Asian Journal of Current Research in Clinical Cancer
ISSN: 3062-4444
2025, Volume 5, Issue 2, Page No: 150-157

Available online at: www.galaxypub.co/page/journals

Galaxy Publication

Galaxy Publication

Elevated Baseline NT-proBNP Identifies Poor Prognosis in Frail Gastroesophageal Cancer: GO2 Post-Hoc Analysis

D. Rexhepi[1*], A. Krasniqi[1], L. Gashi[1]

[1]Department of Medical Oncology, Faculty of Medicine, University of Pristina, Pristina, Kosovo.

***E-mail** ✉ pristina.medonc.74@yahoo.com

Received: 19 August 2025; **Revised:** 21 November 2025; **Accepted:** 23 November 2025

ABSTRACT

More effective prognostic indicators are required for managing malignancy in older adults. Previous research has connected N-terminal pro-B-type Natriuretic Peptide (NT-proBNP) with sarcopenia, a condition linked to decreased cancer survival, yet data on baseline NT-proBNP as a marker of cancer outcome are scarce. The GO2 clinical trial involved elderly or frail patients in the United Kingdom (UK) with advanced gastroesophageal tumors and explored reduced-dose chemotherapy. Using data from this study, we examined whether NT-proBNP could predict outcomes and whether its effect was influenced by frailty. This work represents a secondary analysis of an already completed clinical study. Frailty was determined through Eastern Cooperative Oncology Group (ECOG) performance status (PS) and the GO2 frailty index, which encompassed nine geriatric areas. A corrected NT-proBNP (cBNP) value was obtained for each participant, standardized to the local laboratory upper limit of normal (ULN). A total of 241 participants were assessed. Median age was 76 years (range 52–89); 187 (77.6%) were men, and 211 (87.6%) had adenocarcinoma. At study entry, 80 (33.2%) had NT-proBNP above the ULN. No significant link was found between cBNP and ECOG PS ($p = 0.36$) or the GO2 frailty classification ($p = 0.58$). Individuals in the highest cBNP group ($n = 59$) showed poorer median overall survival of 5.3 months, compared with 6.8 months for the medium group ($n = 120$) and 8.2 months for the lowest group ($n = 61$); HR 1.57 (95% CI, 1.04–2.37), $p = 0.031$. This remained significant in multivariate Cox regression (HR 1.69, $p = 0.01$) after adjusting for GO2 stratification parameters. No substantial interaction between NT-proBNP and frailty was detected. Baseline NT-proBNP appeared to independently predict outcome in older patients with advanced gastroesophageal cancer. Further prospective validation is needed to confirm these findings and to explore whether cardioprotective management may benefit individuals identified with elevated NT-proBNP levels.

Keywords: Gastroesophageal neoplasms, Aging, Frailty, Sarcopenia, Biomarkers

How to Cite This Article: Rexhepi D, Krasniqi A, Gashi L. Elevated Baseline NT-proBNP Identifies Poor Prognosis in Frail Gastroesophageal Cancer: GO2 Post-Hoc Analysis. Asian J Curr Res Clin Cancer. 2025;5(2):150-7. https://doi.org/10.51847/QmwOykJ0u1

Introduction

Gastroesophageal cancer remains one of the leading causes of cancer mortality globally, accounting for around 1.3 million deaths each year [1]. For those diagnosed with advanced, biomarker-negative disease, median survival is typically below one year [2]. Although newer targeted therapies have emerged, cytotoxic chemotherapy continues to serve as the primary treatment for advanced gastroesophageal (aGO) cancer [3].

In the UK, most patients with aGO cancer are older than 70 at the time of diagnosis [4]. Advancing age brings a higher burden of comorbidities and functional impairments across geriatric domains, often resulting in frailty [5, 6]. These age-related factors complicate clinical decision-making and contribute to suboptimal treatment outcomes [7].

