BMC Surgery

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Transcatheter arterial embolization for acute nonvariceal upper Gastrointestinal bleeding in children: a single-center retrospective study

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Abstract

Objective This study aims to provide a preliminary report on the outcomes of transcatheter arterial embolization (TAE) in pediatric patients with acute nonvariceal upper gastrointestinal bleeding (NVUGIB) to establish optimal practices for this intervention and explore its potential value in improving the management of pediatric patients.

Methods A retrospective analysis was conducted on children with NVUGIB who underwent TAE at a single institutional center between February 2022 and April 2024. Comprehensive data were collected, including patient demographics, clinical manifestations, diagnostic and therapeutic procedures, intraoperative findings, and follow-up outcomes.

Results A total of 266 cases with NVUGIB were admitted to the institutional center, with 14 cases (5.26%) undergoing TAE. There were 10 males and 4 females. The average age was 7.21 ± 4.77 years old, and the average hospital stay was 13.14 ± 8.69 days. Nine cases (64.29%) had hematochezia, 2 cases (14.29%) had hematemesis, 3 cases (21.42%) had both hematochezia and hematemesis. Six cases (42.86%) had no significant medical history, 3 cases (21.42%) had previous Helicobacter pylori infections, 2 cases (14.29%) had previous lymphomas, and 1 case (7.14%) each had immune disorders, gastroenteritis, and fever. The mean preoperative minimum hemoglobin level was 57.85 ± 21.25 g/L. All cases underwent gastroenteroscopy before TAE. Ten cases (71.43%) had duodenal bulb ulcers, 3 cases (21.43%) had duodenal ulcers, and 1 case (7.14%) had multiple ulcers in the gastric antrum. Bleeding was visible on endoscopy in 6 cases (Forrest Classification Ib,42.86%) (Table 2; Fig. 2), which were treated. All cases underwent TAE, and the timing of TAE averaged 4.29 ± 4.53 days. The responsible vessel was identified intraoperatively in all cases: gastroduodenal artery in 7 cases (50%) and pancreaticoduodenal artery in 7 cases (50%). A pseudoaneurysm was found in 2 cases (14.29%). Embolization of the responsible vessel was performed in all cases, using platinum coils alone in 8 cases (57.14%) and platinum coils combined with gelatin sponge in 6 cases (42.8%). All cases were followed up for an average of 13.69 ± 8.77 months, and no recurrence was detected.

Conclusion TAE represents a promising intervention for pediatric patients with acute NVUGIB. Nevertheless, optimal timing, embolization techniques, and selection of embolizing agents necessitate further comprehensive investigation.

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Keywords Transcatheter arterial embolization, Nonvariceal upper Gastrointestinal bleeding, Pediatrics, Acute hemorrhage, Endoscopic

Upper gastrointestinal bleeding refers to hemorrhage occurring proximal to the ligament of Treitz. Based on etiology and pathogenesis, upper gastrointestinal bleeding is categorized into two primary types: non-variceal acute upper gastrointestinal bleeding (NVUGIB) and variceal upper gastrointestinal bleeding [1]. Gastrointestinal bleeding presents two distinct clinical manifestations. Although upper gastrointestinal bleeding is relatively uncommon in pediatric populations, children exhibit heightened vulnerability to life-threatening complications due to their lower body weight and limited circulating blood volume compared to adults [2]. Epidemiological data regarding pediatric upper gastrointestinal bleeding remain limited. A representative French epidemiological study documented an annual incidence of 1–2 cases per 10,000 pediatric patients [3].

The etiology of upper gastrointestinal bleeding (UGIB) in pediatric patients demonstrates significant variability, influenced by age, geographic location, and associated comorbidities. Among older children and adolescents, predominant causes of UGIB include variceal bleeding and peptic ulcer disease. Foreign body ingestion represents an uncommon etiology in this demographic. In contrast, infants frequently experience UGIB secondary to Mallory-Weiss tears and reflux esophagitis. Additional prevalent causes in neonates comprise maternal blood ingestion and milk protein allergy [4].

