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Feeding Jejunostomy after esophagectomy cannot be routinely recommended. Analysis of nutritional benefits and catheter-related complications

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ABSTRACT

Background: Patients undergoing esophagectomy for cancer usually deal with malnourishment which increases postoperative morbimortality. The objective of this paper is to analyze the nutritional benefits of feeding jejunostomy (FJ) for early postoperative enteral nutrition (EN) and directly-related complications.

Material and methods: Retrospective study of 100 patients undergoing esophagectomy for cancer between 2008 and 2016.

Results: FJ was placed in 47 patients. 82.98% reached EN requirements in FJ group, with a median EN restart of 1.9 days and median days to objective requirements of 5 days.

51.06% developed directly-related FJ complication, 91.66% of them mild ones (gastrointestinal or catheter-related). 2 patients (4.25%) required re-intervention.

No significant differences were shown in total protein and albumin seric levels during first postoperative week and in anastomotic leak rate between both groups ($p > 0.05$).

Conclusions: Feeding jejunostomies are associated with a great number of complications although most are not life-threatening. Since its nutritional benefit is not proven FJ cannot routinely recommended after esophagectomy. However, the optimal pathway for EN reintroduction, including direct oral intake, is still a matter of debate.

Introduction

Nowadays, surgery is one of the pillars of esophageal cancer treatment. Malnourishment is a common problem in these patients because of progressive tumor-compressive dysphagia and constitutional syndrome which leads to a higher rate of postoperative morbimortality.[1–3] The development of fast-track protocols enables pre-, peri- and postoperative management improvement in order to reduce complications and to provide a faster discharge.[4–7]

Recent clinical guidelines recommend early postoperative enteral nutrition (EN) as it has been shown to reduce major complications, such as infection and anastomotic leak, postoperative ileus and albumin requirements compared to parenteral nutrition (PN)[2,3,8,9]. There are several different options for EN such as feeding jejunostomy tube (FJ) and naso-jejunal tube (NJ) but none has proven superiority.[10–14] However, the placement of a tube for EN is not free from complications and oral NE can often be reintroduced in the first postoperative days so there is no firm evidence in favor of NE given by tube.[11,14–26]

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The aim of this paper is to analyze the nutritional benefits of feeding jejunostomy and directly-related complications.

Methods

Retrospective study of 100 consecutive patients undergoing esophagectomy because of malignant tumors at Universitary and Polytechnic La Fe Hospital, Valencia (Spain). All the patients aged over 18 years old undergoing curative surgery with primary anastomosis for esophageal cancer were included. Database is performed prospectively so directly-related complications such as catheter obstruction, insertion-site infection, and gastrointestinal complications related to enteral nutrition by FJ are well documented. Data was collected from December 2008 to March 2016.

Study periods

From 2008, total esophagectomies for cancer have increased up to 20 interventions per year considering our Unit a high-volume center. From 2010, since the application of fast-track protocols, feeding jejunostomy has been increasingly used and has become a routine procedure during esophagectomy (Fig. 1).

Feeding jejunostomy

FJ is placed during esophagectomy following Witzel technique. A *Pennine*® 3 mm-*diameter suction catheter* was used in all the cases. After enterotomy, FJ tube is adjusted by a tobacco-pouch suture and tunneled through a 10-cm invaginating suture. Finally, gut is fixed to peritoneum in left paramedical position.

Data analysis

Patient, type and tumor location, tumor stage, neoadjuvant treatment, surgery parameters and directly-related FJ complications have been analyzed. Patients have been followed-up until JF tube retirement. For nutritional benefits, total protein and albumin seric levels at 1, 4 and 7 postoperative days have been evaluated. Significant differences have been considered for $p < 0,05$. Data is been analyzed with SPSS v22.

