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Rectal Artery Embolization for Acute Uncontrollable Rectal Bleeding: Case Series and Systematic Literature Review

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ABSTRACT

Purpose: The article aims to evaluate the possibilities of transcatheter arterial embolization (TAE) as a method of hemostasis in inoperable, life-threatening rectal cancer bleeding by embolizing rectal arteries related to the tumor.

Materials and Methods: Using PubMed, Embase, Web of Science, and Cochrane Library, a systematic literature review following the PRISMA 2020 guidelines was performed on October 26, 2023. The search focused exclusively on patients with bleeding rectal cancer controlled by TAE. In addition, in alignment with the PROCESS 2016 guidelines, we describe three patients who underwent transcatheter embolization of the rectal arteries for rectal cancer bleeding from Surgery Department No.2, admitted to the Municipal Saint Trinity Hospital, in Moldova, Chisinau, over the period 2020-2023.

Results: Out of 4,958 articles identified, 89 were included for analysis, and only nine were relevant to the topic addressed. In total, 33 cases of rectal cancer bleeding controlled by the rectal artery embolization (RAE) approach were found. Technical success was achieved in 32 out of 33 patients. Technical failure was encountered in one patient due to a practical shortfall in advancing the microcatheter to the source of bleeding. The most frequently embolized artery was the superior rectal artery (in 22 patients). Bleeding control was achieved in 24 patients from the first attempt. Recurrent bleeding was observed in nine patients who successfully responded to repeated RAE. There was no evidence of bowel infarction, and the procedure was well tolerated, in general.

Conclusions: The present review and case presentation of patients who underwent endovascular approaches to treat rectal cancer bleeding showed that rectal artery embolization is a safe and feasible procedure, with a high technical success rate.

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Acute lower gastrointestinal bleeding is a clinical emergency accounting for up to 30% of all major episodes of gastrointestinal bleeding [1]. Rectal bleeding constitutes approximately 9– 10% of cases of lower gastrointestinal bleeding [2]. The main reported causes of rectal bleeding are hemorrhoids, radiation proctitis, benign rectal ulcers, rectal angiodysplasia, polypectomy, and rectal cancer [2]. Colorectal cancer represents 5-17% of the causes of lower digestive bleeding [3,4].

Most cases of rectal bleeding respond to conservative treatment, in fusional resuscitation, hemostatics, coagulopathy correction, and endoscopic management. Massive rectal hemorrhages requiring surgical intervention on vital indications occur rarely and are mainly caused by ulcerative tumors with advanced local invasion [5]. Usually, these patients incur advanced rectal cancer local invasion or are of old age with multiple comorbidities and submitted to regular anticoagulant treatment.

In this paper, we report three cases of rectal cancer with uncontrolled massive rectal bleeding complications resolved by transcatheter rectal artery embolization, identified as a result of a comprehensive systematic literature review performed following the PRISMA methodology.

Patients and Methods

The article aims to evaluate the possibilities of transcatheter arterial embolization (TAE) as a method of hemostasis for inoperable, life-threatening rectal cancer bleeding by embolizing rectal arteries connected to the tumor. -This paper was approved by the institutional review board, and informed consent was obtained. Three (3) cases of patients who underwent transcatheter embolization of the rectal arteries for massive rectal hemorrhages from Surgery Department no.2, admitted to the Municipal Saint Trinity Hospital, in Moldova, Chisinau, over the course of 2020-2023, were analyzed and presented. Data was retrieved from patient records and presented as per the PROCESS 2016 guidelines [6]. The hospital has owned the interventional radiology department since 2019.

In addition, a systematic literature review following the PRISMA 2020 guidelines was performed [7]. This systematic review was conducted on October 26, 2023, using the following databases: PubMed, Embase, Web of Science, and Cochrane Library.

