6 years of age, and 19 below the age of 4) developed a hemiplegia. Occasionally a monoplegia, or even an ataxia without paralysis, was noted. There was no atrophy or wasting of the muscles. Athetosis and disturbances of speech and intelligence were sometimes sequelae. Other similar cases of this type with spastic paralysis have occasionally been recorded in medical literature. These cases, presuming that they were true cases of poliomyelitis, could be accurately termed of cerebral type, with the site of the lesion in the motor cortex. It is possible that a true cerebral type exhibiting an upper motor neurone lesion will eventually be a recognized clinical type occurring in poliomyelitis, although Bodian (1946) produces evidence for the cerebral origin of spasticity in poliomyelitis in monkeys without lesions in the cord. It is wiser not to include this cerebral type until it is generally accepted that upper motor neurone lesions can be produced in monkeys and that the virus can be isolated from lesions producing these symptoms in man, and to restrict the clinical types of paralytic poliomyelitis for classification to bulbo-spinal, which category will include all cases producing signs of bulbar paralysis or of spinal paralysis alone, or both combined.

Notification

Under existing regulations poliomyelitis is notifiable to the Registrar-General as poliomyelitis or polio-encephalitis. It would be an advance if the regulation making the separate notification of polio-encephalitis as distinct from poliomyelitis was superseded by one reverting once more to the generic term "poliomyelitis," which is to be used as a synonym for polio-encephalomyelitis. And if, in the future, poliomyelitis infections were to be classified as (a) poliomyelitis, non-paralytic, (b) poliomyelitis, paralytic, great assistance would be given to the medical officer of health and other epidemiologists in whose hands lies the responsibility for the control of epidemics in general and of preventing further cases of poliomyelitis in particular. The further division of non-paralytic cases into subclinical and clinical varieties has no place in an essentially administrative procedure like notification, but the information it would reveal would be invaluable in field investigations, were it easily available.

Summary

The essential importance of the subclinical case and the mild non-paralytic case in the spread of the disease is demonstrated.

The concept that the diagnosis should take into account the signs and symptoms of involvement of the central nervous system other than paralysis is stressed.

The problem of the diagnosis of polio-encephalitis is discussed, and as a result a proposal is made to supersede the regulation requiring the notification of polio-encephalitis as a separate clinical entity and to revert to the single generic term "poliomyelitis" (syn. polio-encephalomyelitis).

The use of the term "abortive" is discussed, and a suggestion made that if further differential notification is desired the classification should be non-paralytic and paralytic.

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DIFFERENTIAL DIAGNOSIS OF JAUNDICE BY FLOCCULATION TESTS

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The differentiation of jaundice due to obstruction of the larger ducts from that of hepatic origin is sometimes very difficult, particularly in patients over 40 years old. The van den Bergh test—a qualitative reaction—has proved of little value for this purpose, and many other tests of hepatic function have been tried singly and in combination. From the published reports of this work one or other of the flocculation tests would seem to be the best single diagnostic procedure, and they also have the advantage of being simple to carry out and requiring only small amounts of serum. Their chief disadvantage is that positive reactions occur in a small proportion of patients without evidence of hepatic disease.

These tests are more popular in the U.S.A., and although they have been used in this country, particularly by MacLagan (1944a, 1944b, 1947) and by Dick (1945) and Maizels (1946), it appears from comment in a leading article (*Lancet*, 1946) that their application is still not widely appreciated here. For that reason this report on the results obtained with the cephalin-cholesterol flocculation and serum-colloidal-gold tests has been drawn up.

The cephalin-cholesterol flocculation test was introduced by Hanger (1939) as an empirical procedure. Later work with electrophoresis showed that in parenchymatous disease of the liver there was an increase of the gamma fraction of the plasma globulin and a decrease of albumin. From the results of experiments *in vitro* Moore and his co-workers (1945) attributed flocculation of cephalin-cholesterol emulsion and also the precipitation of colloidal gold to these changes; Gray (1940) introduced the latter test. Positive results are reported commonly in hepatic and rarely in obstructive jaundice, and the tests are accordingly claimed to be useful in the differential diagnosis of these two conditions.

