International Journal of Nursing Studies 100 (2019) 103406

Contents lists available at ScienceDirect

International Journal of Nursing Studies

journal homepage: www.elsevier.com/ijns

Is routine nasogastric decompression after hepatic surgery necessary? A systematic review and meta-analysis

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ARTICLE INFO

Article history:
Received 25 April 2019
Received in revised form 18 July 2019
Accepted 20 August 2019

Keywords:
Nasogastric tube
Decompression
Hepatic surgery
Review
Meta-analysis

ABSTRACT

Objectives: Currently the nasogastric tube (NGT) is routinely inserted in clinical after abdominal surgery for decompression in China, yet the practice varies between regions, the role of NGT for the patients after hepatic surgery remains unclear. Therefore, this present meta-analysis aimed to assess the efficacy and safety of NGT placement after hepatic surgery.
Design: A systematic review and meta-analysis
Data sources: PUBMED, EMBASE, Science Direct, Cochrane Central Register of Controlled Trials, China National Knowledge Infrastructure (CNKI) and Wanfang Database (until Mar 30, 2019) were systematically searched.
Review methods: Randomized controlled studies (RCTs) comparing the efficacy and safety of NGT and no NGT treatment after hepatic surgery were included. Data were synthesized using a random-effects or fixed effect model according to the heterogeneity. Outcomes were presented as Mantel–Haenszel style odd ratios (ORs) or mean differences (MDs) with 95% confidence intervals (95% CIs).
Results: Seven studies with 1306 patients were eligible for inclusion. Compared with NGT treatment, the no NGT decompression could shorten the time to first defecation (MD −0.59; −0.79, −0.39), reduce the time to start diet (MD −0.46; −0.90, −0.03), and decrease the length of hospital stay (MD 0.48; −0.93, −0.03), but it could also increase the risk of NGT re-intubation (OR 6.8; 1.77, 26.72), no significant differences were detected on the first passage of flatus (MD −0.34; −0.86, 0.18), the incidence of nausea (OR 0.81; 0.40, 1.67), vomiting (OR 1.06; 0.19, 5.93), abdominal distention (OR 0.87; 0.60, 1.25).
Conclusion: Given that very limited information for some endpoints in this present meta-analysis, the routinely insertion of NGT after hepatic surgery is not justified, the no NGT decompression seems to be more beneficial to the prognosis of patients after hepatic surgery, more related studies on this issue are needed.

What is already known about the topic?

- NGT decompression is routinely used clinically after hepatic surgery in some regions such as China. Several RCTs report NGT decompression after hepatic surgery results in poorer outcomes.
- Several RCTs have investigated the role of NGT decompression after hepatic surgery, yet the results remain controversial.

What this paper adds

- No NGT decompression can shorten the time to first defecation, reduce the time to start diet, and decrease the length of hospital stay.
- No NGT decompression may also increase the risk of NGT reintubation, no significant differences were detected on the first passage of flatus and the incidence of related complications such as nausea, vomiting and abdominal distention.
- Routinely inserting NGT for gastric decompression after hepatic surgery seems to be unjustified, more rigorously designed, large-scale RCTs with high quality in different regions are needed to identify the role of NGT decompression.

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https://doi.org/10.1016/j.ijnurstu.2019.103406

1. Introduction

It has been a routine procedure in clinic that inserting nasogastric tube (NGT) after abdominal surgery to help the restore of patients' intestinal function (Tsai et al., 2012). Traditionally, the purposes of NGT insertion are to drain the excess gas and liquid in the stomach, prevent the patient from aspiration during surgery, reduce the postoperative complications such as abdominal distension, nausea, vomiting et al. (Nelson et al., 2005). However, to date, this concept has been challenged since the NGT decompression may not function as we hope for. Currently, in China the NGT decompression is routinely used clinically after hepatic surgery, it's unclear that the NGT is routinely used or not in other regions, there can be some regional variation in this practice. Even though many studies (Li et al., 2013; Nelson et al., 2005; Pessaux et al., 2007) have found that the conventional gastrointestinal decompression can reduce the occurrence of postoperative gastrointestinal complications, it can also increase the incidence of postoperative respiratory complications such as aspiration pneumonia, atelectasis (Gomes et al., 2003; Schwarz et al., 2018). Several previous studies have supported that it is unnecessary to routinely perform the NGT decompression after gastrectomy (Wang et al., 2015), elective colon and rectum surgery (Rao et al., 2011). To this regard, there is a trend not to use NGT decompression for abdominal surgeries.

Based on literature review, we have found that numerous randomized controlled trials (RCTs) and meta-analyses have concluded it is unnecessary to routinely use NGT decompression after gastric surgery, but the role of NGT decompression after liver surgery remains uncertain. In recent years, there are several studies to explore the necessity of NGT insertion and the time of gastric tube removal in patients with liver surgery, but the results are inconsistent. To our knowledge, there is only one Chinese meta-analysis (Gan et al., 2018) has focused on the NGT decompression in the population of liver surgery, with more related RCTs being published, it is necessary to conduct updated meta-analysis to address the role of NGT decompression in patients after hepatic resection. Therefore, we aimed to conduct this systematic review and meta-analysis to evaluate if it is necessary to routinely insert NGT for gastric decompression after hepatic surgery.

2. Methods

2.1. Search methods

We have attempted to plan, perform and report this meta-analysis in comply with Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) (Liberati et al., 2009). Related articles either published in English or Chinese were identified and selected by searching PUBMED, EMBASE, Science Direct, Cochrane Central Register of Controlled Trials, China National Knowledge Infrastructure (CNKI) and Wanfang Database (until Mar 30, 2019) using following Mesh search terms: "nasogastric tube / stomach tube / gastric canal / gastric tube/gastrointestinal", "indwelling / placement / insertion / decompression / drainage / removal", "liver / hepar" and "ectomy / resection / removal / surgery / operation", "randomized controlled trial/RCT". We combined these terms in accordance to the instructions of the database. In addition, the reference lists of retrieved studies and pervious reviews and meta-analyses were reviewed and manually searched, and we made no attempt to identify unpublished reports.

