

Role of Endovascular Trans catheter Selective Arterial Embolization In Management of Acute Gastrointestinal Bleeding

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ABSTRACT

Background:

Acute gastrointestinal bleeding (GIB) can lead to significant morbidity and mortality without appropriate treatment. The diagnostic and therapeutic approach of GIB depends on its location, severity, and etiology. The role of interventional radiology via trans-catheter embolization becomes vital in patients whose GIB remains resistant to medical and endoscopic treatment.

Our study aim is to assess the clinical and technical efficacy of Transcatheter Arterial Embolization in management of Acute GIB. This study was conducted for patients presented with active upper or Lower GI bleeding. Sixteen patients underwent selective trans-arterial embolization. Patients were followed up clinically for any complications or episodes of recurrent bleeding.

Results:

Our study was held on 16 patients (10 male patients and 6 female patients), ranging from 50 to 72 years with mean age of 61 years old. Our Technical Success was 100%, with Clinical success within the 1st 30 days post procedure reaching (75%). No Major intra or post-procedural complication was appreciated. The median post-procedural follow-up duration was 90 days. 4 cases showed reccured bleeding with only one case only from them was managed with re embolization. The 30-day mortality rate was 6.2 %, while the overall mortality rate throughout the whole follow up period 90 days was 18.7%.

-Conclusion: Endovascular Transcatheter Selective Arterial Embolization is an effective way in Management of Acute Gastrointestinal Bleeding which is refractory to traditional medial and endoscopic management with our study showing acceptable improvement of the clinical and laboratory data with decrease in the morbidity and mortality rate among the treated patients.

Keywords: Gastrointestinal bleeding, Embolization, Interventional procedure, Endovascular

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BACKGROUND

Gastrointestinal bleeding is a relatively common medical emergency associated with high rate of morbidity and mortality among affected patients especially if management was delayed [1]. Acute Gastrointestinal bleeding is usually categorized according to the exact anatomical location of the bleeding source. A source proximal to the ligament of Treitz, which occurs more frequently, is classified as upper gastrointestinal bleeding, and a source distal to this ligament is classified to be part of lower gastrointestinal bleeding [2]. Aetiology of GIT bleeding is extremely variable. Regarding that of Upper GI bleeding, The most common cause of Non variceal bleeding is a complication of peptic ulcer disease especially that of duodenal ulcers ; however, gastroduodenal erosions, , vascular malformations , trauma (Mallory Weiss tears ,..) and tumors are also frequent causes [3]. Lower Gastrointestinal bleeding is most commonly due to diverticulosis (40%), vascular ectasia (30%), various colitis (20%), colonic neoplasia (14%), and anorectal causes (10%) [4]. Initial evaluation of patients with GIB begins with sufficient present and pervious medical and surgical history taken , physical examination and laboratory data (including CBC , bleeding profile ,..) which can help to determine whether GIB is of upper or lower GI source and guide subsequent workup . Nasogastric tube lavage is sometimes performed to confirm an upper GI source of bleeding, but a negative

result does not necessarily rule it out. Endoscopy is the first diagnostic and therapeutic intervention of choice for both upper and lower GIB and thus a consultation with a gastroenterologist should not be delayed when a patient presents with GIB [5]. Radiological techniques can aid significantly in diagnosis of Gastrointestinal bleeding especially in non-conclusive endoscopic results. It includes Nuclear Scintigraphy which can detect flow rates as low as 0.1 mL/min but no practical in emergency cases .CT Angiography which can detect flow rates as low as 0.3 mL/min and can be considered the diagnostic investigation of choice in major of the emergency situations . Digital subtraction Angiography can be both diagnostic and therapeutic, it can detect flow rate at least 0.5 to 1 mL/min [6]. Cases of acute GIB may resolve spontaneously especially that from the lower GIT source. Most of them respond to medical treatment and endoscopic treatment which is consider the first line of management in such cases, yet GIB refractory to such treatment are at higher risk for severe adverse outcome up to death. Transcatheter arterial embolization is effective for controlling such cases. The goal is super-selective catheterization and embolization of the bleeding vessels via embolizing agents is to reduce arterial perfusion pressure while maintaining adequate collateral blood flow to stop active bleeding with minimizing the risk of bowel infarction at the same time [7].

