THE EFFECTIVENESS OF EMPIRIC TRANSARTERIAL GLUE EMBOLIZATION (TAGE) OF GASTRODUODENAL ARTERY (GDA) FOR BLEEDING DUODENAL ULCER: A RETROSPECTIVE STUDY

W.S. Lee[1*], H.J. Ong[1], Z.W. Chua[1], K.B. Loh[1]

[1]Department of Radiology, Penang General Hospital, Jalan Residensi, 10990 Georgetown, Pulau Pinang, Malaysia

***Corresponding author:**
Wil Sern Lee, Department of Radiology, Penang General Hospital, Jalan Residensi, 10990 Georgetown, Pulau Pinang, Malaysia. Email: leewilsern@gmail.com

DOI: https://doi.org/10.32896/tij.v4n2.1-10
Submitted: 11.04.2024
Accepted: 24.06.2024
Published: 30.06.2024

ABSTRACT:

Purpose

To determine the efficacy of empiric transarterial glue embolization (TAGE) of gastroduodenal artery (GDA) for bleeding duodenal ulcers.

Materials and Methods

All patients treated for bleeding duodenal ulcers between June 2019 and June 2023, in a single tertiary centre (Penang General Hospital) were retrospectively identified based on interventional radiology reports. Patients with bleeding duodenal ulcers underwent empiric TAGE of GDA following endoscopic hemostasis were included.

Results

During the study period, a total of 26 patients had empiric TAGE of GDA for bleeding duodenal ulcer. A total of 25 patients with duodenal ulcers of Forrest Ia (n=5), Ib (n=12), IIa (n=4), IIb (n=3) and IIc (n=1) who successfully underwent prophylactic TAGE of GDA were included in this study. It has a high technical success rate of 96.2% (n=25). Clinical success rate amongst the 25 patients who successfully underwent empiric TAGE of GDA was 84% (n=21) with only four patients developing rebleeding and required repeated endoscopic clipping. One of the four patients succumbed secondary to refractory bleeding.

Conclusion

Empiric TAGE of gastroduodenal artery GDA can be a useful adjunct treatment option in high-risk bleeding duodenal ulcer with high technical and clinical success.

Keywords: Empiric transarterial glue embolization, gastroduodenal artery, bleeding duodenal ulcers

INTRODUCTION

Acute gastrointestinal bleeding is a common surgical emergency associated with an average mortality rate of 10% (1). Despite significant advancements in primary endoscopic and pharmacological treatments for gastrointestinal bleeding, the risk of rebleeding remains a substantial concern. Unsuccessful endoscopic interventions often necessitate surgical management. Nevertheless, in cases involving patients with multiple comorbidities and a high surgical risk profile, an angiographic approach presents an effective alternative. Angiography plays a crucial role in the diagnosis and treatment of acute gastrointestinal bleeding where the site of bleeding may be localised and be effectively treated with embolization. However, the source of upper gastrointestinal bleed is often not evident angiographically due to the intermittent nature of the bleed and the variable bleeding rate during angiography (2). Consequently, in such cases, empiric transarterial glue embolization (TAGE) may be performed in the absence of angiographic evidence of contrast extravasation. TAGE is defined as embolization without angiographic proof of contrast extravasation. In this retrospective study, we sought to evaluate the clinical outcome of empiric transarterial glue embolization of gastroduodenal artery (GDA) for patients with high-risk bleeding duodenal ulcer during the past 4 years in our centre.

MATERIALS AND METHOD

This retrospective cohort study was conducted on patients treated for bleeding duodenal ulcers between June 2019 and June 2023, in a single tertiary centre (Penang General Hospital). These patients were identified retrospectively based on interventional radiology reports. Patients with bleeding duodenal ulcers underwent empiric TAGE of GDA following endoscopic haemostasis were included. Patients with active bleeding of GDA as evidenced by contrast blush on angiogram were excluded from our study. Information was extracted from patients' medical, endoscopic and interventional radiology reports while maintaining their confidentiality. Demographics and clinical characteristics of study patients are summarised in Table 1. This study focused on exploring post empiric TAGE outcomes. Technical success of TAGE, number of patients with rebleeding, and 30-day mortality rate were recorded. Data was computed and analysed using IBM SPSS Statistics for Windows, Version 29.0 (IBM Corp., Armonk, N.Y., USA).