The primary therapeutic modalities for NVUGIB in pediatric patients currently include conservative pharmacological therapy and endoscopic intervention. Despite these approaches, certain patients experience recurrent bleeding following endoscopic treatment. For such cases, where the substantial surgical trauma poses significant challenges, transcatheter arterial embolization (TAE) emerges as a potential alternative intervention. The application of TAE in pediatric NVUGIB remains limited, with only a few reported cases in the medical literature. This retrospective study analyzed the clinical manifestations, diagnostic approaches, therapeutic interventions, and clinical outcomes of pediatric NVUGIB patients to provide insights into the potential utility of TAE in managing refractory cases.

Methods

Patient population

This retrospective study analyzed clinical data from pediatric patients with non-variceal upper gastrointestinal bleeding (NVUGIB) admitted to the institutional center between February 2022 and April 2024. Comprehensive data collection encompassed demographic characteristics, medical history, clinical presentation, diagnostic test results, therapeutic interventions, intraoperative findings, and follow-up outcomes. Inclusion criteria were established as follows: (1) patients aged 0–18 years, (2) confirmed diagnosis of non-variceal upper gastrointestinal bleeding, and (3) receipt of interventional embolization. The study protocol received approval from the Medical Ethics Committee of Fujian Maternal and Child Health Hospital. Guardians were thoroughly informed about specimen collection procedures, diagnostic examinations, and research objectives. Informed consent was obtained for all participating patients.

Pre-TAE treatment

All patients included prior to TAE received treatment with proton pump inhibitors and therapy to protect the gastrointestinal mucosa. If hemoglobin levels fell below 70 g/L, blood transfusions were administered. None of the included patients received antithrombotic therapy. All included patients underwent gastrointestinal endoscopy, and endoscopic treatment was performed when necessary.

In cases where the source of bleeding could not be identified during endoscopy and there was no active bleeding, we initially opted for medication management. Conversely, if active bleeding was present, we first conducted a contrast-enhanced computed tomography (CT) scan to evaluate potential bleeding sites. If the results remained inconclusive, we considered performing a digital subtraction angiography (DSA), contingent upon obtaining prior consent from the patient's family. However, if the patient's vital signs were unstable or there was significant ongoing bleeding, we forgone the contrast-enhanced CT scan and proceeded directly to the DSA examination, administering treatment concurrently.

Indications for rescue TAE

If active bleeding persists or recurs after initial endoscopic intervention, selective TAE was considered as a rescue therapeutic option. The decision to perform a second endoscopic intervention was at the discretion of the gastroenterologist, who will prioritize endoscopic treatment when deemed necessary. The initiation of TAE was a collaborative decision involving interventional radiologists, gastroenterologists, and the patient's family. When the gastroenterologist determines that a second endoscopic intervention was inappropriate or lacks confidence in achieving hemostasis, the interventional radiologist proposes a TAE approach. The potential effects and risks of the procedure are thoroughly explained to

the patient's family. TAE was formally initiated only after obtaining the family's informed consent.

TAE methods

All patients underwent TAE under general anesthesia. The right femoral artery was punctured using a 4-Fr micropenetrating needle according to the modified Seldinger technique. A 4-Fr Pig catheter was introduced into the sheath to the upper abdominal aorta for angiography. The responsible vessel was identified, and a 4-Fr C2 catheter was used to superselect the common hepatic artery with a loach guide wire. A 2.7-Fr microcatheter was then used to superselect the responsible vessel with a microguide wire to confirm the site and type of hemorrhage.

If the microcatheter could pass beyond the bleeding site, platinum coils were placed (0.018″) (Cook Inc., USA) was placed distal to the site. Regardless of whether the microcatheter could pass, platinum coils were placed proximal to the bleeding site, with gelatin sponge embolization performed as needed. The procedure concluded after imaging confirmed no signs of bleeding (Fig. 1).

Statistical analysis

All data analyses were performed using SPSS 21.0 software (IBM Corp., USA). Normality of data distribution was assessed using the Shapiro-Wilk test and Q-Q plots. Continuous variables were expressed as mean ± standard deviation for normally distributed data, or median and interquartile range for non-normally distributed data.

Categorical variables were presented as frequencies and percentages. Comparisons between groups were conducted using independent t-tests (normally distributed continuous variables), Mann-Whitney U tests (non-normally distributed continuous variables), or chi-square/Fisher's exact tests (categorical variables). A significance level of $p < 0.05$ was considered statistically significant.