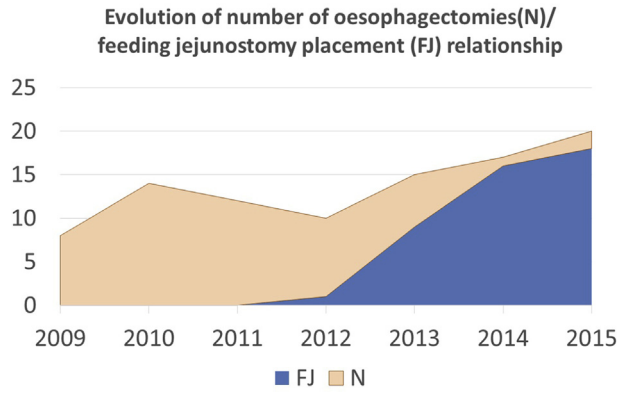

Fig. 1. Evolution of intervention's volume during the study
Number of oesophagectomies has rised during the study reaching a volume of 20 procedures per year. From 2010, FJ tube has been more and more placed for early postoperative enteral feeding becoming a routine procedure during oesophagectomy FJ: Feeding jejunostomies performed; N: Number of oesophagectomies.

Results

Demographics

Of our 100 patients, 87% were males and median age was 60. Median weigh was 70,3 Kg (range 40–115), median height 167,7 cm (range 143–196 cm) and median BMI was 24,5 (range 15,1–38,8). Median total protein and albumin seric levels were 6,8 mg/dL and 4,4 mg/dL respectively prior to surgery.

63% of tumors were adenocarcinoma, 31% epidermoid carcinoma and 6% included other tumors. 71%, 23% and 3% of tumors were located at distal third or gastro-esophageal junction, medium third and upper third respectively. In the preoperative study, T stage was 15%, 17%, 31% and 15% for T1, T2, T3 and T4 respectively. 62% of patients presented affected lymph nodes at diagnosis and 78% received neoadjuvant treatment.

61 patients underwent Ivor-Lewis esophagectomies, 35 went through McKeown procedures and 4 transhiatal approach. Postoperative complications occurred in 27%, mainly respiratory complications. Major and minor anastomotic leak rates were 5% and 8% respectively. 30-day mortality rate was 4%.

Feeding jejunostomy use

Witzel FJ was placed in 47 patients, of which, 39 (82.9%) reached predetermined nutritional requirements. Excluding 4 patients deceased during immediate postoperative FJ successfully-used rate ascent to 90%. 8 patients did not reach nutritional requirements: 4 became postoperative exitus, one patient presented intestinal perforation, another patient had FJ tube displacement with developing peritonitis, another developed FJ tube obstruction and another patient presented digestive intolerance.

Median days to NE reintroduction via FJ tube were 1,9 (range 1–10) and median time to nutritional requirements 5 days (range 2–35). In our study, 76,9% reached nutritional requirements before the fourth postoperative day (POD). NE interruption was longer than 48 h in 3 patients because of digestive intolerance or other causes. Median FJ use was 38.9 days (range 0–242) but FJ tube was retired in 68,8% of patients before 30 POD (Fig. 2).

Group comparison

After data collection, FJ was placed in 47 patients for exclusive EN and 53 patients received PN. There were no significant differences in age, sex, tumor stage, tumor location and histology or neoadjuvant therapy between both groups.

FJ was more frequently placed in patients undergoing 3-field esophaguectomy than 2-field esophaguectomy OR = 4.76 (1.77–13.08) p = 0.001. Postoperative complications were more likely to happen in FJ group OR = 3.82 (1.47–9.88) p = 0.004.

No significant differences were appreciated in anastomosis leak rate between both groups (p = 0.144) even if we consider separately minor and major leakage (requiring surgical reintervention or prosthesis placement) (see Table 1).

Feeding jejunostomy benefits

- Weight and BMI

Median weight was 70.9 Kg in both groups. As immediate postoperative weight depends more on hydric balance than on protein calorie malnutrition, daily weight variations have not been registered to evaluate nutritional status during the first week after surgery.

