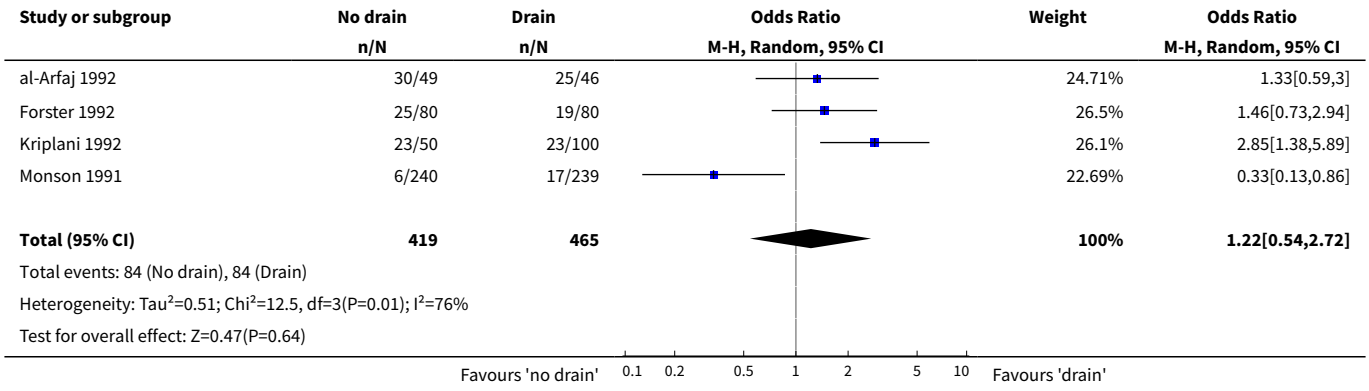




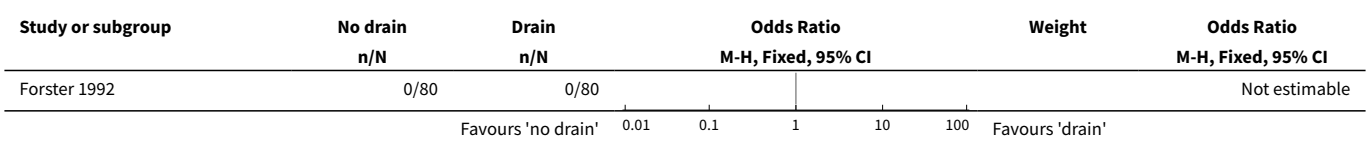
Analysis 8.4. Comparison 8 Subgroup - Brought out through separate wound: no drain versus drain, Outcome 4 Abdominal collections requiring percutaneous aspiration.

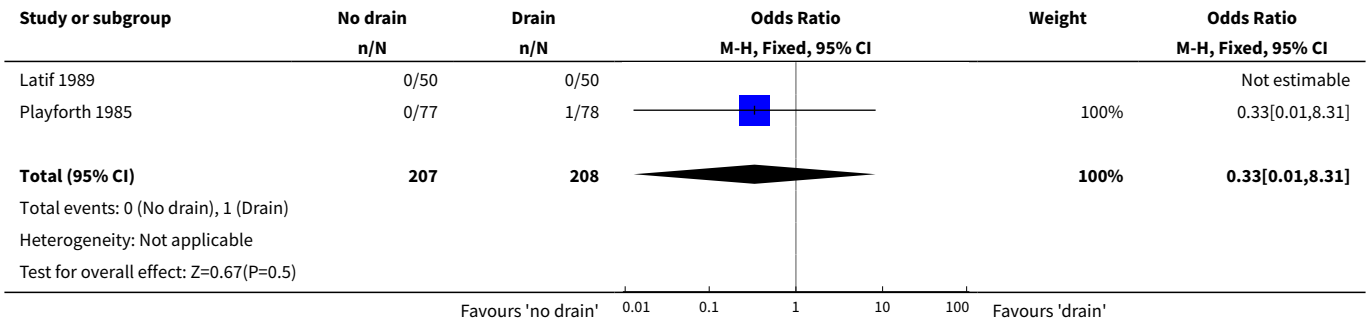


Analysis 8.5. Comparison 8 Subgroup - Brought out through separate wound: no drain versus drain, Outcome 5 Total abdominal collections.

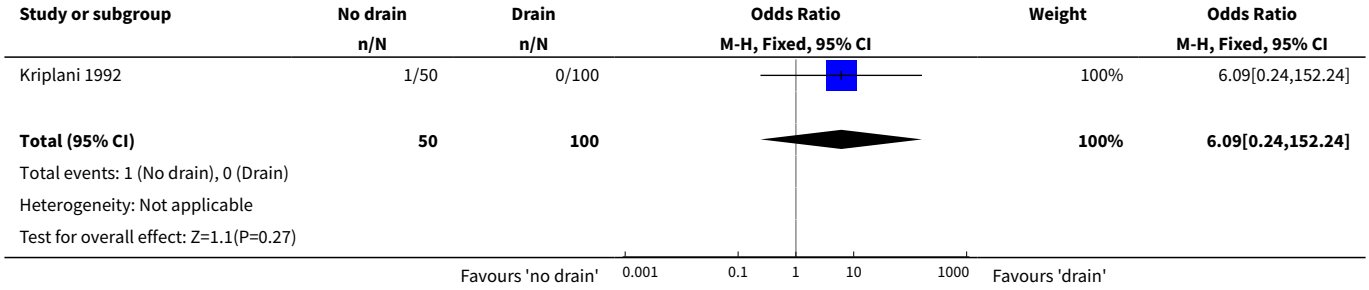


Analysis 8.6. Comparison 8 Subgroup - Brought out through separate wound: no drain versus drain, Outcome 6 Infected intra-abdominal collections.

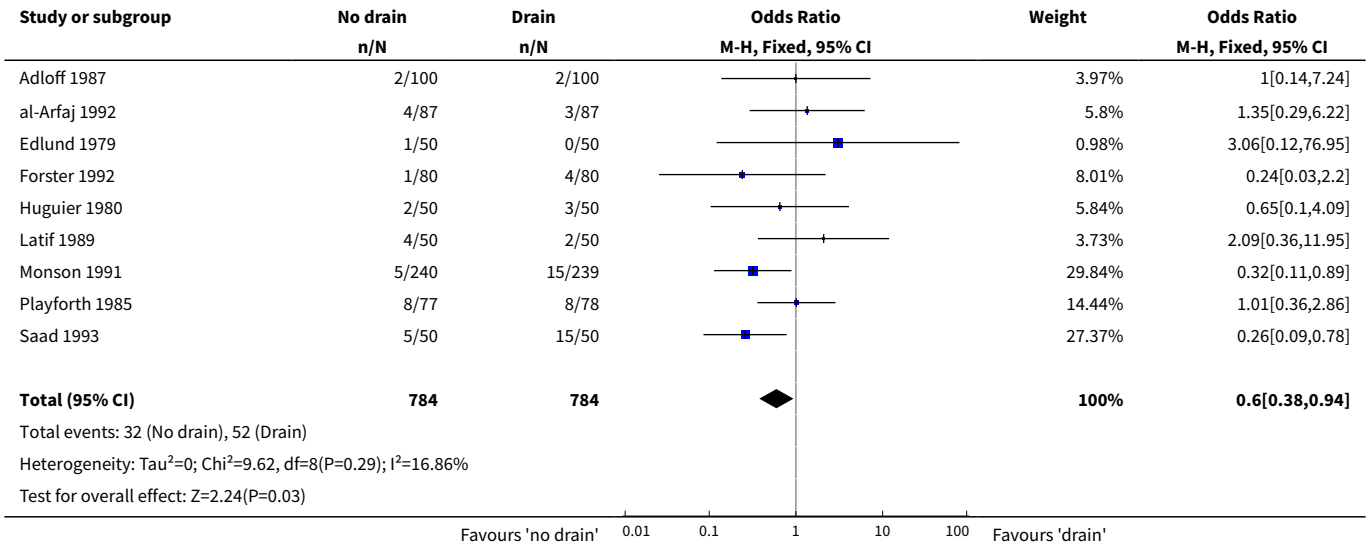




Analysis 8.7. Comparison 8 Subgroup - Brought out through separate wound: no drain versus drain, Outcome 7 Bile peritonitis.

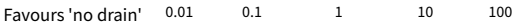


Analysis 8.8. Comparison 8 Subgroup - Brought out through separate wound: no drain versus drain, Outcome 8 Wound infection.



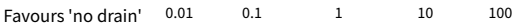
Analysis 8.9. Comparison 8 Subgroup - Brought out through separate wound: no drain versus drain, Outcome 9 Chest infection.

Study or subgroup	No drain n/N	Drain n/N	Odds Ratio M-H, Random, 95% CI	Weight	Odds Ratio M-H, Random, 95% CI
Adloff 1987	6/100	7/100		20.65%	0.85[0.27,2.62]
al-Arfaj 1992	1/87	0/87		5.33%	3.03[0.12,75.53]
Edlund 1979	0/50	1/50		5.3%	0.33[0.01,8.21]
Forster 1992	4/80	1/80		9.6%	4.16[0.45,38.05]
Kriplani 1992	3/50	7/100		16.98%	0.85[0.21,3.43]
Latif 1989	3/50	2/50		12.41%	1.53[0.24,9.59]
Monson 1991	19/240	56/239		29.73%	0.28[0.16,0.49]
Total (95% CI)	**657**	**706**		**100%**	**0.78[0.35,1.75]**
Total events: 36 (No drain), 74 (Drain)					
Heterogeneity: Tau^2=0.49; Chi^2=11.7, df=6(P=0.07); I^2=48.7%					
Test for overall effect: Z=0.61(P=0.54)					



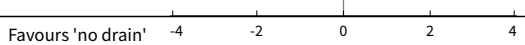
Analysis 8.10. Comparison 8 Subgroup - Brought out through separate wound: no drain versus drain, Outcome 10 Atelectasis.

Study or subgroup	No drain n/N	Drain n/N	Odds Ratio M-H, Fixed, 95% CI	Weight	Odds Ratio M-H, Fixed, 95% CI
al-Arfaj 1992	8/87	12/87		91.62%	0.63[0.25,1.63]
Kriplani 1992	0/50	1/100		8.38%	0.66[0.03,16.41]
Total (95% CI)	**137**	**187**		**100%**	**0.63[0.26,1.58]**
Total events: 8 (No drain), 13 (Drain)					
Heterogeneity: Tau^2=0; Chi^2=0, df=1(P=0.98); I^2=0%					
Test for overall effect: Z=0.98(P=0.33)					



Analysis 8.11. Comparison 8 Subgroup - Brought out through separate wound: no drain versus drain, Outcome 11 Hospital stay (days).

Study or subgroup	No drain N	No drain Mean(SD)	Drain N	Drain Mean(SD)	Mean Difference Random, 95% CI	Weight	Mean Difference Random, 95% CI
Adloff 1987	100	7.6 (0.1)	100	8 (0.1)		26.23%	-0.39[-0.42,-0.36]
Huguier 1980	50	9.4 (3.6)	50	9.2 (2.5)		13.15%	0.2[-1.01,1.41]
Kriplani 1992	50	4.5 (2.3)	100	4.2 (1.2)		20.02%	0.28[-0.4,0.96]
Monson 1991	240	9.1 (3.2)	239	10.3 (5.9)		17.64%	-1.2[-2.05,-0.35]
Saad 1993	50	8.7 (0.9)	50	10.2 (1.4)		22.96%	-1.5[-1.96,-1.04]
Total ***	**490**		**539**			**100%**	**-0.58[-1.2,0.05]**
Heterogeneity: Tau^2=0.39; Chi^2=30.28, df=4(P<0.0001); I^2=86.79%							
Test for overall effect: Z=1.81(P=0.07)							

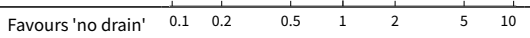


Comparison 9. Subgroup - Brought out through main wound: no drain versus drain

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Mortality	1	50	Odds Ratio (M-H, Fixed, 95% CI)	0.0 [0.0, 0.0]
2 Infected intra-abdominal collections	1	50	Odds Ratio (M-H, Fixed, 95% CI)	0.0 [0.0, 0.0]
3 Wound infection	1	50	Odds Ratio (M-H, Fixed, 95% CI)	0.35 [0.01, 8.93]
4 Atelectasis	1	50	Odds Ratio (M-H, Fixed, 95% CI)	1.1 [0.24, 4.99]

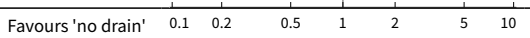
Analysis 9.1. Comparison 9 Subgroup - Brought out through main wound: no drain versus drain, Outcome 1 Mortality.

Study or subgroup	No drain n/N	Drain n/N	Odds Ratio M-H, Fixed, 95% CI	Weight	Odds Ratio M-H, Fixed, 95% CI
Druart 1990	0/24	0/26			Not estimable
Total (95% CI)	**24**	**26**			**Not estimable**
Total events: 0 (No drain), 0 (Drain)					
Heterogeneity: Not applicable					
Test for overall effect: Not applicable					



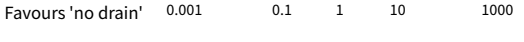
Analysis 9.2. Comparison 9 Subgroup - Brought out through main wound: no drain versus drain, Outcome 2 Infected intra-abdominal collections.

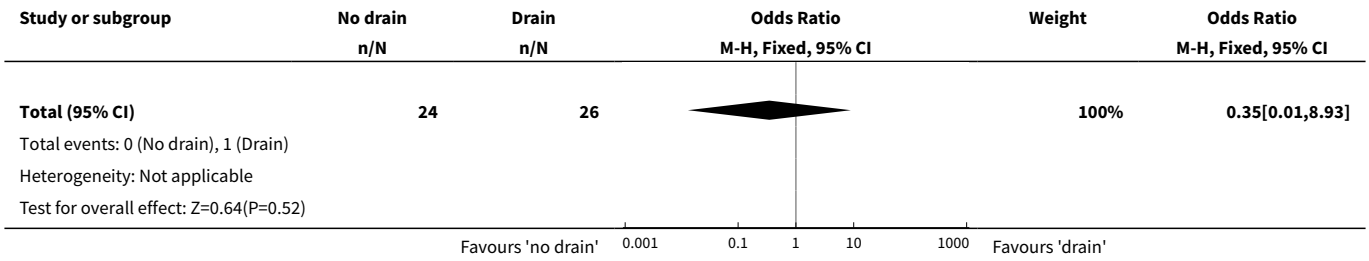
Study or subgroup	No drain n/N	Drain n/N	Odds Ratio M-H, Fixed, 95% CI	Weight	Odds Ratio M-H, Fixed, 95% CI
Druart 1990	0/24	0/26			Not estimable
Total (95% CI)	**24**	**26**			**Not estimable**
Total events: 0 (No drain), 0 (Drain)					
Heterogeneity: Not applicable					
Test for overall effect: Not applicable					



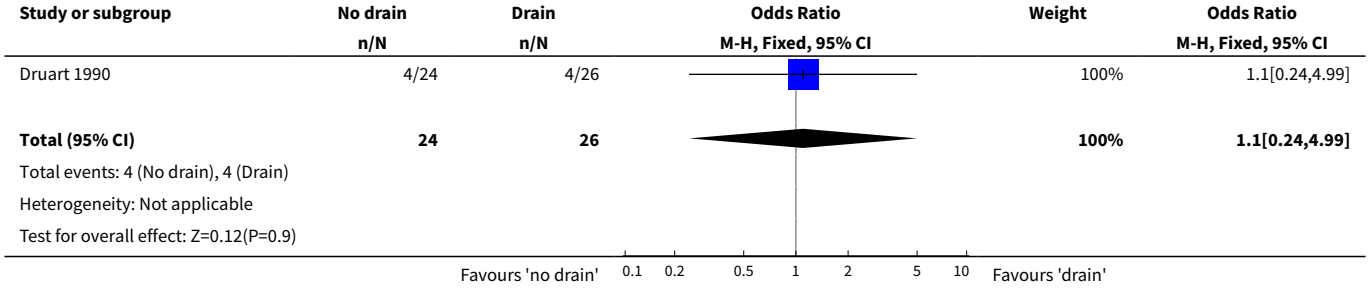
Analysis 9.3. Comparison 9 Subgroup - Brought out through main wound: no drain versus drain, Outcome 3 Wound infection.

Study or subgroup	No drain n/N	Drain n/N	Odds Ratio M-H, Fixed, 95% CI	Weight	Odds Ratio M-H, Fixed, 95% CI
Druart 1990	0/24	1/26		100%	0.35[0.01,8.93]





Analysis 9.4. Comparison 9 Subgroup - Brought out through main wound: no drain versus drain, Outcome 4 Atelectasis.



Comparison 10. Subgroup - Emergency cholecystectomy: no drain versus drain

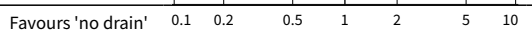
Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Abdominal collections requiring re-operation	1	60	Odds Ratio (M-H, Fixed, 95% CI)	0.0 [0.0, 0.0]
2 Abdominal collections requiring drain insertion	1	60	Odds Ratio (M-H, Fixed, 95% CI)	0.0 [0.0, 0.0]
3 Abdominal collections requiring percutaneous aspiration	1	60	Odds Ratio (M-H, Fixed, 95% CI)	0.0 [0.0, 0.0]
4 Wound infection	2	99	Odds Ratio (M-H, Fixed, 95% CI)	0.56 [0.16, 1.92]
5 Chest infection	1	60	Odds Ratio (M-H, Fixed, 95% CI)	0.24 [0.05, 1.33]

Analysis 10.1. Comparison 10 Subgroup - Emergency cholecystectomy: no drain versus drain, Outcome 1 Abdominal collections requiring re-operation.

