a smaller trunk in transverse section which was found to be responsible for a rise of 1 cm. of water in gastric pressure on stimulation. If the motor and sensory nerves are randomly distributed in both these trunks then it appears that the method as at present used can detect a nerve trunk of about 1/50 the size of an average posterior vagus nerve.

Summary

A method is described which will detect the presence of even small vagal nerve trunks at the time of operation for vagotomy. If this method is used complete nerve-trunk section can be obtained.

We thank Professor Sir Lindor Brown for his advice; Dr. E. L. Harries for his help in the early stages of this work; Mr. H. Tennant and Mr. D. Green for their technical help; Spicers Ltd. for making the electrodes; Negretti and Zambra for making the pressure recorder; and Wm. Warne & Co. for making the gastric tube. We also thank the theatre sister and her staff of the West London Hospital for all their kind help in this work. This investigation has been made possible by the financial help of the Dan Mason Research Foundation of the West London Hospital Medical School.

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Results

Cerebral Tumour.—The results of the cell counts are given in Table I, and the protein levels are found in Table II. A total of 835 cases were examined, and all the results represent the findings at the first lumbar fluid examination. Greenfield and Carmichael record results in only 54 cases in their five-year period, so it will be seen that the incidence of such cases now treated in hospital has risen steeply. The features especially worthy of note are that, of the 835 cases, 766 (91.7%) showed no increase in cell count, and that any increase in cell count occurred chiefly in the glioma series. There were in all 69 cases showing a cell increase, and 36 of these (52.2%) were in cases of cerebral glioma, or 10.7% of all glioma cases. However, in only 242 cases (28.9%) was there a normal protein content. The cerebral glioma group showed a raised protein content in 66.5%, while in secondary carcinoma the figure was 69.6%, and in acoustic neurofibroma it was as high as 100%. The other tests employed did not show any features worthy of note.

TABLE I.—*Cells in Cerebral Tumour per c.mm.*

Tumour	0–4	5–9	10–19	20–29	30–39	40–50	Over 50	Total Fluids
Cerebral glioma ..	299	10	7	4	5	4	6	335
Meningioma ..	136	4	—	—	—	—	1	141
Neurofibroma VIII ..	55	1	—	—	—	—	—	56
,, V ..	7	—	—	—	—	—	—	7
Brain-stem tumour ..	30	2	1	1	—	1	—	35
Cerebellar ,, ..	60	1	1	—	—	—	1	63
Intraventricular tumour	10	1	1	—	—	—	1	13
Choroid plexus ,, ..	10	—	—	—	—	1	—	11
Angioma	31	—	—	1	—	—	1	33
Pituitary tumour ..	61	7	1	—	—	—	—	69
Suprapituitary tumour	22	3	—	—	—	—	1	26
Secondary carcinoma ..	45	1	—	—	—	—	—	46

TABLE II.—*Protein in Cerebral Tumour in mg. per 100 ml.*

Tumour	0–40	45–95	100–295	300–495	500–1,000	Over 1,000	Total Fluids
Cerebral glioma ..	112	131	83	4	4	1	335
Meningioma ..	29	65	45	2	—	—	141
Neurofibroma VIII ..	—	11	27	12	5	1	56
,, V ..	—	1	5	1	—	—	7
Brain-stem tumour ..	12	14	9	—	—	—	35
Cerebellar ,, ..	26	20	15	1	1	—	63
Intraventricular tumour	7	1	4	1	—	—	13
Choroid plexus ,, ..	5	5	1	—	—	—	11
Angioma	13	9	10	1	—	—	33
Pituitary tumour ..	16	35	17	—	—	1	69
Suprapituitary tumour	8	13	5	—	—	—	26
Secondary carcinoma ..	14	21	8	2	—	1	46

It should be mentioned that care is needed if lumbar puncture is resorted to in cerebral tumour cases, and it should be performed only in selected patients and where neurosurgery is available.

Epilepsy.—The results are shown in Table III. As can be seen, in only 11 cases was the cell count raised, whereas the protein was 70 mg./100 ml. or below in 93.9%. It was somewhat surprising to find that two cases had a protein above 100 mg./100 ml., and also that 25 cases showed a figure above 80 mg./100 ml.; but the records were carefully searched, and in no case had any of these patients returned to hospital for further investigation.

