



CLINICAL APPLICATION OF THE PLASMA VISCOSITY TEST

Changes in the concentration of one or more plasma protein fractions will result in a change in plasma viscosity. Plasma viscosity can therefore be used both as a diagnostic tool for the presence of diseases known to alter the proteins, and as a measure of the extent of the condition.

The normal range of E.D.T.A. plasma viscosity, in mPa.s, is from 1.16 at 37° C, to 1.92 at 20° C. General physiological factors have been shown to have no significant effect on plasma viscosity. Infants up to the age of 3 months have a slightly lower plasma viscosity, by about 0.25 mPa.s, and some women in the final 3 months of pregnancy may have an increase in their plasma viscosity of up to 1.80 mPa.s. An individuals' personal normal level is generally stable, and relatively small changes can therefore be of clinical significance.

Diseases which alter the plasma proteins also alter the plasma viscosity, causing it to increase, whereas the E.S.R. may be unaffected. This may be particularly noticeable in severe acute conditions, whilst showing a more gradual and less elevated effect in less severe conditions. Chronic disease increases plasma viscosities in the range 1.75 – 2.00 mPa.s.

The early stages of malignant growths may have no effect on plasma viscosity, but this changes as the growth progresses, and with any secondary deposits, when the plasma viscosity increases. Markedly high plasma viscosities may be found when the nature of the growth alters.

Increased plasma viscosities may be seen to fall in fatal diseases towards the time of death, at which point they may return to normal.

Reference: "The Viscosity of Human Blood Plasma and its Change in Disease and on the Exhibition of Drugs". J. Harkness and R.B. Whittington, (Department of Clinical Pathology, Taunton and Somerset Hospital, Taunton; and Department of Civil Engineering, University of Liverpool.)

COMPARISON OF PLASMA VISCOSITY AND ERYTHROCYTE SEDIMENTATION RATE

Plasma Viscosity	E.S.R
Testing may be carried out up to one week after sample collection.	Testing generally required within 4 hours, up to a maximum of 24 hours
Anaemia has no effect.	Effect of anaemia is debateable, and opinion is divided.
Variation in red cell surface factors has no effect.	Red cell surface differences affect sedimentation.
Standard method gives comparability of results.	No standard method. Differing reagents, tube measurements, and methods of timing the erythrocyte sedimentation make direct comparisons impossible.



Rapid instrument set-up checks ensure optimum conditions. Tests take 30 seconds. Faster than making up a citrate dilution of EDTA blood and setting up a Westergren ESR test.

Normal range of plasma viscosity is only about 2% of the range found during abnormalities.

Gender and age give no variations in normal range of plasma viscosity.

Plasma viscosity unaffected by physiological changes, apart from pregnancy, where the increase is predictable and irregular results can still be detected.

Increased plasma viscosity is always due to a change in the plasma protein fractions.

Increases in plasma viscosity during inflammatory conditions or tissue destruction becomes evident early on.

Plasma viscosity has a low occurrence of false negatives.

Changes in plasma viscosity are proportional to the severity of disease and are the same for both sexes.

Plasma viscosity levels for individuals are stable, unless affected by disease.

Plasma viscosities will not return to the normal range by the use of steroids alone.

Plasma viscosities will not return to normal with the use of salicylates.

Diagnosis of myeloma and macroglobulinaemia are possible using plasma viscosity.

Polycythaemia does not affect plasma viscosity.

Optimum conditions cannot be easily checked. Unclean tubes and variations in temperature may be undetected.

Winrobe technique gives normal range of 6 – 40% of total ESR range.

ESR Range different in men and women.

Raised ESR's in pregnancy are unpredictable so abnormal results are undetectable.

Reasons for an increased ESR are not clearly defined.

Changes in ESR become evident later.

False negatives more frequent with ESR.

Changes in ESR can be less reliably linked to severity of disease and are different between men and women.

ESR levels in individuals are inconsistent, with no clinical explanation.

Influence of steroids will return the ESR to normal. ESR then becomes invalid as a clinical tool.

ESR levels become falsely depressed with sufficient blood concentration of salicylates.

ESR levels in these conditions are not diagnostically significant.

Normal ESR levels may occur with a P.C.V. of 50% or greater.