2.2. Study selection

Study selection was made based on a first screen of identified titles or abstracts and on a second check-up of full-text articles. Studies were considered to be eligible if following criteria were met: (1) RCT design; (2) study subjects have undergone the hepatic surgery; (3) containing the comparison groups of NGT and no NGT treatment; and (4) reporting the relative outcomes such as related complications.

2.3. Data extraction

The following data and information were extracted by two reviewers independently: first author, year of publication, study design, patient population, the NGT and no NGT treatment, main outcomes and study results. The studies selection and data extraction were conducted by two authors independently, and discussions were made for resolving disagreements.

The following main outcomes were extracted: the first passage of flatus; the time to first defecation; the time to start diet; the incidence of NGT reinsertion, which is defined as after surgery, the patients has some complications such as vomiting, nausea et al., a re-insertion of NGT are needed to decompression; the incidence of related complications such as nausea, vomiting, abdominal distention, and the length of hospital stay.

2.4. Quality appraisal

The Cochrane Collaboration's "risk of bias" tool was used for evaluating the methodological quality and risk of bias of included RCTs, seven specific domains were examined and measured in this tool: sequence generation, allocation concealment, blinding of participants and personnel, blinding of outcome assessment, incomplete outcome data, selective outcome reporting, and "other" issues. Every domain can be classified as "low risk of bias", "high risk of bias" or "unclear risk of bias" in accordance to the judgment criteria (Cochrane Handbook for Systematic Reviews of Intervention. Part 2: 8.5).

2.5. Data synthesis and analysis

All the extracted data were put into a freeware program Review Manager (RevMan) Version 5.3. Binary outcomes were presented as Mantel–Haenszel style odd ratios (ORs) with 95% confidence intervals (CIs), and continuous outcomes were reported as inverse variance mean differences (MDs). A fixed-effect model was adopted in cases of homogeneity (p value of χ^2 test >0.10 and $I^2 < 50\%$), while a random-effects model was used in cases of obvious heterogeneity (p value of χ^2 test <0.10 and $I^2 \geq 50\%$). Publication bias was evaluated by the demonstration of funnel plots, and asymmetry was assessed with the Egger regression test (p value < 0.1 was considered to be significance of funnel plot asymmetry).

3. Results

3.1. Literature search

A total of 48 relevant publications were yielded by the first comprehensive search, and the abstracts of all citations were obtained, we included 11 potentially related studies for further full-text review, and finally we included 7 RCTs (Cai et al., 2006; Chen et al., 2014; Ichida et al., 2016; Li et al., 2009; Ni et al., 2014; Pessaux et al., 2007; Yin et al., 2011) for synthesized analysis (Fig. 1).

3.2. Study characteristics

The basic characteristics of 7 included studies (Cai et al., 2006; Chen et al., 2014; Ichida et al., 2016; Li et al., 2009; Ni et al., 2014; Pessaux et al., 2007; Yin et al., 2011) are shown in Table 1. Briefly, for all the included studies, a total of 1306 patients were involved,