Study or subgroup	No drain n/N	Drain n/N	Odds Ratio M-H, Fixed, 95% CI	Weight	Odds Ratio M-H, Fixed, 95% CI
Monson 1991	0/32	0/28			Not estimable
Total (95% CI)	**32**	**28**			**Not estimable**
Total events: 0 (No drain), 0 (Drain)					
Heterogeneity: Not applicable					
Test for overall effect: Not applicable					

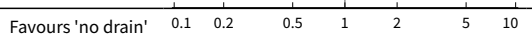
Analysis 10.2. Comparison 10 Subgroup - Emergency cholecystectomy: no drain versus drain, Outcome 2 Abdominal collections requiring drain insertion.

Study or subgroup	No drain n/N	Drain n/N	Odds Ratio M-H, Fixed, 95% CI	Weight	Odds Ratio M-H, Fixed, 95% CI
Monson 1991	0/32	0/28			Not estimable
Total (95% CI)	**32**	**28**			**Not estimable**
Total events: 0 (No drain), 0 (Drain)					
Heterogeneity: Not applicable					
Test for overall effect: Not applicable					



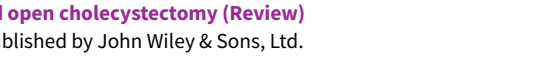
Analysis 10.3. Comparison 10 Subgroup - Emergency cholecystectomy: no drain versus drain, Outcome 3 Abdominal collections requiring percutaneous aspiration.

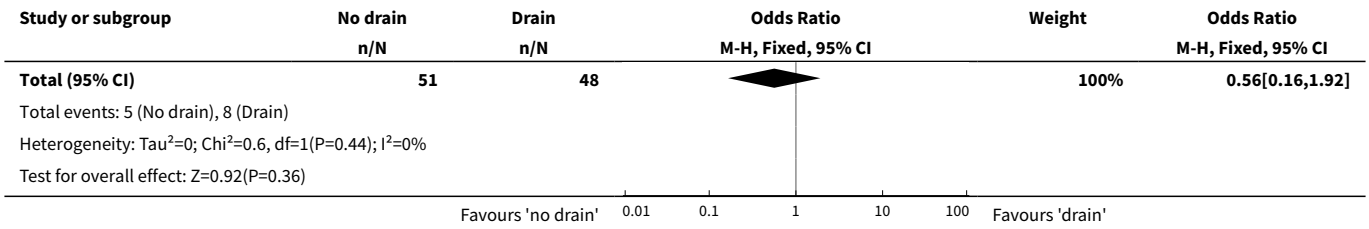
Study or subgroup	No drain n/N	Drain n/N	Odds Ratio M-H, Fixed, 95% CI	Weight	Odds Ratio M-H, Fixed, 95% CI
Monson 1991	0/32	0/28			Not estimable
Total (95% CI)	**32**	**28**			**Not estimable**
Total events: 0 (No drain), 0 (Drain)					
Heterogeneity: Not applicable					
Test for overall effect: Not applicable					



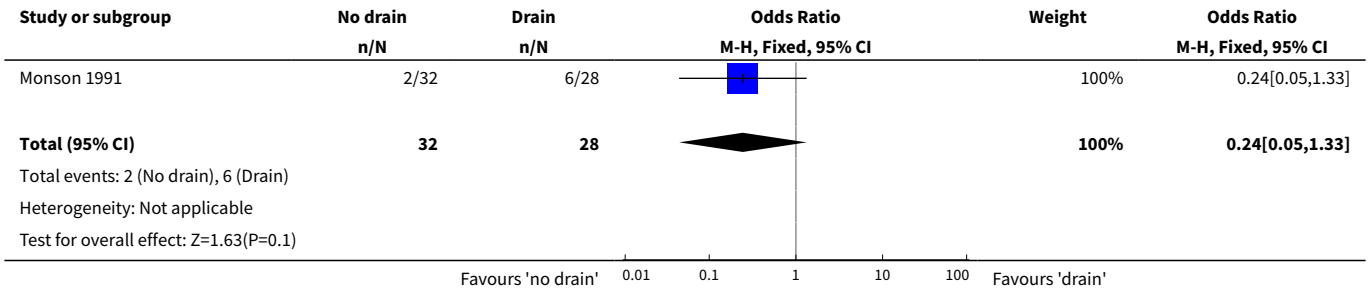
Analysis 10.4. Comparison 10 Subgroup - Emergency cholecystectomy: no drain versus drain, Outcome 4 Wound infection.

Study or subgroup	No drain n/N	Drain n/N	Odds Ratio M-H, Fixed, 95% CI	Weight	Odds Ratio M-H, Fixed, 95% CI
Monson 1991	1/32	3/28		44.63%	0.27[0.03,2.75]
Playforth 1985	4/19	5/20		55.37%	0.8[0.18,3.57]





Analysis 10.5. Comparison 10 Subgroup - Emergency cholecystectomy: no drain versus drain, Outcome 5 Chest infection.



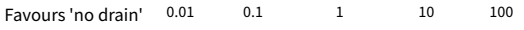
Comparison 11. Subgroup - Elective cholecystectomy: no drain versus drain

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Mortality	9	1588	Odds Ratio (M-H, Fixed, 95% CI)	2.98 [0.31, 29.10]
2 Abdominal collections requiring re-operation	3	1063	Odds Ratio (M-H, Fixed, 95% CI)	0.0 [0.0, 0.0]
3 Abdominal collections requiring drain insertion	2	569	Odds Ratio (M-H, Fixed, 95% CI)	6.09 [0.24, 152.24]
4 Abdominal collections requiring percutaneous aspiration	3	769	Odds Ratio (M-H, Fixed, 95% CI)	4.25 [0.44, 41.43]
5 Total abdominal collections	3	420	Odds Ratio (M-H, Fixed, 95% CI)	1.95 [1.24, 3.08]
6 Infected intra-abdominal collections	7	843	Odds Ratio (M-H, Fixed, 95% CI)	0.98 [0.14, 6.96]
7 Bile peritonitis	3	573	Odds Ratio (M-H, Random, 95% CI)	1.47 [0.10, 21.57]
8 Wound infection	13	2517	Odds Ratio (M-H, Fixed, 95% CI)	0.67 [0.43, 1.03]
9 Chest infection	10	1794	Odds Ratio (M-H, Random, 95% CI)	0.84 [0.48, 1.50]
10 Atelectasis	4	600	Odds Ratio (M-H, Fixed, 95% CI)	0.61 [0.30, 1.23]

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
11 Hospital stay (days)	4	944	Mean Difference (IV, Random, 95% CI)	-0.32 [-0.53, -0.11]

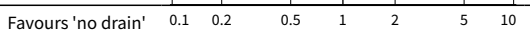
Analysis 11.1. Comparison 11 Subgroup - Elective cholecystectomy: no drain versus drain, Outcome 1 Mortality.

Study or subgroup	No drain n/N	Drain n/N	Odds Ratio M-H, Fixed, 95% CI	Weight	Odds Ratio M-H, Fixed, 95% CI
Budd 1982	0/100	0/200			Not estimable
Chattopadhyay 1990	0/56	0/54			Not estimable
Druart 1990	0/24	0/26			Not estimable
Edlund 1979	1/50	0/50		49.25%	3.06[0.12,76.95]
Kupczyk-Joeris 1991	0/30	0/26			Not estimable
Lewis 1990	0/248	0/246			Not estimable
Locker 1983	1/63	0/60		50.75%	2.9[0.12,72.69]
Porati 1984	0/77	0/78			Not estimable
Schaupp 1988	0/100	0/100			Not estimable
Total (95% CI)	**748**	**840**		**100%**	**2.98[0.31,29.1]**
Total events: 2 (No drain), 0 (Drain)					
Heterogeneity: Tau^2=0; Chi^2=0, df=1(P=0.98); I^2=0%					
Test for overall effect: Z=0.94(P=0.35)					



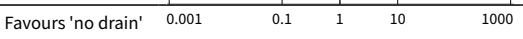
Analysis 11.2. Comparison 11 Subgroup - Elective cholecystectomy: no drain versus drain, Outcome 2 Abdominal collections requiring re-operation.

Study or subgroup	No drain n/N	Drain n/N	Odds Ratio M-H, Fixed, 95% CI	Weight	Odds Ratio M-H, Fixed, 95% CI
Kriplani 1992	0/50	0/100			Not estimable
Lewis 1990	0/248	0/246			Not estimable
Monson 1991	0/208	0/211			Not estimable
Total (95% CI)	**506**	**557**			**Not estimable**
Total events: 0 (No drain), 0 (Drain)					
Heterogeneity: Not applicable					
Test for overall effect: Not applicable					



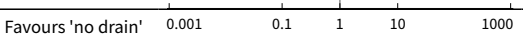
Analysis 11.3. Comparison 11 Subgroup - Elective cholecystectomy: no drain versus drain, Outcome 3 Abdominal collections requiring drain insertion.

Study or subgroup	No drain n/N	Drain n/N	Odds Ratio M-H, Fixed, 95% CI	Weight	Odds Ratio M-H, Fixed, 95% CI
Kriplani 1992	1/50	0/100		100%	6.09[0.24,152.24]
Monson 1991	0/208	0/211			Not estimable
Total (95% CI)	**258**	**311**		**100%**	**6.09[0.24,152.24]**
Total events: 1 (No drain), 0 (Drain)					
Heterogeneity: Not applicable					
Test for overall effect: Z=1.1(P=0.27)					



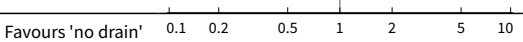
Analysis 11.4. Comparison 11 Subgroup - Elective cholecystectomy: no drain versus drain, Outcome 4 Abdominal collections requiring percutaneous aspiration.

Study or subgroup	No drain n/N	Drain n/N	Odds Ratio M-H, Fixed, 95% CI	Weight	Odds Ratio M-H, Fixed, 95% CI
Kriplani 1992	1/50	0/100		39.8%	6.09[0.24,152.24]
Monson 1991	0/208	0/211			Not estimable
Schaupp 1988	1/100	0/100		60.2%	3.03[0.12,75.28]
Total (95% CI)	**358**	**411**		**100%**	**4.25[0.44,41.43]**
Total events: 2 (No drain), 0 (Drain)					
Heterogeneity: Tau^2=0; Chi^2=0.09, df=1(P=0.76); I^2=0%					
Test for overall effect: Z=1.24(P=0.21)					



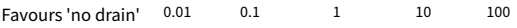
Analysis 11.5. Comparison 11 Subgroup - Elective cholecystectomy: no drain versus drain, Outcome 5 Total abdominal collections.

Study or subgroup	No drain n/N	Drain n/N	Odds Ratio M-H, Fixed, 95% CI	Weight	Odds Ratio M-H, Fixed, 95% CI
Chattopadhyay 1990	10/56	6/54		19.04%	1.74[0.58,5.17]
Forster 1992	25/80	19/80		49.55%	1.46[0.73,2.94]
Kriplani 1992	23/50	23/100		31.41%	2.85[1.38,5.89]
Total (95% CI)	**186**	**234**		**100%**	**1.95[1.24,3.08]**
Total events: 58 (No drain), 48 (Drain)					
Heterogeneity: Tau^2=0; Chi^2=1.76, df=2(P=0.42); I^2=0%					
Test for overall effect: Z=2.87(P=0)					



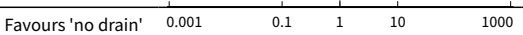
Analysis 11.6. Comparison 11 Subgroup - Elective cholecystectomy: no drain versus drain, Outcome 6 Infected intra-abdominal collections.

Study or subgroup	No drain n/N	Drain n/N	Odds Ratio M-H, Fixed, 95% CI	Weight	Odds Ratio M-H, Fixed, 95% CI
Chattopadhyay 1990	0/56	0/54			Not estimable
Druart 1990	0/24	0/26			Not estimable
Forster 1992	0/80	0/80			Not estimable
Gordon 1976	0/50	0/50			Not estimable
Latif 1989	0/50	0/50			Not estimable
Locker 1983	0/63	1/60		75.57%	0.31[0.01,7.82]
Schaupp 1988	1/100	0/100		24.43%	3.03[0.12,75.28]
Total (95% CI)	**423**	**420**		**100%**	**0.98[0.14,6.96]**
Total events: 1 (No drain), 1 (Drain)					
Heterogeneity: Tau^2=0; Chi^2=0.96, df=1(P=0.33); I^2=0%					
Test for overall effect: Z=0.02(P=0.98)					



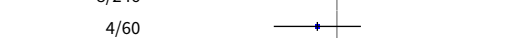
Analysis 11.7. Comparison 11 Subgroup - Elective cholecystectomy: no drain versus drain, Outcome 7 Bile peritonitis.

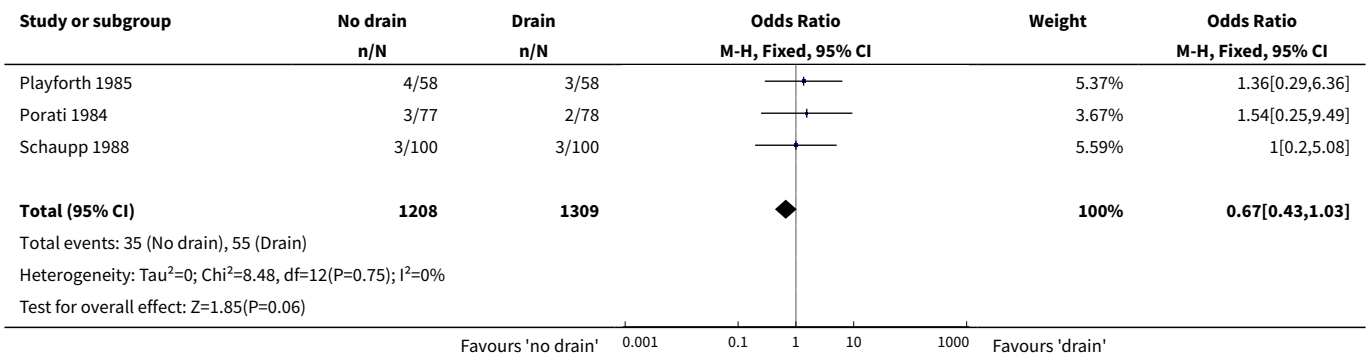
Study or subgroup	No drain n/N	Drain n/N	Odds Ratio M-H, Random, 95% CI	Weight	Odds Ratio M-H, Random, 95% CI
Budd 1982	0/100	2/200		51.88%	0.4[0.02,8.31]
Kriplani 1992	1/50	0/100		48.12%	6.09[0.24,152.24]
Locker 1983	0/63	0/60			Not estimable
Total (95% CI)	**213**	**360**		**100%**	**1.47[0.1,21.57]**
Total events: 1 (No drain), 2 (Drain)					
Heterogeneity: Tau^2=1.2; Chi^2=1.47, df=1(P=0.23); I^2=31.93%					
Test for overall effect: Z=0.28(P=0.78)					



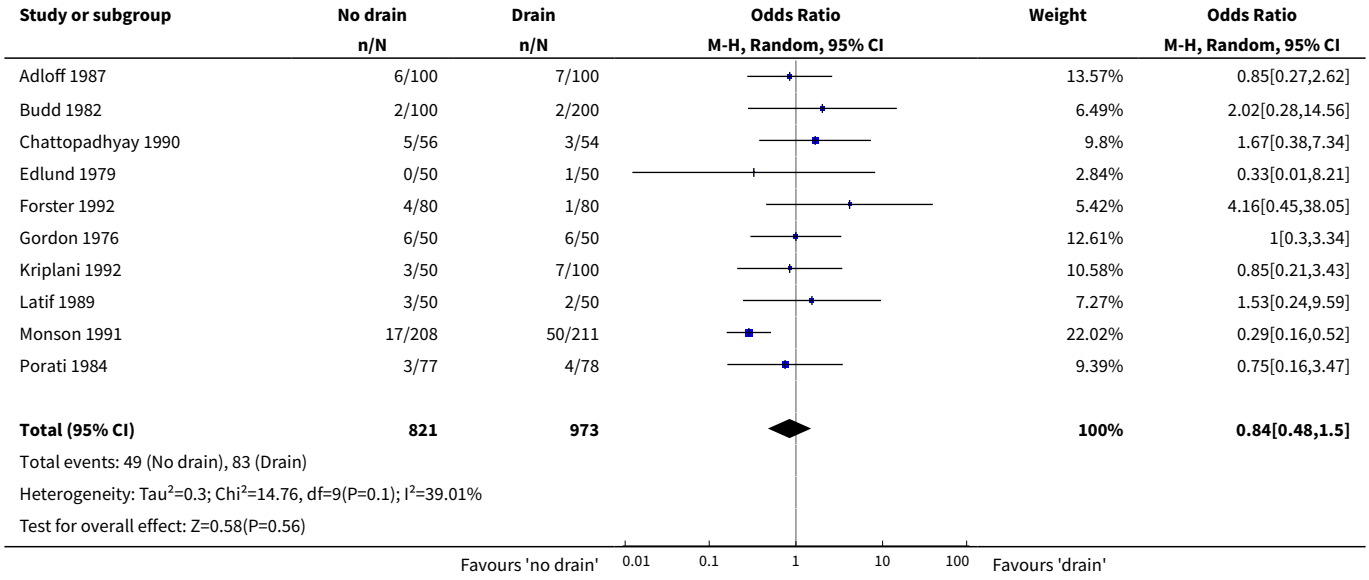
Analysis 11.8. Comparison 11 Subgroup - Elective cholecystectomy: no drain versus drain, Outcome 8 Wound infection.

