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Health-related Quality of Life in Survivors of Autologous Haematopoietic Stem Cell Transplantation: A Cross-Sectional SF-36 Study from a Tertiary Cancer Centre in India

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Abstract: Background: Data on health-related quality of life (HRQoL) of survivors of autologous haematopoietic stem cell transplantation (HSCT) in India are limited. This study describes the HRQoL of autologous HSCT survivors at a tertiary cancer centre in India using the SF-36. Methods: In this single-centre cross-sectional observational study, survivors of autologous HSCT for multiple myeloma (MM) or lymphoma completed the SF-36 through a self-administered Google Form. Scales were scored by the RAND method and converted to norm-based T-scores; physical (PCS) and mental (MCS) component summaries were derived and compared with general-population norms. Associations with routine demographic, clinical and transplant variables from the institutional database were explored with Spearman correlation (Benjamini–Hochberg correction) and multivariable linear regression. Results: Forty-six unique survivors responded (21 MM, 25 lymphoma; 57.5% of 80 eligible); median age was 39 years and median time from transplant 21.8 months. Mean PCS was 50.8 ± 6.1 and MCS 52.4 ± 6.5; only 3 (6.5%) and 1 (2.2%) respondents scored below 40, respectively. Vitality exceeded the population norm (T 59.2; 95% CI 57.8–60.7), whereas social functioning was the only domain below it (T 46.9; 95% CI 45.0–48.8). All respondents rated their health as better than one year earlier. Ceiling effects were marked for role-physical (69.6%) and role-emotional (73.9%). HRQoL did not differ between MM and lymphoma (PCS 49.3 vs 52.1; p = 0.378). None of 12 routine demographic and transplant variables — including age, CD34+ dose, engraftment, mucositis and hospital stay — was associated with PCS or MCS after correction for multiple testing, and multivariable models explained 6% (PCS) and 15% (MCS) of variance. Conclusions: Autologous HSCT survivors attending follow-up reported HRQoL comparable to or above general-population norms, with social functioning the consistent shortfall. Routine transplant variables were not associated with later HRQoL. Ceiling effects, low reliability of two-item scales and survivor selection support prospective, longitudinal measurement with India-specific norms.

Keywords: autologous stem cell transplantation, health-related quality of life, SF-36, multiple myeloma, lymphoma, survivorship, India

INTRODUCTION

High-dose chemotherapy with autologous haematopoietic stem cell transplantation (HSCT) remains standard consolidation for transplant-eligible patients with multiple myeloma (MM) and for patients with chemosensitive relapsed or high-risk lymphoma. In India, autologous HSCT is increasingly available at public and private centres and is delivered at a fraction of the cost reported from high-income countries, although most of that cost is still borne by patients and families [1,2]. As survival after autologous HSCT improves, the quality of that survival — physical recovery, return to work and social roles, and emotional well-being — has become a central survivorship outcome [3–7].

Most of what is known about health-related quality of life (HRQoL) after autologous HSCT comes from Europe and North America. In MM, HRQoL falls during the transplant admission and usually returns to baseline within one to two months [3]. Among long-term MM survivors in the United States, the physical component summary was below the population norm while the mental component summary was not [10]. Norwegian lymphoma survivors treated with high-dose therapy had impaired HRQoL that tracked closely with the burden of late effects [8], and a Seattle cohort found better physical HRQoL in lymphoma than in MM survivors [9]. Fatigue may persist for three to five years [5], and a recent German study linked poor HRQoL to failure to return to work [11]. Indian data are limited to patients on active therapy for haematological cancers assessed with the EORTC QLQ-C30 [12], and data on Indian autologous HSCT survivors measured with a generic instrument that allows comparison against population norms are limited.

Recovery after transplant may also be influenced by the intensity of the acute transplant course, reflected in routinely recorded variables such as CD34+ cell dose, engraftment kinetics, febrile neutropenia, mucositis and length of hospital stay. The association of these variables with HRQoL months to years after transplant is less well described.

