

**Immunophenotypic Estimation of Cord  
Blood Hematopoietic Stem Cells Yield in  
Relation to Fetal and Maternal Physiological  
Factors**

**Thesis**

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# Abstract

**Introduction:** Umbilical cord blood (UCB) is an effective alternative source of HSC for stem cell transplantation. The parameters commonly used to evaluate UCB units and predict transplant outcome have been total nucleated cell (TNC) count, CD34<sup>+</sup> HSC count and total volume of cord blood collected. Some maternal and neonatal factors are believed to affect those parameters.

**Aim of Work:** The aim of this study was to characterize and enumerate CD 34<sup>+</sup> HSC in UCB and to evaluate the impact of some maternal and neonatal factors on the quantity and quality of UCB units.

**Methods:** Forty umbilical cord blood units were collected by puncture of the umbilical vein of the umbilical cord of the newborn before delivery of the placenta. UCB units were collected in blood bags containing CPDA-1 as anticoagulant and processed within 12 hours post collection. Cord blood units were analyzed for volume, total nucleated cell count by automated analyzer and enumeration of CD 34<sup>+</sup> HSC by flow cytometry using ISHAGE sequential gating strategy.

**Results:** The volume of the collected umbilical cord blood units ranged from 42 to 126 ml with a mean value  $\pm$  SD of  $72.6 \pm 18.7$  ml. The total nucleated cell (TNC) count in the UCB units ranged from  $0.15$  to  $2 \times 10^9$  with a mean value  $\pm$  SD of  $0.77 \pm 0.34 \times 10^9$ . The CD34<sup>+</sup> hematopoietic stem cell (HSC) count in the UCB units ranged from  $0.03$  to  $6.4 \times 10^6$  with a mean value  $\pm$  SD of  $1.55 \pm 1.33 \times 10^6$ . Cord blood volume was significantly higher among caesarian section deliveries ( $p < 0.05$ ). There was no statistically significant difference between different modes of delivery as regards to TNC count or CD34<sup>+</sup> cell count. There was a statistically significant positive correlation between UCB volume and placental weight ( $r = 0.36$ ,  $p < 0.05$ ). There was no statistically significant correlation between TNC count or CD 34<sup>+</sup> count and placental weight. There was statistically significant positive correlation between UCB volume and both TNC count ( $p = 0.68$ ,  $p < 0.01$ ) and CD 34<sup>+</sup> cell count ( $r = 0.52$ ,  $p < 0.01$ ) and between TNC count and CD 34<sup>+</sup> cell count ( $r = 0.44$ ,  $p < 0.01$ ). There was no statistically significant correlation between cord blood parameters including volume, TNC count and CD 34<sup>+</sup> HSC and either of maternal age, number of parity, neonatal sex, gestational age, birth weight or umbilical cord length.

**Conclusion:** Cord blood units collected by caesarian delivery and with heavier placenta have larger volume. Total TNC count and CD 34<sup>+</sup> HSC count correlate positively with volume of collected UCB. Further studies with larger number of cases should be conducted to confirm these data and further explore the impact of donor related factors on the quantity and quality of UCB units.

**Keywords:** CD34<sup>+</sup> cells, TNC, Cord blood volume