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Verma R, Nelson RL

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[Intervention Review]

Prophylactic nasogastric decompression after abdominal surgery

Rashmi Verma[1], Richard L Nelson[2]

[1]Vascular Surgery, Leeds General Infirmary, Leeds, UK. [2]Department of General Surgery, Northern General Hospital, Sheffield, UK

Contact: Richard L Nelson, Department of General Surgery, Northern General Hospital, Herries Road, Sheffield, Yorkshire, S5 7AU, UK. altohorn@btinternet.com, Rick.Nelson@sth.nhs.uk.

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ABSTRACT

Background

Routine use of nasogastric tubes after abdominal operations is intended to hasten the return of bowel function, prevent pulmonary complications, diminish the risk of anastomotic leakage, increase patient comfort and shorten hospital stay.

Objectives

To investigate the efficacy of routine nasogastric decompression after abdominal surgery in achieving each of the above goals.

Search methods

Search terms were nasogastric, tubes, randomised, using MEDLINE, EMBASE, Cochrane Central Register of Controlled Trials (Central) and references of included studies, from 1966 through Sep 2009.

Selection criteria

Patients having abdominal operations of any type, emergency or elective, who were randomised prior to the completion of the operation to receive a nasogastric tube and keep it in place until intestinal function had returned, versus those receiving either no tube or early tube removal, in surgery, in recovery or within 24 hours of surgery. Excluded will be randomised studies involving laparoscopic abdominal surgery and patient groups having gastric decompression through gastrostomy.

Data collection and analysis

Data were abstracted onto a form that assessed study eligibility, as defined above, quality related to randomizations, allocation concealment, study size and dropouts, interventions, including timing and duration of intubation, outcomes that included time to flatus, pulmonary complications, wound infection, anastomotic leak, length of stay, death, nausea, vomit ting, tube reinsertion, subsequent ventral hernia.

Main results

37 studies fulfilled eligibility criteria, encompassing 5711 patients, 2866 randomised to routine tube use, and 2845 randomised to selective or No Tube use. Patients not having routine tube use had an earlier return of bowel function ($p<0.00001$), a decrease in pulmonary complications ($p=0.09$) and an insignificant trend toward increase in risk of wound infection ($p=0.39$) and ventral hernia (0.09). Anastomotic leak was no different between groups ($p=0.70$). Vomiting seemed to favour routine tube use, but with increased patient discomfort. Length of stay was shorter when no tube was used but the heterogeneity encountered in these analyses make rigorous conclusion difficult to draw for this outcome. No adverse events specifically related to tube insertion (direct tube trauma) were reported. Other outcomes were reported with insufficient frequency to be informative.

Authors' conclusions

Routine nasogastric decompression does not accomplish any of its intended goals and so should be abandoned in favour of selective use of the nasogastric tube.

PLAIN LANGUAGE SUMMARY

Nasogastric decompression used routinely after abdominal surgery does not speed recovery.

This systematic review of 37 trials showed that routine use of nasogastric tube decompression after abdominal operations, rather than speeding recovery, may slow recovery down and increase the risk of some postoperative complications. On the other hand routine use may decrease the risk of wound infection and subsequent ventral hernia.

BACKGROUND

For the past 300 years tubes have been inserted into the stomach via the nose or mouth for the purpose of evacuating gas and liquid. The reason to perform such an activity may be either therapeutic, as in patients with distention and vomiting from bowel obstruction, diagnostic, as in the case of gastrointestinal bleeding or peptic ulcer disease, or prophylactic, as in patients having major abdominal surgery. The prophylactic use of nasogastric tubes after abdominal operations, flexible tubes inserted through the nose, pharynx, oesophagus and into the stomach, has happened only in the last century, becoming so prevalent that it has been variously described as "the standard of care" (Montgomery 1996), "traditionally used by most surgeons" (Lee 2002), "common practice" (Cunningham 1992, Sakadamis 1999, Manning 2001), "unquestioned" (Savassi-Rocha 1992), and "routine" (Wolff 1989). What is to be achieved by this prophylaxis is gastric decompression, decreased likelihood of nausea and vomit ting, decreased distention, less chance of pulmonary aspiration and pneumonia, less chance of wound separation and infection, less chance of fascial dehiscence and hernia, earlier return of bowel function, and earlier hospital discharge. Many studies have been published that assess the efficacy of this intervention. A meta-analysis of many of the randomised and non-randomised studies published prior to 1995 found that, though vomiting and distension were more common when nasogastric tubes were not routinely used, all other parameters of efficacy were actually better among those who did not have routine insertion and maintenance of nasogastric tubes in the post-operative period (Cheatham 1995). This meta-analysis needs to be updated and revised for several reasons. First, many more studies have been published since 1995, broadening the types of abdominal operations in which NGT are used; for instance to operations for gastric cancer and emergency operations for penetrating abdominal trauma. The original review also included non-randomised studies in the meta-analysis, introducing the potential of substantial selection bias into their results. Two more meta-analysis have been published since then (Lawrence 2006, Yang 2008). Yang 2008 included only RCT's that compared individuals with or without nasogastric or nasojejunal decompression after gastrectomy for gastric cancer. Time to oral diet was significantly shorter in the group which did not use nasogastric or nasojejunal tube. Other parameters like time to flatus, anastomotic leakage, pulmonary complications and length of hospital stay were similar in both groups.Lawrence 2006 looked at a lot of factors related to postoperative pulmonary complications in noncardiothoracic studies, nasogastric tube being one of them. However it used data from the previous meta analysis (Cheatham 1995) and also from our initial review. Since a good number of randomised controlled trials have been reported in this area of inquiry, these alone will form the basis of this systematic review. This is the 2010 update of the initial review and four new RCT's have been included in this (Daryaei 2009, Jiang 2007, Hsu 2007, Pessaux 2007).

OBJECTIVES

To assess the efficacy of prophylactic nasogastric tube decompression in the post-operative period after major abdominal operations.

METHODS

Criteria for considering studies for this review

Types of studies

Randomised controlled trials that compare individuals with and without routine prophylactic use of nasogastric tube gastric decompression after abdominal surgery

Types of participants

Adults over the age of 18 years in whom abdominal operations have been performed of all types, such as from appendectomy to major aortovascular reconstruction, operations for gall stones, gastric cancer and emergency operations for penetrating abdominal trauma. Laparoscopic surgery will not be included in the review.

Types of interventions

The test group will have had a nasogastric tube inserted before or during surgery and maintained in place after the surgery until return of bowel function. This is an endpoint of somewhat vague character, but in general is understood to mean spontaneous passage of flatus after surgery, which usually occurs three to five days after the operation.

The control group will either have no tube inserted or a tube inserted during surgery and withdrawn either while the patient is still in the operating room, in the recovery room, when judged to be fully awake or within 24 hours of surgery.

The type of tube to be used may be a rubber Levine tube or any other tube of similar length, such a polymer tubes with sump lumena.

Patients having tubes inserted through the abdominal wall into the stomach, gastrostomy tubes, or patients with long tubes used traditionally for bowel obstruction such as Dennis tubes, Cantor tubes and Miller-Abbott tubes will not be included in the review.

Types of outcome measures

The following outcomes were sought for:

Time to first flatus
Pulmonary complications: a composite of both atalectasis and pneumonia
Fever
Wound infection
Length of hospital stay, or post-operative hospital stay
Wound dehiscence
Anastomotic leak
Incisional hernia
Gastric upset in the terms of nausea and/or vomitting. This is an alteration of the first review, as three different parameters of gastric discomfort/disfunction are condensed into a single outcome: vomitting, the most commonly problem reported in this area and a more precise outcome than for instance, discomfort.
Need for tube insertion/reinsertion
Mortality
Pain or discomfort that is tube related
Adverse events related to tube insertion

Search methods for identification of studies

The following sources were searched to identify studies to be considered for this review:

MEDLINE (1966 through Sep 2009) (Appendix 1)
EMBASE (1971 through Sep 2009) (Appendix 2)
Cochrane Central Register of Controlled Trials (CENTRAL), in the Cochrane Library 2009 issue 3 (Appendix 3)
Reference lists of published studies and reviews were scutinized. There was no limits about language, date, or other restrictions in the searches.

Major search terms:
Nasogastric
Tubes
Randomized

Data collection and analysis

This review was undertaken initially as a classroom exercise for the Honors 201 seminar at the University of Illinois at Chicago. Undergraduate class members developed a data abstraction form (see attached Word file). Pairs of students reviewed each publication, and all identified studies were presented to the class for discussion and resolution of disagreements in data interpretation.

Study quality was assessed in each case addressing randomization method, concealment, blinding, specification of inclusions, exclusions, number of drop-outs, intention to treat analyses and consistency of interpretations with data.

Statistical issues:

Dichotomous variables, such as wound infection, gastric upset and pulmonary complications were analyzed in Revman 5, using relative risk and the random effects model if significant heterogeneity was seen.

Continuous variables such as time to flatus or length of stay, when both means and standard deviations are presented, were assessed using the weighted mean difference in Metaview, and random effects again if significant heterogeneity is found.

When, in continuous variables, means were presented without standard deviations, we used a method for imputing standard deviations from published "p" values and "t" tables. This method was used to include those studies in the meta-analysis. When no "p" value is presented, but findings stated simply as "significant" or "not significant", "p" values of 0.03 and 0.3 were assigned to those studies respectively.

Many studies presented median times to flatus or length of stay, often with a range and "p" value. Though these studies could not be included in the main meta-analysis, unless the study authors supplied means and standard deviations.

Sensitivity analyses were performed to assess the effect of studies of poor quality on overall results, to assess the effect of imputing standard deviations from p values on overall results, and to identify sources of significant heterogeneity when it arose, and to assess the robustness and consistency of statistical techniques used or developed.

Denominators in all analyses were the original number randomized, not just those completing assessment.

Study authors were contacted in order to retrieve missing data or analyses.

RESULTS

Description of studies

37 studies fulfilled the eligibility criteria. 28 trials were identified in the first published version of this review in 2004. One of them (Otchy 1995) was a follow-up report with a new outcome - incisional hernia - from a group of patients previously reported (Wolff 1989). A broad range of abdominal surgery was covered in these report, including 7 in colorectal surgery (Colvin 1986, Cunningham 1992, Olesen 1983, Ortiz 1996, Petrelli 1993, Racette 1987, Wolff 1989), 7 in gastroduodenal surgery (Adekunle 1979, Bashey 1985, Lee 2002, Miller 1972, Sitges-Serra 1984, Wu 1994; Yoo 2002), 2 each in biliary (Edlund 1979, Hyland1982) and gynaecologic surgery (Cutillo 1999, Pearl 1996). 1 each in vascular (Friedman 1996), and emergency trauma surgery (Knoepp 1999), and finally 7 that included all facets of abdominal surgery (Cheadle 1985, Koukouras 2001, Montgomery 1996, Nathan 1991, Reasbeck 1984, Sakadamis 1999; Savassi-Rocha 1992) .
The 37 included studies encompass 5711 participants, 2866 randomized to prophylactic nasogastric tube insertion for post-operative decompression, and 2845 randomized to no tube in the post-operative period.
Five studies were excluded after review due to reasons specified in the Table of Excluded Studies (Di Saverio 1988; Hoffmann 2001; Manning 2001; Michowitz 1988; Chung 2003). Five studies are added in this first update of the review (Carrere2006, Doglietto 2004, Lei 2004, Goueffic 2005, Zhou 2006), two involving colorectal resections (Zhou 2006, Lei 2004), two gastric resections (Carrere2006, Doglietto 2004) and one aortic reconstruction (Goueffic 2005).

