Systematic review of prophylactic nasogastric decompression after abdominal operations

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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. This meta-analysis of published studies examines the efficacy of this practice after abdominal surgery in achieving each of these goals.

Method: Search terms were ‘nasogastric, tubes, randomized’, using Medline, Embase, the Cochrane Controlled Trials Register and references from included studies. Eligible studies included patients having abdominal operations of any type, emergency or elective, who were randomized before completion of the operation to receive a nasogastric tube and keep it in place until intestinal function had returned or to selective use of a tube with early removal.

Results: Twenty-eight studies fulfilled the eligibility criteria. These included 4194 patients, 2108 randomized to routine tube and 2087 randomized to selective or no tube. Those not having a nasogastric tube routinely inserted experienced an earlier return of bowel function ($P < 0.001$), a marginal decrease in pulmonary complications ($P = 0.07$), and a marginal increase in wound infection ($P = 0.08$) and ventral hernia ($P = 0.09$). Anastomotic leakage was similar in the two groups ($P = 0.70$).

Conclusion: 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.

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Introduction

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 for such an activity may be either therapeutic, as in patients with distension 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, flexible tubes inserted through the nose, pharynx, oesophagus and into the stomach, after abdominal operations has happened only in the past century, becoming so prevalent that it has been variously described up to 2002 as ‘the standard of care’1, ‘traditionally used by most surgeons’2, ‘common practice’3–5, ‘unquestioned’6, and ‘routine’7. What is to be achieved by this prophylaxis is gastric decompression, a decreased likelihood of nausea and vomiting, decreased distension, less chance of pulmonary aspiration and pneumonia, less risk of wound separation and infection, less chance of fascial dehiscence and hernia, earlier return of bowel function, and earlier discharge from hospital.

Many studies assessing the efficacy of this intervention have been published. A meta-analysis of many of the randomized and non-randomized studies published before 1995 found that, although vomiting and distension were more common when nasogastric tubes were not used routinely, all other variables of efficacy were actually improved for those who did not have routine insertion and maintenance of nasogastric tubes in the postoperative period8. This meta-analysis should be updated and revised for several reasons. First, many more studies have been published since 1995, broadening the types of abdominal operations in which nasogastric tubes are used; these include operations for gastric cancer and emergency operations for penetrating abdominal trauma. The original work also included non-randomized studies in the meta-analysis, introducing the potential of substantial selection bias into the results. As a good number of relevant
randomized clinical trials (RCTs) have now been reported, these alone form the basis of the present systematic review.

**Methods**

RCTs were included that compared individuals with and without routine prophylactic use of nasogastric tube gastric decompression after abdominal surgery. The patients studied were adults over the age of 18 years in whom abdominal operations were performed. All types of operations were included, from appendicectomy and operations for gallstones and gastric cancer, to emergency operations for penetrating abdominal trauma and major aortic reconstruction. Laparoscopic surgery is not included in the review.

The test group had a nasogastric tube inserted before or during surgery and maintained in place after the operation 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 3–5 days after the operation. The control group had no tube inserted or a tube inserted during surgery and withdrawn either while the patient was still in the operating room, in the recovery room, when judged to be fully awake or within 24 h of surgery. The type of tube used was rubber Levine tube or any other tube of similar length, such as polymer tubes with sump lumens. Patients who had tubes inserted through the abdominal wall into the stomach (gastrostomy tubes) and patients with long tubes used traditionally for bowel obstruction (such as Dennis tubes, Cantor tubes and Miller-Abbott tubes) are not included in the review.

The outcome measures sought included time to first flatus, pulmonary complications (a composite of atelectasis and pneumonia), fever, wound infection, length of hospital stay or postoperative hospital stay, wound dehiscence, anastomotic leak, ventral hernia, nausea and/or vomiting, need for tube insertion/reinsertion, death, pain or discomfort that was tube related, and adverse events that were related to tube insertion.

The search strategy for identification of studies used for this review included the terms ‘nasogastric, tubes, randomized’. The resources used were Medline, Embase, the Cochrane Controlled Trials Register, and reference lists of published studies and reviews. The review was undertaken as a classroom exercise for the Honors 201 seminar at the University of Illinois at Chicago. Undergraduate class members developed a data abstraction form (available from the authors on request). 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 dropouts, intention-to-treat analyses and consistency of interpretations with data.

