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Original Article

Needle or knife? The role of interventional radiology in managing uncontrolled gastrointestinal bleeding

Thomas G. Morgan^{1,*}, Tarryn Carlsson², Eric Loveday², Neil Collin², Graham Collin², Peter Mezes², and Anne M. Pullyblank³

ABSTRACT

Background: Increasingly interventional radiology has been used to stop uncontrolled gastrointestinal (GI) bleeding leading to a reduction in the requirement for surgical intervention. To examine the safety and efficacy of angiography and embolisation for the treatment of GI bleeding in a United Kingdom tertiary hospital.

Methods: This was a single-centre retrospective study of 112 procedures performed on 105 patients who underwent catheter angiography for GI bleeding over 7 years. Fifty procedures were for upper GI bleeding and 62 were for lower GI bleeding. Primary outcome was clinical success rate. Other measures were re-bleeding rates and 30-day mortality.

Results: In patients with upper GI bleeds, 71.6% of cases had a bleeding point that was identified at the time of initial catheter angiogram. Overall, the clinical success rate was 70.4% with a 20% 30-day mortality. Technical success with embolisation was 98% with no major complications. In patients with lower GI bleeds, 50% of cases had a bleeding point that was identified at the time of initial catheter angiogram. Overall clinical success rate was 83.0% with a 13.6% 30-day mortality. Technical success with embolisation was 100% with no major complications.

Conclusion: Catheter directed angiography and embolisation is safe and efficacious in patients with GI bleeding who have a positive computed tomography angiogram and should be considered as an alternative to surgery.

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Keywords: Endoscopic hemostasis; Gastrointestinal hemorrhage; Hematochezia; Melena; Peptic ulcer hemorrhage

Introduction

Gastrointestinal (GI) bleeding is a common cause for emergency admission in the United Kingdom (UK) with significant morbidity and mortality. The incidence of upper GI bleeding in the UK is 106/100,000 people, with a mortality rate of 14%.¹ The incidence of lower GI bleeding is 33–87/100,000 in western countries.^{2,3} For significant bleeds, diagnosis, localisation and applying therapy to cease the bleed can be challenging. For upper GI bleeding, surgery has historically been the treatment of choice if endoscopic management has failed. Surgery however, can be challenging with one study finding a mortality rate of 34.1%.⁴ The need for intervention for lower GI bleeding is rare.⁵ Early colonoscopy has been recommended by UK and United States of America (USA)

guidelines.^{6,7} However, this can be challenging to perform and no difference in mortality, need for surgery or re-bleed rates has been found between early and elective colonoscopy.⁸ Surgical intervention can be complicated by difficulty localising the source of the bleeding as well as high morbidity and mortality.⁹

Recently, the role of radiology in the management of GI bleeding has become more prominent. Computerized tomography (CT) angiography has been found to be accurate in localising sources of GI bleeding, is non-invasive and can be performed expediently in unstable patients without requiring anaesthesia, sedation or bowel preparation.¹⁰ Via conventional catheter based angiography, trans-arterial embolisation of the bleeding vessel can subsequently be performed to arrest haemorrhage. A number of studies have compared trans-arterial embolisation with surgery

¹Department of Surgery, University of Auckland, Auckland, New Zealand

²Departments of Radiology, Southmead Hospital, Bristol, UK

³Departments of Surgery, Southmead Hospital, Bristol, UK

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* Corresponding author. Southmead Hospital, Bristol BS10 5NB, UK.

