DEMONSTRATION OF COLLOIDOSMOTIC EFFECT OF BLOOD ON CEREBROSPINAL FLUID

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WHEN a hydrocephalic baby dies, the fall of pressure in the vascular tree is accompanied by immediate relief of tension at the fontanelle. Subsequently there occurs progressive retraction at the fontanelle, indicating reduction in volume of the intracranial contents. We have assumed that this is due to a reduction in volume of cerebrospinal fluid occasioned by its reabsorption into the blood; and that this occurs because the cessation of filtration pressure stops the formation of cerebrospinal fluid and permits the colloidosmotic pressure of the blood plasma to draw the fluid back into the blood compartment not only via the venous but also the arterial side of the capillary system.

In order to test the hypothesis we performed experiments with samples of blood and cerebrospinal fluid from four patients. From 2 to 4 ml. of heparinized blood was placed in a small cellophane sac. This was attached to a calibrated 2-ml. pipet and suspended in a 100-ml. glass cylinder containing cerebrospinal fluid removed from the same patient at pneumoencephalography. Cellophane (regenerated cellulose) is a comparatively good substitute for the capillary wall. It is not permeable to albumin, but it is permeable to water, electrolytes, urea, and other materials having molecules smaller than albumin *(Fig. 1).* Care was taken that the hydrostatic pressure of the blood in the sac was always slightly higher than that of the surrounding fluid. This was accomplished by moving the pipet up or down so that the level of the blood was just 1 cm. above the level of the cerebrospinal fluid. Any change in volume of the blood in the cellophane sac and pipet could be accurately read.

In all four experiments there was a continuous increase in volume of the blood, indicating that water from the cerebrospinal fluid was entering the blood compartment. *Figure 2* is a composite graph of the increase in volume of the blood.

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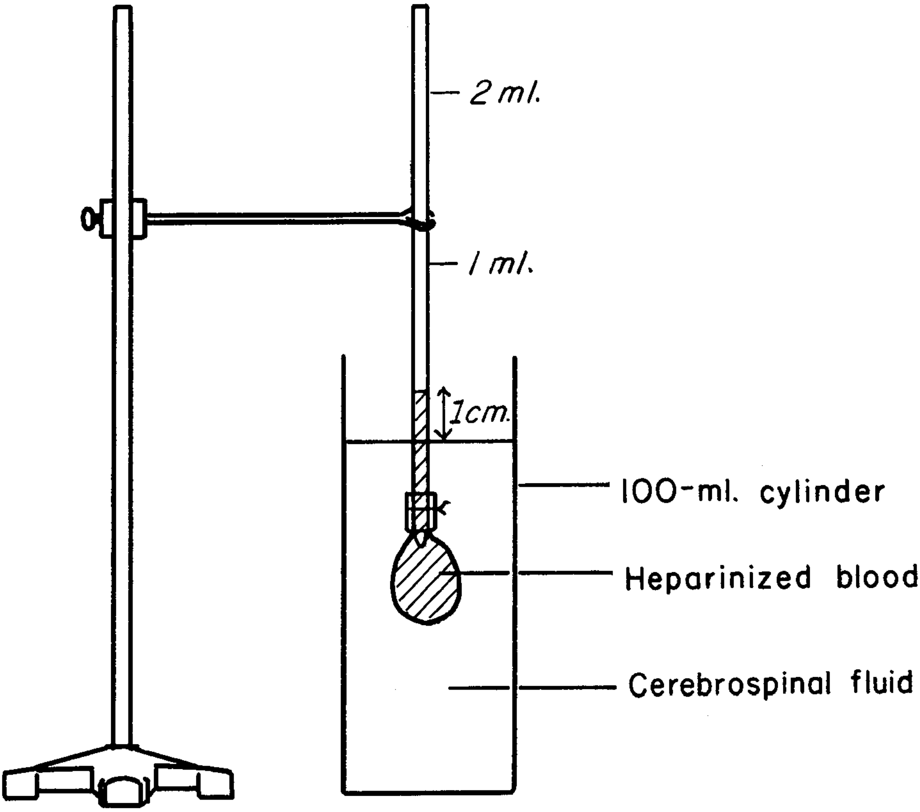

Fig. 1. Diagram showing how the increase of volume of blood in a cellophane sac suspended in cerebrospinal fluid is measured. To insure uniform distention of the sac, the height of the pipet is adjusted at each reading so that the level of the blood is 1 cm. above the level of the cerebrospinal fluid.

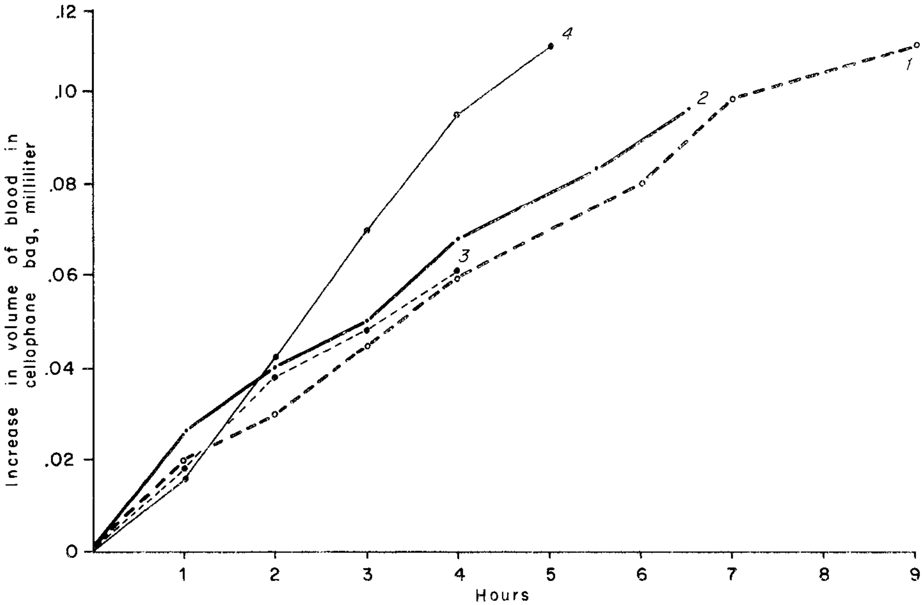

Fig. 2. Composite graph of results of four experiments, showing the volume increase with time of 2 to 4 cm. of blood suspended in cerebrospinal fluid at room temperature. Cellophane sacs each had a surface area of approximately 7.0 square centimeters. Hydrostatic pressure of the blood was maintained 1 cm. higher than that of the cerebrospinal fluid.

Conclusion

The size and shape of the cerebrospinal fluid spaces are not the same in death as they are during life, because colloidosmotic pressure, no longer counteracted by intracapillary pressure on either the arterial or the venous side, causes reabsorption of cerebrospinal fluid into the blood compartment.