Journal of Advanced Zoology

ISSN: 0253-7214

Volume 45 Issue 01 Year 2024 Page 229:234

Role of Interventional Radiology in Management of Gastrointestinal Bleeding

Mohammed Salah Hussain[1]*, Maram Abdulaziz Almasoudi[2], Luay Ali Alshamrani[3], Raied Abdullah Alghamdi[4], Ibrahim Mubarak Alhasawi[5], Abdulaziz Ahmad Alshalali[6], Asma Ahmed Alharthi[7], Faten Abdullah Alzaidi[8], Raghad Ahmed Althomali[9], Wasn Turki Mohammed Alotaibi[10], Rakan Alfuraym Alanazi[11], Reem Ahmed N Al Malhm[12], Wasam Dhafer Albishi[13]

[1] **Department of gastroenterology and endoscopy, Dr Samir Abbas Hospital, Jeddah, Saudi Arabia.* *Email: dr_msalahali@yahoo.com*
[2] *Armed Forces Hospital in Al Hada, KSA. Email: Meemoo424sweet@gmail.com*
[3] *Prince Sattam University. Email: loayalshamrani1419@gmail.com*
[4] *Bukayriyah General Hospital. Email: Drkingfish@hotmail.com*
[5] *AlQara general Hospital. Email: himo_55555@hotmail.com*
[6] *University of Groningen, The Netherlands. Email: Aziz.shalali@gmail.com*
[7] *Shahar Health Center. Email: asmaahmad1418@gmail.com*
[8] *Taif university, Taif, KSA. Email: Faten.aa.ff@gmail.com*
[9] *Taif university, Taif, KSA. Email: Raghad.or025@gmail.com*
[10] *GP, king abdulaziz hospital, KSA. Email: Wasntu1998@gmail.com*
[11] *King Saud bin Abdulaziz health science, KSA. Email: rakan.alfreem@outlook.com*
[12] *Maternity and Children's Hospital in Al-Ahsa, KSA. Email: Reema200815@hotmail.com*
[13] *Primary health care sultan city, KSA. Email: wsan-1412@hotmail.com*

***Corresponding Author:** - Mohammed Salah Hussain*
**Department of gastroenterology and endoscopy, Dr Samir Abbas Hospital, Jeddah, Saudi Arabia.*
Email: dr_msalahali@yahoo.com

Abstract

Gastrointestinal bleeding is a common and potentially life-threatening condition that requires prompt and effective management. Interventional radiology has emerged as a valuable tool in the management of gastrointestinal bleeding, offering minimally invasive techniques that can rapidly control bleeding and improve patient outcomes. This review aims to provide an overview of the role of interventional radiology in the management of gastrointestinal bleeding, including its various techniques and their efficacy. The review discusses the different interventional radiology procedures that can be used to diagnose and treat gastrointestinal bleeding. It also highlights the advantages of techniques used in evaluation and management, including their ability to localize and control bleeding, as well as their low complication rates and shorter recovery times compared to traditional surgical approaches. Furthermore, the review addresses the specific indications for interventional radiology in the management of gastrointestinal bleeding, as well as the role of interventional radiology in the setting of underlying conditions. Overall, this review provides a comprehensive overview of the role of interventional radiology in the

	management of gastrointestinal bleeding, highlighting its effectiveness and potential benefits for patients. It also emphasizes the need for further research and collaboration between interventional radiologists and gastroenterologists to optimize the use of these techniques in clinical practice. ***Keywords: haemorrhage, angiography, radiology, GIT***

Introduction:

