Time-dependent modeling of bacterial abundance kinetics under oral decontamination for allogeneic HSCT – CT-399

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1. INTRODUCTION

Uncertainties for individual HSCT outcomes remain despite comprehensive clinical assessment. Established risk factors (age, Disease Risk Index, HLA matching, HCT-CI) are highly relevant but cannot cover all dynamic and individualized outcome trajectories after HSCT. One of these trajectories related to the ambivalent role of intestinal microbiota in HSCT. While disrupted microbiota diversity has been demonstrated to increase graft-versus-host disease (GVHD) and mortality (Peled et al. NEJM 2020). However, gut decontamination before HSCT and during neutropenia reduced infection risks in a prospective trial (Beelen et al. Blood 1999). Real-world evidence on its efficacy in the current age, particularly regarding the time-dependent character of bacterial abundance kinetics and their relation to current microbiome evidence, remains limited.

2. AIM

We hypothesized that time-dependent modeling of bacterial abundance kinetics under oral decontamination would improve our understanding of the impact of microbiota under HSCT, including associations with overall survival (OS).

3. METHOD

Study Design:
Retrospective, single-center analysis of **1,588 HSCT recipients** (2010-2020)

Data Collection:
9,169 stool samples longitudinally collected
Semi-quantitative culture (range from 0= not detectable to 5= very highly abundant)
Standardized decontamination protocol of metronidazole 400mg 1-1-1 and ciprofloxacin 500mg 1-0-1 per day starting from day -14 until completed neutrophil engraftment.

4. RESULTS

Characteristic	Value
Patients	1,588
Sex	Male 63.1% (n = 1,002) Female 35.8% (n = 568)
Age (years)	17 – 78 (median 55.5)
Follow-up (days)	1 – 4,871
Overall Survival (OS)	Median 211 days (IQR 111–610)

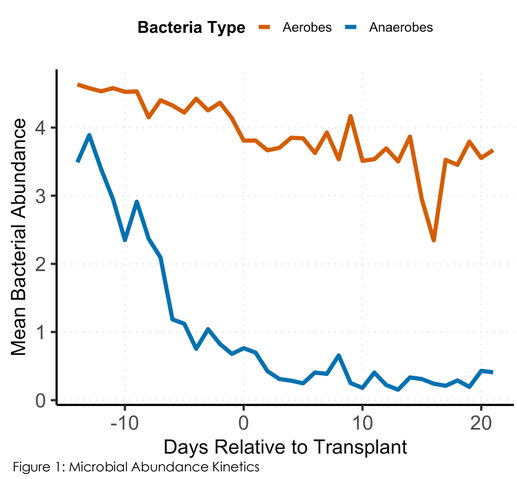


Figure 1: Microbial Abundance Kinetics

4.1 Microbial Kinetics Patterns

Anaerobic bacteria

- Progressive decline before HSCT, steepest drop day –10 to 0 (mean ~3.8 → <1.0).
- Post-HSCT levels remained <1.0 with minor fluctuations.
- Recovery observed from week +7, but not to pre-HSCT levels.

Aerobic bacteria

- Less pronounced decline.
- Maintained relatively high abundance (~4.0) throughout.

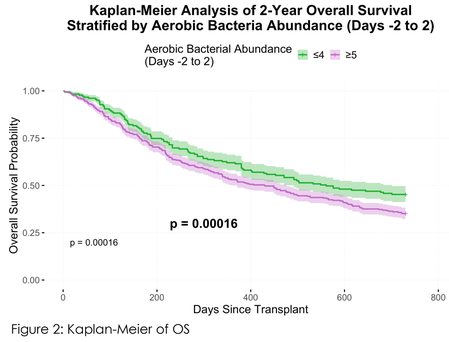


Figure 2: Kaplan-Meier of OS

4.2 Association of Microbial Load around HSCT (Days –2 to +2) with OS

Anaerobic bacteria

- No significant association with 2-year OS (p = 0.39 for 0 vs ≥1; p = 0.66 for ≤1 vs ≥2). Interpretation: strong group imbalance (majority with 0 abundance) likely limited power.

Aerobic bacteria

- Lower abundance associated with significantly better OS (p = 0.00016 for ≥5 vs ≤4; p = 0.008 for ≥4 vs ≤3).
- Interpretation: Better balanced groups, the results indicate that some reduction in aerobic microbiota abundance via decontamination may be tolerable and together with reduced infectious complications improve OS.

5. DISCUSSION

These findings indicate that semi quantitative microbiota kinetics may be used as data source and that aerobic abundance may associate with outcome after HSCT.

Further prospective studies are needed to clarify whether microbial suppression directly influences outcomes or acts as a surrogate for other risk factors.

6. SUMMARY

- Anaerobic suppression was achieved but did not correlate with significant differences in OS.
- High aerobic abundances around the HSCT date (days –2 to +2) were associated with worse OS.
- Microbial kinetics may provide additional context to monitor changing patient risk after HSCT.

7. REFERENCES

1. **Peled JU, Gomes ALC, Devlin SM, et al.**
Microbiota as predictor of mortality in allogeneic hematopoietic-cell transplantation.
N Engl J Med. 2020;382(9):822–834. doi:10.1056/NEJMoa1900623

2. **Beelen DW, Elmaagacli A, Müller KD, et al.**
Influence of intestinal bacterial decontamination using metronidazole and ciprofloxacin on the development of acute graft-versus-host disease after marrow transplantation in patients with hematologic malignancies: final results and long-term follow-up of an open-label prospective randomized trial.
Blood. 1999;93(10):3267–3275. doi:10.1182/blood.V93.10.3267

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