# Nasogastric tube drainage and pyloric intervention after oesophageal resection: UK practice variation and effect on outcomes

On behalf of AUGIS

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# ABSTRACT

#### Background

Over 1,500 patients with oesophageal cancer undergo a resection in the UK each year. At surgery, patients commonly have a nasogastric tube (NGT) placed and may undergo a pyloric intervention. There is conflicting evidence on the use of both NGTs and pyloric interventions during oesophageal resections. We performed a national survey of oesophageal centres and assessed practice variation.

#### Material and methods

An electronic survey was distributed to all resection centres in England, Wales and Scotland. Variations in practice regarding NGTs and pyloric intervention were assessed, and compared to nationally reported centre volumes and length-of-stay data.

#### Results

Most centres (31/39, 79%) responded to the survey. All centres reported routine NGT use. The majority of centres (19/31, 61%) did not perform pyloric interventions. When used, surgical pyloroplasty was the most frequent strategy (8/31, 26%). Routine post-operative radiological assessment was utilised in 9/31 (29%) of centres. Criteria for NGT removal and dietary progression was highly variable, with every centre reporting different protocols. There were no significant differences in practice between high and low volume centres. There were also no trends seen when comparing centres above vs at-or-below the median length-of-stay. The majority (68%) of centres were willing to take part in a trial assessing NGT use and pyloric interventions.

#### Conclusions

Pyloric intervention use varies widely, with no clear link to outcomes. NGT use remains standard practice despite evidence for safe omission. Surgeons require and recognise the need for a trial to assess requirement for NGTs and pyloric intervention after oesophageal resection.

Keywords, Esophageal Cancer, Esophagectomy, Nasogastric Tube, Pyloric Intervention, Delayed gastric emptying, Enhanced Recovery

## Introduction

Nasogastric tubes (NGTs) are used to decompress the stomach in the presence of poor gastric emptying after oesophageal resection. This is thought to reduce the risk of aspiration pneumonia as well as reducing the incidence of anastomotic or stapleline leak due to gastric dilatation. However, NGTs are often a source of substantial patient discomfort[1] and may increase the risk of post-operative morbidity[2,3]. In bariatric[4,5] and colorectal surgery[6], omission of the NGT is now commonplace, as it is associated with less discomfort, earlier return to bowel function, earlier return to diet and reduced respiratory complications. As a consequence, NGTs are now excluded from most enhanced recovery programmes (ERP) in both bariatric and colorectal surgery[5,7]. After oesophageal resection, several studies have reported no differences in respiratory infections or anastomotic leaks with omission of a postoperative NGT[1,8,9].

Practices to reduce the impact of delayed gastric emptying (DGE) are varied and include NGTs, pyloric interventions, delaying oral nutrition, prokinetic medications and differing methods of conduit formation[10,11]. Interventions can be performed to disrupt the pylorus and prevent outflow obstruction. However, there is no evidence to support routine use of pyloric intervention in the prevention of anastomotic leak or respiratory complication rates[12].

We performed a national survey in the United Kingdom to assess trends in current clinical practice and assessed for any differences in unit outcomes.

##  Methods

A steering committee developed an initial set of survey questions based on a review of the literature and expert opinion. The questions aimed to analyse current controversies and management options regarding NGT usage and pyloric intervention. Survey domains included clinical usage of NGTs, usage of pyloric intervention, criteria for NGT removal and progression of oral intake and parameters of gastric conduit construction. Respondents also indicated their main reasons for using NGTs, by ranking the following in order of priority: conduit distention, aspiration risk, anastomotic leak and for clinical assessment. Responses were weighted for priority rank and collated. Surgical equipoise was assessed and respondents were asked to indicate their willingness to recruit to a randomised trial.

A Google Forms questionnaire was designed and distributed to all oesophageal surgery tertiary centres in England, Wales and Scotland.

Data were collated and analysed in Microsoft Excel (Microsoft Corp, Redmond, WA). We considered whether high or low volume centres exhibited differences in practice, and whether these differences had any impact on outcome. We then compared centres above and below the median for annual case volume and length of stay, using publicly available national audit data[13]. Tests used were Chi-squared or Mann-Whitney U tests for categorical and continuous data, respectively.

