Annals of Hematology (2019) 98:1799–1801
https://doi.org/10.1007/s00277-019-03668-0

LETTER TO THE EDITOR

Geriatric nutritional risk index (GNRI) just before allogeneic hematopoietic stem cell transplantation predicts transplant outcomes in patients older than 50 years with acute myeloid leukemia in complete remission

Tatsuya Konishi[1] · Noriko Doki[1] · Yuya Kishida[1] · Akihito Nagata[1] · Yuta Yamada[1] · Satoshi Kaito[1] · Shuhei Kurosawa[1] · Kota Yoshifuji[1] · Shuichi Shirane[1] · Tomoyuki Uchida[1] · Kyoko Inamoto[1] · Takashi Toya[1] · Aiko Igarashi[1] · Yuho Najima[1] · Takeshi Kobayashi[1] · Kazuhiko Kakihana[1] · Hisashi Sakamaki[1] · Kazuteru Ohashi[1]

Received: 14 November 2018 / Accepted: 7 March 2019 / Published online: 21 March 2019

Dear Editor,

To evaluate the eligibility for elderly patients in allogeneic hematopoietic stem cell transplantation (allo-HSCT) is crucial. Hematopoietic cell transplantation specific comorbidity index (HCT-CI) and age are useful for predicting transplant outcomes [1, 2]. Regarding nutritional status at transplant, HCT-CI includes only obesity (body mass index [BMI] > 35 kg/m^2) as comorbidity. The geriatric nutritional risk index (GNRI) is a simple clinical marker of nutrition used as a prognostic tool for elderly patients [3]. The recent study showed that the GNRI was an independent prognostic factor not only for elderly patients, but also for patients with diffuse large B cell lymphoma [4], coronary artery disease [5], and undergoing peritoneal dialysis [6]. Here, we focus on patients older than 50 years with acute myeloid leukemia (AML) in complete remission (CR) and examine the impact of the GNRI just before allo-HSCT on subsequent transplant outcomes. The study included 63 consecutive patients with AML aged > 50 years who underwent first allo-HSCT in our institution between 2012 and 2017. The GNRI within 28 days before initiating a conditioning regimen was calculated using the levels of serum albumin and body weight (BW) using the following equation: GNRI = 14.89 × albumin level (g/dL) + 41.7 × (BW/ideal BW) [3]. When the patient's BW exceeded the ideal BW, the ratio of BW to ideal BW was set to one. Patients were classified into two groups based on previous published thresholds [3]: no-risk (GNRI ≥ 98) and risk (GNRI < 98) group.

The median GNRI was 97.8 (range, 73–111.7). Of the 63 patients, 31 were no-risk, and 32 were risk group. The patients' characteristics by GNRI classification before allo-HSCT are summarized in Supplementary Table 1. Regarding the patients' clinical characteristics, no significant differences were found between the two groups. The median follow-up period for survivors was 1017 days (range, 17–2044 days).

We observed a significant difference in overall survival (OS) and disease-free survival (DFS) between no-risk and risk-group (1-year OS 74% vs. 42%, $p = 0.026$; 1-year DFS 74% vs. 43%, $p = 0.016$; Fig. 1a, b). However, there was no significant difference in the cumulative incidence of relapse between two groups (1 year 11% vs. 20%, $p = 0.47$; Fig. 1c). Risk group tended to show higher non-relapse mortality than no-risk group (1 year 37% vs. 15%, HR = 2.58; 95% confidence interval, 0.93–7.14; $p = 0.07$; Fig. 1d). The cause of death among those who died without relapse is shown in Supplementary Table 2. In multivariate analysis, the GNRI and Eastern Cooperative Oncology Group performance status were found to be significant risk factors for OS (Supplementary Table 3).

This is the first study that evaluated the relevance between GNRI before allo-HSCT and transplant outcomes of AML patients older than 50 years in CR. The recent reports showed that underweight at diagnosis was associated with poorer outcomes in AML patients [7, 8]. Lower BMI at the pre-HSCT stage or during HSCT has also been reported poor survival [9]. The level of serum albumin, regarded as nutritional

Electronic supplementary material The online version of this article (https://doi.org/10.1007/s00277-019-03668-0) contains supplementary material, which is available to authorized users.