Operational definitions

Technical success of TAGE is defined as complete angiographic occlusion of the suspected culprit vessel i.e. gastroduodenal artery. Technical success rate was calculated as the ratio of the number of technically successful empiric TAGE procedures to the total number of empiric TAGE. Clinical success was determined by a combination of technical success and no evidence of ongoing upper gastrointestinal bleed (as suggested by clinical, laboratory or endoscopic findings) within the first 60 days after the procedure. Clinical success rate is calculated as the ratio of the number of patients with clinically successful empiric TAGE procedures to the total number of empiric TAGE.

Operational procedure

With ultrasound guidance, the right common femoral artery was punctured with an 18G puncture needle and subsequently a 5Fr introducer sheath was inserted. Selective cannulation of celiac trunk and common hepatic artery with digital subtraction angiogram (DSA) were performed. Common diagnostic angiographic catheters utilised were 4-Fr Cobra C1 (Cordis; Miami, Florida) and Simmons Sim 1 (Cordis; Miami, Florida) catheters. Subsequently, the gastroduodenal artery was selectively cannulated with a 2.4F Renegade microcatheter from the common hepatic artery. Super-selective embolisation of branches supplying D1, D2 segments of duodenum was performed with N-butylcyanoacrylate (NBCA): Lipiodol mixture with ratio ranging from 1:2 to

1:4, with end point of achieving proximal occlusion of GDA. Post embolisation GDA angiogram was performed to assess the adequacy of embolisation.

RESULTS

Following initial endoscopic haemostasis, 26 patients were planned for TAGE of GDA. Technical and clinical success rates of angiographically negative TAGE were 96.2% and 84%. One of the patients with technical failure was due to tortuous arterial anatomy as the normal anatomy was disrupted by prior surgical repair of perforated gastric ulcer. Recurrent bleeding occurred in four (16%) patients which required further endoscopic clipping. Out of the 25 patients, 7 died within the first-30 days giving a mortality rate of 28%. The causes of death were mostly unrelated to the procedure, which include multiorgan failure (n=1), acute pulmonary embolism (n=1), severe sepsis (n=1), cerebellar stroke (n=1), no data (n=2). Only one of which died from refractory bleeding (n=1) despite surgical intervention (under-running of duodenal ulcer). We have classified our data according to high rebleeding risk (Forrest Ia), increased rebleeding risk (Forrest Ib to IIc) and low rebleeding risk (Forrest III) as proposed by a recent study to simplify Forrest classification [5]. The risk of rebleeding post embolization for each category was tabulated below.

30-day mortality rate is highest in Forrest Ia (n=2) and Ib (n=4) compared to Forrest IIa (n=1), IIb (n=1) and IIc (n=0).

DISCUSSION

Upper gastrointestinal bleed carries a significant mortality rate of 10% with peptic ulcer disease constituting majority (83.6%) of the cases in Malaysia (1,3). Common risk factors attributed to it are alcohol usage, smoking history and history of antiplatelets/ anticoagulants. Massive bleeding or refractory bleeding may lead to mortality.

However, recurrent bleeding remains an important adverse prognostic factor and contributes to morbidity and mortality. Endoscopic hemostasis and pharmacological treatments such as proton-pump inhibitors (PPI) and H2 receptor antagonists remain the mainstay treatment for bleeding peptic ulcer disease. Surgery is usually reserved for cases of massive bleeding and ulcers which are inaccessible to endoscopic control (4).

Forrest classification is widely used by endoscopists to classify peptic ulcers to identify risk of bleeding, rebleeding and mortality. Based on a recent study on reassessing the predictive value of Forrest classification for peptic ulcer rebleeding, it was found that rebleeding rates was highest for Forrest Ia (58.8%), followed by Forrest IIb (31.2%), Forrest Ib (26.0%), Forrest IIa (21.2%), Forrest IIc (15.6%) and Forrest III (6.5%) (5). In addition to that, they proposed to classify the risk of bleeding into three which are high risk of rebleeding which includes Forrest Ia, increased risk of bleeding which includes Forrest Ib-IIc and low risk of bleeding which is Forrest III ulcers (5). The results in our study show reduction in bleeding risk in both high risk and increased risk groups.