Older adults with malignancy frequently have different care priorities compared with younger individuals enrolled in conventional trials, often valuing cognitive preservation, autonomy, and physical function more highly than overall survival [8, 9]. Consequently, identifying objective prognostic markers that can assist in discussions around care goals and therapy choices in this population is essential.

Reduced food intake—a common symptom of aGO cancer—combined with lower physical activity, promotes sarcopenia. Sarcopenia, alongside malnutrition and cancer-related cachexia, has been recognized as an independent adverse prognostic factor in numerous cancers, including gastroesophageal disease [10, 11]. Evidence also supports a physiological link between skeletal muscle health and cardiac function, often described as the "muscle hypothesis" [12].

A cardiac biomarker frequently used to assess heart failure is NT-proBNP, the inactive cleavage fragment of proBNP. ProBNP splits into biologically active BNP, released in response to volume expansion and ventricular strain, and NT-proBNP, which serves as an indicator of cardiac stress. Higher NT-proBNP levels correlate with myocardial strain and worse outcomes in cardiovascular disorders [13].

Elevated NT-proBNP concentrations have been noted in individuals with sarcopenia [14] and in those with heart failure, where inverse associations between muscle mass and peptide levels have been described [15]. Although both sarcopenia and NT-proBNP predict outcomes in heart and systemic diseases [16, 17], their relationship within cancer remains poorly defined. NT-proBNP elevation has been observed in cancer even in the absence of overt cardiac dysfunction [18].

The GO2 trial assessed reduced chemotherapy intensity in older or frail patients with advanced gastroesophageal cancer [19]. Lower-dose capecitabine/oxaliplatin (60% of the standard regimen) achieved similar survival to full-dose therapy, with improved overall treatment utility—a composite measure balancing efficacy, toxicity, and patient-reported wellbeing.

The GO2 population, characterized by age and frailty, is more reflective of real-world practice than typical clinical trial groups. Comprehensive baseline data, including frailty scoring and NT-proBNP testing, provided an opportunity to evaluate NT-proBNP as a prognostic indicator and explore its interaction with frailty.

This secondary investigation aimed to determine whether baseline NT-proBNP levels predicted survival among GO2 participants and whether NT-proBNP correlated with frailty status. We anticipated that patients with higher NT-proBNP at baseline would exhibit reduced overall survival while receiving systemic chemotherapy.

Materials and Methods

Study population

The GO2 trial (ISRCTN44687907) enrolled 559 participants, each of whom underwent detailed baseline evaluations. These assessments included blood sampling (with NT-proBNP measured optionally) and a broad clinical review encompassing several geriatric domains. Using this information, a GO2 frailty index was established, classifying patients as non-frail (deficits in 0–1 domains), mildly frail (deficits in 2 domains), or severely frail (deficits in 3 or more domains).

For inclusion in the current retrospective study, patients needed to meet three conditions:

1. availability of baseline NT-proBNP measurements;
2. receipt of at least one chemotherapy cycle within the GO2 protocol;
3. complete baseline information for ECOG performance status (PS) and/or GO2 frailty score.

Measurement of NT-proBNP

NT-proBNP levels were obtained prior to chemotherapy initiation. Local hospital laboratories performed analyses, and values were reported in picograms per millilitre (pg/mL) with reference to each site's upper limit of normal (ULN).

To normalise data, a corrected NT-proBNP (cBNP) was derived by dividing the NT-proBNP concentration by the local ULN. A cBNP value above 1.0 indicated abnormality.

For further analysis, participants were grouped as normal vs. raised cBNP and also into low (the lowest quartile), middle (25–75th percentile), and high (the upper quartile) categories.

Statistical procedures

The principal endpoint was overall survival (OS), defined from the time of randomisation in GO2 until death from any cause. Follow-up continued to 12 months or to the last contact date.

Kaplan–Meier plots were used to visualise OS by cBNP group, and comparisons were made with the log-rank test.