Study or subgroup	No drain n/N	Drain n/N	Odds Ratio M-H, Fixed, 95% CI	Weight	Odds Ratio M-H, Fixed, 95% CI
Adloff 1987	2/100	2/100		3.77%	1[0.14,7.24]
Budd 1982	0/100	7/200		9.59%	0.13[0.01,2.27]
Druart 1990	0/24	1/26		2.72%	0.35[0.01,8.93]
Edlund 1979	1/50	0/50		0.93%	3.06[0.12,76.95]
Forster 1992	1/80	4/80		7.59%	0.24[0.03,2.2]
Gordon 1976	5/50	7/50		12.11%	0.68[0.2,2.32]
Latif 1989	4/50	2/50		3.54%	2.09[0.36,11.95]
Lewis 1990	6/248	8/246		15.06%	0.74[0.25,2.16]
Locker 1983	2/63	4/60		7.62%	0.46[0.08,2.6]
Monson 1991	4/208	12/211		22.45%	0.33[0.1,1.03]

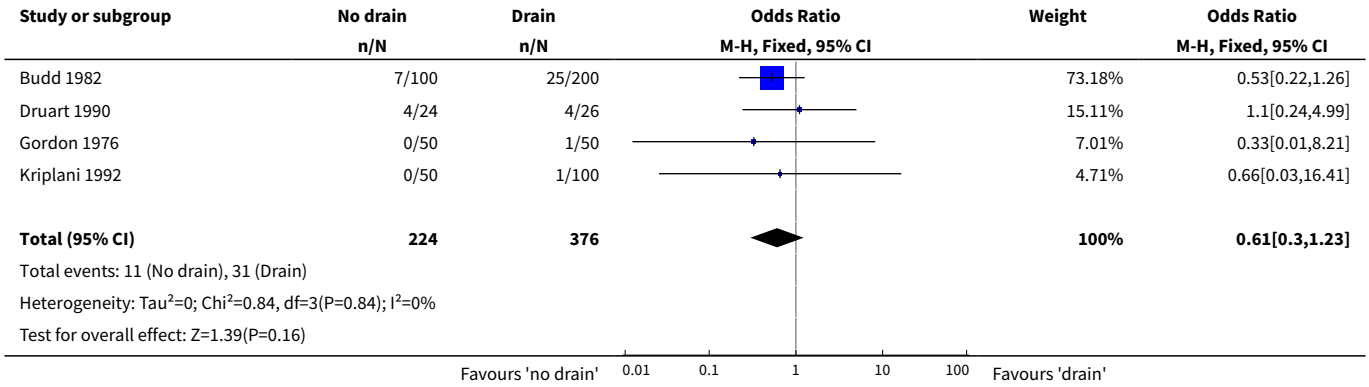




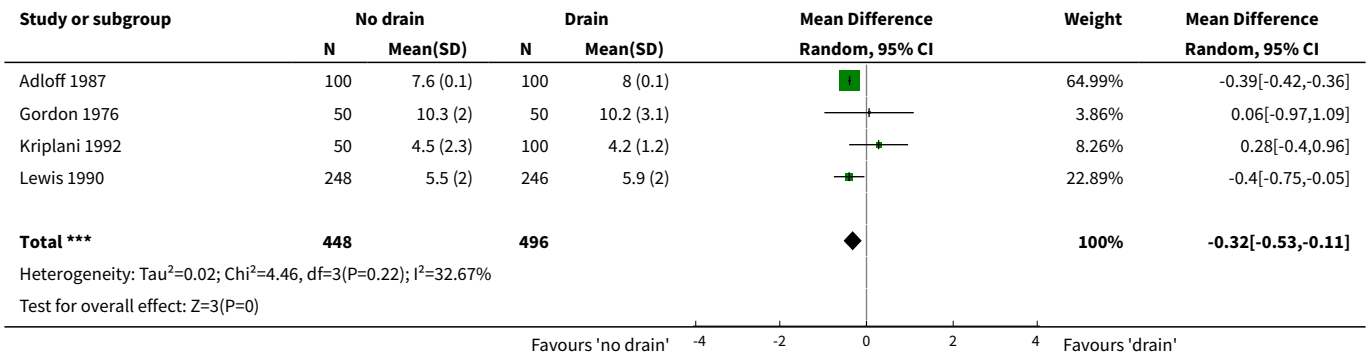
Analysis 11.9. Comparison 11 Subgroup - Elective cholecystectomy: no drain versus drain, Outcome 9 Chest infection.



Analysis 11.10. Comparison 11 Subgroup - Elective cholecystectomy: no drain versus drain, Outcome 10 Atelectasis.



Analysis 11.11. Comparison 11 Subgroup - Elective cholecystectomy: no drain versus drain, Outcome 11 Hospital stay (days).

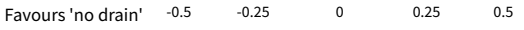


Comparison 12. No drain versus drain (Risk difference)

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Mortality	12	2322	Risk Difference (M-H, Fixed, 95% CI)	-0.00 [-0.01, 0.01]
2 Abdominal collections requiring re-operation	3	1123	Risk Difference (M-H, Fixed, 95% CI)	0.0 [-0.01, 0.01]
3 Abdominal collections requiring drain insertion	2	629	Risk Difference (M-H, Random, 95% CI)	0.00 [-0.02, 0.03]
4 Abdominal collections requiring percutaneous aspiration	3	829	Risk Difference (M-H, Fixed, 95% CI)	0.01 [-0.01, 0.02]
5 Total abdominal collections	5	994	Risk Difference (M-H, Random, 95% CI)	0.07 [-0.06, 0.20]
6 Infected intra-abdominal collections	8	998	Risk Difference (M-H, Fixed, 95% CI)	-0.00 [-0.02, 0.01]
7 Bile peritonitis	3	573	Risk Difference (M-H, Fixed, 95% CI)	0.0 [-0.02, 0.02]
8 Wound infection	17	3090	Risk Difference (M-H, Fixed, 95% CI)	-0.02 [-0.04, -0.01]
9 Chest infection	12	2128	Risk Difference (M-H, Random, 95% CI)	-0.01 [-0.04, 0.02]
10 Atelectasis	5	774	Risk Difference (M-H, Fixed, 95% CI)	-0.04 [-0.07, 0.00]

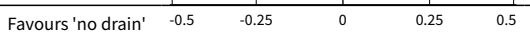
Analysis 12.1. Comparison 12 No drain versus drain (Risk difference), Outcome 1 Mortality.

Study or subgroup	No drain n/N	Drain n/N	Risk Difference M-H, Fixed, 95% CI	Weight	Risk Difference M-H, Fixed, 95% CI
Budd 1982	0/100	0/200		11.65%	0[-0.02,0.02]
Chattopadhyay 1990	0/56	0/54		4.81%	0[-0.03,0.03]
Druart 1990	0/24	0/26		2.18%	0[-0.07,0.07]
Edlund 1979	1/50	0/50		4.37%	0.02[-0.03,0.07]
Huguier 1980	0/50	0/50		4.37%	0[-0.04,0.04]
Kupczyk-Joeris 1991	0/30	0/26		2.43%	0[-0.07,0.07]
Lewis 1990	0/248	0/246		21.59%	0[-0.01,0.01]
Locker 1983	1/63	0/60		5.37%	0.02[-0.03,0.06]
Monson 1991	0/240	2/239		20.93%	-0.01[-0.02,0.01]
Playforth 1985	0/77	1/78		6.77%	-0.01[-0.05,0.02]
Porati 1984	0/77	0/78		6.77%	0[-0.02,0.02]
Schaupp 1988	0/100	0/100		8.74%	0[-0.02,0.02]
Total (95% CI)	**1115**	**1207**		**100%**	**-0[-0.01,0.01]**
Total events: 2 (No drain), 3 (Drain)					
Heterogeneity: Tau^2=0; Chi^2=2.77, df=11(P=0.99); I^2=0%					
Test for overall effect: Z=0.25(P=0.8)					



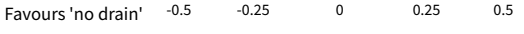
Analysis 12.2. Comparison 12 No drain versus drain (Risk difference), Outcome 2 Abdominal collections requiring re-operation.

Study or subgroup	No drain n/N	Drain n/N	Risk Difference M-H, Fixed, 95% CI	Weight	Risk Difference M-H, Fixed, 95% CI
Kriplani 1992	0/50	0/100		12.05%	0[-0.03,0.03]
Lewis 1990	0/248	0/246		44.65%	0[-0.01,0.01]
Monson 1991	0/240	0/239		43.3%	0[-0.01,0.01]
Total (95% CI)	**538**	**585**		**100%**	**0[-0.01,0.01]**
Total events: 0 (No drain), 0 (Drain)					
Heterogeneity: Tau^2=0; Chi^2=0, df=2(P=1); I^2=0%					
Test for overall effect: Not applicable					

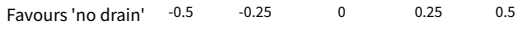


Analysis 12.3. Comparison 12 No drain versus drain (Risk difference), Outcome 3 Abdominal collections requiring drain insertion.

Study or subgroup	No drain n/N	Drain n/N	Risk Difference M-H, Random, 95% CI	Weight	Risk Difference M-H, Random, 95% CI
Kriplani 1992	1/50	0/100		18.54%	0.02[-0.03,0.07]
Monson 1991	0/240	0/239		81.46%	0[-0.01,0.01]
Total (95% CI)	**290**	**339**		**100%**	**0[-0.02,0.03]**
Total events: 1 (No drain), 0 (Drain)					
Heterogeneity: Tau^2=0; Chi^2=1.5, df=1(P=0.22); I^2=33.4%					

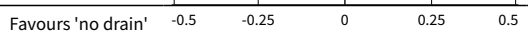


Study or subgroup	No drain n/N	Drain n/N	Risk Difference M-H, Random, 95% CI	Weight	Risk Difference M-H, Random, 95% CI
Test for overall effect: Z=0.31(P=0.76)					



Analysis 12.4. Comparison 12 No drain versus drain (Risk difference), Outcome 4 Abdominal collections requiring percutaneous aspiration.

Study or subgroup	No drain n/N	Drain n/N	Risk Difference M-H, Fixed, 95% CI	Weight	Risk Difference M-H, Fixed, 95% CI
Kriplani 1992	1/50	0/100		16.41%	0.02[-0.03,0.07]
Monson 1991	0/240	0/239		58.97%	0[-0.01,0.01]
Schaupp 1988	1/100	0/100		24.62%	0.01[-0.02,0.04]
Total (95% CI)	**390**	**439**		**100%**	**0.01[-0.01,0.02]**
Total events: 2 (No drain), 0 (Drain)					
Heterogeneity: Tau^2=0; Chi^2=2.34, df=2(P=0.31); I^2=14.54%					
Test for overall effect: Z=0.97(P=0.33)					



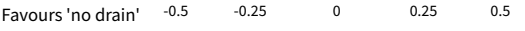
Analysis 12.5. Comparison 12 No drain versus drain (Risk difference), Outcome 5 Total abdominal collections.

Study or subgroup	No drain n/N	Drain n/N	Risk Difference M-H, Random, 95% CI	Weight	Risk Difference M-H, Random, 95% CI
al-Arfaj 1992	30/49	25/46		16.05%	0.07[-0.13,0.27]
Chattopadhyay 1990	10/56	6/54		20.4%	0.07[-0.06,0.2]
Forster 1992	25/80	19/80		19.93%	0.08[-0.06,0.21]
Kriplani 1992	23/50	23/100		18.42%	0.23[0.07,0.39]
Monson 1991	6/240	17/239		25.2%	-0.05[-0.08,-0.01]
Total (95% CI)	**475**	**519**		**100%**	**0.07[-0.06,0.2]**
Total events: 94 (No drain), 90 (Drain)					
Heterogeneity: Tau^2=0.02; Chi^2=23.83, df=4(P<0.0001); I^2=83.22%					
Test for overall effect: Z=1.07(P=0.29)					

Analysis 12.6. Comparison 12 No drain versus drain (Risk difference), Outcome 6 Infected intra-abdominal collections.

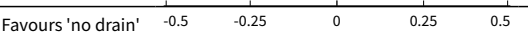
Study or subgroup	No drain n/N	Drain n/N	Risk Difference M-H, Fixed, 95% CI	Weight	Risk Difference M-H, Fixed, 95% CI
Chattopadhyay 1990	0/56	0/54		11.02%	0[-0.03,0.03]
Druart 1990	0/24	0/26		5%	0[-0.07,0.07]
Forster 1992	0/80	0/80		16.04%	0[-0.02,0.02]
Gordon 1976	0/50	0/50		10.02%	0[-0.04,0.04]
Latif 1989	0/50	0/50		10.02%	0[-0.04,0.04]

Study or subgroup	No drain n/N	Drain n/N	Risk Difference M-H, Fixed, 95% CI	Weight	Risk Difference M-H, Fixed, 95% CI
Locker 1983	0/63	1/60		12.32%	-0.02[-0.06,0.03]
Playforth 1985	0/77	1/78		15.53%	-0.01[-0.05,0.02]
Schaupp 1988	1/100	0/100		20.04%	0.01[-0.02,0.04]
Total (95% CI)	**500**	**498**		**100%**	**-0[-0.02,0.01]**
Total events: 1 (No drain), 2 (Drain)					
Heterogeneity: Tau^2=0; Chi^2=1.6, df=7(P=0.98); I^2=0%					
Test for overall effect: Z=0.31(P=0.76)					



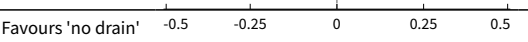
Analysis 12.7. Comparison 12 No drain versus drain (Risk difference), Outcome 7 Bile peritonitis.

Study or subgroup	No drain n/N	Drain n/N	Risk Difference M-H, Fixed, 95% CI	Weight	Risk Difference M-H, Fixed, 95% CI
Budd 1982	0/100	2/200		51%	-0.01[-0.03,0.01]
Kriplani 1992	1/50	0/100		25.5%	0.02[-0.03,0.07]
Locker 1983	0/63	0/60		23.51%	0[-0.03,0.03]
Total (95% CI)	**213**	**360**		**100%**	**0[-0.02,0.02]**
Total events: 1 (No drain), 2 (Drain)					
Heterogeneity: Tau^2=0; Chi^2=1.57, df=2(P=0.46); I^2=0%					
Test for overall effect: Not applicable					

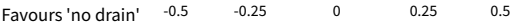


Analysis 12.8. Comparison 12 No drain versus drain (Risk difference), Outcome 8 Wound infection.

Study or subgroup	No drain n/N	Drain n/N	Risk Difference M-H, Fixed, 95% CI	Weight	Risk Difference M-H, Fixed, 95% CI
Adloff 1987	2/100	2/100		6.54%	0[-0.04,0.04]
al-Arfaj 1992	4/87	3/87		5.69%	0.01[-0.05,0.07]
Budd 1982	0/100	7/200		8.72%	-0.04[-0.06,-0.01]
Druart 1990	0/24	1/26		1.63%	-0.04[-0.14,0.06]
Edlund 1979	1/50	0/50		3.27%	0.02[-0.03,0.07]
Forster 1992	1/80	4/80		5.23%	-0.04[-0.09,0.02]
Gordon 1976	5/50	7/50		3.27%	-0.04[-0.17,0.09]
Huguier 1980	2/50	3/50		3.27%	-0.02[-0.11,0.07]
Latif 1989	4/50	2/50		3.27%	0.04[-0.05,0.13]
Lewis 1990	6/248	8/246		16.16%	-0.01[-0.04,0.02]
Locker 1983	2/63	4/60		4.02%	-0.03[-0.11,0.04]
Monson 1991	5/240	15/239		15.67%	-0.04[-0.08,-0.01]
Playforth 1985	8/77	8/78		5.07%	0[-0.09,0.1]
Porati 1984	3/77	2/78		5.07%	0.01[-0.04,0.07]
Saad 1993	5/50	15/50		3.27%	-0.2[-0.35,-0.05]
Schaupp 1988	3/100	3/100		6.54%	0[-0.05,0.05]
Trowbridge 1982	0/50	1/50		3.27%	-0.02[-0.07,0.03]
Total (95% CI)	**1496**	**1594**		**100%**	**-0.02[-0.04,-0.01]**

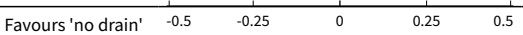


Study or subgroup	No drain n/N	Drain n/N	Risk Difference M-H, Fixed, 95% CI	Weight	Risk Difference M-H, Fixed, 95% CI
Total events: 51 (No drain), 85 (Drain)					
Heterogeneity: Tau^2=0; Chi^2=17.52, df=16(P=0.35); I^2=8.7%					
Test for overall effect: Z=2.84(P=0)					



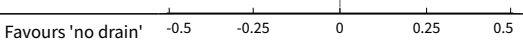
Analysis 12.9. Comparison 12 No drain versus drain (Risk difference), Outcome 9 Chest infection.

Study or subgroup	No drain n/N	Drain n/N	Risk Difference M-H, Random, 95% CI	Weight	Risk Difference M-H, Random, 95% CI
Adloff 1987	6/100	7/100		8.22%	-0.01[-0.08,0.06]
al-Arfaj 1992	1/87	0/87		11.44%	0.01[-0.02,0.04]
Budd 1982	2/100	2/200		11.49%	0.01[-0.02,0.04]
Chattopadhyay 1990	5/56	3/54		6.07%	0.03[-0.06,0.13]
Edlund 1979	0/50	1/50		9.52%	-0.02[-0.07,0.03]
Forster 1992	4/80	1/80		9.53%	0.04[-0.02,0.09]
Gordon 1976	6/50	6/50		4.37%	0[-0.13,0.13]
Kriplani 1992	3/50	7/100		7.05%	-0.01[-0.09,0.07]
Latif 1989	3/50	2/50		6.85%	0.02[-0.07,0.11]
Monson 1991	19/240	56/239		8.63%	-0.16[-0.22,-0.09]
Porati 1984	3/77	4/78		8.48%	-0.01[-0.08,0.05]
Trowbridge 1982	1/50	2/50		8.36%	-0.02[-0.09,0.05]
Total (95% CI)	**990**	**1138**		**100%**	**-0.01[-0.04,0.02]**
Total events: 53 (No drain), 91 (Drain)					
Heterogeneity: Tau^2=0; Chi^2=40.54, df=11(P<0.0001); I^2=72.87%					
Test for overall effect: Z=0.6(P=0.55)					



Analysis 12.10. Comparison 12 No drain versus drain (Risk difference), Outcome 10 Atelectasis.

