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Research Article

Bleeding Control with Hemostatic Radiotherapy in Advanced Gastric Cancer: Real-World Outcomes

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Summary

Background: *Tumor bleeding in gastric cancer is a severe complication associated with anemia, transfusion dependence, and interruption of systemic therapy. Hemostatic radiotherapy (RT) has emerged as a palliative strategy to control bleeding and stabilize patients.*

Objective: *To evaluate bleeding resolution and overall survival after hemostatic RT (OS-RT) in patients with gastric cancer treated at a tertiary cancer center.*

Methods*: A retrospective cohort of 38 patients with histologically confirmed gastric adenocarcinoma treated with hemostatic RT between March 2024 and June 2025 at the National Cancer Institute of Mexico (INCAN) was analyzed. The primary endpoint was bleeding resolution. Secondary endpoints included bleeding recurrence, transfusion requirements, and OS-RT. Survival was estimated using Kaplan–Meier and compared using the log-rank test.*

Results: *Median age was 57 years, and 65.7% were male. Hemostasis was achieved in 86.8% of patients, with a recurrence rate of 47.3% (median 66 days). Transfusion requirements decreased from 92.1% pre-RT (mean 6.9 units) to 55.2% post-RT (mean 3.3 units), with improved hemoglobin levels. Median OS-RT was 3.41 months. Locally advanced disease (6.75 vs. 3.01 months, p=0.03) and albumin ≥3.0 g/dL (6.3 vs. 3.6 months, p=0.04) were associated with improved survival. Lower RT doses were associated with longer OS-RT (p=0.012).*

Conclusions: *Hemostatic RT is an effective and well-tolerated palliative intervention for gastric tumor bleeding, achieving high rates of bleeding control and reducing transfusion needs. Survival remains limited and is influenced by disease stage and nutritional status.*

Keywords: *gastric cancer; tumor bleeding; hemostatic radiotherapy; palliative care; survival.*

Abbreviations

- RT: Radiotherapy
- IMRT: Intensity-modulated radiotherapy
- 3D-CRT: Three-dimensional conformal radiotherapy
- OS-RT: Overall survival after radiotherapy
- ECOG: Eastern Cooperative Oncology Group

Introduction

Background

Gastric cancer continues to be a predominant cause of cancer-related mortality globally, ranking fifth in incidence and fourth in mortality, with particularly elevated rates in Latin America and Asia (1,2). In its advanced stages, it is often associated with severe local complications, including obstruction, perforation, and bleeding. Tumor bleeding presents a complex clinical challenge, leading to severe anemia, multiple transfusions, and the interruption of systemic treatment (3,4).

Therapeutic interventions encompass endoscopic procedures, arterial embolization, palliative surgery, and radiotherapy (RT). However, patient conditions, tumor location, and extent frequently constrain the application of the initial alternatives. In this context, hemostatic RT emerges as a non-invasive, rapid, and well-tolerated approach capable of inducing hemostasis through tumor reduction, fibrosis, and vascular thrombosis (5,6).

Retrospective and prospective studies have demonstrated that hemostatic RT achieves bleeding control rates ranging from 50% to 89%, with median overall survival after radiotherapy spanning from 2.8 to 6.1 months post-treatment (7–8). Short hypofractionated regimens (such as 20 Gy in 5 fractions) have been employed with acceptable efficacy; however, the optimal dose and prognostic factors remain subjects of debate (7,9). Clinical parameters, such as disease stage and serum albumin levels, have been correlated with survival following hemostatic RT (10).

Despite the growing body of international evidence, data from Latin American populations remain limited. Consequently, this study delineates the clinical outcomes, bleeding control, transfusion requirements, and survival of patients with gastric cancer treated with hemostatic RT at INCAN between March 2024 and June 2025.

Methods

Study Design and Patient Population:

A retrospective cohort study was conducted involving consecutive patients aged ≥18 years treated at INCAN, who had histologically confirmed gastric adenocarcinoma and were hospitalized for active tumor-associated upper gastrointestinal bleeding (hematemesis or melena) between March 2024 and June 2025. Inclusion criteria included documented bleeding attributed to the gastric tumor, either endoscopically or clinically, with a hemoglobin drop of ≥2 g/dL, and treatment with hemostatic radiotherapy (RT). Exclusion criteria encompassed patients whose bleeding was controlled solely by endoscopic or surgical measures without RT, those who had received previous RT to the same anatomical region, and those with incomplete clinical or follow-up data.