E-mail address: grenfellmorgan@hotmail.com (T.G. Morgan).

in upper GI bleeding refractory to endoscopic management^{11–15} and have demonstrated that successful embolisation can prevent the need for more invasive intervention such as laparotomy. While not established by randomised controlled trials, potentially this approach may reduce morbidity and mortality.¹⁶

The use of catheter directed embolisation is also becoming an established treatment in the management of massive lower GI bleeding. There were early concerns with the potential for complications such as bowel infarction in earlier reports¹⁷ but the introduction of microcatheters allowing super-selective embolisation has reduced this risk.¹⁸ Utility and safety of embolisation of massive lower GI bleeding has been confirmed in a number of studies.^{18–21} However, of 2,528 patients presenting with lower GI bleeding in a recent UK audit, only 19 underwent angiography, compared to 6 requiring surgery.¹⁵ Guidelines recently published by the British Society of Gastroenterology have recommended that angiography with a view to embolisation should be performed as soon as possible where clinically indicated in unstable patients with lower GI bleeding and positive CT angiography findings.⁷

Management of GI bleeding requires a multi-disciplinary approach, involving gastroenterologists, surgeons, intensivists, emergency physicians and interventional radiologists. We present the outcomes of a 7-year experience of radiological management of bleeding from both the upper and lower GI tract in a tertiary referral centre.

Methods

This retrospective study was performed according to the guidelines of the local ethics committee. Retrospective review of a prospectively collected radiology database of patients who underwent mesenteric angiography between January 2011 and December 2017. This included patients who presented directly to Southmead Hospital and transfers from regional referring hospitals. All patients initially underwent CT angiography if they had clinical evidence of upper GI bleeding and endoscopic management was

unsuccessful or unsuitable, or lower GI bleeding that was causing haemodynamic instability. Patients who presented for catheter angiography on the basis of positive radiological findings of luminal GI haemorrhage on CT angiogram were included in the study. Patients with non-luminal bleeding or who underwent mesenteric angiography for other reasons were excluded. Patients with variceal haemorrhage were excluded. Medical records were retrieved and examined for each of these patients. Parameters measured were the procedure the patient underwent, whether embolisation

Table 1 Upper Gastrointestinal Bleeding Data

Variable	Number (%)	Patients with re-bleeding (n)	Patients without re-bleeding (n)
Total	46 (100)	13	33
Male	31 (67.4)	11	20
Female	15 (32.6)	2	13
Endoscopy prior to procedure	36 (78.3)	12	24
Coagulopathy	5 (10.9)	1	4
Site of bleeding			
Oesophagus	1 (2.1)	0	1
Stomach	4 (8.7)	3	1
Duodenum	41 (89.1)	10	31
Diagnosis			
Duodenal ulcer	34 (73.9)	8	26
Post ERCP sphincterotomy	6 (13.0)	2	4
Gastric ulcer	4 (8.7)	3	1
Iatrogenic following gastric surgery	2 (4.3)	0	2
30-day mortality	9 (19.6)	2	7

ERCP, endoscopic retrograde choangiopancreatography.

Fig. 1. Upper gastrointestinal (GI) bleeding flow chart. OGD, oesophago gastro duodenoscopy; GA, general anaesthetic.

was carried out, whether angiography was successful and 30-day mortality. The study was approved by ethical committee of the institution (IRAS no. 289699).

Technical details

Mesenteric catheter directed angiography was performed by one of the consultant interventional radiologists in our institution via a femoral approach. Access was achieved by ultrasound guided puncture of the common femoral artery and placement of a vascular access sheath ranging between 4Fr and 7Fr in size. Embolisation was performed either via 4Fr vascular catheter with or without the addition of a microcatheter following selective angiography. The type of embolic agent varied depending on anatomy, location of bleed and consultant personal preference. The majority of cases were embolised with (micro)coils and/or Gelfoam® (Pfizer, New York, NY, USA) with only a few requiring liquid embolisation (Onyx-18™; Medtronic, Dublin, Ireland). Haemostasis at the vascular access sheath was achieved either by manual compression or the delivery of a vascular closure device (Angioseal™; St Jude Medical, Saint Paul, MN, USA or Starclose®; Abbott Vascular, Redwood City, CA, USA).

Definitions

Upper GI bleed was defined as bleeding into the lumen of the GI tract proximal to the ligament of Trietz, whereas lower GI bleeding was bleeding distal to this.