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METHODS

This retrospective study was held from the period from July 2018 to June 2020. Informed Written consent was obtained from all patients before the intervention procedure and after informing them with the steps of the procedure, expected outcome, possible complication of the technique and alternative management options. Our study population consisted of 16 patients (10 males and 6 females) with a mean age 61 years (range 50–72 years) who were referred for our interventional radiology department for management of acute GIB in three centers.

Our Inclusion criteria Include: Patient with active either upper or lower GIB refractory to medical and endoscopic treatment. No age predilection. Our Exclusion Criteria were: Patients with intermittent or non-active bleeding, till signs of activity was shown either clinically or radiologically.

All the included patient shows signs of Active GIB , such as Fresh bleeding per rectum , melena or hematemesis .Each case was analyzed individually , Full detailed history taking and Clinical assessment of the patient general condition with the aid of internal medicine physicians (gastroenterologist) , Viewing of endoscopic Results if available (The included patients showed

persistent bleeding after medical and endoscopic management), Labs as Bleeding profile, Rate of Haemoglobin Drop, serum creatinine was reviewed. Pre-intervention CT Mesenteric Angiography were done in about 7 cases (showing positive findings in only 2 patients).

All patients were resuscitated via fluid and blood transfusion before and sometimes during the intervention procedure.

Our Intervention procedures were done on (siemens Atis Zee and Philips angiographic machines). The procedure mean duration extend from 45 minutes up to 150 minutes (with average 97.5 minutes). All the procedures with done under local anesthesia (Only 1 patient was done under general anesthesia because of irritable patient, but local anesthesia was added for puncture).

Puncture of CFA was done via selidenger technique followed by insertion of 5 or 6–Fr sheath .Navigation was done through major abdominal vessels (celiac Trunk , SMA , IMA) via mother 5-Fr catheters (Cobra C2 mainly , Simmons II was used in some cases especially to catheterize the IMA) with the aid of hydrophilic wire (Treumo wire) .After that more distal smaller vessels were superselectively catheterized according to each case individually via microcatheter (Progreat 2.7 /2.4 Fr, Terumo or Renegade 2.7 ; Boston Scientific) on top of microwire . Diagnostic pre-embolization angiograms were taken via contrast injection through the catheter to evaluated the suspected source of bleeding , positive findings were obtained mainly in the form of the presence of Active contrast extravasation , mucosal blushes with abnormal vessels suggestive of tumoral blush +/- neovascularization .other Positive findings include visualization of arteries and veins on the same phase of the study suggestive of an arteriovenous malformation and pseudoaneurysms .

After viewing positive angiographic findings , embolization was done via multiple embolizing agent according to each case individually . The embolizing

agents used in our study were coils , embolizing particles (PVA particles , between 355 and 500µm in size) liquid embolics (N-butylcyanoacrylate (NBCA)) and Gelatin sponge particles (Gel Foam) were used . Embolizing agents were infused in pulsatile form inside the desired artery till stasis of flow in the desired artery was achieved .Controlled angiography was done after that to assess any residual bleeding .After that Removal of the sheath was done and compression of the entry site was done manually for 10 to 15 minutes , after that patients were instructed not to move their unilateral lower limb for 6 hours post catheterization .

Technical success was defined as obtaining complete angiographic occlusion of the targeted vessels or absence of the previously viewed positive angiographic findings. Clinical, laboratory and radiological follow up was done after a day 1, day 3, 1 week and 1 month after the day of embolization was done. Clinical success was defined as the improvement of signs and symptoms of GI bleeding within 24h after the procedure, with improvement of patient Hb level and absence for acute attacks for 30 days following the procedure.

