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Preoperative Embolization of the Splenic and Left Gastric Arteries Does Not Seem to Decrease the Rate of Anastomotic Leaks after Esophagogastroctomy

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Patients and Methods: This is a retrospective, comparative study conducted from 2003 to 2013 of 32 patients undergoing preoperative embolization versus 102 patients not undergoing embolization to assess the impact of this technique on the rate of anastomotic leakage. The variables considered were age, gender, comorbidities, preoperative histopathology, location of the tumor, type of neoadjuvant therapy (if appropriate), type of surgery and type of anastomosis.

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Results: Patients had similar epidemiological and pathologic characteristics, except for the neoadjuvant treatment received. Of the 32 patients having embolization, 28 (87.5%) received chemoradiotherapy preoperatively, whereas only 52 of the 102 (50%) patients not having embolization received this therapy (p=0.0001). Of the 32 patients undergoing embolization, 14 (43.75%) developped an anastomotic leak versus 33 (32.35%) of the 102 patients not having embolization. No statistically significant differences were observed (p=0.289).

Conclusions: Although ischemic conditioning of the constructed gastric tube by embolization of the left gastric artery and splenic artery prior to esophagectomy is a safe approach unrelated with morbidity, we could not demonstrate that it reduces the rate of anastomotic leaks.

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I. Introduction

Anastomotic leakage after esophagectomy is a complication varying in severity that may increase morbidity and mortality in patients depending on the location of the anastomosis (thoracic or cervical). The incidence of anastomotic leaks ranges from 3% to 25%, especially for cervical esophagogastric anastomoses [1,2,3,4].

Esophageal anastomotic leakage is defined as the extravasation of gastric/esophageal luminal contents. Bacterial contamination may cause local abscess, fistula, anastomotic dehiscence, surgical wound dehiscence, sepsis and even death.

Esophagogastric anastomosis may be caused by patient's status (malnutrition, immunosuppression...) and/or the surgical technique employed (insufficient perfusion of the constructed gastric tube, location of the anastomosis, tense anastomosis...)[5].

Embolization of the left gastric artery before esophagectomy has been reported to improve ischemia in the constructed gastric tube during anastomosis.

The objective of this study was to assess the rate of anastomotic leakage in patients undergoing embolization prior to esophagectomy versus that of patients not undergoing preoperative embolization.

II. Patients and Methods

This is a retrospective, observational study of a cohort of patients undergoing esophagectomy either for a malign or benign condition referred to the Esophagogastric Surgery Unit of a third-level hospital between June 2003 and December 2013. All patients were examined preoperatively by a multidisciplinary board. Data were prospectively collected in a database.

We compared the rate of anastomotic leaks in patients undergoing embolization of the left gastric

artery and splenic artery before esophagectomy with that of patients not undergoing preoperative embolization. The following variables were retrospectively analyzed: age, gender, comorbidities, tumor location, administration and type of neoadjuvant treatment, type of surgery, histology of the resected tissue, postoperative complications including type of anastomotic leakage and management of the leak.

Embolization was performed by interventional radiologists three weeks before surgery. Under local anesthesia, the femoral right artery was punctured. Embolization of the splenic artery was performed using a 8mm-Amplatzer®, whereas the left gastric artery was embolized using coils (Figure 1).

Figure 1 : Embolization of the splenic and left gastric arteries. Arrow 1 (→), splenic and left gastric arteries before the embolization; arrow 2 (⇒), right gastroepiploic artery; arrow 3 (⇢) embolization of the splenic and left gastric arteries.

Water-soluble contrast studies were performed on all patients for anastomotic leakage on postoperative day 7 before oral feeding was initiated.

Anastomotic leakage can be detected on X-ray scans and manifest either clinically or biologically in blood tests. When a leak was detected, we used a classification system based on clinical, radiological and endoscopic findings. Then, the protocol established and previously published for the management of anastomotic leaks was implemented.[6] (Figure 2).