Four studies have been added in this second update of the review (Daryaei 2009, Jiang 2007, Hsu 2007, Pessaux 2007), one involving oesophageal resection (Daryaei 2009), one hepatic resection (Pessaux 2007) and 2 involving gastric resections (Jiang 2007, Hsu 2007).

Risk of bias in included studies

Only seven studies in the initial review specified an allocation sequence that was adequate (Adekunle 1979, Cunningham 1992, Cheadle 1985, Hyland 1980, Savassi-Rocha 1992; Yoo 2002; Wolff 1989). In most other cases the method of randomization was not specified. In one case it was by month of birth (Miller 1972). Allocation concealment was reported in three studies (Wu 1994; Yoo 2002; Cheadle 1985). Blinding of neither participants nor observers was attempted in any study - nor would it have been possible. With such a short term intervention in patients confined to hospital, drop outs should have been rare. Only four studies reported a drop out rate that was greater than 10% (Adekunle 1979; Lee 2002; Montgomery 1996; Wu 1994). Inclusion criteria were poorly specified or absent in several studies (Sitges-Serra 1984; Miller 1972; Savassi-Rocha 1992). Comparability of the two participant groups was difficult to assess in several studies (Koukouras 2001; Adekunle 1979; Cunningham 1992; Savassi-Rocha 1992; Miller 1972). Perhaps the biggest quality issue is the subjectivity in reporting of the principal endpoint of the studies: return of

gastrointestinal function. The meter for this was time to first flatus. This is typically reported by the patient to their surgeons to have occurred at some time prior to the ward round, which takes place first thing in the morning. There is an inherent imprecision in this measure. A way in which this imprecision could have systematically biased reporting in favor of "no tube" is not apparent (Patients with a tube may have had an incentive to report flatus in order to get rid of the tube), but it may still exist. The other primary endpoint - pulmonary complications, would have been more precisely reported.
Among the five studies included in the updated review (Carrere2006; Doglietto 2004; Goueffic 2005; Lei 2004; Zhou 2006), quality was generally poor with only two specifying an allocation sequence (Carrere2006; Doglietto 2004), and allocation concealment not specified in any of the five. Blinding of outcome assessment was not possible in this review. Drop outs were not a problem in any of these studies. Only one (Lei 2004) reported that the two allocation groups were not comparable at baseline.

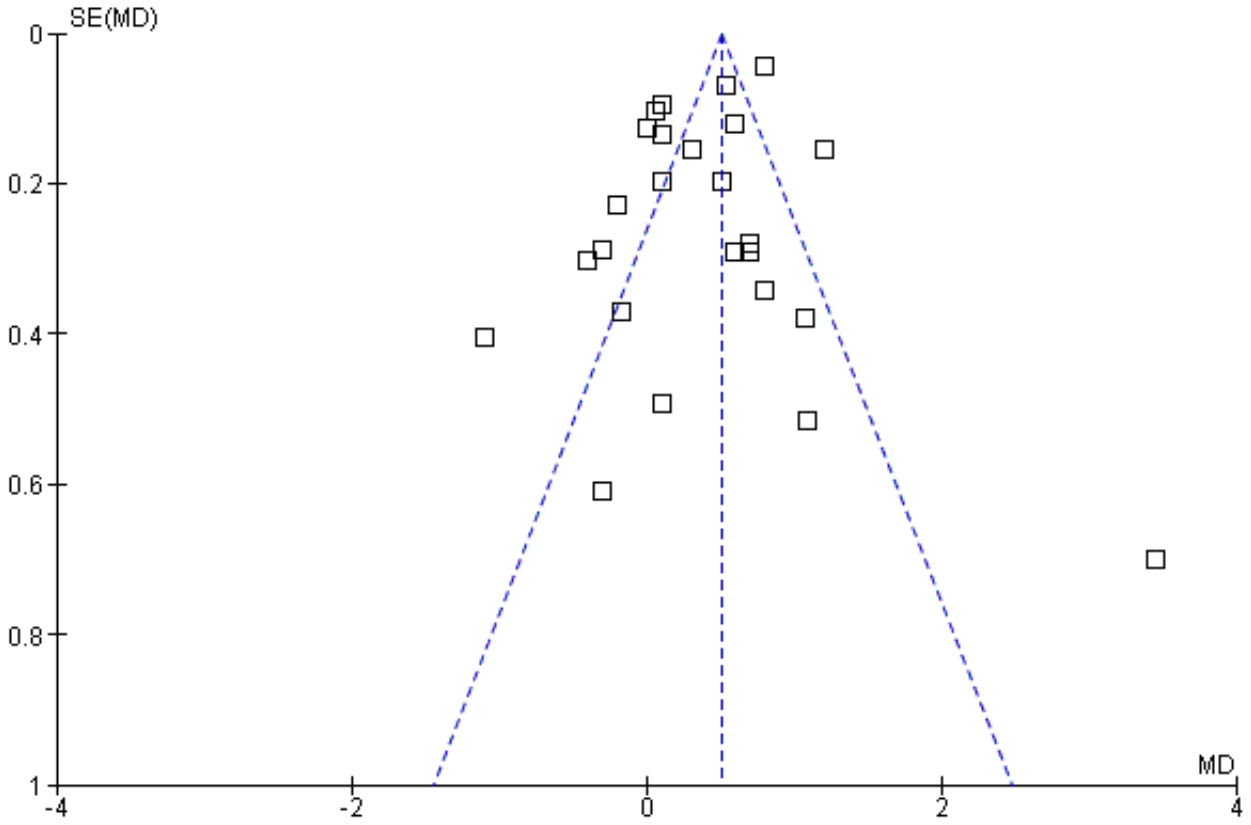
Among the four studies included in the second update of the review (Daryaei 2009; Jiang 2007; Hsu 2007; Pessaux 2007), only two specified an allocation sequence (Pessaux 2007; Hsu 2007) and allocation concealment was stated only in one (Pessaux 2007), it was not used in one (Hsu 2007), and was not stated in the remaining two (Daryaei 2009; Jiang 2007). Blinding of the outcome was obviously not possible in this review. Three studies (Daryaei 2009 ; Pessaux 2007 ; Hsu 2007) had clear definitions of inclusion and exclusion criteria. However in one of these (Hsu 2007), the randomisation appears to have been done prior to surgery despite the fact that one of the exclusion criteria was the type of surgery performed. The study participants were comparable within each study for relevant factors such as age, gender, diagnosis etc.

Effects of interventions

Time to Flatus: In the initial review, using only studies that provided precise standard deviations with the mean, there was a significant benefit to non-routine use of post-operative nasogastric decompression - No Tube, though this included only 8 studies. The remainder of the studies either presented no standard deviations, using instead "p" values or global statements of "significant" or "insignificant" results. Many other studies only presented median times to return of flatus (and therefore evidence of return of gastrointestinal function) usually with "p" values. An attempt was made to include these additional studies by imputing standard deviations from the "p" values using a technique described in a Cochrane Colloquium (but not apparently published) by Frederic Wolf and James Guevara. When results were described as "significant" a "p" value of 0.03 was assigned and for "insignificance" a "p" value of 0.3 was assigned. The broader inclusion resulted in an almost identical summary odds ratio in the meta-analysis, though somewhat narrower confidence intervals, (Graph 1-1) but with the introduction of significant heterogeneity.
All five of the studies in the first update(Carrere2006; Doglietto 2004; Goueffic 2005; Lei 2004; Zhou 2006) provided precise standatd deviations. Nevertheless the heterogeneity they introduced was significant and only disappeared when all but (Zhou 2006) were eliminated. There were certainly some odd standard deviations in two of the studies (Carrere2006; Goueffic 2005). In all analyses, whether in the initial review using precise standard deviations or in addtion of the five studies in the update or those in which the standard deviations were inputed, there was no benefit to nasogastric suction in hastening return of gastrointestinal function as measured by time to flatus. In fact there was an opposite effect with significant benefit to no tube. None of the five added studies individually showed any benefit of prophylactic nasogastric suction in time to flatus and all five concluded it was not necessary.
Looking only at patients having colon surgery and in studies providing precise standard deviations, an earlier return of bowel function was seen with "No Tube" (Graph 9-1). In the case of gastric resections there was an insignificant benefit to No Tube in time to flatus (Graph 10-1). There was significant heterogeneity in both analyses.

All four studies in the recent update (Daryaei 2009; Jiang 2007; Hsu 2007; Pessaux 2007) provided precise standard deviations. Surprisingly two of these (Daryaei 2009; Pessaux 2007) showed earyl return of bowel function with the tube while the other two studies (Hsu 2007; Jiang 2007)showed better results in the no tube group. However there was significant heterogeneity even prior to the addition of these four studies and it worsened with the addition of these studies. Funnel plot (Figure 1) shows slight assymetry but this is not surprising considering the presence of significant heterogeneity. All four studies in the present update however involved upper GI surgery only with Daryaei 2009 and Pessaux 2007 involving hepatic and oesophageal operations respectively, while the other two studies (Hsu 2007; Jiang 2007) involved gastric surgery. Therefore the findings for more distal GI surgery - colon etc remain unchnaged.

Figure 1. Funnel plot of comparison: 1 Time to Flatus, outcome: 1.1 Does Postoperative nasogastric decompression hasten recovery of gastrointestinal function?.



Pulmonary Complications: 27 studies reported the incidence of post-operative pulmonary complications (an amalgam in this report of pneumonia and atalectasis) by group and the non-routine use of nasogastric suction provided a benefit that approached statistical significance (Graph 2-1, OR = 1.45, CI = 1.10-1.92;), without evidence of statistical heterogeneity. A subgroup analysis of those studies looking only at individuals with colon surgery showed no difference in pulmonary complication risk (Graph 9-2; OR=1.93, CI=0.56-6.63). Among those individuals have upper gastrointestinal surgery the risk of pulmonary complications was lower with No Tube, (Graph 10-2; OR 1.49, CI 1.01- 2.21) with no statistical heterogeneity.

Wound Infection: 23 studies reported wound infections and the summary statistic showed that routine use of nasogastric decompression did not affect risk of wound infection, (Graph 3-1; p=0.30), with no statistical heterogeneity. In 7 studies of those having only upper gastrointestinal surgery there was no difference in wound infection risk (Graph 10-3; p=0.65) with no heterogeneity.

Anastomotic Leak: 13 studies reported anastomotic leak and there was no difference between groups in this outcome (Graph 6-1; p=0.58). In 6 studies of those having only colon surgery, there was also no difference in risk of anastomotic leak between groups (Graph 9-3; p=0.79), with no heterogeneity.

Incisional hernia: One study reported long term follow up for the development of ventral incisional hernia (Otchy 1995) and there was no difference between groups (Graph 7-1, p=0.09).

Length of Stay: 16 Studies reported mean length of stay with precise standard deviations, others with "p" values (Graph 4-1). Other studies often presented median lengths of stay . Most showed shorter length of stay with No Tube, though significant heterogeneity was encountered in calculation of a combined effect. Sensitivity analyses done in an attempt to find a specific cause for the heterogeneity were unsuccessful in that regard.

Gastric Upset: 25 Studies reported gastric upset in the post-operative period: vomiting (Graph 5-1). The majority showed more vomitting with No tube, but heterogeneity was encountered in the calculation of a combined effect.