Hazard ratios (HRs) and 95% confidence intervals (CIs) were estimated via Cox proportional hazards models. Adjustments were made for stratification variables from GO2, including age, sex, ECOG PS, chemotherapy dose, metastatic status, and cBNP classification. Sensitivity testing explored possible interactions between frailty and cBNP to evaluate consistency across frailty strata.

All tests were two-tailed, considering $p < 0.05$ as statistically significant. Analyses were performed using R version 4.0.2 (R Foundation for Statistical Computing, Vienna, Austria).

Results and Discussion

Baseline characteristics

Of the original cohort, 241 individuals who received chemotherapy and had available baseline NT-proBNP were analysed. Full demographics appear in **Table 1**. The median age was 76 years (range 52–89), 77.6% (n = 187) were men, and 87.6% had adenocarcinoma. The majority showed ECOG PS 1 (53.1%), and 79.7% exhibited ≥2 deficits in geriatric evaluation. The analysed sample closely reflected the overall GO2 study group.

Although comorbidity data were missing for many, among the included participants, 123 (51%) could not finish the timed up-and-go test in under 10 seconds, 172 (71.4%) were taking five or more medications, and 11 (4.6%) reported two or more falls within six months before enrolment.

Table 1. Participant demographics and baseline clinical data (n = 241).

Characteristic	Value
Age, years (median, range)	76 (52–89)
Sex, n (%)	
Male	187 (77.6%)
Female	54 (22.4%)
Histology, n (%)	
Adenocarcinoma	211 (87.6%)
Squamous	30 (12.4%)
Metastases	
Not present	73 (30.3%)
Present	168 (69.7%)
ECOG Performance Status, n (%)	
0	33 (13.7%)
1	128 (53.1%)
2+	80 (33.2%)
Albumin	
>35 g/dL	148 (61.4%)
<35 g/dL	92 (38.2%)
Haemoglobin (g/dL)	12.1 (6.6–18.0)
GO2 Frailty Grouping	
No frailty (Deficit in zero to one domain)	49 (20.3%)
Mild frailty (Deficit in two domains)	57 (23.7%)
Severe frailty (Deficit in three or more domains)	135 (56.0%)
Corrected NT-proBNP Levels, n (%)	
Elevated	80 (33.2%)
Normal	161 (66.8%)

Overall Survival

Across the analysed sample, median overall survival (mOS) was 7.1 months (95% CI: 6.2–7.9). By treatment intensity, mOS reached 7.9 months (95% CI: 6.7–10.4) at Dose Level A (100% OX), 5.4 months (95% CI: 4.5–8.2) at Dose Level B (80% OX), and 7.1 months (95% CI: 5.8–8.1) at Dose Level C (60% OX).

Reduced-intensity chemotherapy (60% OX, now adopted as routine practice) achieved non-inferior survival compared with full-dose (HR 1.21; 95% CI: 0.84–1.74; p = 0.3), consistent with the parent GO2 findings.
Improved ECOG PS correlated with longer survival, though not significantly: mOS 7.9, 7.5, and 5.8 months for PS 0, 1, and ≥2, respectively. Increasing frailty corresponded to declining outcomes, with mOS 9.4, 8.2, and 5.8 months in non-frail, mildly frail, and severely frail patients. For severe frailty, HR 2.05 (95% CI: 1.38–3.04; p < 0.001) was observed.

NT-proBNP, survival, and frailty

Among the 241 individuals analysed, 80 (33.2%) exhibited NT-proBNP values exceeding the local ULN **(Table 1)**. Elevated cBNP at baseline correlated with worse outcomes **(Figure 1)**, showing mOS 5.2 vs. 7.9 months (HR 1.57; 95% CI: 1.16–2.13; p = 0.004).
When examined by degree of elevation, survival differed significantly across cBNP tertiles: the highest group had mOS 5.3 months, the intermediate group 6.8 months, and the lowest group 8.2 months (HR 1.57; 95% CI: 1.04–2.37; p = 0.031) **(Figure 2)**. After controlling for GO2 stratification factors and albumin, this remained significant (HR 1.69; 95% CI: 1.11–2.57; p = 0.01) **(Figure 3)**.