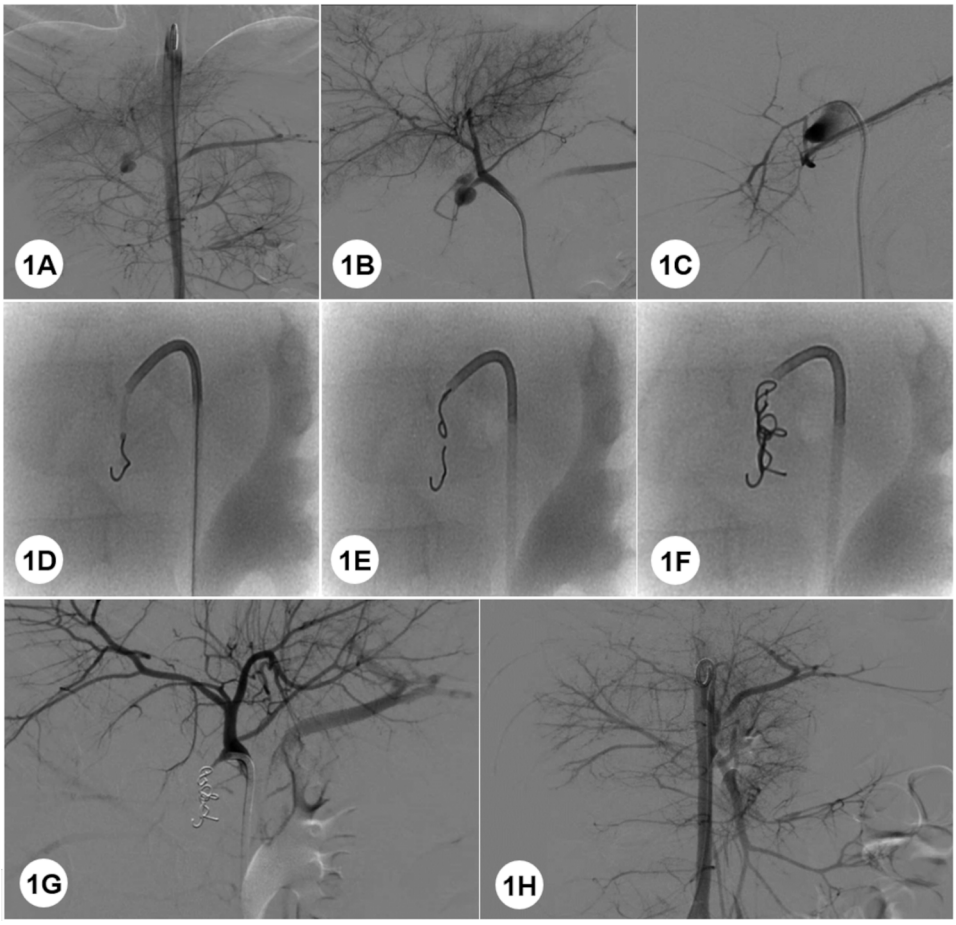

Fig. 1 Transcatheter Arterial Embolization Process. (**1A**, **1B**) Extravasation of contrast agent in the middle of the pancreaticoduodenal artery; (**1C**) The microcatheter was selected to distal end of the hemorrhagic port.; (**1D**, **1E**) Two 2*5 mm platinum coils were placed at distal end of the hemorrhagic port.; (**1F**) At the proximal end of the hemorrhagic port, a 3*60 mm platinum coils was placed; 1G, (**1H**) No contrast agent spillage was found in the pancreatoduodenal artery during re-examination

Result

Clinical characteristics

During the study period, 266 pediatric patients with NVUGIB were treated at the institutional center, with 14 patients (5.26%) undergoing TAE, comprising 10 males and 4 females. Patient ages ranged from 1 to 14 years, with a mean age of 7.21 ± 4.77 years. The hospital length of stay varied from 4 to 26 days, with a mean duration of 13.14 ± 8.69 days. Preoperative hemoglobin levels ranged from 10 to 82 g/L, with a mean of 57.85 ± 21.25 g/L. Clinical symptomatology was universal among patients: 9 (64.29%) presented with hematochezia, 2 (14.29%) with hematemesis, and 3 (21.42%) exhibited both hematochezia and hematemesis. Medical history revealed diverse underlying conditions: 6 patients (42.86%) had no specific medical history, 3 (21.42%) had prior Helicobacter pylori infection, 2 (14.29%) had lymphoma, and individual cases included immune disorders, gastroenteritis, and fever (Table 1).

