Med. J. Cairo Univ., Vol. 92, No. 4, Accepted 25/8/2024
DOI: 10.22608/MJCU. 1495-1508, December 2024
www.medicaljournalofcairouniversity.net

A Comparative Study between Outcomes of Gastric, Jejunal and Colonic Conduits after Esophagectomy: A Systematic Review and Meta-Analysis

ENAS HAMDY M. TOTO, M.Sc.; MOHAMED Sh. KHALIFA, M.D.; AHMED YASSER A. ELRIFAI, M.D. and MOHAMED A.F. ELBAHNASY, M.D.

The Department of General Surger, Faculty of Medicine, Ain Shams University

Abstract

Background: Reconstruction of the digestive tract after esophagectomy is necessary to enable the passage of food and liquids. Common types of conduits are gastric conduit, colonic conduit or jejunal conduit. The choice of conduit depends on the length of the gap, the availability of conduit, and the surgeon's experience with the procedure. The stomach is the most common conduit used to replace the resected esophagus. The stomach is preferred due to its length, adequate vascular supply and the need for a single anastomosis.

Aim of Study: To perform a systematic review and meta-analysis about literature that have compared the clinical outcomes of gastric, jejunal and colonic conduits after esophagectomy, the advantages and disadvantages of each conduit, and to assess whether this practices increase the risk of post-operative complications.

Patients and Methods: The current study included adult participants who had been operated for esophageal resection due to malignant or benign causes, and esophageal reconstruction using gastric, pedicled jejunal or colonic conduit.The primary search identified 1400 potentially eligible citations. Among these, 399 were identified as duplicates and removed. Among the remaining full texts 110 studies were reviewed in detail. After the evaluation of the titles and abstracts of these studies, the reviewers removed 101 citations. The remaining 9 articles included a total of 2713 patients [2187 treated with gastric pull up (GPU), 92 treated with jejunal flap (JF) and 434 treated with colon interposition (CI)], and were the basis of the present meta-analysis.

Results: Anastomosis Leakage: The odds ratio showed that free jejunal flap (0.8255) was better than gastric pull-up (0.4509) and that colon interposition had a high probability of anastomosis leakage (0.2236). Stricture Formation: The odds ratio showed that colon interposition (0.9201) was better than gastric pull-up (0.3131) and that free jejunal flap had a high probability of stricture formation (0.2668). Mortality Rate: The odds ratio showed that free jejunal flap (0.9547) was better than colon interposition (0.3665) and that gastric pull-up had a high probability of mortality rate (0.1788). Length of Hospital Stay: the odds ratio showed that gastric pull-up (0.6495) was better than free jejunal flap (0.5444) and that colon interposition had a high probability of prolonging the length of hospital stay (0.3060).

Conclusion: Regarding the complication of anastomosis leakage; it is not possible to determine the best procedure for reducing anastomosis leakage, but comparing the studies had shown that free jejunal flap was better than gastric pull-up and that colon interposition had a high probability of anastomosis leakage. About stricture formation; it was found that colon interposition was better than gastric pull-up and that free jejunal flap had a high probability of stricture formation. About mortality rate; it was discovered that free jejunal flap was superior to colon interposition and that gastric pull-up had a high probability of increased mortality rate. Regarding the length of hospital stay; it was found that gastric pull-up was better than free jejunal flap and that colon interposition had a high probability of prolonging the length of hospital stay. The choice of conduit should be individualized based on patient characteristics, surgical experience, and institutional resources; with consideration given to the balance between pre -operative risks and long-term functional outcomes.

Key Words: *Colonic conduits – Esophagectomy – Gastric conduits.*

Introduction

ESOPHAGECTOMY is a surgical procedure in which a part or the whole esophagus is removed. Esophageal cancer is the primary reason for performing an esophagectomy, other reasons for esophagectomy unrelated to cancer include benign conditions such as neuromotor dysfunction (e.g., achalasia), strictures, severe cases of gastroesoph-

Correspondence to: Dr. Enas Hamdy M. Toto,
E-Mail: enashamdy07@gmail.com

ageal reflux disease (GERD), Barrett's esophagus with high-grade dysplasia, and acute perforation or caustic injury **[1].**

The goal of the procedure is to remove the diseased or cancerous portion of the esophagus and restore the continuity of the digestive tract **[2].**

There are different approaches to perform esophagectomy, and the choice of technique depends on various factors such as the location and extent of the disease, the patient's general health, and the surgeon's experience, common approaches include:

Open surgery:

Trans-hiatal Esophagectomy (THE): The surgeon accesses the esophagus through an incision in the neck and another in the abdomen.

Trans-thoracic Esophagectomy (TTE): This approach involves making incisions in the chest and abdomen. The diseased portion of the esophagus is removed.

Minimally Invasive Esophagectomy (MIE): This technique uses laparoscopic or robotic-assisted methods to perform the surgery through small incisions. MIE is associated with potentially shorter hospital stay and faster recovery compared to traditional open procedures **[3].**

After resection of the esophagus, reconstruction of the digestive tract is necessary to enable the passage of food and liquids. This requires using a segment of the stomach (gastric conduit) or the large intestine (colonic interposition) or part of the jejunum to create a new connection between the throat and the stomach. The conduit of choice is determined by the gap's length, conduit's accessibility, and the surgeon's level of competence performing the surgery. The most popular route for replacing the removed esophagus is the stomach **[4].**

The stomach is preferred due to its length, adequate vascular supply and the need for a single anastomosis. When the stomach is unavailable for use, because of caustic ingestions that critically injure both the esophagus and stomach, previous gastrectomy and abdominal surgery in which primary arterial supply to the stomach has been removed, gastric extension of distal esophageal tumors or true gastro- esophageal junction tumors. Some patients' previous gastric conduits may fail due to ischemic necrosis. In such cases, an alternative conduit must be selected **[2,5].**

While less frequent than gastric conduit, jejunal conduit is utilized in specific circumstances where the stomach cannot adequately substitute the esophagus. The mesenteric vasculature can be readily separated and mobilized with sufficient length to replace the esophagus since it is relatively lengthy, requires no formal preparation, has the same luminal size as the esophagus, and has intrinsic peristalsis **[6,7].**

Colonic conduit has been used for esophageal reconstruction since the early 1900s. It is long, acid resistant, and has an excellent blood supply **[8,9].**

Aim of the work:

The aim of the study is to perform a systematic review and meta-analysis about literature that have compared the clinical outcomes of gastric, jejunal and colonic conduits after esophagectomy, the advantages and disadvantages of each conduit, and to assess whether this practices increase the risk of post-operative complications.

Patients and Methods

Criteria for considering studies for this review:

Types of studies: Published studies about the efficacy of common conduits done after esophagectomy in adults carried out in the period between 2013 and 2023.

Types of interventions: Reconstruction of a neo-esophagus using gastric, pedicled jejunal or colonic conduit after esophagectomy.

Types of participants: Adult age group who underwent esophageal resection with reconstruction using gastric, pedicled jejunal or colonic conduit (males or females, benign or malignant causes of esophagectomy). A systematic review will be performed in accordance with the PRISMA and PICO guidelines.

Types of outcome measures:

Primary outcome measures: Anastomotic leakage, operative time, conduit necrosis. Secondary outcome measures: length of hospital stay, halitosis, fever, stump fistula, wound infection, blood loss, pneumonia. These were the most common points used for comparison.

Search strategy for identification of studies:

The following Medical Subject Headings (MeSH) terms will be employed: For the resection of esophagus, we used the MeSH terms "esophagectomy" or "esophageal excision" and for the esophageal replacement, we used the MeSH terms "reconstruction " or "conduit" or "neoesophagus".

For the surgical background, we used the MeSH terms "colon" or "large bowel" and "surgery" or "anastomosis" or "resection," while for the population we used the terms "adult" or "old age". We restricted the language of the manuscripts to English.