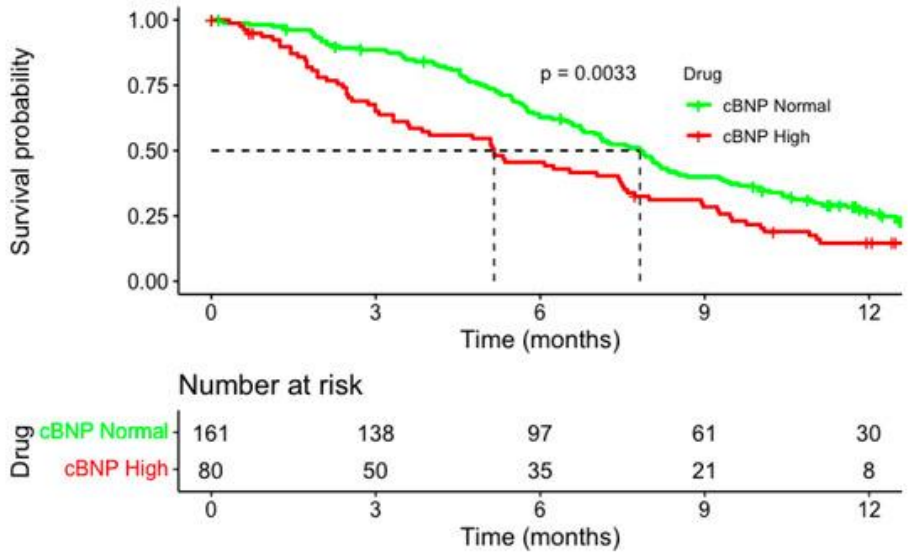

Figure 1. Kaplan–Meier curves for OS comparing normal (green) and high (red) corrected NT-proBNP.

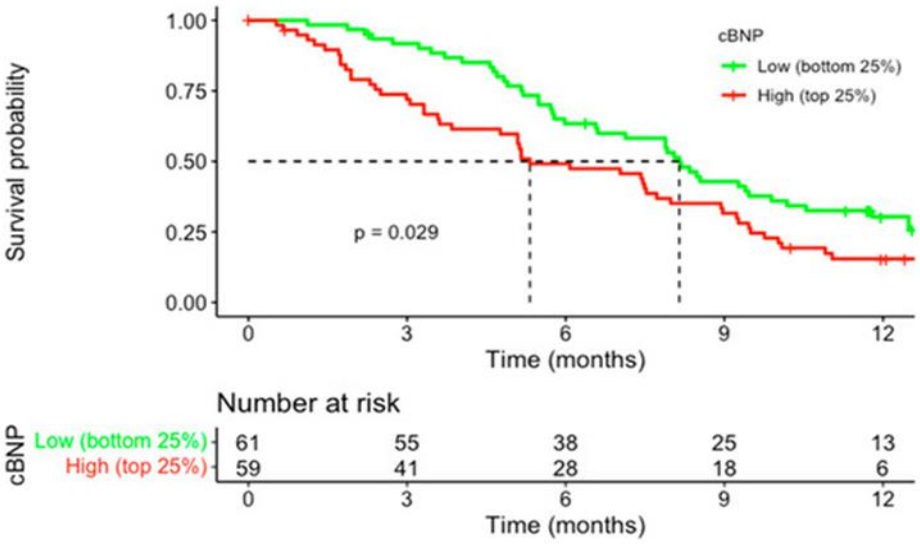

Figure 2. Kaplan–Meier curves illustrating OS by low (lowest quartile, green) and high (upper quartile, red) cBNP categories.