We therefore surveyed autologous HSCT survivors at our centre with the SF-36 and linked their responses to routinely recorded clinical and transplant data. The primary objective was to describe the SF-36 HRQoL profile and compare it with general-population norms. Secondary objectives were to compare MM and lymphoma survivors; to explore associations of routine demographic, clinical and transplant variables, and of time since transplant, with physical and mental component scores; and to examine the internal consistency and floor and ceiling effects of the SF-36 scales in this population.

METHODS

Study Design and Setting

This was a cross-sectional observational study in which HRQoL was measured once, by a self-administered SF-36 survey, and linked to clinical data already recorded during routine care, conducted at the bone marrow transplant unit of the Department of Medical Oncology, Kidwai Memorial Institute of Oncology (KMIO), Bengaluru, a government tertiary cancer centre in South India. The study is reported in accordance with the STROBE statement for cross-sectional studies [13].

Participants

The institutional autologous HSCT database included 80 patients who underwent autologous HSCT between July 2022 and April 2026; all were eligible and were invited to take part if they were alive and attending follow-up. The SF-36 was offered to consecutive eligible survivors at follow-up visits. Patients with MM received high-dose melphalan and patients with lymphoma received BEAM (carmustine, etoposide, cytarabine, melphalan) conditioning, followed by reinfusion of granulocyte colony-stimulating factor (G-CSF)-mobilised peripheral blood stem cells.

Instrument and Scoring

The SF-36 (version 1, standard four-week recall) comprises 36 items covering eight scales — physical functioning (PF), role limitations due to physical health (RP), bodily pain (BP), general health (GH), vitality (VT), social functioning (SF), role limitations due to emotional problems (RE) and mental health (MH) — and a single health-transition item [14]. Patient responses were collected with a self-administered Google Form (Google LLC, Mountain View, CA, USA) containing the SF-36 items and basic identifying details; the form link was shared with eligible survivors attending follow-up, and responses were exported to a spreadsheet for scoring. Items were recoded to 0–100 according to the RAND 36-Item Health Survey 1.0 algorithm and averaged within scales, with a scale scored when at least half of its items were answered; higher scores indicate better health [15]. Scale scores were transformed to norm-based T-scores (mean 50, SD 10) with the 1990 United States general-population means and standard deviations, and PCS and MCS were computed with the published orthogonal factor-score coefficients [16]. The SF-36 has been validated in India [17], but Indian population norms are not available, so the United States norms served as an external reference.

Item 21 (bodily pain intensity) was unanswered by 14 respondents, and none of the remaining respondents selected the response “None”, suggesting that this option was missing or unclear on the Google Form. In the primary analysis BP was therefore scored from item 22 alone for these respondents, as the RAND rules allow; a sensitivity analysis assumed a response of “None”. No other item was missing.

Data Sources and Linkage

Survey responses were linked manually to two institutional datasets using name, age, sex, diagnosis and, where recorded, hospital identification number: (i) the transplant database (demographics, comorbidity, prior lines of therapy, anthropometry, routine pre-transplant haemoglobin and serum albumin, CD34+ cell dose, days of G-CSF, neutrophil and platelet engraftment days, febrile neutropenia, oral mucositis and diarrhoea grade, and length of hospital stay); and (ii) the lymphoma dataset (stage, disease status at transplant by PET-CT, post-transplant PET response, relapse or progression and vital status). Where survey-reported and recorded details disagreed, the clinical record was used; every matching decision was logged (Supplementary Table S7). One blank test submission was excluded, and for three patients who submitted the questionnaire twice (two to seven days apart) the earlier submission was analysed.

Variables

Time since transplant was the interval between transplant and survey dates. Grade 3 mucositis and diarrhoea were taken as recorded. HRQoL below 40 on PCS or MCS (more than 1 SD below the norm) was defined as poor [8].

Statistical Analysis

Continuous variables are summarised as median (interquartile range, IQR) or mean ± SD, and categorical variables as n (%). MM and lymphoma groups were compared with the Mann–Whitney U and Fisher's exact tests. Mean T-scores were compared with the norm of 50 by one-sample t-test (confirmed by Wilcoxon signed-rank test); a difference of 5 T-score points (0.5 SD) was considered the minimal clinically important difference [20]. Internal consistency was assessed by Cronbach's α (≥0.70 acceptable) [18,23], and floor or ceiling effects were considered substantial when more than 15% of respondents had the lowest or highest possible score [19].

