
**CLINICAL STUDY OF NON-TRAUMATIC HEMORRHAGE
MANAGED WITH INTERVENTIONAL RADIOLOGICAL
TECHNIQUES: A REVIEW**

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ABSTRACT

Non-traumatic hemorrhage refers to bleeding that arises without any preceding external injury, typically driven by underlying medical conditions such as chronic hypertension, vascular malformations, coagulation disorders, or anticoagulant therapy. Within the central nervous system it most often presents as spontaneous intracerebral or subarachnoid bleeding, both major contributors to stroke-related disability, while extracranial forms affect the gastrointestinal tract and the postpartum uterus. This review synthesises current literature alongside a prospective clinical study of sixty patients with non-traumatic hemorrhage managed with interventional radiological (IR) techniques, with the aim of consolidating current understanding of its etiology, diagnostic pathway, and treatment outcomes. Across the reviewed evidence and the study cohort, hemorrhage occurred with near-equal frequency in men and women and was most common among middle-aged adults. A precipitating trigger could not be identified in a substantial share of cases, intracranial hemorrhage was the dominant imaging finding, and embolization emerged as the leading interventional technique, associated with favourable outcomes in most patients. These findings reinforce the growing role of image-guided, minimally invasive therapy in the contemporary management of non-traumatic bleeding disorders.

KEYWORDS: Non-Traumatic Hemorrhage, Interventional Radiology, Embolization,

Intracerebral Hemorrhage, Uterine Artery Embolization, Digital Subtraction Angiography.

1. INTRODUCTION

Hemorrhage is the escape of blood from a damaged vessel, occurring either internally within tissue or externally through a break in the body surface. It may follow direct physical trauma, but a large proportion of clinically significant bleeding arises with no external injury at all — a category termed non-traumatic hemorrhage. Such bleeding is instead driven by pre-existing disease: long-standing hypertension, structural vascular lesions such as aneurysms and arteriovenous malformations, disorders of coagulation, or the therapeutic use of anticoagulant agents. The clinical picture depends heavily on the volume and rate of blood loss and the anatomical site involved, ranging from insidious, clinically silent bleeding to a rapidly evolving emergency.

Within the central nervous system, non-traumatic hemorrhage most commonly manifests as spontaneous intracerebral hemorrhage (ICH) or subarachnoid hemorrhage (SAH), both recognised as severe subtypes of hemorrhagic stroke associated with disproportionately high morbidity and mortality relative to ischemic stroke. Reported incidence of non-traumatic ICH is approximately 10–30 cases per 100,000 population annually, accounting for roughly 15% of all strokes, with only about one-third of affected patients surviving beyond one year. Outside the brain, non-traumatic hemorrhage also affects the gastrointestinal tract and the gravid or postpartum uterus, where uncontrolled bleeding after delivery remains one of the most dangerous obstetric emergencies.

The last two decades have seen interventional radiology (IR) transform the management of hemorrhagic conditions that once mandated open surgery. By combining real-time imaging guidance with catheter- and needle-based techniques, IR enables targeted, minimally invasive control of bleeding — most notably through embolization — with reduced procedural risk, shorter hospital stays and preserved organ function. This review consolidates the etiological classification of non-traumatic hemorrhage, summarises the relevant published literature, and presents the design and findings of a prospective clinical study evaluating the diagnostic and therapeutic role of IR in this patient population.

1.1 Classification and Common Etiologies

Non-traumatic hemorrhage can be organised by the underlying vascular lesion and anatomical site. Arteriovenous malformations (AVMs) are congenital tangles of abnormal vessels — the nidus — in which arterial blood bypasses the capillary bed and drains directly

into thin-walled veins prone to rupture, carrying an estimated annual bleeding risk of 1–2%. Dural arteriovenous fistulas (DAVFs) are acquired lesions in which a dural artery communicates abnormally with a venous sinus or cortical vein, raising venous pressure and, when cortical venous reflux is present, substantially increasing the risk of hemorrhage or venous infarction. Saccular (berry) aneurysms, typically arising at the circle of Willis, are the classic cause of subarachnoid hemorrhage when they rupture. Reversible cerebral vasoconstriction syndrome (RCVS), characterised by transient segmental narrowing of cerebral arteries and severe headache, is a less common but clinically important cause of SAH. Beyond the cranium, hemorrhage may occur in the gastrointestinal tract secondary to peptic ulceration or mucosal injury, and in the postpartum uterus due to uterine atony, retained products of conception, or birth-canal trauma.

2. Review of Literature

Several published studies inform the current understanding of non-traumatic hemorrhage and its interventional management, and are summarised below.