Other outcomes were reported with insufficient frequency to be informative (Death, Reinsertion, Fever (often combined with Pulmonary Complications), Wound Dehiscence, and patient discomfort that is tube related).

Adverse Events: Though major adverse events have been reported directly related to tube insertion, such as intracranial insertion (Gianelli 1998) or esophageal perforation (Ahmed 1998), no adverse events specifically related to tube insertion were reported in any of the included studies.

DISCUSSION

There are three published meta-analysis (Cheadle 1985; Lawrence 2006; Yang 2008). Cheatham 1995 included 26 trials of which only 16 were RCTs and even in the sensitivity analysis of higher

quality trials, it included five non-randomized trials. A very broad range of outcome measures were included. The trials that reported each of those measures were not specified. The two comparison groups were participants who had a nasogastric tube until some point in the post-operative period in which intestinal recovery was perceived: flatus or feeding or defecation, and a group described as "selective use". This may be a more intelligent category than "no tube", since participants who needed to have a tube inserted because of vomiting or distension after surgery were therefore not treatment failures in that group but successful judgemental use of the tube. In addition, in most published RCTs, the nasogastric tube was in fact inserted in all participants in both groups but withdrawn in the latter group either in the operating room, recovery room or within 24 hours of surgery. In the selective group there was a significant risk of emesis, distention and tube insertion. In the tube group there was also a significant risk of pulmonary complications. No significant difference was seen for onset of feeding, pulmonary aspiration, wound infection, length of stay, death or overall complications. The inclusion of non-randomized studies and lack of specificity for the outcome measures weaken this publication.

Two more meta-analysis have been published since then (Lawrence 2006; Yang 2008). Yang 2008 included only RCT's that compared individuals with or without nasogastric or nasojejunal decompression after gastrectomy for gastric cancer (Doglietto 2004; Yoo 2002; Wu 1994; Lee 2002; Hsu 2007). Time to oral diet was significantly shorter in the group which did not use nasogastric or nasojejunal tube. Other parameters like time to flatus, anastomotic leakage, pulmonary complications and length of hospital stay were similar in both groups. Lawrence 2006 looked at a lot of factors related to postoperative pulmonary complications in noncardiothoracic studies, nasogastric tube being one of them. However it used data from the previous meta-analysis (Cheatham 1995) and also from our initial review.

By comparison only RCTs are included in this current systematic review and its update, with more focused outcome measures and more than twice as many RCTs over a broad range of abdominal surgery are included. The biggest problem encountered in this review is the nature of reporting of the continuous outcomes: "time to flatus" and "length of stay". In many cases only "p" values were reported rather than confidence intervals for each comparison group. A method of imputing confidence intervals from p values has been presented at a Cochrane Colloquium (Wolf & Guevara; unpublished), but the use of this method introduced significant heterogeneity (comparison graphs 1-1 and 8-1), almost certainly due to the imprecision introduced by this technique. In addition many other RCTs reported time to flatus and length of stay using medians and "p" values rather than means and confidence intervals, precluding inclusion of these studies in the meta-analysis. In the previous updated review significant statistical heterogeneity persisted for both these outcomes, in spite of precise standard deviations being presented in all 5 added studies. In the present update, there is again statistical heterogeneity in spite of precise standard deviations being presented in all 4 added studies. This might suggest that there is an inherent imprecision in the reporting of both these outcomes, yet they are key outcomes in the rationale for routine tube use.

Heterogeneity was not encountered in the meta-analyses for the outcome measures: Pulmonary Complications, Wound Infection, and Anastomotic Leak supporting the validity of the findings of those comparisons. Heterogeneity persisted despite sub-group analyses for Length of Stay, Time to Flatus and the measures of patient tolerance for the tube: Vomiting. Increased discomfort was routinely reported as more common in patients having routine use of the tube but its method of reporting was so variable that a combined effect for this outcome was not done.

AUTHORS' CONCLUSIONS

Implications for practice

Prophylactic nasogastric decompression following abdominal operations was undertaken with the intent of:
1 Hastening return of bowel function
2 By emptying the stomach, easing respiration and diminishing the risk of aspiration of gastric contents and therefore decreasing the risk of pulmonary complications
3 Increasing patient comfort, by lessening abdominal distension
4 Protect intestinal anastomoses and prevent anastomotic leakage
5 Shortening hospital stay
This review has shown that the intervention is ineffective in achieving any of these goals, and in fact significant benefit may be obtained by avoidance of prolonged intubation and only selective tube insertion when needed to relieve gastric symptoms.
Wound infection (and one of its most common sequellae, incisional hernia (Bucknall 1983; Yahchouchy 2003)) may be more common when routine intubation is avoided. The reasons for this are not clear.
Many surgeons already avoid routine intubation. Those that don't, probably should.

Implications for research

What don't we know? Not much. Routine use of the nasogastric tube for prophylaxis in the post-operative period hase been abandoned in many institutions. The previous update added 5 more studies in a broad range of surgical specialties and none of them supported the routine use of a nasogastric tube. This second update added 4 more studies and none of them have shown any benefit of routine use of nasogastric tube.
In regard to the primary benefits claimed for routine nasogastric decompression in the post operative laparotomy patient, this is an intervention that can, with this amount of data, be rightly abandoned.
The reasons for a possible increase in wound complications without routine nasogastric decompression need to be investigated further:
what specific aspects of intubation diminish these risks and what other measures might achieve the same goals, thus avoiding the adverse consequences of routine intubation.

ACKNOWLEDGEMENTS

This review was undertaken as a classroom exercise in the undergraduate Honors 201 Seminar of the Honors College of the University of Illinois at Chicago. All 17 students in the class participated in creation of a data abstraction form, literature search, study allocation, data abstraction, and imputation of standard deviations.

Two of these students, Bonnie Tse and Shmaecka Edwards continued on as co-authors of the first published version of this review but were not able to participate in the update.

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* Indicates the major publication for the study

CHARACTERISTICS OF STUDIES

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

Adekunle 1979

Methods	RCT
Participants	duodenal ulcer surgery
Interventions	NGT
Outcomes	Vomit Chest Compl. Wound Inf. UTI, death
Notes	21

Risk of bias

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

Bashey 1985

Methods	RCT
Participants	Cholecystectomy or vagotomy
Interventions	NGT
Outcomes	Vomit Chest Compl wound Inf. Length of stay Fever
Notes	23

Risk of bias

Bias	Authors' judgement	Support for judgement
Allocation concealment?	Unclear risk	D - Not used

Carrere2006

Methods	RCT
Participants	Gastrectomy
Interventions	NGT
Outcomes	Time to flatus, oral intake and LOS. Vomitting, nausea discomfort, sepsis and fistula, pneumonia
Notes	32 n= 43 tube and 41 no tube.

Risk of bias

Bias	Authors' judgement	Support for judgement
Allocation concealment?	Unclear risk	D - Not used

Cheadle 1985

Methods	RCT
Participants	Major Abdominal Surgery
Interventions	NGT Cimetidine 2x2 design
Outcomes	Chest Compl Wound Inf. Bloody vomit

Cheadle 1985 *(Continued)*

	death anast. leaks
Notes	5

Risk of bias

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

Colvin 1986

Methods	RCT
Participants	Abdominal Colorectal Surgery
Interventions	NGT Long tube
Outcomes	Time to flatus Length of stay Chest Compl. leak, bleeding other GI dysf.
Notes	new

Risk of bias

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

Cunningham 1992

Methods	RCT
Participants	Abdominal colorectal or small bowel surgery
Interventions	NGT
Outcomes	Time to flatus Vomit Cjest Compl Wound inf Anast. leak
Notes	15

Risk of bias

Bias	Authors' judgement	Support for judgement

Cunningham 1992 *(Continued)*

Allocation concealment?	Low risk	A - Adequate

Cutillo 1999

Methods	RCT
Participants	Gyne Onc.
Interventions	NGT
Outcomes	Vomit Time to flatus Nausea
Notes	20

Risk of bias

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

Daryaei 2009

Methods	RCT
Participants	oesophagectomy for oesophageal cancer
Interventions	NGT
Outcomes	time to flatus pneumonia/ atelectasis vomiting wound infection anastomotic leak
Notes	n=22 tube and 18 no tube

Doglietto 2004

Methods	RCT
Participants	Gastrectomy
Interventions	NGT
Outcomes	Leak of esophago-jejunostomy. Time to flatus, oral intake, LOS, pneumonia, mortality, SWI

Doglietto 2004 *(Continued)*

Notes	34 n=115 Tube and 120 No tube

Risk of bias

Bias	Authors' judgement	Support for judgement
Allocation concealment?	Unclear risk	D - Not used

Edlund 1979

Methods	RCT
Participants	Cholecystectomy
Interventions	NGT drains in 2x2 design
Outcomes	vomit fever
Notes	25

Risk of bias

Bias	Authors' judgement	Support for judgement
Allocation concealment?	Unclear risk	D - Not used

Friedman 1996

Methods	RCT
Participants	Abdominal Aortic Surgery
Interventions	NGT
Outcomes	Lenght of stay Time to oral fluids Tubes replaced
Notes	13

Risk of bias

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

Goueffic 2005

Methods	RCT
Participants	Infra-renal arotic surgery
Interventions	NGT
Outcomes	Time to flatus, pneumonia, emeses, LOS, nausea, vomitting, length of ICU stay, morphine consumption
Notes	35 N=20 @

Risk of bias

Bias	Authors' judgement	Support for judgement
Allocation concealment?	Unclear risk	D - Not used

Hsu 2007

Methods	RCT
Participants	gastric cancer surgery
Interventions	NGT
Outcomes	time to flatus and defecation time to oral intake chest complications vomiting wound infection anastomotic leak wound dehiscence hospital stay
Notes	tube:76; no tube:75

Risk of bias

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

Hyland 1980

Methods	RCT
Participants	Cholecystectomy

Hyland 1980 *(Continued)*

Interventions	NGT
Outcomes	Chest Compl Lenght of stay
Notes	22

Risk of bias

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

Jiang 2007

Methods	RCT
Participants	D2 gastrectomy
Interventions	NGT
Outcomes	time to flatus hospital stay duration of IV fluids
Notes	

Risk of bias

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

Knoepp 1999

Methods	RCT
Participants	Trauma laparotomy
Interventions	NGT
Outcomes	Failure (vomit, distenton or other) length of stay
Notes	30

Risk of bias

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

Koukouras 2001

Methods	RCT
Participants	Abdominal surgery
Interventions	NGT
Outcomes	Time to flatus Chest Compl. Wound Inf. vomit nausea anast. leak UTI others
Notes	18

Risk of bias

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

Lee 2002

Methods	RCT
Participants	Gastric Cancer
Interventions	NGT
Outcomes	Time to flatus Chest Compl. Wound Inf. Nausea vomit length of stay reinsertion
Notes	10

Risk of bias

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

Lei 2004

Methods	RCT

Lei 2004 *(Continued)*

Participants	Small or large bowel resection
Interventions	NGT
Outcomes	leak, dilation, pulmonary infection, SWI, pharyngitis. Time to stool, feces,
Notes	36 n=186 tube and 181 no tube

Risk of bias

Bias	Authors' judgement	Support for judgement
Allocation concealment?	Unclear risk	D - Not used

Miller 1972

Methods	RCT
Participants	Vagotomy
Interventions	NGT Gastrostomy no tube
Outcomes	Chest Compl wound inf. dysphagia patient preference
Notes	28 rand. by month of birth