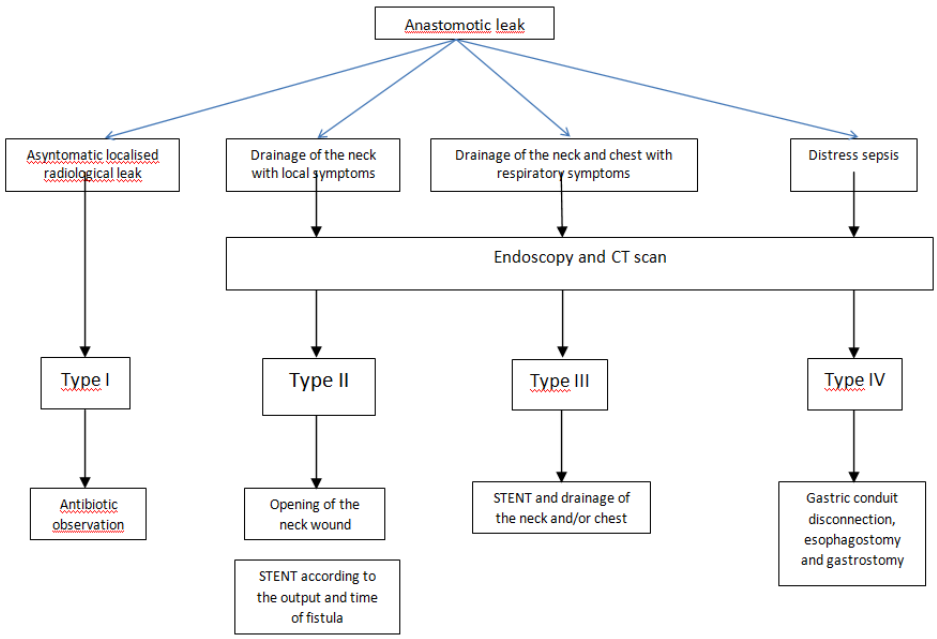

Figure 2 : Management and classification of anastomotic leaks according to clinical, radiological and endoscopic findings.

III. Statistical Analysis

Statistical analysis was performed using SPSS software. Fisher's test was used for comparison of qualitative data, χ^2 for comparison of ≥2 categorical data and the Mann-Whitney U test for continuous variables. A value of $p \leq 0.05$ was considered statistically significant.

IV. Results

A total of 138 patients with esophageal cancer and 4 patients with benign lesions requiring esophagectomy were recorded in the database during the study period. Of the 138 patients registered, 121 were male and 19 were female, with an average age of 60 years.

Figure 3 shows the process of inclusion and exclusion for embolization candidates. Of a total of 142 patients, 108 did not undergo preoperative embolization, whereas 34 underwent embolization of the left gastric artery and splenic artery before esophagectomy.

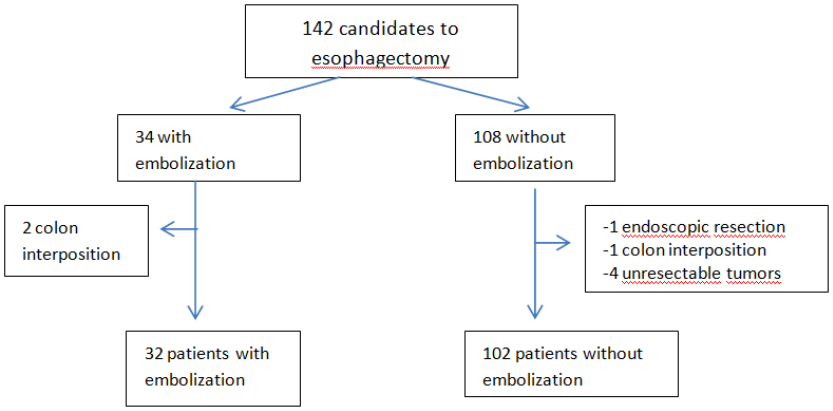

Figure 3 : Included and excluded patients.

Of the patients undergoing embolization, two underwent coloplasty, in one due to the absence of the right gastro-omental artery and in the other case because his tumor at the distal esophagous extended more than 7cm to the stomach and the gastric tube could not be constructed with sufficient tumor-free margins. Finally, a total of 32 patients undergoing embolization were included in the study. As to the 108 patients without embolization, one was candidate to coloplasty for esophageal necrosis and partial gastric necrosis caused by caustic ingestion. In other case, the patient underwent endoscopic resection because the tumor was located at the mucous membrane and the patient presented substantial comorbidities. Four patients had an unresectable tumor. Finally, 102 patients undergoing esophagectomy without preoperative embolization and developping esophageal and gastric anastomosis were included in the study.

