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Evaluation of stent applications for upper gastrointestinal disorders

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Abstract

Aim: Gastrointestinal stents are predominantly used for palliating malignant dysphagia in patients with esophageal cancer when surgical intervention is deemed inappropriate. This research aims to elucidate the diagnostic and follow-up processes of patients who underwent stent placement for upper gastrointestinal system pathologies at our clinic.

Materials and Methods: A retrospective analysis assessed 61 patients who received stents for upper gastrointestinal tract stenosis due to various causes. Patient demographics, including age and gender, underlying pathology, benign-malignant status, location of the pathology, prior surgical or bougie dilation interventions, post-stent survival status, and, if applicable, the duration between the procedure and decease, were evaluated. Patient health records were accessed from the hospital's electronic medical database.

Results: Pre-stent bougie dilation was performed in 26.2% (n=16) of patients, while pre-stent surgery was undertaken in 41% (n=25). Repeat stenting was necessitated in 6.6% (n=4) of cases. Of the patients, 86.9% (n=53) succumbed to their condition, while 13.1% (n=8) survived. Post-stent survival times for deceased patients after stent surgery ranged from 0 to 55 months, with a median survival time of two months. Surviving patients exhibited varied post-stent durations between 65 and 122 months, with a mean stent utilization period of 101 months. A statistically significant correlation was observed between pre-stent surgery and survival status, indicating a higher surgery rate in patients who survived than those who did not ($p<0.05$).

Conclusion: Consequently, due to its cost-effectiveness, stents can be a viable alternative to surgery for both benign and malignant gastrointestinal disorders. This is attributed to its notable advantages, including flexibility and high resistance.

Introduction

The utilization of enteral stents for managing luminal disorders within the gastrointestinal system has seen a notable increase. Initially employed for non-surgical palliative interventions in esophageal cancer, enteral stents now find application in both benign and malignant conditions affecting various segments of the gastrointestinal tract [1]. These devices serve the purpose of safeguarding or restoring luminal integrity. The development of diverse types of flexible and self-expandable stents, primarily composed of materials such as stainless steel, nitinol (nickel and titanium alloy), or other alloys (cobalt, nickel, chromium), has proven highly successful, ensuring flexibility and robust resistance to maintain stent patency and position [2]. Esophageal stents, designed for use in both benign and malignant indications involving the esophagus, gastro-esophageal junction, and gastric cardia, initially found application in addressing dysphagia, followed by malignancies. The expanding usage of stents now encompasses benign esophageal conditions such as strictures (peptic, radiation-induced, anastomotic, caustic), post-operative leaks, iatrogenic perforations, external compression on the esophagus, and tracheo-esophageal fistula. Predominantly, the palliative treatment of inoperable esophageal cancers remains the primary indication for esophageal stent placement. Complications associated with esophageal stents include perforation, stent displacement, bleeding, stent obstruction due to tumoral mass or tissue growth, and tracheal compression .Gastrointestinal stents, frequently employed for palliating malignant dysphagia in patients with esophageal cancer deemed unsuitable for surgery, have witnessed successful applications, particularly with self-expandable metallic stents. Recent

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advancements include the prominence of both covered and uncovered metallic and plastic stents in palliative treatments for malignant or benign digestive system strictures. Despite the higher cost of expandable metallic stents compared to rigid plastic stents, the former poses fewer complications, rendering it a cost-effective option. Comparative to laser recanalization, expandable stents exhibit superior efficacy in symptom improvement and reduced necessity for repetitive interventions [3]. The evolution of self-expandable metallic stents represents a significant stride in the palliation of digestive system strictures, offering advantages over rigid tubes, such as a narrower insertion device, obviating the need for pre-dilatation, and facilitating insertion under endoscopy or fluoroscopy guidance with light sedation [4]. Successfully achieving stent placement at a rate of 95%, the procedure-related mortality remains below 1.5% [5].

This study aims to investigate the diagnostic and follow-up processes of patients receiving stents for upper gastrointestinal system pathologies. Additionally, we seek to evaluate patient outcomes following stent placement, contributing valuable insights to the existing medical literature.

Materials and Methods

This retrospective analysis was conducted to assess 61 patients who underwent stent placement for upper gastrointestinal tract stenosis due to various etiologies. The inclusion criteria encompassed patients subjected to stenting for upper gastrointestinal tract disorders at our clinic from January 2009 to May 2019. Additionally, informed consent was obtained from all participating individuals. Key parameters including age, gender, underlying pathology, benign-malignant classification of the pathology, location of the pathology, prior occurrences of surgery or bougie dilation before stent placement, post-procedural survival status, and, if applicable, the duration between the procedure and decease were meticulously examined. Patient medical records were retrieved from the hospital database to facilitate a comprehensive analysis. Ethics committee approval has been granted from our institution (Inonu University Health Sciences Non-invasive Clinical Research Ethics Committee, decision Number: 2023/5269).