The search terms used in the title, abstract, and keyword fields included combinations as follows: (((rectal bleeding) AND (rectal cancer) AND (rectal artery embolization)) OR (gastrointestinal lower bleeding)) AND (rectal artery embolization))). All articles in English with a case of rectal cancer bleeding controlled by endovascular arterial embolization were selected for analysis. Simulation studies, clinical studies in non-human subjects, articles published in non- scientifically accredited journals, unpublished studies, and articles not expressly stipulating cases of rectal cancer were not included. Studies involving patients who presented rectal bleeding due to other reasons than rectal cancer were also removed.

From the total number of patients involved in the study with digestive bleeding controlled by TAE, only patients with rectal cancer bleeding were analyzed. The following variables were extracted: the name of the first author, the journal and publication year, rectal arteries involved, technical and clinical success, rebleeding, and follow-up. Two authors (ZT and AC) independently identified

Cases Presentation

The cases of three (3) patients (two men and a woman) aged 54, 66, and 66 years, diagnosed with uncontrolled massive rectal bleeding due to rectal cancer over the course of 2020-2023 (Table 1), resolved by TAE at the Surgery Department of Municipal Saint Trinity Hospital, Moldova, Chisinau, are presented in this paper. Rectal tamponade with temporary hemostasis and general hemostatic treatment, resuscitation, and transfusion with correction of coagulopathy were performed in all cases, without significant outcome. The recurrence of massive hemorrhage required percutaneous endovascular embolization of the rectal arteries related to the rectal cancer with Microspheres Terumo - 500 nm, until a total blockage of the bleeding tumor arterial inflow.

Case No: 1

A 66-year-old male, was admitted with advanced rectal cancer with massive rectal bleeding, perineal pain rated 8/10 in the visual analog scale (VAS), and marked asthenia. The patient had previously undergone palliative surgery – terminal colostomy for acute low tumor intestinal occlusion. At the time of admission, laboratory tests presented normal results, with an exception for anemia, with a hemoglobin toll of 60 g/L. The patient presented a stable hemodynamic pulse of 105 b/min and arterial pressure of 105/60 mmHg. General resuscitation and blood transfusion with local rectal tamponade using gauze soaked with hemostatics were performed.

The progression of the destructive local tumor process, with the appearance of repeated rectal hemorrhages gradually increasing in abundance and reaching states of hemorrhagic shock with repeated transfusion and local rectal tamponades with gauze, required another, more radical approach. Considering the inoperability of rectal cancer, percutaneous endovascular bleeding control was the only solution.

Through the right femoral access, the internal iliac catheterization was performed; subsequently, the inferior rectal arteries were super selectively accessed in areas where extravasation of the contrast substance had been determined. Embolization of the bleeding source was achieved with Terumo 500 nm embolization microspheres. The control image demonstrates the cessation of the contrast extravasation, thus blocking the related arterial circulation and stopping the bleeding. (Fig. 1) Light tamponade of the rectum over 24 hours was maintained. The immediate bleeding control of the rectal tumor was obtained. During the rectoscopy control on the third day, the tumor was covered with fine fibrin, mucus, and detritus. Stable hemostasis was obtained. The patient was discharged on day seven after the TAE.

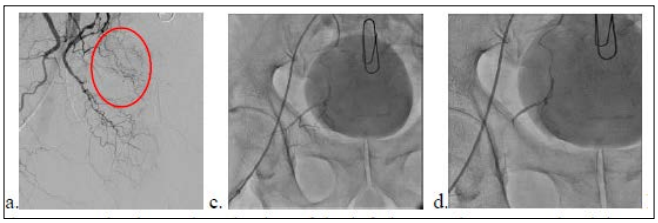

Figure: 1 Through the right femoral access, the super-selective catheterization of the inferior rectal artery on the right and left was performed (a). The source of rectal bleeding is identified by contrast extravasation (a). Embolization of the inferior rectal artery with 500 nm Terumo microspheres was performed. Control image, satisfactory angiographic result stopping of contrast extravasation (c,d).