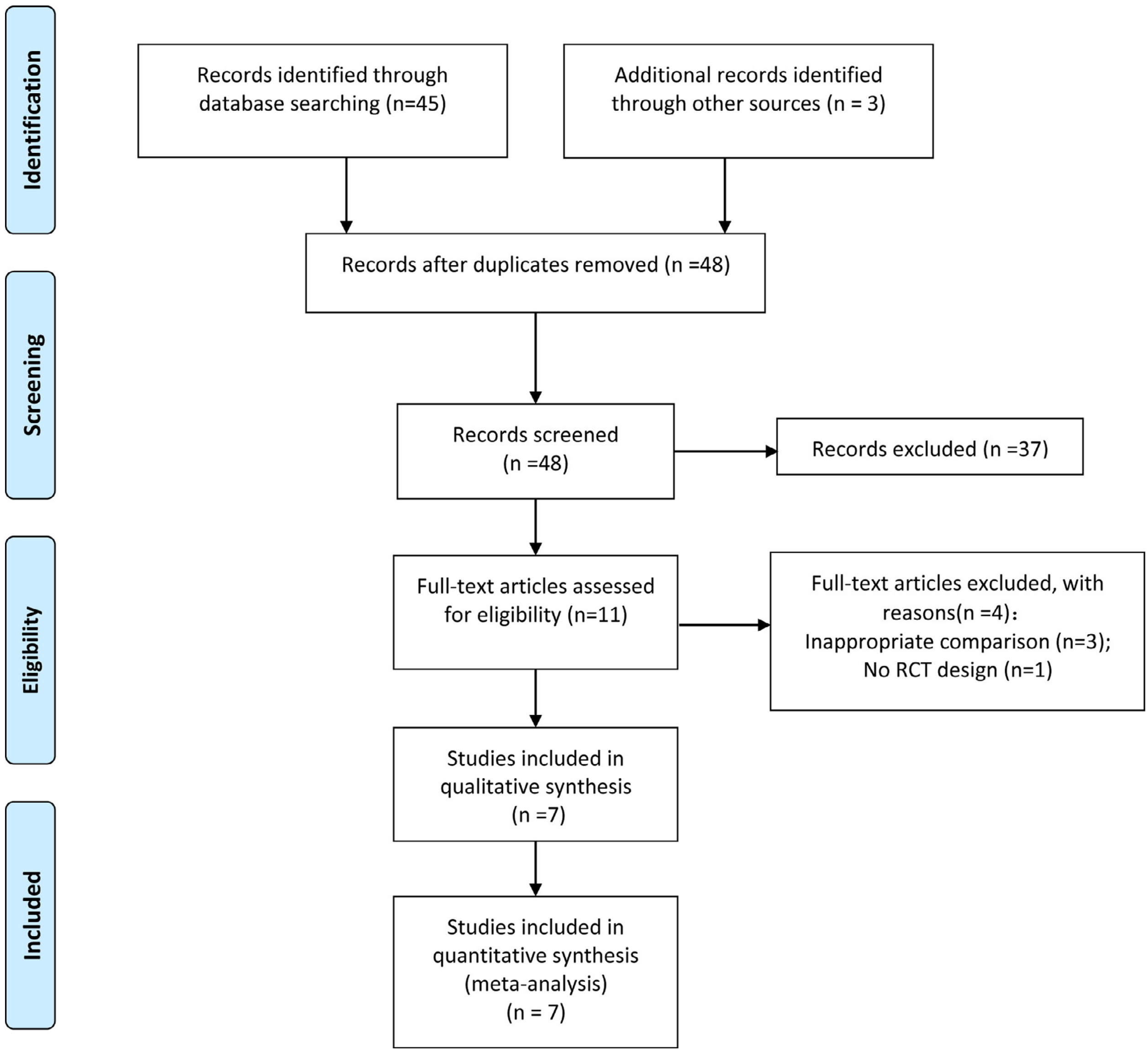

Fig. 1. Flow diagram of study selection.

specifically 647 for no NGT treatment, 659 for NGT treatment, and five studies (Cai et al., 2006; Chen et al., 2014; Li et al., 2009; Ni et al., 2014; Yin et al., 2011) were conducted in China, the sample size ranged from 81 to 372. For NGT treatment, most NGTs were inserted before surgery and retained until the return of bowel function, one study (Ni et al., 2014) maintained the NGT until 24 h after surgery. For no NGT treatment, most NGTs were removed immediately after surgery. And for study conclusions, most studies favored the no NGT decompression for patients after hepatic surgery.

Figs. 2 and 3 illustrate the methodological quality of included RCTs. Briefly, even though all seven included RCTs mentioned randomization, only three RCTs (Ichida et al., 2016; Ni et al., 2014; Pessaux et al., 2007) rendered the detailed descriptions on the method used to produce the random sequence. In general, sequentially numbered, opaque, sealed envelopes are assigned to each participant to prevent from selective bias, only two RCTs (Ichida et al., 2016; Pessaux et al., 2007) described adequate allocation concealments. The adequate blinding, which are adopted for personnel, participants, and outcome assessment, is concerned to prevent against bias. Nevertheless, as a simple and practical intervention, it seems to be impossible to blind participants, no study has reported blinding design on personnel, participants, and outcome assessment, only two RCTs reported a blinding design on participants and outcome assessment. Most included studies seemed to report completed outcome data (low risk of bias). Verification on selective reporting of outcomes are necessary because it may help to evaluate the integrity of outcome reporting and protect against bias, no other significant bias were found.

3.3. *Main analysis*

3.3.1. *The first passage of flatus*

Five studies (Chen et al., 2014; Li et al., 2009; Ni et al., 2014; Pessaux et al., 2007; Yin et al., 2011) have reported the first passage of flatus after NGT and no NGT intervention, the summary MD on the first passage of flatus was −0.34(−0.86, 0.18), with evidence of heterogeneity ($P < 0.001$, $I^2 = 99\%$) (Fig. 4A).

Table 1
The characteristics of included studies.

Author year	Country	Sample (NGT/no-NGT)	Intervention		Main outcomes	Conclusion
			NGT	no-NGT		
Cai 2006	China	123(50/73)	The NGTs were maintained on continuous suction by bottles with negative pressures until return of bowel function	The NGTs were not inserted before or during the operations	The time to first flatus; the time to first defecation; Nausea; vomiting; gastrointestinal hemorrhage, throat discomfort	There is no need for gastrointestinal decompression after elective liver surgery.
Chen 2014	China	218(120/98)	The NGTs were maintained on continuous suction by bottles with negative pressures until the first passage of flatus	The NGTs were not inserted before the operations	The recovery of gastrointestinal function; Postoperative discomfort; The incidence of complications.	Patients with primary liver cancer during the surgery should not insert the NGTs or should remove the NGTs early after surgery, which is conducive to the promotion of postoperative rehabilitation.
Ichida 2016	Japan	210(108/102)	The NGT was retained until the return of bowel function (passage of flatus or passage of stool)	The NGTs were removed in the operation room immediately after the surgery	The incidence of postoperative complications; The time to start oral intake; length of postoperative hospital stay	Routine use of prophylactic NGT after elective hepatectomy is not recommended.
Li 2009	China	81(43/38)	The NGTs were maintained until the first passage of flatus	The NGTs were removed in immediately after patients recovery from the anesthesia	Time to first passage of flatus; Time to first defecation; Surgery related complications; Patients' subjective discomfort; The length of hospital stay	Gastrointestinal decompression after elective liver surgery is not necessary.
Ni 2014	China	371(186/186)	The NGTs were inserted 30 min before the surgeries and maintained until 24 h after surgery	The NGTs were removed in immediately after patients recovery from the anesthesia	Postoperative discomfort; patients' postoperative recovery of gastrointestinal function	It is safe and feasible to not insert and maintain the NGT after hepatectomy.
Pessaux 2007	France	200(100/100)	The NGTs were maintained on continuous suction with a pressure of 40 to 50 mmHg until the return of bowel function (either passage of flatus or stool)	The NGTs were removed immediately after being assigned	Overall surgical complications; mortality; duration of ileus; length of hospital stay; The reinsertion of NGT	Routine NGT decompression after elective hepatectomy had no advantages. Its use was associated with an increased risk of pulmonary complications.
Yin 2011	China	102(52/50)	The NGTs were inserted before the surgery and maintained on until the return of bowel function	The NGTs were not inserted before or during the operations	Time to first passage of flatus; Time to starting oral feeding; the discomfort such as nausea, vomiting, abdominal pain, and sore throat; Pulmonary infections	No NGT decompression does not affect the recovery of postoperative gastrointestinal function in patients undergoing elective liver surgery, and can reduce the chance of respiratory infection.