Methods of the review:

Locating and selecting studies: Abstracts of articles identified using the search strategy above will

be viewed, and articles that appear to fulfill the inclusion criteria will be retrieved in full. Each article identified will be reviewed and categorized into one of the following groups: Included or excluded. When there will be a doubt, a second reviewer will assess the article and a consensus will be reached.

For a study to be included, it needs to: Include adult participants who had been operated for esophageal resection due to malignant or benign causes. Provide sufficient details on the above outcome measures to allow comparison across studies.Report quantitative data.Be written in English language.Be published in full-text and in a peer-reviewed journal.

Data extraction:

A copy of each paper identified will be obtained, and relevant data will be abstracted for a quantitative overview. In case of discrepancies or when the information presented in a study is unclear, abstraction by a second reviewer will be sought to resolve the discrepancy. All included articles will be assessed for quality regarding methodological strength as per the Cochrane collaboration updated guidelines for systematic reviews. The quality of articles will be assessed by two reviewers and in case of any disagreement; consensus will be achieved by discussion.

Statistical considerations:

Outcomes from included studies were combined using the Review Manager software. Reasons for heterogeneity for studies were explored and, if necessary, sensitivity analysis was performed on the basis of methodological quality and random effects versus fixed effects modelling.

Evidence of publication bias:

It was sought using the funnel plot method. A funnel plot is a simple scatter plot of the intervention effect estimates from individual studies against some measure of each study's size or precision.

Statistical analysis:

Review Manager Software® (Rev Man 5.3, Cochrane Collaboration) was used for analyses. A Mantel–Haenszel model was used for pooled analysis, and values were reported as odds ratios (ORs) with 95% confidence intervals (CIs). The significance of pooled ORs was determined using the Z-test. A *p*-value of <0.05 was considered to indicate statistical significance.

Cochran's chi-square statistic was used to assess the statistical heterogeneity for each pooled estimate, which was quantified using I^2 statistic. An I^2 value of >50% was considered to indicate heterogeneity. A random-effect model was employed if heterogeneity was detected, and a fixed-effect model was used in other cases.

Quality assessment:

The Newcastle–Ottawa Scale was used for the quality assessment of the selected studies **[10]**. Two authors (P.-C.H. and H.-Y.C.) independently scored the included studies and any inconsistencies were resolved by consensus.

Bias evaluation:

Publication biases were evaluated by funnel plots. We performed the Egger's test when the included article had a score greater than **[9].**

Results

Literature retrieval:

The complete literature search is presented in (Fig. 1). The initial search identified 1400 potentially eligible citations. Among these, 399 were identified as duplicates and removed. Among the remaining full texts 110 studies were reviewed in detail. After the evaluation of the titles and abstracts of these studies, the reviewers removed 101 citations. The remaining 9 articles included a total of 2713 patients [2187 treated with gastric pull up (GPU), 92 treated with jejunal flap (JF) and 434 treated with colon interposition (CI)], and were the basis of the present meta-analysis.

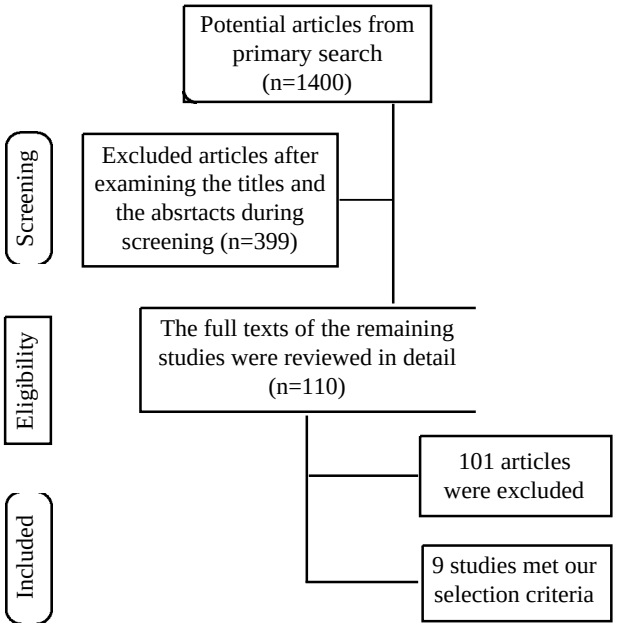

Fig. (1): Flow diagram of the literature search and study selection processes.

Qualitative analysis (Systematic Review):

Five studies were retrospective, three studies were questionnaires, and one prospective study. Four studies were performed in USA, two in Japan, one in Hong Kong, one in Germany and one study in the Belgium. Our meta-analysis demonstrated that the mean age of the included studies was 61.2±9.03 years. The mean follow-up duration was 97.5 months.

Table (1): General characteristics of the included studies.

Author (Ref.)	Country	Study Design	Follow-Up Years	Patient Number	Reconstruction Method					NOS
					Method 1 (n)	AL 1 (n,%)	Method 2 (n)	AL 2 (n,%)	Super-charged	
(Kolh et al., 2000)	Belgium	Retrospective	8 y	130	GPU (92)	6, 6.5%	CI (38)	AL (1.2.6)	No	6
(DeMeester, 2001)	USA	Questionnaires	X	201	GPU (116)	11,9.5%	CI (85)	AL (8.9.4)	No	1
(Hüttl et al., 2002)	Germany	Questionnaires	4y	719	GPU (653)	79, 12.1%	CI (66)	10, 15.1%	No	4
(Davis et al., 2003)	HK	Prospective	16 y	1001	GPU (959)	37, 3.9%	CI (42)	6, 14.3%	No	8
(Briel et al., 2004)	USA	Retrospective	6 y	393	GPU (230)	33.14.3%	CI (163)	10, 6.1%	NR	8
(Daiko et al., 2007)	Japan	Retrospective	10 y	71	GPU (21)	2.9.5%	JF (50)	2, 4%	NR	7
(Doki et al., 2008)	Japan	Retrospective	7y	49	CI (25)	13.52%	JF (28)	6, 21.4%	Yes (both)	9
(Stephens et al., 2015)	USA	Questionnaires	4 y	45	GPU (31)	7.22.5%	JF (14)	4, 28.5%	NR	4
(Luan et al., 2018)	USA	Retrospective	10 y	100	GPU (85)	7.22.5%	CI (15)	4, 28.5%	Yes (JF)	6

NR: Not reported.

Table (2): Clinical characteristics among the included studies.

Author (Ref.)	Mean Age		Pathology (n)	Tumor Location	Pstage	Reconstruction Method		Colon Conduit Choice
	Method 1	Method 2				Method 1	Method 2	
(Kolh et al., 2000)	63.4±10.2	52.3±12.8	Adeno: 62 SqCC: 28 Cardia: 33	Upper: 14 Middle: 49 Lower: 33 Cardia: 34	I: 21 II:51 III:52 IV:6	NR	NR	Right side colon isoperistaltic
(DeMeester, 2001)	NR	NR	NR	NR	NR	NR	NR	NR
(Hüttl et al., 2002)	NR	NR	SqCC: 706 Barret: 282	NR	NR	NR	NR	Right side colon antiperistaltic
(Davis et al., 2003)	62.8±9.3	62±9.7	Adeno: 107 SqCC: 873 other: 21	Cervical: 52 Upper: 64 Middle: 503 Lower: 253 Cardia: 104 Double: 25	0:37 I: 48 II: 249 III: 553 IV: 113	23, 25%	7, 18%	Right side colon antiperistaltic (mostly)
(Briel et al., 2004)	NR	NR	NR	NR	NR	NR	NR	NR
(Daiko et al., 2007)	NR	NR	SqCC: 74	Cervical: 74	I: 6 II:30 III:38	NR	NR	NR
(Doki et al., 2008)	63.75±7.2	66.5±7.8	NR	NR	0:4; I: 7 II:17 III:15 IV:10	9, 35%	8, 35%	Right side colon antiperistaltic
(Stephens et al., 2015)	63±10	55±15	Cancer: 39; benign: 6	NR	NR	NR	NR	NR
(Luan et al., 2018)	63.1±13.1	60.2±11.2	NR	NR	NR	30, 35%	6, 40%	NR

Gastric pull-up = GPU.
Colon interposition = CI.
Free jejunal flap = JF.
Anastomotic leakage = A.
Primary outcome = PO.
Pstage = Pathological stage.
NR: Not reported.