## Results

### Centres

In total, 31 of the 39 centres responded to the survey (79% response rate), representing 88.4% (3619/4091) of resections carried out across UK in the 2016-1019 NOGCA audit period. Twenty-five centres (78%) reported post-operative care was managed within the context of a formalised enhanced recovery program (ERP).

### Use of NGTs

All of the 31 centres routinely used an NGT at the time of the operation (Table 1). Following weighted ranking, the reported priorities for NGT use were to prevent conduit distention (24/31 (77%) responses 1st priority rank), followed by prevention of aspiration, anastomotic complications, and use as a diagnostic assessment tool. Of the 31 centres, no two reported a similar post-operative pathway when considering removal of NGTs, initiation of diet and use or no use of pyloric interventions.

#### Table 1. Survey responses from 31 centres: Nasogastric tube (NGT) use after oesophagectomy for cancer

|  |  |
| --- | --- |
| **Survey question** | **Response n (%)** |
| *Do you routinely use an NGT post-operatively?* |
|  | Yes | 31 (100%) |
| *How do you secure the NGT?* |
|  | Bridle | 15 (48%) |
| Tape | 9 (29%) |
| Stich | 7 (23%) |
| *Do you routinely aspirate the NGT?* |
|  | Yes | 17 (54%) |
| Continuous suction | 2 (6%) |
| No | 12 (39%) |
| *If aspiration how often is this performed? (hourly)* |
|  | 1 | 1(5%) |
| 2 | 3(14%) |
| 4 | 13 (62%) |
| 6  | 4(19%) |
| *Is an NGT mandated for non-invasive positive pressure ventilation* |
|  | Yes | 14 (45%) |
| *Method for re-insertion of NGT if required* |
|  | Blind | 13 (42%) |
| Endoscopy Guidance | 11 (35%) |
| Fluoroscopic Guidance | 7 (23%) |

### Pyloric interventions

Most centres (20/31, 61%) did not perform any pyloric interventions. Of those centres that did, the most common procedure was a surgical pyloroplasty (8/31, 26%), whereas endoscopic balloon dilatation, pyloromyotomy or mechanical stretch were only used in single centres (1/31, 3%).

Criteria for NGT removal and dietary progression

The timing and criteria for NGT removal was highly variable across the centres (Table 2). The most commonly used options were to remove the NGT and allow patients to start free fluids on day five (11/31, 35%), though practice ranged from post-operative day 2 to day 6. A third (33%) of centres started free fluids on the same day as NGT removal, 38% started fluids before NGT removal and 29% after.

The majority of centres did not use routine post-operative imaging in their pathway (22/31, 71%) to guide NGT removal or dietary progression. Volumes of fluids backing up in the NGT were the most commonly used metric to judge care progression (19/31, 61%). Of those centres that used NGT volume to guide removal, 9/19 (46%) gave no specific volumes; the rest either specified a ratio of input to output volumes over a 24-hour period (2/19, 11%) or gave absolute output limits of between 150 and 300 ml in 24 hours (8/19, 42%). Contrast swallow examinations were routinely performed in 7/31 (23%) of centres, and a few centres also reported use of methylene blue dye leak test instead of a contrast study (1/31, 3%) or passage of flatus (2/31, 6%) as specific criteria. Feeding jejunostomy was a routine adjunct in a majority of centres (21/31, 67%).

#### Table 2. Survey responses from 31 centres: criteria for nasogastric tube (NGT) removal and progression of oral intake after oesophagectomy for cancer