Risk of bias

Bias	Authors' judgement	Support for judgement
Allocation concealment?	High risk	C - Inadequate

Montgomery 1996

Methods	RCT
Participants	Abdominal surgery
Interventions	NGT: n9o tube versus tube at surgeons discretion (18/37) plus 12 of 88 dropoouts
Outcomes	Time to flatus length of stay pneumonia anast. leak

Montgomery 1996 *(Continued)*

	etc.
Notes	only 19 got tubes of 88 randomized 3

Risk of bias

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

Nathan 1991

Methods	RCT
Participants	Abdominal surgery
Interventions	NGT
Outcomes	Time to flatus Chest compl wound inf UTI anast. leak vomit fever etc.
Notes	bar graph without outliers 1

Risk of bias

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

Olesen 1983

Methods	RCT
Participants	Abd. colorectal surgery
Interventions	NGT
Outcomes	Time to flatus nausea vomit
Notes	table without specifying outliers 4

Risk of bias

Olesen 1983 *(Continued)*

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

Ortiz 1996

Methods	RCT
Participants	Abd. colorectal surgery
Interventions	NGT
Outcomes	Time to intake Pneumonia wound inf. anast. leak UTI etc.
Notes	new- line graph without specifying outliers new

Risk of bias

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

Otchy 1995

Methods	RCT
Participants	f/u of Wolff CRS
Interventions	NGT
Outcomes	Ventral Hernia
Notes	9**

Risk of bias

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

Pearl 1996

Methods	RCT
Participants	Gyne Onc.
Interventions	NGT
Outcomes	time to flatus Chest compl fever naus/vomit length of stay QOL stuff
Notes	12

Risk of bias

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

Pessaux 2007

Methods	RCT
Participants	Liver resection
Interventions	NGT
Outcomes	time to oral intake time to flatus chest complucations vomiting surgical wound infections anastomotic leaks duration of hospital stay
Notes	tube:100; no tube:100

Petrelli 1993

Methods	RCT
Participants	Abd. colorectal surgery
Interventions	NGT
Outcomes	time to oral intake nausea

Petrelli 1993 *(Continued)*

	vomit fever chest compl
Notes	14

Risk of bias

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

Racette 1987

Methods	RCT
Participants	colon surgery
Interventions	NGT
Outcomes	chest compl naus/vomit anast. leak wound inf.
Notes	2

Risk of bias

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

Reasbeck 1984

Methods	RCT
Participants	GI surgery
Interventions	NGT
Outcomes	vomit Chest compl wound inf anast.leak UTI length of stay
Notes	11

Risk of bias

Bias	Authors' judgement	Support for judgement

Reasbeck 1984 *(Continued)*

Allocation concealment?	Unclear risk	B - Unclear

Sakadamis 1999

Methods	RCT
Participants	Abdominal surgery
Interventions	NGT
Outcomes	time to flatus length of stay anast. leak Chest compl wound inf. nausea vomit QOL stuff
Notes	31

Risk of bias

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

Savassi-Rocha 1992

Methods	RCT
Participants	GI surgery
Interventions	NGT
Outcomes	time to intake length of stay tube insertion
Notes	16

Risk of bias

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

Sitges-Serra 1984

Methods	RCT

Sitges-Serra 1984 *(Continued)*

Participants	vagotomy and pylorectomy
Interventions	NGT Gastrostomy no tube
Outcomes	chest compl time to intake length of stay
Notes	27

Risk of bias

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

Wolff 1989

Methods	RCT
Participants	Abd.colorectal surgery
Interventions	NGT
Outcomes	time to flatus nausea vomit hernia (via otchy)
Notes	9

Risk of bias

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

Wu 1994

Methods	RCT
Participants	Gastrectomy
Interventions	NGT
Outcomes	time to diet naus/vomit reinsertion
Notes	7

Wu 1994 *(Continued)*

Risk of bias

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

Yoo 2002

Methods	RCT
Participants	Gastrectomy
Interventions	NGT
Outcomes	time to flatus length of stay reinsertion fever naus/vomit anast. leak chest compl. wounf inf. eetc
Notes	8

Risk of bias

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

Zhou 2006

Methods	RCT
Participants	Colorectostomy
Interventions	NGT
Outcomes	Time to flatus, stoo & LOS. Leak, fever, sepsis, pulmonary complications, pahrygitis
Notes	33 n=155 Tube and 161 No tube

Risk of bias

Bias	Authors' judgement	Support for judgement
Allocation concealment?	Unclear risk	D - Not used

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

Study	Reason for exclusion
Akbaba 2004	Non-randomized study
Chung 2003	Non-randomized study
Di Saverio 1988	Non randomized trial
Hoffmann 2001	The study groups were nasogastric tube versus gastrostomy tube. There was no No-tube control.
Kerger 2009	Non randomized trial
Manning 2001	The only outcome measured was reflux which was outside of our protocol.
Michowitz 1988	No group had the nasogastric tube in place until some sign of return to bowel function - all were variations of short term insertion.

Characteristics of studies awaiting assessment *[ordered by study ID]*

Ibrahim 1977

Methods	not stated
Participants	53 pts received nasogastric suction, 23 pts did not
Interventions	Postoperative nasogastric suction
Outcomes	not stated
Notes	Published in South Med J 1977; 70(9): 1070-1

DATA AND ANALYSES

Comparison 1. Time to Flatus

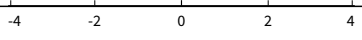
Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Does Postoperative nasogastric decompression hasten recovery of gastrointestinal function?	26	4711	Mean Difference (IV, Fixed, 95% CI)	0.51 [0.45, 0.56]

Analysis 1.1. Comparison 1 Time to Flatus, Outcome 1 Does Postoperative nasogastric decompression hasten recovery of gastrointestinal function?.

Study or subgroup	Tube		No tube		Mean Difference	Weight	Mean Difference
	N	Mean(SD)	N	Mean(SD)	Fixed, 95% CI		Fixed, 95% CI
Cheadle 1985	100	3.1 (1.8)	100	2.5 (2.3)		0.86%	0.6[0.03,1.17]
Friedman 1996	40	4.9 (1.7)	40	4.1 (1.4)		0.62%	0.8[0.13,1.47]
Montgomery 1996	37	4.3 (2.2)	39	4.5 (0.3)		0.53%	-0.18[-0.9,0.54]
Koukouras 2001	50	4.1 (1.4)	50	3.4 (1.4)		0.93%	0.7[0.15,1.25]
Olesen 1983	46	3.2 (1)	51	2.7 (1)		1.88%	0.5[0.12,0.88]
Nathan 1991	97	3.4 (0.7)	100	3.3 (0.8)		6.9%	0.06[-0.14,0.26]
Wolff 1989	274	3.9 (0)	261	3.9 (0)			Not estimable
Lee 2002	70	3.8 (0.9)	66	3.5 (0.9)		3.05%	0.3[-0,0.6]
Cunningham 1992	50	4.2 (2.6)	52	3.1 (2.6)		0.27%	1.09[0.08,2.1]
Savassi-Rocha 1992	57	3.4 (1.5)	52	3.7 (1.5)		0.88%	-0.3[-0.86,0.26]
Pearl 1996	55	4.3 (1.7)	54	3.6 (1.3)		0.87%	0.7[0.13,1.27]
Racette 1987	28	4 (0.4)	28	3.9 (0.4)		7.85%	0.1[-0.09,0.29]
Sitges-Serra 1984	22	3.4 (1.3)	22	4.5 (1.3)		0.45%	-1.1[-1.89,-0.31]
Sakadamis 1999	500	3.3 (1.1)	500	2.7 (1.1)		14.75%	0.53[0.39,0.67]
Carrere2006	43	4.5 (0.2)	41	3.7 (0.2)		38.15%	0.8[0.71,0.89]
Doglietto 2004	116	4.6 (1.3)	121	4.5 (1.7)		1.89%	0.1[-0.28,0.48]
Goueffic 2005	20	6 (3)	20	2.6 (0.9)		0.15%	3.45[2.08,4.82]
Lei 2004	186	3.2 (1.1)	182	3.2 (1.3)		4.6%	0[-0.25,0.25]
Zhou 2006	155	3.6 (1.2)	161	3 (0.9)		5.08%	0.6[0.37,0.83]
Daryaei 2009	22	4.2 (1.3)	18	4.5 (2.3)		0.2%	-0.3[-1.49,0.89]
Pessaux 2007	100	4.3 (1.5)	100	4.5 (1.7)		1.41%	-0.2[-0.64,0.24]
Hsu 2007	76	4.1 (1)	75	4 (0.6)		4.05%	0.1[-0.16,0.36]
Jiang 2007	40	4.5 (0.9)	40	3.3 (0.4)		3%	1.2[0.89,1.51]
Colvin 1986	44	5.1 (2.1)	46	4 (1.4)		0.51%	1.07[0.33,1.81]
Ortiz 1996	95	4.3 (2.1)	95	4.7 (2.1)		0.81%	-0.4[-0.99,0.19]
Wu 1994	37	4.3 (2.3)	37	4.2 (1.9)		0.3%	0.1[-0.86,1.06]
Total ***	**2360**		**2351**			**100%**	**0.51[0.45,0.56]**

Heterogeneity: $Tau^2=0$; $Chi^2=205.46$, df=24(P<0.0001); $I^2=88.32\%$

Test for overall effect: Z=18.83(P<0.0001)

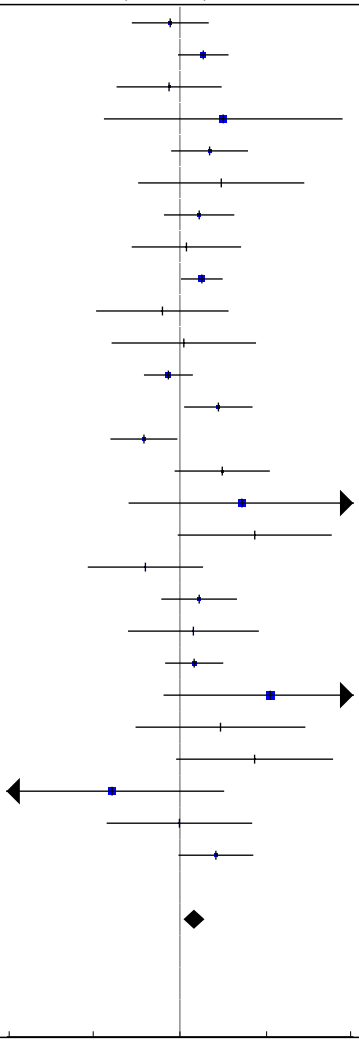


Comparison 2. Pulmonary Complications

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Does post-operative nasogastric decompression diminish the risk of pulmonary complications?	27	4328	Risk Ratio (M-H, Random, 95% CI)	1.45 [1.10, 1.92]

Analysis 2.1. Comparison 2 Pulmonary Complications, Outcome 1 Does post-operative nasogastric decompression diminish the risk of pulmonary complications?.

