CORRESPONDENCE

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Anesthetic Management of Hyperviscosity with Hemodilution

To the Editor:—Hemoconcentration or polycythemia causes a marked reduction in blood flow through microcirculation,[1] and hypoperfusion or infarction caused by blood sludging may occur in important organs.[2]

We recently cared for a 26-yr-old male (153 cm, 43.5 kg) with tetralogy of Fallot who underwent an emergency craniotomy for the drainage of a brain abscess. The laboratory data showed marked increases in the concentration of erythrocytes (8.20 x $10^6/\mu L$), hemoglobin (24.6 g/dL), and in hematocrit level (74%). To avoid the hyperviscosity syndrome, we planned to dilute the patient's blood. General anesthesia was induced with fentanyl 400 μg, propofol 30 mg, and vecuronium bromide 6 mg while using 100% oxygen. After the anesthesia was induced, 820 g blood were collected in three bags that contained citrate-phosphate-dextrose solution for a 60-min period, while 500 ml 6% hydroxyethyl starch and 700 ml lactated Ringer's solution were continuously infused. The hematocrit level decreased to 62%. During surgery, the hematocrit level increased to 66% after the administration of 200 ml 20% mannitol for the reduction of brain edema, which suggested slight hypovolemia. Hemodynamic parameters, arterial blood gas tensions, and the plasma concentration of lactate remained stable throughout the surgery. The hematocrit value at the end of surgery was 64%. The patient recovered from anesthesia without any central nervous system complications.

Postoperatively, the whole-blood viscosity was measured in samples that were collected with heparin. A cone-plate viscometer was used to determine blood viscosity. After calibration of the rotating cone with Newtonian fluids of known viscosity at various shear rates, the sample viscosity was measured using a 0.8° cone at a shear rate of 3.76 to 150.45/s at 25°C. Blood viscosity before hemodilution was 15.1 mPa · s at a shear rate of 75.22/s (fig. 1), which is approximately twice the value in a healthy adult human with a hematocrit level of 41%. The hemodilution to a hematocrit level of 62% reduced blood viscosity to 8.3 mPa · s.

Although no hemodilution benefit can be claimed, there is concern regarding the potential for tissue injury with these high hemoglobin concentrations and hematocrit levels.[3] However, a relatively small degree of controlled hemodilution (from a hematocrit level of 74 to 62%) resulted in near normalization of viscosity. The use of crystalloids and hydroxyethyl starch may have contributed to this change.

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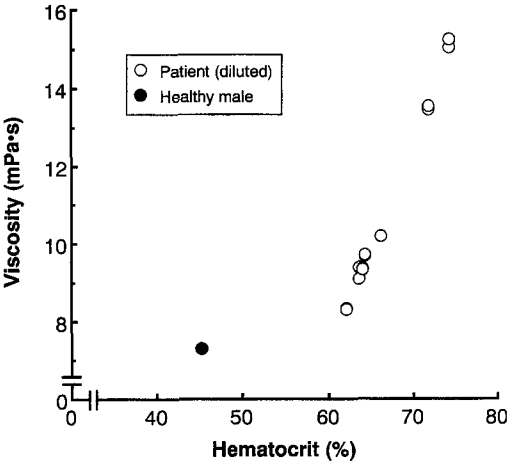

Fig. 1. Effect of hematocrit to viscosity. Relation between hematocrit levels (%) and whole-blood viscosity (mPa · s) at a shear rate of 75.22/s. Patient data throughout surgery (before and after hemodilution) are shown.

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