Table (3): Newcastle–Ottawa scale.

Author (Ref.)	Selection of cohorts					Outcome			
	Represent-ativeness of the Exposed Cohort	Selection of the Non-Exposed Cohort	Ascertain-ment of Exposure	Demonstration That Outcome of Interest Was Not Present at Start of Study	Compa-rability of Cohorts	Assessment of Outcome	Was Follow-Up Long Enough for Outcomes to Occur	Adequacy of Follow-Up of Cohorts	Over-all
(Kolh et al., 2000)	*	*	*	*	*		*		6
(DeMeester, 2001)		*							
(Hüttl et al., 2002)	*	*		*	*				4
(Davis et al., 2003)	*	*	*	*	**	*	*		8
(Briel et al., 2004)	*	*	*	*	*	*	*	*	8
(Daiko et al., 2007)	*	*	*	*		*	*	*	7
(Doki et al., 2008)	*	*	*	*	**	*	*	*	9
(Stephens et al., 2015)	*	*			*		*		4
			*			*			6
(Luan et al., 2018)	*	*					*	*	

*: Appropriate study design. **: One for the most important factor; the other for another factor. * Low study quality.

Quality assessment of included case–control studies (Newcastle–Ottawa scale):

All studies were assessed for methodological quality using the Newcastle–Ottawa scale for case–control study leading to an overall score ranging from 0 to 9.11. The scale assigns up to a maximum of nine points for the least risk of bias in three domains: (a) Selection of study groups (four points), (b) Comparability of study groups (two points), and (c) How to measure exposure and the desired outcome in the selected case–control studies (three points). Among these three domains, comparability is the only category that may receive two points: One if the most important confounders have been adjusted for in the analysis and a second one if other adjustments were made [11]. Survey questions were developed based on the Newcastle–Ottawa scale questions covering all three domains so that authors could provide detailed information about their studies. Two reviewers evaluated independently the risk of bias in each eligible study and disagreements in the process of answering questions were discussed until a consensus was reached.

Quality assessment of studies:

The quality assessment of the studies in the network meta-analysis is shown in Table (3); three studies received a score of 8 or more.

Anastomosis leakage:

The forest plot for anastomosis leakage is shown in (Fig. 2). From the forest plot, it is not possible to deduct the best procedure for reducing anastomosis leakage, but the odds ratio showed that free jejunal flap (0.8255) was better than gastric pull-up (0.4509) and that colon interposition had a high probability of anastomosis leakage (0.2236). The heterogeneity was high (I^2=96%), so a random effect model was used. The chi-square test showed that there was no significant difference between the three procedures (p=0.06).

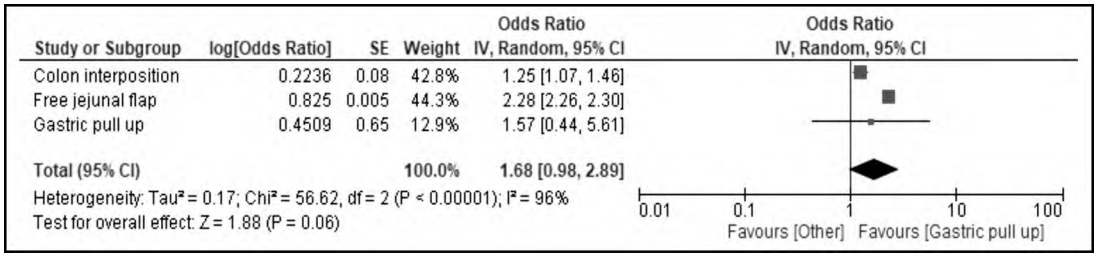

Fig. (2): Forest plot of anastomosis leakage.

The funnel plot analysis of the incidence of anastomosis leakage indicator shows that the overall symmetry was still present (Fig. 3). The results of Egger's test showed that there was no publication bias among the included articles (p>0.05).

Stricture formation:

The forest plot for stricture formation is shown in (Fig. 4). From the forest plot, the odds ratio showed that colon interposition (0.9201) was better than gastric pull-up (0.3131) and that free jejunal flap had a high probability of stricture formation (0.2668). The heterogeneity was high (I^2=68%), so a random effect model was used. The chi-square test showed that there was a significant difference among the three procedures (p=0.003).

The funnel plot analysis of the incidence of stricture indicator shows that the overall symmetry was still present (Fig. 5). The results of Egger's test showed that there was no publication bias among the included articles (p>0.05).

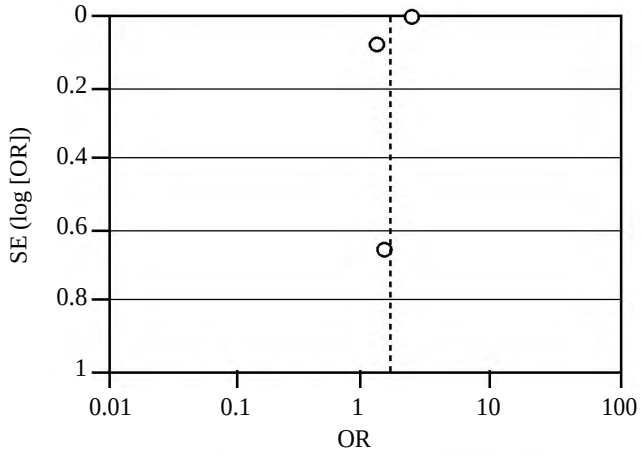

Fig. (3): Funnel plot of anastomosis leakage.

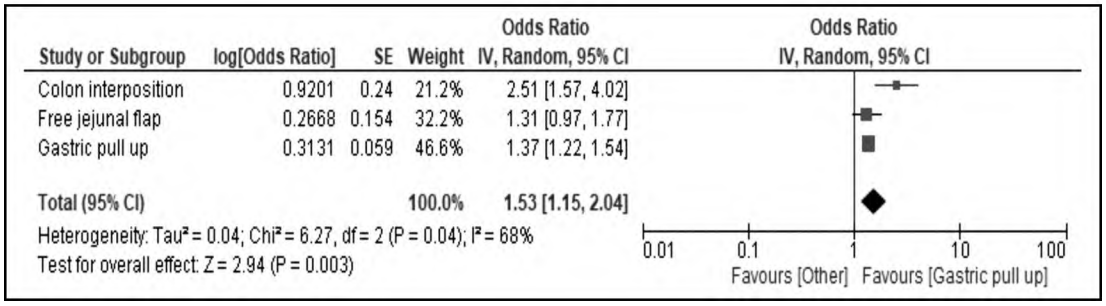

Fig. (4): Forest plot of stricture formation.

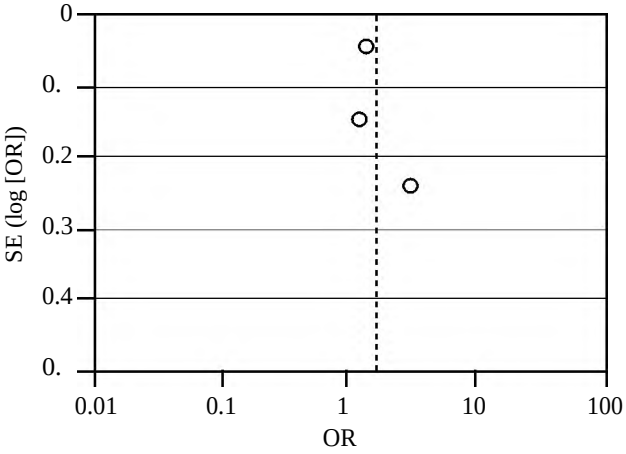

Fig. (5): Funnel plot of stricture formation.