Dichotomous variables, such as wound infection and pulmonary complications, were analysed in Metaview (Update Software, Oxford, UK), using relative risk and the random effects model if significant heterogeneity was noted. Continuous variables, such as time to flatus and length of hospital stay, when both means and standard deviations were presented, were assessed using the weighted mean difference in Metaview, and random effects if significant heterogeneity was found. When means were presented without standard deviations, a method was used for imputing standard deviations from published P values and t tables; this was done in an attempt to include more studies in the meta-analysis. When no P value was presented, but findings were stated simply as ‘significant’ or ‘not significant’, P values of 0.03 and 0.3 respectively were assigned. Many studies presented median times to flatus or hospital stay, often with a range and P value. These could not be included in the main meta-analysis, unless the 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. Sensitivity analyses were also performed to assess the performance of prophylactic nasogastric decompression on different types of abdominal operations. Denominators in all analyses were the original number randomized, not just those completing assessment. Authors of the papers were contacted to retrieve missing data or analyses.

**Results**

**Description of studies**

Twenty-eight studies fulfilled the eligibility criteria. One was a follow-up report with a new outcome (ventral hernia) from a group of patients reported previously. A broad range of abdominal surgery was covered in these papers; there were seven on colorectal surgery, seven on gastroduodenal surgery, two each on biliary and gynaecological surgery, one each on vascular and emergency trauma surgery, and seven that included all facets of abdominal surgery. The included publications described 4195 participants, 2108 randomized to prophylactic nasogastric tube insertion for postoperative
decompression, and 2087 randomized to no tube in the postoperative period.

Five studies were excluded because they were not RCTs, used gastrostomies for decompression, only measured gastro-oesophageal reflux as an endpoint, or had no group in which tubes were maintained in place until the return of gastrointestinal function.

Methodological quality

Only seven papers specified an allocation sequence that was adequate. In most other instances the method of randomization was not specified, in one it was by month of birth. Allocation concealment was reported in three studies. Blinding of either participants or observers was never attempted; it would not 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 per cent. Inclusion criteria were poorly specified or absent in several papers and comparability of the two participant groups was difficult to assess in several. Perhaps the biggest quality issue was the subjectivity in reporting of the principal endpoint of the studies, namely return of gastrointestinal function. The meter for this was time to first flatus, but this is typically reported by the patient to the surgeon to have occurred at some time before the ward round, which takes place in the early morning. There is clearly an inherent imprecision in this measure. A mechanism by which this imprecision might have systematically biased reporting in favour of ‘no tube’ is not obvious, but patients with a tube may have had an incentive to report flatus in order to be rid of the tube. Another primary endpoint, pulmonary complications, may have been reported more precisely.

Outcome measures

Time to flatus

Using only studies that provided precise standard deviations with the mean, there was a significant benefit from non-routine use of postoperative nasogastric decompression (weighted mean difference 0.46 days (95 per cent confidence interval (c.i.) 0.28 to 0.64); \( P < 0.001 \)), although this was based on only eight 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 presented only 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 in some cases a technique described in a Cochrane Colloquium by Wolf and Guevara. When results were described as ‘significant’ a \( P \) value of 0.03 was assigned, and for ‘insignificant’ a \( P \) value of 0.3 was assigned. The broader inclusion resulted in an almost identical summary odds ratio in the meta-analysis, although somewhat narrower confidence intervals, but with the introduction of significant heterogeneity (\( I^2 = 74.2 \) per cent, \( P < 0.001 \)). Considering only patients who had colonic surgery in studies providing precise standard deviations, an earlier return of bowel function occurred in patients without a tube.

Pulmonary complications

Nineteen studies reported the incidence of postoperative pulmonary complications (an amalgam in this report of pneumonia and atelectasis) by group. Non-routine use of nasogastric suction provided a benefit that approached statistical significance (RR 1.35 (95 per cent c.i. 0.98 to 1.86); \( P = 0.07 \) (Fig. 2), without evidence of statistical heterogeneity. A subgroup analysis of studies that considered only individuals who had colonic surgery showed no difference in pulmonary complication risk (\( P = 0.73 \)). Among those who had upper gastrointestinal surgery the risk of pulmonary complications was lower in those without a tube, but this only approached statistical significance (\( P = 0.08 \)).

Wound infection

Fifteen studies reported wound infections and the summary statistic showed that routine use of nasogastric decompression diminished the risk, although this only approached statistical significance (OR 0.72 (95 per cent c.i. 0.50 to 1.04); \( P = 0.08 \) (Fig. 3). In five studies of those having only upper gastrointestinal surgery there was no difference in wound infection risk (\( P = 0.62 \)).