Technical success was defined as there being no angiographic evidence of bleeding at the end of the angiography procedure, including those cases where no active bleeding point was not identified at the time of angiography. Clinical success was defined as no significant re-bleeding episodes in 30 days leading to re-admission, further intervention or death.

Coagulopathy was defined as a platelet count < 80,000/mL, an International Normalised Ratio (INR) > 1.5 or an activated thromboplastin time (aPTT) > 45 seconds.

Major complications were defined by events occurring as a result of the angiography procedure requiring further intervention or death.

Results

There were 112 procedures performed in 105 patients, 72 male and 33 female. Mean age was 69 years (range, 28–100 years), 50 procedures were for upper GI bleeding and 62 were for lower GI bleeding.

Upper gastrointestinal bleeding

Information regarding patients with upper GI bleeding is presented in Table 1 and Fig. 1. There were 46 patients who underwent 50 angiography procedures for upper GI bleeding. 36 of these patients (78.3%) had undergone endoscopy prior to their angiography procedure. Information regarding endoscopy was unavailable for 3 patients who were transferred from other centres for angiography. The site of bleeding was identified in 37 patients (80.4%) at initial angiography. There was no active bleeding at the time of initial angiography in 9 patients (19.6%), so embolisation was not performed. Embolisation was attempted in 40 out of 50 of overall procedures, with cessation of bleeding occurring in 39 patients (97.5%). Overall technical success of cessation of bleeding was achieved in 49/50 procedures (98.0%). Re-bleeding data was

Table 2 Lower Gastrointestinal Bleed Data

Variable	Number (%)	Patients with re-bleeding (n)	Patients without re-bleeding (n)
Total	59 (100)	10	49
Male	41 (69.5)	10	31
Female	18 (30.5)	0	18
Coagulopathy	3 (5.1)	0	3
Endoscopy prior to procedure	9 (15.3)		
Site of bleeding			
Jejunum	6 (10.2)	2	4
Ileum	10 (16.9)	3	7
Right Colon	19 (32.2)	3	16
Left Colon	9 (15.3)	2	7
Rectum	12 (20.3)	0	12
Unknown	3 (5.1)	0	3
Diagnosis			
Diverticular disease	5 (8.5)	1	4
Angiodysplasia	15 (25.4)	2	13
IBD	3 (5.1)	1	2
Haemorrhoids	4 (6.8)	0	4
Vasculitis	3 (5.1)	0	3
Iatrogenic	2 (3.4)	0	2
Bleed around pancreas transplant	1 (1.7)	0	1
Tumour	2 (3.4)	1	1
Meckel's	1 (1.7)	0	1
Postoperative	1 (1.7)	0	1
Stress ulceration	2 (3.4)	1	1
<i>Clostridium difficile</i> colitis	1 (1.7)	0	1
Unknown	19 (32.2)	4	15
30-day mortality	8 (13.6)	0	8

IBD, inflammatory bowel disease.

available for 44 patients and occurred in 13 patients (29.5%). The clinical success rate was 70.4%. The 30-day mortality was 19.6% (9/46).

Two patients died from re-bleeding episodes; both of which were bleeds from a duodenal ulcer. One of these patients had initially undergone an abdomino-perineal resection of a rectal cancer prior to their upper GI bleed. Three of the patients that had re-bleeding episodes had repeat catheter directed angiography, with embolisation being performed in two of these cases. One of these patients, who had a bleed from a duodenal ulcer post anterior resection, had a second angiogram which detected a bleeding point, but successful embolisation was not achieved. This patient went on to have surgical management of their bleeding. There were no major complications recorded in the series of upper GI patients.

