Haemoglobin concentration and erythrocyte sedimentation rate in primary care patients

E J Kanfer MRCP MRCPath B A Nicol

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SUMMARY

The erythrocyte sedimentation rate (ESR) remains a commonly measured indicator of disease, but is subject to several non-disease influences. The haemoglobin concentration (Hb) and ESR were measured in 1249 consecutive patients (492 men, 757 women) from primary care practices.

An inverse correlation was found between Hb and ESR throughout the range of measured Hb, and in particular there was a significant difference in the median ESR of patients in the highest and lowest quartile for non-anaemic Hb ($P < 0.001$).

These results indicate that correct clinical analysis of an ESR result should take into account the Hb, both in anaemic and in non-anaemic patients. Interpretative difficulties due to external influences on the measured ESR could be resolved by replacement of this test with plasma viscosity estimation.

INTRODUCTION

The erythrocyte sedimentation rate (ESR) is commonly used as a non-specific indicator of inflammatory or malignant conditions, both as a diagnostic screening test and in the assessment of disease activity[1–5]. However, the effects of various non-disease influences on the measured ESR have led to the suggestion that it should be replaced by the zeta sedimentation rate (ZSR) or plasma viscosity estimation[6,7]. Despite these proposals the ESR remains one of the most frequently requested laboratory tests, in particular from primary care practice[8]. Although most clinicians know that anaemia is associated with a raised ESR, few take into account normal haemoglobin values when interpreting an ESR result.

PATIENTS AND METHODS

All requests for blood count and ESR received in the laboratory from patients attending their general practitioner surgeries during a consecutive 8 week period were investigated. Haemoglobin concentration (Hb) was measured with an automated analyser (STKS; Coulter Electronics, Luton, UK), and ESR was estimated by a modified Westergren method (Seditainer; Becton Dickinson, Oxford, UK). The Hb and ESR results, together with patient sex, were analysed with Prism Statistical Software (GraphPad Software, San Diego, USA). Because of non-Gaussian distribution of the ESR values nonparametric methods were used to compare groups and calculate correlation (Mann–Whitney, Spearman). Patient age and diagnosis (or reason for request) were not included in the analysis since one or other of these was commonly missing from the sample request form.

RESULTS

The total number of samples received was 1249 (492 men, 757 women). 249 patients (111 men, 138 women) were anaemic, while in 1000 patients (381 men, 619 women) the Hb result was in the normal range for this laboratory (men, 13.5–17.5; women, 12.0–16.0 g/dL). The median ESR with inter-quartile ranges (IQR) for non-anaemic and anaemic patients were 8 (4–16) and 18 (10–34) mm/1st h, respectively ($P < 0.001$). This difference was present in both men and women [men, 6 (2–12) versus 16 (9–30); women, 10 (6–18) versus 22 (10–40); both $P < 0.001$]. Of 1000 patients with a normal Hb the ESR was above the normal range for this laboratory (men, 0–10; women 0–15 mm/1st h) in 306 cases (31%). Figures 1 and 2 show plots of Hb against ESR in men and women. In both sexes a significant inverse correlation was demonstrated in all patients and notably also in non-anaemic patients.

Within the non-anaemic group there was a significant difference in median ESR between patients in the highest and lowest quartiles for Hb: males with Hb 15.3–17.1 g/dL had a median ESR of 3 (IQR 2–6) and those with Hb 13.5–14.1 g/dL had a median ESR of 9 (4–18); women with Hb

Department of Haematology, Charing Cross and Westminster Medical School, Charing Cross Hospital, London W6 8RF, England

Correspondence: Dr E J Kanfer, Department of Haematology, 4th Floor CWB, Hammersmith Hospital, DuCane Road, London W12 0NN, England