Associations of 12 continuous or ordinal demographic and routine transplant variables with PCS and MCS were assessed by Spearman correlation, with Benjamini–Hochberg false-discovery-rate (FDR) correction across the 24 tests [21]; binary factors were compared by Mann–Whitney U test. Multivariable linear regression models for PCS and MCS included five covariates chosen in advance — age, sex, diagnosis, two or more prior lines of therapy, and time since transplant — limiting the model to about nine observations per parameter. Because the PCS residuals were not normally distributed (Shapiro–Wilk $p = 0.001$), heteroscedasticity-consistent (HC3) standard errors were used [24]; variance inflation factors were below 2.6. Sensitivity analyses addressed the missing item 21 and the choice of submission for repeat responders. Respondents were compared with non-respondents in the transplant database to assess selection. All analyses were exploratory, with no formal sample-size calculation because every eligible survivor was approached. Tests were two-sided with $\alpha = 0.05$. Analyses used Python 3 (pandas, SciPy and statsmodels 0.15).

Ethics

This study was conducted in accordance with the Declaration of Helsinki and the ICMR National Ethical Guidelines (2017). The study was reviewed and approved by the Institutional Ethics Committee of Kidwai Memorial Institute of Oncology, Bengaluru.

Informed consent was obtained electronically through a consent section built into the online questionnaire: before any questions were shown, participants read a statement explaining the purpose of the study, the voluntary nature of participation and the confidentiality of their responses, and only those who gave consent could proceed to the questionnaire.

Declining to participate had no effect on clinical care. Clinical data were extracted from records maintained during routine care, and all data were de-identified before analysis.

RESULTS

Participants

Fifty submissions were received. After excluding one blank test entry and three repeat submissions, 46 unique survivors were analysed — a response rate of 57.5% of the 80 eligible patients in the transplant database (Supplementary Figure S1). All 46 were linked to the transplant database and all 25 lymphoma survivors to the lymphoma dataset. Respondents and the 34 non-respondents were similar in age, sex, diagnosis, prior lines, CD34+ dose, engraftment, febrile neutropenia and length of stay (Supplementary Table S3). Of the 46 respondents, 21 (45.7%) had MM and 25 (54.3%) lymphoma: 14 Hodgkin lymphoma (13 classical, one nodular lymphocyte-predominant), eight B-cell non-Hodgkin lymphoma (six diffuse large B-cell, one primary mediastinal, one mantle cell) and three T-cell lymphoma (two ALK-negative anaplastic large-cell, one peripheral T-cell not otherwise specified). Median age at transplant was 39 years (IQR 28–50) and 27 (58.7%) were male (Table 1). Lymphoma survivors were younger (32 vs 44 years), more heavily pretreated (88.0% vs 14.3% with two or more prior lines), and had more febrile neutropenia (64.0% vs 4.8%), slower platelet engraftment and longer hospital stay than MM survivors. Of the lymphoma survivors, 24 (96.0%) were in complete metabolic response at transplant and 21 (84.0%) had stage III–IV disease at diagnosis. The survey was completed a median of 21.8 months (IQR 15.3–31.4; range 3.4–45.0) after transplant.

Table 1: Demographic, disease and transplant characteristics of 46 autologous HSCT survivors