Study or subgroup	Tube n/N	No tube n/N	Risk Ratio M-H, Random, 95% CI	Weight	Risk Ratio M-H, Random, 95% CI
Nathan 1991	6/97	8/100		4.97%	0.77[0.28,2.15]
Adekunle 1979	20/84	11/86		8.04%	1.86[0.95,3.64]
Bashey 1985	3/26	4/26		3.14%	0.75[0.19,3.03]
Montgomery 1996	1/37	0/39		0.73%	3.16[0.13,75.16]
Cheadle 1985	11/100	5/100		4.97%	2.2[0.79,6.1]
Hyland 1980	3/30	1/30		1.43%	3[0.33,27.23]
Koukouras 2001	10/50	6/50		5.59%	1.67[0.66,4.24]
Yoo 2002	4/64	3/57		2.94%	1.19[0.28,5.08]
Miller 1972	24/47	12/42		9.47%	1.79[1.03,3.11]
Lee 2002	2/70	3/66		2.14%	0.63[0.11,3.64]
Olesen 1983	2/46	2/51		1.84%	1.11[0.16,7.55]
Pearl 1996	12/55	16/54		8.32%	0.74[0.39,1.41]
Petrelli 1993	15/40	5/37		5.78%	2.78[1.12,6.88]
Racette 1987	5/28	13/28		5.94%	0.38[0.16,0.94]
Reasbeck 1984	8/45	3/52		3.65%	3.08[0.87,10.92]
Cunningham 1992	2/50	0/52		0.8%	5.2[0.26,105.62]
Savassi-Rocha 1992	8/57	1/52		1.64%	7.3[0.94,56.39]
Sitges-Serra 1984	2/22	5/22		2.7%	0.4[0.09,1.85]
Sakadamis 1999	10/500	6/500		5.08%	1.67[0.61,4.55]
Carrere2006	3/43	2/41		2.18%	1.43[0.25,8.13]
Doglietto 2004	14/116	10/121		7%	1.46[0.68,3.16]
Goueffic 2005	5/20	0/20		0.9%	11[0.65,186.62]
Lei 2004	3/186	1/182		1.38%	2.94[0.31,27.96]
Zhou 2006	7/155	1/161		1.59%	7.27[0.91,58.41]
Daryaei 2009	0/22	2/18		0.82%	0.17[0.01,3.24]
Hsu 2007	2/76	2/75		1.81%	0.99[0.14,6.82]
Pessaux 2007	13/100	5/100		5.15%	2.6[0.96,7.02]
Total (95% CI)	**2166**	**2162**		**100%**	**1.45[1.1,1.92]**
Total events: 195 (Tube), 127 (No tube)					
Heterogeneity: Tau^2=0.13; Chi^2=36.15, df=26(P=0.09); I^2=28.08%					
Test for overall effect: Z=2.64(P=0.01)					

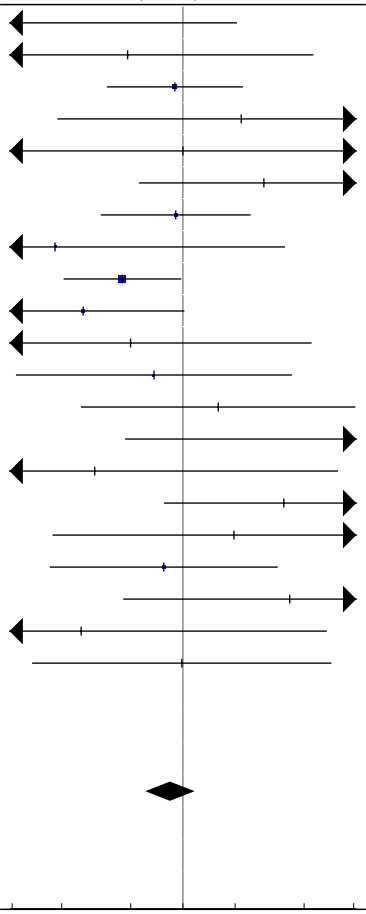


Comparison 3. Wound Infection

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Does post-operative nasogastric decompression diminish the risk if wound infection?	23	3968	Odds Ratio (M-H, Fixed, 95% CI)	0.84 [0.61, 1.17]

Analysis 3.1. Comparison 3 Wound Infection, Outcome 1 Does post-operative nasogastric decompression diminish the risk if wound infection?.

Study or subgroup	Tube n/N	No tube n/N	Odds Ratio M-H, Fixed, 95% CI	Weight	Odds Ratio M-H, Fixed, 95% CI
Adekunle 1979	0/84	4/86		5.6%	0.11[0.01,2.05]
Bashey 1985	1/26	2/26		2.44%	0.48[0.04,5.65]
Cheadle 1985	10/100	11/100		12.54%	0.9[0.36,2.22]
Montgomery 1996	2/37	1/39		1.17%	2.17[0.19,25.01]
Koukouras 2001	1/50	1/50		1.24%	1[0.06,16.44]
Miller 1972	6/47	2/42		2.33%	2.93[0.56,15.37]
Nathan 1991	8/97	9/100		10.3%	0.91[0.34,2.46]
Lee 2002	0/70	2/66		3.24%	0.18[0.01,3.88]
Pearl 1996	17/55	27/54		23.85%	0.45[0.2,0.98]
Reasbeck 1984	3/45	11/52		12.07%	0.27[0.07,1.02]
Sakadamis 1999	1/500	2/500		2.53%	0.5[0.05,5.52]
Cunningham 1992	2/50	3/52		3.58%	0.68[0.11,4.25]
Yoo 2002	3/64	2/67		2.36%	1.6[0.26,9.89]
Savassi-Rocha 1992	4/57	0/52		0.61%	8.83[0.46,168.14]
Carrere2006	0/43	1/41		1.92%	0.31[0.01,7.84]
Doglietto 2004	7/116	2/121		2.33%	3.82[0.78,18.79]
Lei 2004	2/186	1/182		1.27%	1.97[0.18,21.89]
Zhou 2006	3/155	4/161		4.88%	0.77[0.17,3.52]
Pessaux 2007	4/100	1/100		1.22%	4.13[0.45,37.57]
Daryaei 2009	0/22	1/18		2.04%	0.26[0.01,6.76]
Hsu 2007	2/76	2/75		2.48%	0.99[0.14,7.19]
Goueffic 2005	0/1	0/1			Not estimable
Hyland 1980	0/1	0/1			Not estimable
Total (95% CI)	**1982**	**1986**		**100%**	**0.84[0.61,1.17]**
Total events: 76 (Tube), 89 (No tube)					
Heterogeneity: Tau^2=0; Chi^2=21.13, df=20(P=0.39); I^2=5.36%					
Test for overall effect: Z=1.04(P=0.3)					

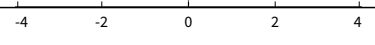


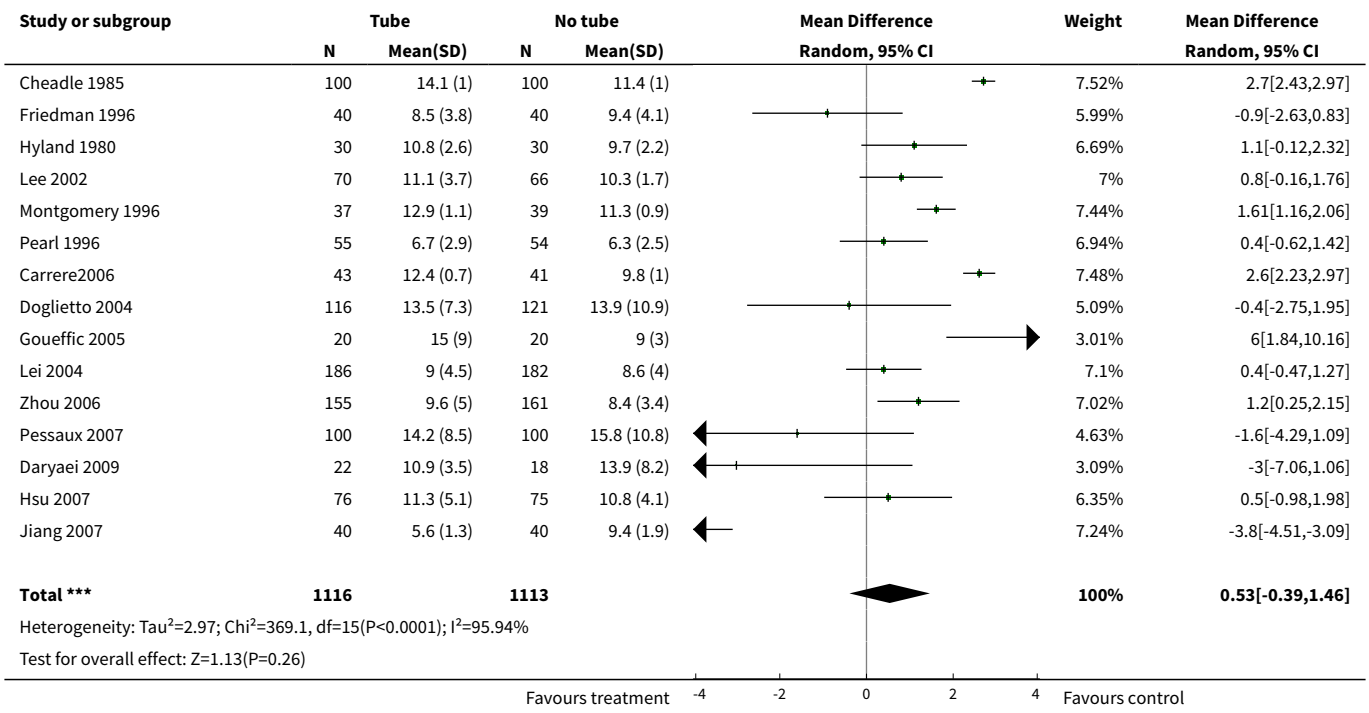
Comparison 4. Length of Post-operative Stay

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Does post-operative nasogastric decompression shorten the lenght of stay?	16	2229	Mean Difference (IV, Random, 95% CI)	0.53 [-0.39, 1.46]

Analysis 4.1. Comparison 4 Length of Post-operative Stay, Outcome 1 Does post-operative nasogastric decompression shorten the lenght of stay?.

