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Real-World Experience of Home-Based Care for Terminal Gastric Cancer: Prognostic Factors and Health Outcomes

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Abstract

With Japan's population steadily aging, delivering healthcare services at home has become increasingly vital. Nevertheless, only a small proportion of patients with terminal cancer actually receive end-of-life care in a home setting, and forecasting the prognosis for those with terminal-stage gastric cancer continues to be difficult. To examine real-world clinical data from patients with terminal gastric cancer who received end-of-life care at home, to offer practical insights into their management and health outcomes. A two-center retrospective study. The study included terminal gastric cancer patients who passed away at home between 2021 and 2024 in Japan. In total, 27 individuals (14 males and 13 females) participated, with a median age of 78 years. We first reviewed the complete clinical trajectories of these patients throughout their home care period. Next, we conducted a comparative analysis by splitting the cohort into two groups based on the median overall survival (OS).

The median OS while receiving home care was 22 days. Patients were categorized into a long OS group (OS-L) and a short OS group (OS-S). Strong opioid administration was documented in 22 patients, and home oxygen therapy was used by nine patients. In the OS-S group, the proportion of patients maintaining oral intake was markedly lower (25.0% vs. 66.7%, P = 0.032). Serum albumin levels also differed significantly between the groups (2.8 vs. 2.4 mg/dL, P = 0.038). Additionally, the neutrophil-to-lymphocyte ratio divided by albumin (NLR/albumin) was substantially elevated in the OS-S group relative to the OS-L group (1.0 vs. 2.3, P = 0.032). Oral intake status, serum albumin concentration, and the NLR/albumin ratio emerged as key prognostic indicators for patients with terminal gastric cancer receiving end-of-life care at home.

Keywords: Gastric cancer, Home-based care, Health outcomes, Prognostic factors

Introduction

Providing end-of-life care in the patient's own home is essential for improving overall outcomes and easing pressure on the broader healthcare system. Research has consistently shown that regular home visits can lower emergency department utilization and deliver critical assistance to patients who face barriers to hospital access [1]. Such care typically involves effective symptom control, psychological support, and basic medical interventions. Moreover, it tends to foster more positive views of the care experience among both family members and the surrounding community. Throughout the pandemic, home-based palliative services proved especially valuable for sustaining ongoing care, emotional support, and dignified end-of-life support [2]. For people diagnosed with terminal gastric cancer, home care offers the advantage of allowing them to remain in a familiar and comforting setting during their final days.

Gastric cancer ranks among the most frequent cancers in Japan [3], and numerous prognostic indicators have already been established [1, 4, 5]. That said, the majority of prior research has concentrated on end-stage gastric

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cancer prognosis in general or on predicting results following surgical procedures [1, 4, 5]. Consequently, relatively little is known about the survival outlook for terminal gastric cancer patients specifically managed with end-of-life care at home. The uncertainty surrounding prognosis is recognized as a significant source of distress for family caregivers [3, 6]. In addition, relatives often experience considerable emotional and physical strain while providing care, which may compromise the overall quality of the support they deliver. While certain tools—including the Palliative Prognostic Index (PPI), neutrophil-to-lymphocyte ratio (NLR), Prognostic Nutritional Index (PNI), and NLR/albumin (Alb) ratio—can offer partial direction [1, 5, 7, 8], reliable outcome prediction remains problematic, especially within home care contexts. Home-based care depends heavily on effective teamwork between healthcare professionals and families, underscoring the need for straightforward, reliable prognostic instruments. However, solid evidence on prognostic forecasting for terminal cancer patients in home end-of-life settings is still scarce.

The present study sought to help fill this knowledge gap by investigating factors linked to survival in terminal gastric cancer patients undergoing end-of-life care at home. Greater clarity on these factors could support more effective patient oversight and enhance the quality of end-of-life care.

Materials and Methods

Patients

This two-center retrospective analysis included individuals diagnosed with terminal gastric cancer who received care exclusively at home from January 2021 to June 2024 across Japan. All relevant information was extracted from electronic medical records. Eligibility required a confirmed terminal gastric cancer diagnosis, discontinuation or avoidance of curative interventions such as surgery, chemotherapy, or radiation therapy, age exceeding 18 years, and receipt of end-of-life support either at home or within assisted living facilities for seniors [9]. Cancer staging was performed according to the 8th edition of the Union for International Cancer Control classification [10]. Individuals moved to dedicated palliative care wards or inpatient hospital settings were not included.

Japan introduced its comprehensive medical insurance framework in 1961, ensuring universal coverage for all citizens through a combination of national and employment-based social insurance programs. This same system supports home-based medical services, enabling patients unable to travel to medical facilities to receive scheduled care in their homes or in suitable community-based settings if they prefer.