Among the greatest prevalent reasons behind visits to the emergency room and hospitalizations is gastrointestinal bleeding. "GIB" refers to haemorrhage from the abdomen's blood vessels, arteries, and veins. GIBs are distinguished by their place of residence. Upper GIB is increasingly prevalent and is defined physically by haemorrhage from git organs proximal to the Treitz ligaments, which involves the stomach, oesophagus, and duodenal. Lower GIB is one-quarter as prevalent as upper GIB and is described as haemorrhaging in git organs distal to the Treitz ligaments, such as the jejunum, the ileum, the colon, and the rectum. Aside from physical differences, both upper and lower git bleeding frequently have distinct symptoms, causes, and therapies [1]. In the United Kingdom (UK), is a prevalent reason for hospitalization, with a high death rate? Upper GI haemorrhage affects 106 persons out of every 100,000 in the UK, with a 14% fatality incidence. Lower GI haemorrhage occurs at a rate of 33-87/100,000 in Western countries [2], while in USA it is yearly prevalence of around 122 occurrences per 100,000 people [1]. Surgical solution has always been the therapy preferred for upper GI haemorrhage when endoscopy therapy is unsuccessful. Surgery, on the other hand, can be risky, with one research reporting a 34.1% death rate [3]. Intervention for lower GI haemorrhage is uncommon [4]. Regulations in the United Kingdom (UK) and USA both advocate earlier colonoscopy [5]. It may be difficult to do, and there was no variation in death rates, necessity of surgery, or re-bleeding rates between sooner and optional colonoscopy [6]. The most critical part of acute bleeding care is preserving a patient's respiration, airway, and circulation, which begins with examining the patient's airway and respiration for symptoms of discomfort and obstructions to the airway. In this step, intubation might be required for airway management. Circulation entails the insertion of 2 large-bore IV lines, at least 22 gauges IV, as well as the start of revived fluids with the crystalloids and blood-derived substances. Coagulopathy correction may necessitate the introduction of platelets or other procoagulants and is indicated prior to any additional examinations or interventions [1]. The importance of radiography in the treatment of bleeding from the gastrointestinal tract is now gaining prominence. The use of computed tomography (CT) has been demonstrated to be effective in localizing sites of bleeding from the gastrointestinal tract, is non-intrusive and may be conducted quickly in patients with instability without needing sedation, anaesthesia, or gastrointestinal preparation [7]. Besides colonoscopy, the two treatments available for active LGIB (Lower gastrointestinal bleeding) are interventional radiology (IR), embolization, and surgery [8]. GI surgeons, specialists in surgery, intensive care doctors, emergency doctors, and interventional radiology specialists must all work together to control GI haemorrhage [4]. Since most recurring haemorrhage patients are old with multiple medical conditions, interventional radiology is often favoured if it is accessible regionally. Tran's arterial embolism is therefore suggested if haemorrhage persists despite adequate endoscopic therapy, while surgery may be undertaken if radiographic treatment is going to be postponed [9].

Role of radiology in diagnosis of GIT bleeding:

1- Latest research imply that until Cohn's disease, a small-bowel restriction or blockage, or NSAIDs-induced enteropathy are suspected, small bowel tract and traditional enteroclysis have a restricted efficacy in the examination of GIB. And, that's due to Capsule endoscopy has substantially lowered the importance of standard small bowel tract and enteroclysis in the assessment of GIB [10].
2- Acute GIB can be diagnosed using two kinds of nuclear examines: technetium 99m-labeled red blood cell scan and technetium 99m-labeled sulphur colloid scan. A red-cell scan, on the other hand, is more routinely used. It possesses a detection accuracy of 93% and a precision of 95% for detecting bleeding that is on-going at an incidence of 0.05-0.01 mL/min. Although the accuracy of positive prediction has been estimated to be as great as 84%, radionuclide scintigraphy has a mistaken location rate that is roughly 22%, limiting its utility as a method of diagnosis. Furthermore, when definite abnormalities are

confirmed by other methods, the precision of a positive scanning for lesion localisation might be as low as 41% Moreover, because nuclear-based scans are not therapeutic, other modalities, such as conventional angiography or endoscopy, must be followed [11,10].

3- When contrasted with traditional angiography, computerized tomography angiography (CTA) is faster and easier to conduct. To identify severe GI bleeding, a triphasic multidetector CTA procedure involving unenhanced, blood vessel, and vein stage scanning is typically utilized. Recent developments in the field of CT have greatly improved CTA's ability to diagnose. CTA offers an accuracy of 50% to 86% and a precision of 92% to 95% for GIB abnormalities and may identify with flow rates that are as low as 0.3-0.5 mL/min. Whenever hyperattenuating extravasated contrast substance is visible inside the gut tract on CTA, active GIB is diagnosed. CTA examination of GIB can frequently reveal its cause, which could prove important in subsequent treatments. In addition, the shape of the extravagated contrast substance differs depending on the cause. Expansion that is "jet-like" could mean a high incidence of GIB or bleeding from the anterior side of the bowel lumen, which is cloud-like extravasation, could suggest a small amount of haemorrhage or leaking from the posterior part of the intestinal lumen. If the haemorrhaging ceases or does not approach the CTA limit, an intraluminal higher-density clot may be the solitary finding. Though CTA is simply a method of diagnosis, it can offer essential knowledge of artery anatomy that can be used to guide experimental or surgical interventions [10, 11, and 12].