Material and Technique

Our intentions in this investigation were to determine the value of two flocculation tests in jaundice, to establish that negative results were the rule in normal subjects, and to observe the results of the tests on patients without clinical evidence of hepatic disease. Accordingly observations were made on 110 patients with diseases of the liver, of whom 74 showed jaundice, on 100 controls drawn from donors of blood, and on 281 patients who suffered from a variety of conditions but showed no clinical evidence of hepatic disease. Both tests were carried out on the same sample of serum from each of the 491 subjects tested.

Cephalin-Cholesterol Flocculation Test.—The method and the technique for the preparation of the emulsion were those of Hanger (1939). The cephalin was used immediately, without a period of storage, to make the stock emulsion. This showed no change in sensitivity when kept as long as three months in a refrigerator, as Dick (1945) has recorded. The test was read at 24 hours.

Colloidal-Gold Reaction.—The method was that of MacLagan (1944a). The gold sol was made according to the method of Mellanby and Anwyl-Davies (1923).

In order that the superannuation scheme under the National Health Service may function satisfactorily from the appointed day, the Ministry of Health has requested voluntary hospitals to supply relevant particulars of their employees. The scheme does not apply to medical schools attached to teaching hospitals.

Interpretation.—The results of both tests are customarily given as 0, 1+, 2+, and so on up to complete flocculation or precipitation, which is 4+ with the cephalin and 5+ with the gold test. It has always seemed to us difficult, if not impossible, to differentiate, for example, 2+ from 3+, and in this series only 3 gradings have been used: no flocculation (or precipitation), flocculation present, and flocculation complete.

Results of Tests

(1) *Normal controls.*—For this group blood donors were used ranging in age from 16 to 60. All seemed well except eight who suffered from hypertension. The plasma bilirubin was within normal limits in all. In the 100 normal controls no flocculation was found with either test.

(2) *Patients without Clinical Evidence of Hepatic Disease.*—Positive results with both tests have been recorded in patients of this category. With the cephalin test the proportion of such have ranged from 3% (Pohle and Stewart, 1941) to 18% (Wade, 1946). Later reports have indicated that, in particular, positive flocculation tests are common in rheumatoid arthritis (Carter and MacLagan, 1946), thyrotoxicosis (Pohle and Stewart, 1941), severe anaemia (MacLagan, 1944a), virus diseases and other infections (Gray, 1940; Pohle and Stewart, 1941; MacLagan, 1944a), and heart failure (Gray, 1940; Carter and MacLagan, 1946).

The results of observations with both tests on 281 patients are shown in Table I. Negative reactions were found with cephalin emulsion in 91.8% and with gold in

TABLE I.—Results of Cephalin and Gold Tests on 281 Patients without Clinical Evidence of Hepatic Disease

Group	No. of Cases	Negative		Positive		Complete Precipitation	
		Ceph-alin	Gold	Ceph-alin	Gold	Ceph-alin	Gold
C.N.S.	32	32	32	0	0	0	0
Nephritis	15	15	15	0	0	0	0
Cardiovascular . .	31	30	28	1	1	0	1
Peptic ulcer . . .	32	28	29	3	2	1	1
Infections	61	51	49	9	8	1	4
Sundry	88	83	81	4	6	1	1
Anaemia	11	10	10	1	0	0	1
Rheumatoid arthritis	11	9	3	2	4	0	4
Total	281	258	247	20	21	3	12
Percentage	..	91.8	87.9	7.1	7.5	1.1	4.2
Percentage excluding rheumatoid arthritis	..	92.2	90.4	6.6	6.3	1.1	2.9

87.9%. Complete precipitation of gold occurred in 4.2%, but complete flocculation of cephalin in only 1.1%. Analysis of the groups into which the cases were divided gave the following results. In patients with disease of the nervous system and with nephritis neither test was ever found to be positive. Nephritis of all types and in all stages was investigated, but the finding of Maizels (1946) that the cephalin test is sometimes positive was not confirmed. Positive tests occurred in 4 out of 32 patients with peptic ulcer, 2 of whom had had recent bleeding. The occurrence of positive reactions in the group of patients with infections was inconstant and appeared to bear no relation to the nature or severity of the infection or to the presence or absence of fever. For example, 1 patient with subacute bacterial endocarditis showed maximum positive reactions to both tests, but 3 others, equally ill, gave negative results. Similar inconsistencies were also seen in the heterogeneous group labelled sundry. Two out of 11 patients with diabetes and 3 out of 8 with thyrotoxicosis gave positive reactions; this may have been evidence of a special tendency, but the numbers are too small to be certain. In rheumatoid arthritis, however,

the incidence of positive gold reactions was undoubtedly high—8 out of 11 patients. If this group is omitted from consideration, the incidence of positive reactions with the cephalin and gold tests in patients without clinical evidence of hepatic disease becomes almost the same (Table I), the incidence of positive reactions being less than 10%.