Mortality rate:

The forest plot for mortality rate is shown in (Fig. 6). From the forest plot, the odds ratio showed that free jejunal flap (0.9547) was better than colon interposition (0.3665) and that gastric pull-up had a high probability of mortality rate (0.1788). However, only one study compared free jejunal flap with gastric pull-up, and therefore, the results should be used cautiously. The heterogeneity was high (I^2=95%), so a random effect model was used. The chi-square test showed that there was a significant difference among the three procedures (p=0.03).

The funnel plot analysis of the incidence of mortality rate shows that the overall symmetry was still present (Fig. 7). The results of Egger's test showed that there was no publication bias among the included articles (p>0.05).

Length of hospital stay:

The forest plot for length of hospital stay is shown in (Fig. 8). From the forest plot, the odds ratio showed that gastric pull-up (0.6495) was better than free jejunal flap (0.5444) and that colon interposition had a high probability of prolonging the length of hospital stay (0.3060). The heterogeneity was high (I^2=91%), so a random effect model was used. The chi-square test showed that there was a significant difference among the three procedures (p=0.00001).

The funnel plot analysis of the incidence of hospital stay shows that the overall symmetry was still present (Fig. 20). The results of Egger's test showed that there was no publication bias among the included articles (p>0.05).

Sensitivity analysis:

Results for sensitivity analysis are shown in (Fig. 10). The odds ratio was as follows: Free jejunal flap, 0.8044; gastric pull-up, 0.4640; and colon interposition, 0.2316. Thus, we can conclude that our results are reliable.

The funnel plot analysis of the incidence of sensitivity analysis shows that the overall symmetry was still present (Fig. 11). The results of Egger's test showed that there was no publication bias among the included articles (p>0.05).

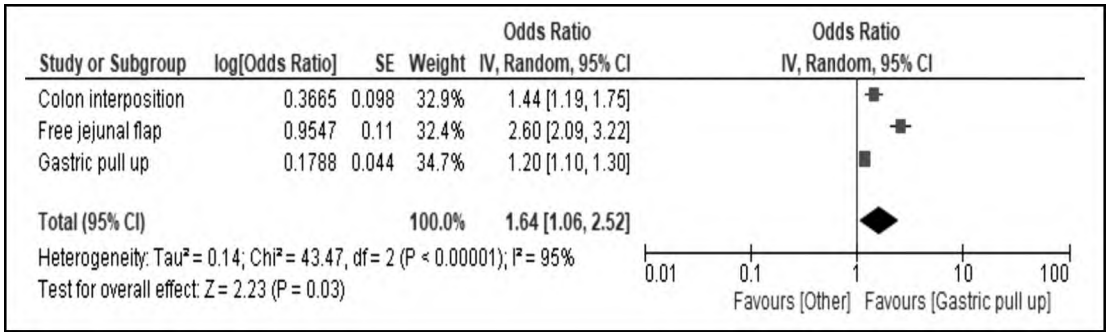

Fig. (6): Forest plot of mortality rate.

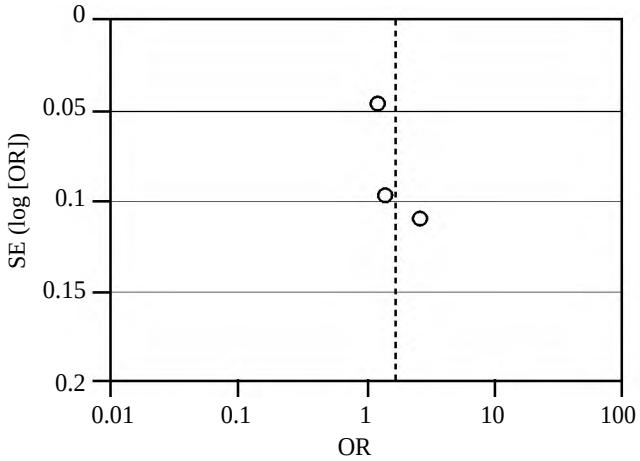

Fig. (7): Funnel plot of mortality rate.

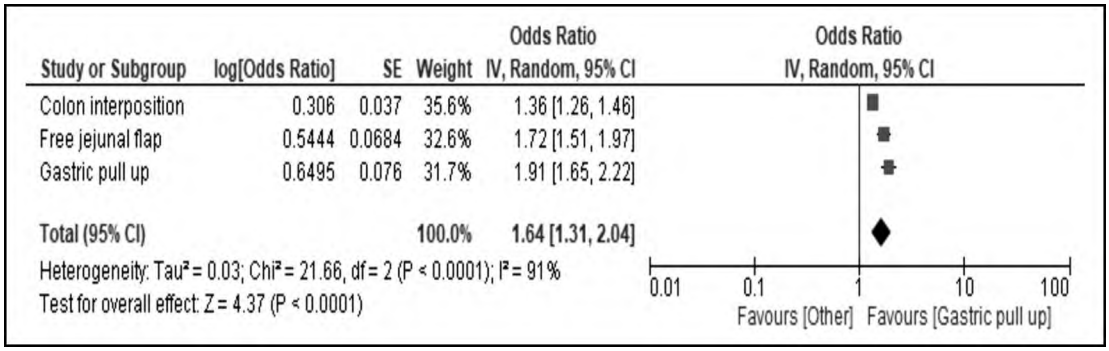

Fig. (8): Forest plot of hospital stay.

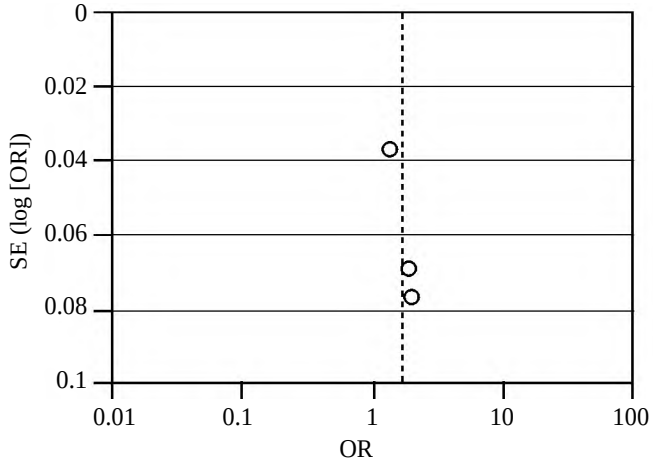

Fig. (9): Funnel plot of hospital stay.

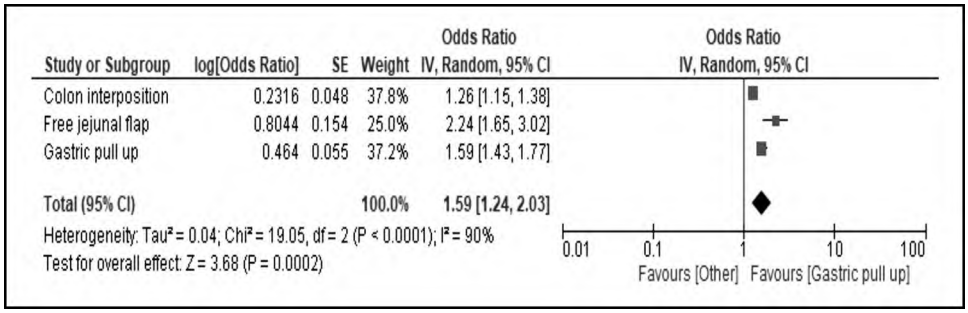

Fig. (10): Forest plot of sensitivity analysis.