Findings at upper gastroenteroscopy for children with NVUGIB

Gastroenteroscopy performed prior to TAE revealed the following endoscopic findings: 10 patients (71.43%) presented with duodenal bulb ulcers, 3 patients (21.43%) had duodenal ulcers, and 1 patient (7.14%) exhibited multiple ulcers in the gastric antrum. Active bleeding was endoscopically visible in 6 patients (Forrest Classification Ib,42.86%) (Table 2; Fig. 2) and managed accordingly. Of these cases, 4 patients (66.67%) received combination therapy involving hemostatic clamp and epinephrine injection, while 2 patients (33.33%) underwent epinephrine injection monotherapy (Table 2).

Intraoperative findings in TAE

All patients underwent transcatheter arterial embolization TAE, with the procedure timing ranging from the day of admission to 17 days post-admission, with a mean interval of 4.29 ± 4.53 days. Intraoperatively, the responsible vessel was identified in all patients: the gastroduodenal artery in 7 patients (50%) and the pancreaticoduodenal artery in 7 patients (50%). A pseudoaneurysm was detected in 2 patients (14.29%). Vessel embolization was performed using two primary approaches: platinum coils (0.018″) (Cook Inc., USA) as monotherapy in 8 patients (57.14%) and a combination of platinum coils with gelatin sponge in 6 patients (42.86%) (Table 3).

Postoperative recovery and follow-up

All children were followed up for 1 to 27 months, with a mean follow-up duration of 13.69 ± 8.77 months. During the follow-up period, no complications directly attributable to TAE were observed, such as intestinal necrosis, limb ischemia, or thrombosis. Recurrence was defined as the reoccurrence of active bleeding after TAE, regardless of whether additional endoscopic or TAE interventions were subsequently performed. No recurrence was observed during the follow-up period.

Discussion

Currently, there is a notable absence of authoritative epidemiological data regarding acute NVUGIB in pediatric populations. The mean age of onset in this study was 7.2 years, with a marked male predominance. While these observations provide preliminary insights, they are insufficient to establish comprehensive epidemiological

Table 1 Demographic and clinical characteristics of children undergoing transarterial embolization for nonvariceal upper Gastrointestinal bleeding

Number	Age of onset (years)	Gender	First Symptoms	Past medical history	Minimum preoperative hemoglobin (g/L)	Hospital Length of Stay (days)
1	7	Male	Hematochezia	T-lymphoblastoid lymphoma	18	8
2	3	Female	Hematochezia	Variant Immunodeficiency Disease (VID)	68	26
3	2	Male	Hematochezia	Fever	50	22
4	6	Male	Hematochezia	T-lymphoblastoid lymphoma	10	23
5	12	Male	Hematochezia and Hematemesis	None	78	6
6	13	Male	Hematochezia	None	82	5
7	3	Female	Hematemesis	None	66	12
8	4	Female	Hematemesis	Helicobacter pylori infection	74	25
9	12	Male	Hematochezia and Hematemesis	Helicobacter pylori infection	48	6
10	2	Female	Hematochezia	None	57	4
11	14	Male	Hematochezia	Helicobacter pylori infection	64	10
12	12	Male	Hematochezia	None	57	8
13	10	Male	Hematochezia	None	77	5
14	1	Male	Hematochezia and Hematemesis	Gastroenteritis	61	24

Table 2 Findings at upper gastroenteroscopy for children with nonvariceal upper Gastrointestinal bleeding

Number	Gastroenteroscopy	Site of lesion	Forrest Classification at time of first endoscopy	Modality of treatment	Number of gastroenteroscopy
1	Treatment	Duodenal ulcers	Ib	Adrenaline injection	1
2	Examination only	Duodenal bulb ulcers	IIc	N/A	2
3	Examination only	Duodenal bulb ulcers	IIc	N/A	2
4	Treatment	Duodenal ulcers	Ib	Adrenaline injection and Hemostatic clamp	2
5	Examination only	Duodenal ulcers	IIb	N/A	1
6	Examination only	Duodenal bulb ulcers	IIc	N/A	1
7	Treatment	Ulcers in gastric antrum	Ib	Adrenaline injection and Hemostatic clamp	2
8	Treatment	Duodenal bulb ulcers	Ib	Adrenaline injection	2
9	Treatment	Duodenal bulb ulcers	Ib	Adrenaline injection and Hemostatic clamp	1
10	Examination only	Duodenal bulb ulcers	IIc	N/A	1
11	Examination only	Duodenal bulb ulcers	IIb	N/A	1
12	Treatment	Duodenal bulb ulcers	Ib	Adrenaline injection and Hemostatic clamp	1
13	Examination only	Duodenal bulb ulcers	IIb	N/A	1
14	Examination only	Duodenal bulb ulcers	IIc	N/A	2

