

The Nutrition Route following Esophagectomy

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Abstract

Esophagectomy remains a high-risk surgical procedure. Esophageal cancer is often associated with a weight loss. The best nutritional condition is crucial for successful oesophageal surgery. The increased septic complications and costs have limited the wide use of total parenteral nutrition. Currently, enteral nutrition is the preferred nutrition method following esophagectomy. However; jejunostomy-tube was associated with rare major complications that may lead to discontinuing nutrition. Choosing an enteral feeding route after esophagectomy depends greatly on the surgeon preference. The safety and benefits of early oral feeding on outcomes after major gastrointestinal surgery have been well documented. However, the surgical community is still reticent about initiating early oral feeding after esophageal surgery. Despite the limited number of published reports, comparative trials have clearly shown the feasibility, safety with no increase in morbidity rate. In this brief review, we tried to discuss the different routes of nutritional support after oesophagectomy with providing the current insights on early oral feeding.

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Introduction

Neoadjuvant therapies, centralisation and perioperative care improvement have resulted in significant improvement of outcomes and overall survival of esophageal cancer patients, during the last decades [1,2]. Malnutrition is a common clinical condition associated with oesophageal cancer. The weight loss is related to reduce oral intake and cancer disease. As an important paramount influencing postoperative outcomes, a poor nutritional status is associated with poor outcome following major gastrointestinal surgery [3,4,5]. Nevertheless, esophagectomy remains a high-risk surgical procedure with high complications and mortality rates. Therefore, the perioperative nutrition is highly recommended to improve the nutritional condition of patients for successful surgery. Nutritional support can be provided through enteral and parenteral routes. The enteral nutrition (EN) is the preferred nutritional method after esophagectomy. EN can be provided through various routes, including oral intake, nasoduodenal tube and jejunostomy-tube. Implemented successfully in several gastrointestinal surgical procedures, especially in colorectal and gastric surgery, enhanced recovery after surgery (ERAS) protocol implementation has improved postoperative outcomes with reduced complications [6]. Oral feeding is an important component of the ERAS programs. Several elements of the ERAS programs such as prehabilitation protocols, minimally invasive surgical procedures, and early mobilisation have been already introduced in oesophageal surgery and the published results are promising [7,8,9]. However, reticence still exists about the initiation of the early oral feeding after esophageal surgical procedure. In this brief review, we tried to discuss the different routes of nutritional support after esophagectomy with providing the current insights on early oral feeding.

Nutritional Support Routes

As previously précised, early postoperative nutritional support following esophagectomy is crucial to meet daily patient nutritional requirement and preserve the best nutritional condition of the patient

Total Parenteral Nutrition (TPN)

TPN was the first route used to

provide adequate nutritional support following surgery [10]. Compared with postoperative starvation or nil-by-mouth, TPN has improved wound healing and reduced postoperative complications [11].

However, TPN was associated with venous-catheter complications varying from 9.3% to 29.8%, and were listed in table 1 [12,13,14,15]. Additionally, TPN was associated with higher incidence of severe complications and increased septic complications requiring active interventions [12]. Compared to enteral feeding tube, there were no significant differences in related venous catheter complications [12,16,17]. Furthermore, critically ill patients who received early TPN were more likely to develop sepsis with longer recovery time compared to late initiation of TPN [18]. The mortality rates were similar in both early and delayed TPN. Altogether, TPN was associated with increased hospital stay length and relatively high costs comparing with enteral nutrition (EN) [16,18,19]. Therefore, TPN should be only used when EN is contraindicated or impossible.

Enteral Feeding

In colorectal surgery, the superiority of the enteral feeding in term of potential benefits on the immune response and postoperative outcomes has clearly been demonstrated by the published reports of comparative studies [20,21]. In addition, the recent evidence suggests that early oral feeding is associated with shorter length of hospital stay, faster return of bowel function (ROBF), and improved quality of life following major gastrointestinal surgery [22].

Inspired by the better results obtained in colorectal surgery, the enteral feeding was introduced in oesophageal surgery and has become as standard of care following esophagectomy [23]. The early postoperative enteral nutrition is introduced 24-48h after surgery and gradually increased in volume to reach the required nutritional volume with five to seven days. The enteral feeding can be provided through oral intake, nasoduodenal tube or tube-jejunostomy.

