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Abstract Topic:- Prenatal, perinatal and developmental genetics

Abstract Title:- Heterogeneous Cell Populations and Dynamics in the Placenta of Indian Women

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Aims:- The placenta, a complex yet under-studied organ consists of heterogeneous cell types. Trophoblasts, a distinctive cell type, are vital for late-stage placental development. Immune responses and alterations at the maternal-fetal interface are pivotal in regulating pregnancy and initiating parturition. Immune cells within the placenta play essential roles in trophoblast invasion, tissue remodeling, immune tolerance, immunomodulation, and protection against pathogens, ensuring the well-being of the developing fetus. Understanding gene expression of these complex cell types and interactions in healthy pregnancy is of immense importance for development of prediction tools and intervention measures for managing pregnancies in future.

Methods:- We have used the droplet-based single-cell RNA-seq method with four placenta samples collected at term delivery where 5' single-cell gene expression libraries were prepared and sequenced deeply at single cell level.

Results:- We captured transcriptomic profiles of about 25,000 cells in these samples. Our investigation unveiled the predominant cell types and their cell states and transitions with distinctive gene expression patterns within the placental microenvironment. We found changes in gene expression of critical biological processes among these trophoblast cell states which might be involved in the activation of trophoblasts, essential for healthy placental development. Additionally, we found downregulation of cadherin binding and elevation in angiogenesis pathway stimulators in endovascular extravillous trophoblasts which are remarkably similar to such events usually observed in epithelial-mesenchymal transition. We also identified various myeloid cell populations, including maternal and fetal macrophages, dendritic cells, and lymphoid cells encompassing T lymphocytes, B lymphocytes, and NK cells. Moreover, we detected also rare sub-populations of myeloid cells in our dataset, including two distinct proliferative myeloid cell clusters, two subtypes of dendritic cells, and myeloid stem cells.

Conclusions:- This study provides, for the first time in term placentae, valuable insights into the complex interplay of heterogeneous cell populations and dynamic processes within the placental microenvironment, illuminating the delicate balance between fetus and mother at the time of delivery that is crucial for maintaining a healthy pregnancy.

Keywords:- Placenta, Heterogeneous, Single-cell RNA seq, Term, Cell types