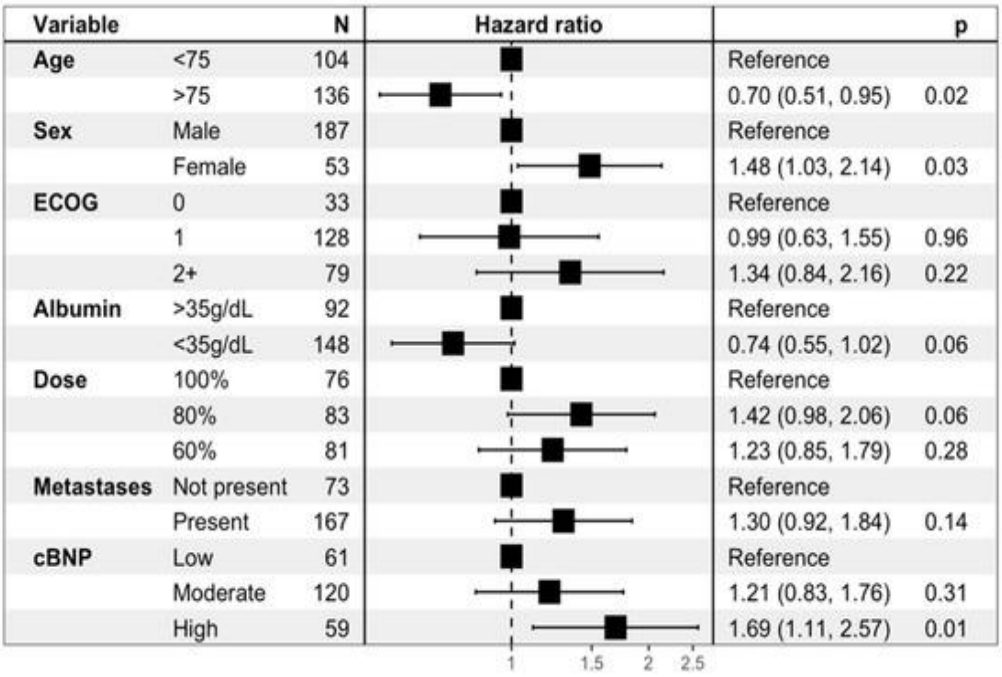

Figure 3. Forest plot of HRs for OS by baseline characteristics and cBNP group, with 95% CIs.

No meaningful differences in cBNP were seen between age categories (<75 vs. >75 years; p = 0.885) or ECOG PS (p = 0.522) **(Table 2)**. Although a modest upward trend of cBNP with higher frailty was observed, this was statistically insignificant (p = 0.706). Likewise, evaluating chemotherapy dose by baseline BNP revealed no dose-dependent differences in outcome for either normal or elevated cBNP.

Table 2. Corrected BNP (cBNP) shown as median (range) across age groups, ECOG PS, and GO2 frailty classes.

Group	Baseline cBNP (Median, Range)	p-Value
Age Group		
<75 (n = 104)	0.65 (0.03, 10.3)	0.885
≥75 (n = 136)	0.70 (<0.005, 9.29)	
ECOG PS		
0 (n = 33)	0.84 (0.09, 6.89)	0.522
1 (n = 128)	0.59 (<0.005, 7.24)	
2+ (n = 79)	0.71 (0.03, 10.3)	
GO2 Frailty Group		
No frailty (n = 49)	0.53 (0.09, 7.70)	0.706
Mild frailty (n = 58)	0.65 (<0.005, 9.29)	
Severe frailty (n = 134)	0.73 (0.033, 10.3)	

Globally, the incidence of cancer in the elderly population continues to rise [20]. However, older individuals commonly seen in everyday clinical settings differ markedly from those typically enrolled in standard clinical trials, often presenting with greater levels of frailty and multiple comorbidities [21]. This discrepancy forces clinicians to rely on extrapolated trial data, which may risk under- or over-treating older adults with malignancy [22]. Such mismatches can translate into inferior outcomes, heightened treatment-related toxicity, diminished quality of life, and shorter survival. Therefore, identifying reliable prognostic biomarkers is essential to enhance shared decision-making and support more individualised care. This need is especially pressing for patients with advanced gastroesophageal (aGO) cancer, given their heavy symptom burden, treatment toxicity, and generally poor survival rates [19, 23].