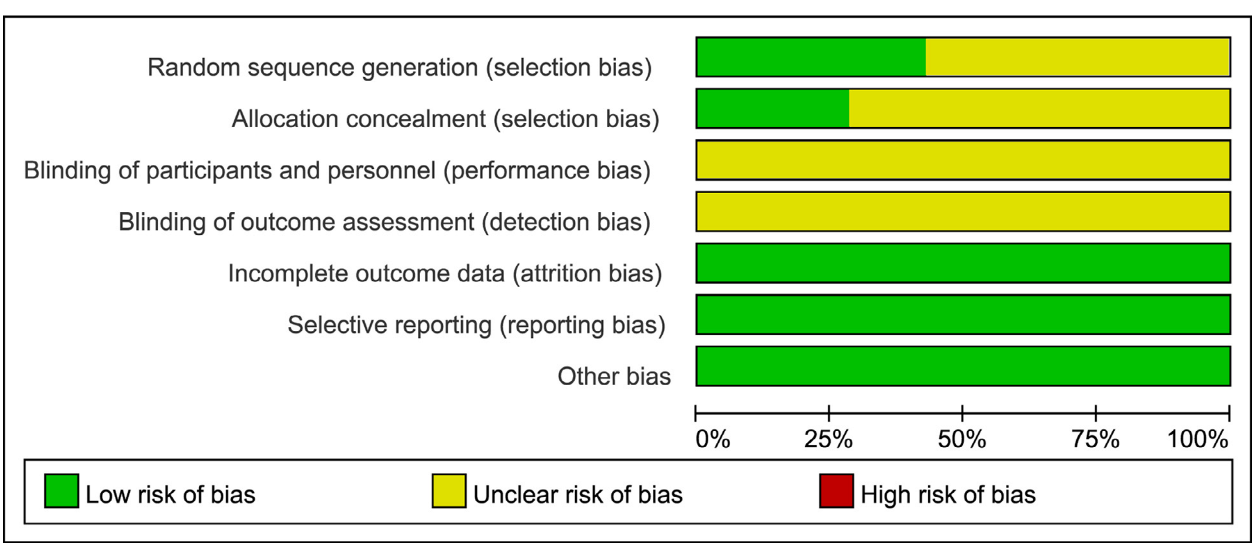

Fig. 2. Risk of bias graph.

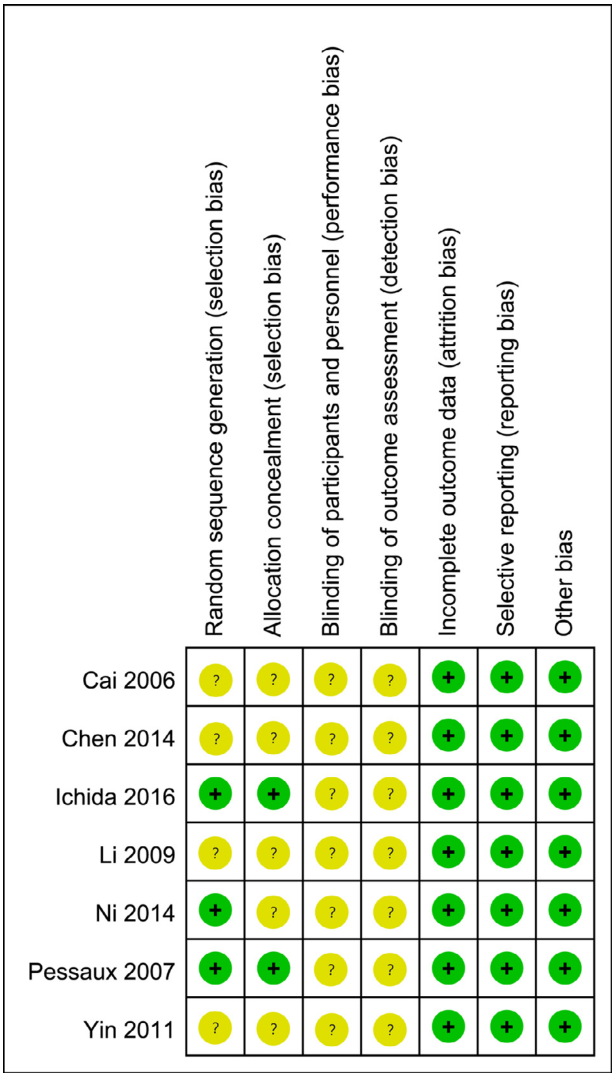

Fig. 3. Risk of bias summary.

3.3.2. The time to first defecation

Two studies (Chen et al., 2014; Ni et al., 2014) have reported the time to first defecation after NGT and no NGT intervention, the summary MD on the time to first defecation was −0.59(−0.79, −0.39), with no evidence of heterogeneity ($P = 0.97$, $I^2 = 0\%$) (Fig. 4B).

3.3.3. The time to start diet

Three studies (Chen et al., 2014; Pessaux et al., 2007; Yin et al., 2011) have reported the time to start diet after NGT and no NGT intervention, the summary MD on the time to start diet was −0.46(−0.90, 0.03), with evidence of heterogeneity ($P < 0.001$, $I^2 = 92\%$) (Fig. 4C).

3.3.4. The incidence of NGT reintubation

Two studies (Ichida et al., 2016; Pessaux et al., 2007) have reported the incidence of reintubation after NGT and no NGT intervention, the summary OR on the incidence of NGT reintubation was 6.88(1.77, 26.72), with no evidence of heterogeneity ($P = 0.94$, $I^2 = 0\%$) (Fig. 4D).

3.3.5. The incidence of nausea

Three studies (Ichida et al., 2016; Li et al., 2009; Pessaux et al., 2007) have reported the incidence of nausea after NGT and no NGT intervention, the summary OR on the incidence of nausea was 0.81(0.40, 1.67), with evidence of heterogeneity ($P = 0.14$, $I^2 = 50\%$) (Fig. 5A).