TABLE III.—*Cells and Protein in Epilepsy*

Cells/c.mm.	No. of Fluids	Protein (mg./100 ml.)	No. of Fluids
0–4	893	0–40	559
5–9	7	45–70	290
10–19	3	75–100	53
20–30	1	105–150	2

Multiple Sclerosis.—Some 690 cases were investigated, and Table IV shows the findings obtained. The cell count was normal in 589 cases (85.4%) and in only three patients was there a count above 50/c.mm. However, in six patients one or two polymorphs were present in the fluid, which is usually

CEREBROSPINAL FLUID IN VARIOUS DISEASES

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Greenfield and Carmichael in 1925 wrote a monograph on the cerebrospinal fluid (C.S.F.) which since that time has been one of the standard books of reference on this subject. The second part of that book was devoted to the results they found in various diseases seen during a period of five to six years. During the past 30 years innumerable papers and books have been written in which small series of results or even individual records were published. It was felt that it would be worth while to record the results of C.S.F. examinations in one neurological hospital over a period of 14 years, during which time the incidence of certain diseases has altered. The period chosen—1936 to 1949—was one in which almost all the fluids, totalling just under 12,000, were examined by one of us, and it also enabled us to obtain a period of follow-up should the need arise for revision of the original diagnosis, which had been determined when the patient left hospital.

A small group of diseases have been chosen for this special study as being common conditions, or because some variation was found from previously accepted views. The methods employed are standard ones as employed in this hospital, and are mostly those of Greenfield and Carmichael, with only minor variations.

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said not to occur; also in eight patients large mononuclear cells were present, on one occasion numbering as many as 13%.

TABLE IV.—*Cells and Protein in Multiple Sclerosis*

Cells/c.mm.	No. of Fluids	Protein (mg./100 ml.)	No. of Fluids
0–4	589	0– 40	349
5–9	50	45– 70	254
10–19	34	75–100	62
20–29	8	105–120	12
30–39	6	125–150	7
40–49	—	155–200	3
50–82	3	205–300	3

The protein level was 100 mg./100 ml. or lower in 665 cases (96.4%), and in only 1.9% was a protein higher than 150 mg./100 ml. found. The clinical findings in all the cases showing a figure above 100 mg./100 ml. have been checked, and in all cases the diagnosis was accurate, being verified in many of them at necropsy and subsequent histology.

The Nonne-Apelt test was positive in 138 (20%) and the Pandy positive in 280 (40%). The Lange curve was normal or virtually normal in 481 (69.7%), a well-marked luetic curve was found in 125 (18.1%), and a paretic curve in 84 (12.2%). The Wassermann reaction was invariably negative.

Subacute Combined Degeneration.—Forty-one cases were examined, and in no case was the cell count abnormal; while the protein was normal in 20 cases, 100 mg. or less in 39, and in only two was it between 100 and 200 mg./100 ml. Globulin tests were positive on only 12 occasions, and a mild luetic Lange curve was obtained twice, while in 39 cases it was not abnormal.

Diabetic Neuritis.—No cell increase was noted in the 22 cases examined, and the protein was normal in 6, raised up to 100 mg./100 ml. in 19, between 100 and 200 mg./100 ml. in 2, and over 200 mg./100 ml. in only one case.

Infective Polyneuritis.—Table V shows the results found in 75 cases. The cell count was much more normal than

TABLE V.—*Cells and Protein in Polyneuritis*

Cells/c.mm.	No. of Fluids	Protein (mg./100 ml.)	No. of Fluids
0–4	66	0–40	16
5–10	6	45–100	22
11–100	2	105–200	19
Over 100	1	205–500	15
		505–1,000	2
		3,500	1

had been anticipated, but in more than half of the cases (37) the protein exceeded 100 mg./100 ml., and in all these the Nonne-Apelt and Pandy tests were positive. There was a coagulum in only five fluids, and in these the protein was 250 mg./100 ml. or more, while the fluid was coloured yellow in nine cases.

Syringomyelia.—Fluids from 78 cases have been examined, and in all except five a normal cell count was obtained, while 70 cases showed a protein below 100 mg./100 ml. The cells varied between 5 and 20 in the five abnormal cases, and the protein between 100 and 200 mg./100 ml. in seven cases, while one case had a protein of 240 mg./100 ml. No other abnormality was found.

Subdural Haematoma.—The fluids from 22 cases were examined, and in only four was there an increase of cells, on two occasions being between 5 and 10/c.mm. and in the other two cases being between 11 and 20/c.mm. The protein was normal in nine cases and between 45 and 100 mg./100 ml. in 13 patients. A slightly straw-coloured fluid was seen only twice.