Variables Collected:

Demographic data (age, sex), performance status (ECOG), histologic variables (intestinal vs. diffuse type, presence of signet-ring cells, differentiation grade), tumor location (cardia, body, antrum-pylorus), and disease stage at the bleeding event (locally advanced vs. metastatic) were collected. Laboratory values at the time of bleeding included hemoglobin, serum albumin, and neutrophil/lymphocyte ratio. Treatment variables included RT technique (IMRT, 3-D conformal RT), dose and fractionation schedule, interval from hospital admission to RT start, and preceding interventions (endoscopy, arterial embolization). Transfusion data were collected pre-RT (units, Hb) and post-RT (units, Hb). Systemic therapy data included whether patients received palliative chemotherapy after RT and the number of cycles.

Radiotherapy Protocol:

All patients received hemostatic RT with palliative intent. Common regimens included 20 Gy in 5 fractions, 24 Gy in 4 fractions, 25 Gy in 5 fractions, or 30 Gy in 10 fractions. Technique selection (IMRT, 3-D CRT) was based on tumor volume, patient status, and available resources. Treatment planning incorporated standard institutional guidelines, with the target volume encompassing the gross tumor plus margin, and organ-at-risk (OAR) constraints as per institutional policy.

Endpoints:

The primary endpoint was bleeding resolution. Secondary endpoints included bleeding recurrence, transfusion requirements, and overall survival after radiotherapy (OS-RT), defined as the time from completion of RT to death from any cause or last follow-up.

Statistical Analysis:

Categorical variables were summarized as counts and percentages, while continuous variables were presented as mean ± SD or median (interquartile range) depending on distribution. OS was estimated using the Kaplan–Meier method, and comparisons between groups (stage locally advanced vs. metastatic; albumin <3.0 vs. ≥3.0 g/dL, RT dose) were performed using the log-rank test. Statistical significance was set at $p < 0.05$. Analyses were conducted using SPSS version 25 (IBM Corp., Armonk, NY).

Ethical Considerations:

Given the retrospective design, the requirement for individual informed consent was waived. Patient confidentiality was preserved, and data were analyzed anonymously in accordance with the Declaration of Helsinki and relevant Mexican regulatory norms.

Results

A cohort of 38 patients diagnosed with gastric cancer and hospitalized due to tumor bleeding received hemostatic radiotherapy (RT) at the National Cancer Institute (INCAN) between March 2024 and June 2025. The median age of the patients was 57 years (±10.3), with a male predominance (65.7%, n = 25). The Eastern Cooperative Oncology Group (ECOG) performance status was 1 in 24 patients (63.1%) and 2 in 14 patients (36.9%).

The predominant histological type was adenocarcinoma, with a diffuse pattern observed in 52.7% and an intestinal type in 47.3% of cases. A signet-ring cell component was identified in 55.2% of the cases, and the majority of tumors were poorly differentiated (76.3%). The most common tumor location was the antrum–pylorus (39.5%), followed by the body (34.2%) and cardia (26.3%). In terms of clinical stage, 12 patients (31.5%) presented with locally advanced disease, while 26 (68.5%) had metastatic disease at the time of bleeding (Table 1).

Variable	n (%) or mean ± SD
Age (yr), median	57 ± 10.3
Male	25 (65.7)
Female	13 (34.3)
ECOG – no. (%)	
1	24 (63.1)
2	14 (36.9)
Histology – no. (%)	
Intestinal	18 (47.3)
Diffuse	20 (52.7)
Signet ring component	21 (55.2)
Differentiation grade – no. (%)	
Moderately	9 (23.6)
Poorly	29 (76.3)
Tumor location – no. (%)	
Cardia	10 (26.3)
Body	13 (34.2)
Antrum – Pylorus	15 (39.5)
Clinical stage – no. (%)	
Locally advanced	12 (31.5)
Metastatic	26 (68.5)

Table 1. Clinical and pathological characteristics of hospitalized gastric cancer patients receiving hemostatic radiotherapy (n = 38)

Radiotherapy Treatment

Radiotherapy was administered with hemostatic intent in all cases. The most frequently prescribed doses were 25 Gy (39.4%), 20 Gy (31.6%), 24 Gy (15.8%), and 30 Gy (13.2%). The predominant technique employed was intensity-modulated radiotherapy (IMRT) in 71.1% of patients, followed by 3D conformal RT in 28.9%. Additionally, 12 patients (31.5%) underwent endoscopic treatment, and 5 patients (13.1%) received arterial embolization (RAI) either before, during, or after RT (Table 2).