ILLUSTRATED CASE

Case 1

- ✓ **History:** A 64 years old female patient presented with acute attack of active fresh bleeding per rectum.
- ✓ **Important Labs:** dropped Hemoglobin more than 2 gram /dl per day.
- ✓ **Investigations done:** Colonoscopy was done multiple erythematous patches of rectal telangiectasia actively bleeding.
- ✓ **Procedure:** Mesenteric Angiography with selective catheterization of the main abdominal vessels was done, followed by super selective catheterization of the superior rectal artery (suspected source of bleeding) with Renegade micocatheter. Diagnostic pre-embolization angiogram were done and revealed: 2 foci of active extravasation of contrast media (**Fig .1**) .After that embolization was done via PVA particles (300 - 500 microns) **Controlled angiography** was done after that : showing absence of the previously noted foci of active extravasation .
- ✓ **Complications:** No appreciable complication was noted
- ✓ **Follow up:** Day 1,2,3 ,7 & Day 30 clinical and Laboratory follow up was done showing cessation of the attacks of Active fresh bleeding per rectum , with improvement of the HB level reaching normal range within 3 days.

Case 2

- ✓ **History:** A 58 years old male patient, known case of recurrent duodenal ulcers, anemic presented with acute attack of hematemesis
- ✓ **Important Labs:** Sudden drop of Hemoglobin more than 3 gram /dl in 4hours .
- ✓ **Investigations done :** Rapid clinical scenario , no time for other investigations.
- ✓ **Procedure:** Mesenteric Angiography with selective catheterization of the celiac trunk and Superior mesenteric artery was done via 5fr cobra catheter ,

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followed by super selective catheterization of the Gastroduodenal artery with Renegade microcatheter . Diagnostic pre-embolization angiogram were done and revealed: A bleeding pseudo aneurysm is noted arising from the lateral wall of GDA . (Fig .2) . Embolization was done with coils of the proximal portion of the GDA .

- ✓ **Controlled angiography** was done after that : showing complete obliteration of the

pseudoaneurysm

- ✓ **Complications** : No appreciable complication was noted

- ✓ **Follow up** : Day 1,2,3 ,7 & Day 30 clinical and Laboratory follow up was done showing cessation of the attack of Hematemesis within few hours post embolization , with improvement of the HB level reaching normal range within 2 days. No new attacks detected within the next 30 days .