Characteristic	All (n = 46)	MM (n = 21)	Lymphoma (n = 25)	p
Age at transplant, years	39.0 (28.0–50.0)	44.0 (38.0–53.0)	32.0 (23.0–44.0)	0.008
Male sex	27 (58.7)	12 (57.1)	15 (60.0)	1.000
Any comorbidity	10 (21.7)	6 (28.6)	4 (16.0)	0.475
BMI, kg/m²	23.7 (21.8–26.8)	25.2 (22.2–28.0)	22.5 (21.7–24.4)	0.048
Prior lines of therapy	2.0 (1.0–2.0)	1.0 (1.0–1.0)	2.0 (2.0–3.0)	<0.001
≥2 prior lines	25 (54.3)	3 (14.3)	22 (88.0)	<0.001
Haemoglobin, g/dL	12.2 (11.0–13.5)	12.0 (11.3–12.9)	12.5 (10.3–13.6)	0.869
Serum albumin, g/dL	4.2 (4.1–4.5)	4.2 (4.1–4.4)	4.4 (4.2–4.6)	0.263
CD34+ dose, ×10⁶/kg	8.2 (6.8–11.3)	8.0 (6.1–11.8)	8.4 (7.0–9.7)	0.834
G-CSF days	10.0 (8.0–10.0)	8.0 (8.0–10.0)	10.0 (10.0–12.0)	<0.001
Neutrophil engraftment, day	10.0 (10.0–11.0)	10.0 (10.0–11.0)	10.0 (10.0–12.0)	0.102
Platelet engraftment, day	11.0 (9.0–12.0)	10.0 (8.0–11.0)	12.0 (11.0–14.0)	<0.001
Febrile neutropenia	17 (37.0)	1 (4.8)	16 (64.0)	<0.001
Grade 3 oral mucositis	2 (4.3)	1 (4.8)	1 (4.0)	1.000
Grade 3 diarrhoea	7 (15.2)	3 (14.3)	4 (16.0)	1.000
Hospital stay, days	22.0 (18.0–25.0)	18.0 (17.0–22.0)	25.0 (22.0–26.0)	<0.001
Time from transplant to survey, months	21.8 (15.3–31.4)	23.4 (10.2–31.1)	21.4 (18.8–31.4)	0.930
Survey ≥24 months post-transplant	20 (43.5)	9 (42.9)	11 (44.0)	1.000

Values are median (IQR) or n (%). p values from Mann–Whitney U or Fisher's exact test. BMI, body mass index; G-CSF, granulocyte colony-stimulating factor; MM, multiple myeloma.

HRQoL Profile and Comparison with Norms

Mean PCS was 50.8 ± 6.1 and mean MCS 52.4 ± 6.5 (Table 2). Only three respondents (6.5%) had a PCS below 40 and one (2.2%) an MCS below 40; 13 (28.3%) scored below 50 on each.

Mean PCS did not differ from the norm (50.8; 95% CI 49.0–52.6; p = 0.380), whereas MCS was slightly higher (52.4; 95% CI 50.5–54.3; p = 0.016), although the difference was below the minimal clinically important difference.

Across scales, vitality was clearly above the norm (T 59.2; 95% CI 57.8–60.7; p < 0.001), a difference of almost one SD. General health (52.7), bodily pain (52.3) and mental health (52.9) were modestly but significantly above it, while physical functioning, role-physical and role-emotional were at the norm. Social functioning was the only scale below the norm (T 46.9; 95% CI 45.0–48.8; p = 0.003) (Figure 1). Self-rated general health was excellent in 18 (39.1%), very good in 25 (54.3%), good in two and fair in one respondent, and all 46 reported their health as much better (n = 23) or somewhat better (n = 23) than one year earlier.

Table 2: SF-36 scores, measurement properties, comparison with general-population norms and comparison by diagnosis

Scale	α	Mean ± SD (0-100)	Floor %	Ceiling %	T-score, all (95% CI)	p vs norm	T-score, MM	T-score, lymphoma	p, MM vs lymph.
Physical functioning	0.88	83.7 ± 17.7	0.0	30.4	49.6 (47.4–51.9)	0.753	47.5	51.4	0.213
Role – physical	0.91	79.3 ± 36.2	13.0	69.6	49.5 (46.4–52.6)	0.731	48.5	50.2	0.408
Bodily pain	0.32	80.9 ± 12.3	0.0	21.7	52.3 (50.8–53.8)	0.005	51.9	52.6	0.628
General health	0.71	77.6 ± 11.9	0.0	4.3	52.7 (51.0–54.4)	0.003	51.3	53.9	0.223
Vitality	0.58	80.3 ± 10.3	0.0	6.5	59.2 (57.8–60.7)	<0.001	59.0	59.5	0.643
Social functioning	0.25	76.6 ± 14.8	0.0	15.2	46.9 (45.0–48.8)	0.003	46.7	47.1	0.991
Role – emotional	0.92	79.7 ± 37.5	15.2	73.9	49.5 (46.2–52.8)	0.776	48.9	50.0	0.448
Mental health	0.78	80.0 ± 11.6	0.0	4.3	52.9 (51.0–54.7)	0.004	52.4	53.2	0.964
PCS	–	50.8 ± 6.1	–	–	50.8 (49.0–52.6)	0.380	49.3	52.1	0.378
MCS	–	52.4 ± 6.5	–	–	52.4 (50.5–54.3)	0.016	52.5	52.3	0.877