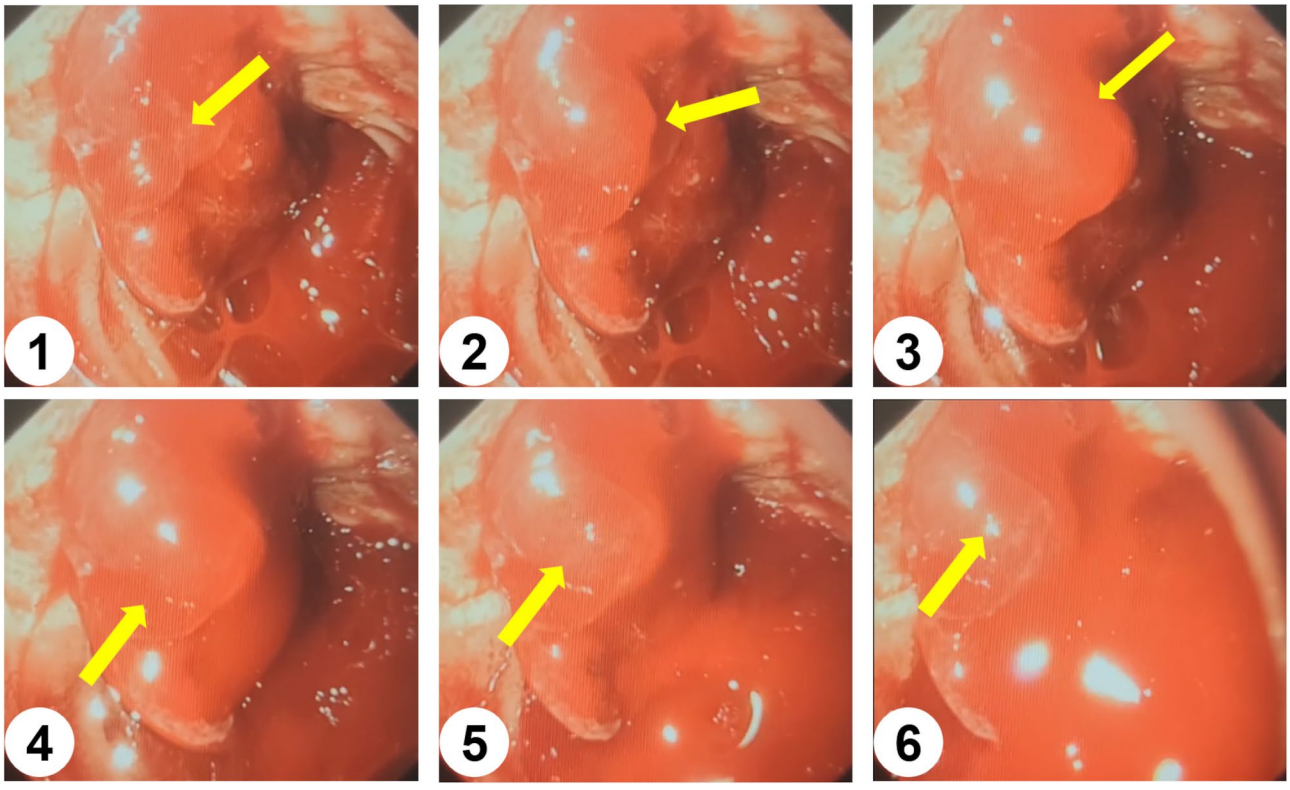

Fig. 2 Gastroscopy showed pulsatile hemorrhage in the descending part of the duodenal bulb
Yellow arrow: Pulsatile hemorrhage observed under gastroscopy

patterns, necessitating further extensive research. In contrast, acute NVUGIB represents a critical clinical emergency in adult populations [5]. The observed preoperative minimum hemoglobin level of 10 g/L is particularly noteworthy. Given children's inherently limited blood volume and reduced physiological compensatory mechanisms, acute NVUGIB presents a significantly more complex clinical challenge in pediatric patients. These findings underscore the critical importance of rapid etiological identification, precise localization of bleeding sources, and implementation of aggressive management strategies in pediatric NVUGIB cases. In our study, the vast majority of patients (13/14, 92.86%) experienced bleeding associated with duodenal ulcers. This underscores the