Spinal Tumour.—The fluids from 238 cases were examined, and Table VI shows the results. Our findings were so similar in many ways to those of Greenfield and Carmichael that we have not classified them into intrathecal and extrathecal tumours. We have, however, found higher protein figures than they recorded, for, of the nine cases with figures above 3,000 mg./100 ml., two were as high as 4,000 mg./100 ml.

TABLE VI.—*Cells and Protein in Spinal Tumour*

Cells/c.mm.	No. of Fluids	Protein (mg./100 ml.)	No. of Fluids
0–4	202	0–40	41
5–9	19	45–100	68
10–19	6	105–200	42
20–29	4	205–500	43
30–49	2	505–1,000	13
50–100	4	1,005–3,000	22
More than 100	1	More than 3,000	9

Findings in Neurosyphilis

The findings in four groups only are given—meningo-vascular syphilis, tabes, G.P.I., and congenital syphilis. During the 14 years of this survey 770 cases falling into these four groups have been examined, but this number is relatively less than that of Greenfield and Carmichael, and agrees with our general view that tabes and G.P.I. are now relatively uncommon diseases.

Table VII shows the results in all these conditions. There are a few special features. The cell count was raised above

TABLE VII.—*Cells and Protein in Syphilis*

	Meningo-vascular	Tabes	G.P.I.	Congenital
Cells/c.mm.:				
0–4	141 (64·7%)	154 (66·4%)	121 (54·5%)	40 (63·5%)
5–9	14	17	28	8
10–19 ..	16	16	20	5
20–39 ..	20	18	25	6
40–69 ..	14	13	16	2
70–100 ..	8	8	8	2
105–300 ..	5	6	4	—
Protein (mg./100 ml.):				
0–40 ..	62	63	55	30 (47·6%)
45–100 ..	120 (52·2%)	144 (59·3%)	124 (51·9%)	29 (46·0%)
105–150 ..	25	25	40	3
155–300 ..	16	9	18	1
305–500 ..	7	2	—	—
Over 1,000 ..	—	—	2	—
Lange curve:				
No change ..	59 (25·6%)	97 (40·9%)	35 (15·1%)	39 (61·9%)
Luetic	143 (62·2%)	108 (45·5%)	49 (21·1%)	10 (15·9%)
Paretic ..	28 (12·2%)	32 (13·5%)	148 (63·8%)	14 (22·2%)
Wassermann reaction:				
Positive in C.S.F. and blood ..	88 (39·3%)	147 (60·5%)	193 (81·4%)	13
Positive in C.S.F., negative in blood	14 (6·2%)	11 (4·5%)	6 (2·5%)	2
Negative in C.S.F., positive in blood ..	57 (25·4%)	26 (10·7%)	19 (8·0%)	19
Negative in C.S.F. and blood ..	43 (19·2%)	59 (24·3%)	19 (8·0%)	15
Positive in C.S.F. No blood ..	13 (5·8%)			4
Negative in C.S.F. No blood ..	9 (4·0%)			

100/c.mm. in only a very few cases, but polymorphs and large mononuclear cells were found in a number of fluids. In meningo-vascular disease there were 12 (5.5%) instances in which polymorphs were present, and these totalled 30% on two occasions. Large mononuclears were seen in 22 (10.1%) fluids, with a highest count of 20%. Polymorphs were present in fluids from tabetic patients on 21 (9.0%) occasions, and large mononuclear cells 28 times (12.1%). In G.P.I., polymorphs were seen in 32 fluids (14.4%), while large mononuclears were found in 46 (20.7%); and as many as half the total cell count has on occasion been composed of these types of cell.

The protein content had been above 300 mg./100 ml. on very few occasions, and in the vast majority of cases (92.5%) had been below 150 mg./100 ml.

The findings in the Lange and Wassermann tests were a little unexpected. A small but appreciable number of paretic curves were seen in both meningo-vascular syphilis and in tabes, while slightly more luetic curves were seen in

G.P.I. There were a relatively large number of negative Wassermann reactions in both blood and C.S.F. in meningovascular syphilis, and certainly more (8%) than were expected in G.P.I. There was also 8% of cases of G.P.I. in which, although the blood Wassermann reaction was positive, the C.S.F. Wassermann reaction was negative. This is unexpected, as it is usually thought that the Wassermann reaction is almost always positive in the C.S.F. The wide variations in the findings in congenital syphilis were not unexpected.

Other Neurological Disorders

The findings in some other neurological disorders investigated were in general agreement with those already published in standard textbooks, but one or two points might be mentioned. The C.S.F.s from 29 patients with a cerebral abscess have been examined, and only seven of them were even faintly turbid. In eight the cell count was normal, while, of the remainder, 13 showed between 5 and 100 cells; polymorphonuclear leucocytes were seen in only 19 of the 29 fluids. The protein was normal on 10 occasions and less than 200 mg./100 ml. in all except three fluids. No other significant features were noted.