3.3.6. The incidence of vomiting

Three studies (Cai et al., 2006; Ichida et al., 2016; Pessaux et al., 2007) have reported the incidence of vomiting after NGT and no NGT intervention, the summary OR on the incidence of vomiting was 1.06(0.19, 5.93), with evidence of heterogeneity ($P = 0.006$, $I^2 = 81\%$) (Fig. 5B).

3.3.7. The incidence of abdominal distention

Four studies (Cai et al., 2006; Chen et al., 2014; Ni et al., 2014; Yin et al., 2011) have reported the incidence of abdominal distention after NGT and no NGT intervention, the summary OR on the incidence of abdominal distention was 0.87(0.60, 1.25), with no evidence of heterogeneity ($P = 0.48$, $I^2 = 0\%$) (Fig. 5C).

3.3.8. The length of hospital stay

Three studies (Li et al., 2009; Ni et al., 2014; Pessaux et al., 2007) have reported the length of hospital stay after NGT and no NGT intervention, the summary MD on the length of hospital stay was −0.48(−0.93 to −0.03), with no evidence of heterogeneity ($P = 0.19$, $I^2 = 40\%$) (Fig. 5D).

3.4. Subgroup and sensitivity analyses

No subgroup analyses were made in this present study. Sensitivity analyses which investigate the impact of a single study on the overall risk estimate by abandoning one study in each turn, suggested that the overall risk estimates did not significantly changed by any single study.

4. Discussion

The synthesized results indicate that compared with NGT treatment, no NGT decompression can shorten the time to first defecation, reduce the time to start diet, and decrease the length of hospital stay, yet it may also increase the risk of NGT reintubation, no significant differences have been detected on the first passage of flatus and the incidence of related complications such as nausea, vomiting and abdominal distention. With comprehensive consideration on the merits and demerits of no NGT decompression, we have preferred that it is unnecessary to routinely insert the NGT for gastric decompression after hepatic surgery. Currently, it's a routine procedure in China to insert NGTs after hepatic surgery, whether it's also the same for other countries is a question we barely know, and very limited reports on this issue in other regions have published, more studies on this issue in different areas are needed. A recent meta-analysis (Gan et al., 2018) has discussed the necessary of NGT placement in patients with hepatobiliary surgery, and come to the conclusion that it is feasible to no NGT decompression for patients with hepatobiliary surgery, and this study has classified the extracted detailed outcomes into respiratory, digestive complications. Different from that, we have extracted and synthesized the detailed results to evaluate the merits and demerits of NGT decompression, which may provide more insights into clinical settings.

In this present study, the NGT and no NGT decompression after hepatic surgery provide similar effect on the first passage of flatus, which is consistent with previous study (Pessaux et al., 2007). However, the no NGT decompression shortens the time to first defecation, it may be related to that no NGT decompression accelerates the early ambulation for patients after hepatic surgery (Nelson et al., 2007), also, this would be likely to be due to the

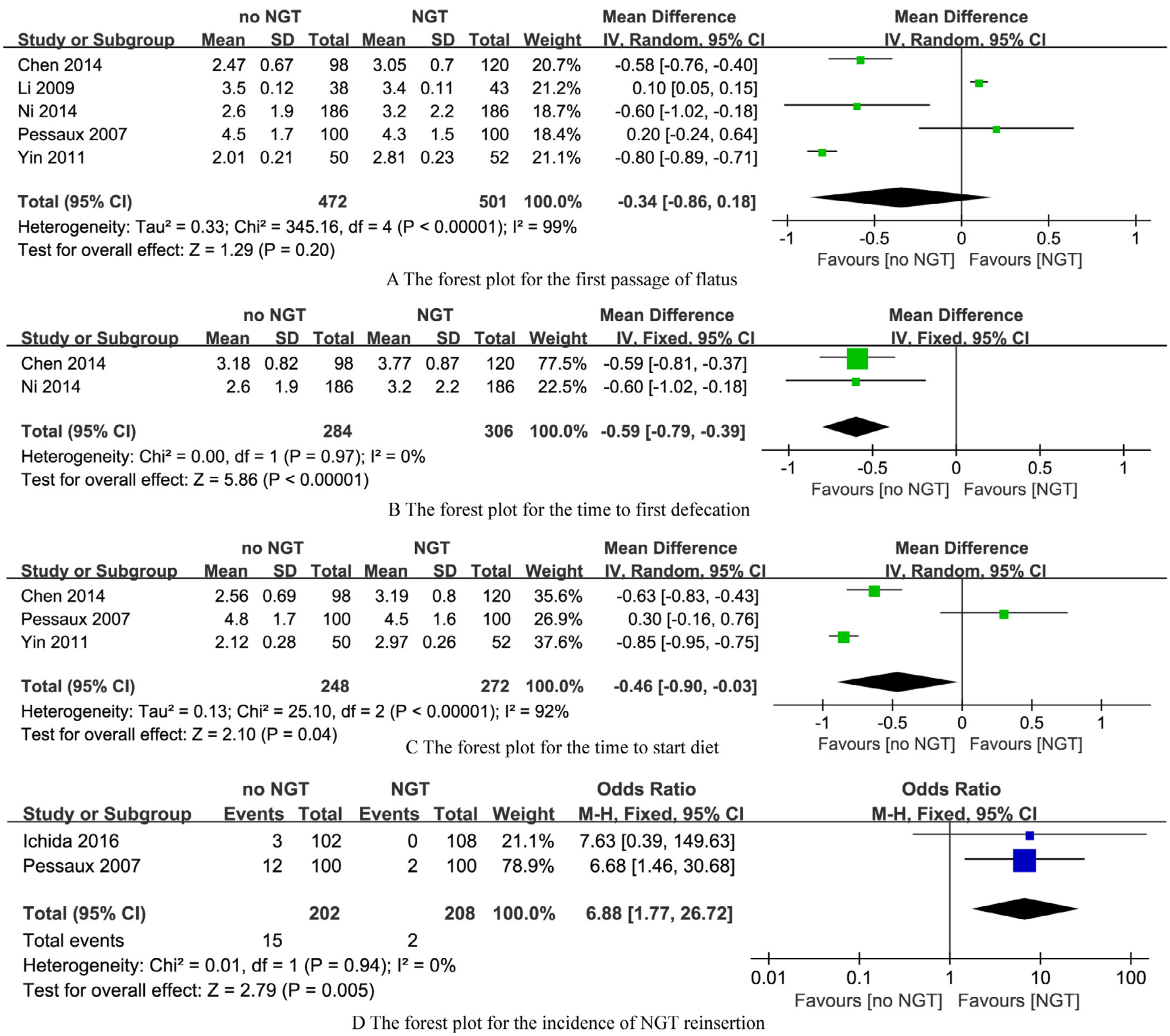

Fig. 4. The forest plots for different outcomes.