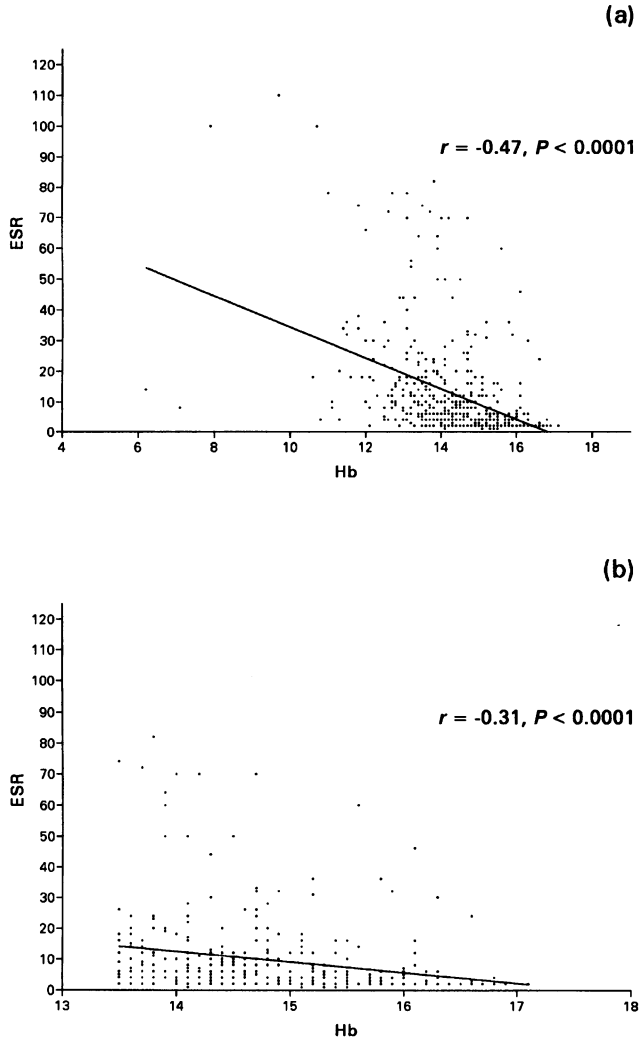

Figure 1 **Haemoglobin concentration and ESR: (a) all male patients (*n*=492) and (b) non-anaemic male patients (*n*=381)**

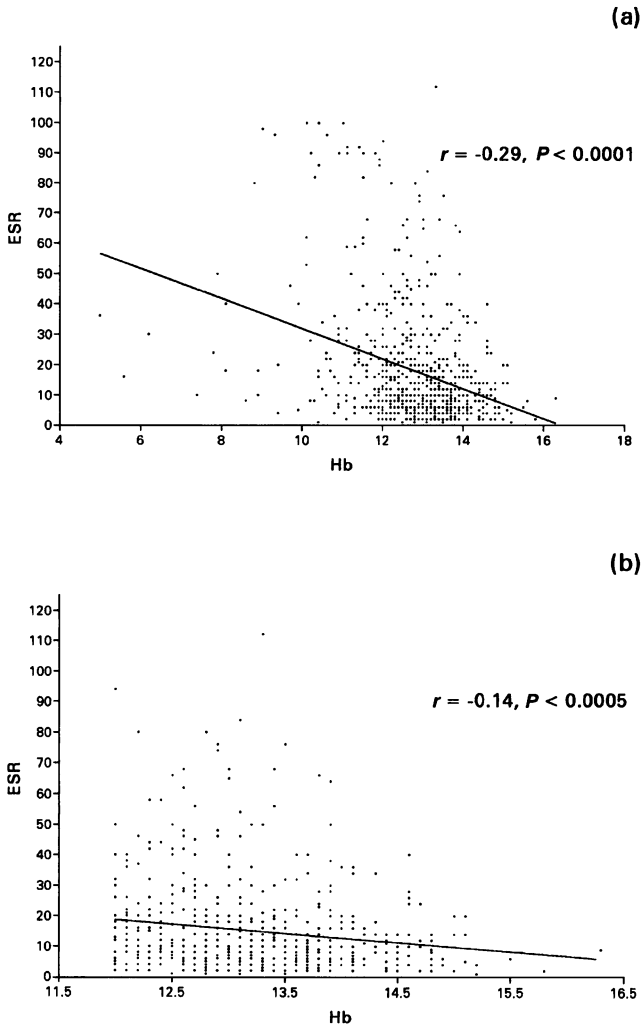

Figure 2 **Haemoglobin concentration and ESR: (a) all female patients (*n*=757) and (b) non-anaemic female patients (*n*=619)**

13.7–16.3 g/dL had a median ESR of 9 (IQR 4–14) and those with Hb 12.0–12.6 g/dL had a median ESR of 12 (6–24); both $P<0.0001$.

DISCUSSION

The finding of a raised ESR in an individual patient may prompt detailed investigation or (in the case of disease monitoring) therapeutic intervention. If wrongly interpreted, the investigation may therefore generate unnecessary patient anxiety, discomfort and expense. A spurious increase of ESR in anaemic patients is well recognized[6,9]. While an inverse correlation between Hb (in the normal range) and ESR has been documented in normal individuals[9,10], our study has demonstrated a similar relationship in non-anaemic primary care patients. The ESR should therefore be interpreted with due regard to the Hb in both anaemic and non-anaemic patients.

Almost one-third of patients with a normal Hb in this study had a raised ESR. While many of these may have had underlying organic disease, in some the apparent abnormality was probably related to the effects of Hb variation (and additionally to age and smoking habit[7,9,10]). It is difficult for a reporting laboratory to provide a normal range for ESR that allows for all relevant non-disease influences. The results of this study support the argument for abandonment of ESR measurement in favour of plasma viscosity[11].

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