Study or subgroup	Tube N	Tube Mean(SD)	No tube N	No tube Mean(SD)	Mean Difference Random, 95% CI	Weight	Mean Difference Random, 95% CI
Bashey 1985	26	10.3 (1.1)	26	9.6 (0.6)		7.42%	0.7[0.22,1.18]





Study or subgroup	Tube N	Tube Mean(SD)	No tube N	No tube Mean(SD)	Mean Difference Random, 95% CI	Weight	Mean Difference Random, 95% CI
Cheadle 1985	100	14.1 (1)	100	11.4 (1)		7.52%	2.7[2.43,2.97]
Friedman 1996	40	8.5 (3.8)	40	9.4 (4.1)		5.99%	-0.9[-2.63,0.83]
Hyland 1980	30	10.8 (2.6)	30	9.7 (2.2)		6.69%	1.1[-0.12,2.32]
Lee 2002	70	11.1 (3.7)	66	10.3 (1.7)		7%	0.8[-0.16,1.76]
Montgomery 1996	37	12.9 (1.1)	39	11.3 (0.9)		7.44%	1.61[1.16,2.06]
Pearl 1996	55	6.7 (2.9)	54	6.3 (2.5)		6.94%	0.4[-0.62,1.42]
Carrere2006	43	12.4 (0.7)	41	9.8 (1)		7.48%	2.6[2.23,2.97]
Doglietto 2004	116	13.5 (7.3)	121	13.9 (10.9)		5.09%	-0.4[-2.75,1.95]
Goueffic 2005	20	15 (9)	20	9 (3)		3.01%	6[1.84,10.16]
Lei 2004	186	9 (4.5)	182	8.6 (4)		7.1%	0.4[-0.47,1.27]
Zhou 2006	155	9.6 (5)	161	8.4 (3.4)		7.02%	1.2[0.25,2.15]
Pessaux 2007	100	14.2 (8.5)	100	15.8 (10.8)		4.63%	-1.6[-4.29,1.09]
Daryaei 2009	22	10.9 (3.5)	18	13.9 (8.2)		3.09%	-3[-7.06,1.06]
Hsu 2007	76	11.3 (5.1)	75	10.8 (4.1)		6.35%	0.5[-0.98,1.98]
Jiang 2007	40	5.6 (1.3)	40	9.4 (1.9)		7.24%	-3.8[-4.51,-3.09]
Total * **	**1116**		**1113**			**100%**	**0.53[-0.39,1.46]**

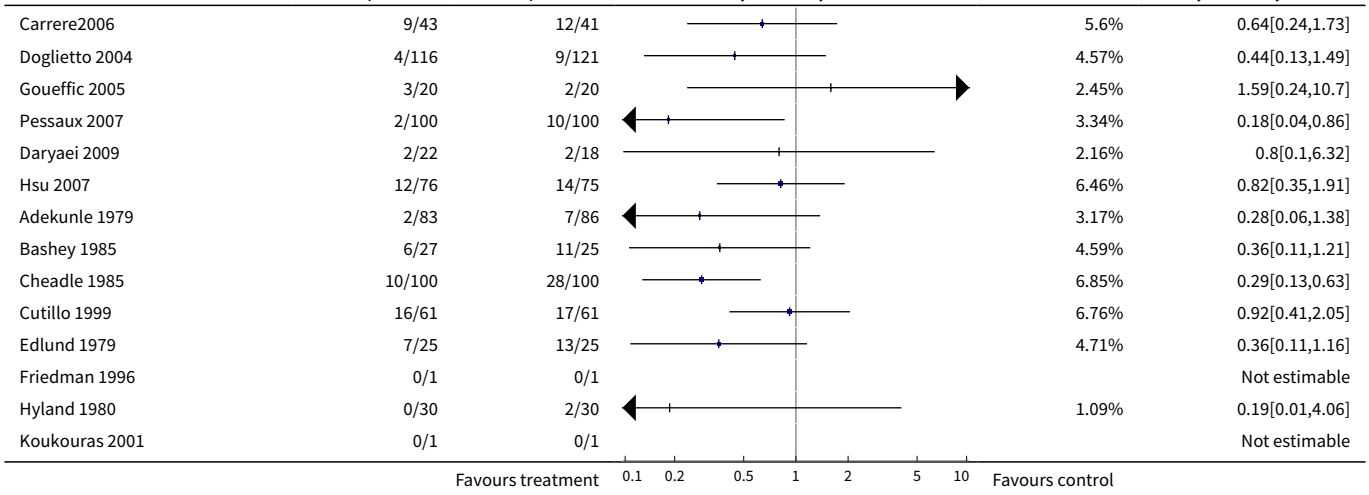
Heterogeneity: Tau²=2.97; Chi²=369.1, df=15(P<0.0001); I²=95.94%

Test for overall effect: Z=1.13(P=0.26)

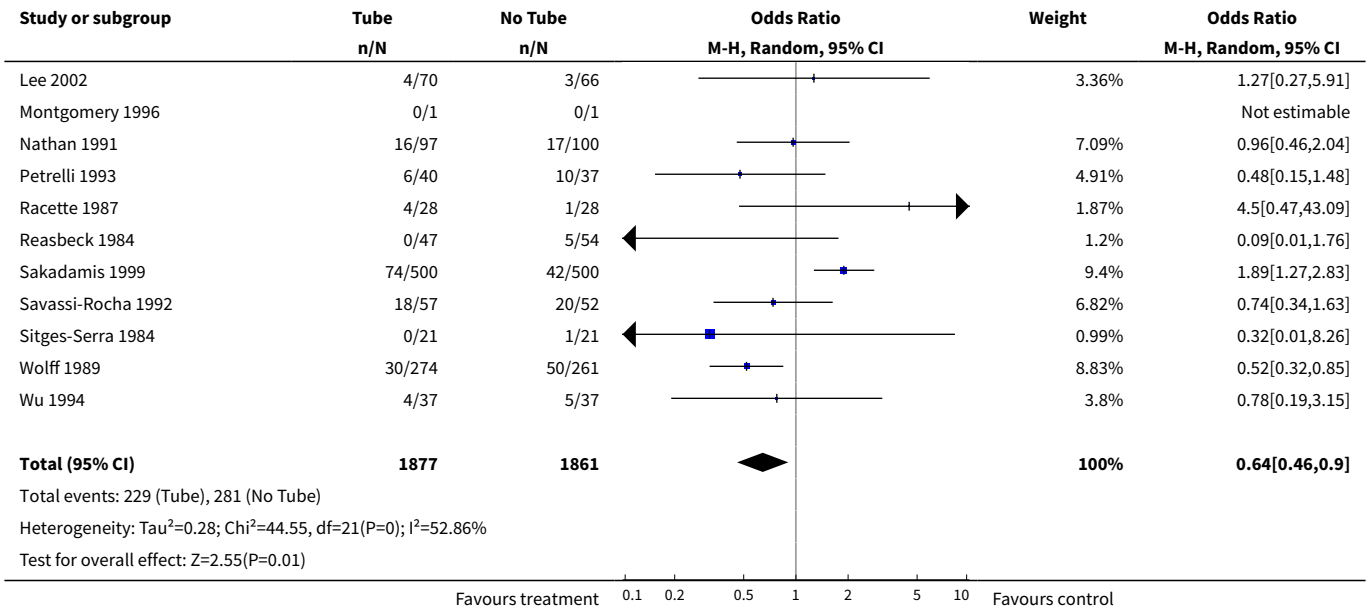
Comparison 5. Gastric upset

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 How many patients have gastric upset (vomiting)?	25	3738	Odds Ratio (M-H, Random, 95% CI)	0.64 [0.46, 0.90]

Analysis 5.1. Comparison 5 Gastric upset, Outcome 1 How many patients have gastric upset (vomiting)?.



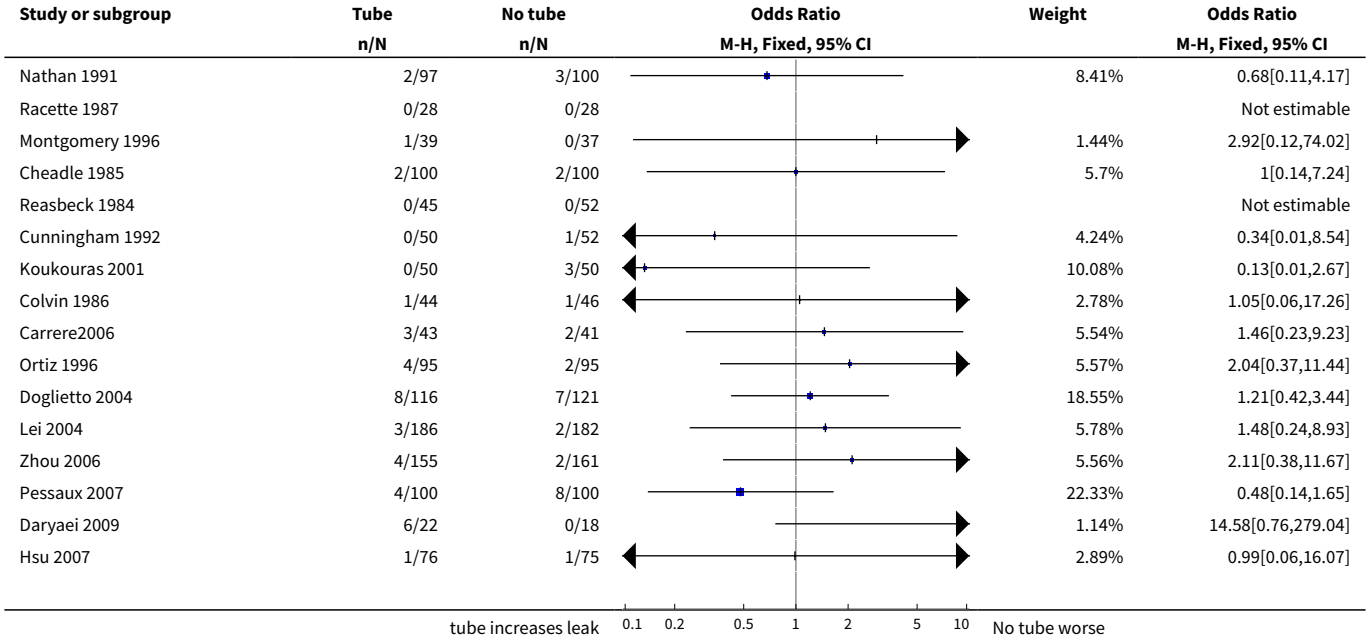
Study or subgroup	Tube n/N	No Tube n/N	Odds Ratio M-H, Random, 95% CI	Weight	Odds Ratio M-H, Random, 95% CI
Carrere2006	9/43	12/41		5.6%	0.64[0.24,1.73]
Doglietto 2004	4/116	9/121		4.57%	0.44[0.13,1.49]
Goueffic 2005	3/20	2/20		2.45%	1.59[0.24,10.7]
Pessaux 2007	2/100	10/100		3.34%	0.18[0.04,0.86]
Daryaei 2009	2/22	2/18		2.16%	0.8[0.1,6.32]
Hsu 2007	12/76	14/75		6.46%	0.82[0.35,1.91]
Adekunle 1979	2/83	7/86		3.17%	0.28[0.06,1.38]
Bashey 1985	6/27	11/25		4.59%	0.36[0.11,1.21]
Cheadle 1985	10/100	28/100		6.85%	0.29[0.13,0.63]
Cutillo 1999	16/61	17/61		6.76%	0.92[0.41,2.05]
Edlund 1979	7/25	13/25		4.71%	0.36[0.11,1.16]
Friedman 1996	0/1	0/1			Not estimable
Hyland 1980	0/30	2/30		1.09%	0.19[0.01,4.06]
Koukouras 2001	0/1	0/1			Not estimable

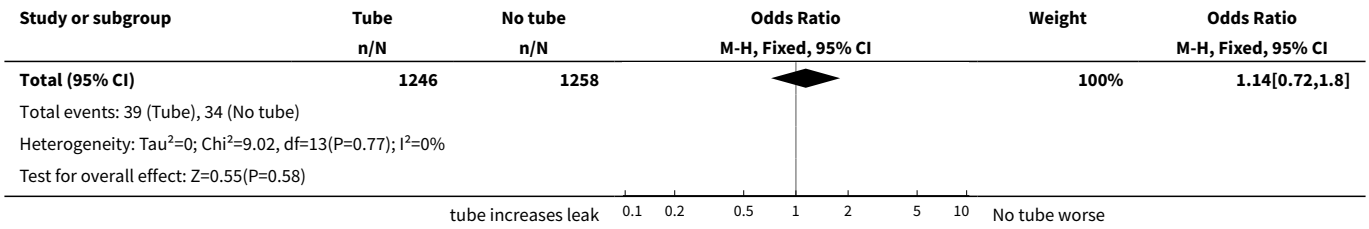


Comparison 6. Anastomotic Leak

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Does the nasogastric tube prevent anastomotic leak?	16	2504	Odds Ratio (M-H, Fixed, 95% CI)	1.14 [0.72, 1.80]

Analysis 6.1. Comparison 6 Anastomotic Leak, Outcome 1 Does the nasogastric tube prevent anastomotic leak?.