Therefore, of the 134 candidates to esophagectomy, 32 (23.8%) underwent embolization and 102 (76.2%) had no embolization. Table I shows demographics and comorbidities. No statistically significant differences were found between patients undergoing embolization and patients not undergoing embolization.

Table I : Demographics and comorbidities.

	WITH EMBOLIZATION (n=32)	WITHOUT EMBOLIZATION (n=102)	p-value
AGE (YEARS)	61 (46-75)	59.95 (29-88)	0.603
Gender			
Female	5 (15%)	14 (13.7%)	0.982
Male	27 (85%)	88 (86.2%)	
Comorbidities			
Smoker	13 (40%)	37 (36.3%)	0.679
Drinker	0	13(12.6%)	0.065
Heart Disease	13 (40.6%)	39 (38.23%)	0.837
COPD	6 (18.7%)	14 (13.7%)	0.570
Obesity	2 (6.2%)	1 (0.98%)	0.141
Diabetes	1 (3.1%)	9 (8.8%)	0.450
Chronic liver disease	1 (3.1%)	4(3.9%)	1.000

Table II shows the histopathological findings following esophagectomy and the location of the esophageal tumors. No statistically significant differences were found between patients undergoing embolization and patients not having embolization.

Table II : Tumor Histopathology and Location.

	WITH EMBOLIZATION (n=32)	WITHOUT EMBOLIZATION (n=102)	p-value
HISTOPATHOLOGY			
Adenocarcinoma	16 (50%)	48 (47.05%)	0.684
Ca. Epidermoid	16 (50%)	47(46.07%)	0.676
Ca. Neuroendocrine	0	1 (0.98%)	-
GIST	0	3 (2.94%)	-
Other (achalasia, necrosis, peptic stricture)	0	3(2.94%)	-
LOCATION			
Proximal esophagus	9 (28.1%)	21 (20.58%)	0,267
Mediastinal esophagus	14 (13.7%)	60 (58.82%)	
Distal esophagus	9 (28.1%)	18 (17.64%)	

Table III shows the preoperative treatment administered and the type of surgery performed. Of the 32 patients undergoing embolization, 28 (87.5%) received chemoradiotherapy preoperatively, whereas 52 of the 102 (50.9%) patients without embolization received chemoradiotherapy preoperatively (p=0.0001). Statistically significant differences were found between the embolization group and the no-embolization group (p=0.0001).

Table III : Preoperative Treatment and Type of Surgery.

	WITH EMBOLIZATION (n=32)	WITHOUT EMBOLIZATION (n=102)	p-value
PREOPERATIVE CHEMOHERAPY/RADIATION THERAPY			
No	4 (12.5%)	50 (49.1%)	0.0001
Yes	28 (87.5%)	52 (50.9%)	
SURGERY			
Ivor-Lewis	10 (31.25%)	37 (36.2%)	0.693
Transhiatal esophagectomy	3 (9.37%)	13 (12.74%)	
Three-stage esophagectomy	19 (59.37%)	52 (50.9%)	
Minimally invasive esophagectomy	30 (93.75%)	93 (91.17%)	1
LOCATION OF THE ANASTOMOSIS			
Cervical	21(65.62%)	65(63.7%)	0.586
Thoracic	11(34.38%)	37(36.3%)	

As regards the type of surgery, no statistically significant differences were found between patients undergoing embolization and patients not undergoing embolization. Minimally invasive esophagectomy was performed in 30 (93.75%) of the patients with embolization and in 93 (91.17%) of the patients without embolization. As to the location of the anastomosis (cervical vs thoracic), no statistically significant differences were observed (p=0.586).

As many as 14 patients (43.75%) undergoing embolization developed anastomotic leaks, of which 6 (18.75%) were detected on X-ray scans or due to mild symptomatology. Eight leaks manifested clinically. As to the patients without embolization, 33 (32.35%) developped anastomotic leakage, of which 12 (11.7%) had clinical symptoms. As regards the development of anastomotic leakage, no statistically significant differences were found between the two groups (p=0.289). No statistically significant differences were found between the two groups concerning the incidence of the most severe anastomotic leaks (type III and IV) (p= 0.087). (See Table IV).

Table IV : Postoperative Complications and Mortality.