HEMORRHAGING Rates VOLUMETRIC Evaluation:

Three instances of serious haemorrhaging were assessed using 3D volumetric imaging. A further endoscopic evaluation revealed substantial clots in the blood, but no bleeder was found. Endoscopists performed a subjective numerical assessment of clot size [13].

Extravagated contrasting volumetric assessment was performed at the workstations. DICOM pictures were viewed using the "CT viewer" tool. The contrasting extravagated area with an HU of over +90 was mechanically planted using "Clipping and 3D segment" after eye assessment of plain and contrasting pictures. The program computed its volume. Pictures were volume generated using "Tissue managing" to create a 3D show, and volumes were estimated. In general, bleeding quantity is estimated using the formula 'ABC/2x slice the thickness,' where A, B, and C indicate the length and width of the chosen attenuator model. The following equation is often used in calculating the amount of cerebral bleed.7 the degree of bleeding is estimated and recorded using two data sets, artery and portal vein phase. The exact moment of bolus activation determines arterial readings. After 50 seconds, the portal stage was achieved. When the volume change elapsed between the two phases of CT acquisition is calibrated for time units, a rate of haemorrhage may be calculated. Volumes estimates have been compared. Patients with an increased likelihood of bleed were identified as needing immediate care [13].

Case: After chemo for acute lymph leukaemia, a 3-year-old female with a condition called graft-versus-host disease appeared with significant rectal haemorrhage and clog passing. Her colonoscopy revealed erythematous colonic mucosa with many types of erosion. There was no evidence of an on-going bleeding. Her medical situation deteriorated due to the development of hypotension and hypothermia, and she was given blood-related medications to help her. Although blood product transfusions, the level of her haemoglobin dropped to 10.3 g/dl from 10.6 g/dl and her haematocrit plummeted from 32.8% to 30.9% in 24 hours . As a result, CT was conducted. The transversal, descending, and sigmoid colons all had hyper dense material on plain CT. Artery phases imaging revealed no enlarged arteries or bleeding vessels. In artery phase, a hyper dense nodular centre was observed in the sigmoid. The number of particles of this centre within the sigmoid lumen gradually grew. On postponed images, there was evidence of on-going contrasting extravasation, the amount of which was computed using software. According to computed estimating, the total amount of contrast pooling within the lumen among stages collected at 50-second intervals, was 15.2 cc. As a result, the haemorrhage rate was determined to be 0.3 cc/s or 18 cc/min. Because the patient's angiogram revealed no on-going arterial bleeder, embolization was not tried. An urgent sigmoidoscopy revealed a recto-sigmoid haemorrhage with numerous clogs within the lumen. Blood ooze from the hematoma's base was discovered. Following the use of a haemostat, the haemorrhaging controlled it and the patient's hemodynamic improved [14].

Management of GI bleeding:

1- Endoscopy because it helps us to find and treat haemorrhage lesions, it is considered the first-line technique of choice for evaluating bleeding from the upper GI tract. Upper endoscopy and colonoscopy may cure bleeding from the gastrointestinal tract if a lesion is found and sample tissues if cancer is indicated. Endoscopy, on the other hand, may not be readily accessible in numerous healthcare settings and may be hard to conduct in hemodynamic ally unresponsive patients. Active large haemorrhage may make it difficult to see the origin of the haemorrhage. Although emergency colonoscopy can be conducted without intestinal planning, colonoscopy often requires bowel preparation, making its use in an emergency clinical context challenging.8, 9 the bulk of the small bowel cannot be seen with upper endoscopy. Yet, the most recent advancement of capsule endoscopy allows for the examination of the small bowel, which takes both money and time [11].