Because of the recognised association between skeletal muscle condition (a marker of sarcopenia, known to predict survival in cancer) and cardiac function, we examined whether baseline NT-proBNP, a cardiac biomarker,

might predict prognosis in older or frail individuals with advanced GO malignancy. Participants in this post-trial analysis were highly representative of real-world cases—median age 76 years, mainly with ECOG PS 1, and ≥2 geriatric deficits [24, 25].

Our analysis revealed that, even in the absence of documented cardiovascular disease, around one-third of patients presented with elevated NT-proBNP levels before treatment initiation. When survival outcomes were compared, higher baseline NT-proBNP was strongly associated with shorter overall survival. Individuals in the top 25% of corrected NT-proBNP (cBNP) values experienced the poorest prognosis, living almost three months less than those in the lowest quartile. This difference persisted after adjustment for major confounders (HR = 1.67, p = 0.016).

These findings imply that both the presence and degree of NT-proBNP elevation correlate with adverse survival in patients undergoing chemotherapy for advanced GO cancer. Similar prognostic associations have been described in other chronic illnesses [26, 27] and even within oncologic supportive care contexts [28], suggesting that NT-proBNP could serve as a valuable prognostic biomarker deserving further study.

A potential explanation involves sarcopenia, which contributes to frailty and independently predicts outcomes in cancer. Elevated NT-proBNP may thus mirror not only cardiac stress but also systemic physiological decline, reflecting the intertwined effects of frailty, muscle wasting, and reduced reserve in older adults [29]. Consequently, NT-proBNP may have utility for risk stratification, integrating oncologic and cardiometabolic aspects of vulnerability.

Nevertheless, our data did not show a significant relationship between cBNP levels and either ECOG PS or GO2 frailty grouping. The lack of association could result from population heterogeneity or the limited resolution of these categorical frailty measures, which may fail to capture subtle biological variability.

Even so, serum NT-proBNP may contribute distinct prognostic information beyond what conventional frailty scales provide. Clinicians often rely on ECOG PS or the Rockwood Clinical Frailty Scale to estimate fitness for therapy, yet these instruments can overlook the multifaceted nature of age-related decline and multimorbidity [30]. As a biomarker that reflects cardiovascular strain, NT-proBNP could supplement these measures, promoting a more individualised therapeutic strategy. For example, a patient with markedly elevated NT-proBNP might be considered for dose-reduced chemotherapy or even supportive care alone, aiming to balance benefit and tolerability.

While preliminary, our observations raise biologically intriguing questions about why NT-proBNP elevation predicts survival. It may signify a confluence of sarcopenia, systemic inflammation, and cachexia, all known to affect outcomes in older adults with cancer. Future research should explore these mechanisms and evaluate whether NT-proBNP-based screening can help identify patients who would benefit from prehabilitation, cardioprotective therapy, or tailored chemotherapy regimens.

This study's key strength lies in its post-hoc analysis of a completed randomised trial, ensuring robust baseline and longitudinal data. The large sample size and concurrent frailty assessments enabled an in-depth examination of NT-proBNP's prognostic value. Moreover, the cohort reflects the real-world older/frail population seen in practice, enhancing the clinical relevance of our findings. To our knowledge, this is among the first investigations evaluating NT-proBNP as a prognostic marker specifically in aGO cancer, underscoring its novelty.

Despite these advantages, several limitations must be acknowledged. NT-proBNP was measured only at baseline, so temporal changes during therapy were not captured. Ongoing monitoring might provide insights into disease trajectory and treatment response. Additionally, due to the absence of formal sarcopenia assessment, a detailed analysis of the interplay among frailty, muscle mass, NT-proBNP, and survival could not be performed. Finally, although the cohort mirrors an older and frailer population, results may not extend to younger or fitter individuals with aGO cancer, necessitating external validation.