|  |  |
| --- | --- |
| **Survey question** | **Response n (%)** |
| *What post-operative day is the NGT typically removed?* |
|  | 2 | 4 (13%) |
| 3 | 4 (13%) |
| 4 | 4 (13%) |
| 5 | 11 (35%) |
| 6 | 1 (3%) |
| No specific day | 7 (23%) |
| *What is your main criteria for removal of the NGT?* |
|  | Specific POD | 7 (23%) |
| Individual judgement | 4 (13%) |
| Specific diagnostic criteria | 20 (65%) |
| *If other specific criteria what are these? (multiple responses allowed) \** |
|  | NG volumes – input compared to output | 19 (61%) |
| Contrast study to show evidence of leak and / or delayed gastric emptying | 7 (23%)  |
| Methylene Blue Test | 1 (3%)  |
| Tolerating Free Fluids | 3 (10%)  |
| No clinical evidence of leak | 3 (10%) |
| Patient passing flatus | 2 (6%) |
| Conduit size on imaging | 1 (3%)  |
| No specific criteria | 8 (26%)  |
| *How is post-operative nutrition managed?* |
|  | Feeding jejunostomy used | 19 (61%) |
| Oral feeding initial form of nutrition | 11 (35%) |
| Routine total parenteral nutrition | 1 (3%) |
| *What post-operative day do you start free fluids?* |
|  | 5 | 11 (35%) |
| 4 | 10 (32%) |
| 3 | 8 (26%) |
| 2 | 1 (3%) |
| 1 | 1 (3%) |
| *Other criteria used to guide starting an oral diet? (multiple responses allowed)* |
|  | Contrast imaging showing no leak and/or evidence of delayed gastric emptying | 9 (26%) |
| Aspiration volumes on NGT | 5 (15%) |
| Methylene Blue Test | 1 (3%) |
| NUn score analysis\*\* | 1 (3%) |
| Patient passing flatus | 2 (6%) |
| No clinical signs of leak | 3 (9%) |
| None mentioned | 13 (38%) |
| *Do you use routine post-operative cross-sectional / fluoroscopic imaging?* |
|  | None | 22 (71%) |
| Contrast-topography with oral contrast | 3 (10%) |
| Water soluble contrast swallow | 6 (19%) |

\*As centres could select multiple criteria percentages add up to more than 100%

\*\*Nun score: Noble / Underwood score[14]

### Diameter of gastric tube and height of anastomosis

Most centres (25/31, 81%) formed a conduit with a diameter of less than 5cm and the rest used a greater diameter. The majority of centres (28 of 31, 90%) placed their anastomosis above the azygous vein.

### Practice differences between centres

There were no discernible trends in practice comparing high with low volume centres. Use of an Enhanced Recovery Program, use of post-operative imaging, feeding routes, the post-operative day of initiating oral fluids and rates of pyloric intervention use were not statistically significantly different between the two groups (Table 3). Similarly, comparing centres with length-of-stay at or less than median with those longer than the median, did not show any trends. The groups were similar in terms of ERP use, feeding route, use of post-operative imaging, NGT use, initiation of diet, height of anastomosis and diameter of gastric tube (Table 4).

#### Table 3. Practice variation by centre volume of oesophagectomy for cancer \*\*

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Process | Overall30\* | Annual volume above median (n=15) | Annual volume at or below median (n=15) | P value |
| Within-group volume, median (range) |  | 156 | 90 | - |
| ERP Use | Yes | 24 (80%) | 13 (87%) | 11 (74%) | 0.361 |
| Feeding route | Only oral feeding | 8 (27%) | 7 (47%) | 1 (7%) | 0.140 |
| Feeding jejunostomy  | 21 (70%) | 7 (47%) | 14 (93%) |
| TPN | 1 (3%) | 1 (7%) | 0 |
| Post-op imaging | None | 21 (70%) | 12 (80%) | 9 (60%) | 0.183 |
| CT oral contrast | 5 (17%) | 3 (20%) | 2 (13%) |
| Water soluble | 4 (13%) | 0 | 4 (27%) |
| Pyloric intervention | None | 18 (60%) | 8 (53%) | 10 (67%) | 0.330 |
| Pyloroplasty | 6 (20%) | 5 (33%) | 1 (7%) |
| Pyloromyotomy | 1 (3%) | 1 (7%) | 0 |
| Mechanical dilatation | 2 (7%) | 1 (7%) | 1 (7%) |
| LoS, median (range) | (7-15) | 10 (7-15) | 11 (8-13) | 0.345 |
| POD starting free fluid, median (range) | 4 (1-5) | 4 (1-5) | 4 (2-5) | 0.533 |
| POD NG tube removal, median (range) | 4 (2-6) | 3.5 (2-5) | 5 (2-6) | 0.449 |
| Gastric tube | Less than 5cm | 25 (83%) | 12 (80%) | 13 (87%) | 0.624 |
|  | More than 5cm | 5 (17%) | 3 (20%) | 2 (13%) |
| Anastomosis level | Above azygous | 28 (93%) | 15 (100%) | 13 (87%) | 0.343 |
| Below azygous | 2 (7%) | 0 | 2 (13%) |