Study or subgroup	No drain n/N	Drain n/N	Risk Difference M-H, Fixed, 95% CI	Weight	Risk Difference M-H, Fixed, 95% CI
al-Arfaj 1992	8/87	12/87		24.04%	-0.05[-0.14,0.05]
Budd 1982	7/100	25/200		36.84%	-0.05[-0.12,0.01]
Druart 1990	4/24	4/26		6.9%	0.01[-0.19,0.22]
Gordon 1976	0/50	1/50		13.81%	-0.02[-0.07,0.03]
Kriplani 1992	0/50	1/100		18.42%	-0.01[-0.05,0.03]
Total (95% CI)	**311**	**463**		**100%**	**-0.04[-0.07,0]**
Total events: 19 (No drain), 43 (Drain)					
Heterogeneity: Tau^2=0; Chi^2=2.77, df=4(P=0.6); I^2=0%					
Test for overall effect: Z=1.81(P=0.07)					

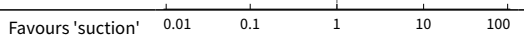


Comparison 13. Suction drain versus passive closed drain

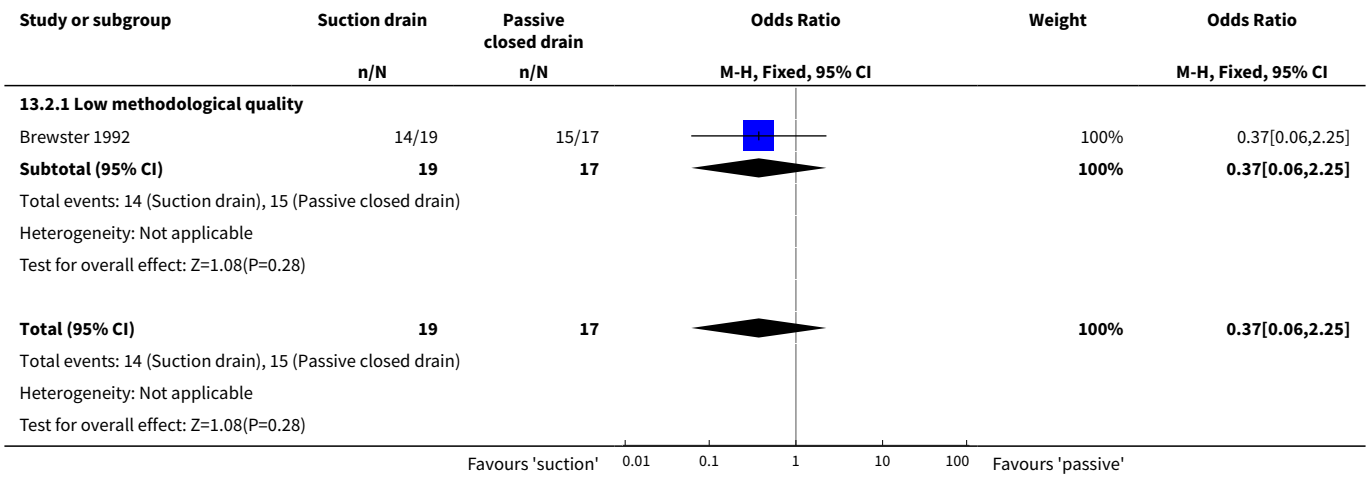
Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Mortality	1	184	Odds Ratio (M-H, Fixed, 95% CI)	1.0 [0.06, 16.23]
1.1 High methodological quality	1	184	Odds Ratio (M-H, Fixed, 95% CI)	1.0 [0.06, 16.23]
2 Total abdominal collections	1	36	Odds Ratio (M-H, Fixed, 95% CI)	0.37 [0.06, 2.25]
2.1 Low methodological quality	1	36	Odds Ratio (M-H, Fixed, 95% CI)	0.37 [0.06, 2.25]
3 Wound infection	3	396	Odds Ratio (M-H, Random, 95% CI)	0.87 [0.31, 2.41]
3.1 High methodological quality	2	276	Odds Ratio (M-H, Random, 95% CI)	1.14 [0.28, 4.64]
3.2 Low methodological quality	1	120	Odds Ratio (M-H, Random, 95% CI)	0.47 [0.11, 2.00]
4 Chest infection	3	396	Odds Ratio (M-H, Random, 95% CI)	0.43 [0.10, 1.86]
4.1 High methodological quality	2	276	Odds Ratio (M-H, Random, 95% CI)	0.46 [0.02, 9.23]
4.2 Low methodological quality	1	120	Odds Ratio (M-H, Random, 95% CI)	0.6 [0.15, 2.37]
5 Pain at drain site	1	92	Odds Ratio (M-H, Fixed, 95% CI)	0.16 [0.04, 0.61]
5.1 High methodological quality	1	92	Odds Ratio (M-H, Fixed, 95% CI)	0.16 [0.04, 0.61]

Analysis 13.1. Comparison 13 Suction drain versus passive closed drain, Outcome 1 Mortality.

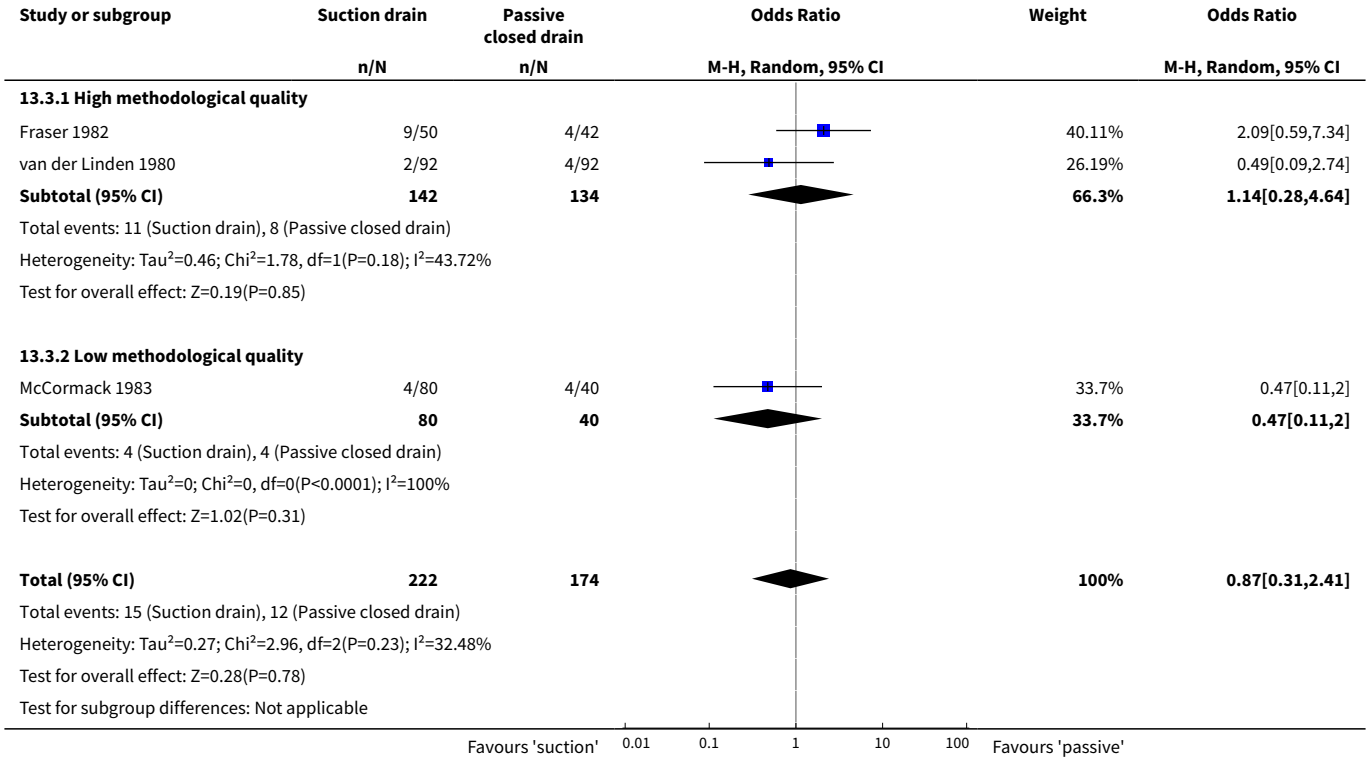
Study or subgroup	Suction drain n/N	Passive closed drain n/N	Odds Ratio M-H, Fixed, 95% CI	Weight	Odds Ratio M-H, Fixed, 95% CI
13.1.1 High methodological quality					
van der Linden 1980	1/92	1/92		100%	1[0.06,16.23]
Subtotal (95% CI)	**92**	**92**		**100%**	**1[0.06,16.23]**
Total events: 1 (Suction drain), 1 (Passive closed drain)					
Heterogeneity: Not applicable					
Test for overall effect: Not applicable					
Total (95% CI)	**92**	**92**		**100%**	**1[0.06,16.23]**
Total events: 1 (Suction drain), 1 (Passive closed drain)					
Heterogeneity: Not applicable					
Test for overall effect: Not applicable					



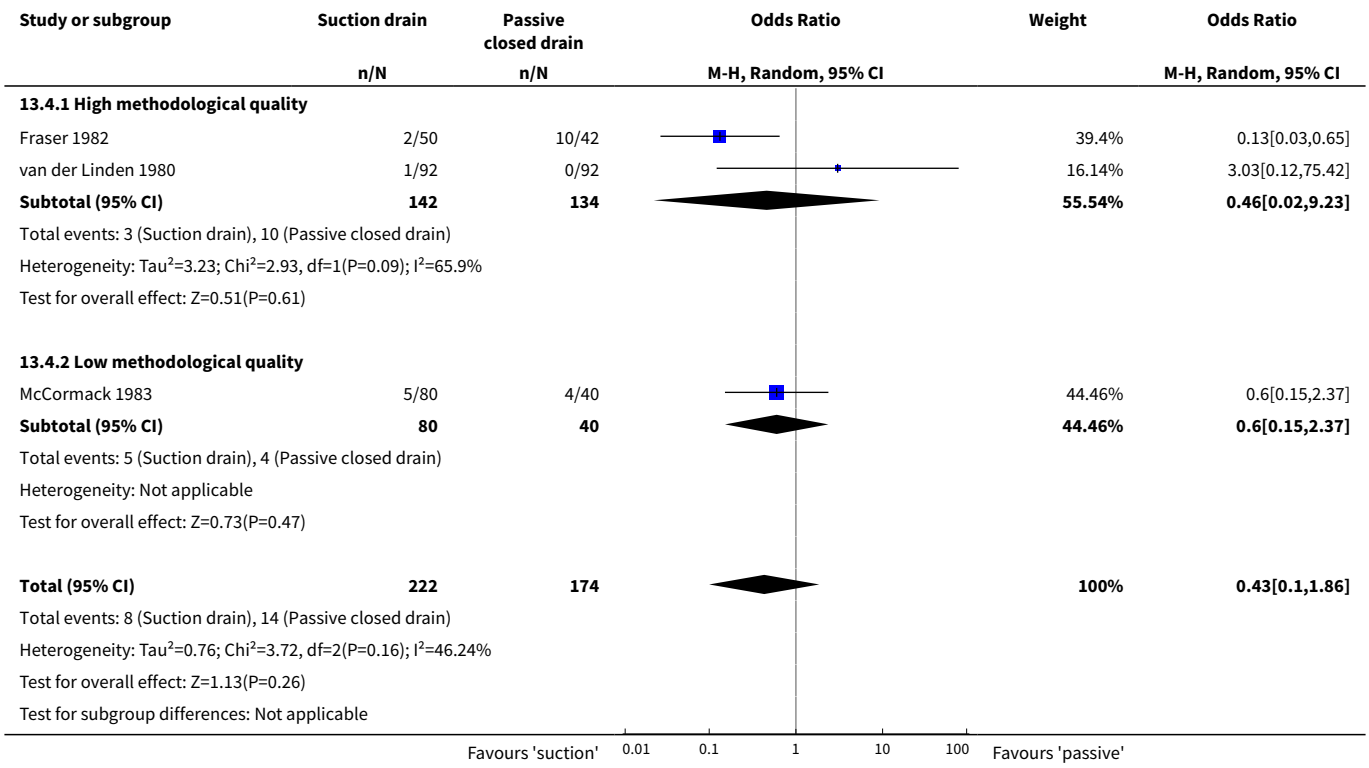
Analysis 13.2. Comparison 13 Suction drain versus passive closed drain, Outcome 2 Total abdominal collections.



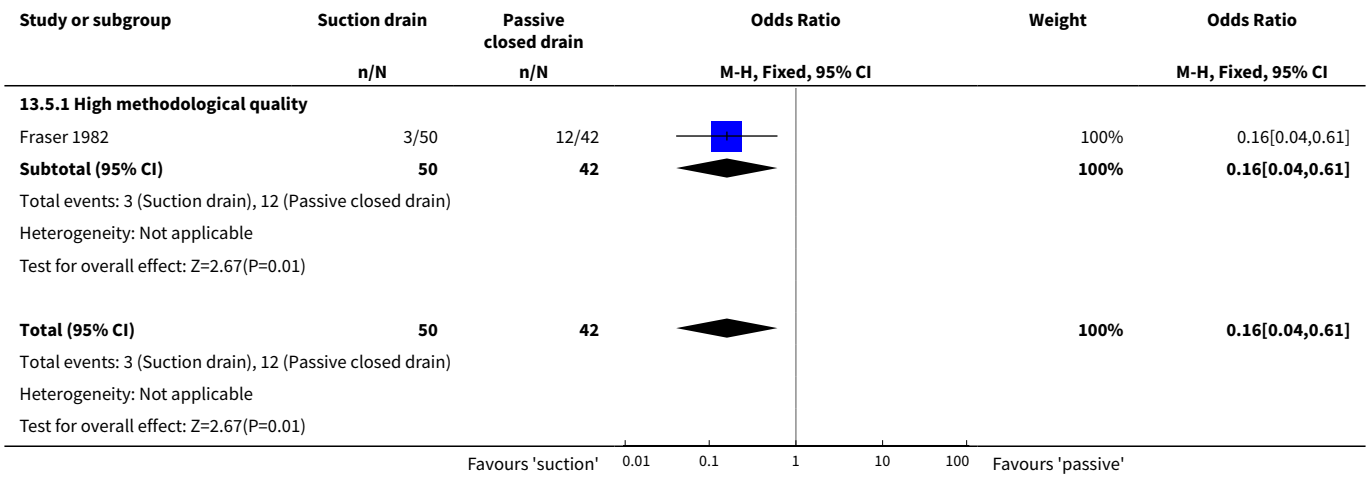
Analysis 13.3. Comparison 13 Suction drain versus passive closed drain, Outcome 3 Wound infection.



Analysis 13.4. Comparison 13 Suction drain versus passive closed drain, Outcome 4 Chest infection.



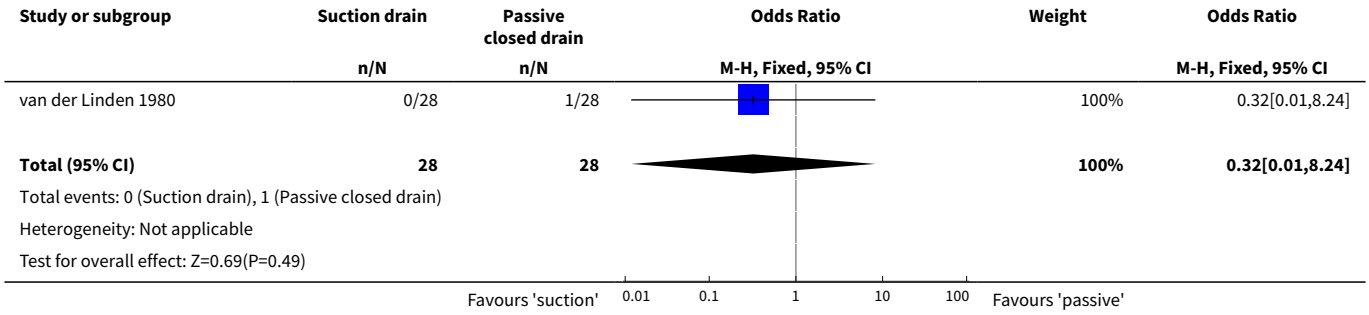
Analysis 13.5. Comparison 13 Suction drain versus passive closed drain, Outcome 5 Pain at drain site.