Conclusion

In conclusion, this study demonstrates that NT-proBNP serves as an independent prognostic indicator in elderly and/or frail patients with advanced gastroesophageal cancer. Incorporating NT-proBNP testing into clinical evaluation may enable more refined patient selection and better-informed treatment decisions. Further studies are needed to verify these findings and define NT-proBNP's role in oncologic management. Should its prognostic utility be confirmed, it could support research into cardioprotective strategies—for example, incorporating ACE inhibitors or beta-blockers alongside standard cancer therapy.

Acknowledgments: None

Conflict of Interest: None

Financial Support: None

Ethics Statement: None

References

1. Bray F, Ferlay J, Soerjomataram I, Siegel RL, Torre LA, Jemal A. Global cancer statistics 2018: GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers in 185 countries. CA Cancer J Clin. 2018;68(6):394–424.
2. Cunningham D, Starling N, Rao S, Iveson T, Nicolson M, Coxon F, et al. Capecitabine and oxaliplatin for advanced esophagogastric cancer. N Engl J Med. 2008;358(1):36–46.
3. Lordick F, Carneiro F, Cascinu S, Fleitas T, Haustermans K, Piessen G, et al. Gastric cancer: ESMO Clinical Practice Guideline for diagnosis, treatment and follow-up. Ann Oncol. 2022;33(10):1005–20.
4. National Oesophago-Gastric Cancer Audit. National Oesophago-Gastric Cancer Audit: State of the Nation Report. London: National Oesophago-Gastric Cancer Audit; 2025.
5. Handforth C, Clegg A, Young C, Simpkins S, Seymour MT, Selby PJ, et al. The prevalence and outcomes of frailty in older cancer patients: A systematic review. Ann Oncol. 2015;26(6):1091–101.
6. Barnett K, Mercer SW, Norbury M, Watt G, Wyke S, Guthrie B, et al. Epidemiology of multimorbidity and implications for health care, research, and medical education: A cross-sectional study. Lancet. 2012;380(9836):37–43.
7. Crowder SL, Hoogland AI, Small BJ, Carpenter KM, Fischer SM, Li D, et al. Associations among frailty and quality of life in older patients with cancer treated with chemotherapy. J Geriatr Oncol. 2022;13(7):1149–55.
8. Soto Perez De Celis E, Li D, Sun CL, Kim H, Twardowski P, Fakih M, et al. Patient-defined goals and preferences among older adults with cancer starting chemotherapy. J Clin Oncol. 2018;36(15_suppl):10009.
9. Mac Eochagain C, Barrell A, Murphy J, Pattwell M, Cumming J, Slavova-Boneva V, et al. "What matters to you?" Patient-reported treatment goals in geriatric oncology: A cross-sectional survey. J Geriatr Oncol. 2024;15:101641.
10. Anjanappa M, Corden M, Green A, Roberts D, Hoskin P, McWilliam A, et al. Sarcopenia in cancer: Risking more than muscle loss. Tech Innov Patient Support Radiat Oncol. 2020;16:50–7.
11. Yule MS, Brown LR, Waller R, Wigmore SJ. Cancer cachexia. BMJ. 2024;387:e080040.
12. Coats AJ. The "muscle hypothesis" of chronic heart failure. J Mol Cell Cardiol. 1996;28(11):2255–62.
13. Tcheugui JB, Zhang S, McEvoy JW, Ndumele CE, Hoogeveen RC, Coresh J, et al. Elevated NT-ProBNP as a Cardiovascular Disease Risk Equivalent: Evidence from the Atherosclerosis Risk in Communities (ARIC) Study. Am J Med. 2022;135(11):1461–7.
14. Yoo TK, Wu MY, Kim MS, Lee MY, Lee YT, Yoon KJ, et al. Association between N-Terminal Prohormone Brain Natriuretic Peptide and Decreased Skeletal Muscle Mass in a Healthy Adult Population: A Cross-Sectional Study. Endocrinol Metab. 2023;38(2):269–76.
15. Selvaraj S, Kim J, Ansari BA, Zhao L, Cvijic ME, Fronheiser M, et al. Body Composition, Natriuretic Peptides, and Adverse Outcomes in Heart Failure with Preserved and Reduced Ejection Fraction. JACC Cardiovasc Imaging. 2021;14(2):203–15.
16. Mirzai S, Sarnaik KS, Persits I, Martens P, Estep JD, Chen PH, et al. Combined prognostic impact of low muscle mass and hypoalbuminemia in patients hospitalized for heart failure: A retrospective cohort study. J Am Heart Assoc. 2024;13:e030991.
17. Rosner MH. Measuring risk in end-stage renal disease: Is N-terminal pro brain natriuretic peptide a useful marker? Kidney Int. 2007;71(6):481–3.
18. Chovanec J Jr, Chovanec J Sr, Chovanec M, Mego M. Levels of NT-proBNP in patients with cancer. Oncol Lett. 2023;26:280.
19. Hall PS, Swinson D, Cairns DA, Waters JS, Petty R, Allmark C, et al. Efficacy of reduced-intensity chemotherapy with oxaliplatin and capecitabine on quality of life and cancer control among older and frail

