Red Cell Volume Distribution Curves in Diagnosis of Glomerular and Non-Glomerular Haematuria

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Dear Sir,

Docci et al. [1] reported recently that urinary red cell volume distribution curves (RCVDC) obtained using red cell analysers (RCA) were useful in diagnosing glomerular and non-glomerular haematuria. In an evaluation of the technique in patients with haematuria referred to a hospital-based nephrourology unit we found the technique lacked specificity and sought reasons to explain this.

We used a Coulter S + IV RCA and a modification of the method of Shichiri et al. [2] to prepare the samples. 10 ml of fresh urine was centrifuged (1,500 rpm, 5 min), the supernatant removed and the sediment resuspended in Isoton III buffer and injected directly into the red cell counting chamber. Urine was passed through polycarbonate filters (0.8 and 3.0 μm , Nucleopore) and these examined with scanning electron microscopy. Centrifugation of urine against a sucrose polymer was used in an attempt to separate urinary RBC from urinary debris. The serial dilution of normal peripheral blood in urine produced in turn, non-glomerular, mixed and glomerular RCVDC at decreasing cell concentrations. In addition, urine from 7 normal subjects (6 without urinary RBC and 1 with $35 \times 10^6/\text{l}$) all showed glomerular RCVDC. Filtration of haematuric urine from a 79-year-old man after prostatectomy (fig. 1a) trapped RBC (3.5–9.5 μm diameter) and particulate debris (1.0–7.5 μm diameter). Urine from a 56-year-old man with crescentic glomerulonephritis (fig. 1b) produced similar results although it was not possible to carry out an estimate of red cell size (particulate debris 1–13 μm diameter). RCVDC from the cells obtained following centrifugation of urine against the sucrose polymer showed modal cell volumes < 50 fl or 80–100 fl, i.e. RCVDC thought to indicate glomerular or

0 12 3 4 Diameter, μm

9 10 11 12 13 14 15 16

Fig. 1. Size distribution of urinary particles obtained by filtration of haematuric urine from a 79-year-old man after prostatectomy (a) and a 56-year-old man with crescentic glomerulonephritis (b). $\frac{3}{4}$ = RBC.

non-glomerular haematuria. Direct microscopy showed predominantly cellular debris with the RBC pellet and predominantly amorphous debris at the supernatant/ sucrose junction.

These results suggest that separation of RBC from other particles in urine may be carried out more successfully in urine from patients where the predominant cell is the RBC. The shape of the RCVDC and the modal cell

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volume are altered by the presence of other debris, i.e. non-cellular particles, other cells and bacteria. In patients with urinary tract inflammation or infection and haematuria, particles, other than RBC, are likely to be counted in the RCA. It is of interest that Shichiri et al. [2] found 'glomerular' curves were obtained in patients with lower urinary tract bleeding who had urinary tract infection. In contrast, 10 of 60 patients reported by Docci et al. [1] were found to have a urinary tract infection and non-glomerular haematuria. The difficulty of obtaining haematuric urine free of debris means that the true MCV of glomerular RBC remains unknown.

Shichiri et al. [2] excluded 257 of 1,012 (25%) patients with haematuria from their study on the basis that 'full investigation was either refused or not justified since haematuria was slight'.

Therefore their study group was probably biased towards those with higher numbers of urinary RBC. In addition, 566 patients (55%) were excluded for reasons that were not clearly defined although a definite diagnosis was reached. No information is provided by Docci et al. [1] as to the numbers of RBC in the urine of their patients. We agree with DeCaestecker et al. [3] that the shape of the RCVDC obtained with RCA is altered by the presence of debris in urine. This debris is present in normal urine and urine with small, but clinically significant, numbers of RBC.

Because of this the

usefulness of RCA in the diagnosis of haematuria is likely to be limited to patients with large numbers of urinary RBC where the relative proportions of RBC to urinary debris enable the RCA to produce a meaningful RCVDV. We suggest that the clinical usefulness of this technique in the evaluation of haematuric urine remains unproven.

References

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