Table 3 Intraoperative findings in TAE

Number	Timing of TAE[a] (days)	Responsible vessel	Embolization methods
1	1	PDA	Platinum coils + gelatin sponge
2	7	GDA	Platinum coils
3	0	PDA	Platinum coils
4	17	GDA	Platinum coils
5	2	GDA	Platinum coils + gelatin sponge
6	1	PDA	Platinum coils
7	6	GDA	Platinum coils
8	4	PDA (pseudoaneurysm)	Platinum coils
9	3	GDA	Platinum coils + gelatin sponge
10	0	PDA	Platinum coils + gelatin sponge
11	5	GDA	Platinum coils + gelatin sponge
12	3	PDA	Platinum coils
13	2	PDA	Platinum coils + gelatin sponge
14	9	GDA (pseudoaneurysm)	Platinum coils

a: time from admission to TAE; GDA: Gastroduodenal artery; PDA: Pancreaticoduodenal artery

importance of thoroughly considering this etiology when managing non-variceal upper gastrointestinal bleeding in pediatric patients.

Gastroscopy currently represents the primary diagnostic modality for identifying the etiology of upper gastrointestinal bleeding in pediatric patients. The diagnostic efficacy of endoscopy, particularly in emergency contexts, ranges from 80 to 90%, establishing it as the preferred diagnostic approach for acute upper gastrointestinal bleeding [6]. The temporal window of gastroscopy critically influences diagnostic yield. Contemporary clinical consensus recommends performing endoscopy within 24 h following bleeding cessation, emphasizing the significance of expedited examination when clinical conditions permit [7]. From a diagnostic perspective, strategic timing differentiates between active bleeding and post-bleeding periods. Gastroscopy enables precise identification and targeted intervention of bleeding lesions, offering multiple clinical advantages including procedural simplicity, rapidity, minimal invasiveness, and immediate therapeutic potential. Reported immediate hemostatic success rates under endoscopic intervention exceed 80% [8]. While all patients in this study underwent gastroscopy, not all required endoscopic intervention. This selective approach stemmed from endoscopic detection of lesions or clots without active bleeding, rendering therapeutic intervention unnecessary. In 6 patients (42.86%), persistent active bleeding following endoscopic management necessitated transcatheter arterial embolization (TAE). Comparative adult literature indicates that approximately 5–15% of patients fail to achieve hemostasis through endoscopic techniques, subsequently requiring TAE or surgical intervention [9]. Notably, in our study, 6 patients (42.86%) underwent a second gastrointestinal endoscopy. Although these repeated endoscopies did not ultimately achieve hemostasis, it is crucial to emphasize that endoscopy remains the first-line intervention for patients experiencing recurrent gastrointestinal bleeding.

TAE has emerged as a promising alternative to emergency surgical intervention for adult patients with NVUGIB. Currently, it is recognized as the primary therapeutic approach following unsuccessful endoscopic management [6]. The technical success rate of TAE typically ranges between 89% and 98%, while the clinical success rate demonstrates considerable variability, spanning from 44 to 94% [10]. Despite the limited pediatric-specific literature, an existing study examining TAE for gastrointestinal bleeding associated with pseudoaneurysm in pediatric patients reported a 100% success rate with no observed complications [11]. Our study's findings are consistent with these observations, suggesting that TAE represents a potentially safe and effective intervention for managing acute NVUGIB in pediatric populations. Nevertheless, we recognize the critical need for comprehensive further research to elucidate the nuanced aspects of this therapeutic approach.