2.1 Triggering Factors in Non-Traumatic Intracerebral Hemorrhage

Using a case-crossover design at a tertiary care centre, this study compared patient exposure to candidate precipitating events — Valsalva-type activity, vigorous exercise, sexual activity, rapid postural change, large meals, temperature shifts and traffic exposure — in the two hours preceding symptom onset against the same window on the previous day. Of 216 patients with ICH, 97 provided analysable data. No single trigger reached significance in isolation, but the combined burden of physical triggers was significantly associated with ICH onset (relative risk 1.32, 95% CI 1.01–1.73), suggesting a cumulative rather than singular precipitating mechanism.

2.2 Etiology and Imaging of Non-Hypertensive Intracerebral Bleeding

A cross-sectional study of 200 patients with non-traumatic, non-hypertensive ICH who underwent cerebral angiography found non-contrast CT positive in approximately 95% of cases, confirming its value as a first-line screening tool, while cerebral angiography identified an underlying vascular abnormality in 52% of patients. Aneurysms, predominantly at the circle of Willis, accounted for 43% of positive angiographic findings, underscoring the complementary role of angiography once trauma and hypertension have been excluded as causes.

2.3 Interventional Radiology in Disease Management

A narrative review spanning publications from 2000 to 2023 across major databases synthesised 40 studies on the broader role of IR in diagnosis and treatment. It concluded that image-guided, minimally invasive techniques — including embolization, angioplasty, stenting and image-guided biopsy — offer a viable alternative to conventional surgery in appropriately selected patients, with fewer procedural complications, shorter hospitalisation and lower overall healthcare costs.

2.4 Interventional Radiology in Obstetric Hemorrhage

A retrospective analysis of 63 patients with obstetric hemorrhage (22 ectopic pregnancies and 41 postpartum hemorrhages) evaluated selective uterine artery embolization (UAE). Bleeding was controlled in all patients, with UAE alone effective in 95.24% of cases and only three patients requiring repeat embolization. No peri- or post-procedural complications were reported, and fertility was preserved in a majority of conservatively managed patients who later conceived successfully, supporting UAE as a safe, fertility-sparing option for obstetric bleeding.

2.5 Epidemiology and Risk Factors of Non-Traumatic Intracranial Hemorrhage

Consistent with global data, non-traumatic ICH accounts for roughly 15% of strokes, carries a substantially higher mortality than ischemic stroke, and is more common with advancing age and male sex. Hypertension remains the principal modifiable risk factor, with diabetes mellitus, anticoagulant use, dyslipidemia and heavy alcohol intake as additional contributors; complications such as hydrocephalus and cerebral herniation further influence prognosis.

2.6 Endovascular Treatment of Acute Ischemic Stroke and Hemorrhage Risk

A systematic review and meta-analysis pooling 11 controlled studies (1,499 endovascularly treated patients versus 1,320 receiving standard medical care) found a significantly higher incidence of total and asymptomatic intracranial hemorrhage after endovascular therapy, but no significant difference in symptomatic hemorrhage between groups — suggesting that the additional bleeding risk associated with endovascular intervention does not necessarily translate into worse clinical outcomes.

2.7 Clinical Course of Primary Non-Traumatic Cerebral Hemorrhage

A 53-month observational study at a large referral hospital evaluated 138 patients presenting as neurological emergencies with suspected primary cerebral bleeding: 64% had intraparenchymal hematomas and 36% had subarachnoid hemorrhage. Hypertension was implicated in 43% of intraparenchymal cases, with aneurysm rupture, alcohol-related coagulopathy and anticoagulant use as other identified causes; in about 21% of cases no

definite etiology was found despite thorough investigation, reinforcing the frequently idiopathic nature of the condition.

3. MATERIALS AND METHODOLOGY

The clinical component of this review was a prospective observational study conducted over six months, enrolling sixty patients with non-traumatic hemorrhage who underwent interventional radiological treatment. Clinical and procedural data — demographic profile, putative triggering factors, imaging findings, the specific IR technique employed, and post-treatment outcome — were collected prospectively and analysed using standard descriptive statistical methods.

Inclusion criteria comprised patients above 25 years of age with non-traumatic hemorrhage who underwent an IR procedure involving embolization. Patients under 25 years, those with traumatic bleeding, those who did not undergo an IR procedure, and those who declined participation were excluded from the study.

4. RESULTS AND ANALYSIS

The study cohort was almost evenly split by sex — 31 women (51.66%) and 29 men (48.33%) — indicating no meaningful gender predilection for non-traumatic hemorrhage in this population.