Jejunostomy-Tube Feeding

First described by Delany et al. the jejunostomy tube is generally placed in the proximal jejunum while performing esophagectomy. Multiple modifications have

been added to original technique resulting in increased reduction of tube - related complications [24,25]. The minor tube-related complications include dislocation, rotation, obstruction, entry site leakage or infection and skin erosion. As systematic review including 3,243 patients, reported that these minor complications occurred in 13–38% of patients [26]. A reduced rate of major complications has been reported with mortality and reoperation rates of 0–0.5% and 0–2.9%, respectively [26]. Gastrointestinal complaints related to nutrient infusion mainly include abdominal cramps and diarrhea that may need to slow down the infusion debt or temporarily suspend the infusion [26]. Complications associated with jejunostomy feeding are listed in table 2 [24,27–32]. Although the minor complications associated with jejunostomy feeding that may potentially hamper functional recovery time resulting in a longer hospital stay [32], the postoperative jejunostomy feeding resulted in reduced hospital stay length and life-threatening complications, compared to TPN (Table 3) [12,16,23,33]. In addition, it was associated with improved short-term survival at 90 days and quality of life, in comparison to TPN [34,35]. Another advantage of enteral feeding via jejunostomy that it can be continued after discharge from hospital when needed, especially in patients who have a poor oral intake and reduced daily requirement of calories [22]. Also, home jejunostomy feeding was associated with reduced costs related to unplanned hospital attendances and re-admissions [36]. Overall, Feeding via jejunostomy tube is safe and widely well-tolerated with reduced life - threatening complications and hospital stay length, decreased costs, and improved short-term survival at 90 days and quality of life.

Nasoduodenal Feeding

Nasoduodenal or nasojejunal feeding is an alternative route for enteral feeding. A tube is placed during or shortly following surgery via the nasal cavity into the jejunum or duodenum. This nutrition route is less invasive with lower incidence of major complications. The tube dislocation was the most frequent complication and occurred in 20–35% of patients [26,32]. Tube obstruction and gastrointestinal complaints occurred in 3% and 7%, respectively [26], with sore throat and nasal discomfort [37]. As listed in

table 2, the tube-related complications were similar in both nasojejunal feeding and jejunostomy feeding. The nutritional target was reached on the postoperative day 3 (POD 3) which was similar with jejunostomy feeding [32].

Nowadays, there is no evident superiority of one method over other and both nasojejunal and jejunostomy feeding routes can be used in the postoperative setting after esophagectomy.

Early Oral Feeding

As part of ERAS protocols, postoperative early oral feeding has become standard of care following various gastrointestinal surgical procedures, especially gastric and colorectal surgery, over the last years. Instead of other ERAS components, reticence still exists about the early initiation of oral feeding following esophagectomy. The most reasons advocated delaying oral feeding after esophagectomy are fear of pneumonia (aspiration) and increase of anastomotic leakage sequelae. Besides, the feasibility and the safety of early oral feeding following esophagectomy have been assessed. A recent prospective multicenter trial (2016), comparing early oral feeding started on POD1 with delayed oral feeding initiated on POD5, revealed that early oral feeding following esophagectomy was feasible, safe and did not result in increased major complications including pneumonia and anastomotic leakage [38]. Moreover, a recent randomised trial (2015) comparing early oral feeding started on POD1 with delayed oral feeding after esophagectomy showed a significant short length of stay with no difference in surgical complication rates, in the early oral feeding group [39,40]. In the other hand, relatively recent studies have shown that early oral feeding after esophagectomy was associated with significant anastomotic leak rates, however, these studies were retrospective [41] Tomaszek, [42]. The results of studies comparing early oral feeding with delayed oral feeding are listed in table 4. Despite the safety and benefits of early feeding on outcomes after esophagectomy, the daily caloric requirement in patients receiving early oral feeding could be a concern [38]. In fact, only 58% of the daily caloric needs have been met on POD 5 with a median intake of 1,205 kcal. Additionally, 30% of

Table 1. Catheter-Related Complications (TPN)

author	Study design N	Venous thrombosis	Catheter dislocation	Lumen occlusion	Catheter local Infection	Systemic infection	Total
Paolo Cotogni et al.	Prospective 254	3 (2.8)	25 (8.6)	12 (4.1)	9(3.5)	18(7.0)	67(26.3)
Crispin A et al.	prospective 481	—	2(0.4)	11(2.2)	15(3.1)	17(3.5)	45(9.3)
Vashi et al.	Randomized 102	9(17.4)	3 (5.9)	8 (15.7)	5 (9.9)	—	25(24.5)
Baigrie RJ	Randomized 47	2	1	2	3	7	14(29.8)

Table 2. complications related to jejunostomy and nasojejunla feeding

	Author	Data collection N	Entry site infection	Entry site leakage	Reoperation	Occlusion	Dislocation	Mortality	Bowel obstruction	GI-complaints
jejunostomy Feeding	Srinathan 2013	Retrospective 103	-	-	3(2.9)	7(6.7)	2(1.9)	-	-	40(39)
	Fenton 2011	Retrospective 143	18(12.8)	2(91,4)	1(0.7)	5(3.6)	1(0.7)	0 (0)	3(2.1)	
	Wani 2010	Retrospective 463	-	-	7(1.5)	34 (7.3)	-	-	-	44(10)
	Ryan 2005	Prospective 205	3(1.4)	3 (1.4)	3(1.4)	6(3)	3(1.4)	1 (0.5)	-	30(15)
	Sica 2005	Retrospective 262	2(0.8)	-	4(1.5)	-	1(0.4)	0 (0)	-	
	Boukerrouche A 2012	Retrospective 105	-	1	1	2	1	0	0	7(6.6)
nasojejunla Feeding	Gabor 2006	Prospective 44					9(20)			3 (7)
	Han-Geurts 2006	Prospective 79				2(3)	18(25)			5 (7)