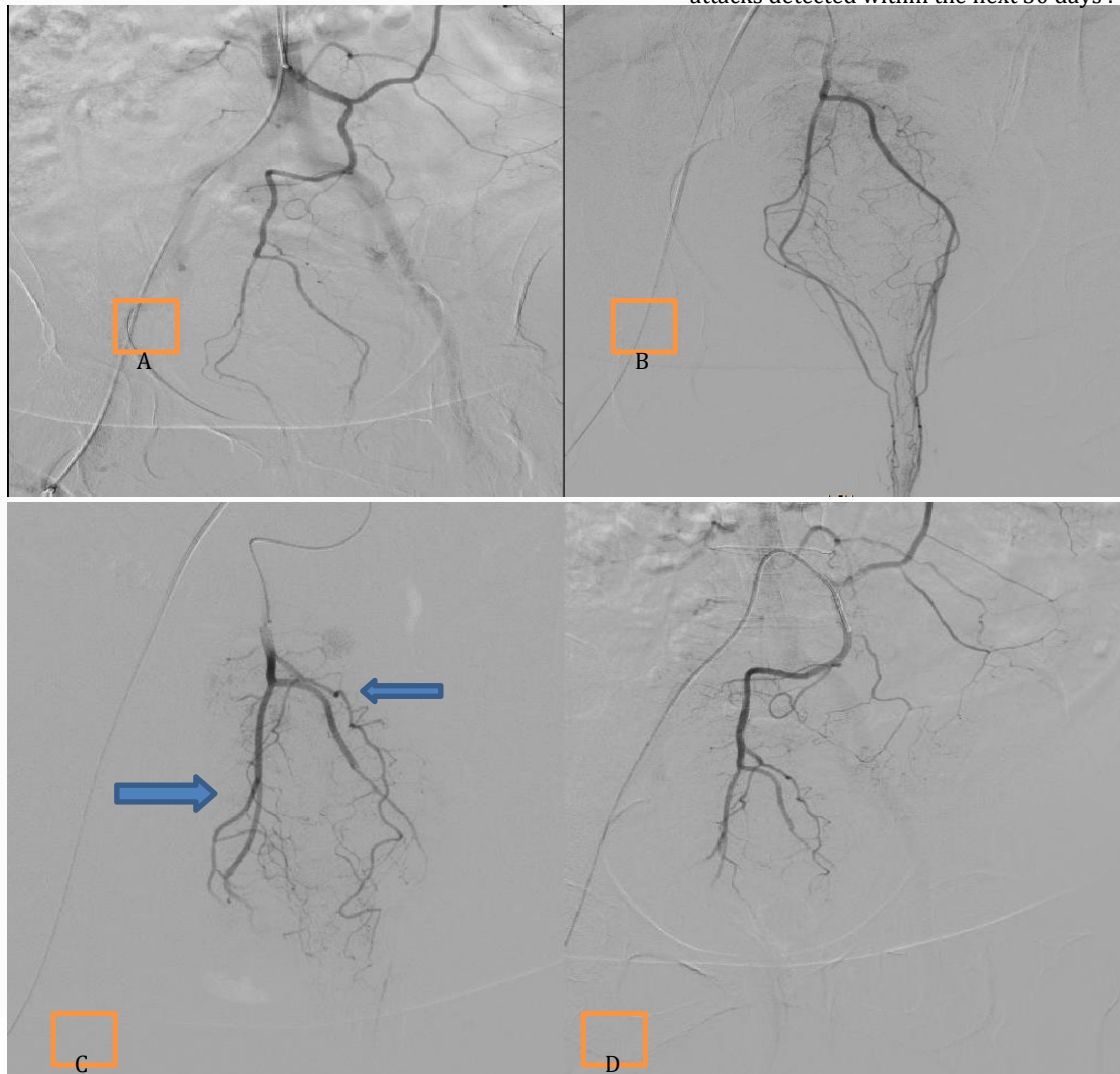


Fig. 1 a Selective IMA angiography showing no specific blush or contrast extravasation. **b** superselective catheterization of the superior rectal artery was done via microcatheter showing foci of active extravasation with increased lower rectal mucosal blush . **c** Zoomed SRA super selective

angiogram shows 2 prominent foci of extravasation (Blue arrow). **d** Post-embolization SRA super selective angiogram demonstrates absence of the previously noted foci of active extravasation with reduced of the abnormal lower rectal mucosal blush .

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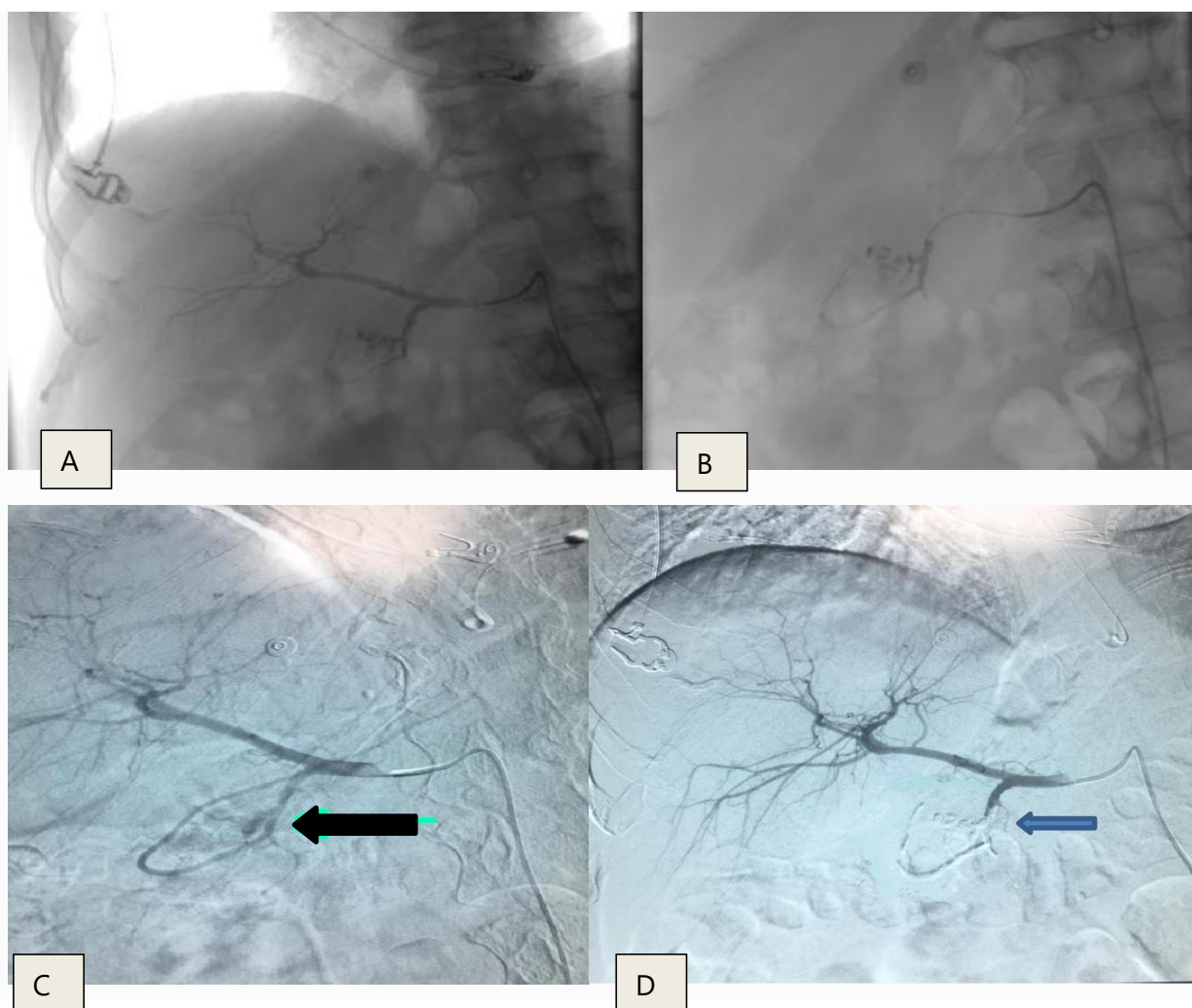