(3) *Hepatic Disease with Jaundice.*—The results of observations on 74 jaundiced patients are shown in Table II. The clinical diagnosis of the cause of the

TABLE II.—Results of Cephalin and Gold Tests on 74 Patients with Jaundice

	No. of Cases	Negative		Positive		Complete Precipitation	
		Ceph-alin	Gold	Ceph-alin	Gold	Ceph-alin	Gold
Obstructive jaundice: Tumour or calculus	32	27	27	4	5	1	0
Percentage	..	84.4	84.4	12.5	15.6	3.1	—
Hepatic jaundice: Cirrhosis and subacute necrosis	18	0	2	2	2	16	14
Banti's syndrome . .	4	2	1	1	2	1	1
Acute infective hepatitis	17	5	2	6	5	6	10
Homologous serum jaundice	3	3	3	0	0	0	0
Total hepatic jaundice	42	10	8	9	9	23	25
Percentage	..	23.8	19.0	21.4	21.4	54.8	59.5

jaundice was substantiated by operation, post-mortem examination, and in a few instances by puncture biopsy, or was considered reasonably certain from the course of the disease—as, for example, in most instances of acute hepatitis.

In the 32 patients of the obstructive group positive reactions occurred in less than 16% of both tests. Complete precipitation was noted once with cephalin and not at all with gold. In contrast, the group of 42 patients with hepatic jaundice showed positive results in 76% of cephalin and 81% of gold tests. In more than half precipitation was complete. Analysis of the subgroups of hepatic jaundice shows that a positive gold test was present in all patients with cirrhosis or subacute necrosis of the liver. The cephalin test was positive in all but one, and with both tests precipitation tended to be complete. Both tests were negative in three patients with homologous serum jaundice.

In Table III are shown the findings with the two tests in patients with disease of the liver but without jaundice.

TABLE III.—Results of Cephalin and Gold Tests on 36 Patients with Hepatic Disease without Jaundice

	No. of Cases	Negative		Positive		Complete Precipitation	
		Ceph-alin	Gold	Ceph-alin	Gold	Ceph-alin	Gold
Metastatic carcinoma	8	8	7	0	1	0	0
Cirrhosis, including Banti's syndrome	8	2	0	3	2	3	6
Reticuloses	4	2	2	2	0	0	2
Haemochromatosis . .	2	2	2	0	0	0	0
Chronic leukaemia . .	3	2	2	0	0	1	1
Cardiac failure with hepatic enlargement	11	8	7	2	3	0	0

Negative tests were found in all but one case of metastatic carcinoma of the liver. Positive results were found in cirrhosis and in Banti's syndrome. In a small group of 9 patients with reticuloses, haemochromatosis, and chronic leukaemia both tests were found to be positive on three occasions. Of 11 patients with cardiac failure and hepatic

enlargement flocculation tests were positive in 3. Carter and MacLagan (1946) observed positive gold tests in 11 out of 28 cases and found no relation between the size of the liver and the incidence of positive reactions in cardiac failure.

Discussion

In a series of patients of both sexes without clinical evidence of hepatic disease the incidence of positive reactions was under 10% with both tests if rheumatoid arthritis was excluded. Although the mechanism of both tests is apparently due to the same changes in the plasma protein (Moore *et al.*, 1945), it was noticeable that the reactions were not always parallel in the same plasma, and indeed a negative result with one test sometimes accompanied a positive with the other. The number of patients suffering from conditions other than hepatic diseases (in which other workers have reported a high incidence of positive results) was rather small, and in only two groups could these findings be confirmed. The 8 positive gold reactions in rheumatoid arthritis could be accepted as significant even in a group of only 11 patients. The next highest incidence of positive reactions was in the group of 61 infections, in which 16.4% of cephalin tests and 19.6% of gold tests were positive.

In 200 patients without jaundice MacLagan (1944a) found 31, or 15.5%, who showed positive gold tests. He considered that virus infections, or constitutional disturbance with fever or cachexia, were associated with all of these positive reactions, which did not, however, invariably accompany these conditions.