Lower gastrointestinal bleeding

Information regarding patients with lower GI bleeding is presented in Table 2 and Fig. 2. Fifty-nine patients underwent 62 angiography procedures for lower GI bleeding. Nine patients (15.3%) had undergone endoscopy prior to angiography. In 50.0%

Fig. 2. Lower gastrointestinal (GI) bleeding flow chart.

of angiography procedures (31/62) a bleeding point was identified at the time of initial angiogram and embolisation was carried out. A bleeding point was not found at the time of angiography in the other 31 cases. In only one of these cases was embolisation carried out. Overall technical success of cessation of bleeding was achieved in all 62 procedures (100%). Overall clinical success rate was 83.0% with re-bleeding episodes occurring in 10 patients (16.9%). Of those who were embolised, 4 patients had a rebleeding episode within 30 days (12.9%). Nine of the patients with rebleeding episodes required further interventions; seven needed a laparotomy and resection for haemostasis and the other three patients underwent a repeat angiography, where again no bleeding point was found and no embolisation performed. Thirty-day mortality data was 13.6% with 8 patients dying within 30 days of the procedure. No major complications occurred in this series of lower GI bleeds.

Of the patients who did not have any further intervention within 30 days, one patient required a second embolisation 3 months later due to a transitional cell carcinoma of the bladder invading into the rectum. They had an initial lower GI bleed from tumour which was embolised successfully. This patient had a further bleed three months later. A bleeding point was not seen on angiography, but as there were abnormal vessels present, embolisation was carried out. There was stenosis of the right external iliac artery from tumour encasement seen at the time of angiography, so a stent was placed through this stenosis at the time of angiography.

Discussion

This study has confirmed that catheter directed angiography with embolisation is a fundamental intervention for gaining haemostasis in patients with GI bleeding; With regards to bleeding in the upper GI tract, IR is usually considered after failure of endoscopic management to achieve haemostasis. On the other hand, in our institution, catheter directed embolisation is considered as a first line treatment in lower GI bleeding over and above endoscopic and surgical management, which can be called upon

should IR be unsuccessful. There are minimal complications associated with the angiography, with or without embolisation. This study has demonstrated that that interventional radiological catheter directed embolisation is largely successful at haemorrhage control in patients with upper and lower GI bleeding. We found a re-bleed rate of 29.5% and a 30-day mortality rate of 20.4% in upper GI bleeds and a re-bleed rate of 19.6% and a 30-day mortality rate of 13.4% in lower GI bleeds, comparable to published literature.^{22–25}

The majority of patients presenting to secondary care with GI bleeding will not require GI angiography. A series of 863 patients with lower GI bleeding from the same institution, only 2.5% of patients required angiography.²⁶ The recent UK guidelines have recommended CT angiography be performed in patients who are suspected of having a lower GI bleed and are haemodynamically unstable and/or are suspected of having active bleeding and if there is evidence of active luminal bleeding, the patient should proceed to catheter angiography.⁷ In this series, a significant number of patients who have lower GI bleeding will not have active bleeding at the time of angiography, with only 50% of patients found to have a bleeding point. This is a similar finding to another paper which looked at all patients undergoing angiogram for lower GI bleeding.²² In spite of this, 6 patients who did not have bleeding seen at the time of angiography subsequently had re-bleeding episodes.

The role of angiography and embolisation in upper GI bleeding is less established. The UK National Institute for Health and Care Excellence (NICE) guidelines have suggested that angiogram be considered in patients with failure of endoscopic treatment, who were haemodynamically unstable.²⁷ There was a higher rate of re-bleeding episodes and mortality in our upper GI bleeding series compared to our lower GI series. A systemic review found varying rates of reported re-bleeding episodes, from 0% to 55%.²⁵ This same review found overall mortality rates from 0% to 50%.²⁵ The stomach and duodenum usually have multiple blood supplies and this may contribute to the re-bleeding episodes. Despite this higher rate of re-bleeding, only two patients died from a rebleeding episode.