\*30 centres as part of analysis as no outcome data (LOS and volume) for the included Scottish Centre

\*\*Volume data April 2016 – March 2019

### Table 4. Practice variation in centres conducting oesophagectomy for cancer by length-of-stay

|  |  |  |  |
| --- | --- | --- | --- |
| Process(No LoS for one centre) | LoS at or less median (n=16) | LoS longer than median (n=14) | P value |
| ERP Use | Yes | 12 (40%) | 12 (40%) | 0.643 |
| Feeding route | Only oral feeding | 7 (23%) | 11 (37%) | 0.669 |
| Feeding jejunostomy  | 8 (27%) | 3 (10%) |
| TPN | 1 (3%) | 0 |
| Post-op imaging | None | 12 (40%) | 10 (33%) | 0.360 |
| CT oral contrast | 1 (3%) | 1 (3%) |
| Water soluble | 3 (10%) | 3 (10%) |
| Pyloric intervention | None | 10 (33%) | 9 (30%) | 0.845 |
| Pyloroplasty | 3 (10%) | 5 (17%) |
| Pyloromyotomy | 1 (3%) | 0 |
| Mechanical dilatation | 2 (7%) | 0 |
| POD starting free fluid, median (range) | 4 (3 - 5) | 4 (1 - 5) | 0.963 |
| POD NG tube removal, median (range) | 4 (2-6) | 4 (3-5) | 0.446 |
| Gastric Tube | Less than 5cm | 14 (47%) | 11 (37%) | 0.395 |
| Greater than 5cm | 2 (7%) | 3 (10%) |
| Anastomosis level | Above Azygous | 15 (50%) | 13 (43%) | 0.950 |
| Below Azygous | 1 (3%) | 1 (3%) |

\*30 centres as part of analysis as no outcome data (LOS and volume) for the included Scottish Centre

### Surgeon equipoise

Most centres (21/31, 68%) were willing to take part in a randomised trial comparing NGT use combined with surgeon’s current practice for pyloric intervention versus NGT omission with intra-operative pyloric balloon dilatation.

## Discussion

Despite the general reduction in use of NGTs after surgery, they remain commonplace after oesophagectomy in the UK. This survey of unit practice, demonstrates the large variation between centres, in terms of the timing of their removal and concurrent management of oral nutritional intake. Pyloric interventions are again variably used and are always combined with NGTs, despite similar primary functions.

The placement of an NGT after oesophageal resection, is thought to prevent acute dilatation of the gastric tube as a consequence of DGE. This potentially raises the risk of aspiration pneumonia, anastomotic leak or gastric tube necrosis. Despite the widespread use of NGTs shown in this study, evidence suggests that NGTs do not actually alter the course of delayed gastric emptying. A meta-analysis of seven studies, including four RCTs, found that ‘no tube’ or ‘early removal’ did not result in any difference in anastomotic leakage, mortality or respiratory complications[9]. However, the data in this study was highly heterogenous, with the largest RCT accounting for 54% of the ‘no-tube’ group. Also, NGT removal was at 48 hours after surgery, rather than being completely omitted. A further small RCT (n=80) has shown no adverse outcomes for rates of pneumonia, anastomotic leak or NGT re-insertion when comparing removal on POD 1 or 7[8]. Another RCT, with a small sample size of 40 patients, showed an increased risk of cervical anastomotic leak, when using an NGT vs no NGT, 27% vs 0%, p = 0.016[15]. These studies suggest that although omission or early removal of the NGT may be safe, the evidence to support this is weak.