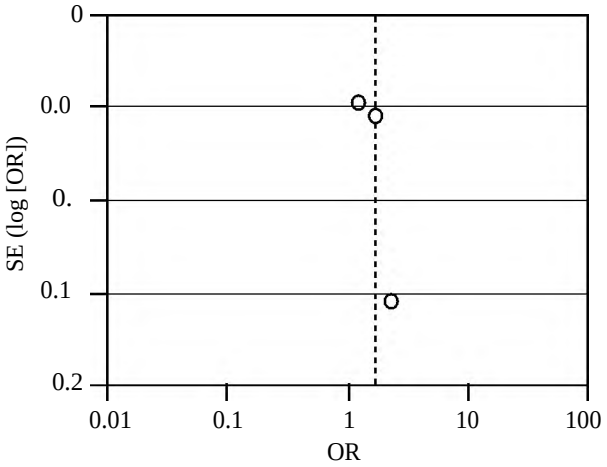

Fig. (11): Funnel plot of sensitivity analysis.

Discussion

Reconstruction of the digestive tract after esophagectomy is required to enable the passage of food and liquids. Gastric conduit, colonic conduit, and jejunal conduit are three common types of conduits. The choice of conduit is determined by the length of the gap, conduit availability, and the surgeon's experience with the procedure. The stomach is the most frequently used conduit to replace the resected esophagus **[4].**

The stomach is preferred due to its length, adequate vascular supply and the need for a single anastomosis. When the stomach is unavailable for use, because of caustic ingestions that critically injure both the esophagus and stomach, previous gastrectomy and abdominal surgery in which primary arterial supply to the stomach has been removed, gastric extension of distal esophageal tumors or true gastro- esophageal junction tumors. Some patients' previous gastric conduits may fail due to ischemic necrosis. In such cases, an alternative conduit must be selected **[2,5].**

Jejunal conduit is less common than the gastric conduit, but it is used in certain conditions when the stomach is unavailable to replace the esophagus. It is reasonably long, does not need a formal preparation, has the same luminal size compared to the esophagus, has intrinsic peristalsis, the mesenteric vasculature can readily be separated and mobilized with sufficient length to replace the esophagus **[6,7].**

Colonic conduit has been employed for esophageal reconstruction since the early 1900s. It is long, acid resistant, and has an excellent blood supply **[8,9].**

The aim of this study was to perform a systematic review and meta-analysis about literature published in the period from 2013-2023 that have compared the clinical outcomes of gastric, jejunal and colonic conduits after esophagectomy, the advantages and disadvantages of each conduit, and to assess whether this practices increase the risk of post-operative complications.

Abstracts of articles identified using the search strategy above will be viewed, and articles that appear to fulfill the inclusion criteria will be retrieved in full. Each article identified will be reviewed and categorized into one of the following groups: Included or excluded. When there will be a doubt, a second reviewer will assess the article and a consensus will be reached.

The current study included adult participants who had been operated for esophageal resection due to malignant or benign causes. We have provided sufficient details on the above outcome measures to allow comparison across studies, reported quantitative data, the selected articles were written in English language, published in full-text and in a peer-reviewed journal.

Outcomes from included studies were combined using the Review Manager software. Reasons for heterogeneity for studies were explored and, if necessary, sensitivity analysis was performed on the basis of methodological quality and random effects versus fixed effects modeling.

Review Manager Software® (Rev Man 5.3, Cochrane Collaboration) was used for analyses. A Mantel–Haenszel model was used for pooled analysis, and values were reported as odds ratios (ORs)

with 95% confidence intervals (CIs). The significance of pooled ORs was determined using the Z-test. A *p*-value of <0.05 was considered to indicate statistical significance.

Cochran's chi-square statistic was used to assess the statistical heterogeneity for each pooled estimate, which was quantified using I^2 statistics. An I^2 value of >50% was considered to indicate heterogeneity. A random-effect model was employed if heterogeneity was detected, and a fixed-effect model was used in other cases.

The Newcastle–Ottawa Scale was used for the quality assessment of the selected studies *[10]*. Two authors (P.-C.H. and H.-Y.C.) independently scored the included studies and any inconsistencies were resolved by consensus.

Publication biases were evaluated by funnel plots. We performed the Egger's test when the included article had a score greater than 9.

The primary search identified 1400 potentially eligible citations. Among these, 399 were identified as duplicates and removed. Among the remaining full texts 110 studies were reviewed in detail. After the evaluation of the titles and abstracts of these studies, the reviewers removed 101 citations. The remaining 9 articles included a total of 2713 patients [2187 treated with gastric pull up (GPU), 89 treated with jejunal flap (JF) and 437 treated with colon interposition (CI)], and were the basis of the present meta-analysis.

Five studies were retrospective, three studies were questionnaires, and one prospective study. Four studies were performed in USA, two in Japan, one in Hong Kong, one in Germany and one study in the Belgium. Our meta- analysis demonstrated that the mean age of the included studies was 61.2±9.03 years. The mean follow-up duration of 97.5 months.

All studies were assessed for methodological quality using the Newcastle–Ottawa scale for case–control study leading to an overall score ranging from 0 to 9 *[11]*. The scale assigns up to a maximum of nine points for the least risk of bias in three domains: (a) Selection of study groups (four points), (b) Comparability of study groups (two points), and (c) How to measure exposure and the desired outcome in the selected case–control studies (three points). Among these three domains, comparability is the only category that may receive two points: one if the most important confounders have been adjusted for in the analysis and a second one if other adjustments were made.11Survey questions were developed based on the Newcastle–Ottawa scale questions covering all three domains so that authors could provide detailed information about their studies. Two reviewers evaluated independently the risk of bias in each eligible study and disagreements in the process of answering questions were discussed until a consensus was reached.

This meta-analysis has reviewed Kolh et al. *[12]* study which aimed to determine whether using the colon as a conduit after esophagectomy was associated with post-operative complications and compared it with gastric pull up in the adult population.

From January 1990 to December 1998, 130 patients (103 males and 27 females) underwent esophageal resection for malignancy. The mean age at resection was 61.3±11.5 years old (range 36-78 years). There were 84 subtotal esophagectomies performed, 44 with anastomosis in the neck, 40 in the thoracic inlet, and 46 with distal oesophageal resection. Digestive continuity was restored with the stomach in 92 patients (age: 63.4±10.2 years) and the colon in 38 (age: 52.3±12.8 years). The tumor was detected in the upper third of the oesophagus in 14 cases (11%), in the middle third of the oesophagus in 49 cases (38%), in the lower third of the esophagus in 33 cases (25%), and located in the cardia in 34 cases (26%). Except for age (*p*, 0:0001), there was no significant preoperative difference between gastric and colonic groups. Hospital mortality rate was 8.5% (11 patients), with one patient (2.5%) died in the colonic graft group and ten (11%) in the gastric pull-up group (*p*. 0:17). Postoperative complications occurred in 40 patients (31%), respectively, in ten (26%) and 30 (33%) patients after colonic and gastric transplants (*p*. 0:48), and were pulmonary insufficiency or infection in 29 patients, anastomotic fistula in six, myocardial infarction in five, recurrent nerve palsy in four, renal insufficiency in three, and cerebrovascular accident in one. All fistulas developed in the gastric pull-up group. So, colonic grafts do not increase postoperative mortality or complications.

The current meta-analysis has discussed Demeester *[13]* study which attempted to evaluate the outcomes of using the colon as a conduit after esophagectomy.

Demeester *[13]* extracted data from University of Southern California comparing gastric pull-up and colon interposition at several centers following esophagectomy. 201 adult patients were included in this study; 116 of them underwent gastric pull up (GPU) and 85 underwent colon interposition (CI). Anastomotic leakage is 9.5% in the GPU group, and is 9.4% in the CI group. Anastomotic stricture in GPU group is 19%, and in CI group is 4%. Mortality rate in GPU group is 4.3% and in CI group is 4.7%. It was discovered that the incidence of an anastomotic stricture is lower following a colon graft. There was no difference in the overall mortality rate or the incidence of anastomotic leakage between the two methods.

This meta-analysis has discussed Hüttl et al. *[14]* study which assessed the methods and immediate outcomes of surgical therapy for esophageal cancer in Germany in 1999 by a nationwide representative survey.