Statistical analysis

Patient data collected within the study's parameters underwent analysis utilizing the IBM Statistical Package for the Social Sciences (SPSS) for Windows version 26.0 (IBM Corp., Armonk, NY). Descriptive values, including frequency and percentage for categorical data, as well as mean with standard deviation for continuous data, were utilized in the analysis.. Comparative assessments between groups were conducted using the "Independent Sample T–test" for two groups, while the "Pearson Chi-Square Test" was applied for categorical variables. Statistical significance was established with a p-value below 0.05.

Results

Sixty-one patients aged between 21 and 93 were included in this study. The mean age of the patients was 62 years old; 39.3% (n=24) were female, and 60.7% (n=37) were male. Demographic and clinical findings of patients are shown in Table 1. Pre-stent bougie dilatation was performed in 26.2% (n=16) of the patients, pre-stent surgery was performed in 41% (n=25), and repeat stent was required in 6.6% (n=4). While 86.9% (n=53) of the patients died, 13.1% (n=8) survived. Post-stent survival times of patients who died after stent surgery ranged from 0 to 55 months, and the median survival time was two months. In patients who survived, the time after stent use varied between 65 – 122 months, and the mean duration of

Table 1. Demographic and clinical findings of patients.

Variables (n=61)	n (%)	Mean±SD	Median (Min-Max)
Age (years)		62±16	62 (21-93)
Gender			
Female	24 (39.3)		
Male	37 (60.7)		
Anatomical localization of pathology			
Upper esophagus	6 (9.8)		
Middle esophagus	14 (23)		
Gastro-esophageal junction	32 (52.5)		
Gastroenterostomy opening	6 (9.8)		
Pylor	2 (3.3)		
Duodenum 2nd segment	1 (1.6)		
Bougie dilatation before stent	16 (26.2)		
Pre-stent surgery	25 (41)		
The need for a re-stenting	4 (6.6)		
Stent length (cm)		11.4±2.6	12 (8-23)
Final Status			
Survived	8 (13.1)		
Exitus	53 (86.9)		
Survival time after stent (months)	n=53	7.2±11.9	2 (0-55)
Time elapsed after stent (months)	n=8	101±21.5	108 (65-122)

Table 2. Diagnoses of patients with upper gastrointestinal stenting.

Variables (n=61)	n (%)
Benign	18 (29.5)
Gastric bypass anastomosis leak	5 (27.8)
Esophageal injury during cervical fracture operation	1 (5.6)
Stricture due to caustic substance intake	1 (5.6)
Esophageal perforation	5 (27.8)
Anastomotic leakage after gastrectomy due to stomach cancer	3 (16.7)
Duodenal perforation	1 (5.6)
Stricture after esophagitis	1 (5.6)
Tracheo-esophageal fistula	1 (5.6)
Malignant	43 (70.5)
Esophageal cancer	20 (46.5)
Stomach cancer	15 (34.9)
Pulmonary cancer esophageal compression	6 (14)
Nasopharynx cancer	1 (2.3)
Pancreatic cancer duodenum compression	1 (2.3)

Table 3. Distribution of demographic and clinical findings of patients according to tumor groups.

Variables (n=61)	Benign (n=18)	Malignant (n=43)	p value
Age (years)			**<0.001**
Mean±SD	**50±17**	**67±14**	
Median (Min-Max)	**52 (21-93)**	**66 (33-91)**	
Gender			0.810
Female	8 (44.4)	16 (37.2)	
Male	10 (55.6)	27 (62.8)	
Anatomical localization of pathology			**0.025**
Upper esophagus	**1 (5.6)**	**5 (11.6)**	
Middle esophagus	**3 (16.7)**	**11 (25.6)**	
Gastro-esophageal junction	**8 (44.4)**	**24 (55.8)**	
Gastroenterostomy opening	**5 (27.8)**	**1 (2.3)**	
Pylor	**0 (0)**	**2 (4.7)**	
Duodenum 2nd segment	**1 (5.6)**	**0 (0)**	
Bougie dilatation before stent	3 (16.7)	13 (30.2)	0.350
Pre-stent surgery	**14 (77.8)**	**11 (25.6)**	**<0.001**
The need for a re-stenting	1 (5.6)	3 (7)	1.000
Stent length (cm)			0.953
Mean±SD	12.2±4.1	11±1.5	
Median (Min-Max)	10 (8-23)	12 (8-14)	
Final Status			**<0.001**
Survived	**8 (44.4)**	**0 (0)**	
Exitus	**10 (55.6)**	**43 (100)**	
Survival time after stent (months)			0.726

stent use was 101 months. Gastric bypass anastomosis leak was the most benign cause, and esophageal cancer was the most malign cause of upper gastrointestinal stenting. Other causes of upper gastrointestinal stenting are shown in Table 2. The patient's demographic and clinical characteristics categorized by tumor types are shown in Table 3. When the table was examined, it was seen that there was a statistically significant difference between the groups in terms of age, anatomical localization of the pathology, pre-stent surgery, and survival ($p<0.05$). While the age of the malignant patient group was higher than that of the benign patient group, the surgery rate before the stent was higher in the benign patient group. As for survival, all of the malignant patients died, while 55.6% (n=10) of the benign patient group died.