During data review for this investigation, patient-specific consent was not required because an opt-out procedure was in place. The study received ethics clearance from the Medical Governance Research Institute under reference MG2024-02. Every aspect of the research followed established ethical standards and regulatory requirements.

Treatment

Management decisions centered entirely on relieving symptoms and included prescribing strong opioids or commencing home oxygen therapy (HOT) whenever appropriate. No chemotherapy or radiation treatments occurred within the home environment. Care centered on comfort-focused end-of-life measures and symptom relief tailored to the needs of terminal gastric cancer patients, without any ongoing hospital-directed cancer therapies.

Evaluation and statistical analysis

We began by thoroughly reviewing the complete clinical pathways of terminal gastric cancer patients during their period of home-based end-of-life care. This encompassed their health status upon each visit, co-existing medical conditions, cancer stage at inclusion, utilization of strong opioids and HOT, plus laboratory blood results. Oral food consumption was categorized simply as either absent or reduced (moderate to severe). Laboratory blood draws were performed approximately 1 week before and 1 week after the onset of home care. To contrast brief versus extended home care experiences, the cohort was divided into two subgroups using the median survival duration as the cutoff. Variables examined included age, gender, disease stage, opioid administration, oxygen therapy, and laboratory findings. Neutrophil-to-lymphocyte ratio (NLR) was computed by dividing neutrophil count by lymphocyte count [7]. The NLR divided by albumin (NLR/Alb) used albumin concentration in mg/dL [5]. Prognostic Nutritional Index (PNI) followed the standard equation: 10 × albumin (mg/dL) + 0.005 × lymphocyte count [8]. Group comparisons used the Mann-Whitney U test for continuous measures and Pearson's chi-square test for categorical measures, with $P < 0.05$ considered statistically significant. Receiver operating characteristic (ROC) curves were used to determine sensitivity, specificity, and the area under the curve (AUC) for overall survival (OS). All calculations were executed with JMP software version 15 (SAS Institute, Cary, NC, USA).

Results and Discussion

Patient background and blood examination

Details on the 27 consecutive patients participating in the study are presented in **Table 1**. The median patient age was 78 years, ranging from 43 to 100. Within the group of 27, 14 males (51.9%) and 13 females (48.1%) were included. Median overall survival following palliative care initiation reached 22 days. Division into subgroups yielded 12 patients in the longer-survival category (surviving beyond 23 days; OS-L, representing 44.4%) and 15 patients in the shorter-survival category (surviving 22 days or fewer; OS-S, representing 55.6%). Nearly half the cohort displayed severely diminished oral intake (48.2%). Disease progression was the primary factor in 22 cases (81.5%) in deciding to start home care. The other five cases (18.5%) stemmed from advanced age or dementia-related issues. Strong opioid therapy occurred in 22 patients (81.5%), including continuous subcutaneous delivery in five of those instances (18.5%). Home oxygen therapy was implemented for 9 patients (33.3%), and in 8 of these cases (29.6%), it began only after home care had started.

Table 1. Background information of patients with terminal gastric cancer

Parameter	Value
Median age (min–max), years	78 (43–100)
Male/female sex	14 (51.9%) / 13 (48.1%)
Comorbidity	
Hypertension	10 (37.0%)
Hyperlipidemia	2 (7.4%)
Diabetes mellitus	2 (7.4%)
Dementia	7 (25.9%)
Place of death	
At home	26 (96.3%)
Serviced housing for older people	1 (3.7%)
Median overall survival at home (min–max), days	22 (0–406)
OS-long (OS-L)	12 (44.5%)
OS-short (OS-S)	15 (55.5%)
Condition at time of visit	
Performance status 1/2/3/4	8 (29.6%)/10 (37.0%)/7 (25.9%)/2 (7.4%)
Oral intake absence/moderate reduced/severely reduced	7 (25.9%)/7 (25.9%)/13 (48.2%)
Delirium	7 (25.9%)
Primary TNM stage	
Stage 1/2/3	8 (29.6%)
Stage 4	19 (70.3%)
Recurrence	3 (11.1%)
Histopathological classification	
Differentiated type	5 (18.5%)
Undifferentiated type	7 (25.9%)
ND (Not Determined)	15 (55.5%)
Metastasis	
Liver	9 (33.3%)
Lung	3 (11.1%)
Peritoneal dissemination	11 (40.7%)
Strong opioid usage	22 (81.5%)
Opioid type (max dose/day)	
Fentanyl transdermal (6 mg)	16 (59.3%)
Fentanyl buccal (100 mg)	1 (3.7%)
Oxycodone oral (5 mg)	1 (3.7%)
Hydromorphone oral (8 mg)	1 (3.7%)
Morphine suppository (30 mg)	1 (3.7%)
Rescue use only	1 (3.7%)
CSIs use only	1 (3.7%)
Opioid CSI	5 (18.5%)
CSI type (max dose/day)	