Fig. 2. a Selective CHA angiography shows a bleeding pseudo aneurysm arising from GDA . b superselective catheterization of the gastroduodenal artery was done via microcatheter showing the pseudoaneurysm arising from the lateral wall of GDA . c Subtracted DSA

image showing the GDA pseudo aneurysm (Black arrow). d Post-embolization subtracted DSA image of the GDA with coils showing obliteration of the pseudoaneurysm (Blue arrow).

RESULTS & STATISTICAL ANALYSIS

Our Study Data were coded and entered using the statistical package SPSS (Statistical Package for the Social Sciences) version 23. Data were summarized using mean, standard deviation, median, minimum and maximum in quantitative data and using frequency (count) and relative frequency (percentage) for categorical data.

Results

Our study was done on 16 patient (10 male patients , and 6 female patients), ranging from 50 to 72 years with mean age of 61 years old . (Table 1)

Table 1: representing the statistical data analysis for different ages enrolled at our study.

Age (years)	No of patients =16
Mean ± SD	61
Range	50 -72 y
Age < 61	7 (43.7%)

Age > 61	9 (56.3%)
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The included patients in our study were presented to our department with symptoms and signs of active either upper or lower GIT bleeding , 5 patients presented with hematemesis (31%) , 4 patients presented with Fresh bleeding per rectum (25%), 3 patients presented with melena only (18.7 %), 3 patients presented with mixed symptoms included hematemesis and melena (18.7%),1 patient presented with other symptoms & signs included sudden acute Hemoglobin drop (6.2%) .(Fig.3)

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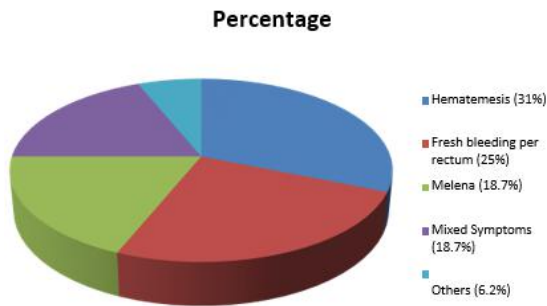


Fig. 3.: representing the percentage of patients presented with various symptoms and signs of active upper and lower GIT bleeding .