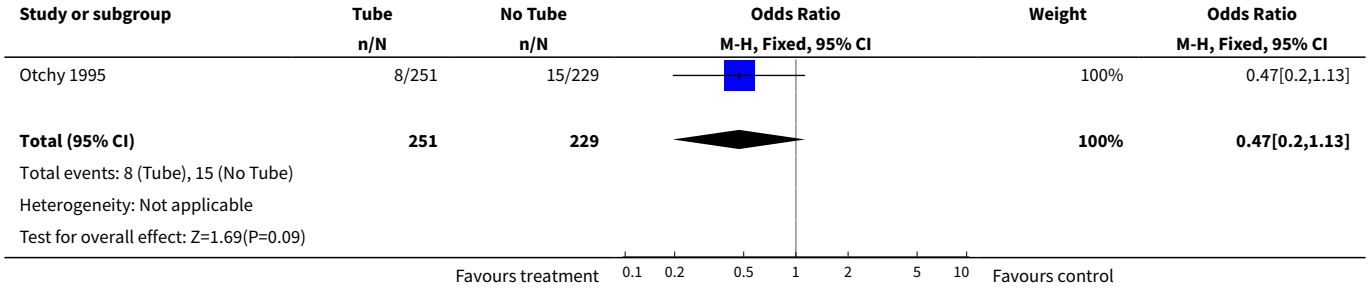




Comparison 7. Incisional Hernia

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Does NG Tube use lessen the Risk of Incisional Hernia?	1	480	Odds Ratio (M-H, Fixed, 95% CI)	0.47 [0.20, 1.13]

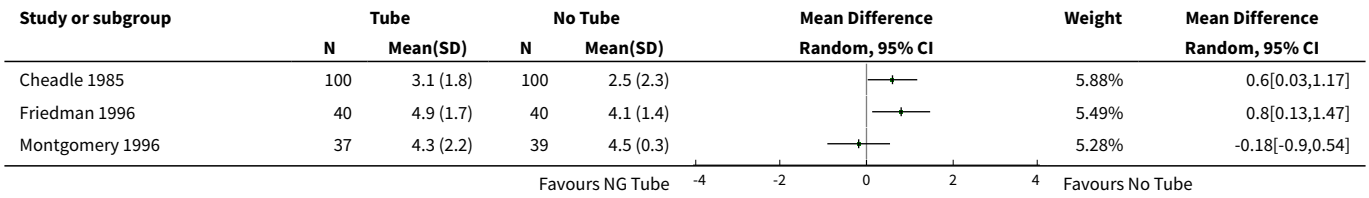
Analysis 7.1. Comparison 7 Incisional Hernia, Outcome 1 Does NG Tube use lessen the Risk of Incisional Hernia?.

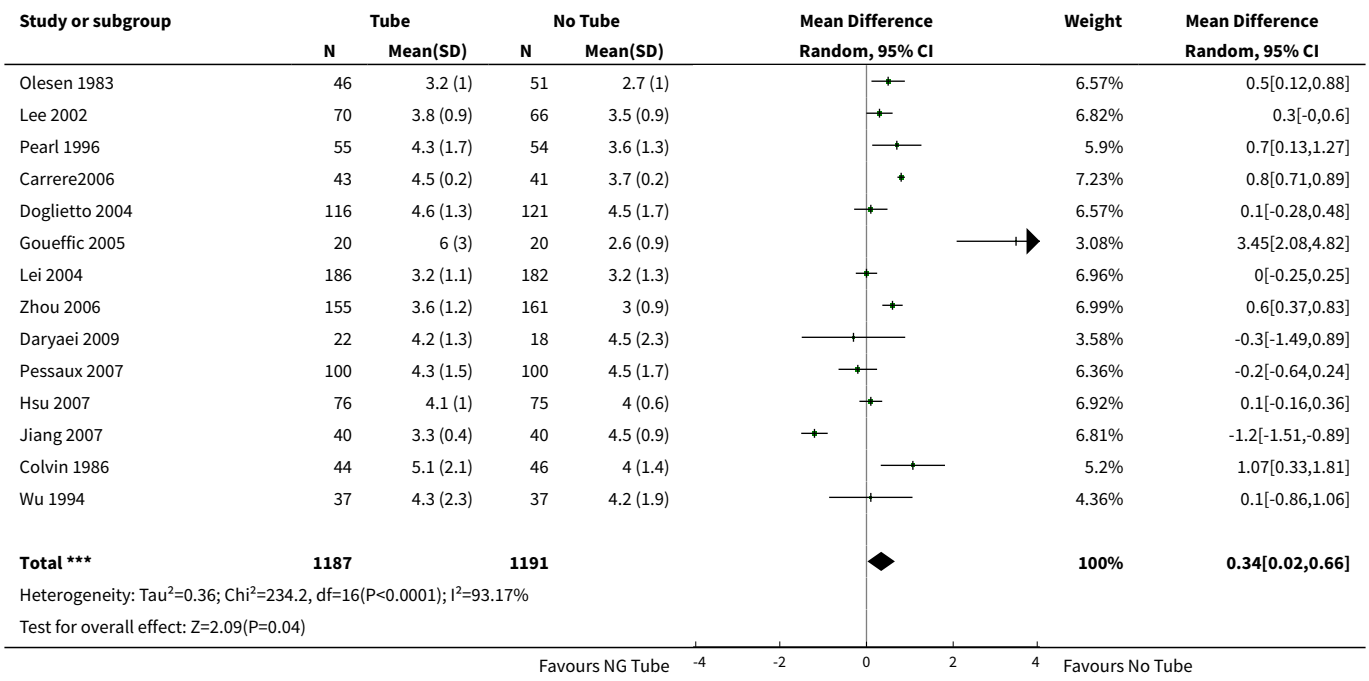


Comparison 8. Sensitivity Analysis: Time to Flatus

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Time To Flatus: Only Studies providing precise Standard Deviations	17	2378	Mean Difference (IV, Random, 95% CI)	0.34 [0.02, 0.66]

Analysis 8.1. Comparison 8 Sensitivity Analysis: Time to Flatus, Outcome 1 Time To Flatus: Only Studies providing precise Standard Deviations.

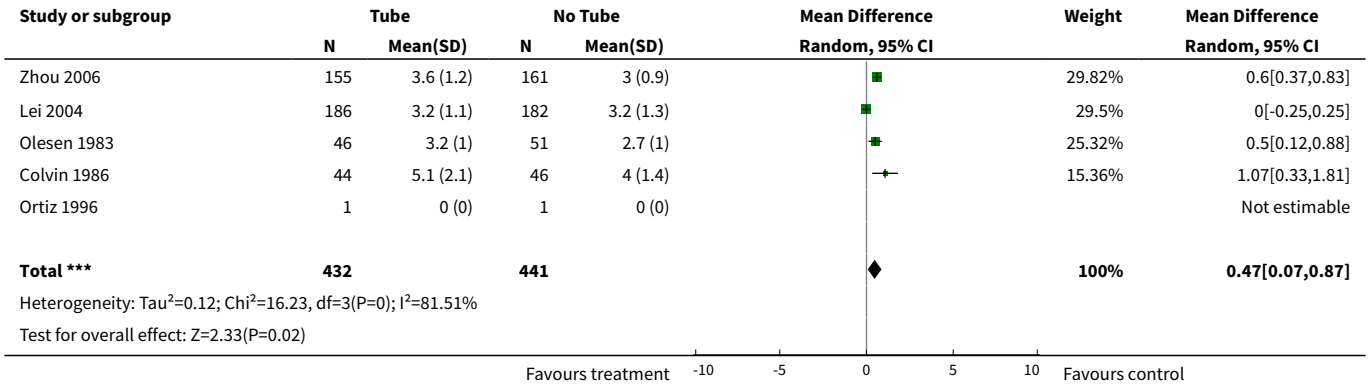




Comparison 9. Colon Surgery

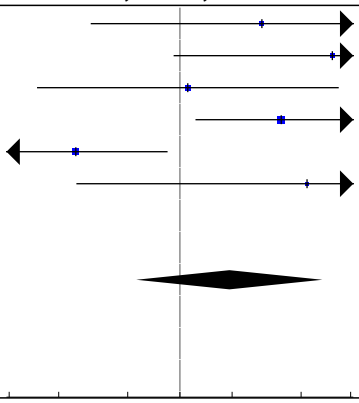
Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Time To Flatus	5	873	Mean Difference (IV, Random, 95% CI)	0.47 [0.07, 0.87]
2 Pulmonary Complications	7	1018	Odds Ratio (M-H, Random, 95% CI)	1.93 [0.56, 6.63]
3 Anastomotic Leak	6	1122	Odds Ratio (M-H, Fixed, 95% CI)	1.13 [0.46, 2.74]

Analysis 9.1. Comparison 9 Colon Surgery, Outcome 1 Time To Flatus.



Analysis 9.2. Comparison 9 Colon Surgery, Outcome 2 Pulmonary Complications.

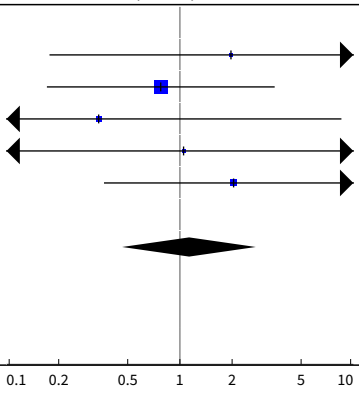
Study or subgroup	Tube n/N	No Tube n/N	Odds Ratio M-H, Random, 95% CI	Weight	Odds Ratio M-H, Random, 95% CI
Lei 2004	3/186	1/182		14.28%	2.97[0.31,28.79]
Zhou 2006	7/155	1/161		15.32%	7.57[0.92,62.24]
Olesen 1983	2/46	2/51		16.02%	1.11[0.15,8.24]
Petrelli 1993	15/40	5/37		22.37%	3.84[1.23,12]
Racette 1987	5/28	13/28		21.76%	0.25[0.07,0.85]
Cunningham 1992	2/50	0/52		10.25%	5.41[0.25,115.59]
Ortiz 1996	0/1	0/1			Not estimable
Total (95% CI)	**506**	**512**		**100%**	**1.93[0.56,6.63]**
Total events: 34 (Tube), 22 (No Tube)					
Heterogeneity: Tau^2=1.44; Chi^2=14.26, df=5(P=0.01); I^2=64.94%					
Test for overall effect: Z=1.04(P=0.3)					



Favours treatment — Favours control

Analysis 9.3. Comparison 9 Colon Surgery, Outcome 3 Anastomotic Leak.