Variable	n (%)
Total RT dose	
20 Gy / 5 fr	12 (31.6)
24 Gy / 4 fr	6 (15.8)
25 Gy / 5 fr	15 (39.4)
30 Gy / 10 fr	5 (13.2)
RT technique	
IMRT	27 (71.1)
3D conformal	11 (28.9)
Complementary treatments	
Post-RT arterial embolization	5 (13.1)
Pre-RT Hemospray	12 (31.5)

Table 2. Hemostatic radiotherapy regimens and techniques

Hemostatic Response and Transfusion Support

Hemostatic response was achieved in 33 patients (86.8%) following RT, with rebleeding occurring in 18 cases (47.3%) after a median of 66 days. Prior to RT, 35 patients (92.1%) required red blood cell transfusions, with a mean of 6.9 ± 4.9 units and an average hemoglobin level of 7.0 ± 1.24 g/dL. Post-RT, 21 patients (55.2%) required additional transfusions, with a mean of 3.3 ± 4.6 units and a mean hemoglobin level of 10.3 ± 1.78 g/dL. Furthermore, 23 patients (60.5%) continued systemic therapy after RT, with an average of 2.3 ± 3 cycles of palliative chemotherapy (Table 3).

Variable	n (%) or mean ± SD
Hemostasis achieved	33 (86.8)
Refractory to RT	5 (13.2)
Tumor bleeding recurrence	18 (47.3)
Time to recurrence (days, median)	66 ± 7.2
Transfusion before RT	35 (92.1)
Number of RBC units (mean ± SD)	6.9 ± 4.9
Hemoglobin (g/dL, mean ± SD)	7.0 ± 1.24
Transfusion after RT	21 (55.2)
Number of RBC units (mean ± SD)	3.3 ± 4.6
Hemoglobin (g/dL, mean ± SD)	10.3 ± 1.78
Continued systemic therapy after RT	23 (60.5)
Number of cycles (mean ± SD)	2.3 ± 3.0

Table 3. Hemostatic response and hematologic parameters before and after radiotherapy

Overall Survival

The median overall survival after radiotherapy (OS-RT) for the entire cohort was 3.41 months (95% CI: 1.25–5.57). When analyzed by clinical stage, patients with locally advanced disease had a median OS-RT of 6.75 months (95% CI: 0.00–17.95), which was significantly longer than that of patients with metastatic disease (3.01 months; 95% CI: 0.97–5.06; p = 0.03) (Table 4; Figure 1).

In the subgroup analysis by RT dose, significant differences in OS-RT were observed. Median OS-RT was 4.17 months (95% CI: 1.12–7.22) for patients receiving 20 Gy, 2.85 months for 24 Gy, 1.90 months (95% CI: 1.76–2.04) for 25 Gy, and 0.92 months (95% CI: 0.65–1.18) for 30 Gy (p = 0.012) (Table 5; Figure 3).

When stratified by serum albumin level, patients with albumin ≥3.0 g/dL had a median OS-RT of 6.3 months (95% CI: 0.00–16.78), compared with 3.6 months (95% CI: 0.91–5.23) in those with albumin <3.0 g/dL (p = 0.04) (Figure 2).

