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Reliability of Spinal Fluid Analysis in the Diagnosis of Drunkenness.

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The medico-legal importance of establishing the state of inebriety of an individual has given rise to a great mass of research on the reliability of analysis of the various body fluids as an index of drunkenness. Those most commonly used are the blood, the urine, and the breath, but most authors mention that except for its impracticability the spinal fluid should yield the most reliable information.

Nicloux[1] found that in dogs about an hour after ingestion of a single dose of alcohol the values in the blood and spinal fluid were approximately equal. Schumm and Fleishmann[2] administered a constant dose of alcohol to a series of patients, puncturing each at a different period after ingestion, and so obtaining a composite curve of blood and spinal fluid alcohol. They found that during the first hour the blood alcohol rose more rapidly than did the spinal fluid alcohol, but that during the decline of the blood alcohol the spinal fluid alcohol surpassed it and remained at a higher level. Because of their use of single punctures on various patients some of their figures fall far out of line. Recently Abramson and Linde[3] repeated this work, using a dose of alcohol proportional to body weight, and leaving the lumbar needle in place during the 3 hours over which they collected their specimens. They showed that the alcohol content of the spinal fluid rises more slowly than that of the blood, and reaches its maximum later. This maximum is lower than that reached by the blood. During the period of decline the spinal fluid alcohol remains higher than the blood alcohol.

In support of the contention that the spinal fluid alcohol is the best index of intoxication, Gettler and Freireich[4] showed in a series of cases coming to autopsy that there was a more constant relation between the alcohol content of the brain and spinal fluid than between

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[1] Nicloux, M., *Compt. rend. de la Soc. de Biol.*, 1900, **52**, 620.

[2] Schumm, O., and Fleishmann, R., *Deutsche Z. f. Neivenheilkunde*, 1913, **46**, 275.

[3] Abramson, L., and Linde, P., *Arch. Internat. de Pharmacodynamie et de Ther.*, 1930, **39**, 325.

[4] Gettler, A. O., and Freireich, A. W., *J. Biol. Chem.*, 1931, **92**, 199.

the brain and blood. Some of their values appear rather bizarre, probably being accounted for by the fact that the material was obtained post mortem.

If we subscribe to their theory, we must assume that a person does not become intoxicated for an hour or so after taking liquor, since the work first quoted shows a lag of that long in the rise of the spinal fluid alcohol. This does not agree with our experience, which includes some 50 cases of experimentally induced intoxication, both by the intravenous and the oral route. We therefore undertook to confirm or refute the theory.

We first determined the course of the lumbar fluid alcohol after a dose of 1 cc. per kilo, administered intravenously by the technic described by us previously.[5] The results (Fig. 1) confirm the work of the previous investigators. In none of 7 cases so treated did the spinal fluid alcohol reach the level of the blood alcohol in less than 80 minutes, yet our observation of these patients, as well as of many others after the same dose, showed them to be more intoxicated at the end of the injection, when the spinal fluid alcohol was negligible, than at any subsequent time. This would seem to show that at least during the first hour after imbibition the spinal fluid alcohol is a poor index of intoxication.

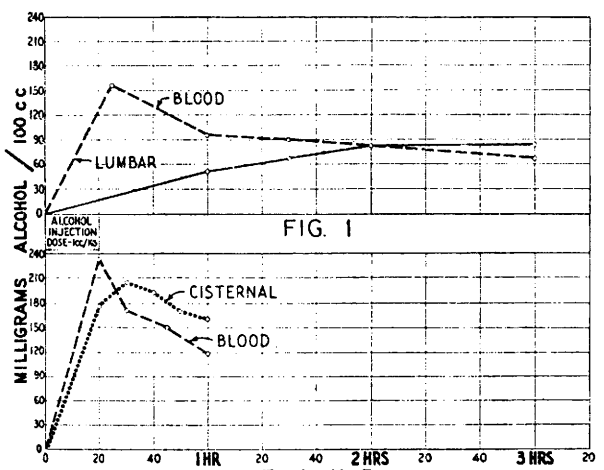

FIG. 1

FIG 2

[5] Newman, H. W., and Mehrtens, H. G., PROC. SOC. EXP. BIOL. AND MED., 1932, **30**, 145.

We repeated the experiment, but instead of removing the fluid by lumbar puncture as our predecessors had done we did cisternal punctures. The results (Fig. 2) demonstrated how promptly the

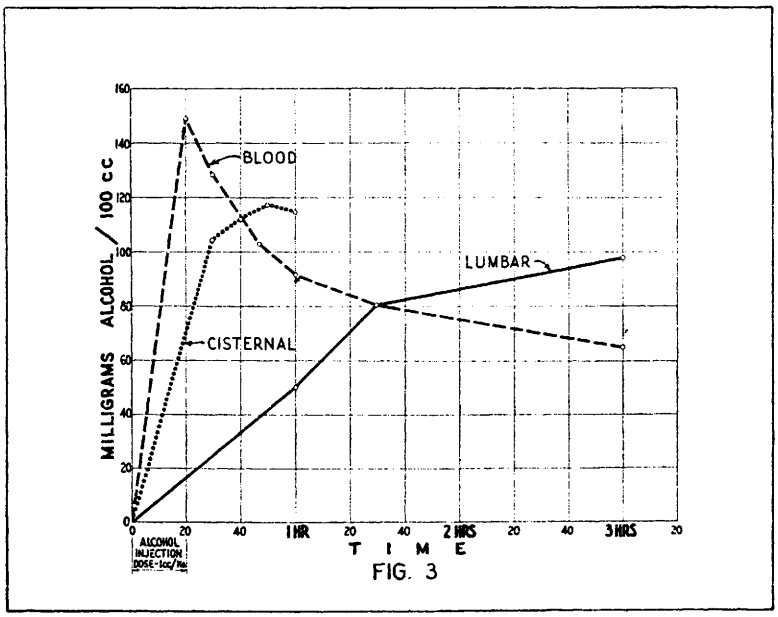

FIG. 3

values in the cisternal fluid follow those in the blood. The third figure shows a comparison of the rise in cisternal and lumbar fluid in another patient after a single injection. The lag of the lumbar fluid is striking.

Thus we can say that the alcohol content of the cerebral fluid closely follows that of the blood, and correlates well with the symptoms of intoxication, while that of the lumbar fluid shows a lag of about an hour. From this it would seem that at least during a period of an hour or so after the ingestion of alcohol the content of the cisternal fluid is a better index of intoxication than that of the lumbar fluid, while that of the blood is probably the best of all.

The explanation of the more rapid rise in the cisternal fluid over the lumbar fluid is still obscure. Two possibilities present themselves: that the alcohol is secreted by the choroid plexuses and diffuses slowly down the cord; or, that the process is a simple transudation from the blood vessels, the greater vascularity of the cerebral end of the system accounting for the more prompt attainment of equilibrium in that region. We intend to investigate this point in detail.