Comparison 14. Subgroup - Emergency cholecystectomy: suction drain versus passive closed drain

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Mortality	1	56	Odds Ratio (M-H, Fixed, 95% CI)	0.32 [0.01, 8.24]

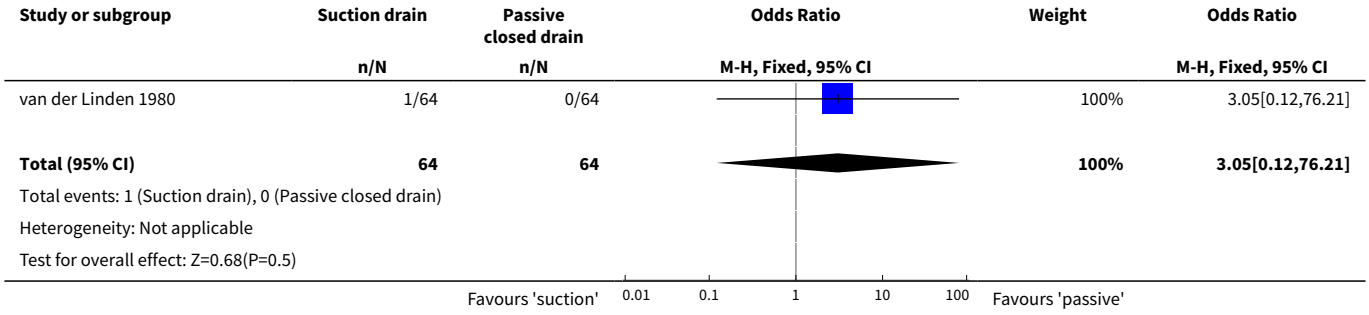
Analysis 14.1. Comparison 14 Subgroup - Emergency cholecystectomy: suction drain versus passive closed drain, Outcome 1 Mortality.



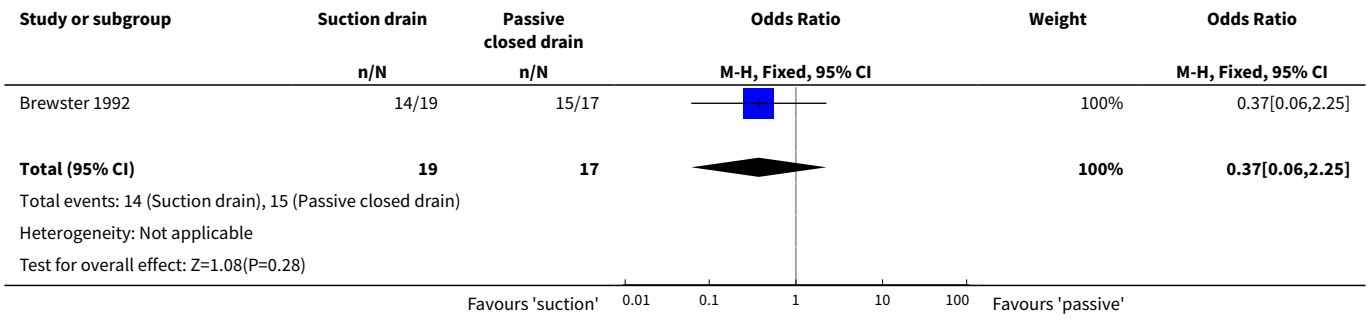
Comparison 15. Subgroup - Elective cholecystectomy: suction drain versus passive closed drain

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Mortality	1	128	Odds Ratio (M-H, Fixed, 95% CI)	3.05 [0.12, 76.21]
2 Total abdominal collections	1	36	Odds Ratio (M-H, Fixed, 95% CI)	0.37 [0.06, 2.25]
3 Wound infection	1	92	Odds Ratio (M-H, Random, 95% CI)	2.09 [0.59, 7.34]
4 Chest infection	1	92	Odds Ratio (M-H, Random, 95% CI)	0.13 [0.03, 0.65]
5 Pain at drain site	1	92	Odds Ratio (M-H, Fixed, 95% CI)	0.16 [0.04, 0.61]

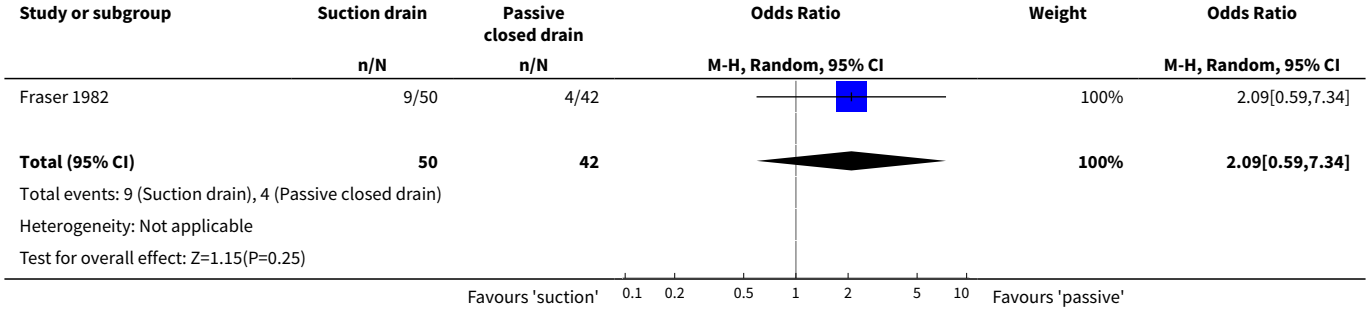
Analysis 15.1. Comparison 15 Subgroup - Elective cholecystectomy: suction drain versus passive closed drain, Outcome 1 Mortality.



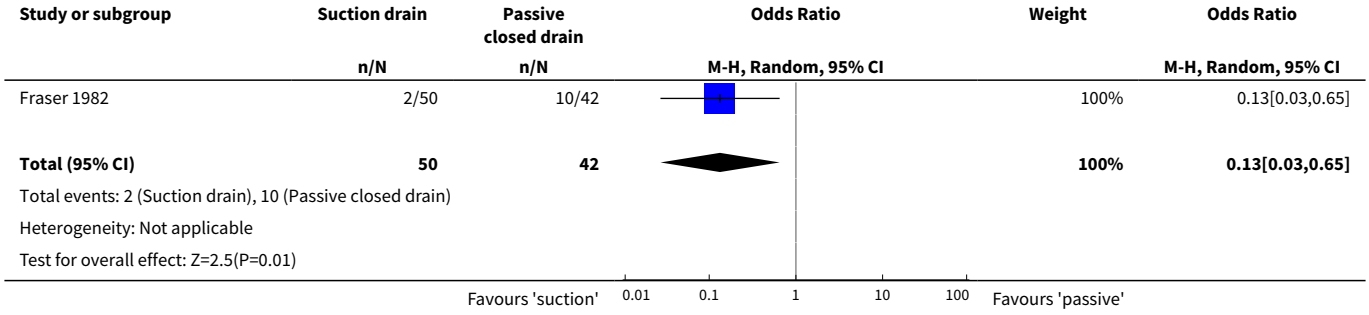
Analysis 15.2. Comparison 15 Subgroup - Elective cholecystectomy: suction drain versus passive closed drain, Outcome 2 Total abdominal collections.



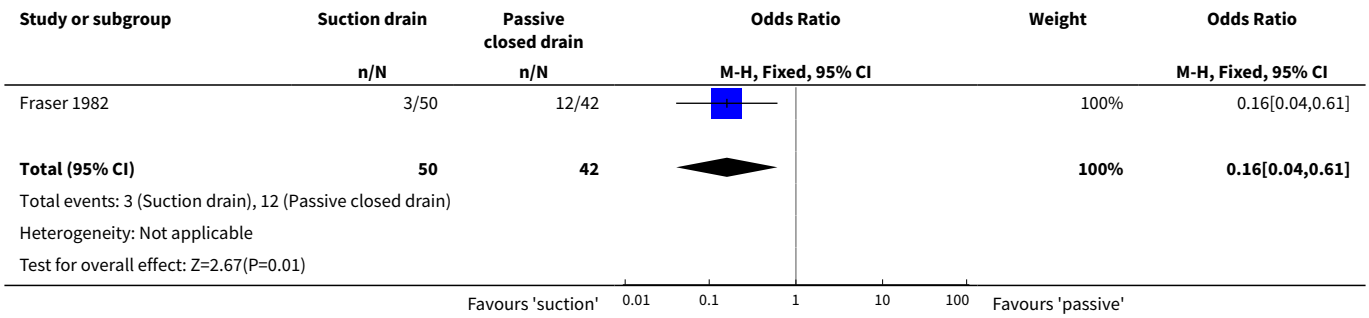
Analysis 15.3. Comparison 15 Subgroup - Elective cholecystectomy: suction drain versus passive closed drain, Outcome 3 Wound infection.



Analysis 15.4. Comparison 15 Subgroup - Elective cholecystectomy: suction drain versus passive closed drain, Outcome 4 Chest infection.



Analysis 15.5. Comparison 15 Subgroup - Elective cholecystectomy: suction drain versus passive closed drain, Outcome 5 Pain at drain site.



Comparison 16. Suction drain versus passive open drain

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Mortality	2	328	Odds Ratio (M-H, Fixed, 95% CI)	0.0 [0.0, 0.0]
2 Abdominal collections requiring re-operation	1	100	Odds Ratio (M-H, Fixed, 95% CI)	0.0 [0.0, 0.0]
3 Abdominal collections requiring drain insertion	1	100	Odds Ratio (M-H, Fixed, 95% CI)	0.0 [0.0, 0.0]
4 Abdominal collections requiring percutaneous aspiration	1	100	Odds Ratio (M-H, Fixed, 95% CI)	0.0 [0.0, 0.0]
5 Total abdominal collections	1	100	Odds Ratio (M-H, Fixed, 95% CI)	0.71 [0.28, 1.82]
6 Infected abdominal collections	1	128	Odds Ratio (M-H, Fixed, 95% CI)	0.0 [0.0, 0.0]
7 Bile peritonitis	3	428	Odds Ratio (M-H, Fixed, 95% CI)	1.0 [0.06, 16.21]
8 Wound infection	3	379	Odds Ratio (M-H, Fixed, 95% CI)	0.77 [0.28, 2.11]
9 Chest infection	2	300	Odds Ratio (M-H, Fixed, 95% CI)	0.81 [0.23, 2.91]
10 Atelectasis	2	300	Odds Ratio (M-H, Fixed, 95% CI)	0.71 [0.32, 1.60]
11 Pain at drain site	1	128	Odds Ratio (M-H, Fixed, 95% CI)	0.91 [0.12, 6.65]
12 Hospital stay (days)	2	228	Mean Difference (IV, Fixed, 95% CI)	0.39 [0.30, 0.48]

Analysis 16.1. Comparison 16 Suction drain versus passive open drain, Outcome 1 Mortality.

Study or subgroup	Suction drain n/N	Passive open drain n/N	Odds Ratio M-H, Fixed, 95% CI	Weight	Odds Ratio M-H, Fixed, 95% CI
Budd 1982	0/100	0/100			Not estimable
Sarr 1987	0/67	0/61			Not estimable
Total (95% CI)	**167**	**161**			**Not estimable**
Total events: 0 (Suction drain), 0 (Passive open drain)					
Heterogeneity: Not applicable					
Test for overall effect: Not applicable					

Favours 'suction' 0.1 0.2 0.5 1 2 5 10 Favours 'passive'

Analysis 16.2. Comparison 16 Suction drain versus passive open drain, Outcome 2 Abdominal collections requiring re-operation.

Study or subgroup	Suction drain n/N	Passive open drain n/N	Odds Ratio M-H, Fixed, 95% CI	Weight	Odds Ratio M-H, Fixed, 95% CI
Kriplani 1992	0/50	0/50			Not estimable
Total (95% CI)	**50**	**50**			**Not estimable**
Total events: 0 (Suction drain), 0 (Passive open drain)					
Heterogeneity: Not applicable					
Test for overall effect: Not applicable					

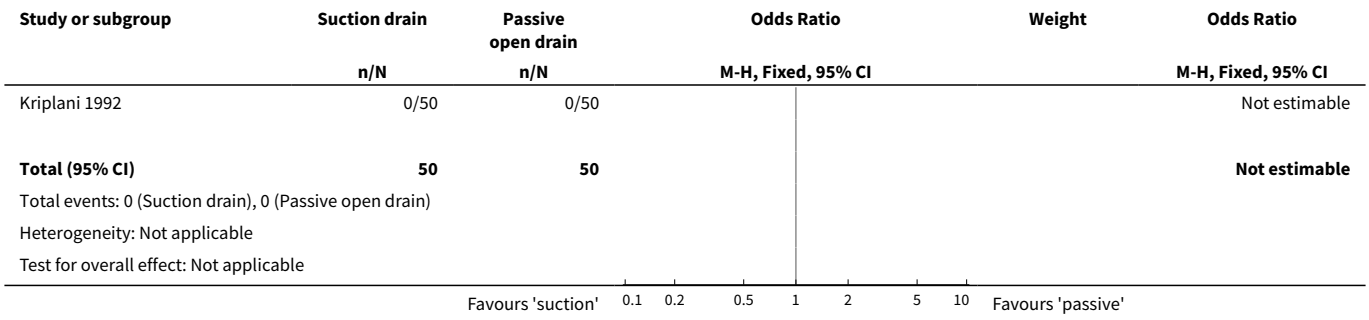
Favours 'suction' 0.1 0.2 0.5 1 2 5 10 Favours 'passive'

Analysis 16.3. Comparison 16 Suction drain versus passive open drain, Outcome 3 Abdominal collections requiring drain insertion.

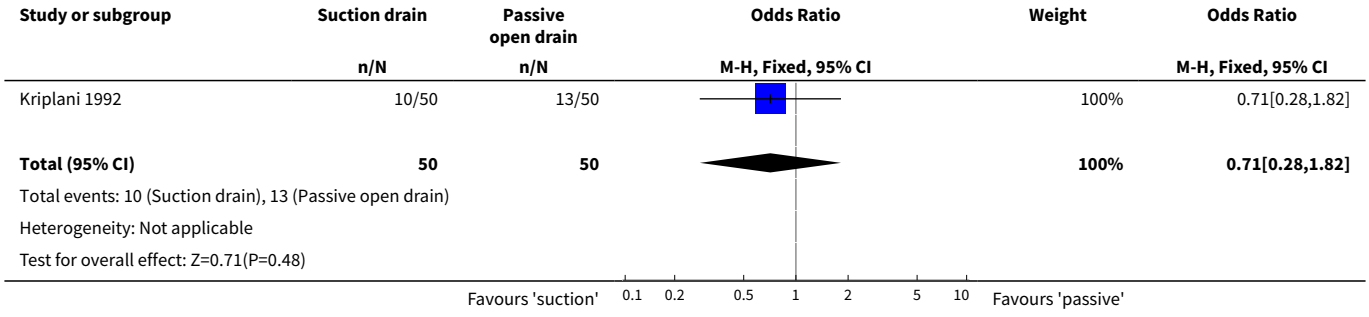
Study or subgroup	Suction drain n/N	Passive open drain n/N	Odds Ratio M-H, Fixed, 95% CI	Weight	Odds Ratio M-H, Fixed, 95% CI
Kriplani 1992	0/50	0/50			Not estimable
Total (95% CI)	**50**	**50**			**Not estimable**
Total events: 0 (Suction drain), 0 (Passive open drain)					
Heterogeneity: Not applicable					
Test for overall effect: Not applicable					

Favours 'suction' 0.1 0.2 0.5 1 2 5 10 Favours 'passive'

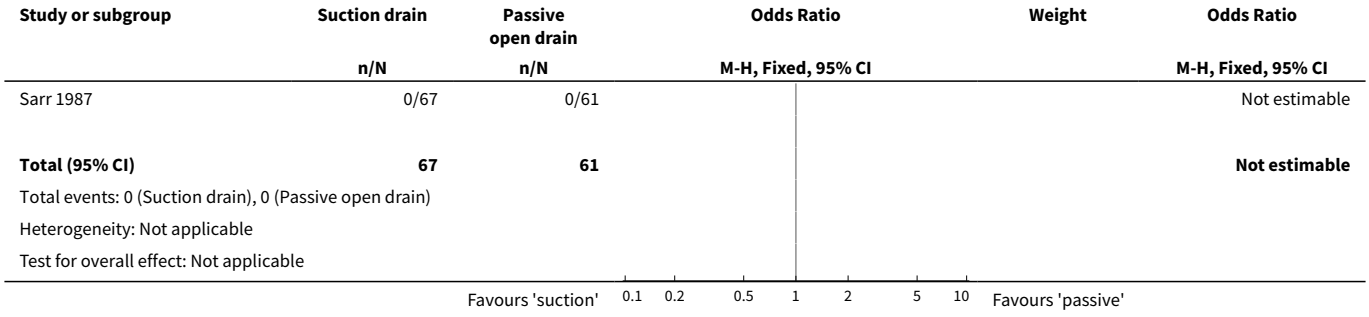
Analysis 16.4. Comparison 16 Suction drain versus passive open drain, Outcome 4 Abdominal collections requiring percutaneous aspiration.



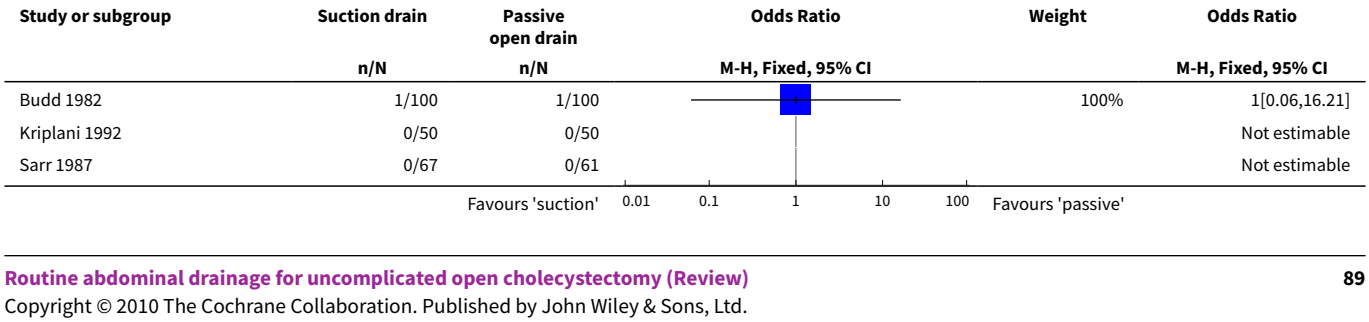
Analysis 16.5. Comparison 16 Suction drain versus passive open drain, Outcome 5 Total abdominal collections.