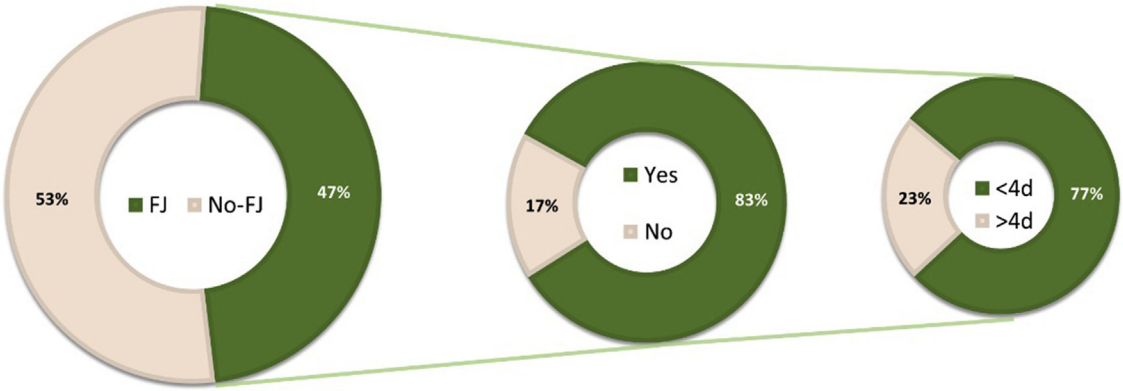

Fig. 2. Graphic showing placement and real use of feeding jejunostomy
FJ was placed in 47 patients. Of these, 82.98% reached nutritional requirements during early postoperative with median time for reintroduction of 1.9 days (range 1–10). FJ was retired before 30 POD in 68.8% of patients. 77% reached requirements before 4POD with a median time of 5 days (range 2–35)
FJ: Feeding jejunostomy group; No-FJ: No FJ group.

- Nutritional parameters in both groups

Total protein (TP) seric levels before surgery were 5.5 mg/dL and 5.4 mg/dL in FJ and no-FJ groups respectively. At the first post-operative day (POD) levels were 4.7 mg/dL and 4.5 mg/dL respectively; at the fourth POD levels were 5.5 mg/dL and 5.4 mg/dL respectively and at the seventh POD increased to 5.6 mg/dL and 5.7 mg/dL respectively. No significant differences were found between groups.

Albumine (ALB) seric levels before surgery were 4.1 mg/dL in both groups. At the first post-operative day (POD) levels were 2.9 mg/dL and 2.8 mg/dL respectively; at the fourth POD levels were 2.8 mg/dL and 2.7 mg/dL respectively and at the seventh POD increased to 3.1 mg/dL and 3.2 mg/dL respectively. No significant differences were found between groups (Fig. 3).

Nutritional parameters related to surgery technique

When we analyze nutritional parameters depending on surgical technique (Ivor-Lewis vs. Mckeown) and histopathology type (adenocarcinoma vs. epidermoid), independently from FJ placement, no differences were appreciated preoperatively, but lower TP and ALB seric levels were seen in patients diagnosed with epidermoid cancer and undergoing McKeown esophagectomy during first postoperative week. Significant lower TP and ALB seric levels were observed in patients with cervical anastomosis: 4.4 vs. 4.8 mg/dL

Table 1
Clinical characteristics in both groups.

Study groups (n = 100)				OR
	No-FJ (%) (n = 53)	FJ (%) (n = 47)	p	
Sex			0,42	
Male	45 (84,9)	37 (78,8)		
Female	8 (15,1)	10 (21,2)		
Pathological anatomy			0,38	
Adenocarcinoma	32 (60,4)	31 (66)		
Epidermoid	19 (35,9)	12 (25,5)		
Others	2 (3,7)	4 (8,5)		
Localization			0,49	
Distal	41 (77,3)	33 (70,2)		
Medium	10 (18,9)	13 (27,7)		
Upper	2 (3,8)	1 (2,1)		
T			0,71	
T0	4 (7,5)	3 (6,4)		
T1	6 (11,3)	10 (21,2)		
T2	15 (28,3)	14 (29,8)		
T3	19 (35,8)	14 (29,8)		
T4	9 (17,1)	6 (12,8)		
N			0,44	
N0	22 (41,5)	16 (34)		
N+	31 (58,5)	31 (66)		
Neoadjuvant treatment	31 (58,5)	31 (66)	0,27	
Surgery				
Ivor-Lewis	40 (75,5)	21 (44,7)	0,001	4,76 (1,77–13,08)
McKewon	10 (18,9)	25 (53,2)		
Other	3 (5,6)	1 (2,1)		
Surgical complications	8 (15,1)	19 (44,1)	0,004	3,82 (1,47–9,88)
Anastomotic leak			0,144	
No	49 (92,5)	38 (80,9)		
Minor	0 (0)	5 (10,6)		
Major	4 (7,5)	4 (8,5)		