Case No: 2

A 54-year-old female diagnosed with advanced inoperable rectal cancer at 10 cm distance, T4N2Mx, was admitted with massive rectal bleeding and tumor destruction. Laboratory findings showed a hemoglobin level of 70 g/L and elevated leukocytosis (13x103/µl). Furthermore, the patient presented a hemodynamically unstable pulse of 115 b/min and a level of blood pressure of 85/60 mmHg. A general resuscitation procedure was initiated, with hemostatics, and blood transfusion. A rectal tamponade with gauze soaked with hemostatics under intravenous anesthesia was performed; control of bleeding was attained. Repeated massive bleeding with states of shock persisted after the removal of the rectal tampon. Transcatheter rectal tumor-related arterial angiography was performed through the internal iliac artery entrance. Bilateral selective transcatheter embolization of the middle and lower rectal arteries was executed, achieving their total occlusion and angiographically defined hemostasis. (Figure.2)

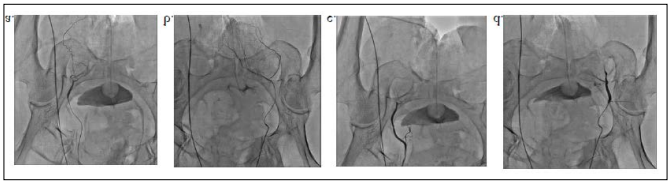

Figure: 2 Bilateral selective angiography of the middle and lower rectal arteries (a,b) with contrast extravasation. Bilateral selective embolization of the middle and lower rectal arteries and their total occlusion and angiographically defined hemostasis.

Case No: 3

A 66-year-old male was admitted with manifestations of expansive anaerobic phlegmon of the left lower limb and sepsis. An emergency wide necrectomy and drainage of phlegmon was performed under general anesthesia. Laboratory findings presented as follows: Hb 115 g/L, elevated leukocytosis (20x103/µl), hyperglycemia (16 mmol), fibrinogen 8,4 g/l, procalcitonine 20 ug/L. The patient had several comorbidities: operated renal cancer without recurrence, decompensated diabetes mellitus type two, stage III obesity with a BMI of 43, chronic heart disease manifested by permanent tachysystolic atrial fibrillation with a very high risk of thromboembolism, stage III hypertension, and stage III chronic heart insufficiency according to NYHA classification.

The patient was treated in the intensive care unit over a period of seven days, receiving antibacterial therapy, insulin therapy, fluid resuscitation, and anticoagulants. While the phlegmon was removed, the patient presented massive rectal bleeding on the 13th day following admission. An endoscopic rectal examination was performed; however, due to numerous clots in the rectal lumen and massive hemorrhage, the source of bleeding could not be identified. Resuscitation, coagulopathy correction, and administration of hemostatic medication were initiated. A total rectal tamponade with compression of the hemorrhagic area was performed under intravenous anesthesia. While bleeding continued, hemoglobin dropped to 66 g/L, making the patient hemodynamically unstable and in need of transfer to the intensive care unit. After hemodynamic stabilization was achieved, the patient was transported to the interventional radiology room.

Emergency selective transcatheter angiography was performed by catheterizing the internal iliac artery and a similar operation was incurred by the lower rectal artery super- selectively, which does not show contrast extravasation. Further, through the lower mesenteric artery, superior rectal arteries were selectively catheterized and the extravasation of the contrast substance was observed. The embolization of superior rectal arteries was done with Terumo 500 nm microspheres (Figure. 3), leading to an adequate angiographic contrast stop and clinically definitive hemostasis.