✉ Noriko Doki
n-doki@cick.jp

[1] Hematology Division, Tokyo Metropolitan Cancer and Infectious Diseases Center Komagome Hospital, 3-18-22 Honkomagome, Bunkyo-ku, Tokyo 113-8677, Japan

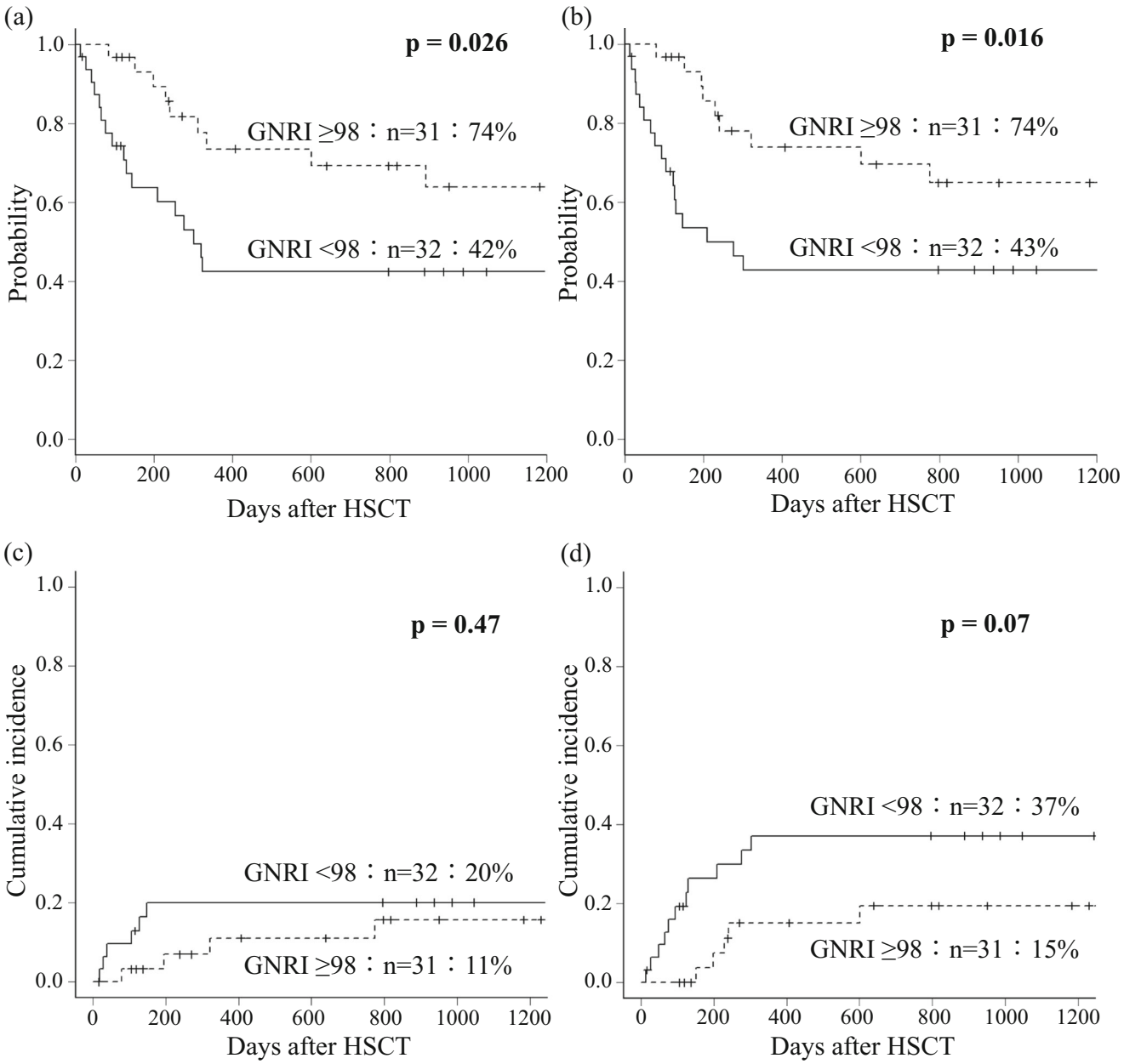

Fig. 1 The probabilities of overall survival (**a**), disease-free survival (**b**), cumulative incidence of relapse (**c**), and non-relapse mortality (**d**) in no-risk and risk group

biomarker, is more related to inflammation than to nutrition status [3, 4]. In this study, these single parameters were not associated with OS. However, only the GNRI was a significant prognostic factor as nutritional index (Supplementary Table 3).