Ventral hernia

One study reported long-term follow-up for the development of ventral incisional hernia and there was no difference between groups (OR 0.47 (95 per cent c.i. 0.20 to 1.13); \( P = 0.09 \) (Fig. 4)).

Anastomotic leak

Nine studies reported anastomotic leak and there was no difference between groups in this outcome (OR 0.86 (95 per cent c.i. 0.39 to 1.90); \( P = 0.70 \) (Fig. 5). In three studies of those who had colonic surgery only, there was also no difference in risk of anastomotic leak between groups.
Reference Tube Time (days)* No tube Time (days)* WMD (fixed) Weight (%) WMD (fixed)
---
11 46 3:20 (0.98) 51 2:70 (0.95) 2:50 (2.26) 21.85 0.50 (0.12, 0.88)
27 100 3:10 (1.84) 100 2:50 (2.26) 2:50 (2.26) 9.92 0.60 (0.03, 1.17)
10 44 5:10 (2.10) 46 4:03 (1.40) 1:07 (0.33, 1.81)
19 37 4:30 (2.30) 37 4:20 (1.90) 3:50 0.10 (−0.86, 1.06)
25 40 4:90 (1.65) 40 4:10 (1.39) 7:24 0.80 (0.13, 1.47)
1 37 4:33 (2.23) 39 4:51 (0.25) 6:20 0.18 (-0.90, 0.54)
24 55 4:30 (1.70) 54 3:60 (1.30) 10.05 0.70 (0.13, 1.27)
2 70 3:80 (0.90) 66 3:50 (0.90) 35.34 0.30 (0.30, 0.60)
Total 429 433

Fig. 1 Analysis of time to flatus. Values are mean(s.d.). Weighted mean differences (WMDs) are shown with 95 per cent confidence intervals. Test for heterogeneity: $\chi^2 = 9.18, 7$ d.f., $P = 0.24, I^2 = 23.8\%$; Test for overall effect: $Z = 5.00, P < 0.001$

Proportion with pulmonary complications

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<th>Weight (%)</th>
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<td>4 of 26</td>
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<td>100.00</td>
<td>1.35 (0.98, 1.86)</td>
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Fig. 2 Analysis of incidence of pulmonary complications (atelectasis and pneumonia). Relative risks (RRs) are shown with 95 per cent confidence intervals. Test for heterogeneity: $\chi^2 = 27.49, 18$ d.f., $P = 0.07, I^2 = 34.5\%$; Test for overall effect: $Z = 1.83, P = 0.07$

Length of stay

Seven studies reported mean length of hospital stay with precise standard deviations, others with $P$ values and more with median lengths of stay. Most showed a shorter length of stay without a tube, although the heterogeneity encountered in calculation of a combined effect ($I^2 = 92.5\%$ per cent, $P < 0.001$) made it unwise to present a summary statistic. Sensitivity analyses performed in an attempt to find a specific cause for the heterogeneity were unsuccessful.

Gastric upset and other outcomes

Nineteen studies reported various aspects of gastric upset in the postoperative period, from nausea through vomiting...
Prophylactic nasogastric decompression after abdominal surgery

**Fig. 3** Analysis of incidence of wound infection. Odds ratios (ORs) are shown with 95 per cent confidence intervals. Test for heterogeneity: $\chi^2 = 13.62$, 13 d.f., $P = 0.40$, $I^2 = 4.6$ per cent; Test for overall effect: $Z = 1.74$, $P = 0.08$

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<td>0.72 (0.50, 1.04)</td>
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**Fig. 4** Analysis of incidence of ventral hernia. Odd ratios (ORs) are shown with 95 per cent confidence intervals. Test for overall effect: $Z = 1.69$, $P = 0.09$

<table>
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<th>Reference</th>
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<td>15 of 229</td>
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<td>0.47 (0.20, 1.13)</td>
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</table>

**Fig. 5** Analysis of incidence of anastomotic leak. Odds ratios (ORs) are shown with 95 per cent confidence intervals. Test for heterogeneity: $\chi^2 = 3.43$, 6 d.f., $P = 0.75$, $I^2 = 0$ per cent; Test for overall effect: $Z = 0.38$, $P = 0.70$
to discomfort. The majority showed more discomfort with the routine use of a tube, but the extreme heterogeneity encountered in the calculation of a combined effect ($I^2 = 62$ per cent, $P < 0.001$) made it unwise to present a summary statistic for this outcome. Other outcomes were reported with insufficient frequency to be informative (death, tube reinsertion, fever (often combined with pulmonary complications), wound dehiscence). Sensitivity analyses that selected only high-quality studies greatly diminished the number of studies being analysed.