Seven patients in our study has either upper or lower Endoscopy , before intervention with failed trial of endoscopic management of the active bleeding , yet endoscopy was helpful as a diagnostic tool is 3 cases in detecting source of bleeding .All patients were resuscitated and clinically stabilized via fluid and Packed RBCs transfusion before and sometimes during our intervention procedure .

All Patients underwent diagnostic mesenteric angiography , with detecting site and source of bleeding was done , the source of bleeding in 6 patients (37.5%) were from stomach and duodenum related vessels (Upper GI bleeding source) , and in the rest 10 patients (62.5%) was from large bowel related vessels (Lower GI

bleeding source) . Angiographic findings were mainly in the form of active extravasation seen in 11 cases (68.7%) , pseudo aneurysm in 2 cases (12.5 %) , vascular malformations in 2 cases (12.5 %) , Tumoral blush with active extravasation in 1 case (6.25%) .(Fig.4)

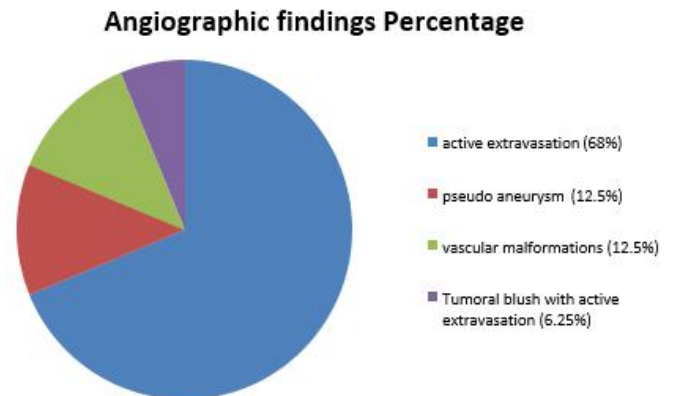


Fig. 4.: representing the percentage of Angiographic findings among the catheterized patients after diagnostic mesenteric angiography.

All patients after then were embolized with various embolic agents including (coils , embolizing particles , liquid embolics and Gelatin sponge particles) were used. The cause of bleeding source, angiographic Findings and Embolic Agent used in management and number of sessions were summarized in Table 2.

Table 2: Illustrating the bleeding cause & source if diagnosed before catheterization, angiographic Findings ,Embolic Agent used in management and number of sessions enrolled at our study.

Case no.	Bleeding cause & source	Angiographic findings	Embolic agent used in management	Endosession
1	Stomach vascular malformation (Left gastric artery)	Abnormal vascular Malformation with early abnormal venous drainage	2 coils & Gelatin sponge particles	1
2	Bleeding Rectal Telangiectasia (Superior rectal artery)	Foci of active extravasation	PVA	1
3	Bleeding Superior mesenteric artery telangiectatic vessels (Right colic Artery)	Foci of active extravasation	Gelatin sponge particles	1
4	Bleeding Superior mesenteric artery telangiectatic vessels (Right colic Artery)	Foci of active extravasation	Coils and Gelatin sponge particles	2

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5	Bleeding Gastroduodenal artery (GDA)	Foci of active extravasation	coils	1
6	Bleeding Telangiectasia (Superior Rectal rectal artery)	Foci of active extravasation	Gelatin sponge particles	1
7	Bleeding Superior mesenteric artery telangiectatic vessels (middle colic Artery)	Foci of active extravasation	Coils and Gelatin sponge particles	1
8	Bleeding Left gastric artery (post inflammation).	Foci of active extravasation	Gelatin sponge particles	1
9	Bleeding Gastroduodenal artery (Post Peptic ulcer)	Pseudo-aneurysmal sac Communicating with GDA	Coils	1
10	Bleeding Gastroduodenal artery (Post Peptic ulcer)	Pseudo-aneurysmal sac Communicating with GDA	Coils	1
11	Colonic angiodysplasia (Inferior mesenteric vessels)	Ectatic vessels with early venous filling (Vascular malformation)	Gelatin sponge particles	1
12	Duodenal mass (gastrointestinal stromal tumor)/Gastroduodenal artery)	Tumoral blush and active contrast leak	Coil then Gelatin sponge particles and NBCA	1
13	Bleeding Superior mesenteric artery telangiectatic vessels (Right colic Artery)	Foci of active extravasation	Gelatin sponge particles	1