Subgroup	**Median OS (months)**	**95% CI**	***p-value***
OS after hemostatic RT			
Locally advanced	6.75	0.00–17.95	0.03
Metastatic	3.01	0.97–5.06	
Serum albumin level (g/dL)			
≥ 3.0	6.30	0.00–16.78	0.04
< 3.0	3.60	0.91–5.23	

Table 4 Overall survival after radiotherapy (OS-RT) according to clinical variables

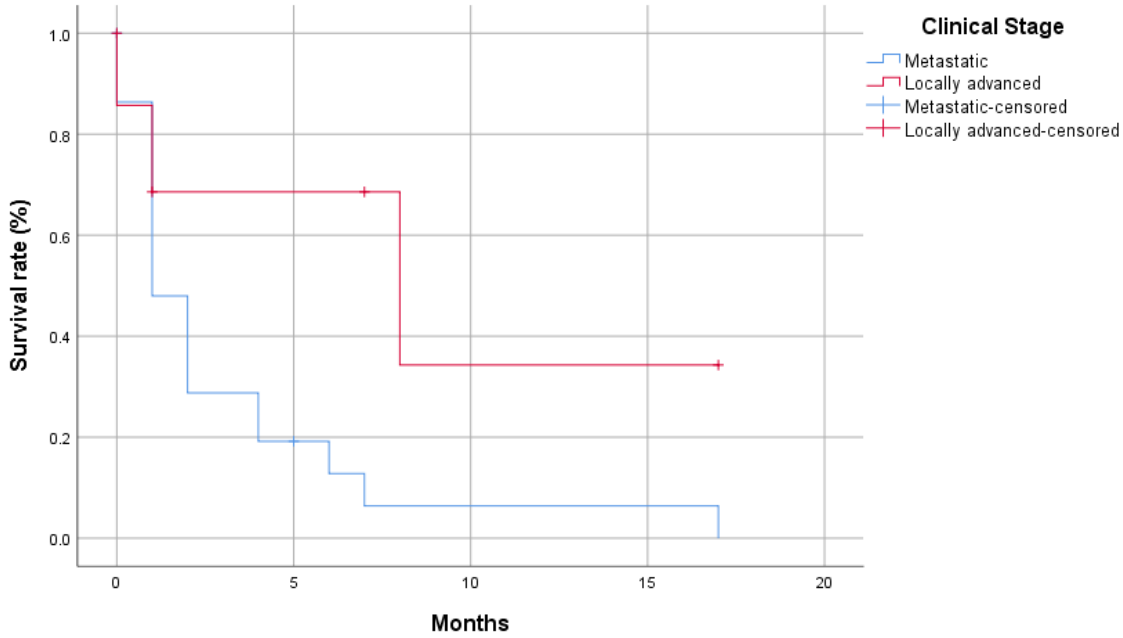

Figure 1. Overall survival after radiotherapy (OS-RT) according to clinical stage (p = 0.03)

RT Dose (Gy)	Median OS-RT (months)	95% CI	p-value
20 Gy	4.17	1.12 – 7.22	0.012
24 Gy	2.85	–	
25 Gy	1.90	1.76 – 2.04	
30 Gy	0.92	0.65 – 1.18	