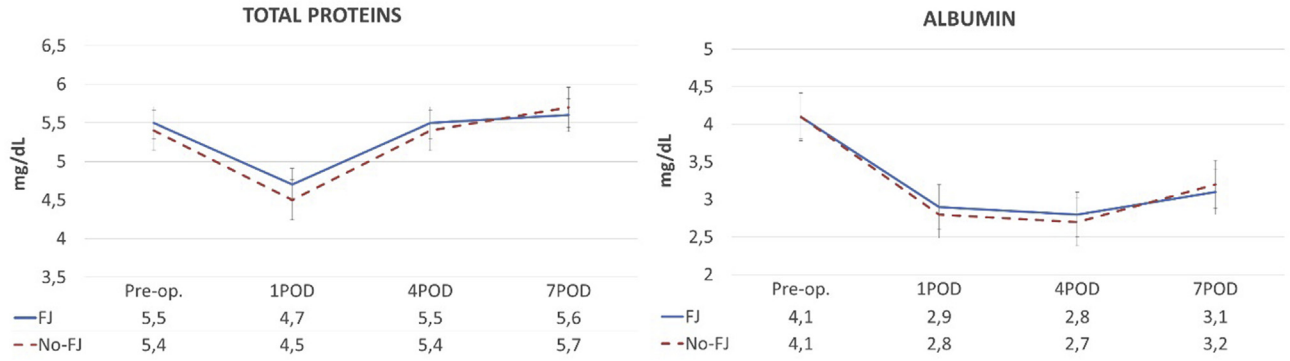

Fig. 3. Nutritional parameters evolution during first post-operative week
As shown, TP levels recover during first week but albumin levels take longer to recover. No significant differences were found in total protein and albumin seric levels at 1POD, 4POD and 7POD in FJ and no-FJ groups
TP: total protein; FJ: Feeding jejunostomy group; No-FJ: No FJ group.

($p = 0.013$) and 2.7 vs. 3.03 mg/dL ($p = 0.04$) respectively (Fig. 4).

Feeding jejunostomy directly-related complications

Directly-related FJ complications were observed in 24 patients (51.06%). 88% ($n = 22$) were mild complication and did not require hospitalization: 8 patients developed gastrointestinal complications (abdominal distention or diarrhea), 7 presented catheter obstruction solved by high-pressure washing or metallic wire, 5 presented catheter dislodgement and 2 developed insertion-site infection. Two patients required reoperations: one of them due to bowel perforation and the other because of catheter dislodgement with associated peritonitis. Severe directly-related FJ complication rate was 4.25% in our series.

Discussion

Malnourishment in esophageal cancer patients

Patients diagnosed with esophageal cancer become easily affected of undernourishment because of several reasons: tumor-related dysphagia, catabolic disease and neoadjuvant treatment side-effects as nausea, anorexia and mucositis-related dysphagia. Up to 57–78.9% of patients deal with malnutrition at time of diagnosis.[27,28] ESPEN Guidelines recommend the application of validated nutritional screening scales, as NRS-2002, to detect and amend nutritional status in order to prevent physical deterioration, postoperative complications and to achieve faster recovery and shorter hospitalization.[29]

Preoperative nutrition to prevent complications

Nutritional screening is essential in patients diagnosed with esophageal cancer to detect malnourishment and to design an optimal preoperative nutrition plan as it has been demonstrated to reduce postoperative morbimortality.[29–31] In patients developing moderate to severe dysphagia FJ is a useful way to provide preoperative EN[5] and to prevent from aspiration pneumonia.[32,33] We believe preoperative nutritional assessment plays a key role in achieving optimal postoperative results.