passage of gastric contents into the intestine as they are not being drained via the NGT. However, this result should be interpreted with caution, because we have included only two RCTs in this outcome, significant bias may exist. Besides, we have found that the no NGT decompression shortens the time to start diet, it is understandable that no NGT allows an early return to a liquid diet with more convenience compared with NGT compression (Hur et al., 2011). Among the included studies of this present meta-analysis, the beginning of oral feeding is all based on the recovery time of gastric and intestinal function, but we haven't found any efficacy difference on the first passage of flatus, it still needs further investigation. Previous studies (Balayla et al., 2015; Liu et al., 2014) have evidenced that the early oral feeding after abdominal surgery tends be effective and safe, and it is also tolerated by a majority of patients. Related guidelines also recommend the use of early mobilization and oral nutrition after abdominal surgery (de Groot et al., 2016; Marquez Mesa et al., 2017; Pedziwiatr et al., 2018), yet the use of NGT decompression is still under debate. Based on literature review, we have found that a plenty of studies have focused on the necessity of NGT decompression for patients with gastrectomy or intestinal resection, yet the studies in the population of hepatic surgery are very rare. Therefore, we conduct this meta-analysis to fill this gap and provide more evidence to this issue.

Specifically, the incidence of NGT reinsertion in the no NGT decompression group is significantly higher than that of NGT decompression group. There is no deny that the gastric tube can drain the contents in the stomach, prevent patients from aspiration during surgery, reduce the postoperative abdominal distension and acute gastric dilatation (Virgilio et al., 2018). The hepatic surgery is also a stress resource for patients, the secretion of digestive systems can be increased, to some extent, the insertion of NGT assists the drainage of excessive secretions and gas (Sandler et al., 1998). However, the time period for re-intubation remains unclear among this reports, it doesn't mean that it is necessary to routinely insert the NGT for decompression. The indication of NGT re-insertion (Ichida et al., 2016) is that patients develop a clinical need for

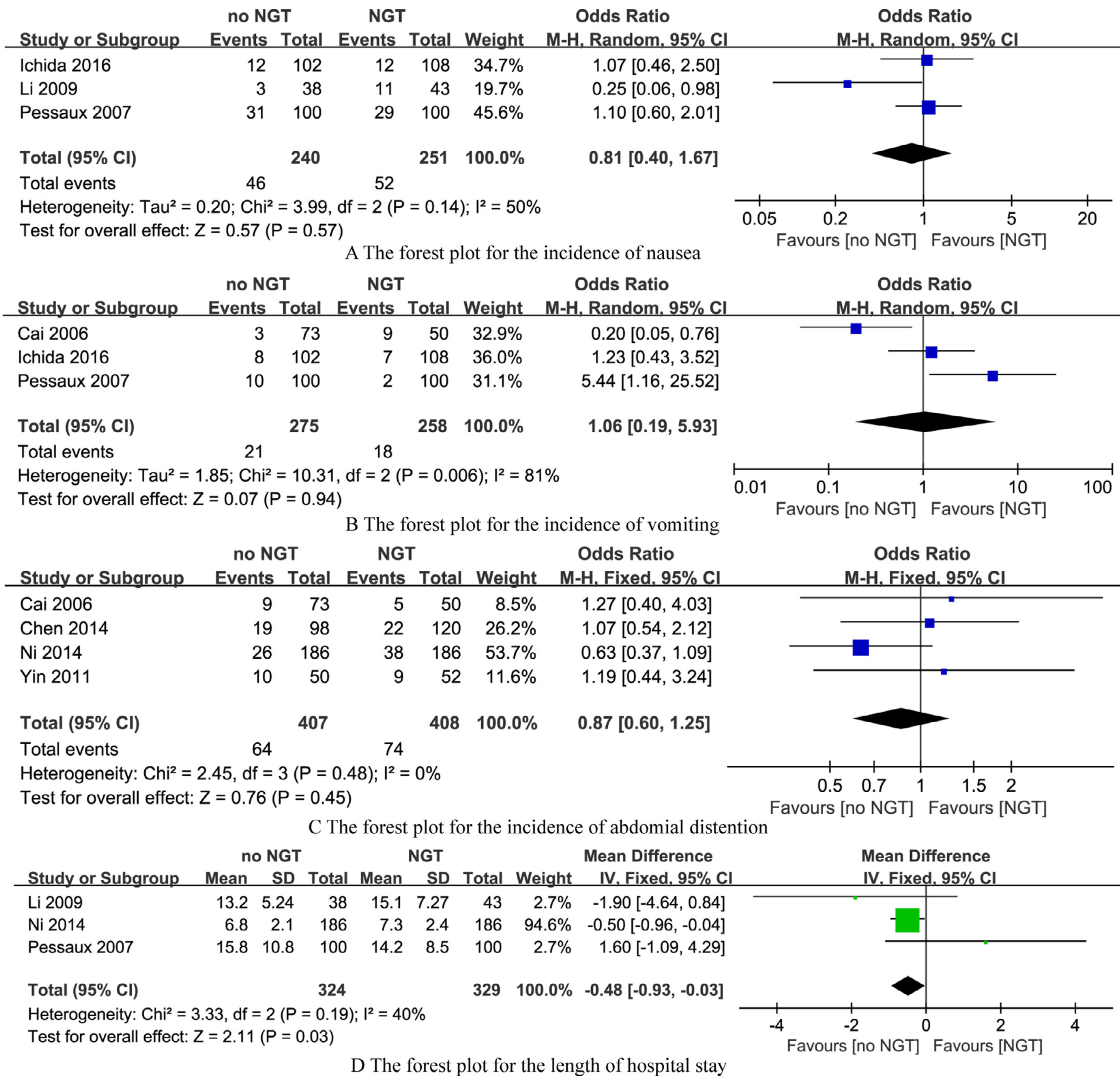

Fig. 5. The forest plots for different outcomes.

