Abstract

Automated Detection of Immature Myeloid Precursors in Healthy Newborns and those with Early Onset Bacterial Infection (EOBI)

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Background:
Historically, the interpretation of white blood cell count and microscopic differential served as laboratory parameters of primary interest in the detection of early onset bacterial infection (EOBI), the most common cause of neonatal mortality and morbidity. Due to their natural occurence postnatally and limitations in microscopic detection, the diagnostic value of immature to total neutrophil ratio (I/T ratio) in EOBI remains lower than that of cytokines and/or C-reactive protein (CRP). Automated flow cytometric methods for enumeration of immature myeloid precursors have now become available (Sysmex XE 2100, Norderstedt, Germany).

Objective:
To investigate kinetics of immature myeloid precursors in non-infected full term neonates by differences in membrane permeability (immature myeloid information, IMI channel) and to test the hypothesis that the detection of immature granulocytes via IMI channel is superior to that via I/T ratio in the prediction of EOBI.

Patients and methods:
68 neonates with clinical and serological signs of EOBI comprised our study group, 228 term neonates with risk factors, but without EOBI served as controls. White blood cell count, IMI positive cells, blood film morphology (100 cells), Interleukin-8 (IL-8) and CRP were analyzed.

Results:
In the control group IMI positive cells were 890/mm^3 (range 34 – 3622) up to 6 hours after birth and dropped to 490/mm^3 (24 – 2318) after 12, 299/mm^3 (3 – 3146) after 24, 153/mm^3 (2 – 808) after 48, and 132/mm^3 (2 – 699) after 72 hours (all $p < 0.05$ vs. 0 and 12 hours). We found no influence of gender, birth weight, or mode of delivery on IMI positive cells up to 6 hours after birth. Absolute cell number and percentage of immature granulocytes via IMI channel were lower than those detected by microscopy, with an I/T ratio of 0.2 corresponding to an IMI / granulocyte ratio of 0.12. In the EOBI group, IMI positive cells were 2121/mm^3 (range 116 – 18857) up to 6 hours and decreased to 760/mm^3 (34 – 4600) after 12, 353/mm^3 (17 – 2790 after 24 h (all $p < 0.05$ vs. corresponding control), and 183/mm^3 (4 – 1520) after 48 hours (n.s.). The sensitivity of IMI positive cells vs. I/T ratio for EOBI was 0.76 vs. 0.14 after 6 hours and 0.45 vs. 0.14 after 24 hours. Corresponding values for specificity were 0.64 vs. 0.90 after 6 and 0.60 vs. 0.99 after 24 hours. The sensitivity of IL-8 vs. CRP for EOBI was 0.78 vs. 0.05 after 6 hours and 0.15 vs. 0.95 after 24 hours. Corresponding values for specificity were 0.96 and 0.93 after 6 and 0.60 vs. 0.99 after 24 hours.

Conclusion:
Although not reaching the initial diagnostic accuracy of IL-8, our results suggest that the automated detection of immature granulocytes via IMI channel is superior to microscopic differentiation in the prediction of EOBI and may therefore become a useful diagnostic tool.