Discussion

It seemed quite clear that the case was one of lead encephalopathy, but owing to the presence of left-sided weakness and ocular changes, and marked increase in C.S.F. pressure, a space-occupying lesion in the cranium had to be considered. The history and chemical findings here led us to adopt an expectant policy, and the subsequent progress of the patient justified this fully. There are records of similar cases, especially in children, in which cerebral decompression and exploration for tumour have been carried out. Thus Bucy and Buchanan (1935) report three cases of encephalopathy in children in which similarity to cerebral tumour was so great that two of them were submitted to suboccipital decompression before the correct diagnosis was reached. Both of these, as well as a third case which was treated medically, ended in recovery. Machle (1935) described the occurrence in tetra-ethyl lead workers of delirious mania and confusion which resembled schizophrenia. Similarity of encephalopathy to cerebral tumour was observed by Eden (1935), whilst McKhann and Vogt (1933) noted that in children lead poisoning may resemble acute encephalitis. They mention as symptoms projectile vomiting, visual disturbance, stupor, coma, convulsions, elevation of blood pressure, choked disks, and, in extreme cases, separation of cranial suture. They believe that all this can be attributed to increased intracranial tension due to intense cerebral oedema, which if prolonged leads to degenerative processes owing to impairment of circulation.

We have not been able to discover records of lead content in cerebrospinal fluid in cases of lead encephalopathy, and although only a trace of it was found in the fluid of our patient, it is difficult to assess the exact significance of it because Rabinowitch and his co-workers (1933) reported the presence of lead in the cerebrospinal fluid of every individual in a small series of cases of lead poisoning. On the other hand, we recently had a patient suffering from severe lead colic whose blood lead was 0.335 mg. per 100 c.cm. (normal is *nil* to 0.1 mg.), whose twenty-four-hour excretion of lead in the urine was 0.89 mg. per 100 c.cm. (normal, *nil* to 0.11 mg.), and whose cerebrospinal fluid contained no lead.

It is interesting to note also that no gross abnormality was found in the urine of our patient, although renal function appeared impaired, and his urea clearance was still at the lowest limit of normal even after he had improved.

Considering the possible changes in the brain, which include liquefaction of the nerve cells (Lehmann *et al.*, 1926), extensive chromatolysis, and some glial proliferation (Cadwalader, 1912), our patient appears to have escaped lightly, from the point of view both of mental and of eye changes.

Summary

The findings of a patient with lead encephalopathy are described.

Superficial similarity to cerebral tumour is pointed out.

Full recovery on expectant treatment is outlined.

We should like to record our gratitude to Mr. F. Morton, the hospital biochemist, for carrying out the analyses and for his helpful criticism.

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SULPHANILAMIDE AS A PRESERVATIVE
IN STORED BLOOD

BY

R. F. HUNWICKE, B.Sc., F.I.C.

(From the Bacteriological Department, Glaxo Laboratories Ltd.)

Milan Novak (1939) describes experiments which indicate that the addition of small amounts of sulphanilamide to stored blood may be expected to prevent the development of contaminating saprophytes at low temperatures. These contaminants are often present in blood that has been stored for transfusion purposes, and they develop at refrigerator temperature, making the blood unfit for use for transfusions. The same phenomenon has been observed at times in this laboratory with horse blood for culture media: blood which is apparently sterile immediately after withdrawal from the horse begins to show the development of organisms after storage for a certain period in the refrigerator, with resultant wastage. The possibility of adding a harmless substance which will prevent the development of organisms during storage is of some importance. The following experiments are confirmatory of Novak's conclusions.

Experiment 1

A rabbit was bled from the ear into citrate solution. To the blood a mixture of organisms isolated from contaminated human blood was added so as to give approximately 100 per c.cm. These organisms were mostly staphylococci and streptococci, with a few common sporing bacilli of the *subtilis-mycoides* type. To one portion of blood sulphanilamide 1:5,000 was added. The other portion was a control without any addition. Both samples were stored in the refrigerator at 2° C. and plated at intervals, the plates being incubated for three days at 37° C. The results are shown in Table I.

TABLE I

	Initial	3 Days	7 Days	14 Days	20 Days
+ Sulph. 1 : 5,000...	150	200	400	22	26
Control	100	2,000	Uncountable	Uncountable	Uncountable

Experiment 2

240 c.cm. of oxalated rabbits' blood freshly drawn was divided into twelve equal portions. Sulphanilamide was added to give three portions containing 1:1,250, three with 1:2,500, and three with 1:5,000. The remaining three portions had none. To each dilution and each control a suspension of (a) *B. subtilis*, (b) *B. pyocyaneus*, (c) staphylococcus was added to give 10 to 100 organisms per c.cm. The samples were kept in the refrigerator and plated at intervals. The temperatures of refrigeration and incubation of the plates were the same as in Experiment 1. The results are shown in Table II.

TABLE II

	Initial	3 Days	6 Days	14 Days	22 Days	29 Days
<i>B. subtilis</i> :						
1 : 1,250	28	17	7	11	8	11
1 : 2,500	29	33	34	7	14	4
1 : 5,000	24	28	13	6	22	42
Control	56	19	48	14	800	1,000
<i>B. pyocyaneus</i> :						
1 : 1,250	35	20	7	13	0	7
1 : 2,500	26	33	22	16	2	0
1 : 5,000	21	22	38	42	2	0
Control	99	26	60	40	29	2,000
Staphylococcus :						
1 : 1,250	22	21	24	7	10	10
1 : 2,500	16	34	20	12	21	16
1 : 5,000	39	31	26	27	13	2
Control	48	37	49	49	20	13

It will be seen that the staphylococcus failed to develop in the control sample. It is also of interest to notice that the sulphanilamide was relatively effective against *B. subtilis*, presumably preventing the development of spores as well as inhibiting the multiplication of vegetative forms.