With the increased availability of interventional radiology services, empiric transarterial embolisation of gastroduodenal artery plays an important role in reducing rebleeding risk in bleeding peptic ulcer. Based on a meta-analysis evaluating 12 studies with a study population of 1329 patients, empiric transcatheter arterial embolization is associated with lower risk of rebleeding (6). In our retrospective study, the clinical success rate amongst the 25 patients with duodenal ulcers of high risk or increased risk of rebleeding (Forrest I-II) who successfully underwent empiric TAGE of GDA was 84% (n=21) with only four patients developed rebleeding and required repeated endoscopic clipping. Apart from that, GDA embolisation has a relatively high technical success rate of 70-100% with a technical success rate of 96.2% in our study.

Various embolic agents can be used in transcatheter arterial embolisation of gastroduodenal artery such as metallic coils,

polyvinyl alcohol (PVA), gelatin sponge, vascular plug and last but not least NBCA glue. In our centre, we utilise NBCA glue as our embolic agent for empiric GDA embolisation of bleeding duodenal ulcer as it is more cost effective in our settings, and it achieves faster and effective hemostasis. Based on a meta-analysis carried out by Kim et al., it demonstrates that embolisation of upper GI bleed with NBCA is associated with lower risk of rebleeding (7). Besides that, it is also effective in patients with coagulation disorder especially patients with disseminated intravascular coagulation (DIC) following massive upper gastrointestinal bleeding as the polymerization of glue does not depend on coagulation parameters of the patient (8). However, utilisation of glue as embolic material requires a steep learning curve and should be administered by experienced and skillful interventional radiologists as it may cause non-target embolisation and premature polymerization causing microcatheter blockage or retention (9). The main complication of TAGE of GDA is duodenal ischemia which may present as duodenal erosion, ulcer, necrosis in acute manner or stricture in a delayed manner (10,11).

The principal limitation of this study is the retrospective study design, which may decrease the statistical strength of the study. For instance, the difference in time between the GI bleeding and angiography, the hemodynamic parameters just prior to the angiography and presence of coagulopathy were not evaluated. Additionally, we did not compare the outcomes between surgical intervention and embolization. There was also limited data in this study regarding the complications of TAGE of GDA, and therefore not included. Besides, another limitation of this study is the small sample size which we are unable to study specifically on each population based on Forrest classification. Despite these limitations, our study remains vital in studying the clinical outcome of patients with angiographically negative bleeding duodenal ulcer post TAGE of GDA. In view of sample size limitation, further data collection and study should be focused on each group of Forrest classification to evaluate the clinical outcome of empiric TAGE with control group to avoid overtreating with empiric TAGE.

CONCLUSION

Empiric TAGE of GDA can be an effective treatment adjunct for high and increased risk bleeding duodenal ulcer with high clinical success rate and technical success rate.

CONFLICTS OF INTEREST

The authors have no potential conflicts of interest to disclose and are in agreement with the contents of the manuscript.

FUNDING

This article did not receive specific funding.

REFERENCES

1. Aljarad Z, Mobayed BB. The mortality rate among patients with acute upper GI bleeding (with/without EGD) at Aleppo University Hospital: A retrospective study. Annals of Medicine and Surgery [Internet]. 2021 Nov 1;71:102958. Available from: https://www.sciencedirect.com/science/article/pii/S2049080121009080#tbl1
2. Hastings GS. Angiographic Localization and Transcatheter Treatment of Gastrointestinal Bleeding. 2000 Jul 1;20(4):1160–8.
3. Lakhwani MN, Ismail AR, Barras CD, Tan WJ. Upper gastrointestinal bleeding in Kuala Lumpur Hospital, Malaysia. The Medical Journal of Malaysia [Internet]. 2000 Dec 1;55(4):498–505. Available from: https://pubmed.ncbi.nlm.nih.gov/11221164/
4. Author: Malaysia. Kementerian Kesihatan, Academy Of Medicine Of Malaysia, And G. Management of non-variceal upper gastrointestinal bleeding.