Hüttl et al. [14] extracted data from 56 participating hospitals performed 891 esophagectomies. Gastric transposition was carried out in 86% of cases, colon interposition was performed in 12% and alternative conduits like jejunal grafts in 2% of cases. Following gastric interposition, the complication rate was 36% and following colon interposition, it was 42%. Anastomotic leakage occurred in 12% in gastric interposition and 15% in colon interposition. In both groups, the incidence of graft necrosis was 3%. The hospital mortality rate for gastric transposition was 8%, while the rate for colon interposition was 11%. The average hospital stay following surgery was 24 days.

The current meta-analysis has discussed Davis et al. [15] study which used prospective studies on patients of the Academic University Hospital department of surgery in Hong Kong from January 1, 1982, to December 31, 2000, to compare gastric interposition with colonic interposition following esophagectomy for cancer.

Davis et al. [15] compared 959 patients who underwent gastric transposition with 42 patients who underwent colonic interposition after esophagectomy. They discovered that colonic interposition resulted in higher blood loss: (median 1000 ml vs 700 mL in gastric interposition; p.001) and a longer operation time (median, 270 vs 225 minutes; p.001). Cardiopulmonary complications were the same. Intra-abdominal septic problems (9.5% vs 0.2%; p.001) and anastomotic leakage (14.3% vs 3.9%; p=.007) were observed in the colon group. In the gastric group, conduit ischemia occurred in 5 patients (0.5%), 3 of whom had successful reconstruction using colon. In the colon group, one patient (2.4%) had conduit ischemia and died. Seven patients (16.7%) from the colon group and 102 patients (10.6%) from the gastric group had hospital mortality rates (p=.21). In the second part of the study period, these numbers improved to 0 and 27 (5.5%), respectively (p=.99). For the gastric and colon groups, the median survival was 12.8 and 10.4 months, respectively (p=.4).

This meta-analysis has discussed Briel et al. [16] study which studied prevalence and risk factors for ischemia, leak, and stricture of esophageal anastomosis using a retrospective study at the University of Southern California, USA, to compare gastric pull-up with colon interposition between January 1996 and July 2002.

According to Briel et al. [16], a study population of 393 individuals underwent esophageal reconstruction utilizing gastric interposition, including 230 patients, and colon interposition, including 163 patients. Using an interrupted suture technique, the colon or stomach was anastomosed to the cervical esophagus in the neck using a hand-sewn technique. Eleven patients' records were unavailable for review, and eleven patients were monitored for less than a month. Of the patients, 14 died within 30 days of the procedure (operative mortality = 3.5%), and 5 died while they were in the hospital (total hospital mortality = 4.7%). As a result, 363 individuals were included in the study population: 214 underwent gastric pull-up and 149 underwent colon interposition. 9.2% of patients experienced conduit ischemia following esophagectomy. 13.9% of people died from conduit ischemia. In 10.9% of cases, an anastomotic leak happened. 11.6% of patients died from anastomotic leaks. Anastomotic leak was more likely to occur in cases of ischemia, neoadjuvant therapy, and concomitant diseases. After esophagectomy 10% of patients developed conduit ischemia or anastomotic leak and 22% developed anastomotic stricture. Compared to colon interposition, anastomotic leaks and strictures are more frequent, and the strictures are more severe following stomach pull-up. Dilatation is a secure and useful procedure.

A stricture occurred in 22.0% of patients. Risk factors for development of a stricture were identified in 48% of patients who had an ischemic conduit, in 47% of patients who had an anastomotic leak and in comorbid conditions. The combination of ischemia and leak led to stricture in 50% of patients. Prevalence of ischemia was 10.4% in gastric interposition and 7.4% in colonic interposition. Anastomotic leak was 14.3% in gastric pull up and 6.1% in colonic interposition. Prevalence of stricture was 31.3% in gastric pull up and 8.7% in colon interposition. After esophagectomy 10% of patients will develop conduit ischemia or an anastomotic leak and 22% will develop anastomotic stricture. Anastomotic leak and strictures are more common and the strictures are more severe after gastric pull-up compared with colon interposition. Dilatation is a safe and effective treatment.

This meta-analysis has discussed Daiko et al. [17] study which aimed to study surgical management of squamous cell carcinoma of the cervical esophagus and compare gastric pull up with jujenal flap in esophageal reconstruction after esophagectomy from January 1982 till December 2002 using a retrospective study at the National Cancer Center East Hospital and Central Hospital in Japan.

Daiko et al. [17] included a study population of 74 patients (53 males and 21 females). Of them, 50 underwent free jejunal transfer, 19 underwent gastric pull-up, and 5 underwent other procedures. There was a 34% operative morbidity rate and a 4% in-hospital mortality rate. Significant complications occurred in 34% of patients, of them, four patients experienced anastomotic leakage, two for each reconstructive procedure, five had graft necrosis, three underwent free jejunal transfer and two underwent gastric pull-up. This study found that there was no significant difference in morbidity rates based on the reconstruction approach (p=0.238).

The current meta-analysis has discussed Doki et al. [18] study who aimed to study long-term and short-term evaluation of esophageal reconstruction using the colon or the jejunum in esophageal cancer patients after gastrectomy from 1998 to 2005 using a retrospective study at the Department of Gastroenterological Surgery, Graduate School of Medicine, Osaka University in Japan.

Doki et al. [18] included a study population of 53 individuals in their research group; 25 of them had jejunum repair and 28 had colon reconstruction. Both the operation time and blood loss were the same. The jejunum reconstruction group stayed in the hospital for 45 days, while the colon group stayed for 65 days (p=0.0120). The jejunum group had a 24% incidence of anastomotic leakage, while the colon group had a 46% incidence (p=0.1507). Between the two groups, there was no difference in other operative morbidity. According to this retrospective analysis, the jejunum is a better option for reconstruction following esophagectomy than the colon.

This meta-analysis has discussed Stephens et al. [19] study who discussed super-charged pedicled jejunal interposition in comparison with gastric conduit after esophagectomy between January 1, 2009 and December 31, 2013 in USA by representative survey.

Stephens et al. [19] extracted data from 45 patients. The mean age of the patients was 60.6±12.5 years, with 63±10 for gastric conduit patients and 55±15 for those patients undergoing SPJ (super-charged pedicled jejunum) conduit. Sixty-nine percent of the patients were male, and eighty-seven percent of them had esophageal cancer. Thirteen patients had gastric interposition and fourteen had SPJ interposition. Death happened in 7% and 14% of gastric and SPJ conduits, reflux happened in 58% and 36% of gastric and SPJ conduits, dumping and dysphagia happened in 50% and 57% of gastric and SPJ conduits, and stricture happened in 26% and 15% of gastric and SPJ conduits. 31 patients underwent gastric interposition and 14 patients underwent SPJ interposition. Mortality rate was 7% in gastric conduit and 14% in SPJ conduit, reflux occurred in 58% of gastric conduit and in 36% of SPJ conduit, dumping and dysphagia occurred in 50% of gastric conduit and in 57% of SPJ conduit, stricture occurred in 26% of gastric conduit and in 15% of SPJ conduit.

This meta-analysis has discussed Luan et al. [20] study which aimed to study the comparison of outcomes of total esophageal reconstruction with supercharged jejunal flap, colonic interposition and gastric pull-up between 2004 and 2014 using a retrospective study at the Department of Surgery, Stanford University, USA.

Luan et al. [20] included a study population of 100 patients underwent total esophageal reconstruction with GPU (Gastric Pull-Up) in 85 patients, with SPJ (Super charged pedicled Jejunum) in 15 patients and with CI (Colon Interposition) in 4 patients. Mean follow-up period was 17.8 months. The mean ICU stay and hospital stay were 4.3±5.4 days and 17.6±14.8 days for the SPJ group, and 2.9±5.7 days and 11.6±6.9 days for the GPU group (p=0.38, p<0.05). The CI group had significantly longer recoveries than either of the other groups, at 28.5± 24.0 days and 109.5±112.7 days (all p<0.05). Rates of anastomotic leakage were higher in the CI group than in the SPJ (p<0.05) and GPU groups (p<0.05), at 75%, 13.3%, and 12.9%, respectively.