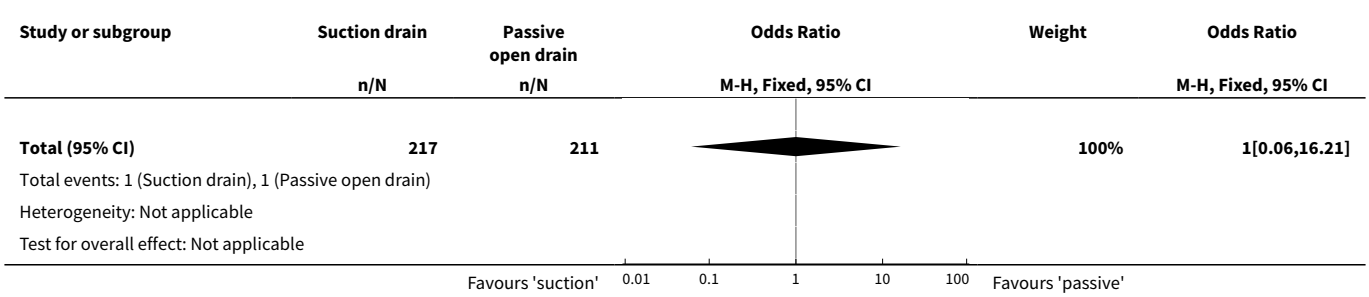


Analysis 16.6. Comparison 16 Suction drain versus passive open drain, Outcome 6 Infected abdominal collections.

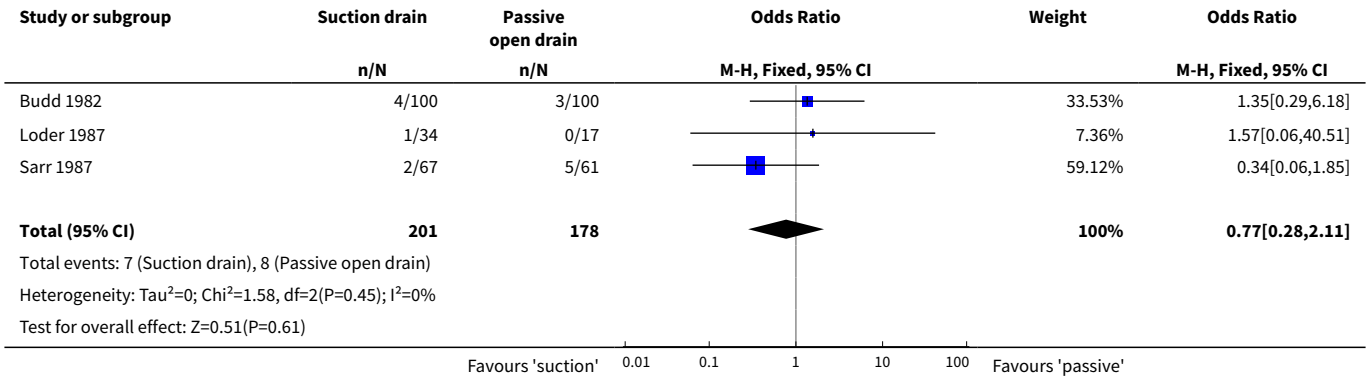


Analysis 16.7. Comparison 16 Suction drain versus passive open drain, Outcome 7 Bile peritonitis.

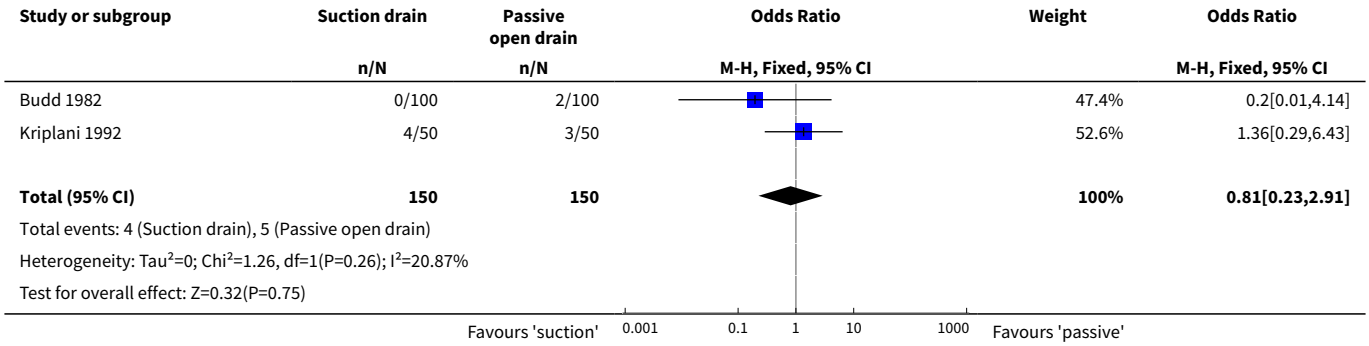




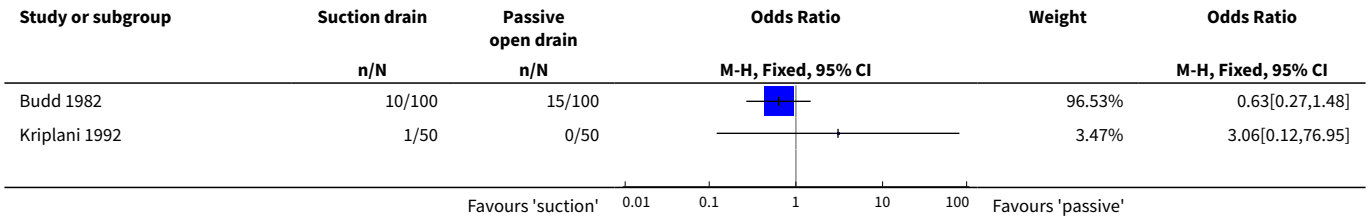
Analysis 16.8. Comparison 16 Suction drain versus passive open drain, Outcome 8 Wound infection.

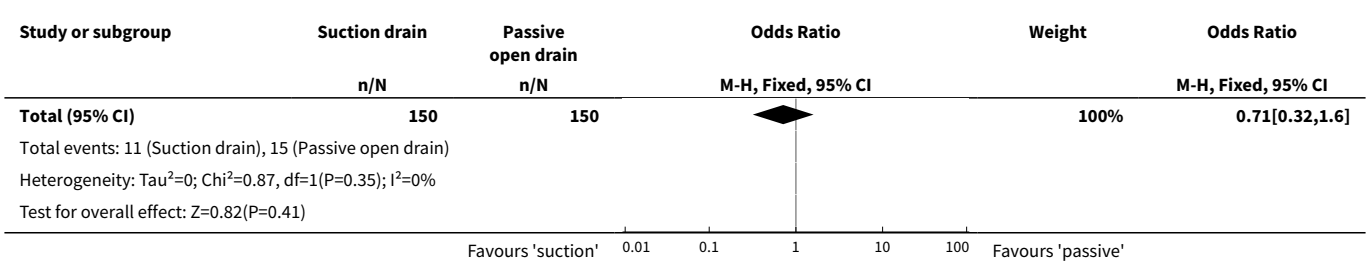


Analysis 16.9. Comparison 16 Suction drain versus passive open drain, Outcome 9 Chest infection.

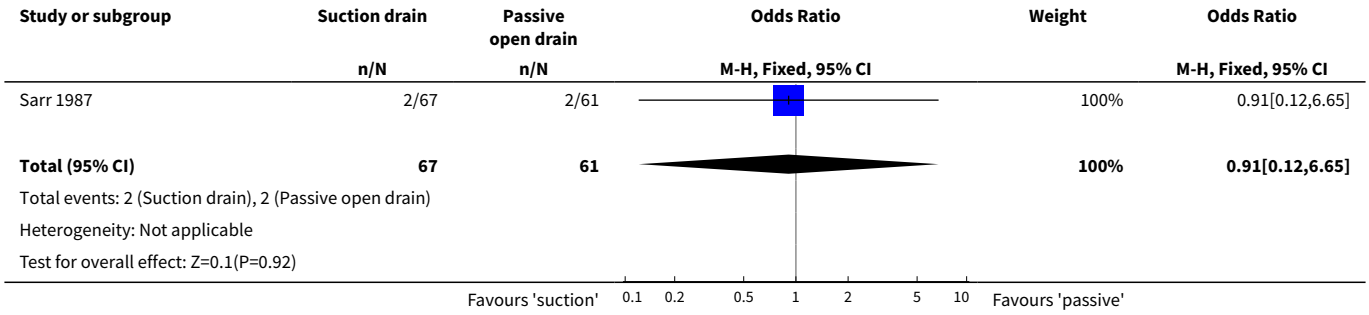


Analysis 16.10. Comparison 16 Suction drain versus passive open drain, Outcome 10 Atelectasis.

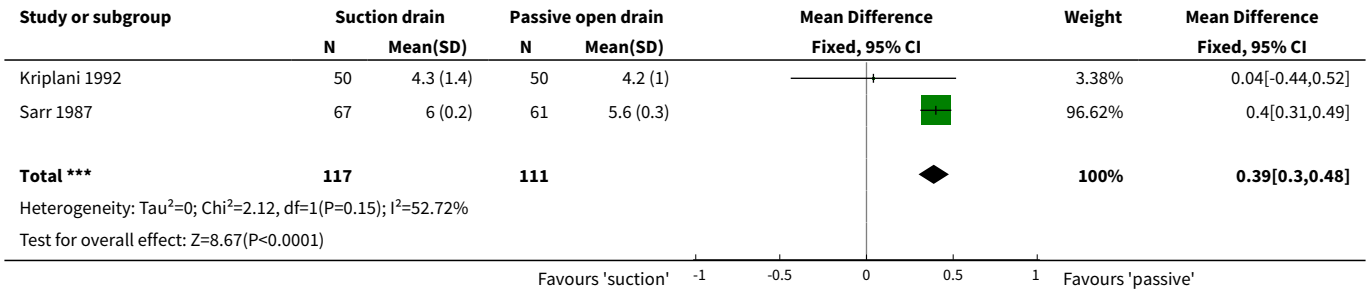




Analysis 16.11. Comparison 16 Suction drain versus passive open drain, Outcome 11 Pain at drain site.



Analysis 16.12. Comparison 16 Suction drain versus passive open drain, Outcome 12 Hospital stay (days).



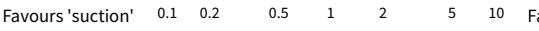
Comparison 17. Subgroup - Elective cholecystectomy: suction drain versus passive open drain

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Mortality	1	200	Odds Ratio (M-H, Fixed, 95% CI)	0.0 [0.0, 0.0]
2 Abdominal collections requiring re-operation	1	100	Odds Ratio (M-H, Fixed, 95% CI)	0.0 [0.0, 0.0]
3 Abdominal collections requiring drain insertion	1	100	Odds Ratio (M-H, Fixed, 95% CI)	0.0 [0.0, 0.0]

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
4 Abdominal collections requiring percutaneous aspiration	1	100	Odds Ratio (M-H, Fixed, 95% CI)	0.0 [0.0, 0.0]
5 Total abdominal collections	1	100	Odds Ratio (M-H, Fixed, 95% CI)	0.71 [0.28, 1.82]
6 Bile peritonitis	2	300	Odds Ratio (M-H, Fixed, 95% CI)	1.0 [0.06, 16.21]
7 Wound infection	1	200	Odds Ratio (M-H, Fixed, 95% CI)	1.35 [0.29, 6.18]
8 Chest infection	2	300	Odds Ratio (M-H, Fixed, 95% CI)	0.81 [0.23, 2.91]
9 Atelectasis	2	300	Odds Ratio (M-H, Fixed, 95% CI)	0.71 [0.32, 1.60]
10 Hospital stay (days)	1	100	Mean Difference (IV, Fixed, 95% CI)	0.04 [-0.44, 0.52]

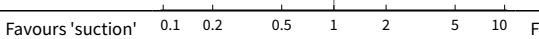
Analysis 17.1. Comparison 17 Subgroup - Elective cholecystectomy: suction drain versus passive open drain, Outcome 1 Mortality.

Study or subgroup	Suction drain n/N	Passive open drain n/N	Odds Ratio M-H, Fixed, 95% CI	Weight	Odds Ratio M-H, Fixed, 95% CI
Budd 1982	0/100	0/100			Not estimable
Total (95% CI)	**100**	**100**			**Not estimable**
Total events: 0 (Suction drain), 0 (Passive open drain)					
Heterogeneity: Not applicable					
Test for overall effect: Not applicable					



Analysis 17.2. Comparison 17 Subgroup - Elective cholecystectomy: suction drain versus passive open drain, Outcome 2 Abdominal collections requiring re-operation.

Study or subgroup	Suction drain n/N	Passive open drain n/N	Odds Ratio M-H, Fixed, 95% CI	Weight	Odds Ratio M-H, Fixed, 95% CI
Kriplani 1992	0/50	0/50			Not estimable
Total (95% CI)	**50**	**50**			**Not estimable**
Total events: 0 (Suction drain), 0 (Passive open drain)					
Heterogeneity: Not applicable					
Test for overall effect: Not applicable					

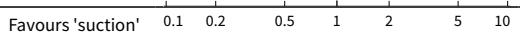


Analysis 17.3. Comparison 17 Subgroup - Elective cholecystectomy: suction drain versus passive open drain, Outcome 3 Abdominal collections requiring drain insertion.

Study or subgroup	Suction drain n/N	Passive open drain n/N	Odds Ratio M-H, Fixed, 95% CI	Weight	Odds Ratio M-H, Fixed, 95% CI
Kriplani 1992	0/50	0/50			Not estimable
Total (95% CI)	**50**	**50**			**Not estimable**
Total events: 0 (Suction drain), 0 (Passive open drain)					
Heterogeneity: Not applicable					
Test for overall effect: Not applicable					

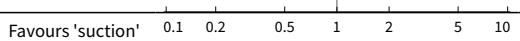
Analysis 17.4. Comparison 17 Subgroup - Elective cholecystectomy: suction drain versus passive open drain, Outcome 4 Abdominal collections requiring percutaneous aspiration.

Study or subgroup	Suction drain n/N	Passive open drain n/N	Odds Ratio M-H, Fixed, 95% CI	Weight	Odds Ratio M-H, Fixed, 95% CI
Kriplani 1992	0/50	0/50			Not estimable
Total (95% CI)	**50**	**50**			**Not estimable**
Total events: 0 (Suction drain), 0 (Passive open drain)					
Heterogeneity: Not applicable					
Test for overall effect: Not applicable					

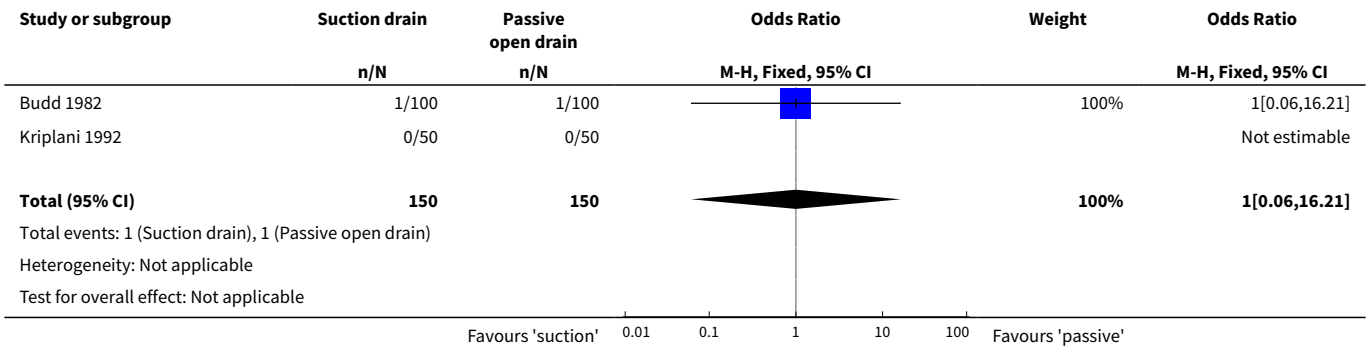


Analysis 17.5. Comparison 17 Subgroup - Elective cholecystectomy: suction drain versus passive open drain, Outcome 5 Total abdominal collections.