Study or subgroup	Tube n/N	No Tube n/N	Odds Ratio M-H, Fixed, 95% CI	Weight	Odds Ratio M-H, Fixed, 95% CI
Racette 1987	0/28	0/28			Not estimable
Lei 2004	2/186	1/182		10.9%	1.97[0.18,21.89]
Zhou 2006	3/155	4/161		41.94%	0.77[0.17,3.52]
Cunningham 1992	0/50	1/52		15.88%	0.34[0.01,8.54]
Colvin 1986	1/44	1/46		10.41%	1.05[0.06,17.26]
Ortiz 1996	4/95	2/95		20.88%	2.04[0.37,11.44]
Total (95% CI)	**558**	**564**		**100%**	**1.13[0.46,2.74]**
Total events: 10 (Tube), 9 (No Tube)					
Heterogeneity: Tau^2=0; Chi^2=1.43, df=4(P=0.84); I^2=0%					
Test for overall effect: Z=0.27(P=0.79)					



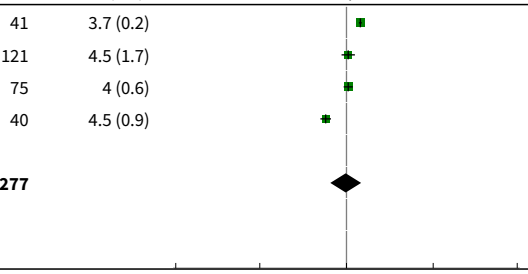
Favours treatment — Favours control

Comparison 10. Gastroduodenal Surgery

Outcome or subgroup title	No. of studies	No. of participants	Statistical method	Effect size
1 Time to flatus	4	552	Mean Difference (IV, Random, 95% CI)	-0.04 [-0.93, 0.84]
2 Pulmonary Complications	9	1085	Odds Ratio (M-H, Fixed, 95% CI)	1.49 [1.01, 2.21]
3 Wound Infection	8	1051	Odds Ratio (M-H, Fixed, 95% CI)	1.16 [0.61, 2.22]

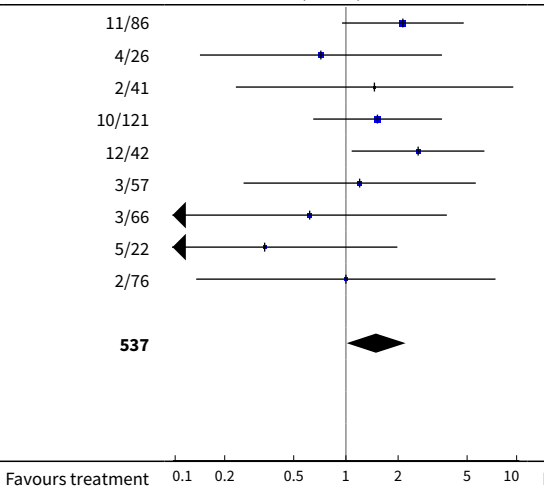
Analysis 10.1. Comparison 10 Gastroduodenal Surgery, Outcome 1 Time to flatus.

Study or subgroup	Tube N	Tube Mean(SD)	No tube N	No tube Mean(SD)	Mean Difference Random, 95% CI	Weight	Mean Difference Random, 95% CI
Carrere2006	43	4.5 (0.2)	41	3.7 (0.2)		25.58%	0.8[0.71,0.89]
Doglietto 2004	116	4.6 (1.3)	121	4.5 (1.7)		24.46%	0.1[-0.28,0.48]
Hsu 2007	76	4.1 (1)	75	4 (0.6)		25.08%	0.1[-0.16,0.36]
Jiang 2007	40	3.3 (0.4)	40	4.5 (0.9)		24.88%	-1.2[-1.51,-0.89]
Total ***	**275**		**277**			**100%**	**-0.04[-0.93,0.84]**
Heterogeneity: Tau^2=0.8; Chi^2=174.86, df=3(P<0.0001); I^2=98.28%							
Test for overall effect: Z=0.1(P=0.92)							



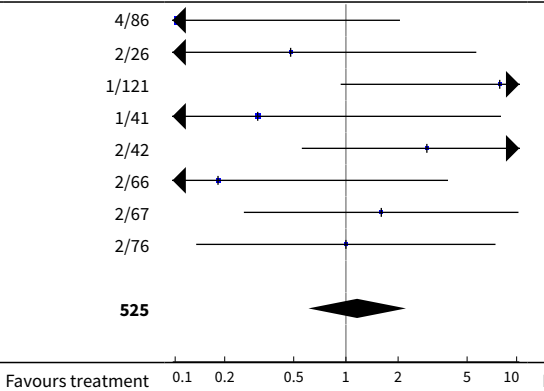
Analysis 10.2. Comparison 10 Gastroduodenal Surgery, Outcome 2 Pulmonary Complications.

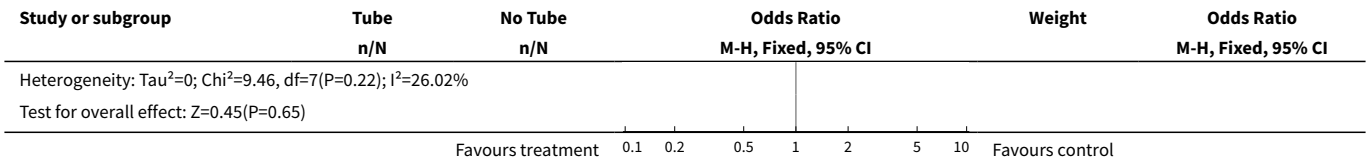
Study or subgroup	Tube n/N	No Tube n/N	Odds Ratio M-H, Fixed, 95% CI	Weight	Odds Ratio M-H, Fixed, 95% CI
Adekunle 1979	20/84	11/86		20.2%	2.13[0.95,4.78]
Bashey 1985	3/26	4/26		8.63%	0.72[0.14,3.58]
Carrere2006	3/43	2/41		4.65%	1.46[0.23,9.23]
Doglietto 2004	14/116	10/121		20.99%	1.52[0.65,3.58]
Miller 1972	24/47	12/42		15.13%	2.61[1.08,6.29]
Yoo 2002	4/64	3/57		7.26%	1.2[0.26,5.61]
Lee 2002	2/70	3/66		7.32%	0.62[0.1,3.82]
Sitges-Serra 1984	2/22	5/22		11.09%	0.34[0.06,1.98]
Hsu 2007	2/76	2/76		4.75%	1[0.14,7.29]
Total (95% CI)	**548**	**537**		**100%**	**1.49[1.01,2.21]**
Total events: 74 (Tube), 52 (No Tube)					
Heterogeneity: Tau^2=0; Chi^2=6.93, df=8(P=0.54); I^2=0%					
Test for overall effect: Z=2(P=0.05)					



Analysis 10.3. Comparison 10 Gastroduodenal Surgery, Outcome 3 Wound Infection.

Study or subgroup	Tube n/N	No Tube n/N	Odds Ratio M-H, Fixed, 95% CI	Weight	Odds Ratio M-H, Fixed, 95% CI
Adekunle 1979	0/84	4/86		26.03%	0.11[0.01,2.05]
Bashey 1985	1/26	2/26		11.32%	0.48[0.04,5.65]
Doglietto 2004	7/116	1/121		5.41%	7.71[0.93,63.65]
Carrere2006	0/43	1/41		8.93%	0.31[0.01,7.84]
Miller 1972	6/47	2/42		10.85%	2.93[0.56,15.37]
Lee 2002	0/70	2/66		15.04%	0.18[0.01,3.88]
Yoo 2002	3/64	2/67		10.96%	1.6[0.26,9.89]
Hsu 2007	2/76	2/76		11.46%	1[0.14,7.29]
Total (95% CI)	**526**	**525**		**100%**	**1.16[0.61,2.22]**
Total events: 19 (Tube), 16 (No Tube)					





APPENDICES

Appendix 1. MEDLINE search strategy

NEL 076 MEDLINE 25.09.09

1. (nasogastr* or nasojejun*).mp. [mp=title, original title, abstract, name of substance word, subject heading word]

2. exp Intubation, Gastrointestinal/

3. 1 or 2

4. ($tube* or decompress*).mp. [mp=title, original title, abstract, name of substance word, subject heading word]

5. (abdom* and surg*).mp. [mp=title, original title, abstract, name of substance word, subject heading word]

6. gastrectom*.mp. [mp=title, original title, abstract, name of substance word, subject heading word]

7. (colo* or $operat*).mp. [mp=title, original title, abstract, name of substance word, subject heading word]

8. 6 or 7 or 5

9. 8 and 4 and 3

10. randomized controlled trial.pt.

11. controlled clinical trial.pt.

12. randomized.ab.

13. placebo.ab.

14. clinical trial.sh.

15. randomly.ab.

16. trial.ti.

17. 10 or 11 or 12 or 13 or 14 or 15 or 16

18. humans.sh.

19. 17 and 18

20. 9 and 19

Appendix 2. Embase search strategy

NEL 076 Embase 25.09.09

1. (nasogastr* or nasojejun*).mp. [mp=title, abstract, subject headings, heading word, drug trade name, original title, device manufacturer, drug manufacturer name]

2. exp Intubation, Gastrointestinal/

3. 1 or 2

4. *tub*/ or decompress*.mp. [mp=title, abstract, subject headings, heading word, drug trade name, original title, device manufacturer, drug manufacturer name]

5. randomized controlled trial/

6. randomization/

7. controlled study/

8. multicenter study/

9. phase 3 clinical trial/

10. phase 4 clinical trial/

11. double blind procedure/

12. single blind procedure/

13. ((singl* or doubl* or trebl* or tripl*) adj (blind* or mask*)).ti,ab.

14. (random* or cross* over* or factorial* or placebo* or volunteer*).ti,ab.

15. 10 or 7 or 11 or 13 or 6 or 12 or 8 or 5 or 14 or 9

16. "human*".ti,ab.

17. (animal* or nonhuman*).ti,ab.

18. 17 and 16

19. 17 not 18

20. 15 not 19

21. 4 and 3 and 20

Appendix 3. CLib search strategy

NEL 076 25.09.09

ID	Search	Hits	Edit	Delete
#1	nasogastr* OR nasojejun*	883	edit	delete
#2	MeSH descriptor Intubation, Gastrointestinal explode all trees	436	edit	delete
#3	(#1 OR #2)	1120	edit	delete
#4	*tub*	17539	edit	delete
#5	(decompress*)	914	edit	delete
#6	(#4 OR #5)	18348	edit	delete
#7	(abdom*) and (surg*)	6791	edit	delete
#8	(gastrectom*)	805	edit	delete
#9	(#7 OR #8)	7489	edit	delete

(Continued)

#10	(#3 AND #6 AND #9)	132	edit	delete

WHAT'S NEW

Date	Event	Description
30 January 2010	New search has been performed	Second update

HISTORY

Protocol first published: Issue 3, 2004
Review first published: Issue 1, 2005

Date	Event	Description
5 August 2008	Amended	Converted to new review format.
17 April 2007	New citation required and conclusions have changed	Substantive amendment

CONTRIBUTIONS OF AUTHORS

Rick Nelson conceived the project and led the student team, in study identification, construction of a data abstraction form, data abstraction, assessment of study quality, and performance of data anaysis.
Bonnie Tse and Shamecka Edwards peformed data abstraction, imputations of standard deviations, data summaries and wrote protions of the final manuscript of the original review. However they could not be contacted at the time of second update of the review.

Rashmi Verma performed data abstraction, assessment of study quality, data analysis and wrote the final manuscript of the second update of the review.

DECLARATIONS OF INTEREST

None known

INDEX TERMS

Medical Subject Headings (MeSH)

*Gases; *Recovery of Function; Abdomen [*surgery]; Flatulence [physiopathology]; Intubation, Gastrointestinal [adverse effects] [*methods]; Postoperative Complications [*prevention & control]; Randomized Controlled Trials as Topic; Treatment Outcome

MeSH check words

Adult; Humans