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14	Bleeding Inferior mesenteric Artery telangiectatic vessels (Superior rectal artery)	Foci of active extravasation	PVA	1
15	Bleeding Superior mesenteric Artery telangiectatic vessels (Middle colic artery)	Foci of active extravasation	Gelatin sponge particles	1
16	Bleeding Superior Mesenteric Artery telangiectatic vessels (Post IBD) /Right colic artery	Foci of active extravasation	Gelatin sponge particles	1

PVA (polyvinyl alcohol particles), IBD (inflammatory bowel disease), NBCA (N-butyl cyanoacrylate)

Technical success as defined before was reported in 100% of the cases, otherwise Clinical success as defined before was achieved in 12 case (75%). In 4 cases , the bleeding recurred during the 1st month (at day 4 , 7 , 20 and 25 after the date of the embolization procedure) , only one patient was treated by re-embolization (In this patient , we use Gel sponge in the 1st session and Coils in the 2nd session) , the other 3 patients , two of them were treated conservatively and the 3rd was treated surgically. As regard the complications, No major appreciated complications among the included cases, 12 patients developed mild to moderate abdominal pain which was controlled by prescribed Analgesics , 3 patients developed on- significant hematoma at the puncture site , which was treated conservatively . The post procedural average follow up duration was 90 days , mortality rate within the 1st 30 days was only 1 case (6.2%) , the patient died at day 7 from recurrent non controllable bleeding attack . The overall mortality rate among the patient during the follow up mentioned period was 3 patients (18.7 %).

DISCUSSION

Recent Studies support the claim that Transcatheter Selective Arterial Embolization become an important effective way in Management of Acute Gastrointestinal Bleeding which is considered a common medical emergency associated with significant increase in morbidity and mortality rate among affected patients especially if not managed properly [8-10]. Diagnostic mesenteric angiography may be negative in some patients complaining from upper or lower GIT bleeding, due to many issues , the most important is doing the procedure during non-active bleeding attack , or low rate of bleeding during the intervention procedure , DSA requires a relatively higher rate of bleeding(than other diagnostic tools) of at least 0.5 to 1ml/minute to detect the bleeder .Other diagnostic tools may be used before intervention including Radionuclide scintigraphy (RS) and Post

contrast enhanced CT Angiography. Scintigraphy has a high sensitivity rate and can detect bleeding rates as low as 0.1ml/minute but is less specific and not practical for unstable urgent patients due to a longer study time required as well as reduced diagnostic yield with brisk bleeding and unavailability of the Radionuclide agent all the time . CT Angiography is able to detect bleeding rates of 0.3–0.5ml/min and is highly sensitive and specific especially when done via high flow rate of contrast injection during the investigation (5 ml/sec) . [11-13]. As regard upper GIT bleeding, Endoscopic therapy is considered the 1st recommended line of treatment ,however Uncontrolled bleeding after medical and endoscopic management , in such cases is still frequent , here percutaneous Trans catheter Selective Arterial Embolization is considered the accepted and most efficient way of management in such cases [14]. In a recent study, Audrius Š et al (2017) reported 100% technical success rate with 77.8% clinical success rate among 36 patients who underwent transcatheter arterial embolization for acute nonvariceal upper gastrointestinal bleeding [15-16]. As regard Lower GIT bleeding, in most cases the bleeding attacks stops spontaneously. Colonoscopy has been advocated as first-line management of LGIB especially it has both diagnostic and intervention roles , yet a lot of patients couldn't be managed or re-bleed even after the colonoscopy , In such cases Percutaneous TAE is considered the most important next step in management [17]. Waugh et al (2004) performed a review of 27 embolization cases over a period of 63 months at a metropolitan teaching hospital in Melbourne . They achieved technical success in 26 cases and clinical success in 19 cases with repeat embolization in 6 cases [18]. Additionally Tan et al. (2008) reviewed a series of 32 cases of mesenteric embolization over a period of 82 months at a large teaching hospital in Singapore. Technical success was achieved in 31 cases ; however , clinical success was achieved only in 20 cases. 7 cases rebleed with 1 managed with repeat embolization, 1

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treated with colonoscopy, and 4 progressing to surgery, and the remaining case was managed conservatively [19]. A More recent study was one via D. Chan et al.(2014) in which Mesenteric embolization was performed in 26 patients with LGIB .Technical success rate was 100%, with no occurrence of post-embolization ischaemia. Clinical success rate was 65.4%, with nine patients re-bleeding within 30 days post- embolization . [20].