Experiment 3

To three bottles of oxalated horse blood collected without any aseptic precautions was added sulphanilamide to give concentrations of 1:1,250, 1:2,500, 1:5,000. A fourth contained no sulphanilamide. The bottles were plated immediately after the addition of the sulphanilamide, were stored in the refrigerator, and plated at intervals. The results are given in Table III.

TABLE III

	Initial	8 Days	15 Days	21 Days	29 Days	35 Days	42 Days	49 Days
1:1,250...	10	72	300	250	12	26	20	45
1:2,500...	18	500	80	480	17	17	23	12
1:5,000...	19	124	500	368	95	480	1,600	Uncountable
Control....	120	800	1,150	Uncountable				

The contaminants were a mixture of various cocci and sporing bacilli as in Experiment 1. This experiment is perhaps the most informative of the series, since it approximates most closely to natural conditions. There are some anomalous counts in this table, but in general it will be seen that the two higher concentrations of sulphanilamide have, after some initial increase, prevented the development of the contaminants. A true condition of bacteriostasis has been achieved.

Discussion

The observation that sulphanilamide in comparatively low concentrations exerts a preservative effect in blood stored at refrigerator temperatures is confirmed. Novak recommends the addition of 20 mg. of sulphanilamide to 100 c.cm. of blood. This may be expressed as 1:5,000, a concentration which in one of the experiments reported here did not prove adequate. The use of higher concentrations, up to, say, 1:1,000, would seem to offer a solution of the problem of storing blood in the refrigerator, provided the initial contamination is very small, as it should be if adequate precautions are taken in drawing blood. Where complete sterility is achieved there is obviously no need for any addition to the blood, but examinations of many specimens of stored transfusion blood and experiences with horse blood have shown that this is a rare condition; there are usually a very few organisms present which do not reveal themselves until the blood has been in the refrigerator for some days or weeks. Then they begin to multiply, and the blood is lost. It is to guard against this wastage and possible danger that the addition of sulphanilamide is suggested.

Novak, referring to his recommended concentration of 1:5,000 for storing transfusion blood, estimates that on transfusion of 500 c.cm. of blood the amount of sulphanilamide introduced would be 0.1 gramme, which he considers an extremely small dose. He adds: "Since the drug is readily absorbed from the blood by the tissues and since it is likewise rapidly excreted it is doubtful that any detectable elevation of blood sulphanilamide level will result even when multiple transfusions are administered." Colebrook and Purdie (1937) have shown that a 0.8% solution can be administered by intravenous drip without any ill effects. The only question, therefore, would seem to be whether there is any objection to giving small doses of sulphanilamide to patients who need blood only.

The sulphanilamide must be added to the blood in concentrated sterile solution. The powder is not readily

soluble in water, and the most convenient method is to dissolve the requisite weight with heat in fifty times its weight of water and boil in a beaker for twenty minutes. The volume will then be reduced to about one-half the original quantity. This solution must be added to the blood while still warm, before the sulphanilamide begins to crystallize out. Sulphanilamide is stable to heat, and solutions may be autoclaved for five minutes. The simple method of boiling in a beaker as described is, however, quite adequate.

Summary

Sulphanilamide in concentrations of 1:1,000 to 1:5,000 is effective as a preservative in blood stored in the refrigerator at 2° C.

The possibility of using the method to assist in the preservation of stored blood for transfusion purposes is discussed.

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THE WAR AS AN AETIOLOGICAL FACTOR IN PSYCHIATRIC CONDITIONS

BY

W. S. MACLAY, M.D., M.R.C.P., D.P.M.

AND

E. GUTTMANN, M.D., L.R.C.P.Ed.

Among many other changes which the war will bring to the medical profession will be an increase of bureaucratic work: war injuries require not only treatment but also administrative measures, and the allotment of the expenses incurred will be based in many instances on the "attributability" to war injury. Many practitioners will be called on to express their expert opinion and to answer questionnaires which will influence decisions regarding this thorny problem. The first condition necessary for the answering of such questions is obviously knowledge of the regulations on which decisions are based. Knowing, for instance, that "war injury" in respect of civilians means physical injury, the practitioner who is asked for advice or a certificate need not waste much time in discussing the prospect of a claim based on damage by fear, anxiety, or mental shock. When official certificates are required the forms to be filled in will usually quote the regulations concerned or will contain them implicitly in the questions.

The main difficulties encountered by medical experts are the incomplete aetiological knowledge in many conditions and the frequent incompatibility of medical and administrative (legal) conceptions. In no other branch of medicine are these difficulties so apparent as they are in psychiatry, where classification of illness is still so ill defined, where hardly any condition is regarded as due to one simple cause, and where prognosis and influence on earning capacity are so uncertain.

As it is to be expected that a great many cases to be judged will have a psychiatric aspect, it seems worth while to review the more common psychiatric conditions from this medico-administrative angle, not presuming to judge the final attributability, which depends on many factors and will ultimately be the province of experts, but to help doctors to answer questions in as useful a way as possible. This survey will mainly be an application of the aetiology as outlined for the various conditions in the chapter on medical psychology by D. Curran and one of us (E. G.) in Conybeare's *Textbook of Medicine*.