	WITH EMBOLIZATION (n=32)	WITHOUT EMBOLIZATION (n=102)	p-value
ANASTOMOTIC LEAKS	14 (43.75%)	33 (32.35%)	0.289
Type I	2 (6.25%)	11 (10.78%)	
Type II	4 (12.5%)	10 (9.8%)	
Type III	6 (18.75%)	10 (9.8%)	
Type IV	2 (6.25%)	2 (1.9%)	
III-IV leaks	8 (25%)	12 (11.7%)	0.087
Stricture	14 (13.7%)	4 (3.92%)	0.628
Deaths (<30 postoperative days)	3 (9.37%)	10 (9.8%)	1

No complications were associated with embolization. Regarding long-term complications, two (6.25%) of the patients with embolization and four (3.92%) of the patients without embolization developed anastomotic stricture formation. Three (9.37%) patients with embolization died soon after surgery (one died of pneumony and two of anastomotic leakage); ten (9.8%) patients without embolization died (four died of anastomotic leakage, one of liver failure caused by existing cirrhosis, one of heart failure and four of respiratory complications). (See Table IV).

V. Discussion

This non-randomized retrospective study revealed that no statistically significant differences exist concerning anastomotic leak rates between patients undergoing embolization and patients not undergoing embolization before esophagectomy.

Anastomotic leakage is a severe complication of esophageal surgery. The incidence of this complication ranges between 10 and 25% [7,8] and may increase mortality rates up to 50%[9]. Anastomotic leakage is defined as a leak of luminal contents from a surgical join between two hollow viscera[10]. The escape of luminal contents may cause local abscess, fistula, sepsis or death.

Variations in reported rates of esophageal anastomotic leaks may be due to the different definitions used to classify this complication and its location; this also has an impact on therapeutic algorithms[7,11,12]. With regard to the physiopathogeny of anastomotic esophagogastric dehiscences Turkyilmaz et al.[7] defined four types according to the triggering factors; thus dehiscences may be caused : a) by a systemic disease; b) by the intrinsic anatomy of the esophagus; c) by the technical factors of the surgery; d) by postoperative care and complications.

As to the classification of esophagogastric anastomotic fistulae, like Lerut el al[11], we classify them according to their clinical impact as assessed through clinical, radiological and endoscopic examination and to the therapy required [6].

The gastric flow has been proven to decrease both in animals and humans by more than 70% after resection of the left gastric artery, the short vessels and their veins, which is required to rise the constructed gastric tube[13,14,15]. The decrease in gastric flow results in ischemia.

Different authors have described a variety of techniques for improving blood flow and venous drainage in esophagogastric anastomosis and reduce the rate of anastomotic leakage and its severe effects, with different outcomes[16,17,18].

To improve microvascularization in the reconstructed gastric tube through ischemic conditioning of the stomach, Akiyama et al[19] described the technique of embolization of the left gastric artery and splenic artery through the femoral artery 12 days prior to the esophagectomy. Although Akiyama did not report statistically significant differences in anastomotic leak rates, he demonstrated that vascularization of the reconstructed gastric tube at the moment of esophagogastric anastomosis improved in patients undergoing embolization. Diana et al[20] did not found statistically significant differences either between patients with embolization and patients without embolization. However, they observed that patients undergoing embolization were more likely to develop esophagogastric stricture (32% vs 3%).

Similarly, transient bloodletting of the short gastric vein seems to be an efficient mechanism for conditioning microcirculation, which improves the circulation of the oral side of the gastric tube during esophagectomy[17]. However, outcomes have not been reported.

A different method to improve microcirculation is performing delayed conditioning by two-stage esophageal surgery [21,22,23] (the gastric tube is reconstructed in the first stage and esophagectomy is performed some days later in a second stage).

Yoshimi et al[16] revascularized the gastric tube using the splenic artery and vein, external carotid artery, and internal jugular vein in 21 patients who did not develop anastomotic leakage. However, differences in anastomotic leak rates between this group and the control group were not statistically significant.

This study has several limitations. Firstly, this is not a randomized, prospective, case control study.

Secondly, the sample of patients undergoing embolization was very small, which reduced its statistical power. Third, chemoradiotherapy was administered to the two groups differently, which may affect outcomes regarding the rate of anastomotic leakage.

In conclusion, according to the results of this study, it cannot be concluded that embolization of the left gastric artery and the splenic artery before esophagectomy reduces the rate of anastomotic leaks.

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