In this study, nine centres removed the NGT before day 4 (9/31, 29%), of which three centres preceded NGT removal with a contrast study. The rest (6/9, 66%) were guided by NGT volumes to assess gastric emptying. Only one centre started fluids before NGT removal, two on the same day and six after removal. Without starting oral fluids or using contrast imaging prior to NGT removal, it is difficult to predict patients with DGE in the early post-operative phase. The NGT is, therefore, unlikely to prevent complications from DGE, unless left for extended periods, when patients have adequate oral intake to demonstrate or assess for delayed gastric emptying. Half of the centres (15/31, 48%) in the survey, left the NGT in for 4 to 6 days. Amongst this group, there were 12 different criteria for removal and 3 centres with no specific criteria apart from the POD.

The lack of consensus on the prevention, management, and definition of DGE is a recognised clinical problem. A recent Delphi consensus attempted to address this[16], defining early (i.e. postoperative) DGE as >500mL daily NGT output between day 5 and 14. This definition relies on the presence of an NGT beyond POD 5, which is contrary to most ERPs and the practice of many centres as reported in this survey (39% of centres would have routinely removed NGTs before POD 5). In addition, the centres in this study where NGT output volume was routinely monitored as a criterion for its removal, did not use an upper limit of 500mL/24 hours as diagnostic for DGE, setting instead thresholds between 150-300mL for the safe removal of the NGT.

Another factor which contributes to the function and emptying of the neo-oesophagus is the formation of a gastric tube. Historically the whole stomach was used, however, evidence including a 2014 systematic review, demonstrates that using a narrower gastric tube is associated with an improvement in quality of life, a reduction in reflux and lower rates of DGE. The included studies had an estimated conduit dimeter of 2 to 6cm[17]. The majority (81%) of surgeons in this study, aim to form a tube with a diameter of less than 5cm. Although, it is likely that this is not measured accurately and an estimation on diameter is made instead.

NGTs can be used to reduce contamination in the presence of an anastomotic leak. However, even with delayed removal, the majority of patients will have had their NGT removed before a leak is detectable. A recent systematic review of nine studies showed that the mean time to presentation of an anastomotic leak was nine days (range 2 to 30)[18]. The majority of centres in this study have removed the NGT by day 6. There is no conclusive evidence around the timing of NGT removal with the majority of studies showing no reduction in overall complications, when comparing prolonged use of NGTs to early removal or non-use [8,9,19].

The most recent systematic review of pyloric interventions showed a non-significant trend towards reducing the incidence of anastomotic leaks, pulmonary complications and DGE; but the level of evidence was poor due to heterogeneity in definition, techniques and lack of well-powered studies[12]. The present survey showed that although the majority (61%) of centres do not use a pyloric intervention, a significant proportion still do. The most commonly used technique being pyloroplasty (27%). In these centres, the use of a pyloroplasty does not appear to affect subsequent management of NGTs and oral intake post-operatively. When comparing centres that used pyloric interventions to those that did not, the pyloric intervention did not change the POD that NGTs were removed or free fluids started. This suggests that surgeons are still equally concerned about the risk of DGE despite the use of a pyloric intervention. The use of a pyloric intervention did not appear to influence LoS when comparing the different units.

An oral diet is not typically used immediately after surgery due to the fear of DGE and leak (median, POD of free fluids = 4), though evidence for this is mixed. A review found that early oral feeding (before POD day 3) is associated with shorter LOS, earlier return to bowel function and improved patient quality of life[20]. However, the authors also found mixed evidence with reference to anastomotic leaks, with some studies suggesting the risk may be higher. A more recent systematic review that focused only on anastomotic leak, reported that there was no evidence of an increased rate with early feeding[21]. The recently reported NUTRIENT II trial (a multicentre, international RCT), compared oral feeding from POD 1 (starting with 500ml/24 hours of liquid food) to tube feeding until day 5. They found there was no difference in anastomotic leak or respiratory complications.[22]

The majority of centres in this survey reported using feeding jejunostomies, in agreement with the findings of a recent jejunostomy-specific national survey[23]. Evidence on their use is mixed, with most evidence suggesting equivalence to care without jejunostomy tubes. There remain concerns about the addition of this procedure and potential for additional morbidity. A systematic review of 12 studies showed a mortality rate of between 0-0.5%, a reoperation rate of 0-2.9%, entry site infection rate of 0.4-16% and entry site leakage in 0.4-16% in the absence of benefit[24].

