IMPACT OF ORAL AND GUT MICROBIOME DYSBIOSIS ON TREATMENT COMPLICATIONS IN PEDIATRIC ALLOGENEIC HEMATOPOIETIC STEM CELL TRANSPLANTATION

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Background: Allogeneic hematopoietic cell transplantation (HCT) offers curative potential for various pediatric hematologic diseases, but complications such as graft-versus-host disease (GVHD), infections, and mucositis remain major challenges. Recent studies highlight the influence of the oral and gut microbiome (OM and GM) on transplant outcomes. We investigated microbiome diversity dynamics and their association with post-HCT complications in pediatric patients.
Methods: Thirty pediatric patients who underwent HCT between January 2024 and January 2025 were enrolled. Oral and rectal swabs were collected before conditioning and at neutrophil engraftment. Microbiome profiling was performed using 16S rRNA sequencing. Patients were stratified into higher- and lower-diversity groups based on median Shannon index values at each time point.
Results: The cohort included 19 patients with malignant diseases and 11 with non-malignant diseases. Both OM and GM diversity significantly declined from pre-HCT to engraftment ($p<0.001$). The cumulative incidence of grade 2–4 acute GVHD was 41.7% ± 10.1%. Higher pre-HCT GM diversity was associated with lower GVHD incidence (38.9% vs. 65.8%, $p=0.112$), with a significant difference in the non-malignant subgroup (33.3% vs. 80.0%, $p=0.036$). CMV reactivation was significantly lower in the higher-diversity group at engraftment (20.0% vs. 58.0%, $p=0.036$). Ten patients developed grade ≥3 oral mucositis, which showed no association with OM diversity.
Conclusions: Loss of oral and gut microbial diversity during HCT was associated with increased risks of GVHD and CMV reactivation. Microbiome profiling before and during HCT may offer prognostic insight. Further studies are needed to validate microbial diversity as a biomarker and assess interventions to preserve microbiome health and improve transplant outcomes.