2- Catheter angiography Catheter angiography is the only radiographic technique that may be used to diagnose and treat both the upper as well as the lower gastrointestinal bleeding. It is appropriate for patients who are unsteady and have bleeding from the lower gastrointestinal tract as well as failed upper endoscopy and colonoscopy.5 Catheter angiography has a great spatial accuracy and can identify haemorrhage rates as low as 0.5 mL/min. Extravasation of contrast into the gut lumen is a diagnosis direct indicator of on-going GI haemorrhage . Pseudo aneurysm, arteriovenous fistula, hyperaemia, neovascularity, and contrasting the extravasation into a restricted area could be indirect symptoms. Catheter angiography has become the initial-line technique for acute UGIB and LGIB that is not treatable by endoscopy or operation due to the introduction of micro-catheters and embolic materials with super-selective embolization. The main drawbacks of catheter angiography are its invasiveness and tedious nature, as well as the possibility of receiving radiation during the treatment. Catheter angiography may produce an unreliable negative result for slow or subtle haemorrhage [15]. As a result of these factors, the importance of catheter angiography as a tool for diagnosis has declined [11, 16].

Embolization

Embolization refers to the deliberate occlusion of a blood vessel, with the specific objective of achieving hemostasis in the given context. Interventional radiology offers a viable approach for the treatment of arterial UGIB as well as LGIB, using a comparable procedure for both conditions. The distinction only pertains to the location at which the therapy is administered in relation to the target vascular. Before performing embolization on a hemorrhaging artery, it is necessary for an interventional radiologist to first locate and then guide a catheter to the specific artery, all from inside the arterial system. The procedure is conducted angiographically, commencing with the first step of obtaining arterial access by the insertion of a needle into the lumen of an artery [17]. This is often achieved by means of an ultrasound-guided puncture of either the common femoral artery or the left radial artery. A flexible wire with a soft tip is inserted through the needle as a temporary placeholder, after which the needle is withdrawn, and a hollow vascular sheath is introduced as an access port. Different iterations of the "needle-wire-catheter" method for vascular entry have been used since the middle of the twentieth century. Utilizing a range of wires and catheters, the operator is able to effectively maneuver through the aorta and access other visceral arteries with the use of fluoroscopy. The trajectories of the vessels are deduced, since they are not immediately observable by x-ray imaging. The catheter now in use may be used to inject dense iodinated contrast, which serves the purpose of enhancing the visibility of arteries during imaging procedures. This not only facilitates the visualization of arterial architecture but also enables the detection of contrast extravasation. The presence of contrast extravasation serves as an indication of ongoing bleeding, hence guiding the focus of embolization interventions. A range of embolization procedures may be used, such as metallic coil implantation, cyanoacrylate injection, particle/microsphere injection, and the use of absorbable gelatin sponge. The selection of embolic agent is beyond the focus of this text [17, 18].

Computed Tomography (CT)

Recently, several hospitals have included CTA into their treatment protocols. In our academic institution, it is customary to do a multiphase CT scan before proceeding with embolization, provided that the patient's condition allows for sufficient time and stability. The CT protocol implemented involves the inclusion of a non-contrast phase to evaluate the presence of preexisting hyperdense material or structures that could potentially be mistaken for extravasated contrast media in subsequent post-contrast phases. Additionally, an arterial phase is conducted to identify any active arterial extravasation or hemorrhage, while a portal venous phase is employed to detect the accumulation of blood. The use of oral contrast should be avoided since it might hinder the detection of extravasation of intravenous contrast [19].