Oxycodone (84 mg)	3 (11.1%)
Morphine (192 mg)	2 (7.4%)
HOT (Home Oxygen Therapy)	9 (33.3%)
Median HOT usage period (min–max), days	13 (2–19)

Abbreviations: CSI = continuous subcutaneous injection; OS = overall survival; HOT = home oxygen therapy; ND = not described; TNM = tumor, node, metastasis.

The blood test information compiled in **Table 2** showed occasional gaps attributable to the investigation's retrospective nature.

Table 2. Blood examination data for patients with terminal gastric cancer

	Lack number	Median (min–max)
WBC (/uL)	0	7990 (2300–18,120)
Neutrophil (/uL)	1	5800 (1400–15,840)
Lymphocytes (/uL)	1	1625 (200–17600)
Alb (g/dL)	2	2.6 (1.5–3.9)
Cr (mg/dL)	2	0.76 (0.31–2.71)
T-bil (mg/dL)	1	0.5 (0.3–39)
AST (U/L)	1	26.5 (14–208)
ALT (U/L)	1	18.5 (8–97)
C-reactive protein (mg/dL)	5	2.6 (0.0–34.6)
NLR	1	2.8 (0.3–12.6)
PNI	2	35.5 (20.5–102.0)
NLR/Alb	3	1.5 (0.3–6.7)

Abbreviations: Alb = albumin; ALT = alanine aminotransferase; AST = aspartate aminotransferase; Cr = creatinine; NLR = neutrophil-to-lymphocyte ratio; PNI = prognostic nutritional index; T-bil = total bilirubin; WBC = white blood cells.

Association between OS and patient characteristics

No further meaningful connections emerged between overall survival (OS) and other clinical variables, including age, sex, gastric cancer stage, strong opioid use, or HOT **(Table 3)**. The OS-S group experienced a substantially smaller decline in oral intake compared with the OS-L group (25.0% vs. 66.7%, P = 0.032). Overall, these observations imply that the ability to maintain oral intake could affect survival duration.

Table 3. Comparison of patient characteristics in the overall survival groups

	P	OS-S (n = 15)	OS-L (n = 12)
Age (years)	0.070	72 (54–100)	84 (43–91)
Sex	0.343	Male 9 (33.3%)	Male 5 (18.5%)
Hypertension	0.040	3 (20.0%)	7 (58.3%)
Hyperlipidemia	0.100	0 (0%)	2 (16.7%)
Diabetes mellitus	0.870	1 (6.7%)	1 (8.3%)
Dementia	0.095	2 (13.3%)	5 (41.7%)
PS ≥ 3	0.411	6 (40.0%)	3 (25.0%)
Oral intake has been severely reduced	0.032	10 (66.7%)	3 (25.0%)
Delirium	0.922	4 (26.7%)	3 (25.0%)
OS	< 0.001	13 (0–22)	81 (28–406)
Stage IV	0.931	11 (75.3%)	8 (66.7%)
Distant metastasis at home care	0.438	13 (86.7%)	9 (75.0%)
Liver metastasis	0.411	6 (40.0%)	3 (25.0%)
Lung metastasis	0.681	2 (13.3%)	1 (8.3%)
Peritoneal dissemination	0.484	7 (46.7%)	4 (33.3%)
Opioid usage	1.000	12 (80.0%)	10 (83.3%)
Opioid CSI	1.000	3 (20.0%)	2 (16.7%)
HOT	1.000	5 (33.3%)	4 (33.3%)

Association between OS and blood examination

The relationship between overall survival and laboratory findings is summarized in **Table 4**. There were no statistically significant differences between the short- and long-survival groups in white blood cell count, kidney function, or liver function. C-reactive protein, an indicator of systemic inflammation, likewise showed no notable variation. Standard prognostic markers in oncology, such as the neutrophil-to-lymphocyte ratio (NLR) and prognostic nutritional index (PNI), also failed to differ significantly. In contrast, serum albumin (Alb), which reflects nutritional condition, was considerably reduced in the OS-S group relative to the OS-L group (2.8 mg/dL vs. 2.4 mg/dL, P = 0.038). Furthermore, the NLR/Alb ratio was markedly elevated in the OS-S group (1.0 vs. 2.3, P = 0.032). When Alb was assessed at a cutoff below 2.4 mg/dL, it yielded an AUC of 0.744, with 54% sensitivity and 62.9% specificity. For the NLR/Alb ratio, a cutoff above 2.2 yielded an AUC of 0.757, with 58.3% sensitivity and 50.0% specificity.