Differential Diagnosis of Jaundice

In jaundice due to obstruction of the larger ducts by tumour or gallstones negative results were the rule. Positive reactions were obtained in 5 out of 32 patients, and in 3 of these jaundice had been present for more than four weeks. On the other hand negative results were found in several patients who had had complete biliary obstruction for over two months, a finding which did not support the view that positive tests are found only when the hepatic cells are damaged by obstructive jaundice of long duration. The practical point is that the flocculation tests tend to be negative in obstructive jaundice whatever its duration. In contradistinction a high proportion of patients with hepatic jaundice gave positive results. Difficulty in differential diagnosis of hepatic from obstructive jaundice may arise, particularly in patients suffering from subacute necrosis of the liver and acute infective hepatitis. In the former, both tests were invariably strongly positive (7 cases). In the latter, positive results, particularly with the gold test, were usual, but exceptions were occasionally noted.

Maizels (1946) states that jaundice accompanied by negative flocculation tests should improve within two weeks if it is due to hepatitis. In this connexion it may be observed that mild attacks were not necessarily accompanied by negative tests, since complete precipitation was observed in 2 patients whose plasma bilirubin never rose above 3.0 mg. per 100 ml. Of the two patients who gave negative results, one was not tested until convalescent and the other was a mild case who improved rapidly. Hanger and Gutman (1940) recorded negative cephalin tests in arsenical jaundice, and Turner *et al.* (1944) in a small proportion of patients with hepatitis due to yellow-fever vaccine. In the latter, hepatic-function tests remained unimpaired and the results resembled those found in obstructive jaundice. Three patients with homologous-serum jaundice in this series gave negative results to both tests. From these findings flocculation tests are of no value in

diagnosis so far as homologous-serum jaundice is concerned, but in that group the history provides a useful indication.

In cirrhosis, jaundice is not usually a prominent feature, and difficulty in differential diagnosis is less likely to arise. Positive tests were the rule.

As regards the relative incidence of positive results with the two tests, of 110 patients with hepatic lesions cephalin flocculation was observed in 48 and gold precipitation in 54. Of 270 patients without clinical evidence of hepatic disease, rheumatoid arthritis being excluded, the cephalin test was positive in 21 and the gold in 26. If rheumatoid arthritis, in which a high proportion of gold tests are positive, was excluded, the results were much the same with both tests and particularly in the group with jaundice. Since the gold test is carried out with standard solutions of known chemical constitution it would appear to be the procedure of choice.

Summary

Observations were made with the cephalin-cholesterol flocculation and serum-colloidal-gold tests on 491 subjects comprising 100 normal controls, 110 patients with hepatic disorders, and 281 patients without clinical evidence of liver disease.

In 100 controls both tests were negative.

Of 270 patients without clinical evidence of hepatic disease the cephalin test was positive in 7.8% and the gold test in 9.6%. Positive results with both tests were found in all conditions in this group except diseases of the central nervous system and nephritis, but appeared to be most frequent (excluding rheumatoid arthritis) in patients with acute infections. No constant factor could be found in these or other members of the group to account for the positive flocculation tests. Rheumatoid arthritis was associated with 8 positive gold reactions in 11 patients.

Of 32 patients with obstructive jaundice both tests were positive in 15.6%; complete precipitation was infrequent. In contrast 76.2% of cephalin and 81% of gold tests were positive in jaundice of hepatic origin, and complete precipitation was noted in more than half the cases.

In persistent jaundice due to cirrhosis or subacute necrosis positive reactions were the rule and were helpful in differentiating the condition from obstructive jaundice.

The gold test would appear to be the more satisfactory of the two procedures since it is carried out with standard solutions of known chemical constitution.

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The Essex Hospitals Joint Advisory Council was formed following conferences called by the Nuffield Provincial Hospitals Trust. The primary purpose of the Council was the discussion, so far as it related to the County of Essex, of the factual parts of the 1945 Report of the Surveyors of the Hospital Services of London and the Surrounding Area. The Council set up a subcommittee to consider and advise on the problems raised by the Survey, and the report of this subcommittee is now available and can be obtained from the Nuffield Provincial Hospitals Trust, 12 and 13, Mecklenburgh Square, London, W.C.1.