Table 5. Overall survival according to hemostatic RT dose

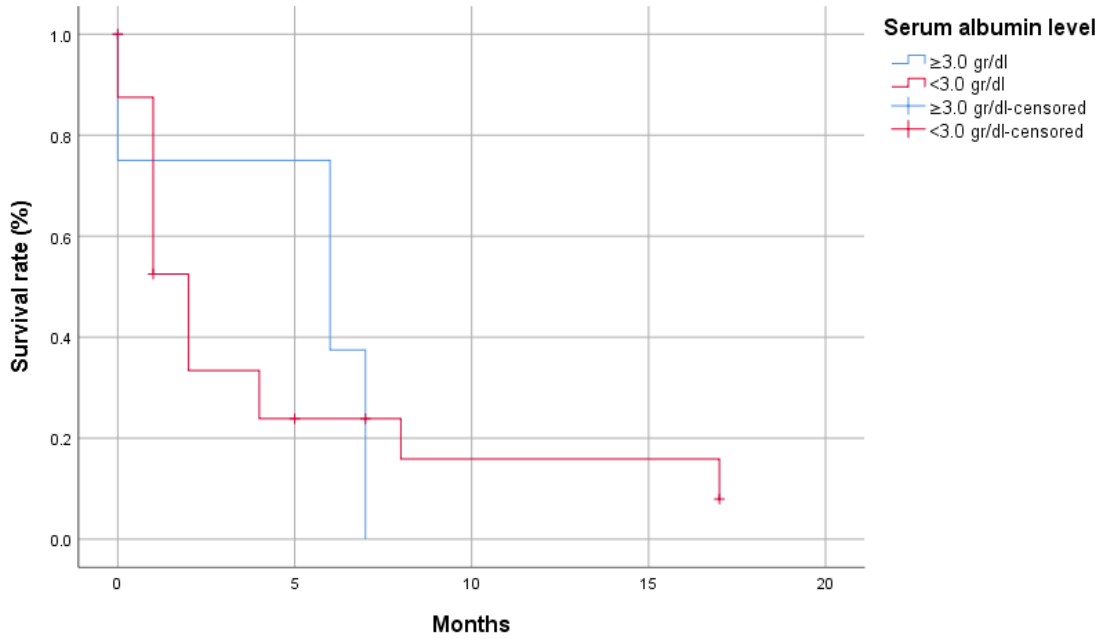

Figure 2. OS-RT according to serum albumin level (p = 0.04)

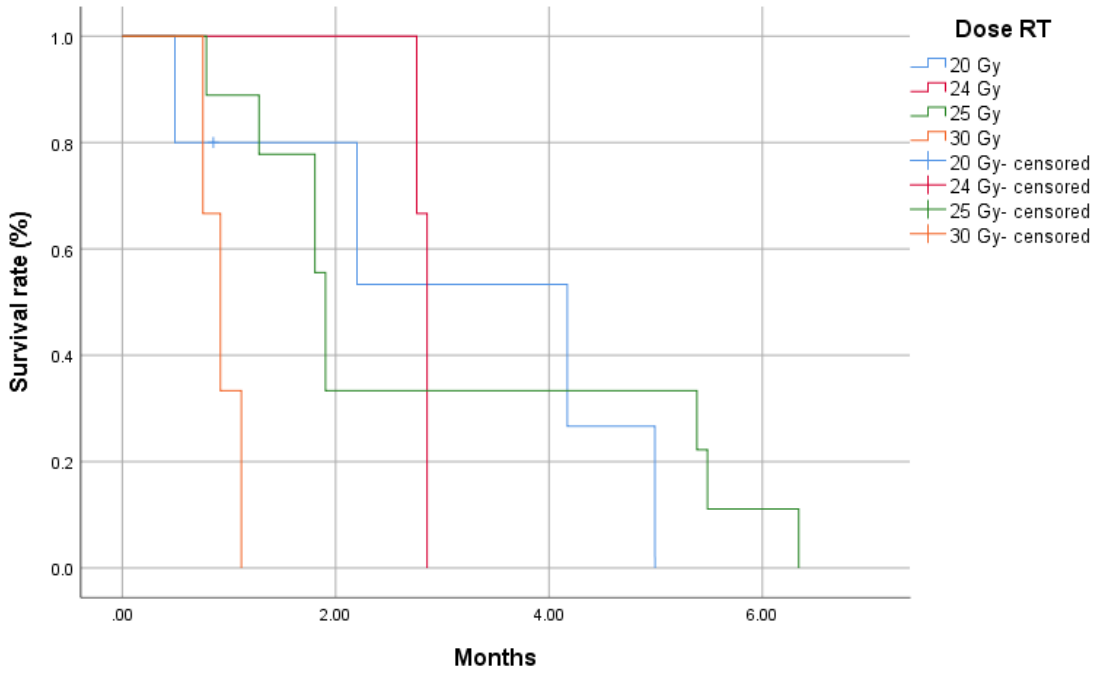

Figure 3. OS-RT according to RT dose (p = 0.012)

Discussion

In this retrospective series of patients with gastric cancer hospitalized due to tumor bleeding, hemostatic radiotherapy (RT) demonstrated a high bleeding control rate (86.8%) and a significant reduction in transfusion requirements, findings that support its role as an effective palliative strategy in this clinical setting. These results are consistent with international reports, in which bleeding control rates range between 50% and 89%, with favorable clinical responses in most patients treated with palliative RT (3–7). Bleeding resolution in nearly nine out of ten patients in our cohort confirms the immediate efficacy of RT in managing upper gastrointestinal bleeding associated with advanced gastric tumors. In the series by Kim et al., bleeding control was achieved in 88% of cases, with a median OS-RT of 3.7 months—comparable to the median OS observed in our study (3). In the present study, a significant association was observed between radiotherapy (RT) dose and OS-RT. Interestingly, patients receiving lower RT doses demonstrated longer OS-RT compared to those treated with higher doses. However, this finding should be interpreted cautiously, as it most likely reflects selection bias rather than a true dose–response relationship. Patients receiving higher doses may have had more advanced disease, worse performance status, or greater tumor burden, which could negatively impact survival outcomes. These findings align with previous reports suggesting that, in bleeding gastric cancer, the primary benefit of RT is symptomatic control rather than survival prolongation. Short-course regimens, such as 20–25 Gy delivered in 5 fractions, have been shown to achieve rapid hemostasis with minimal toxicity,