patients with advanced gastroesophageal cancer: The GO2 Phase 3 randomized clinical trial. JAMA Oncol. 2021;7(6):869–77.
20. Pilleron S, Gnangnon F, Noronha V, Soto-Perez-de-Celis E. Cancer incidence estimates in adults aged 60 years and older living in low-and-middle-income countries for the years 2020 and 2040. Ecancermedicalscience. 2023;17:1594.
21. Kennedy-Martin T, Curtis S, Faries D, Robinson S, Johnston J. A literature review on the representativeness of randomized controlled trial samples and implications for the external validity of trial results. Trials. 2015;16:495.
22. DuMontier C, Loh KP, Bain PA, Silliman RA, Hshieh T, Abel GA, et al. Defining undertreatment and overtreatment in older adults with cancer: A scoping literature review. J Clin Oncol. 2020;38(22):2558–69.
23. Cullen M, Taylor L, Steedman P, McCleary E, Lord H, Merrick C, et al. SIOG2023-4-P-268—The NHS Tayside Single Point of Contact clinic (SPOC) for patients with newly diagnosed cancer. J Geriatr Oncol. 2023;14(Suppl S1):S37.
24. Cavanagh KE, Baxter MA, Petty RD. Best supportive care and prognosis: Advanced gastroesophageal adenocarcinoma. BMJ Support Palliat Care. 2021;online first.
25. Baxter MA, Rowe M, Zucker K, Peters AL, Rohan M, Marsh A, et al. UK national observational cohort study investigating tolerance of anti-cancer systemic therapy in the elderly: The TOASTIE study. BMJ Oncol. 2024;3:e000459.
26. Malachias MVB, Wijkman MO, Bertoluci MC. NT-proBNP as a predictor of death and cardiovascular events in patients with type 2 diabetes. Diabetol Metab Syndr. 2022;14:64.
27. Chaikijurajai T, Demirjian S, Tang WHW. Prognostic value of natriuretic peptide levels for adverse renal outcomes in patients with moderate to severe acute kidney injury with or without heart failure. J Am Heart Assoc. 2023;12:e031453.
28. Hui D, Naberhuis J, Dibaj S, Naqvi M, Liu D, Bruera E. Association between plasma brain natriuretic peptide and overall survival in patients with advanced cancer: Preliminary findings. J Pain Symptom Manage. 2019;58(3):465–71.
29. Prokopidis K, Ishiguchi H, Jordan C, Irlik K, Nabrdalik K, Formiga F, et al. Association between natriuretic peptides and C-reactive protein with frailty in heart failure: A systematic review and meta-analysis. Aging Clin Exp Res. 2024;36:57.
30. Simcock R, Wright J. Beyond performance status. Clin Oncol. 2020;32(9):553–61.