Editorial: Kuala Lumpur: Ministry Of Health Malaysia; 2003.
5. de Groot NL, van Oijen MGH, Kessels K, Hemmink M, Weusten BLAM, Timmer R, et al. Reassessment of the predictive value of the Forrest classification for peptic ulcer rebleeding and mortality: can classification be simplified? Endoscopy [Internet]. 2014 Jan 1;46(1):46–52. Available from: https://pubmed.ncbi.nlm.nih.gov/24218308/
6. Boros E, Sipos Z, Hegyi P, Teutsch B, Levente Frim, Szilárd Váncsa, et al. Prophylactic transcatheter arterial embolization reduces rebleeding in non-variceal upper gastrointestinal bleeding: A meta-analysis. World Journal of Gastroenterology [Internet]. 2021 Oct 28 [cited 2023 Aug 18];27(40):6985–99. Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8567479/
7. Pyeong Hwa Kim, Jiaywei Tsauo, Ji Hoon Shin, Yun SC. Transcatheter Arterial Embolization of Gastrointestinal Bleeding with N-Butyl Cyanoacrylate: A Systematic Review and Meta-Analysis of Safety and Efficacy. Journal of Vascular and Interventional Radiology. 2017 Apr 1;28(4):522-531.e5.
8. http://fyra.io. Embolization for Upper GI Bleeding [Internet]. Endovascular Today. Available from: https://evtoday.com/articles/2016-apr/embolization-for-upper-gi-bleeding
9. Hill H, Beecham Chick JF, Hage A, Srinivasa RN. N-butyl cyanoacrylate embolotherapy: techniques, complications, and management. Diagnostic and Interventional Radiology. 2018 May 15;
10. Kuyumcu G, Latich I, Hardman R, Fine G, Oklu R, Quencer K. Gastrodoudenal Embolization: Indications, Technical Pearls, and Outcomes. Journal of Clinical Medicine. 2018 May 2;7(5):101.
11. Aina R, Oliva VL, Therasse E, Perreault P, Bui BT, Dufresne MP, et al. Arterial Embolotherapy for Upper Gastrointestinal Hemorrhage: Outcome Assessment. Journal of Vascular and Interventional Radiology. 2001 Feb 1;12(2):195–200.

TABLE LEGENDS:

Table 1: Demographics and clinical characteristics of study patients.

Sex	
Male	17 (68%)
Female	8 (32%)
Age (mean) [range]	66.12 [19-86] years
Comorbidities	
Hypertension	20 (80%)
Diabetes mellitus	13 (52%)
Dyslipidaemia	8 (32%)
Malignancy	3 (12%)
Ischaemic heart disease	4 (16%)
Liver cirrhosis	1 (4%)
Forrest classification	
Ia	5 (20%)
Ib	12 (48%)
IIa	4 (16%)
IIb	3 (12%)
IIc	1 (4%)
III	0 (0%)

Table 2: Outcomes of patients post TAGE of GDA.

Technical success	25/26 (96.2%)
Clinical outcome[a]	
Recurrent bleeding	4 (16%)
No recurrent bleeding	21 (84%)
Total 30-day mortality rate[a]	7 (28%)
Mortality due to refractory bleed	1 (4%)
Mortality due to other causes	6 (24%)
Survival at 30-day[a]	17 (68%)

[a]Only includes patients with angiographically negative technical successful TAGE of GDA.

Table 3: Number of patients with rebleeding after TAGE based on rebleeding risk (simplified Forrest classification)

Rebleeding Risk	Total number of patients, n (%)	Rebleeding Post TAGE of GDA, n (%)
High	5 (20%)	1 (20%)
Increased	20 (80%)	3 (15%)
Low	0	0

FIGURE LEGENDS:

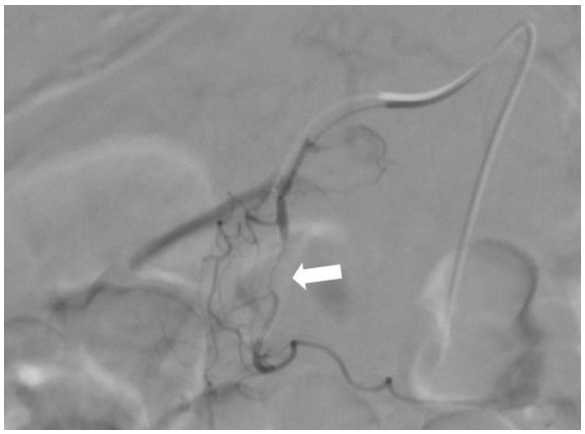

Figure 1: Selective catheterization of GDA with microcatheter demonstrating segmental spasm of GDA (arrow) which is an indirect sign of recent bleeding.

Figure 2: Post embolization angiogram demonstrates glue cast (arrow) and immediate obliteration of GDA.