In our center patients go through a nutritional screening so we can prevent and treat malnutrition prior to surgery. When indicated, patients receive neoadjuvant treatment depending on tumoral stage and histology. For adenocarcinoma we prefer three-agent therapies (MAGIC or EOX) and for epidermoid carcinoma preoperative radio-chemotherapy (Al-Sarraf squeme: cisplatine 75 mg/m2 + 5-Fluorouracile 1000 mg/m2 + 50Gy). These patients usually take nutritional supplementation during preoperative treatment.

Feeding jejunostomy benefits

In our retrospective series analysis, we found no differences in basal characteristics between groups but we cannot ignore its intrinsic limitations of a retrospective revision and risk of bias, so results must be taken with caution. As shown in Fig. 3, no significant differences have been shown in TP and ALB seric levels between FJ and no-FJ group. FJ does not seem to reduce anastomotic leak rate, neither minor nor major (8.51% in FJ group vs. 7.54% in no-FJ group, $p > 0.05$). However, postoperative complications were more likely to happen in FJ group.[34] We attribute this difference to the fact that FJ has become increasingly used in the second half of the study period and probably, postoperative complications are better recorded during the most recent years.

82.9% of patients in FJ group reached nutritional requirements (90% if we exclude 4 postoperative deaths) with an EN reintroduction at 1.9 median days and in a 5-day median time. However, 68.8% of patients used FJ for enteral nutrition for less than 30 days after surgery. In 2011, Fenton et al. concluded that up to 77% of FJ after esophagectomy were not used for EN after the first postoperative month questioning FJ routinely use. They analyzed long-FJ-use risk factors identifying BMI<18.5 as only significant factor ($p = 0.03$).[35] Age, albumin seric levels <3.2 mg/dL, tumoral stage or surgical technique fail to reach significance. Couper published a retrospective study of 262 patients carrying FJ and only 19% used it for EN after 20POD. He concluded that in 80% of patients FJ was not useful at time of discharge.[16] In our center, patients keep on receiving EN via FJ after discharge (night-continuous perfusion) until sufficient oral intake.

Feeding jejunostomy complications

FJ as early postoperative EN is not harmless. In our series, 51.06% of patients developed directly-related FJ complications. Wide majority of them were mild complications but 2 patients required surgical intervention. Weijs et al. published in 2015 a literature review reporting a directly-related FJ complication rate of 13–38%.[10] As shown in our series, gastrointestinal complications are the most frequent, involving abdominal distension o diarrhea (10–39%), followed by insertion-site infection (0.4–16%) and catheter-related complications, dislodgement (0–11%) and obstruction (0–7.3%). Reintervention rate due to directly-related FJ

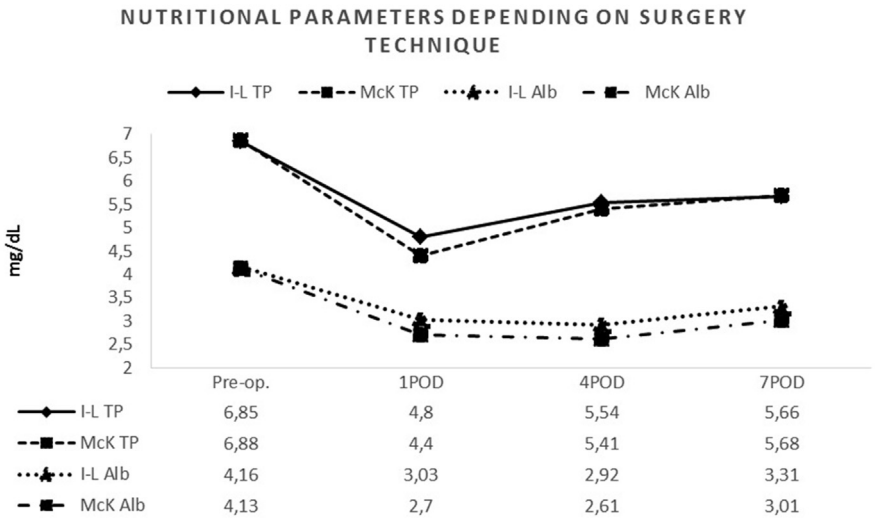

Fig. 4. Nutritional parameters evolution depending on surgery technique
Significant lower level are shown in patients undergoing McKeown esophagectomy ($p = 0.04$)
I–L: Ivor-Lewys technique; McK: Mckeown technique; TP: Total proteins seric levels; Alb: Albumin seric levels; POD: post-operative day.