Table 1. Age distribution of the study population, showing a predominance of middle-aged patients (26–55 years, together 70% of the cohort).

Age Group (years)	Frequency	Percentage
26–35	14	23.3%
36–45	14	23.3%
46–55	14	23.3%
56–65	12	20.0%
66–75	6	10.0%
Total	60	100%

Table 2. Distribution of putative triggering factors; over a third of patients had no identifiable precipitant, consistent with a multifactorial etiology.

Triggering Factor	Frequency	Percentage
None identified	21	35.0%
Alcohol use	11	18.3%
Postpartum status	9	15.0%
Psychological stress	9	15.0%
BP fluctuation	6	10.0%
Anticoagulant use	4	6.7%
Total	60	100%

Table 3. Distribution of diagnostic imaging findings, dominated by intracranial hemorrhage.

Imaging Finding	Frequency	Percentage
Intracranial hemorrhage	40	66.6%
No abnormality detected (NAD)	8	13.3%
Enlarged uterus with increased vascularity	7	11.6%
Anticoagulant-related bleed	5	8.3%
Total	60	100%

Table 4. Interventional radiological techniques employed, with embolization the predominant modality.

IR Technique	Frequency	Percentage
Embolization	35	58.3%
Supportive care	10	16.7%
Uterine artery embolization	6	10.0%
No intervention	9	15.0%
Total	60	100%

Table 5. Clinical outcomes following interventional treatment, showing improvement or stability in 85% of patients.

Outcome	Frequency	Percentage
Improved	31	51.7%
Stable	20	33.3%
Deteriorated	9	15.0%
Total	60	100%

5. DISCUSSION

The nearly equal sex distribution observed in this cohort supports the broader view that non-traumatic hemorrhage — particularly of intracerebral origin — is driven predominantly by underlying vascular and physiological pathology rather than sex-linked risk. The concentration of cases in middle-aged adults suggests that cumulative vascular and systemic risk factors, such as hypertension, tend to manifest clinically during this stage of life.

The finding that over a third of patients had no identifiable trigger aligns with case-crossover evidence indicating that individual precipitating events rarely act alone; rather, the combined burden of several physiological stresses appears to confer a modest but measurable increase in risk. This multifactorial pattern is echoed in the substantial proportion of 'idiopathic' cases reported across the literature, even after extensive diagnostic work-up.

Intracranial hemorrhage was overwhelmingly the leading imaging finding, reinforcing the central role of neuroimaging in the initial assessment of suspected non-traumatic bleeding. This is consistent with literature showing non-contrast CT to be highly sensitive as a first-line

test, with angiography reserved to characterise an underlying vascular lesion once trauma and hypertension have been excluded. The complementary staged use of non-invasive and then catheter-based imaging appears to be the most efficient diagnostic pathway.

Embolization was clearly the dominant therapeutic technique, mirroring its established role across the interventional radiology literature as a minimally invasive alternative to open surgery with a favourable safety profile. In obstetric bleeding specifically, uterine artery embolization achieved high technical success with fertility preservation, corroborating prior retrospective series. Overall outcome data — improvement or stability in 85% of patients, with deterioration in only 15% — are consistent with published evidence associating early, image-guided intervention with better clinical trajectories, even though endovascular approaches in other settings (such as acute ischemic stroke) may carry a modestly elevated risk of asymptomatic hemorrhage without a corresponding rise in symptomatic events or worse outcomes.

Taken together, the reviewed literature and the study findings converge on a consistent picture: non-traumatic hemorrhage is a heterogeneous, frequently multifactorial condition in which prompt imaging and minimally invasive interventional therapy — chiefly embolization — meaningfully improve the likelihood of a favourable outcome.

6. CONCLUSION

Non-traumatic hemorrhage remains a significant clinical challenge encountered across neurological, gastrointestinal and obstetric practice, frequently arising without a clearly identifiable precipitant and disproportionately affecting middle-aged adults regardless of sex. The synthesis of current literature with prospective clinical data confirms that intracranial bleeding is the most common presentation, that a staged imaging strategy beginning with non-contrast CT and proceeding to angiography where indicated offers the most effective diagnostic route, and that interventional radiology — most notably embolization — has become the therapeutic cornerstone, delivering high rates of clinical improvement or stability with a favourable safety profile compared to open surgical alternatives. Continued large-scale, multicentre studies are warranted to further clarify the role of triggering factors and to refine interventional protocols across diverse patient populations, consolidating the expanding role of interventional radiology in the contemporary management of hemorrhagic disease.

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