Interference in MCHC measurement: experience in our laboratory in analysing causes and management with the help of CBCO-Sysmex software.

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INTRODUCTION: Mean corpuscular haemoglobin concentration (MCHC) is a complete blood count parameter calculated from haemoglobin and haematocrit (Hb/Ht). Elevated values usually indicate analytical interferences, but may also reflect true erythrocyte disorders.

The most frequent interferences include falsely decreased red blood cell (RBC) counts due to cryoagglutinins and falsely increased haemoglobin (Hb) values caused by plasma abnormalities. Conventional strategies to resolve these interferences involve incubation at 37°C for an accurate measurement of RBC thus correcting haematocrit (Ht), mean corpuscular volume (MCV), mean haemoglobin concentration (MHC) and mean corpuscular haemoglobin concentration (MCHC).

For samples with plasma abnormalities leading to Hb measurement interferences, different strategies had been proposed, including plasma replacement with isotonic solutions, optical Hb measurement, and manual recalculation of parameters (time-consuming, requiring manual handling, and increasing risk of analytical errors). Recently a thorough review has been published on this topic[1] .

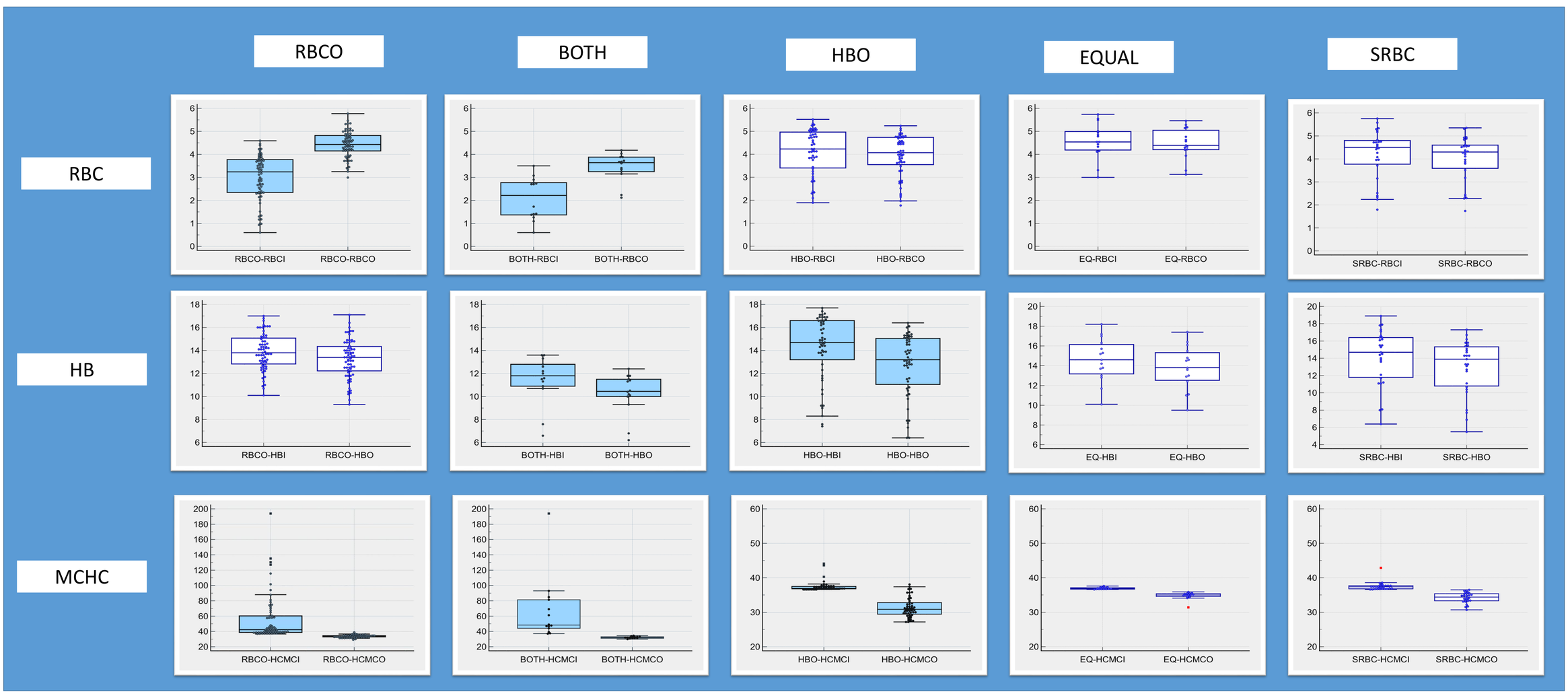
The CBC-O module of the Sysmex e-IPU software is automatically activated when MCHC exceeds 36.5 g/dL. It analyses samples in reticulocyte mode at 41°C, generating optical RBC and Hb values. Based on discrepancies between impedance and optical results, this software suggest to report RBC optical values and recalculate CBC indexes, Hb optical values, equivalent results between the two methods, or inform us about suspected erythrocyte pathology.