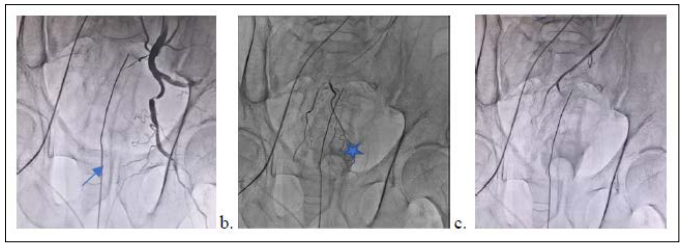

Figure: 3 Internal Ileac Artery Angiography with Supra-Selective Rectal Arteries Catheterization (a), no contrast extravasation has been seen. b. Superior rectal arteries were selectively catheterized and the extravasation of the contrast substance was noticed (asterisk *). c. Performed selective embolization of the superior rectal arteries and their total occlusion and angiographically defined hemostasis obtained. Arrow – rectal tube, rectal tamponade.

On the 6th day after TAE, a rectoromanoscopy was performed and a tumor of the upper rectum, on the posterior wall was found, at a distance of 20 cm, occupying one-third of the rectal lumen, with fibrine cover, without bleeding. A biopsy of 2 fragments, without bleeding, was performed. The histological evaluation detected a poorly differentiated adenocarcinoma of the rectum. A pseudomembranous colitis developed later as a result of the antibiotic therapy received for the treatment of the phlegm on (vancomycin). Three months after the procedure, the patient's general condition was satisfactory (no complaints expressed) and he was transferred to the oncological center for mesorectal resection.

Table 1. Clinical Characteristics of Three Patients with Massive Rectal Cancer Bleeding

Patient	Gender	Age	Diagnosis	Symptoms	Comorbidities	Hb, g/L	Intervention	Technical success rate, %	Clinical success rate, %	Rebleeding,	Fellow-up	Complications
1	M	54	Inoperable rectal cancer, with locally advanced invasion	Massive rectal bleeding, chronic pain, chronic rectal detritus discharge	None	60	TAE of RA bilateral	100	100	no	Three months - rebleeding, managed by medication	no
2	F	66	Inoperable rectal cancer, with locally advanced invasion	Massive rectal bleeding, chronic pain, chronic rectal detritus discharge	None	70	TAE of RA bilateral	100	100	no	Uterine bleeding at one month, TAE of uterine arteries, deaths at one week due to general disease decompensation	no
2	M	66	Rectal cancer	Massive rectal bleeding	Anaerobic infection of the lower left limb. Chronic heart diseases	66	TAE of SRA and MRA bilateral	100	100	no	Three months, prepare for radical surgery	no

M- Male, F- Female, TAE - Transcatheter Arterial Embolization, SRA - Superior Rectal Artery, MRA – Middle Rectal Artery, RA - Rectal Arteries, HB – Hemoglobin.

Results

Selective embolization for hemorrhagic rectal tumors is rarely described in the literature. No publications were found on transcatheter embolization of rectal arteries in advanced destructive rectal cancer with massive hemorrhage. Unfortunately, there is a lack of studies on rectal artery embolization for rectal cancer bleeding. Some studies were found on TAE for lower digestive bleeding that included patients with rectal bleeding, who underwent rectal artery embolization. In the only existing 20-year retrospective study led by Suyoung Park et al, published in the Journal of Vascular Interventional Radiology in 2019, 34 patients underwent rectal artery

embolization for the treatment of massive rectal hemorrhage, with seven patients presenting rectal cancer bleeding [2]. They reported a technical success rate of 97.1% (33 out of 34 patients). The unsuccessful case had a severe stenosis at the origin of the IMA. Bleeding control was achieved in 64.7% (22) of patients. The most common cause of recurrent bleeding was estimated to be incomplete initial angiography (90.9%; 10 out of 11), followed by multifocal bleeding (9.1%; 1 out of 11). Among the 10 patients with incomplete initial angiography, six (6) underwent IMA angiography and the remaining four (4) were submitted to IIA angiography. Within the same group of 10 patients, two (2) underwent a second rectal artery embolization session, and a complementary angiogram was performed allowing to identify the bleeding focus and therefore achieving bleeding control. The embolization procedures were well-tolerated, although a major complication occurred in one (1) patient (2.9%): thrombosis developed in the punctured right common femoral artery approximately within six (6) hours following the RA [2].