n = 46 (MM 21, lymphoma 25). Scale scores 0–100 by RAND scoring (higher = better); PCS and MCS are norm-based and shown on the T-score scale. T-scores (mean 50, SD 10) are based on 1990 United States general-population norms; p vs norm from one-sample t-test against 50; p for MM vs lymphoma (lymph.) from Mann–Whitney U test. Floor/ceiling: percentage of respondents with the lowest/highest possible score. α, Cronbach's alpha; MCS, mental component summary; MM, multiple myeloma; PCS, physical component summary.

Measurement Properties

Internal consistency was acceptable for PF (α = 0.88), RP (0.91), RE (0.92), MH (0.78) and GH (0.71), but low for VT (0.58) and the two-item BP (0.32) and SF (0.25) scales. Ceiling effects were substantial for RE (73.9%), RP (69.6%), PF (30.4%), BP (21.7%) and SF (15.2%), and floor effects for RE (15.2%) and RP (13.0%) (Table 2). The three repeat responders showed within-person differences of 3.7–11.7 points on PCS and 5.0–15.8 points on MCS over two to seven days (Supplementary Table S5).

Multiple Myeloma Versus Lymphoma

No scale or summary score differed significantly between MM and lymphoma survivors (Table 2). Physical functioning (T 47.5 vs 51.4) and PCS (49.3 vs 52.1; difference 2.8; 95% CI −0.9 to 6.5; p = 0.378) were numerically lower in MM, whereas MCS was nearly identical (52.5 vs 52.3; p = 0.877). Mean PCS and MCS were similar across Hodgkin lymphoma (52.4 and 52.4), B-cell lymphoma (52.1 and 52.7), T-cell lymphoma (50.6 and 51.0) and MM (49.3 and 52.5) (Kruskal–Wallis p = 0.793 and 0.986).

Factors Associated with HRQoL

No routine demographic, clinical or transplant variable was associated with PCS or MCS after FDR correction (Supplementary Table S1; all q ≥ 0.29). Before correction, later neutrophil engraftment correlated weakly with higher PCS (ρ = 0.30; p = 0.045) and higher diarrhoea grade with higher MCS (ρ = 0.37; p = 0.012); both run counter to clinical expectation and are most likely chance findings. Serum albumin, CD34+ dose, G-CSF days and length of stay showed no meaningful association. HRQoL did not vary with time since transplant (PCS ρ = 0.09, MCS ρ = 0.09; Supplementary Figure S2). Binary comparisons were similarly null (Supplementary Table S4); female respondents had a lower median MCS than male respondents (51.1 vs 55.3; p = 0.069). In multivariable models (Supplementary Table S2), no covariate was independently associated with PCS or MCS. Female sex showed a trend towards lower MCS (β −4.31; 95% CI −8.91 to 0.29; p = 0.066). The models explained 5.7% of the variance in PCS and 14.5% in MCS.

Sensitivity Analyses and Disease Status

Assuming a response of "None" for the missing pain item raised mean BP from 80.9 to 82.0 and left PCS (50.9) and MCS (52.4) essentially unchanged; retaining the later rather than the earlier submission of repeat responders also had no material effect (PCS 50.5, MCS 52.3) (Supplementary Table S5). Four lymphoma survivors had relapse or progression recorded — three before and one after the survey — and three of them subsequently died. The patient surveyed 16 days after relapse had the lowest MCS in the lymphoma cohort (36.8) and a PCS of 44.3, compared with 52.4 ± 4.0 and 52.6 ± 6.5 in lymphoma survivors without relapse (Supplementary Table S6).