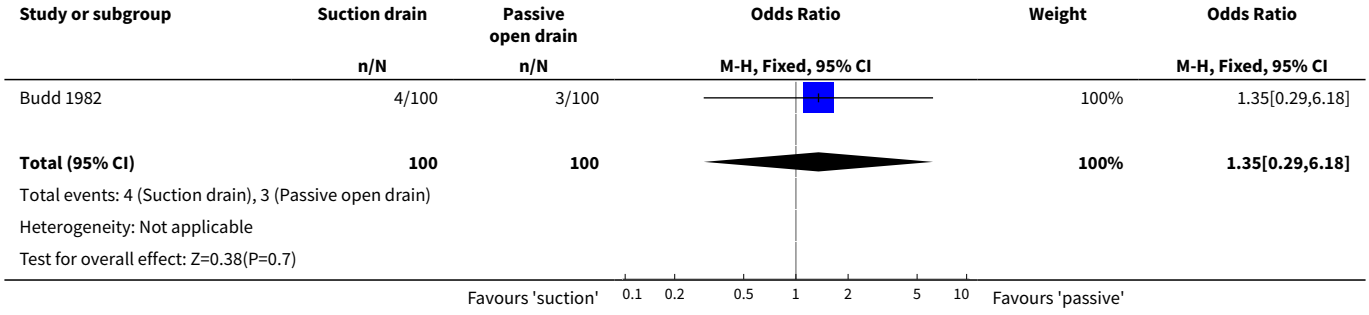
Study or subgroup	Suction drain n/N	Passive open drain n/N	Odds Ratio M-H, Fixed, 95% CI	Weight	Odds Ratio M-H, Fixed, 95% CI
Kriplani 1992	10/50	13/50		100%	0.71[0.28,1.82]
Total (95% CI)	**50**	**50**		**100%**	**0.71[0.28,1.82]**
Total events: 10 (Suction drain), 13 (Passive open drain)					
Heterogeneity: Not applicable					
Test for overall effect: Z=0.71(P=0.48)					



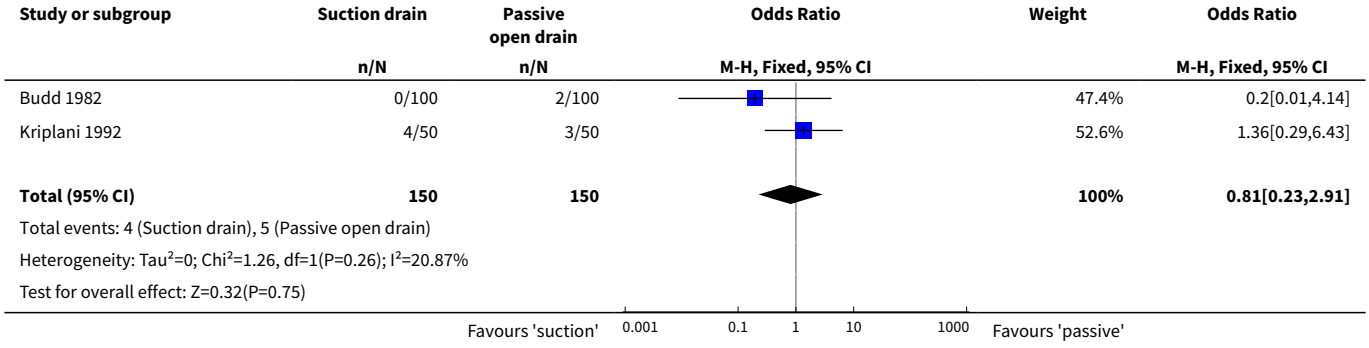
Analysis 17.6. Comparison 17 Subgroup - Elective cholecystectomy: suction drain versus passive open drain, Outcome 6 Bile peritonitis.



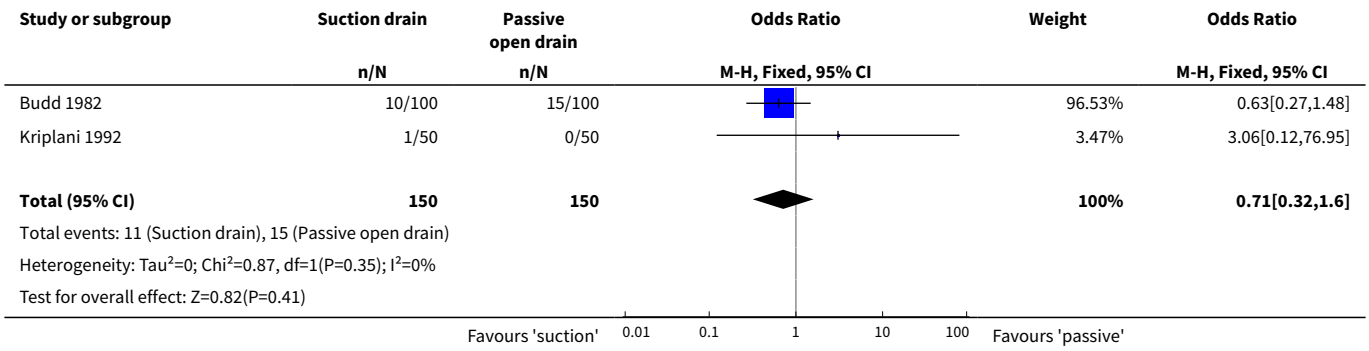
Analysis 17.7. Comparison 17 Subgroup - Elective cholecystectomy: suction drain versus passive open drain, Outcome 7 Wound infection.



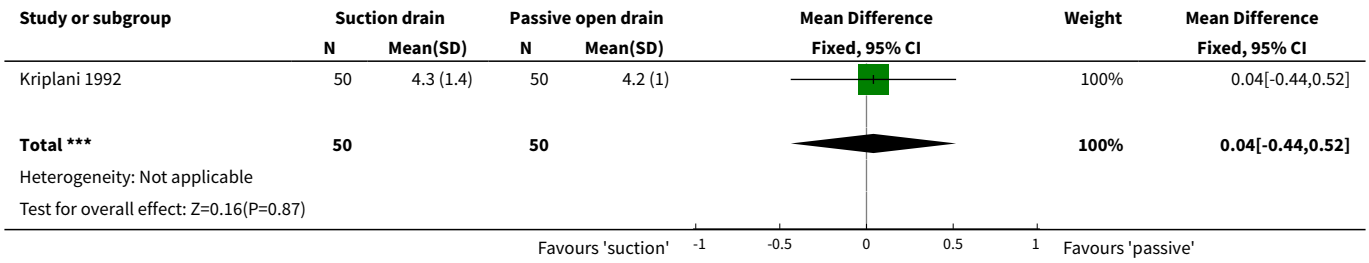
Analysis 17.8. Comparison 17 Subgroup - Elective cholecystectomy: suction drain versus passive open drain, Outcome 8 Chest infection.



Analysis 17.9. Comparison 17 Subgroup - Elective cholecystectomy: suction drain versus passive open drain, Outcome 9 Atelectasis.



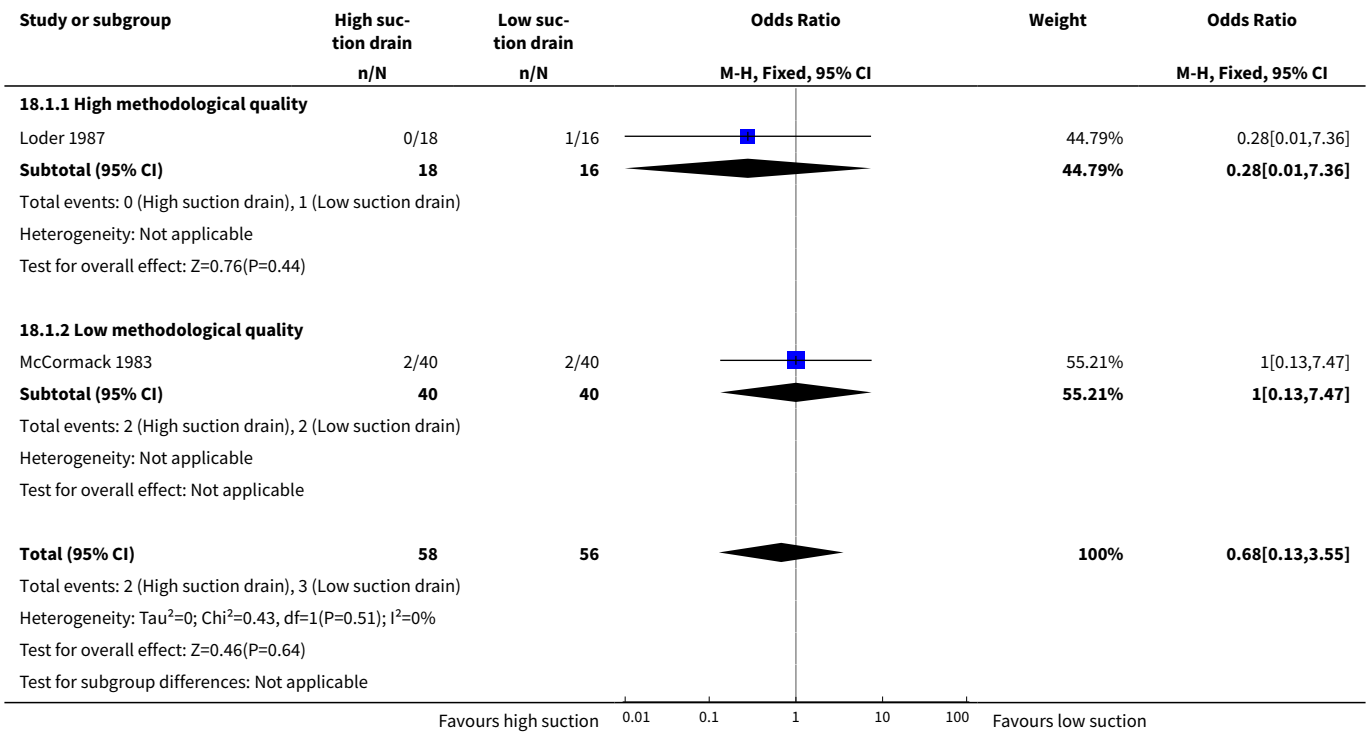
Analysis 17.10. Comparison 17 Subgroup - Elective cholecystectomy: suction drain versus passive open drain, Outcome 10 Hospital stay (days).



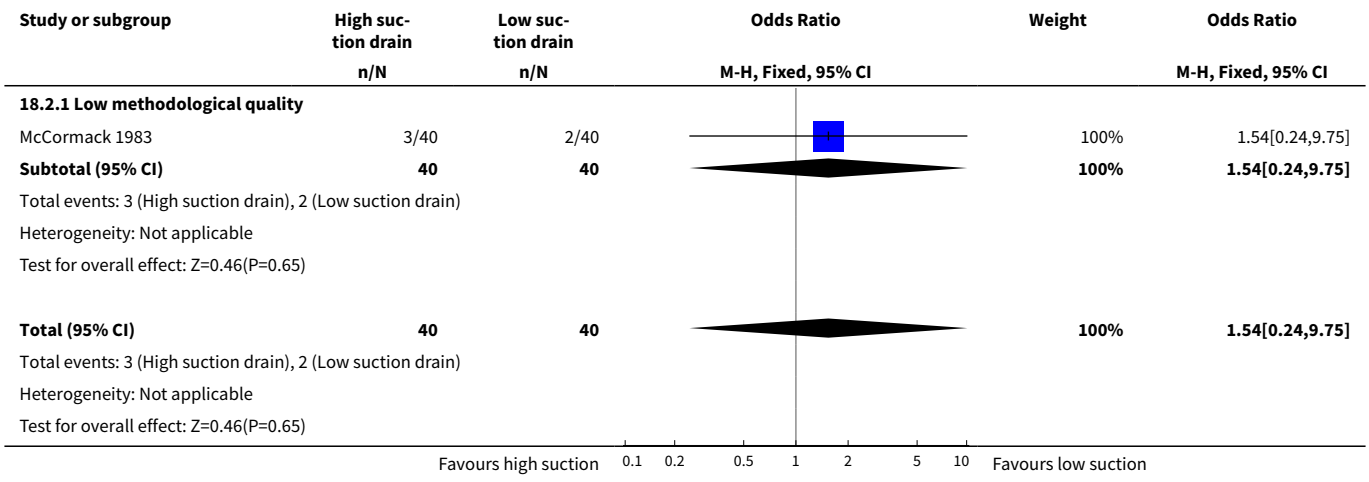
Comparison 18. High suction drain versus low suction drain

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Wound infection	2	114	Odds Ratio (M-H, Fixed, 95% CI)	0.68 [0.13, 3.55]
1.1 High methodological quality	1	34	Odds Ratio (M-H, Fixed, 95% CI)	0.28 [0.01, 7.36]
1.2 Low methodological quality	1	80	Odds Ratio (M-H, Fixed, 95% CI)	1.0 [0.13, 7.47]
2 Chest infection	1	80	Odds Ratio (M-H, Fixed, 95% CI)	1.54 [0.24, 9.75]
2.1 Low methodological quality	1	80	Odds Ratio (M-H, Fixed, 95% CI)	1.54 [0.24, 9.75]

Analysis 18.1. Comparison 18 High suction drain versus low suction drain, Outcome 1 Wound infection.



Analysis 18.2. Comparison 18 High suction drain versus low suction drain, Outcome 2 Chest infection.

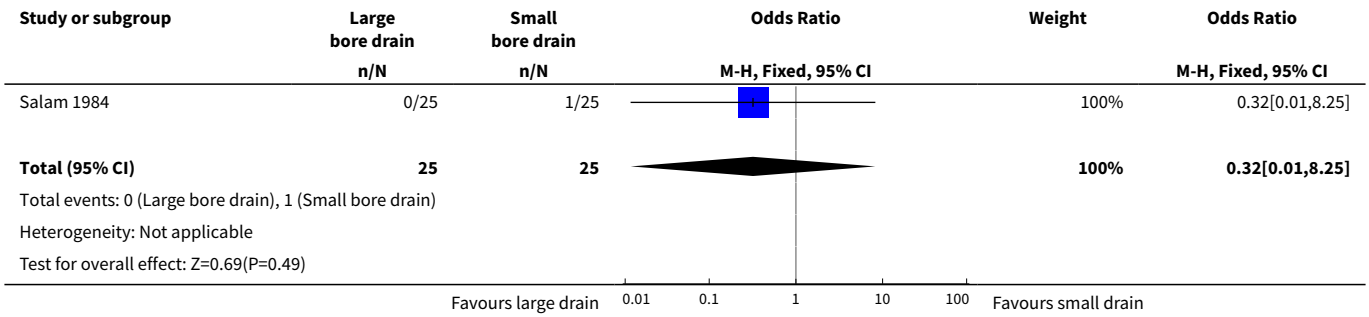


Comparison 19. Large bore suction drain versus small bore suction drain

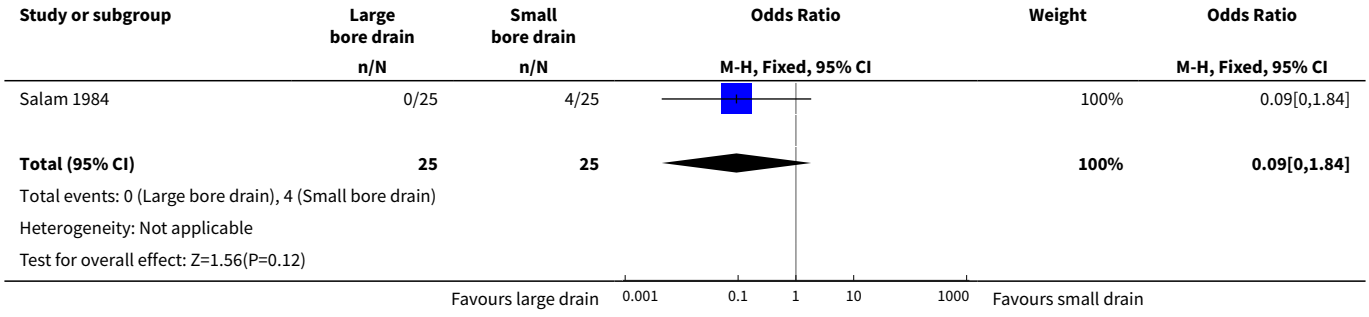
Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Abdominal collections requiring re-operation	1	50	Odds Ratio (M-H, Fixed, 95% CI)	0.32 [0.01, 8.25]

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
2 Total abdominal collections	1	50	Odds Ratio (M-H, Fixed, 95% CI)	0.09 [0.00, 1.84]
3 Chest infection	1	50	Odds Ratio (M-H, Fixed, 95% CI)	0.32 [0.01, 8.25]

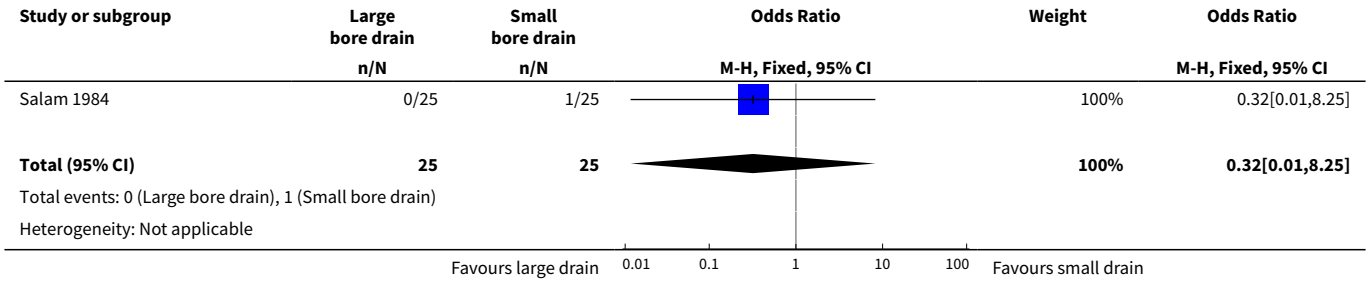
Analysis 19.1. Comparison 19 Large bore suction drain versus small bore suction drain, Outcome 1 Abdominal collections requiring re-operation.

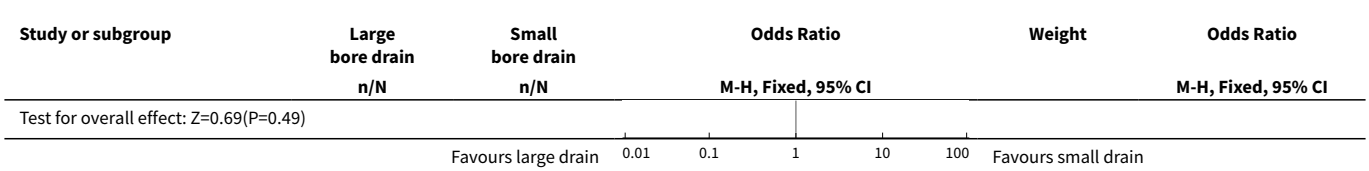


Analysis 19.2. Comparison 19 Large bore suction drain versus small bore suction drain, Outcome 2 Total abdominal collections.