Using "rectal cancer" as a keyword, 4,958 articles could be identified; adding keywords such as "bleeding" and "embolization" to the search reduced the number of results to 89 articles, only nine (9) of which proved to be relevant to the topic addressed. Only patients with bleeding rectal cancer described in the select studies were referred to. In total, 33 cases of rectal cancer bleeding controlled by the rectal artery embolization approach were found. Technical success of rectal artery embolization was achieved in 32 out of 33 patients. Technical failure was encountered in one (1) patient due to a shortfall in advancing the microcatheter to the source of bleeding. The most frequently embolized artery was the superior rectal artery (22 patients). Bleeding control was achieved in 24 patients from the first attempt. Recurrent bleeding was observed in nine (9) patients, all of whom successfully responded to repeated RAE. There was no evidence of bowel infarction, and the procedure was well tolerated, in general. Some of the complications reported included abdominal discomfort, tenesmus, nausea, vomiting or fever, and puncture site–related complications.

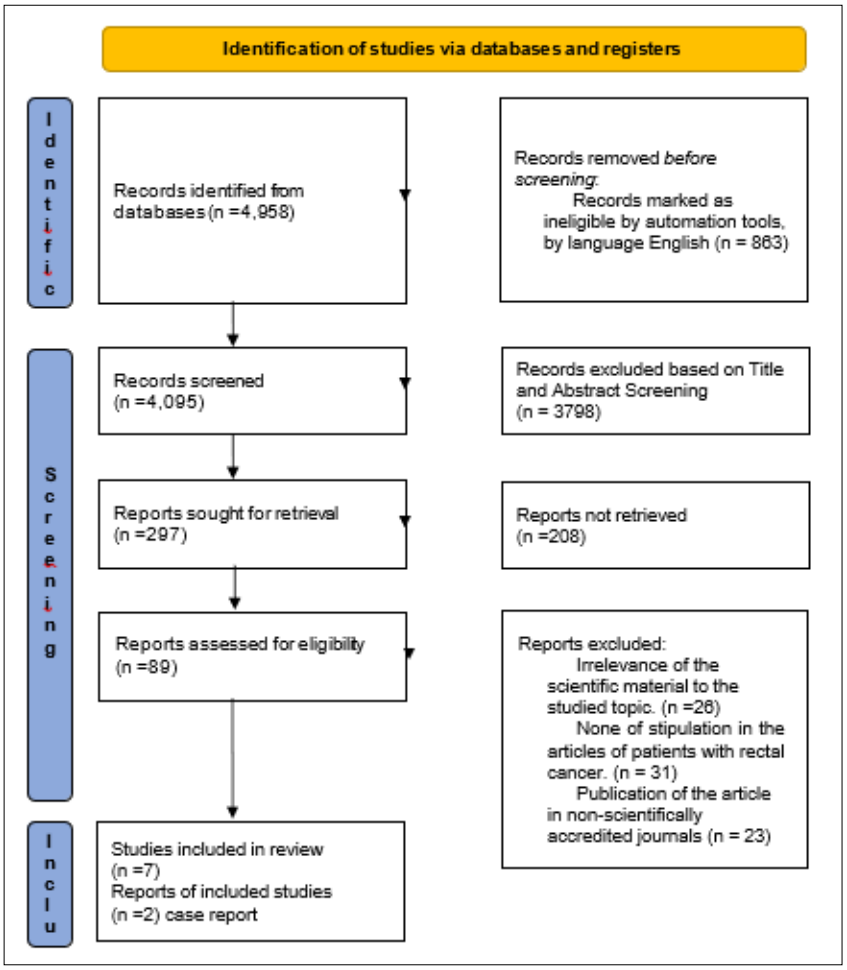

Figure. 4 Flow Diagram of Searching Eligible Studies

Table 2: Selected Articles Reporting Transcatheter Rectal Artery Embolization for Massive Rectal Cancer Bleeding