facilitating timely resumption of systemic therapy or hospital discharge. Similarly, Tey et al. reported hemostatic response rates of 80% using a 20 Gy in 5-fraction regimen, without significant toxicity (4). The rebleeding rate of 47% in the present analysis is comparable to that reported by Hashimoto et al., who documented recurrence in 35.2% of patients (6). In our cohort, the median time to recurrence was 66 days, suggesting that while RT achieves effective hemostatic control, the benefit may be temporary in patients with advanced disease and ongoing local progression. Regarding survival outcomes, the median OS of 3.41 months aligns with several studies reporting median survivals between 2.8 and 6.1 months following palliative RT (11,12). In subgroup analysis, patients with locally advanced disease had significantly longer OS compared with those with metastatic disease (6.75 vs. 3.01 months; p 0.03), consistent with findings from Yagi et al., who observed improved prognosis in patients with a lower metastatic burden (11).

Serum albumin level has emerged as a significant prognostic factor, with elevated albumin levels (≥3.0 g/dL) being associated with prolonged overall survival (6.3 vs. 3.6 months; p = 0.04). This finding corroborates existing evidence that nutritional and systemic status directly impact treatment tolerance and clinical outcomes. Takeda and Katano et al. have demonstrated that hypoalbuminemia, along with poor performance status, independently correlates with decreased survival following hemostatic radiotherapy (12,13). The predominant utilization of intensity-modulated radiotherapy (IMRT) (71.1%) in our series underscores the adoption of advanced radiotherapy techniques that enhance target conformality and spare adjacent organs from excessive dose exposure, without compromising hemostatic efficacy. While earlier studies primarily employed three-dimensional conformal radiotherapy (3D-CRT) techniques, the integration of IMRT may contribute to reduced gastrointestinal toxicity and improved treatment tolerance (5,8). Compared to other modalities, RT offers several logistical advantages: it can be administered on an outpatient basis or during hospitalization, is non-invasive, and achieves a rapid hemostatic response. In contrast, endoscopic or arterial embolization procedures may be constrained by tumor location or the patient's clinical condition (5,6,9). Despite these promising results, certain limitations must be acknowledged. The small sample size and retrospective design introduce potential biases in data collection and patient selection. Furthermore, acute and late RT-related adverse events were not systematically evaluated, although no severe toxicities were observed in clinical practice. Finally, the absence of a control group precludes direct comparison with other hemostatic modalities. Nevertheless, this study represents the first institutional experience at INCAN with hemostatic RT for gastric tumor bleeding, providing local evidence consistent with the international literature. Our findings reinforce the role of RT as an effective, low-risk, and rapidly acting palliative tool that improves hematologic parameters and facilitates the resumption of systemic therapy in more than 60% of patients.

Conclusion

Hemostatic radiotherapy constitutes an efficacious and safe palliative approach for managing tumor bleeding in patients with advanced gastric cancer. In this institutional series, bleeding resolution was achieved in approximately 87% of patients, accompanied by a significant reduction in transfusion requirements and an improvement in hematologic status. Nevertheless, the high rate of bleeding recurrence (47%) highlights the need to optimize fractionation schedules, enhance clinical follow-up, and explore combined strategies—endoscopic, pharmacologic, or systemic—to prolong hemostatic control. This study represents the first institutional experience of the National Cancer Institute of Mexico (INCAN) with hemostatic radiotherapy for gastric cancer, providing valuable evidence in a Latin American population. Future prospective and multicenter studies are warranted to confirm these findings, define optimal dose and fractionation schemes, and develop predictive models to guide personalized palliative radiotherapy in gastrointestinal tumors.

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