decompression in the postoperative period, such as the repeated episodes of vomiting or abdominal distension, the routinely NGT decompression after hepatic seem to be a redundant treatment. To the best of our knowledge, no related meta-analysis have given attentions to the incidence of NGT re-insertion, it is an issue that warrants further investigation.

It is noteworthy that the NGT and no NGT decompression intervention after hepatic surgery don't have any significant difference on the related complications, such as nausea, vomiting, and abdominal distention, which is different from the results of included RCTs (Cai et al., 2006; Li et al., 2009; Pessaux et al., 2007). The no NGT decompression does not increase the digestive complications further justifies that it is unnecessary to routinely insert the NGT after hepatic surgery, it is been reported that the vomiting episodes occur within a few hours or one day (Ichida et al., 2016). However, Ni's study (Ni et al., 2014) hasn't detected significant difference in both groups with 24 h after hepatic surgery, a possible explanation is the gastric and intestinal system is rather intact, the NGT decompression mainly works in the gastric. There are several concerns (Mack et al., 2004; Schuchert et al., 2008) that inability to decompress the stomach or upper duodenum in the early stage after hepatic surgery may increase the risk of biliary fistula. In this present study, due to the limited included data, no synthesized analysis on those outcomes has been conducted.

Several limitations in this study must be considered. Firstly, five of seven included RCTs are conducted in China, population and area bias can exist. Secondly, several previous studies (Chughtai et al., 2017; Kim et al., 2018; Studer et al., 2016) have referred that aspiration pneumonia is a dreadful postoperative pulmonary complication for patients with abdominal surgery, and NGT is an independently associated factor for pulmonary complications post surgeries, we couldn't perform analysis on those outcomes because the lacking of data. Thirdly, due to the data limitation, we did not perform the sub-group analysis and funnel plot, the role and timing of NGT decompression after hepatic surgery still need further elucidation.

5. Conclusions

In conclusion, given that the routinely NGT decompression can increase the time to first defecation and start diet, prolong the length of hospital stay, the routinely NGT decompression after hepatic surgery is not justified. However, the NGT decompression during the hepatic surgery and the timing for NGT decompression still remain unclear, more rigorously designed, large-scale RCTs with high quality are highlighted to identify the role of NGT decompression after surgery.

Conflict of interest

No conflict of interest has been declared by the authors.

Sources of funding

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

CRediT authorship contribution statement

Zunjia Wen: Conceptualization, Funding acquisition, Data curation, Formal analysis. **Xin Zhang:** Funding acquisition, Data curation, Formal analysis. **Yingfei Liu:** Funding acquisition, Data curation, Formal analysis. **Lanzheng Bian:** Funding acquisition, Data curation, Formal analysis. **Junyu Chen:** Formal analysis. **Li Wei:** Conceptualization.

Acknowledgments

None.

Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.ijnurstu.2019.103406.

References

Balayla, J., Bujold, E., Lapensee, L., Mayrand, M.H., Sansregret, A., 2015. Early versus delayed postoperative feeding after major gynaecological surgery and its effects on clinical outcomes, patient satisfaction, and length of stay: a randomized controlled trial. J. Obstet. Gynaecol. Can. 37 (12), 1079–1085.

Cai, Y., He, F., Wen, C., Chen, X., 2006. The feasibility of no gastric decompression after surgery for patients with liver tumor. Nurs. J. Chin. People's Lib. Army 23 (3), 2.

Chen, M., Zhang, L., Liu, Q., Huang, Y., Liu, Y., 2014. The effect of no decompression or early removal of gastric tube after surgery after patients with primary liver cancer. Nurs. Pract. Res. 11 (12), 3.

Chughtai, M., Gwam, C.U., Mohamed, N., Khlopas, A., Newman, J.M., Khan, R., Nadhim, A., Shaffiy, S., Mont, M.A., 2017. The epidemiology and risk factors for postoperative pneumonia. J. Clin. Med. Res. 9 (6), 466–475.

de Groot, J.J., Ament, S.M., Maessen, J.M., Dejong, C.H., Kleijnen, J.M., Slangen, B.F., 2016. Enhanced recovery pathways in abdominal gynecologic surgery: a systematic review and meta-analysis. Acta Obstet. Gynecol. Scand. 95 (4), 382–395.

Gan, T., Zhao, L., Shi, Y., Li, H., Yue, M., 2018. Feasibility of selective nasogastric tube indwelling in patients with hepatobiliary surgery: a meta-analysis. Nurs. J. Chin. People's Lib. Army 35 (6), 7.

Gomes, G.F., Pisani, J.C., Macedo, E.D., Campos, A.C., 2003. The nasogastric feeding tube as a risk factor for aspiration and aspiration pneumonia. Curr. Opin. Clin. Nutr. Metab Care 6 (3), 327–333.

Hur, H., Kim, S.G., Shim, J.H., Song, K.Y., Kim, W., Park, C.H., Jeon, H.M., 2011. Effect of early oral feeding after gastric cancer surgery: a result of randomized clinical trial. Surgery 149 (4), 561–568.