OBJECTIVE: To evaluate the performance of the CBC-O software in our laboratory by analysing RBC, Hb, and MCHC values and correlating them with analytical findings and patient diagnosis.

METHODS: Samples were analysed using a Sysmex XN-20 analyser and processed with the CBC-O application of Sysmex e-IPU software. Six months CBC-O reports were reviewed, and data were recorded in an Excel database. Samples were analysed individually and grouped into RBCO (software suggesting to report optical RBC), HBO (software suggesting to report optical Hb), EQUAL (no significant differences between the two results), and SRBC (suspected RBC pathologies) categories. 14 samples results indicate to report both RBCo and HBo (**BOTH).** Mean, standard deviation, and range were calculated for each group.

RESULTS: A total of 187 samples from 133 patients were analysed. (*"-i" indicates impedance-derived values; "-o" indicates optical values.*). Here are the values for each parameter, mode of analysis and group. We display mean, standard deviation and range.

	N	RBC-I (MEAN/DS/RANGE)	RBC-O (MEAN/DS/RANGE)	HB-I (MEAN/DS/RANGE)	HB-O (MEAN/DS/RANGE)	MCHC-I (MEAN/DS/RANGE)	MCHC-O(MEAN/DS/RANGE)
RBCO	92	**2,70**/1,09/0,6-4,6	**4,1**/0,83/2-5,8	**12,95**/2,42/22,20-36,10	**12,29**/2,43/6,20-17,10	**57,1**/27,1/36,7-193,8	**31,25**/2,35/22,2-36,1
HBO	52	**4,12**/0,97/1,89-5,52	**3,95**/0,91/1,77-5,24	**14,24**/2,78/7,4-17,7	**12,76**/2,69/6,4-16,4	**37,44**/1,45/36,6-44,1	**33,41**/1,12/31,3-35,7
EQUAL	15	**4,59**/0,76/3-5,74	**4,46**/0,67/3,13-5,46	**14,59**/2,18/10,10-18,20	**13,77**/2,19/9,50-17,4	**36,96**/0,30/36,6-37,6	34,79/1,05/31,40-35,90
SRBC	27	**4,19**/1,10/1,80-5,75	**4**/0,99/1,74-5,35	**14,14**/3,23/6,40-18,90	**12,94**/3,15/5,50-17,30	**37,51**/1,21/36,6-42,9	**34,22**/1,52/30,7-36,5
RBCO+HBO (BOTH)	14	**2,09**/0,91/0,6-3,5	**3,44**/0,61/2,12-4,18	**11,45**/2,07/606-13,6	**10,26**/1,81/6,20-12,40	**68,58**/45,52/30,6-210	**29,96**/2,79/22,2-33,1



The columns labels indicate the different groups where the samples were classified. RBCO, the parameter reported was optical RBC, and the indexes recalculated. BOTH: optical RBC and HB were reported, indexes recalculated. HBO: optical Hb reported, MCHC recalculated. EQUAL: no differences, no change of parameters. SRBC: suspect of erythrocyte pathology, no change of parameters. The rows shows, for each group, the comparison between initial readings (impedance, photometric or calculated) and the optical and optical derived parameters, for RBC, haemoglobin and MCHC. Highlighted boxes on blue colour indicate the main differences found. Note the MCHC value scale is different between the RBCO and BOTH groups and the rest, as shown in the y axis.

The **RBCO** and **BOTH** groups showed similar behavior, with red blood cell optical values higher than the initial results. Of the 25 samples analyzed using the direct antiglobulin test, 24 were positive. Most of the samples were classified as having interference from cryoagglutinins. In the **HBO** group, no significant differences were observed in red blood cell results, but the hemoglobin optical values were lower than the initial results. The **EQUAL** group (N=15) showed minimal differences between the impedance and optical MCHC values. In the **SRBC** group (N=27), the corrected MCHC values remained borderline, suggesting true erythrocyte pathology.

Clinically, the RBCO group presented an increased reticulocyte count and, occasionally, positive direct Coombs tests. The HBO group was associated with elevated lipemia, hemolysis, and jaundice, as well as increased bilirubin and triglyceride levels. The SRBC group included patients with sickle cell anemia, hemoglobin C, and congenital stomatocytosis.

There may be some overlap between the HBO, EQUAL, and RBCO groups, as in some cases we must check the box for normal or abnormal plasma color, and the algorithm then indicates whether or not to report optical Hb values. Since plasma color can be subjective, it may influence the results. This occurs mainly in cases with low MCHC, close to 36.5, and small differences between Hb-o and Hb-i.

CONCLUSIONS: The CBC-O software enables automated and reliable evaluation of samples with elevated MCHC, effectively correcting analytical interferences while reducing manual processing and the risk of analytical errors.

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