Analysis 19.3. Comparison 19 Large bore suction drain versus small bore suction drain, Outcome 3 Chest infection.

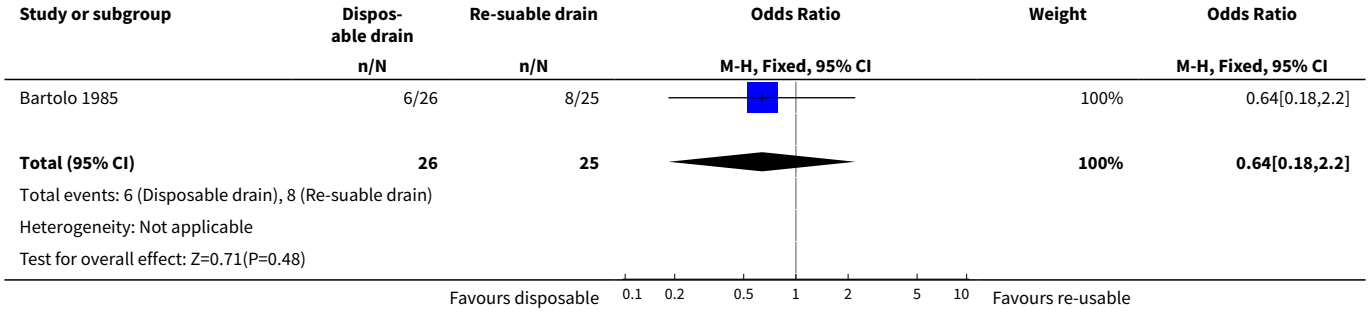




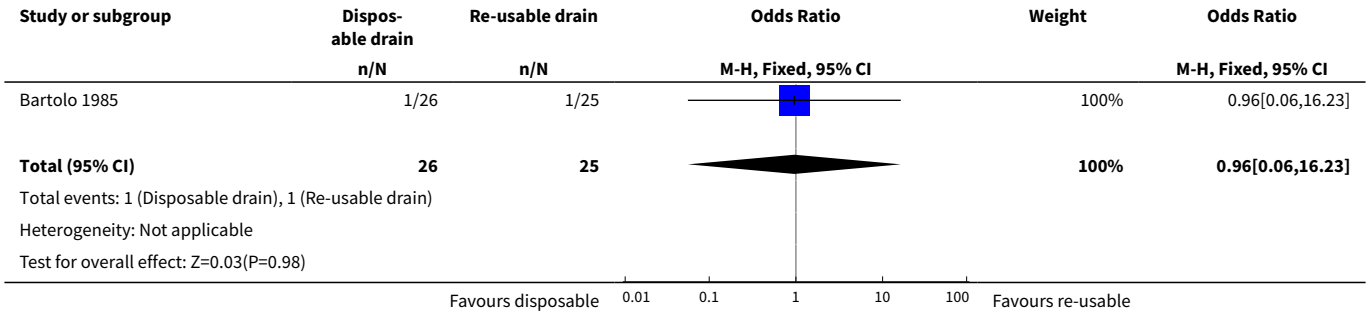
Comparison 20. Disposable suction drain verus re-usable suction drain

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Total abdominal collections	1	51	Odds Ratio (M-H, Fixed, 95% CI)	0.64 [0.18, 2.20]
2 Wound infection	1	51	Odds Ratio (M-H, Fixed, 95% CI)	0.96 [0.06, 16.23]

Analysis 20.1. Comparison 20 Disposable suction drain verus re-usable suction drain, Outcome 1 Total abdominal collections.



Analysis 20.2. Comparison 20 Disposable suction drain verus re-usable suction drain, Outcome 2 Wound infection.



ADDITIONAL TABLES

Table 1. Odds ratios and risk difference (95% confidence intervals)

Outcome	Fixed-effect	Random-effects	High method quality	Emergency cholecyst	Elective cholecyst	Suction drain	Passive closed drain	Passive open drain	Risk difference
01 Mortality	0.79 [0.21, 2.97]	0.84 [0.17, 4.08]	0.54 [0.11, 2.58]	Not applicable.	2.98 [0.31, 29.10]	0.55 [0.12, 2.62]	Not estimable.	Not estimable.	0.00 [-0.01, 0.01]
02 Abdominal collections requiring re-operation	Not estimable.	Not estimable.	Not estimable.	Not estimable.	Not estimable.	Not estimable.	Not applicable.	Not estimable.	0.00 [-0.01, 0.01]
03 Abdominal collections requiring drain insertion	6.09 [0.24, 152.24]	6.09 [0.24, 152.24]	6.09 [0.24, 152.24]	Not estimable	6.09 [0.24, 152.24]	3.06 [0.12, 76.95]	Not applicable.	3.06 [0.12, 76.95]	0.00 [-0.02, 0.03]
04 Abdominal collections requiring percutaneous aspiration	4.25 [0.44,41.43]	4.29 [0.44, 41.71]	4.25 [0.44, 41.43]	Not estimable.	4.25 [0.44, 41.43]	3.06 [0.12, 76.95]	Not applicable.	3.06 [0.12, 76.95]	0.01 [-0.01, 0.02]
05 Total abdominal collections	1.33 [0.93, 1.89]	1.30 [0.67, 2.53]	1.00 [0.12, 8.23]	Not applicable.	1.95 [1.24, 3.08]	0.82 [0.20, 3.39]	2.44 [1.14, 5.21]	1.80 [1.05, 3.07]	0.07 [-0.06, 0.20]
06 Infected intra-abdominal collections	0.70 [0.14, 3.59]	0.68 [0.11, 4.37]	0.70 [0.14, 3.59]	Not applicable.	0.98 [0.14, 6.96]	0.33 [0.01, 8.31]	Not estimable.	Not estimable.	0.00 [-0.02, 0.01]
07 Bile peritonitis	1.33 [0.22, 8.01]	1.47 [0.10, 21.57]	1.33 [0.22, 8.01]	Not applicable.	1.47 [0.10, 21.57]	1.00 [0.14, 7.18]	Not applicable.	1.00 [0.14, 7.18]	0.00 [-0.02, 0.02]
08 Wound infection	0.61 [0.43, 0.87]*	0.64 [0.44, 0.93]*	0.58 [0.38, 0.91]*	0.56 [0.16, 1.92]	0.67 [0.43, 1.03]	0.63 [0.28, 1.44]	0.68 [0.25, 1.88]	0.58 [0.29, 1.17]	-0.02 [-0.04, -0.01]*
09 Chest infection	0.59 [0.42, 0.84]*	0.84 [0.49, 1.44]	0.63 [0.33, 1.23]	0.24 [0.05, 1.33]	0.84 [0.48, 1.50]	0.51 [0.20, 1.25]	1.00 [0.48, 2.11]	1.20 [0.60, 2.39]	-0.01 [-0.04, 0.02]
10 Atelectasis	0.61 [0.35, 1.08]	0.62 [0.35, 1.10]	0.52 [0.23, 1.17]	Not applicable.	0.61 [0.30, 1.23]	0.60 [0.29, 1.21]	0.78 [0.22, 2.79]	0.53 [0.25, 1.15]	-0.04 [-0.07, 0.00]*
11 Hospital stay	-0.39 [-0.43, -0.36]*	-0.50 [-0.90, -0.10]*	-0.33 [-0.59, -0.07]*	Not applicable.	-0.32 [-0.53, -0.11]*	-0.46 [-1.89, 0.98]	-0.92 [-2.01, 0.17]	0.22 [-0.28, 0.73]	Not applicable.

Table 2. Odds ratios (continued)

Outcome	Antibiotic prophylaxis	No prophylaxis	Separate wound	Main wound
01 Mortality	0.25 [0.03, 2.23]	Not estimable.	0.55 [0.12, 2.62]	Not estimable.
02 Abdominal collections requiring re-operation	Not estimable.	Not estimable.	Not estimable	Not applicable.
03 Abdominal collections requiring drain insertion	Not estimable.	Not applicable.	6.09 [0.24, 152.24]	Not applicable.
04 Abdominal collections requiring percutaneous aspiration	Not estimable.	Not applicable.	6.09 [0.24, 152.24]	Not applicable.
05 Total abdominal collections	0.75 [0.15, 3.75]	Not applicable.	1.22 [0.54, 2.72]	Not applicable.
06 Infected intra-abdominal collections	0.33 [0.01, 8.31]	0.33 [0.01, 8.31]	0.33 [0.01, 8.31]	Not applicable.
07 Bile peritonitis	Not applicable.	Not applicable.	6.09 [0.24, 152.24]	Not applicable.
08 Wound infection	0.70 [0.29, 1.67]	0.83 [0.35, 1.97]	0.60 [0.38, 0.94]*	0.35 [0.01, 8.93]
09 Chest infection	0.67 [0.22, 2.01]	0.75 [0.16, 3.47]	0.78 [0.35, 1.75]	Not applicable
10 Atelectasis	Not applicable	1.10 [0.24, 4.99]	0.63 [0.26, 1.58]	1.10 [0.24, 4.99]
11 Hospital stay	-1.20 [-2.05, -0.35]*	-0.40 [-0.75, -0.05]*	-0.58 [-1.20, 0.05]	Not applicable

Table 3. Hospital stay ('no drain' versus 'drain')

Study	No drain	Drain	Description	Statistical significance
Chattopadhyay 1990	6.65 days	7.63 days	Mean	Significant
Al-Arfaj 1992	73/87	52/87 drain	Number discharged < 7 days	Significant
Budd 1982	5.6 days	5.4 days (suction drain) 6.5 days (passive open drain)	Median	Not stated
Edlund 1979	7.0 days	6.8 days	Mean	Not significant.
Forster 1992	9 days	9 days	Mean	Not significant.
Kupczyk-Joeris 1991	9.2 days	8.2 days	Mean	Not stated.
Latif 1989	6 days	18 days	Mean	Significant

Table 3. Hospital stay ('no drain' versus 'drain') *(Continued)*

Locker 1983	53/63	35/60	Number discharged < 6 days	Significant
Playforth 1985	6 days	7 days	Median	Not stated.
Porati 1984	11 days	13 days	Mean	Not stated.
Schaupp 1988	9.4 days	9.9 days	Mean	Not stated.

Table 4. Meta-analysis (one type of drain versus another type of drain)

Outcome	Suction versus passive closed drain	Column 2 High quality	Column 2 Emergency	Column 2 Elective	Suction versus passive open drain	Column 6 Elective	High pressure versus low pressure suction drain	large bore versus small bore drain	Re-usable versus disposable drain
01 Mortality	1.00 [0.06, 16.23]	1.00 [0.06, 16.23]	0.32 [0.01, 8.24]	3.05 [0.12, 76.21]	Not estimable.	Not estimable.	Not applicable.	Not applicable.	Not applicable.
02 Abdominal collections requiring re-operation	Not applicable.	Not applicable.	Not applicable.	Not applicable.	Not estimable.	Not estimable.	Not applicable.	0.32 [0.01, 8.25]	Not applicable.
03 Abdominal collections requiring drain insertion	Not applicable	Not applicable	Not applicable	Not applicable	Not estimable	Not estimable	Not applicable.	Not applicable.	Not applicable.
04 Abdominal collections requiring percutaneous aspiration	Not applicable	Not applicable	Not applicable	Not applicable	Not estimable	Not estimable	Not applicable.	Not applicable.	Not applicable.
05 Total abdominal collections	0.37 [0.06, 2.25]	0.37 [0.06, 2.25]	Not applicable	0.37 [0.06, 2.25]	0.71 [0.28, 1.82]	0.71 [0.28, 1.82]	Not applicable.	0.09 [0.00, 1.84]	0.64 [0.18, 2.20]
06 Infected intra-abdominal collections	Not applicable.	Not applicable.	Not applicable.	Not applicable.	Not estimable	Not applicable	Not applicable.	Not applicable.	Not applicable.
07 Bile peritonitis	Not applicable.	Not applicable.	Not applicable.	Not applicable.	1.00 [0.06, 16.21]	1.00 [0.06, 16.21]	Not applicable	Not applicable.	Not applicable.
08 Wound infection	0.87 [0.31, 2.41]	1.14 [0.28, 4.64]	Not applicable.	2.09 [0.59, 7.34]	0.77 [0.28, 2.11]	1.35 [0.29, 6.18]	0.68 [0.13, 3.55]	Not applicable.	0.96 [0.06, 16.23]
09 Chest infection	0.43 [0.10, 1.86]	0.46 [0.02, 9.23]	Not applicable.	0.13 [0.03, 0.65]*	0.81 [0.23, 2.91]	0.81 [0.23, 2.91]	1.54 [0.24, 9.75]	0.32 [0.01, 8.25]	Not applicable.
10 Atelectasis	Not applicable.	Not applicable.	Not applicable.	Not applicable.	0.71 [0.32, 1.60]	0.71 [0.32, 1.60]	Not applicable.	Not applicable.	Not applicable.
11 Pain at drain site	0.16 [0.04, 0.61]*	0.16 [0.04, 0.61]*	Not applicable.	0.16 [0.04, 0.61]*	0.91 [0.12, 6.65]	Not applicable	Not applicable.	Not applicable.	Not applicable.
12 Hospital stay	Not applicable.	Not applicable.	Not applicable.	Not applicable.	0.39 [0.30, 0.48]*	0.04 [-0.44, 0.52]	Not applicable.	Not applicable.	Not applicable.

Table 5. Hospital stay (one type of drain versus another type of drain)

Study	Comparison	Drain 1	Drain 2	Description	Statistical significance
Fraser 1982	Suction vs passive closed drain	7.1	7.1	Mean	Not significant.
McCormack 1983	Suction vs passive closed drain	9.6	11	Mean	Not significant.
Budd 1982	Suction vs passive open drain	5.4	6.5	Median	Not significant.
McCormack 1983	High suction vs low suction	10.3	8.9	Mean	Not significant.

APPENDICES

Appendix 1. Search strategies for identification of studies

Database	Period	Search strategy used
The Cochrane Hepato-Biliary Group Controlled Trials Register	April 2006.	(cholecystecto* or colecystecto*) AND drain*
Cochrane Central Register of Controlled Trials (CENTRAL) in The Cochrane Library	Issue 2, 2006.	#1 cholecystecto* or colecystecto* in All Fields in all products #2 MeSH descriptor Cholecystectomy explode all trees in MeSH products #3 drain* in All Fields in all products #4 MeSH descriptor Drainage explode all trees in MeSH products #5 ((#1 OR #2) AND (#3 OR #4))
MEDLINE (Pubmed)	1950 to April 2006.	((cholecystecto* or colecystecto* OR "Cholecystectomy"[MeSH]) AND (drain* OR "Drainage"[MeSH])) AND (randomized controlled trial [pt] OR controlled clinical trial [pt] OR randomized controlled trials [mh] OR random allocation [mh] OR double-blind method [mh] OR single-blind method [mh] OR clinical trial [pt] OR clinical trials [mh] OR ("clinical trial" [tw]) OR ((singl* [tw] OR doubl* [tw] OR trebl* [tw] OR tripl* [tw]) AND (mask* [tw] OR blind* [tw])) OR (placebos [mh] OR placebo* [tw] OR random* [tw] OR research design [mh:noexp]) NOT (animals [mh] NOT human [mh]))
EMBASE (Dialog datastar)	1980 to April 2006.	1 cholecystect$ OR colecystect$ OR CHOLECYSTECTOMY#.W..DE. 2 drain$ OR SURGICAL-DRAINAGE#.DE. OR DRAIN#.W..DE. 3 1 AND 2 4 RANDOMIZED-CONTROLLED-TRIAL#.DE. OR RANDOMIZATION#.W..DE. OR CONTROLLED-STUDY#.DE. OR MULTICENTER-STUDY#.DE. OR PHASE-3-CLINICAL-TRIAL#.DE. OR PHASE-4-CLINICAL-TRIAL#.DE. OR DOUBLE-BLIND-PROCEDURE#.DE. OR SINGLE-BLIND-PROCEDURE#.DE. 5 RANDOM$ OR CROSSOVER$ OR CROSS-OVER OR CROSS ADJ OVER OR FACTORIAL$ OR PLACEBO$ OR VOLUNTEER$ 6 (SINGLE OR DOUBLE OR TREBLE OR TRIPLE) NEAR (BLIND OR MASK) 7 4 OR 5 OR 6 8 7 AND HUMAN=YES 9 3 AND 8

(Continued)

Science Citation Index Expanded (http://portal.isi-knowledge.com/portal.cgi?DestApp=WOS&Func=Frame)	1970 to April 2006.	#1 TS=((cholecystecto* OR colecystecto*) AND drain*) #2 TS=(random* OR blind* OR placebo* OR meta-analysis) #3 #2 AND #1

WHAT'S NEW

Date	Event	Description
21 October 2008	Amended	Converted to new review format.

CONTRIBUTIONS OF AUTHORS

K Gurusamy is the lead author of the review and identified the trials for inclusion, extracted the data, performed statistical analysis, and wrote the review. K Samraj identified the trials and extracted the data independently. K Samraj also critically commented on the discussion.

DECLARATIONS OF INTEREST

None known.

SOURCES OF SUPPORT

Internal sources

- None, Not specified.

External sources

- None, Not specified.

INDEX TERMS

Medical Subject Headings (MeSH)

*Drainage [adverse effects] [instrumentation] [methods]; Cholecystectomy [*methods]; Cholecystolithiasis [*surgery]; Randomized Controlled Trials as Topic; Suction [instrumentation]

MeSH check words

Humans