There was no statistical difference in the incidence of anastomotic leakage between the GPU and SPJ groups. During their initial hospital stay after surgery, four patients (27%) in the SPJ group needed reoperation, whereas 75% of patients after CI and 19% after GPU did not. There were no SPJ failures and only one CI graft failure that needed to be removed.

The following were specific complications that were encountered after total esophageal reconstruction: Anastomotic leak/fistula, stricture, bowel obstruction, wound infection and/or dehiscence, pulmonary complications (e.g., infection, effusions requiring intervention) and cardiac complications (e.g., arrhythmia requiring intervention).

Comparing the different conduits complications; the current meta-analysis results showed thatit is not possible to deduct the best procedure for reducing anastomosis leakage, but the odds ratio showed that free jejunal flap (0.8255) was better than gastric pull-up (0.4509) and that colon interposition had a high probability of anastomosis leakage (0.2236). The heterogeneity was high (I^2=96%), so a random effect model was used. The chi-square test showed that there was no significant difference between the three procedures (p=0.06).

The funnel plot analysis of the incidence of anastomosis leakage indicator shows that the overall symmetry was still present (Fig. 15). The results of Egger's test showed that there was no publication bias among the included articles (p>0.05).

About the complication of Stricture Formation; this meta-analysis results showed thatthe odds ratio showed that colon interposition (0.9201) was better than gastric pull-up (0.3131) and that gastric pull-up had a high probability of stricture formation (0.2668). The heterogeneity was high (I^2=68%), so a random effect model was used. The chi-square test showed that there was a significant difference among the three procedures (p=0.003).

The funnel plot analysis of the incidence of stricture indicator shows that the overall symmetry was still present. The results of Egger's test showed that there was no publication bias among the included articles (p>0.05).

About the complication of Mortality Rate; this meta-analysis results showed that odds ratio showed that free jejunal flap (0.9547) was better than colon interposition (0.3665) and that gastric pull-up had a high probability of mortality rate (0.1788). However, only one study compared free jejunal flap with gastric pull-up, and therefore, the results should be used cautiously. The heterogeneity was high (I^2=95%), so a random effect model was used. The chi-square test showed that there was a significant difference among the three procedures (p=0.03).

The funnel plot analysis of the incidence of mortality rate shows that the overall symmetry was still present. The results of Egger's test showed that there was no publication bias among the included articles (p>0.05).

About the complication of Length of Hospital Stay; the current meta-analysis results showed thatthe odds ratio showed that gastric pull-up (0.6495) was better than free jejunal flap (0.5444) and that colon interposition had a high probability of prolonging the length of hospital stay (0.3060). The heterogeneity was high (I^2=91%), so a random effect model was used. The chi-square test showed that there was a significant difference among the three procedures (p=0.00001).

The funnel plot analysis of the incidence of hospital stay shows that the overall symmetry was still present. The results of Egger's test showed that there was no publication bias among the included articles (p>0.05).

The current meta-analysis study was agreed to a numerous study from the literature till present and they were demonstrated in the following section as follow:

Hung et al. [21] documented thatfree jejunal flap was the better procedure regarding anastomosis leakage, regarding stricture formation, colon interposition was the better procedure; regarding mortality rate, free jejunal flap was the better procedure; regarding length of hospital stay, gastric pull-up was the better treatment. Hung et al. [21] documented thatif technically possible, free jejunal flap is a better choice than colon interposition when gastric conduit cannot be used, but further study should be conducted to compare groups with equal supercharged patients. In addition, jejunal flap (JF) cannot replace traditional gastric pull-up (GPU) due to technical complexities, more anastomotic sites, and longer operation times. However, the GPU method with the supercharged procedure would be a possible solution to lower postoperative leak. The limitation of this meta-analysis is that the number of articles included was low; we aim to update the result when new data are available.

Irino et al. [22] stated that Short-term outcomes have extensively been reported regarding the use of the three different conduits. A recent study comparing gastric pull-up with colon interposition concluded that anastomotic leak and stricture formation were more common after a gastric pull-up. On the other hand, another study claimed that colonic graft was not associated with an increased postoperative morbidity and mortality compared with gastric conduit. A recent literature review, where the authors assessed the colonic graft in comparison with the pedicled jejunum suggested that graft loss and leakage were comparable while mortality was higher in the colon graft. Based on the evidence, the three different conduits seem to be comparable in terms of short-terms outcomes, however, the gastric conduit may be recommended because of its technical easiness.

Jiang et al. [23] compared with the colon group; the jejunum group had a lower incidence of postoperative anastomotic leakage, lesser duration of postoperative drainage, and faster recovery. Furthermore, the scores were better in the jejunum group than in the colon group, in terms of short-term overall quality of life, physical function and social relationships. In esophageal cancer, when gastric tube construction is not feasible, a pedicled jejunum may be preferred over a colonic conduit due to lower incidence of acid reflux, anastomotic leakage and higher postoperative short-term quality of life, and rapid postoperative recovery.

Marks & Hofstetter [24] the literature on colon interposition for esophageal reconstruction shows good short-term and long-term results. Rates of anastomotic leak range from 0% towhereas; reported rates of graft loss are 0% to 9.4%. Reported rates of perioperative mortality vary widely, from 0% to 17% and inherently reflect the different patient populations in need of esophageal reconstruction. Results published by experienced centers are not significantly different than that seen with gastric pull-up procedures. However, there is a need for late reoperation in up to 30% of patients for conduit redundancy, dilation, and associated stasis. Limited functional data exists comparing swallowing function with colon compared with jejunal grafts but it is thought that jejunal conduits maintain peristalsis after transposition and therefore may lead to better functional outcomes.

Kim et al. [25] Colon conduits were associated with higher morbidity rates than gastric conduits, the long-term outcomes of colon conduits are considered acceptable. The difference in mortality between the groups is likely attributable to underlying medical conditions rather than the surgical technique employed. Furthermore, during the perioperative period, more consideration should be given to

the use of a colon conduit, particularly in cervical anastomosis. Regarding anastomotic leakage, when comparing the rate of this complication between cases with thoracic anastomosis and those with cervical anastomosis, colon conduits showed a sharper increase compared to gastric conduits. Furthermore, cervical anastomosis was identified as a significant risk factor for conduit related complications in patients with colon conduits.

Conclusion:

Regarding the complication of anastomosis leakage; it is not possible to determine the best procedure for reducing anastomosis leakage, but comparing the studies had shown that free jejunal flap was better than gastric pull-up and that colon interposition had a high probability of anastomosis leakage.

About stricture formation; it was found that colon interposition was better than gastric pull-up and that free jejunal flap had a high probability of stricture formation.

About mortality rate; it was discovered that free jejunal flap was superior to colon interposition and that gastric pull-up had a high probability of increased mortality rate.

Regarding the length of hospital stay; it was found that gastric pull-up was better than free jejunal flap and that colon interposition had a high probability of prolonging the length of hospital stay.

The choice of conduit should be individualized based on patient characteristics, surgical experience, and institutional resources; with consideration given to the balance between perioperative risks and long-term functional outcomes.

Acknowledgement:

Nil.

Conflict of Interests:

None to be declared.

References

1- KIGHT C.E.: Nutrition considerations in esophagectomy patients. Nutr. Clin. Pract., Oct-Nov. 23 (5): 521-8, 2008.

2- GUO W., YANG S. and LI H.: Esophagectomy with gastric conduit reconstruction for benign disease: Extreme but important. Ann. Transl. Med., Apr. 6 (7): 117, 2018.

3- FLANAGAN J.C., BATZ R., SABOO S.S., NORDECK S.M., ABBARA S., KERNSTINE K., et al.: Esophagectomy and Gastric Pull-through Procedures: Surgical Techniques, Imaging Features, and Potential Complications. Radiographics., Jan-Feb. 36 (1): 107-21, 2016.