"GI-complaints include aspiration, nausea, abdominal distension, and diarrhoea"

Table 3. outcomes after esophagectomy with using Enteral feeding vs. TPN

		Number of patients		No. complications		Anastomotic leakage		Pneumonia		Mortality		Median hospital stay	
author	Study design	EN	TPN	EN	TPN	EN	TPN	EN	TPN	EN	TPN	EN	TPN
<i>Baigrie et al.</i>	Randomized	50	47	17 (34)	27 (57.4)*	5(10)	9 (19.1)			4(8)	6 (12.8)		
<i>Braga et al.</i>	Randomized	126	131	62 (49.2)	74 (56.5)	9(7.1)	11 (8.4)	3 (2.3)	6 (4.6)	3 (2.3)	4(3)		
<i>Gabor et al.</i>	Prospective	44	44			21 (47.8)	23 (52.3)	4 (9.1)	11 (25)	3 (6.8)	4(9.1)	26	43*
<i>Fujita et al.</i>	Randomized	76	88	41 (53.9)	52 (59.1)	8 (10.5)	17 (19.3)	4 (5.2)	10 (11.3)	2 (2.6)	2(2.2)	15	19*

EN: enteral feeding; TPN: total parenteral feeding; No.: number of; (): percentage of total. *:statistically significant.

Table 4. Risk of oral feeding on anastomotic leakage after esophagectomy

Route nutrition	author	Study Design	N (I/C)	% esoph- agectomy	Anasto- mosis	OR (95% CI)	P value
Early oral feeding	<i>Mahmooza-deh et al.</i>	Prospective	109 (54/55)	75	Mixed	1.02 (0.14–7.51)	0.985
	<i>Sun et al.</i>	Prospective	133 (68/65)	100	Cervical	0.47 (0.04–5.31)	0.542
	<i>Weijjs et al.</i>	Prospective	100 (50/50)	100	Thoracic	0.52 (0.18–1.44)	0.207
Delayed enteral feeding	<i>Tomaszek et al.</i>	Retrospective	386 (110/276)	100	Mixed	4.84 (1.45–16.14)	0.010*
	<i>Bolton et al.</i>	Retrospective	120 (33/87)	100	Cervical	9.57 (1.20–76.7)	0.034*

N:number of patients; I:number of patients in intervention group; C: number of patients in control group.
*:P<0.05.

patients in the early oral feeding group received artificial nutritional support on POD5 because of complication prohibiting oral feeding [38]. Conclusively, the current literature has clearly demonstrated that early oral feeding following esophagectomy is feasible, safe and can be considered in patients undergoing esophagectomy. However, further randomised controlled trials are needed to substantiate the published results on early oral feeding following esophagectomy.

In summary, TPN was associated with high costs, severe catheter-related complications and increased septic complications requiring active intervention. The TPN is only used when EN is contraindicated or not accessible. The EN currently is a standard of care after esophagectomy. EN can be provided through feeding tube including mainly jejunostomy-tube and nasojejunal tube, and both routes were associated with route-related complications. Furthermore, there is no evidence of superiority of one method over the other, and both routes can be used postoperatively. The ERAS programs have successfully been implemented and generalized to a growing list of surgical subspecialties. Postoperative early oral feeding (EOF) is an important element of the ERAS protocols, and safety and benefits on outcomes of EOF has been clearly demonstrated after major gastrointestinal surgical procedures including esophagectomy. Moreover; EOF did not result in increased pneumonia (aspiration) and anastomotic leak rates. Besides, large randomised controlled trials are needed to substantiate the already published results and to assess the potential beneficial impact of early oral feeding on postoperative recovery and quality of life following esophagectomy.

Overall, choosing the feeding route greatly depends on the surgeon preference. We suggest using the early oral feeding as a primary nutritional method after esophagectomy. Furthermore, surgical jejunostomy placement during esophagectomy is safe; and should be placed in selective patients to avoid common jejunostomy-tube related complications. Therefore, routine insertion of jejunostomy feeding is recommended to ensure adequate nutrition in high

surgical patients with high-risk to develop post-operative complications, especially anastomotic leak with need to suspend oral feeding. Also, jejunostomy feeding is very useful in patients with long-term reduced appetite and poor oral intake who clearly need dietary supplementation after discharge from hospital. So, the presence of a jejunostomy feeding remains a necessary back-up plan in such special condition.

Conflicts of Interest

None Declared.

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