There are many grounds for doing multiphase CT prior to embolization. Initially, it should be noted that computed tomography (CT) has the capability to identify instances of bleeding transpiring at rates as little as 0.3 ml/min, in contrast to traditional angiography which can only detect such bleeding at rates of 0.5 ml/min [20]. Hence, in cases when active bleeding is not visually detected using computed tomography angiography (CTA), it follows that it would also not be observable through traditional angiography. Performing conventional angiography in such instances would expose the patient to the potential hazards associated with an intrusive treatment, without the advantage of identifying the specific target for embolization. However, the occurrence of intermittent arterial bleeding might provide a challenge in terms of diagnosis [12]. Although there are challenges associated with detecting an active bleed on CTA, similar to those encountered during endoscopy or traditional angiography, CTA is often a more accessible and less intrusive procedure compared to the other two methods listed. Another crucial use of CTA is in the context of preprocedure planning. CT angiography enables the visualization of the vascular architecture and identification of the location of active bleeding in advance, facilitating the interventional radiologist in developing a precise and effective treatment strategy in advance. It has been shown that this phenomenon leads to decreased durations of angiographic procedures. From an anecdotal perspective, it is believed that making decisions quickly inside a procedure may be reduced, which may help to minimize errors made by the operator. In conclusion, computed tomography (CT) has the capability to provide a diagnostic for several prevalent sources of bleeding, such as diverticulosis, angiodysplasia, colitis, and tumor, among others [19, 21].

Individuals experiencing gastrointestinal bleeding often exhibit medical complexity, depletion of bodily fluids, and thus have an increased susceptibility to renal failure. It is important to consider that both conventional angiography and CTA need the use of iodinated intravascular contrast agents, which have been linked to the development of contrast-induced nephropathy (CIN). Nephrology often engages from a multidisciplinary perspective due to these rationales. The primary focus in managing CIN is prevention, namely by avoiding the administration of unnecessary contrast media. However, in cases when the patient is experiencing hemorrhage, achieving hemostasis is often prioritized despite the possible risk of renal failure. The optimal approach for patients with impaired renal function remains a topic of debate, specifically on the choice between doing CTA or proceeding directly to conventional angiography. According to the author, it is believed that CT angiography has the potential to provide a greater amount of information, specifically identifying the specific vessel that is experiencing bleeding. Consequently, this would enable the interventionalist to develop a treatment plan that is highly focused, involving arterial access, direct intervention on the bleeding vessel, embolization, and closure. This approach is expected to result in time and contrast media savings. Operator preferences may vary, and the determination of the appropriate course of action must be decided on an individual basis [22].

Conclusion:

In conclusion, interventional radiology plays a crucial role in the management of gastrointestinal bleeding. With its minimally invasive techniques, interventional radiology offers effective and efficient options for diagnosing and treating various causes of gastrointestinal bleeding. From embolization to angiography, these procedures have proven to be successful in controlling bleeding and improving patient outcomes. As technology continues to advance, the role of interventional radiology in managing gastrointestinal bleeding will only continue to grow, providing patients with less invasive and more effective treatment options.

Reference:

1. Azeze, S., Rahim, S., Sands, A., Shrewsbury, J., & Tavri, S. (2018).The role of interventional radiology in the management of acute gastrointestinal bleeding. *Journal of Radiology Nursing*, *37*(3), 188-197.
2. Hreinsson, J. P., Gumundsson, S., Kalaitzakis, E., & Björnsson, E. S. (2013). Lower gastrointestinal bleeding: incidence, aetiology, and outcomes in a population-based setting. *European journal of gastroenterology & herpetology*, *25*(1), 37–43.
3. Czymek, R., Großmann, A., Roblick, U., Schmidt, A., Fischer, F., Bruch, H. P., & Hildebrand, P. (2012). Surgical management of acute upper gastrointestinal bleeding: still a major challenge. *Hepato-gastroenterology*, *59*(115), 768– 773
4. Morgan, T. G., Carlsson, T., Loveday, E., Collin, N., Collin, G., Mezes, P., & Pullyblank, A. M. (2021). Needle or knife? The role of interventional radiology in managing uncontrolled gastrointestinal bleeding .*International Journal of Gastrointestinal Intervention*, *10*(1), 17-22.