Author	Journal	Year	Total patients	RC	Artery embolized	Recurrent bleeding	Technical success	Clinical success after first RAE	Complication	Follow-Up
Azeemuddin M., et al. [1]	Cureus vol. 11,3	2019	32	1	Branches of SRA and MRA	None	100%	100%	None	Discharged
Diamond NG, et										
al [9].	RSNA Journal	1979	9	1	RSHA	None	100%	100%	None	Discharged
Greco, L. et al [10].	Thieme Medical Publishers	2020	25	1	N/d	1	100%	0%	None	Discharged
Kelly LS, et al [11].	The American Surgeon™									
2023	1	1	RIIA	None	100%	100%	None	Discharged		
Lai Hai- Yang , et al [12].	SCANDINAVIAN JOURNAL OF GASTROENTEROL OGY	2020	158	19	SRA (15),					
IRA and hemorrhoidal artery (4)	3	100%	94.7%	Abdominal discomfort (5),						
tenesmus(3), nausea(2),										
vomiting(1) or fever (1)	During follow-up, 1 patient underwent successful surgery									
Ledermann, H P et al. [13].	Journal of Vascular and Interventional Radiology : JVIR vol.									
9,5	1998	10	1	SRA	1	100%	0%	Recurrent minor self-limiting hemorrhage was reported		
3 days after embolization	Discharged with 5 months follow-up									
Park, Suyoung et al. [14].	Journal of vascular and interventional radiology	2020	34	7	SRA(5), MRA(1)					
IRA(1)	3	85.7%	57,14	One patient had a puncture site–						
related complication	Discharged									
Vorčák M, et al.										
[15].	"Medicina". Lithuania	2022	27	1	n/d	1	100%	0%	n/d	Discharged
Yata, Shinsaku et al [16].	Journal of vascular and Interventional Radiology: JVIR vol.									
24,3	2013	37	1	Obturator artery	None	100%	100%	n/d	Discharged	
Total			327	33		9	98,41%	61,32%		

SRA- Superior Rectal Artery; MRA - Middle Rectal Artery; IRA- Inferior Rectal Artery; RSHA- Right Superior Hemoroidal Artery; RIIA- Right Internal Iliac Artery; RC – Rectal Cancer; N/d –Not Determed

Postoperative hemostasis was achieved immediately in all three cases. Follow-up of patients at one month post-intervention revealed that one patient presented massive uterine bleeding due to invasion of rectal cancer; TAE of bilateral uterine artery was performed with the attainment of bleeding control. However, the patient died within one week due to general disease decompensation. Observations at three months post-intervention revealed mild, medication- responsive rectal bleeding in one (1) patient; another patient presented no recurrence of bleeding and a satisfactory general condition allowing for his preparation for radical surgery.

Discussion

The present review and case presentation of patients who underwent endovascular approaches to treat rectal cancer bleeding showed that rectal artery embolization is safe and feasible, with a high technical success rate. The analyzed studies report a technical success rate of up to 100%. this was also obtained in our series of

cases. However, according to published data, the clinical success rate in the case of tumoral rectal hemorrhages is only 61.32%, and the majority of recurrences were managed therapeutically or surgically. These recurrence data may be due to the complex influx of vessels to the rectal tumor, and the presence of the anastomosis network developed at the level of the rectum.

For patients with massive rectal bleeding, the initial treatment consists of volume resuscitation and transfusions and, if necessary, administration of hemostatics and discontinuation of anticoagulant preparations with correction of the underlying coagulopathy. Due to the accessibility of the rectal lumen without bowel preparation, the initial intervention is the endoscopic examination with the assessment of the source of hemorrhage and endoscopic hemostasis [17]. However, the endoscopic approach may fail due to profuse bleeding and blood clots filling the rectal lumen. Under such conditions, it is necessary to intervene promptly with another method of hemostasis.