In Our study , 16 patient with either upper or lower Gastrointestinal bleeding were involved . Our Technical Success was 100% , and our Clinical success within the 1st 30 days post procedure was 75% . 4 cases showed recurred bleeding with only one case only from them was managed with re embolization .The 30-day mortality rate was 6.2 % , while the overall mortality rate throughout the whole follow up period 90 days was 18.7%.

Trans catheter arterial embolization is preferred to surgery in most of cases with failed or inapplicable endoscopic management especially in elder and other high-risk patients, because it is not as invasive as surgery , has few complications , with lower rate of mortality and anesthesia related complications in comparison to surgery as almost most of the cases were done vial local anesthesia [21-23].

Trans arterial Embolization as any intervention may be associated with complications , most of them are minor , non-significant like small puncture site hematoma , post-procedural abdominal pain , however more serious complications may happen such as non-target embolization , which may arise from non-experienced operator or abnormal refluxing of embolizing agents into non targeted vessels , bowel ischemia is not uncommon .In our study only 3 patients developed puncture site related non-significant hematoma, with 12 patients developed mild to moderate abdominal pain post-procedural pain which was controlled by prescribed Analgesics , yet No major appreciated complications among the included cases. [24].

Our study is limited by its retrospective nature and inclusion of only small numbers of patients, variation in etiology of upper and lower GIT cases included in the study , in addition to the variation in the detected angiographic Findings, different embolic material used . Also Post procedural follow up time was not too long in this study We Recommend Further Extended blind randomized trial on larger group of patients need to be done with prolonged period of follow-up to assess the effectiveness of Transcatheter Arterial Embolization as a Management option for Acute Gastrointestinal Bleeding in decreasing long term mortality and morbidity among the treated patient in comparison to other available options like surgical intervention.

CONCLUSIONS

Advances in catheter-based techniques and newer embolic agents, as well as recognition of the effectiveness of minimally invasive treatment options, have expanded the role of Endovascular Transcatheter Selective Arterial Embolization in the management of Acute Gastrointestinal Bleeding with our study showing acceptable improvement of the clinical and laboratory data with decrease in the morbidity and mortality rate , without major complications among the treated patients

GIB : Gastrointestinal Bleeding
CFA: Common Femoral artery .
IMA : Inferior mesenteric artery .
PVA: polyvinylalcohol particles
SRA : Superior rectal artery .
CHA : common hepatic artery
DSA: Digital subtraction angiography
LGIB: Lower Gastrointestinal bleeding
NBCA: N-butyl cyanoacrylate
GDA: Gastroduodenal artery
TAE: Transarterial embolization

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blush or contrast extravasation. b superselective catheterization of the superior rectal artery was done via microcatheter showing foci of active extravasation with increased lower rectal mucosal blush . c Zoomed SRA super selective angiogram shows 2 prominent foci of extravasation (Blue arrow). d Post-embolization SRA super selective angiogram demonstrates absence of the previously noted foci of active extravasation with reduced of the abnormal lower rectal mucosal blush .

Fig. 2: a Selective CHA angiography shows a bleeding pseudo aneurysm arising from GDA . b superselective catheterization of the gastroduodenal artery was done via microcatheter showing the pseudoaneurysm arising from the lateral wall of GDA . c Subtracted DSA image showing the GDA pseudo aneurysm (Black arrow). d Post-embolization subtracted DSA image of the GDA with coils showing obliteration of the pseudoaneurysm (Blue arrow).

Fig.3: representing the percentage of patients presented with various symptoms and signs of active upper and lower GIT bleeding .

Fig 4: representing the percentage of Angiographic findings among the catheterized patients after diagnostic mesenteric angiography .

Tables titles and legends:

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Figures titles and legends

Fig.1: a Selective IMA angiography showing no specific