Fluids from 10 patients with a cerebral tuberculoma diagnosed during life were examined, and all seven who died were seen in the pre-streptomycin era. The only significant features that emerged from the examinations made in this very small series was that the pre-operative fluid may contain neither an increased cell count nor a raised protein content.

Many other comments could be made, but the evidence for these is slight; one remark can, however, be added—namely, that there was found to be a rather wider variation in the results than one is commonly inclined to allow; and one lesson that we have personally learned is to be rather less dogmatic than had previously been our custom.

Summary

An analysis of the results obtained from the examination of nearly 12,000 C.S.F.s from various neurological disorders has been made.

The C.S.F. in 835 cases of all types of cerebral tumour has shown a cell increase in only 8.3% of cases, but a protein increase in 71.1%, cerebral glioma giving figures of 10.7% and 66.5% respectively. Fluids from cases of neurofibromata—whether on the fifth or the eighth cranial nerve—contained a protein content raised above the normal.

In 6.1% of the cases of epilepsy the fluid protein was raised above 70 mg./100 ml., and in two cases a figure of over 100 mg./100 ml. was obtained.

The findings in 690 patients with multiple sclerosis are discussed, and in 1.9% of cases—many verified at necropsy—there was a protein content in the fluid above 150 mg./100 ml.

Unexpected results were not found in subacute combined degeneration, diabetic neuritis, infective polyneuritis, syringomyelia, or subdural haematoma.

The results of fluid examination in 238 cases of spinal tumour were in conformity with previous reports, but figures for protein as high as 4,000 mg./100 ml. were found.

The cases of neurosyphilis examined (770) are fewer than expected, but the findings, apart from the results of the Lange and Wassermann tests, were similar to those previously recorded. The most unexpected finding was an occasional negative fluid Wassermann reaction in G.P.I.

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BRONCHITIS MORTALITY RATES IN ENGLAND AND WALES AND IN DENMARK

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In England and Wales bronchitis is recorded as the cause of death in over 25,000 people every year, and it accounts for half the deaths due to respiratory diseases and 5% of deaths due to all causes. The recorded mortality rates in other European countries and in the United States of America are much lower. In this paper the causes of death in England and Wales and in Denmark are analysed and compared, and some factors are considered which might be responsible for the recorded excess mortality from bronchitis in England and Wales.

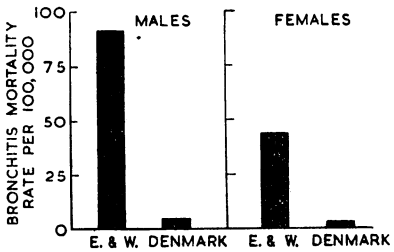

FIG. 1.—Mortality rates per 100,000 from bronchitis in England and Wales (E. & W.) and in Denmark: average for 1951–5. Bronchitis includes: acute bronchitis (500); bronchitis, unqualified (501); chronic bronchitis (502), including bronchitis with emphysema (502.0) and other (502.1). The International List numbers are given in parentheses.

The difference in mortality rates for bronchitis in the two countries obtained from the Registrar-General's Statistical Review and the Causes of Death in the Kingdom of Denmark is shown in Fig. 1.

Choice of Cause of Death from Death Certificates

The current form of death certificate used in England and Wales, which has space for recording the underlying cause, complications, and contributory causes, was introduced in 1927. For thirteen years the selection of the cause of death for tabulation from certificates giving multiple causes was governed by a set of rules which gave priority to certain causes. For example, any definite disease of the kidneys or heart (and this included myocardial degeneration) was preferred to any respiratory disease. In 1940 the International Statistical Classification of Diseases, Injuries, and Causes of Death was adopted, and this lays down that, with certain exceptions, the cause of death for tabulation shall be that which the certifier records as the underlying cause.

The effect of this change in selection procedure on bronchitis mortality rates for men in England and Wales in 1939 was calculated by Schilling and Goodman (1951). They found that by applying the 1940 method of classification to the 1939 figures it increased the age specific mortality rates from bronchitis by the following amounts: 25–34 years, 31%; 35–44 years, 48%; 45–54 years, 71%; 55–64 years, 97%; and 65–69 years, 114%.

Since 1951 Denmark has also used both the International Certificate of Cause of Death and the International Statistical Classification of Diseases, Injuries, and Causes of