Methods and materials for TAE

Our approach for transcatheter arterial embolization (TAE) involves method and material selection based on the specific bleeding location. Following angiographic identification of the bleeding site, we attempt to navigate a micro-guide wire and micro-catheter to the precise location, performing embolization from the distal to the proximal end. To mitigate the risk of excessive embolization potentially leading to intestinal necrosis, we generally avoid using gelatin sponge particles. In instances where bleeding occurs in peripheral vessels not directly accessible, we employ gelatin sponge injection at the middle or proximal vessel segment, subsequently deploying a metal coil at the proximal end. This methodology is primarily adapted from established adult embolization techniques [12–13]. Our study revealed that 57.14% of cases utilized platinum coils for TAE. However, we raise critical concerns regarding the feasibility of employing the smallest platinum coil (2 × 4 mm) in very young pediatric patients. The relatively thin blood vessels in children may prevent the coil from achieving an optimal configuration. We currently contemplate the potential development of smaller platinum coils specifically designed for

pediatric embolization, noting a notable absence of existing literature addressing this technical challenge. We eagerly anticipate future research that will develop more refined embolization strategies tailored to pediatric vascular anatomy.

Timing of TAE

The study findings demonstrate a mean interval of 4.29 days from admission to TAE, with one exceptional case extending to 17 days, reflecting the potential efficacy of conservative management. This timeframe corresponds reasonably with contemporary clinical standards, as TAE is increasingly recognized as the primary interventional approach following unsuccessful endoscopic management in adult NVUGIB patients. While cautiously extrapolating these insights to pediatric populations, we acknowledge the current literature's significant gap regarding optimal intervention timing across both adult and pediatric cohorts. Considering the substantial success rate of gastroscopic treatment and the potential long-term radiation risks in pediatric patients, we assert that endoscopy remains the preferred initial management strategy for acute upper gastrointestinal bleeding in children. It is crucial to emphasize that even in cases of recurrent gastrointestinal bleeding, particularly for patients in whom the initial endoscopy did not reveal active bleeding, endoscopic intervention remains the first-line treatment when rebleeding occurs. However, in cases of unsuccessful endoscopic intervention, particularly given the limited physiological compensatory mechanisms inherent in pediatric circulatory systems, we recommend a proactive approach utilizing TAE. The evolving TAE techniques offer a comprehensive and targeted therapeutic strategy, ensuring optimal clinical management with minimized procedural risks.

Could empiric or blind TAE be used in children?

In adult patients, detecting intermittent gastrointestinal bleeding presents significant diagnostic challenges during angiographic evaluation, particularly in hemodynamically stable individuals [14]. Previous research has proposed 99mTc-RBC scintigraphy as a potential method for confirming and localizing bleeding in cases of intermittent or occult hemorrhage with negative angiographic findings [13]. However, the clinical utility of this approach remains controversial. Contemporary adult literature suggests that empirical TAE in angiography-negative acute upper gastrointestinal bleeding demonstrates comparable safety and efficacy to targeted interventional strategies [15–17]. However, the efficacy and safety of empiric or blind TAE in pediatric patients require more direct evidence for definitive confirmation.

Operational procedures, specifications or consensus

The diagnosis and management of NVUGIB in adult populations have evolved to a well-established clinical protocol [18–19]. Notably, while multiple guidelines address upper gastrointestinal bleeding in pediatric populations [20–22], these recommendations conspicuously omit explicit guidance regarding TAE. Notwithstanding the current research limitations, emerging evidence increasingly supports the potential efficacy of TAE as a viable therapeutic intervention for pediatric hemorrhagic disorders. For instance, Kubilay's research [23] demonstrated the successful application of interventional embolization technology in managing abdominal solid organ injuries in children, with a 100% procedural success rate and complete patient recovery without documented complications.

Recognizing the significant technical challenges associated with femoral artery access in pediatric patients, particularly in neonates and infants under one year of age, contemporary interventional radiology is actively developing innovative embolization techniques to mitigate these procedural complexities. We recommend that this complex procedure be performed by physicians with extensive experience in pediatric interventional radiology to effectively manage potential clinical scenarios. The primary operator should possess advanced interventional radiology certification, specialized training in pediatric vascular interventions, and at least 5 years of experience in complex pediatric interventional procedures. The physician must be proficient in real-time ultrasound and fluoroscopic guidance techniques, comprehensively understand pediatric vascular anatomy, and demonstrate exceptional capabilities in radiation dose management, contrast agent optimization, and individual risk assessment. Particularly in complication management, the primary operator must possess professional skills for rapid identification and precise intervention. For potential severe complications such as intestinal necrosis, immediate comprehensive assessment should be conducted with maximal efforts to salvage the intestinal segment; if irreversible local intestinal ischemia is confirmed, timely surgical resection and anastomosis are necessary. In cases of post-embolization rebleeding, the bleeding extent should be rapidly evaluated, with active consideration of endoscopic treatment and assessment of the potential need for repeated percutaneous arterial embolization. For limb ischemia or thrombosis, physicians should cautiously select anticoagulation or thrombolytic therapy, developing individualized treatment plans based on a comprehensive evaluation of hemorrhagic risks.