**Adverse events**

Although major adverse events directly related to tube insertion have been reported, such as intracranial insertion$^{35}$ and oesophageal perforation$^{36}$, no adverse event related specifically to tube insertion was reported in any of the included studies.

**Sensitivity analyses**

The results of sensitivity analyses on quality, imputing of confidence intervals and in the investigation of statistical heterogeneity have been presented above. Regarding the benefit of nasogastric decompression in different types of abdominal operations, comparing time to flatus, patients having colorectal surgery did better without a tube (weighted mean difference (WMD) 0·62 (95 per cent c.i. 0·28 to 0·96); two studies), those having gastric surgery did slightly, but insignificantly, better without a tube (WMD 0·12 (95 per cent c.i. −0·15 to 0·39); three studies), and patients undergoing gynaecological procedures also did better without a tube (WMD 0·70 days (95 per cent c.i. 0·13 to 1·27); one study). In other words comparable results were seen across all three types of operation. Regarding comparisons of pulmonary complications, patients having colorectal surgery did only slightly better without a tube (OR 1·33 (95 per cent c.i. 0·27 to 6·62); four studies), those having gastric surgery did somewhat better without a tube (OR 1·52 (95 per cent c.i. 0·95 to 2·43); six studies) and those undergoing gynaecological operations had an opposite, although still insignificant, result (OR 0·74 (95 per cent c.i. 0·39 to 1·41); one study). In no type of operation that showed a significant benefit in favour of prophylactic nasogastric decompression did that benefit relate either to time to flatus or pulmonary complications.

**Discussion**

There has been one previously published meta-analysis$^8$. It 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 was included. The trials that reported each of these measures were not specified. The two comparison groups were participants who had a nasogastric tube until some point in the postoperative period at which intestinal recovery was perceived (flatus, feeding or defaecation), and a group described as ‘selective use’. This may be a more intelligent category than ‘no tube’, as participants who needed to have a tube inserted because of vomiting or distension after surgery were therefore not treatment failures in that group but represented 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 one group either in the operating room, recovery room or within 24 h of surgery. In the selective group there was a significant risk of emesis, distension and tube reinsertion. In the tube group there was a significant risk of pulmonary complications. No significant difference was noted 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.

In the present systematic review, by comparison, only RCTs were included, with more focused outcome measures and almost twice as many trials over a broad range of abdominal surgery. The biggest problem encountered was the nature of reporting of the continuous outcomes ‘time to flatus’ and ‘length of stay’. In many cases only $P$ values were given rather than confidence intervals for each group. The method of imputing means and confidence intervals from $P$ values introduced significant heterogeneity, almost certainly owing 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.

Heterogeneity was not encountered in the meta-analyses for the outcome measures time to flatus (when only studies reporting confidence intervals were included), pulmonary complications, wound infection and anastomotic leak, supporting the validity of the findings from these comparisons. Heterogeneity persisted despite subgroup analyses for length of stay and the measures of patient tolerance for the tube (nausea and vomiting), suggesting that a meta-analysis should not be reported for these outcome measures. Sensitivity analyses have shown, although with diminished statistical power, that the efficacy of prophylactic nasogastric decompression is similar across a broad range of abdominal operations. These findings, along with the analyses of statistical heterogeneity, support...
the inclusion of all types of abdominal surgery within a single systematic review.

In conclusion, prophylactic nasogastric decompression following abdominal operations has been undertaken with the intent of hastening return of bowel function; by emptying the stomach, easing respiration and diminishing the risk of aspiration of gastric contents, and therefore decreasing the risk of pulmonary complications; increasing patient comfort by lessening abdominal distension; protecting intestinal anastomoses and preventing anastomotic leakage; and shortening hospital stay. This review has shown that the intervention is ineffective in achieving any of these goals. Significant benefit may accrue from avoidance of prolonged intubation and selective tube insertion only when needed to relieve gastric symptoms. Wound infection (and one of its sequelae, incisional hernia) may be more frequent when routine intubation is avoided; the reasons for this are not clear. Many surgeons already avoid routine nasogastric intubation. Those who do not probably should.

References