complication was 0–2.9%.[10,16,17,19,36,37]

As seen, in the literature FJ related-complications appear up to 13–38% of patients. Although more are not life-threatening, this percentage of complications cannot be ignored. We advocate for a selective indication of FJ placement to select patients benefiting most from FJ as no differences in serum markers have been shown during the first postoperative with in FJ and no-JF groups (see Table 2).

Enteral nutrition pathways

Nowadays, most published literature seems to prove the superiority of EN over PN reducing complications and anastomotic leakage. In 2016, Peng et al. performed a meta-analysis of 10 studies comparing EN to PN reporting lower respiratory infection and anastomotic leak rate in NE group.[4] Most studies in EN arm had used a nasojejunal tube (NJT) for nutrition. However, there is no evidence in the optimal pathway to EN.[8] In a meta-analysis published by Wang et al., in 2017 comparing NJT with FJ for EN in patients undergoing surgery for upper-digestive neoplasia, NJT proved to get better results in terms of hospital stay, shorter EN time, shorter adequate oral intake time (3 days faster) and lower catheter dislodgement (RR = 0,16).[38]

On the other hand, it has been shown that EN by FJ at home after discharge does not prevent from weight loss once retired.[39] Blakeley et al. recommend, when necessary, the use of NJY to reduce direct-related FJ complications as only 25% of 182 patients who underwent esophagectomy required FJ for EN at time of discharge in their study (17.6% as supplemental nutrition and 7.1% as main nutrition).[26]

Since the development of fast-track protocols, oral intake is increasingly reintroduced earlier in digestive surgery. The latest publications suggest early oral intake does not worsen postoperative morbimortality or anastomotic leak rates.[20–24] Berkelmans et al. compared direct early oral intake versus long-time FJ for EN after mini-invasive esophagectomy.[25] FJ group showed significant higher weight during first 3 months after surgery but there differences disappeared from 3 month. Direct early oral intake was nor related with number of reinterventions and has been posed as a safe pathway for EN in selected patients.

In our center patients with FJ who do not reach nutritional requirements on discharge continue with night-period enteral nutrition by FJ at home. However, in our series almost 70% of patients did not use FJ for EN more than 30 days. Other authors, such as Fentol et al. have published similar data showing that up to 77% of FJ after esophagectomy were not used for EN after the first postoperative month questioning FJ routinely use. Moreover, it has been shown that EN by FJ at home after discharge does not prevent from weight loss once retired with similar weigh recovery at 3 months.

On the other hand, patients without FJ who do not reach nutritional requirements with common diet can be fed with protein calorie supplements until sufficient oral intake.

New markers of nutritional situation

In a 50-patient study, Shenoy et al. evaluated hemoglobin, albumin levels and weight after upper-gastrointestinal surgery and showed significant higher levels of hemoglobin (11.43 vs. 11.65 mg/dL, $p < 0.001$) and albumin (3.24 vs. 3.54 mg/dL, $p < 0.001$) in those with a FJ for EN.[40] However, they did not analyze whether a real clinical benefit is obtained. Although the differences seen in our study and in other series, Ihara et al. advocate for shorter half-life protein levels determination for immediate postoperative nutritional status evaluation, such as pre-albumin or retinol binding protein (RBP).[41] RBP seems to be an optimal nutritional marker as it is more sensitive to quick changes in nutrients availability than pre-albumin, is less sensitive to stress response, shows lack of energy more than lack of amino acids and it recovers faster when nutrients are supplied.[42]

Recommendations in our group

In view of these results, feeding jejunostomy for early postoperative EN cannot be routinely recommended after esophagectomy. However, we believe FJ could be beneficial for selected patients (see Table 3):

- Patients with severe dysphagia or aphagia prior to surgery.