4- KUMAR R. and WEI B.: The Difficult Esophageal Conduit. Surg. Clin North Am., Jun. 99 (3): 471-478, 2019.

5- BAKSHI A., SUGARBAKER D.J. and BURT B.M.: Alternative conduits for esophageal replacement. Ann. Cardiothorac. Surg., Mar. 6 (2): 137-143, 2017.

6- GAUR P. and BLACKMON S.H.: Jejunal graft conduits after esophagectomy. J. Thorac. Dis., May 6 (3): S333-40, 2014.

7- BAIRDAIN S., FOKER J.E., SMITHERS C.J., HAMILTON T.E., LABOW B.I., BAIRD C.W., et al.: Jejunal interposition after failed esophageal atresia repair. J. Am. Coll. Surg., Jun. 1; 222 (6): 1001-8, 2016.

8- BROWN J., LEWIS W.G., FOLIAKI A., CLARK G.W.B., BLACKSHAW G.R.J.C. and CHAN D.S.Y.: Colonic Interposition After Adult Oesophagectomy: Systematic Review and Meta-analysis of Conduit Choice and Outcome. J. Gastrointest Surg., Jun. 22 (6): 1104-1111, 2018.

9- KESLER K.A., PILLAI S.T., BIRDAS T.J., RIEGER K.M., OKEREKE I.C, CEPPA D., et al.: "Supercharged" isoperistaltic colon interposition for long-segment esophageal reconstruction. Ann. Thorac. Surg., Apr. 95 (4): 1162-8, 2013; discussion 1168-9.

10- STANG A.: Critical evaluation of the Newcastle-Ottawa scale for the assessment of the quality of nonrandomized studies in meta-analyses. Eur. J. Epidemiol., Sep. 25 (9): 603-5, 2010.

11- WELLS G.A., SHEA B, O'CONNELL D., PETERSON J., WELCH V., LOSOS M., et al.: The Newcastle-Ottawa Scale (NOS) for assessing the quality of non-randomised studies in meta-analyses. NOS Oxford, 1-12, 2000.

12- KOLH P., HONORE P., DEGAUQUE C., GIELEN J., GERARD P. and JACQUET N.: Early stage results after oesophageal resection for malignancy - colon interposition vs. gastric pull-up. Eur. J. Cardiothorac Surg., Sep. 18 (3): 293-300, 2000.

13- DEMEESTER S.R.: Colon interposition following esophagectomy. Dis. Esophagus, 14 (3-4): 169-72, 2001.

14- HÜTTL T.P., WICHMANN M.W., GEIGER T.K., SCHILDBERG F.W. and FÜRST H.: Techniques and results of esophageal cancer surgery in Germany. Langenbecks Arch. Surg., Jul. 387 (3-4): 125-9, 2002.

15- DAVIS P.A., LAW S. and WONG J.: Colonic interposition after esophagectomy for cancer. Arch Surg., Mar. 138 (3): 303-8, 2003.

16- BRIEL J.W., TAMHANKAR A.P., HAGEN J.A., DEMEESTER S.R., JOHANSSON J., CHOUSTOULAKIS E., et al.: Prevalence and risk factors for ischemia, leak, and stricture of esophageal anastomosis: Gastric pull-up versus colon interposition. J. Am. Coll. Surg., Apr. 198 (4): 536-41, 2004; discussion 541-2.

17- DAIKO H., HAYASHI R., SAIKAWA M., SAKURABA M., YAMAZAKI M., MIYAZAKI M., et al.: Surgical management of carcinoma of the cervical esophagus. J. Surg. Oncol., Aug. 1; 96 (2): 166-72, 2007.

18- DOKI Y., OKADA K., MIYATA H., YAMASAKI M., FUJIWARA Y., TAKIGUCHI S., et al.: Long-term and short-

term evaluation of esophageal reconstruction using the colon or the jejunum in esophageal cancer patients after gastrectomy. Dis Esophagus., 21 (2): 132-8, 2008.

19- STEPHENS E.H., GAUR P., HOTZE K.O., CORREA A.M., KIM M.P. and BLACKMON S.H.: Super-Charged Pedicled Jejunal Interposition Performance Compares Favorably With a Gastric Conduit After Esophagectomy. Ann. Thorac. Surg., Aug. 100 (2): 407-13, 2015.

20- LUAN A., HUNTER C.L., CROWE C.S. and LEE G.K.: Comparison of Outcomes of Total Esophageal Reconstruction With Supercharged Jejunal Flap, Colonic Interposition, and Gastric Pull-up. Ann. Plast. Surg., May 80 (5): S274-S278, 2018.

21- HUNG P.C., CHEN H.Y., TU Y.K. and KAO Y.S.: A Comparison of Different Types of Esophageal Reconstructions: A Systematic Review and Network Meta-Analysis. J. Clin. Med., Aug. 26; 11 (17): 5025, 2022.

22- IRINO T., TSEKREKOS A., COPPOLA A., SCANDAVINI C.M., SHETYE A., LUNDELL L., et al.: Long-term functional outcomes after replacement of the esophagus with gastric, colonic, or jejunal conduits: A systematic literature review. Dis. Esophagus, Dec 1; 30 (12): 1-11, 2017.

23- JIANG S., GUO C., ZOU B., XIE J., XIONG Z., KUANG Y., et al.: Comparison of outcomes of pedicled jejunal and colonic conduit for esophageal reconstruction. BMC Surg., Jul. 16; 20 (1): 156, 2020.

24- MARKS J.L. and HOFSTETTER W.L.: Esophageal reconstruction with alternative conduits. Surg. Clin. North Am., Oct. 92 (5): 1287-97, 2012.

25- KIM J.H., YUN J.K., KIM C.W., KIM H.R. and KIM Y.H.: Long-Term Outcomes of Colon Conduits in Surgery for Primary Esophageal Cancer: A Propensity Score-Matched Comparison to Gastric Conduits. J. Chest Surg., Jan. 5; 57 (1): 53-61, 2024.

دراسة مقارنة بين نتائج توصيل القنوات المعدية والمعى الصائم والقولون بعد استئصال المرىء : مراجعة منهجية وتحليل تلوى

فى هذا البحث تم مراجعة المقالات المنشورة واستعراضها وإجراء دراسة تحليلية لمقارنة النتائج السريرية لاستخدام المعدة والمعى الصائم والقولون كقنوات بعد استئصال المرىء، ومزايا وعيوب كل قناة، ولتقييم ما إذا كانت هذه الممارسات تزيد من خطر حدوث مضاعفات ما بعد الجراحة.

فيما يتعلق بالمضاعفات؛ فإنه لم يكن من السهل تحديد أفضل إجراء للحد من التسريب من مكان التوصيل ولكن مقارنة الدراسات أوضحت أن استخدام المعى الصائم أفضل من استخدام المعدة وأن استخدام القولون ينتج عنه الاحتمال الأكبر للتسريب من مكان التوصيل.

وبالنسبة للضيق المتكون عند مكان التوصيل؛ فقد وجد أن استخدام القولون أفضل من استخدام المعدة وأن استخدام المعى الصائم ينتج عنه الاحتمال الأكبر لحدوث ذلك الضيق.

وبالنسبة لمعدل الوفيات؛ فقد تم اكتشاف أن استخدام المعى الصائم أفضل من استخدام القولون وأن استخدام المعدة ينتج عنه معدل وفيات أكبر.

وفيما يتعلق بمدة الإقامة بالمستشفى؛ فقد وجد أن استخدام المعدة أفضل من استخدام المعى الصائم وأن استخدام القولون كان له احتمال مرتفع لزيادة مدة الإقامة بالمستشفى.

يجب أن يتم اختيار القناة بناءً على خصائص المريض، والخبرة الجراحية ؛ مع مراعاة التوازن بين المخاطر المحيطة بالجراحة والنتائج الوظيفية طويلة الأمد.