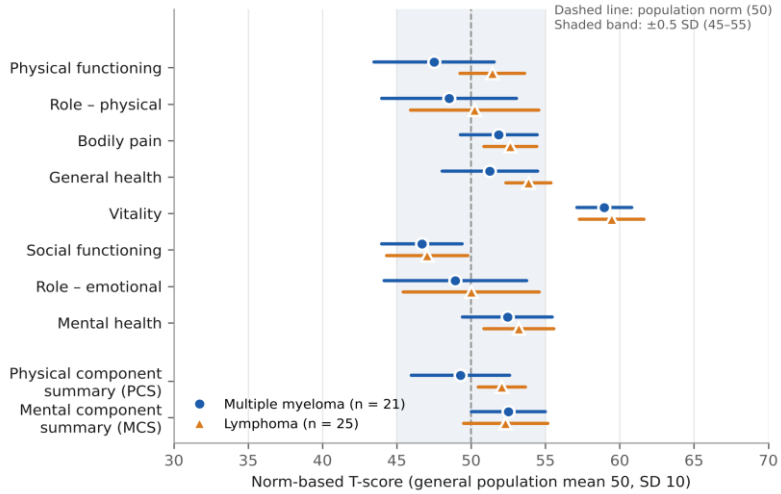


Figure 1: Norm-based SF-36 profile of autologous HSCT survivors by diagnosis

Points are mean T-scores and bars are 95% confidence intervals. The dashed line marks the general-population mean (50) and the shaded band ±0.5 SD, the minimal clinically important difference.

DISCUSSION

In this cross-sectional study, SF-36 responses of autologous HSCT survivors were linked to their transplant records. Survivors seen a median of almost two years after transplant

reported HRQoL at or above general-population norms on most scales, with social functioning the one domain consistently below. HRQoL did not differ between MM and lymphoma survivors and was not associated with routinely recorded transplant variables, including CD34+ dose, engraftment speed, mucositis and length of stay.

Our summary scores are higher than those reported from high-income settings. Mean PCS was 50.8, compared with 44.9 in Norwegian lymphoma survivors [8], 45.5 in long-term MM survivors in the United States [10] and median values of 49.1 (lymphoma) and 44.5 (MM) in Seattle [9]; the prevalence of poor physical HRQoL (6.5%) was a fraction of the 33% reported in Norway [8]. Several factors probably contribute. Our cohort was young (median 39 years), almost all lymphoma survivors were in complete metabolic response at transplant, follow-up was shorter than in the long-term survivor studies and so late effects had had less time to accumulate [8], and respondents were survivors well enough to attend clinic. Response shift — recalibration of internal standards after a life-threatening illness — may raise self-ratings [22], an interpretation supported by every respondent rating their health as better than a year earlier. Finally, norms derived from the United States population may not reflect the expectations against which Indian patients judge their health [17]. An Indian study of patients with haematological cancers likewise found global health scores above the EORTC reference values [12]. These scores should therefore be read as favourable relative to an external reference rather than as proof of full recovery.

The vitality result deserves particular caution. Fatigue is among the most persistent complaints after autologous HSCT [5,11], yet vitality was the highest-scoring scale here, close to one SD above the norm. The vitality scale also had poor internal consistency ($\alpha = 0.58$), which suggests that its two positively worded and two negatively worded items ("worn out", "tired") were not answered consistently — a known problem with mixed-direction items in self-administered and translated questionnaires. We regard this finding as possibly reflecting measurement artefact and would not conclude that fatigue is absent in this population.

Social functioning, by contrast, was the only domain below the norm in both diagnostic groups. Disruption of work, family roles and social participation after transplant is well described [6,11], and in India it is likely amplified by the financial burden of transplant [1], the long periods of restricted contact recommended after HSCT and travel to a regional centre. Although the two-item social functioning scale had low reliability, the direction of the finding is consistent with the literature and points to social and vocational reintegration as an unmet need in our survivorship clinic [7].

The absence of a difference between MM and lymphoma survivors contrasts in part with the Seattle cohort, in which lymphoma survivors had better physical HRQoL, a difference that was attenuated after adjustment for age [9]. We observed a similar direction for physical functioning and PCS, but the effect was small and imprecise, and the older age of our MM patients was offset by heavier pretreatment and more toxic transplant courses in the lymphoma group.