Rectal tamponade in massive rectal hemorrhages caused by inoperable cancer with local invasion would be a method of local hemostasis in the short term, allowing for the stabilization of the patient. Unfortunately, from the experience of our clinic, after the extraction of the rectal tampon, the bleeding repeats on the second or third day.

Surgical treatment has limited possibilities in patients with locally advanced rectal cancer with destruction and hemorrhage previously considered inoperable due to the risks associated with morbidity. Massive rectal bleeding caused by non-advanced local rectal cancer could be caused by the administration of anticoagulant preparations. In such patients, the surgical intervention carries major risks because these patients present advanced comorbidities. Interventional radiology and transarterial catheterization have experienced impressive development. Thus, nowadays, angiography and angioembolization possibilities are vast and allow for minimally invasive treatment in hemodynamically unstable patients with massive bleeding,

where the rest of the resources have been exhausted. Therefore, transcatheter rectal arterial embolization can be considered as a first-choice treatment modality for these patients [5]. Transcatheter arterial embolization was described for the first time as a method of hemostasis in digestive bleeding by Bookstein et al. in 1974, using the examples of nine patients with upper digestive hemorrhages due to duodenal ulcers, with good hemostatic results [18]. The origins of superior rectal artery embolization for symptomatic haemorrhoidal disease appear to date back to the 1990s, when Galkin et al. published a 34-patient case series in the Russian Journal ‘‘Vestnik rentgenologii i radiologii’’[19,20].

It is important to catheterize both the inferior mesenteric artery and the internal iliac artery from which the middle and inferior rectal arteries emerge. In the study by Suyoung Park et al., the main cause of the recurrence of bleeding was the non-catheterization and angiography of the iliac artery to visualize the middle and lower rectal arteries [2].

The vascular anatomy of the rectum is complex and is supplied by three paired arterial sources. The superior rectal artery emerges from the inferior mesenteric artery and divides into two main branches that supply the vascularization of the superior rectum and the rectosigmoid junction. The middle rectal arteries arise from the internal iliac artery. A study by Tradi et al. demonstrates that the basic blood flow prevails from the middle rectal artery in 43% of cases [21]. Sun et al. have also observed significant communication between the superior and inferior rectal arteries in 43% of cases, unilateral in 13%, and bilateral in 30%, respectively. Interestingly, even with the embolization of these prominent IRA branches, there were no occurrences of post- procedure ischemia or pain [19,22]. The extensive anastomotic networks in the rectum’s wall between the SRA and the middle and inferior rectal arteries create collateral blood supply that decreases the risk of ischemic events and makes it possible to intervene in acute bleeds with selective arterial embolization. Necrosis of the tumor may follow embolization and cause up to several days of pain, flu-like symptoms, or nausea and vomiting [23].

More, recently arterial embolization has been applied to patients with internal hemorrhoids, described as the ”Emborrhoid technique” – an endovascular embolization of the superior rectal artery (SRA). Because it is an emerging technique, its detailed physiological and histologic outcomes are not yet completely evaluated [16].

Unfortunately, there is limited literature on the palliative treatment of bleeding in patients with advanced cancer, including only a few prospective studies, showing a lack of consistent endpoints and no randomized trials. Treatment of bleeding patients should proceed based on patient preferences and resource availability [24].

Conclusion

Potentially, rectal arteries embolization with cessation of the related arterial inflow in the rectal area facilitates the stopping of rectal hemorrhages of any origin. Angiography of bilateral internal iliac arteries, as well as the inferior mesenteric artery, is highly recommended in the initial rectal artery embolization session to achieve a high rate of bleeding control.

The rectal artery embolization remains the only alternative method in the case of failure of other surgical and endoscopic procedures in the conditions of the restricted rectal space and amorphous tumoral hemorrhagic sources in destruction. Obviously, as endovascular embolization is a palliative treatment method, it cannot claim to definitively resolve the tumor process but can help avoid premature death through bleeding.

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