A number of different strategies were used in our study to treat patients with re-bleeding episodes following angiography. Three patients with recurrent upper GI bleeding underwent repeat angiogram, two of them achieved clinical success but one eventually required surgery. Two lower GI patients, both with initially negative angiograms, underwent repeat angiogram. In one of these patients, the repeat procedure was clinically successful, the other eventually required surgery. The decision on which modality to use was based on discussion by the clinical team involved, considering the particular factors in each clinical situation. One study had found a higher rate of complications in patients who had a second attempt at angiogram.²² One key intervention in our practice is that the radiologist will give clear advice in the first radiology report and will state whether a second attempt at angiography would be appropriate. Good clinical communication is essential in managing these complex patients and giving clinical advice in the report enables prompt decision making. There were no significant complications, including ischaemia of the GI tract requiring resection. This low rate of ischaemia requiring intervention is consistent with other recent series on embolisation in lower GI bleeds.^{23,24}

Access to interventional radiology facilities frequently requires transfer from another hospital which does not have the appropriate interventional radiology facilities. In the UK National Confidential Enquiry into Patient Outcome and Death (NCEPOD) review of GI bleeding 'time to get control' only 55% of hospitals could provide 24/7 access to interventional radiology.⁵ In this series, 8 patients were tertiary referrals, transferred from other hospitals. It is essential that services should be set up to allow early transfer for those who present with persistent bleeding despite initial therapy if their local unit does not provide this. However, this can lead to challenges in the accepting hospital due to increased bed days. We would recommend a region wide service level agreement set up along the lines of a major trauma service where a tertiary IR service is adequately funded with agreements in place regarding repatriation in a timely manner once the bleeding has been controlled and the patient is fit for transfer.

The recent guidelines on lower GI bleeding from the British Society of Gastroenterology recommends using the Oakwood risk assessment to risk stratify patients with lower GI bleeding.⁷ We implemented a risk assessment in 2012. Whilst it is much simpler than the Oakwood score, our audited data demonstrated it to be safe and effective.²⁸ Contrary to the recommendation for colonoscopy as the first line investigation, only 15.3% of patients with lower GI bleeding had a colonoscopy. This is because we find this unhelpful in the emergency situation with the exception of a post polypectomy bleed where there is a clear opportunity for intervention.²⁹ In other circumstances, the source of bleeding is often obscured by blood and colonoscopy does not help with either diagnosis or treatment. In addition, where there is a 24/7 interventional radiology service as in our institution, access to radiology is often more prompt than access to endoscopy, especially during office hours.

Finally, surgery was more often needed for patients with lower GI bleeding, 7 patients required an operation compared to 2 for upper GI bleeding. This means there were 9 patients in total over 7 years, approximately one each year. This might have implications for surgical training and the maintenance of expertise. This is not so important for lower GI bleeding as resectional surgery is required which is a very common operation. However, for gastroduodenal bleeding, this is an anatomical area not commonly operated on, making it hard for surgeons to gain experience in this operation.

There were a number of limitations to this study. The data was non-randomised and was collected retrospectively. This study looked at a heterogeneous group of conditions in a variable patient cohort. We had difficulty accessing follow up data in patients who had initially been transferred in from other hospitals.

In conclusion, our study has confirmed that catheter directed angiography with embolisation is a fundamental intervention for gaining haemostasis in patients with GI bleeding; this is particularly true in upper GI bleeding where most patients had prior unsuccessful endoscopy. There are minimal complications associated with the angiography with or without embolisation. This study has demonstrated that that IR catheter directed embolisation is largely successful at haemorrhage control in patients with upper and lower GI bleeding with 30 day mortality rates comparable to the published literature.²²⁻²⁵ We propose that angiography with a view to embolise should be the first line intervention in patients with a significant upper GI bleed failing endoscopic therapy and first line treatment in significant lower GI bleeds.

Conflicts of Interest

No potential conflict of interest relevant to this article was reported.

ORCID

Thomas G. Morgan, <https://orcid.org/0000-0001-8776-8255>

Tarryn Carlsson, <https://orcid.org/0000-0003-3958-6734>

Eric Loveday, <https://orcid.org/0000-0001-6244-3163>

Neil Collin, <https://orcid.org/0000-0002-4898-3654>

Graham Collin, <https://orcid.org/0000-0003-3193-3105>

Peter Mezes, <https://orcid.org/0000-0002-3322-5236>

Anne M. Pullyblank, <https://orcid.org/0000-0002-2199-1777>

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