5. Oakland, K., Chadwick, G., East, J. E., Guy, R., Humphries, A., Jairath, V., McPherson, S., Metzner, M., Morris, A. J., Murphy, M. F., Tham, T., Uberoi, R., Veitch, A. M., Wheeler, J., Regan, C., & Hoare, J. (2019). Diagnosis and management of acute lower gastrointestinal bleeding: guidelines from the British Society of Gastroenterology. *Gut*, *68*(5), 776–789.
6. Kouanda, A. M., Somsouk, M., Sewell, J. L., & Day, L. W. (2017). Urgent colonoscopy in patients with lower GI bleeding: a systematic review and meta-analysis. *Gastrointestinal endoscopy*, *86*(1), 107–117.e1.
7. Wortman, J. R., Landman, W., Fulwadhva, U. P., Viscomi, S. G., & Sodickson, A. D. (2017). CT angiography for acute gastrointestinal bleeding: what the radiologist needs to know. *The British journal of radiology*, *90*(1075), 20170076.
8. Pannatier, M., Duran, R., Denys, A., Meuli, R., Zingg, T., & Schmidt, S. (2019). Characteristics of patients treated for active lower gastrointestinal bleeding detected by CT angiography: Interventional radiology versus surgery. *European journal of radiology*, *120*, 108691.
9. Stanley, A. J., & Laine, L. (2019). Management of acute upper gastrointestinal bleeding. *BMJ (Clinical research ed.)*, *364*, l536 .
10. Kwon, S. H., Noh, S. Y., & Oh, J. H. (2023). Interventional radiological approaches to non-variceal gastrointestinal bleeding .*International Journal of Gastrointestinal Intervention*, *12*(1), 37-42.
11. Lee, C. M., Jang, J. K., Shin, J. H., Song, S. Y., & Kang, B. K. (2018). Role of computed tomography angiography for acute gastrointestinal bleeding .*Gastrointestinal Intervention*, *7*(3), 106-111.
12. Geffroy, Y., Rodallec, M. H., Boulay-Coletta, I., Jullès, M. C., Ridereau-Zins, C., & Zins, M. (2011). Multidetector CT angiography in acute gastrointestinal bleeding: why, when, and how. *Radiographics: a review publication of the Radiological Society of North America, Inc.*, *31*(3), E35–E46.
13. Amritha, P. P., Gadabanahalli, K., Bhat, V., & BN, K. K. (2021). A novel concept on volumetric assessment and quantification of gastrointestinal bleed on computed tomography angiography: Observations based on a case series. *Annals of Hepato-biliary-pancreatic Surgery*, *25*(1), 160-166.
14. Amritha, P. P., Gadabanahalli, K., Bhat, V., & BN, K. K. (2021). A novel concept on volumetric assessment and quantification of gastrointestinal bleed on computed tomography angiography: Observations based on a case series. *Annals of Hepato-biliary-pancreatic Surgery*, *25*(1), 160-166.
15. Lee, S. S., Oh, T. S., Kim, H. J., Chung, J. W., Park, S. H., Kim, A. Y., & Ha, H. K. (2011). Obscure gastrointestinal bleeding: diagnostic performance of multidetector CT heterography. *Radiology*, *259*(3), 739–748.
16. Green, B. T., & Rockey, D. C. (2005). Lower gastrointestinal bleeding—management. *Gastroenterology Clinics*, *34*(4), 665-678.
17. Nicholas, C. (2019). Interventional Radiology in GI Hemorrhage. In: Lim, R. (eds) Multidisciplinary Approaches to Common Surgical Problems. Springer, Cham.
18. Xenogiannis, I., Varlamos, C., Keeble, T. R., Kalogeropoulos, A. S., & Karamasis, G. V. (2023). Ultrasound-Guided Femoral Vascular Access for Percutaneous Coronary and Structural Interventions. *Diagnostics (Basel, Switzerland)*, *13*(12), 2028.
19. Reis, F. R. S., Cardia, P. P., & D'Ippolito, G. (2015). Computed tomography angiography in patients with active gastrointestinal bleeding. *Radiologia Brasileira*, *48*, 381-390.
20. Wu, L. M., Xu, J. R., Yin, Y., & Qu, X. H. (2010). Usefulness of CT angiography in diagnosing acute gastrointestinal bleeding: a meta-analysis. *World journal of gastroenterology: WJG*, *16*(31), 3957.
21. Storace, M., Martin, J. G., Shah, J., & Bercu, Z. (2017). CTA as an adjuvant tool for acute intra-abdominal or gastrointestinal bleeding. *Techniques in Vascular and Interventional Radiology*, *20*(4), 248-257.
22. Mohammed, N. M., Mahfouz, A., Achkar, K., Rafie, I. M., & Hajar, R. (2013). Contrast-induced nephropathy. *Heart views: the official journal of the Gulf Heart Association*, *14*(3), 106.