Discussion

Surgery remains the preferred treatment modality for operable cancers, but for patients ineligible for surgery, palliative interventions become imperative. The primary objective of palliative therapy is to uphold digestive system patency, facilitate the passage of solid foods, and mitigate pain. Presently, the predominant indication for stent placement is in patients with inoperable esophageal cancer. Notably, self-expanding covered metal stents find application in anastomotic leaks, tracheoesophageal fistulas, and both malignant and benign stenoses [6]. The deployment of stents exerts equal tension force on all sides of the esophageal wall. Yet, complications such as chest pain, reflux complaints, proximal and distal stenosis, tracheoesophageal fistula development, and stent migration may arise due to reactive hyperplasia and fibrosis induced by stent mechanical effects [7, 8]. Migration rates vary, with uncoated stents exhibiting low migration (0–3%) and an increased incidence (6%) when placed in the cardia [9,10]. Covered stents, while resistant to tumor growth, have a higher migration rate, particularly when fully covered [11]. Notably, the migration rate of covered stents, especially at the cardia, has been reported to be 25–32% [12], with causative factors including insufficient stent expansion, tumor shrinkage from chemotherapy or radiotherapy, stent malposition, excessive stenosis dilation before stent placement, or esophageal peristalsis [13]. Encouragingly, covered stents demonstrate notable efficacy in treating esophagorespiratory fistulas, with closure observed in 67–100% of cases [14].

Esophageal stents play a pivotal role in palliating significant dysphagia resulting from external compression in esophageal or metastatic cancers. While brachytherapy is effective for mild dysphagia, stent placement is emphasized in palliative treatment for severe dysphagia with low life expectancy [15,16]. Our study revealed pre-stent bougie dilation in 26.2%, pre-stent surgery in 41%, and a repeat stent requirement in 6.6% of patients. Among them, 86.9% succumbed, while 13.1% survived, with post-stent survival times ranging from 0 to 55 months for deceased patients and 65–122 months for survivors, with a mean stent utilization duration of 101 months. All malignant patients died, while 55.6% of benign patients succumbed. Comparable research by Türkyılmaz et al. demonstrated a decrease in dysphagia severity post-stent placement [17], and meta-analysis by Fuccio et al. highlighted successful results in 40% of patients with benign esophageal strictures [18]. Various additional symptoms or complaints may raise post-stent placement. Anti-reflux valve stents attempted to address tumor-induced dysphagia, yet in some cases, reflux persisted. Proximally and cervically located stents demonstrated better tolerance for dysphagia complaints than distally located ones [19,20]. A multicenter retrospective study in 2020 covering 2036 stents across 1778 patients reported a 94.7% technical success rate, with chest pain being the most common complication [21]. Other studies investigating metallic stents revealed fever exceeding 38 degrees and chest pain as notable complications [22,23].

Esophageal stents find diverse applications in benign and malignant indications of the esophagus, gastro-esophageal junction, and gastric cardia. The primary indications include dysphagia and malignancy, while the use extends to benign conditions like strictures, post-operative leaks, iatrogenic perforations, external compression, and tracheoesophageal fistulas. Common complications include perforation, stent displacement, bleeding, obstruction, or tracheal compression [24]. Gastric outlet obstruction, prevalent in advanced stomach, duodenum, and pancreatic cancers, presents with complaints of nausea, vomiting, and early satiety. Gastro-duodenal stent application is an alternative to surgery, offering rapid oral intake tolerance and a brief hospital stay. Fully covered metal stents prove effective in treating gastric leaks post-bariatric surgery,

with an 88% success rate reported in a meta-analysis [25,26]. Our study found no statistically significant relationship between patient outcomes and bougie dilation before the stent, but a significant association existed with pre-stent surgery. Surgery rates were higher in surviving patients, emphasizing the efficacy of metallic stents in palliating inoperable digestive tract stenosis. Despite limited morbidity, the short-term application of metallic stents proves effective for quality palliation without mortality. The use of self-expanding metal stents offers relief for both malignant and benign dysphagia [22–25].

Conclusion

In conclusion, the cost-effectiveness and advantageous properties, such as flexibility and high resistance position, make stent application a viable alternative to surgery in benign and malignant gastrointestinal diseases. The findings underscore the efficacy of metallic stents for quality short-term palliation, supporting their utilization in managing inoperable digestive tract stenosis with no mortality and minimal morbidity. The alleviation of malignant and benign dysphagia can be successfully achieved through the deployment of self-expanding metal stents.

Ethical approval

Approval was received for this study from the Inonu University Health Sciences Non-invasive Clinical Research Ethics Committee (Decision Number: 2023/5269).

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