Table 4. Comparison of blood examination results in the overall survival groups

	P	OS-S (n = 15)	OS-L (n = 12)
WBC (/uL)	0.903	7990 (2300–18120)	8135 (4500–14300)
Neutrophil (/uL)	0.700	5832 (1400–15840)	5800 (2500–9500)
Lymphocytes (/uL)	0.411	1219 (200–17600)	1958 (700–5700)
Alb (g/dL)	0.038	2.4 (1.5–3.2)	2.8 (2.2–3.9)
Cr (mg/dL)	0.355	0.92 (0.42–2.64)	0.70 (0.31–2.71)
T-bil (mg/dL)	0.131	0.7 (0.3–39)	0.4 (0.3–1.4)
AST (U/L)	0.520	28 (15–208)	25 (14–87)
ALT (U/L)	0.063	20 (10–97)	12 (8–43)
C-reactive protein (mg/dL)	0.5310	3.6 (0–34.6)	2.1 (0.1–19.7)
NLR	0.440	5.5 (0.3–12.5)	2.7 (1.3–12.6)
PNI	0.057	33.1 (20.5–102.0)	36.9 (32.5–56.0)
NLR/Alb	0.0327	2.3 (0.3–6.7)	1.0 (0.4–4.3)

This investigation utilized real-world clinical information from individuals with advanced gastric cancer who were provided end-of-life support in a home setting. The data revealed substantial differences in overall survival times, including cases of very brief survival. When the short-survival and long-survival subgroups were compared, clear links were observed with serum albumin concentration and the NLR/Alb ratio. These results suggest that albumin levels, along with routine blood cell parameters, may assist clinicians in forecasting prognosis for patients with terminal gastric cancer receiving home care.

Japan records approximately 50,000 deaths from gastric cancer every year, positioning the disease as the second leading cause of cancer mortality [3]. Even so, survival expectations for those managed at home remain poorly characterized. This situation illustrates a notable mismatch between the large number of gastric cancer fatalities and the relatively infrequent adoption of home-based terminal care. Within our cohort, the maximum duration of home care extended to 406 days, while the minimum was 0 days. Evidence indicates that extremely short survival can erode confidence in home care services and intensify emotional distress for both patients and families [6], underscoring the value of precise prognostic tools in fostering better communication and trust with healthcare teams. Many traditional Japanese residences feature stairs and split-level floors, which often require installing handrails or undertaking major renovations to ensure safe, comfortable end-of-life living at home. Such modifications, however, generally demand considerable time to complete. Consequently, patients facing a very limited life expectancy may derive little practical benefit even when official support is offered.

Additionally, Japan's ongoing demographic shift toward an older population, combined with the growing prevalence of nuclear families, means that home-based end-of-life care cannot rely solely on physician and nursing visits; it also requires active participation from case managers and other administrative resources. Developing a well-coordinated multidisciplinary team is a time-intensive process, which is why reliable prognosis estimation is essential for effective planning and resource allocation. Accordingly, the present work specifically examined prognostic factors in terminal gastric cancer patients under home end-of-life care by reviewing demographic details and blood test data.

In our analysis, patient age showed no correlation with prognosis (84 vs. 72 years, P = 0.070). Some earlier investigations have reported that younger individuals with gastric cancer more commonly exhibit poorly differentiated histology and later-stage disease [11]. In contrast, other studies conclude that age has minimal independent influence on outcomes after curative surgery [12]. Hypertension as a comorbidity appeared more commonly in the longer-survival group (25.9% vs. 11.1%, P = 0.040). Confirmation of these patterns will require future research involving larger patient populations. Patients who presented with a more substantial reduction in oral intake upon the first home visit were found to have inferior survival prospects. Oral intake capacity proved to be a relevant prognostic element in this cohort and has previously been integrated into the Prognostic Palliative

Index (PPI) [13]. Research has confirmed that people with terminal cancer can often continue taking small oral amounts almost until the final moments [8]. Therefore, tracking shifts in oral intake represents a potentially valuable approach for estimating prognosis among terminal gastric cancer patients managed with home-based palliative care.

