Reference intervals for haematology analytes Preliminary results from the Nordic Reference Interval Project (NORIP)

Arne Mårtensson (arne.martensson@equalis.se) EQUALIS, SE-751 09 Uppsala, Sweden

Half of the laboratories participating in the clinical chemistry part of NORIP also measured the common haematology analytes in samples from the reference persons. The decision to include the haematology in the NORIP was first made in Finland and since then joined all participating laboratories in Sweden and Iceland, one third of the Danish and one laboratory in Norway this part of the project.

The haematology part of the project can be looked upon as an addition to the original NORIP. The reference persons are the same and the information from the questionnaire to them is the same. This description focuses on the differences compared to the clinical chemistry.

At the same time as the samples for the clinical chemistry analyses were collected from the reference person, venous samples with EDTA as anticoagulant were also drawn. These samples, from altogether about 1 800 reference persons, were analysed as routine samples on the haematology instruments in the participating laboratories. The analytical data, method data and reference person data were submitted to the central database where it is stored in a MS Access relational database administered by Gunnar Nordin and Arne Mårtensson at EQUALIS, Uppsala.

Different criteria for exclusion of data have been considered. However, data exclusion has been kept to a minimum. Data have been excluded only for the following reasons:

- For laboratories with more than one series of data from different instruments, only one series is included into the calculations.
- Single results outside mean ± 5 *s* (*s* - standard deviation) have been excluded. This exclusion was repeated until no more outliers were found (twice needed). In total 28 results out of about 21 000 were excluded.

The haematology samples were collected in different types of EDTA-tubes in the participating laboratories. Results from samples collected in tubes with liquid K_3-EDTA are affected by a dilution effect. Better agreement between the analyte means from different laboratories can be achieved if the results are corrected for this dilution effect. Furthermore, an increasing number of laboratories are using tubes with dry K_2-EDTA, which are recommended already 1993 by the ICSH (The International Council for Standardization in Haematology). Accordingly, all results were corrected, to the expected values in undiluted samples, before the reference intervals were calculated centrally by EQUALIS. The calculations, of the reference intervals with simple nonpa-

rametric method and the decisions for partitioning into subgroups, were done in the same way as in the clinical chemistry part of the project.

The database contains further information, which have not yet been examined, for example differential counts on leukocytes or the results in relation to haematology instrument used.

For haematology analytes there is no easily obtained common calibrator. The working group believes that results from the different national external quality control programs could be used to define quality specifications to be fulfilled by the laboratories sharing the new reference intervals.

Preliminary haematology reference intervals

Analyte	Gender subgroup	NORIP calculated	NORIP suggested
B–Haemoglobin (mmol/L)*	Women	7,09 – 9,27	7,1 – 9,3
	Men	8,12 – 10,30	8,1 – 10,3
B–Haemoglobin (g/L)	Women	117 – 153	117 – 153
	Men	134 – 170	134 – 170
B–Erc, volume fraction	Women	0,348 – 0,459	0,35 – 0,46
	Men	0,395 – 0,500	0,40 – 0,50
B–Erythrocytes (10^{12}/L)	Women	3,94 – 5,16	3,9 – 5,2
	Men	4,25 – 5,71	4,2 – 5,7
Erc–MCV (fL)		82,0 – 98,0	82 – 98
Erc–MCH (fmol)*		1,64 – 2,02	1,6 – 2,0
Erc–MCH (pg)		27,1 – 33,3	27 – 33
Erc–MCHC (mmol/L)*		19,2 – 21,6	19,2 – 21,6
Erc–MCHC (g/L)		317 – 357	317 – 357
B–Leukocytes (10^9/L)		3,47 – 8,81	3,5 – 8,8
B–Thrombocytes (10^9/L)#	Women	165 – 387	–
	Men	145 – 348	–
	All	153 – 367	145 – 390

* Unit recommended by IFCC/IUPAC.

For B–Thrombocytes the partitioning rules suggest separate low reference limits for women and men but the working group tends to propose a common reference interval for both genders.

The results in the table do not present the final proposal and the discussions in the working group are not finalised. Some results remain to be explained and the working group has not yet considered all details. Rounding off is another question for further discussions.

The Nordic working group has the following participants: Eeva-Riitta Savolainen (Oulu/Uleåborg Finland), Veli Kairisto (Turku/Åbo Finland), Niels Jørgen Christensen (Aarhus/Århus Denmark), Leifur Franzson (Reykjavik Iceland), Vigfus Thorsteinsson (Akureyri Iceland), Sverre Sandberg (Bergen Norway), Marthe Wedø Aune (Trondheim Norway), Birgitta Swolin (Gothenburg/Göteborg Sweden), Gunnar Nordin and Arne Mårtensson (Uppsala Sweden).

The haematology results from the project are shown on the project home site http://www.furst.no/norip Specific details of each analyte can be viewed by selecting the specific analyte on the web page by selecting “Haematology data” and then “Data for each analyte”.

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