Limitations of this study must be considered. While only 31 of the 39 (79%) of centres responded to the survey, this represents a high response rate to a survey study and included centres accounting for 88.4% of resections carried out nationally. Although there is likely to be variance between individual surgeons at each centre, we specifically worded the survey asking respondents to give the most representative view of their centre aiming to reduce this bias. We analysed LOS using national outcomes data, with a median LOS for each centre. Due to confounding factors and lacking granularity of data it is impossible to demonstrate a direct link between differing post-operative protocols and LOS. However, it shows the wide variations which exist between centres in terms of nutrition, pyloric interventions and post-operative protocols.

## Conclusions

Current strategies to mitigate the impact of DGE by using NGTs and pyloric interventions are highly variable and not evidence based. Emerging evidence in oesophageal surgery suggests these methods may cause unnecessary discomfort, slow recovery, and potentially even increase risk of complications. Equipoise over the prevention and diagnosis of DGE is clearly reflected in the fact that the majority of centres indicated willingness to recruit to an RCT on this topic.

## Bibliography

[1] Mistry RC, Vijayabhaskar R, Karimundackal G, Jiwnani S, Pramesh CS. Effect of short-term vs prolonged nasogastric decompression on major postesophagectomy complications: A parallel-group, randomized trial. Arch Surg 2012;147:747–51. https://doi.org/10.1001/archsurg.2012.1008.

[2] Sato T, Takayama T, So K, Murayama I. Is retention of a nasogastric tube after esophagectomy a risk factor for postoperative respiratory tract infection? J Infect Chemother 2007;13:109–13. https://doi.org/10.1007/s10156-007-0504-0.

[3] Nelson R, Edwards S, Tse B. Prophylactic nasogastric decompression after abdominal surgery. Cochrane Database Syst Rev 2007. https://doi.org/10.1002/14651858.CD004929.pub3.

[4] Huerta S, Arteaga JR, Sawicki MP, Liu CD, Livingston EH. Assessment of routine elimination of postoperative nasogastric decompression after Roux-en-Y gastric bypass. Surgery 2002;132:844–8. https://doi.org/10.1067/msy.2002.127678.

[5] Thorell A, MacCormick AD, Awad S, Reynolds N, Roulin D, Demartines N, et al. Guidelines for Perioperative Care in Bariatric Surgery: Enhanced Recovery After Surgery (ERAS) Society Recommendations. World J Surg 2016;40:2065–83. https://doi.org/10.1007/s00268-016-3492-3.

[6] Rao W, Zhang X, Zhang J, Yan R, Hu Z, Wang Q. The role of nasogastric tube in decompression after elective colon and rectum surgery : A meta-analysis. Int J Colorectal Dis 2011;26:423–9. https://doi.org/10.1007/s00384-010-1093-4.

[7] Gustafsson UO, Scott MJ, Hubner M, Nygren J, Demartines N, Francis N, et al. Guidelines for Perioperative Care in Elective Colorectal Surgery: Enhanced Recovery After Surgery (ERAS®) Society Recommendations: 2018. World J Surg 2019;43:659–95. https://doi.org/10.1007/s00268-018-4844-y.

[8] Hayashi M, Kawakubo H, Shoji Y, Mayanagi S, Nakamura R, Suda K, et al. Analysis of the Effect of Early Versus Conventional Nasogastric Tube Removal on Postoperative Complications After Transthoracic Esophagectomy: A Single-Center, Randomized Controlled Trial. World J Surg 2019;43:580–9. https://doi.org/10.1007/s00268-018-4825-1.

[9] Weijs TJ, Kumagai K, Berkelmans GHK, Nieuwenhuijzen GAP, Nilsson M, Luyer MDP. Nasogastric decompression following esophagectomy: A systematic literature review and meta-analysis. Dis Esophagus 2017;30:1–8. https://doi.org/10.1111/dote.12530.