HOT and strong opioids play essential roles in end-of-life care for individuals with terminal cancer, helping to relieve symptoms such as pain and breathing difficulties. In the current study, HOT was administered to 33.3% of the patients, a rate that is considerably higher than the less than 10% reported in earlier research involving terminal cancer patients in home care environments [14]. Previous work has linked HOT to conditions including lung cancer, reduced performance status, and ascites, all of which increase the risk of dyspnea in terminal cancer cases [15]. Regarding opioid use, 85.2% of patients in this study received opioids, which aligns closely with prior findings showing approximately 88% usage among terminal cancer patients in hospital settings [16]. Morita *et al*. [16] noted that opioid needs are affected by elements such as bone metastases, patient age, and brain metastases, factors that also require attention in home care. Sumimoto *et al*. [17] described risk factors for refractory cancer pain in terminal patients as including younger age, respiratory cancers, and prior opioid rotations. In our cohort, transdermal fentanyl was the preferred option in the majority of cases (59.3%). This preference likely stems from the challenges with oral intake commonly caused by advanced gastric cancer. Ultimately, clinicians delivering home-based care must possess a detailed understanding of each patient's specific clinical picture to guide appropriate decisions on opioid therapy and HOT. Personalized care plans tailored to individual symptoms and co-existing conditions can enhance the effectiveness of palliative support and elevate the overall quality of life for patients with terminal cancer managed at home.

This study identified a statistically significant difference in serum albumin (Alb) levels between the longer-survival (OS-L) and shorter-survival (OS-S) groups. Although earlier investigations have emphasized indices such as the prognostic nutritional index (PNI) and neutrophil-to-lymphocyte ratio (NLR) as important prognostic tools in cancer [6, 7], no such differences appeared in our analysis. Serum albumin, a straightforward and widely recognized nutritional marker, offers practical value for everyday clinical decision-making. Reduced serum albumin concentrations have consistently been tied to worse outcomes, with large-scale studies indicating a higher mortality risk when levels drop below 4.2 g/dL at the time of diagnosis [18]. Among patients with stage III/IV gastric cancer, serum albumin values were markedly lower than in early-stage disease, with a commonly cited cutoff of 4.0 g/dL [19]. These observations imply that serum albumin mirrors disease advancement in gastric cancer and could serve as a helpful predictor of prognosis for those receiving end-of-life care in a home setting. In addition, the NLR/Alb ratio emerged as an indicator of poorer prognosis in patients with end-stage gastric cancer under home-based end-of-life care. By combining immune and nutritional information, the NLR/Alb ratio helps reduce potential confounding related to patients' nutritional and immune conditions [5]. While this ratio has been recognized as a prognostic factor following curative surgery for gastric cancer [5], no prior reports have examined its utility for predicting survival in terminal gastric cancer patients receiving home palliative care. The PNI, derived from albumin and lymphocyte counts, has been established as a reliable prognostic marker in multiple studies [8]. Kanda *et al*. [8] found that a PNI cutoff of 45 was associated with overall survival in pancreatic cancer. Oyama *et al*. [4] further observed that shorter expected survival correlated with progressively lower PNI cutoff values. Such patterns may result from advancing gastric cancer, which tends to decrease both albumin levels and lymphocyte counts, thereby altering PNI. In the present study, the median PNI was 35.5, indicating that physicians providing home care should recognize that the most relevant PNI threshold shifts as gastric cancer progresses. Nevertheless, no prognostic association with PNI was detected in this analysis. Additional research involving larger patient groups will be required to validate the usefulness of these markers specifically within home-based end-of-life care.

This study has several limitations. Its retrospective design and the relatively small sample drawn from only two institutions restrict the depth of statistical evaluation. Plans are underway to expand the number of participating home clinics, thereby increasing the total number of cases in future work. Furthermore, incomplete blood examination records hindered a full assessment of laboratory parameters. Histological information was unavailable for 55.5% of the cases, preventing any analysis of tumor histology. Hospital-based physicians are encouraged to supply comprehensive clinical data to support accurate prognostic estimation, while home care clinicians should consider ordering blood tests when essential information is lacking.

Conclusion

Our results indicate that oral intake capacity, along with serum albumin levels and routine blood cell counts, may serve as practical prognostic markers for patients with terminal gastric cancer who are receiving end-of-life care at home. Close attention to nutritional status appears important for optimizing the management of home-based end-of-life care in gastric cancer, potentially leading to more effective support strategies for terminally ill individuals.

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Ethics statement: The authors are accountable for all aspects of this work and ensure that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. This study was conducted in accordance with the Declaration of Helsinki (2013 revision). Regarding data analysis in this study, participant consent was waived using an opt-out method. Approval for this study was obtained from the Medical Governance Research Institute (MG2024-02). All methods were performed in accordance with the relevant guidelines and regulations.

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