Ichida, H., Imamura, H., Yoshimoto, J., Sugo, H., Ishizaki, Y., Kawasaki, S., 2016. Randomized controlled trial for evaluation of the routine use of nasogastric tube decompression after elective liver surgery. J. Gastrointest. Surg. 20 (7), 1324–1330.

Kim, G., Baek, S., Park, H.W., Kang, E.K., Lee, G., 2018. Effect of nasogastric tube on aspiration risk: rResults from 147 patients with dysphagia and literature review. Dysphagia.

Li, G.Q., Zhang, F., Lu, H., Lu, L., Li, X.C., Wang, X.H., Sun, B.C., 2013. Drainage by urostomy bag after blockage of abdominal drain in patients with cirrhosis undergoing hepatectomy. Hepatobiliary Pancreat. Dis. Int. 12 (1), 99–102.

Li, Z., Li, B., Su, X., Liu, Y., Zhou, Y., Yang, J., 2009. Clinical study of the effect of no gastrointestinal decompression in patients with elective hepatectomy. Chin. J. Hepatobiliary Surg. 15 (12), 2.

Liberati, A., Altman, D.G., Tetzlaff, J., Mulrow, C., Gotzsche, P.C., Ioannidis, J.P., Clarke, M., Devereaux, P.J., Kleijnen, J., Moher, D., 2009. The PRISMA statement for reporting systematic reviews and meta-analyses of studies that evaluate health care interventions: explanation and elaboration. PLoS Med. 6 (7), e1000100.

Liu, X., Wang, D., Zheng, L., Mou, T., Liu, H., Li, G., 2014. Is early oral feeding after gastric cancer surgery feasible? a systematic review and meta-analysis of randomized controlled trials. PLoS One 9 (11), e112062.

Mack, L.A., Kaklamanos, I.G., Livingstone, A.S., Levi, J.U., Robinson, C., Sleeman, D., Franceschi, D., Bathe, O.F., 2004. Gastric decompression and enteral feeding through a double-lumen gastrojejunostomy tube improves outcomes after pancreaticoduodenectomy. Ann. Surg. 240 (5), 845–851.

Marquez Mesa, E., Baz Figueroa, C., Suarez Llanos, J.P., Sanz Pereda, P., Barrera Gomez, M.A., 2017. Nutrition management in enhanced recovery after abdominal pancreatic surgery. Cir. Esp. 95 (7), 361–368.

Nelson, R., Edwards, S., Tse, B., 2007. Prophylactic nasogastric decompression after abdominal surgery. Cochrane Database Syst. Rev. (3), CD004929.

Nelson, R., Tse, B., Edwards, S., 2005. Systematic review of prophylactic nasogastric decompression after abdominal operations. Br. J. Surg. 92 (6), 673–680.

Ni, C., Chang, Y., Fu, L., Huang, X., Zhou, H., Wang, Z., Yang, Y., 2014. Randomized controlled trial of the necessity of gastrointestinal decompression in patients after hepatectomy. J. Nurs. 21 (18), 3.

Pedziwiatr, M., Mavrikis, J., Witowski, J., Adamos, A., Major, P., Nowakowski, M., Budzynski, A., 2018. Current status of enhanced recovery after surgery (ERAS) protocol in gastrointestinal surgery. Med. Oncol. 35 (6), 95.

Pessaux, P., Regimbeau, J.M., Dondero, F., Plasse, M., Mantz, J., Belghiti, J., 2007. Randomized clinical trial evaluating the need for routine nasogastric decompression after elective hepatic resection. Br. J. Surg. 94 (3), 297–303.

Rao, W., Zhang, X., Zhang, J., Yan, R., Hu, Z., Wang, Q., 2011. The role of nasogastric tube in decompression after elective colon and rectum surgery: a meta-analysis. Int. J. Colorectal Dis. 26 (4), 423–429.

Sandler, A.D., Evans, D., Ein, S.H., 1998. To tube or not to tube: do infants and children need post-laparotomy gastric decompression? Pediatr. Surg. Int. 13 (5–6), 411–413.

Schuchert, M.J., Pettiford, B.L., Landreneau, J.P., Waxman, J., Kilic, A., Santos, R.S., Kent, M.S., El-Sherif, A., Abbas, G., Luketich, J.D., Landreneau, R.J., 2008. Transcervical gastric tube drainage facilitates patient mobility and reduces the risk of pulmonary complications after esophagectomy. J. Gastrointest. Surg. 12 (9), 1479–1484.

Schwarz, M., Coccetti, A., Murdoch, A., Cardell, E., 2018. The impact of aspiration pneumonia and nasogastric feeding on clinical outcomes in stroke patients: a retrospective cohort study. J. Clin. Nurs. 27 (1–2), e235–e241.

Studer, P., Raber, G., Ott, D., Candinas, D., Schnuriger, B., 2016. Risk factors for fatal outcome in surgical patients with postoperative aspiration pneumonia. Int. J. Surg. 27, 21–25.

Tsai, Y.F., Luo, C.F., Illias, A., Lin, C.C., Yu, H.P., 2012. Nasogastric tube insertion in anesthetized and intubated patients: a new and reliable method. BMC Gastroenterol. 12, 99.

Virgilio, E., Balducci, G., Mercantini, P., Giarnieri, E., Giovagnoli, M.R., Montagnini, M., Proietti, A., D'Urso, R., Cavallini, M., 2018. Utility of nasogastric tube for medical and surgical oncology of gastric cancer: a prospective institutional study on a new and precious application of an old and economic device. Anticancer Res. 38 (1), 433–439.

Wang, D., Li, T., Yu, J., Hu, Y., Liu, H., Li, G., 2015. Is nasogastric or nasojejunal decompression necessary following gastrectomy for gastric cancer? A systematic review and meta-analysis of randomised controlled trials. J. Gastrointest. Surg. 19 (1), 195–204.

Yin, X., Yin, X., Tan, L., Luo, G., Li, T., 2011. Effect of no gastrointestinal decompression on the recovery of patients undergoing elective liver surgery. J. Nurs. Sci. 26 (16), 2.