[10] Konradsson M, Nilsson M. Delayed emptying of the gastric conduit after esophagectomy. J Thorac Dis 2019;11:S835–44. https://doi.org/10.21037/jtd.2018.11.80.

[11] Zhang R, Zhang L. Management of delayed gastric conduit emptying after esophagectomy. J Thorac Dis 2019;11:302–7. https://doi.org/10.21037/jtd.2018.11.101.

[12] Arya S, Markar SR, Karthikesalingam A, Hanna GB. The impact of pyloric drainage on clinical outcome following esophagectomy: A systematic review. Dis Esophagus 2015;28:326–35. https://doi.org/10.1111/dote.12191.

[13] Royal College of Surgeons England. National Oesophagogastric Cancer Audit 2020.

[14] Noble F, Curtis N, Harris S, Kelly JJ, Bailey IS, Byrne JP, et al. Risk Assessment Using a Novel Score to Predict Anastomotic Leak and Major Complications after Oesophageal Resection. J Gastrointest Surg 2012;16:1083–95. https://doi.org/10.1007/s11605-012-1867-9.

[15] Daryaei P, Vaghef Davari F, Mir M, Harirchi I, Salmasian H. Omission of nasogastric tube application in postoperative care of esophagectomy. World J Surg 2009;33:773–7. https://doi.org/10.1007/s00268-009-9930-8.

[16] Konradsson M, Van Berge Henegouwen MI, Bruns C, Chaudry MA, Cheong E, Cuesta MA, et al. Diagnostic criteria and symptom grading for delayed gastric conduit emptying after esophagectomy for cancer: International expert consensus based on a modified Delphi process. Dis Esophagus 2020;33:1–9. https://doi.org/10.1093/dote/doz074.

[17] Akkerman RDL, Haverkamp L, Van Hillegersberg R, Ruurda JP. Surgical techniques to prevent delayed gastric emptying after esophagectomy with gastric interposition: A systematic review. Ann Thorac Surg 2014;98:1512–9. https://doi.org/10.1016/j.athoracsur.2014.06.057.

[18] Verstegen MHP, Bouwense SAW, Van Workum F, Ten Broek R, Siersema PD, Rovers M, et al. Management of intrathoracic and cervical anastomotic leakage after esophagectomy for esophageal cancer: A systematic review. World J Emerg Surg 2019;14:1–12. https://doi.org/10.1186/s13017-019-0235-4.

[19] Zhang R, Zhang L. Feasibility of complete nasogastric tube omission in esophagectomy patients. J Thorac Dis 2019;11:S819–23. https://doi.org/10.21037/jtd.2018.11.98.

[20] Zheng R, Devin CL, Pucci MJ, Berger AC, Rosato EL, Palazzo F. Optimal timing and route of nutritional support after esophagectomy: A review of the literature. World J Gastroenterol 2019;25:4427–36. https://doi.org/10.3748/wjg.v25.i31.4427.

[21] Zhang C, Zhang M, Gong L, Wu W. The effect of early oral feeding after esophagectomy on the incidence of anastomotic leakage: an updated review. Postgrad Med 2020;132:419–25. https://doi.org/10.1080/00325481.2020.1734342.

[22] Berkelmans GHK, Fransen LFC, Dolmans-Zwartjes ACP, Kouwenhoven EA, Van Det MJ, Nilsson M, et al. Direct Oral Feeding Following Minimally Invasive Esophagectomy (NUTRIENT II trial): An International, Multicenter, Open-label Randomized Controlled Trial. Ann Surg 2020;271:41–7. https://doi.org/10.1097/SLA.0000000000003278.

[23] P Ireland 1 SJ 2. Feeding jejunostomy in upper gastrointestinal resections: a UK-wide survey. Ann R Coll Surg Engl 2020;102:697–701.

[24] Weijs TJ, Berkelmans GHK, Nieuwenhuijzen GAP, Ruurda JP, Hillegersberg R v., Soeters PB, et al. Routes for early enteral nutrition after esophagectomy. A systematic review. Clin Nutr 2015;34:1–6. https://doi.org/10.1016/j.clnu.2014.07.011.