None of the routinely recorded transplant variables was associated with HRQoL at the time of the survey. This is consistent with evidence that HRQoL recovers within weeks of autologous HSCT [3], so that acute toxicity, engraftment speed and length of stay leave little lasting imprint. The determinants of long-term HRQoL are more likely to be post-transplant factors — disease control, late effects, financial and social circumstances [8,11]

— as illustrated by the lowest MCS in our lymphoma cohort occurring in a patient surveyed shortly after relapse. The two nominal correlations we observed ran contrary to clinical expectation and did not survive correction for multiple testing.

The measurement findings have implications for future studies. Ceiling effects above 70% on the role scales, which in SF-36 version 1 use dichotomous yes/no responses, mean that the instrument could not discriminate among the majority of respondents, and the two-item BP and SF scales were unreliable. The within-person variability of the three repeat responders over a few days further suggests limited test–retest stability. SF-36 version 2, which uses five-level responses for the role items, or a cancer-specific instrument such as the EORTC QLQ-C30 with its high-dose chemotherapy module, would likely give more informative data in this population.

STRENGTHS AND LIMITATIONS

Strengths of the study include the use of a widely validated generic instrument that permits norm-based comparison, linkage of every respondent to routinely recorded transplant data, a transparent linkage log, prespecified multivariable models with robust standard errors and correction for multiple testing, and sensitivity analyses for the main data problems. Limitations are substantial. The cross-sectional design measures HRQoL at a single time point, gives no pre-transplant baseline, cannot establish temporal or causal relationships, and cannot show change within patients. The sample was small, which limits power to detect modest associations; the null associations should be read as absence of large effects rather than evidence of no effect. With a 57.5% response rate and only survivors attending clinic able to respond, selection towards healthier patients is likely, although respondents and non-respondents had similar measured characteristics. United States norms may not apply to the Indian population. One response option of the pain item appears to have been missing from the Google Form, and several scales had low reliability and marked ceiling effects. Socioeconomic status, employment, education, and depression or anxiety were not measured, and MM response depth and post-transplant maintenance were not available for analysis.

IMPLICATIONS

For clinicians, these results are reassuring for survivors who remain in remission: most report physical and mental health comparable to the general population within two years of autologous HSCT. Survivorship care should nonetheless screen actively for difficulties in social functioning and for relapse-associated psychological distress, in line with international survivorship recommendations [7]. For researchers, the priorities are prospective, longitudinal HRQoL measurement from before transplant, instruments with less ceiling effect, collection of socioeconomic and occupational data, and development of Indian population norms.

CONCLUSION

Survivors of autologous HSCT for MM and lymphoma at an Indian tertiary cancer centre reported HRQoL comparable to or above general-population norms, with social functioning

the consistent shortfall. HRQoL did not differ by diagnosis and was not associated with routinely recorded transplant variables. Prospective studies with pre-transplant baseline measurement and India-specific norms are needed to define the trajectory and determinants of recovery.

Declarations

Funding: None.

Conflicts of interest: The authors declare no conflicts of interest.

Ethics approval and consent to participate: The study was reviewed and approved by the Institutional Ethics Committee of Kidwai Memorial Institute of Oncology, Bengaluru, and was conducted in accordance with the Declaration of Helsinki. Informed consent was obtained electronically from all participants through a consent section built into the online questionnaire before participation. All data were de-identified before analysis.

Consent for publication: Not applicable. This manuscript contains no individually identifiable patient data or images.

Data availability: The de-identified dataset is available from the corresponding author on reasonable request, subject to institutional approval.

Author contributions: Deepa Aggarwal and Mohammed Hafeez conceived and designed the study. Sutanuka Chakrabarti, B R Sai Ganesh Reddy, Kashinath Benakatti, Pooja Dadmi, Sindhuja Ramachandran and Muddhapuram Shashikiran collected the data and contributed to patient management. Mohammed Hafeez performed data linkage, statistical analysis and drafted the manuscript. Rudresh A H, Beulah Elizabeth Koshy, Rajeev L K and Lokesh K N supervised the study and critically revised the manuscript. All authors approved the final version.

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