Table 2
Feeding jejunostomy use and directly-related complications (n = 47).

Requirements reached	Yes	39 (82,9%)
	No	8 (17,1%)
	- Postoperative death	4
	- Severe FJ complications	2
	- FJ obstruction	1
	- Requirements not reached	1
Enteral nutririon re-start		1,9 (1–10) days
Days to reach requirements		5 (1–35) days
	Requirements reached <4POD	30 (76,9%[a])
Total use		38,9 (0–242) days
	FJ used <30POD	32 (68,8%)
Interruption >48 h		3 (6,4%)
Complications		24 (51%)
	Mild	22 (46,75%)
	- GI (distention/diarrhea)	8
	- Catheter obstruction	7
	- Catheter dislodgement	5
	- Site infection	2
	Severe (reoperation)	2 (4,25%)
	- Bowel perforation	1
	- Dislodgement with peritonitis	1

[a] Calculated over patients reaching nutritional requirements (n = 39).

Table 3
Feeding jejunostomy placement recommendations in our group.

1) Patients with severe dysphagia or aphagia prior to surgery
2) Malnourished patients prior to surgery. NRS-2002 $\leq$ 3
3) Patients undergoing McKeown esophagectomy

Feeding jeunostomy allows these patients to reach nutritional requirements prior to neoadjuvant treatment when indicated and improves postoperative morbimortality.

- Malnourished patients prior to surgery. NRS-2002 $\leq$ 3

Malnourished patients undergoing surgery are more likely to develop postoperative complications. Preoperative nutritional screening tests help in detecting malnourishment at diagnosis and providing pre- and peri-operative nutritional support. Feeding jeunostomy seems beneficial in patients scoring 3 or less in NRS-2002 screening test at the time of surgery or who have failed preoperative nutritional program objectives.

- Patients undergoing McKeown esophagectomy.

3-field esophagectomy poses a real surgical challenge because of technical complexity as well as gastric pull-up vascularization, which involves higher anastomotic leak rate (7.1% in Ivor-Lewys procedure vs. 31.7% in McKeown procedure).[26] Furthermore, as seen in this paper, nutritional impact is bigger in 3-field esophagectomy so feeding jejunostomy seem a good pathway for early postoperative EN avoiding oral intake in these patients.

Commonly upper esophageal tumors are epidemoid carcinoma in patients with antecedent alcoholism and smoking who are going to receive preoperative chemo-radiotherapy. These patients are in high risk of malnutrition and anastomotic leak so we prefer to place a FJ as a “safety value” in order to provide optimal nutrition if complications appear.

After data analysis, we have changed FJ catheter given that 50% of directly-related FJ complications were due to catheter dislodgement or obstruction. Since 2017 we use an Ultrathrane® 14Fr. multipurpose pig-tail drainage catheter following Witzel technique for feeding jejunostomy placement. FJ-related complications after this modification are under evaluation.

Study limitations

We are conscious of the intrinsic limitations and risk of bias of a retrospective series. Moreover, superiority of EN over PN has been widely proven and in our study we compare a FJ group (EN) with no-FJ group (PN). Another limitation is the heterogeneity of the study population including patients with different types of tumors and stages but no differences in basal characteristics have been seen between both groups.

However, this is the first publication comparing total protein and albumin seric levels evolution in these groups during the first postoperative week in a 100-patient series undergoing esophagectomy. Despite these limitations, this analysis sheds light on the role and indications of the FJ after esophagectomy.

CONCLUSSION

Feeding jejunostomies are associated with a great number of complications, although most are not life-threatening. Since its nutritional benefit is not proven FJ cannot be routinely recommended after esophagectomy for early postoperative EN. Fast-track protocols trend to enhance pre-operative nutritional status and early reintroduction of oral intake. However, the optimal pathway for EN reintroduction is still a matter of debate.

Conflict of interest

We declare that the material has not been previously published or submitted elsewhere for publication and will not be sent to another journal until a decision is made concerning publication by AMERICAL JOURNAL OF SURGERY.

We have no conflict of interest to declare.

We declare not having any financial support.

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