While definitive high-quality evidence remains to be established, we strongly recommend considering TAE as a viable therapeutic intervention for pediatric NVUGIB, particularly in cases of unsuccessful endoscopic

management. Based on our experience and the existing literature, we propose the following feasible protocol: for pediatric patients with acute non-variceal gastrointestinal bleeding, it is recommended to initiate multidisciplinary treatment immediately upon admission, involving departments such as gastroenterology, intensive care unit (ICU), interventional radiology, gastrointestinal surgery, ultrasound, and radiology. If the patient does not have active bleeding, medical treatment may be considered; however, if there is active bleeding, priority should be given to endoscopic examination and treatment. If the patient is unable to undergo gastrointestinal endoscopy, or if the endoscopy cannot identify the site of bleeding or is ineffective, or if there is still active bleeding after multiple endoscopic treatments, early consideration should be given to TAE. For patients with stable vital signs, a CT scan with contrast may be performed prior to DSA to clarify the site of bleeding and the responsible vessel; if the vital signs are unstable or there is significant bleeding, DSA should be performed directly for examination and treatment. Should TAE be impossible or fail, or if endoscopic hemostasis is unsuccessful, surgical exploration should be considered for critically ill patients. This proposed plan can be appropriately adjusted based on the specific circumstances of each medical team.

We strongly encourage clinical guideline development committees to integrate comprehensive guidance on interventional embolization techniques, providing both detailed operational protocols and standardized procedural frameworks. This strategic approach aims to enhance clinical understanding, promote methodical implementation, and ultimately optimize pediatric patient management through advanced interventional strategies.

While this study provides important insights into non-variceal upper gastrointestinal bleeding in children, several limitations should be acknowledged. First, as a single-center study, our findings may lack broad generalizability and require validation through multi-center, large-sample research. Second, the study population primarily consisted of children from Fujian Province, China, necessitating caution when extrapolating results to other racial or geographic populations. Third, this retrospective observational study employed only descriptive statistical analysis without a control group, limiting our ability to determine definitive influencing factors or compare alternative treatment methods. Fourth, our relatively limited sample size might compromise the robustness of statistical analyses and the representativeness of results. Future studies should expand the sample size and include patients from diverse backgrounds to comprehensively assess the characteristics and influencing factors of non-variceal upper gastrointestinal bleeding in children.

Conclusion

TAE emerges as a promising interventional approach for managing NVUGIB in pediatric patients. Nevertheless, significant research gaps persist, necessitating comprehensive investigations into critical domains, including optimal intervention timing, nuanced embolization methodologies, and strategic selection of embolic agents. The complex clinical landscape of acute pediatric NVUGIB management compellingly demonstrates the urgent need for robust, evidence-based diagnostic and therapeutic guidelines.

Acknowledgements
N/A.

Author contributions
Concept and design: Teng Hui Zhan; data collection and analysis: Rong Zhang, Jian Feng He, Yang Mei Chen, Tian Hong Cai and Shi Biao Wang; drafting of the article: Teng Hui Zhan and Rong Zhang; critical revision of the article for important intellectual content: Shi Biao Wang; study supervision: Teng Hui Zhan. All authors reviewed the manuscript.

Funding
This work was supported by Joint Funds for the innovation of science and Technology, Fujian province (2021Y9159).

Data availability
The data used to support the findings of this study are available from the corresponding author upon request.

Declarations

Ethical approval
The study was ethically approved by the Fujian Provincial Maternal and Child Health Institute and approval for publication was granted. The authors have obtained all necessary patient consent forms. The patient's guardian provided written consent for their clinical information to be reported in the journal.

Conflict of interests
The authors declared no potential conflicts of interest with respect to the research, author- ship, and publication of this article.

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Received: 7 August 2024 / Accepted: 9 April 2025
Published online: 19 April 2025

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