In conclusion, the GNRI would be a useful predictor for allo-HSCT outcomes in AML patients 50 years of age or older in CR. Risk group of patients should be carefully considered when determining transplant adaptation. Large patient cohorts are necessary to validate the utility of GNRI in HSCT.

Compliance with ethical standards This study was approved by the ethics committee of Tokyo Metropolitan Cancer and Infectious Diseases Center Komagome Hospital.

Conflict of interest The authors declare that they have no conflict of interest.

Ethical approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

References

1. Sorror ML, Maris MB, Storb RF et al (2005) Hematopoietic cell transplantation (HCT)-specific comorbidity index: a new tool for risk assessment before allogeneic HCT. Blood 15:2912–2919
2. Sorror ML, Storb RF, Sandmaier BM, Maziarz RT, Pulsipher MA, Maris MB, Bhatia S, Ostronoff F, Deeg HJ, Syrjala KL, Estey E, Maloney DG, Appelbaum FR, Martin PJ, Storer BE (2014) Comorbidity-age index: a clinical measure of biologic age before allogeneic hematopoietic cell transplantation. J Clin Oncol 32: 3249–3256
3. Bouillanne O, Morineau G, Dupont C, Coulombel I, Vincent JP, Nicolis I, Benazeth S, Cynober L, Aussel C (2005) Geriatric nutritional risk index: a new index for evaluating at-risk elderly medical patients. Am J Clin Nutr 82:777–783
4. Kanemasa Y, Shimoyama T, Sasaki Y, Hishima T, Omuro Y (2018) Geriatric nutritional risk index as a prognostic factor in patients with diffuse large B cell lymphoma. Ann Hematol 97:999–1007
5. Kunimura A, Ishii H, Uetani T, Aoki T, Harada K, Hirayama K, Negishi Y, Shibata Y, Sumi T, Kawashima K, Tatami Y, Kawamiya T, Yamamoto D, Suzuki S, Amano T, Murohara T (2017) Impact of geriatric nutritional risk index on cardiovascular outcomes in patients with stable coronary artery disease. J Cardiol 69:383–388
6. Kang SH, Cho KH, Park JW, Yoon KW, Do JY (2013) Geriatric nutritional risk index as a prognostic factor in peritoneal dialysis patients. Perit Dial Int 33:405–410
7. Harada K, Doki N, Miyazaki Y, Wakita A, Ohtake S, Takada S, Komatsu H, Kubo K, Takeshita A, Adachi Y, Kiyoi H, Yamaguchi T, Yoshida M, Naoe T, Ohashi K (2018) Clinical impact of underweight status at diagnosis on elderly patients with acute myeloid leukemia: a retrospective study of JALSG GML200. Ann Hematol 97:1481–1483
8. Harada K, Doki N, Hagino T, Miyawaki S, Ohtake S, Kiyoi H, Miyazaki Y, Fujita H, Usui N, Okumura H, Miyamura K, Nakaseko C, Fujieda A, Nagai T, Yamane T, Sakamaki H, Ohnishi K, Naoe T, Ohno R, Ohashi K (2018) Underweight status at diagnosis is associated with poorer outcomes in adult patients with acute myeloid leukemia: a retrospective study of JALSG AML 201. Ann Hematol 97:73–81
9. Ren G, Cai W, Wang L, Huang J, Yi S, Lu L, Wang J (2018) Impact of body mass index at different transplantation stages on postoperative outcomes in patients with hematological malignancies: a meta-analysis. Bone Marrow Transplant 53:708–721