the average epinephrin content expressed as percentages resulting from the respective procedures.

CONCLUSIONS

Shock is a composite, in which epinephrin exhaustion and oligemia are predominant factors. Anesthesia, pain, fright and trauma are immediate agents in producing epinephrin exhaustion as well as shock.

ABSTRACT OF DISCUSSION

DR. J. E. MOORE, Minneapolis: About forty years ago we saw a great deal of what we called shock. I realize that many of these cases were acute anemia. Our methods of hemostasis were not so good as they are now. Now we can with impunity secure bleeding points and take all sorts of tissue along with them, with catgut ligatures. In those days we had a great deal of sepsis. Why do we see little shock today? We rarely see shock in the operating room. I realize that before eliminating these cases of hemorrhage we still had a much larger percentage of shock than today. The question arises, why? Dr. Corbett claims it is because of exhaustion of epinephrin in these cases. He says epinephrin is exhausted by sepsis. There is very little sepsis today and therefore we have removed one cause of shock. We have learned to use anesthetics more carefully and less of them, and therefore we have removed another cause of reduction of epinephrin. We are careful in the handling of our patients and the general public is not afraid of an operation today, and therefore the element of fear is taken away. And so on down the line we make the practical application of Dr. Corbett's paper. Infection, fright, too much anesthetics, etc., that lower the production of epinephrin should be eliminated. I am glad he states that epinephrin is not the whole thing. I am glad he looks on shock as a symptom complex. We all agree with him in that. The question I want to ask is, that if these symptoms of shock are due to the loss of epinephrin, why can't we relieve these symptoms by the administration of epinephrin?

DR. J. F. CORBETT, Minneapolis: The purpose of this paper was to show that shock developed rapidly in the absence of residual epinephrin, and by what means the epinephrin content of the suprarenal gland became exhausted. The reason for doing this was to point out methods for conserving this epinephrin content. I do not think that epinephrin administered artificially is the antidote for shock, because the amounts of epinephrin normally in the blood are exceedingly small, and if we try to maintain blood pressure by forcing epinephrin we have to use continued larger doses to maintain our results. The continuous administration of increasing doses of epinephrin has a deleterious effect on the blood vessels and might increase the concentration of the blood, adding this factor to shock.

Practice of Medicine in Colombia.—U. S. Consul Isaac A. Manning at Barranquilla, Colombia, gives in *Daily Consular Reports* the requirements for foreigners practicing medicine in Colombia, according to the law of 1914. An individual having a diploma issued by a foreign faculty must present to the government of the department in which he wishes to practice his diploma properly certified by a Colombian diplomatic or consular officer resident in the country of issue, must prove his identity by a photograph attached to the diploma, stamped with the seal of the legation or consulate where legalized, and must pass an examination of an hour in clinics in a hospital and before a council of four examiners named by the board of hygiene, or by the medical faculties, where such exist. There are some other provisions of the law for those who have practiced in the country previous to the passage of the law referred to. Natives graduating at approved medical schools abroad on proper certification of their diplomas may practice without examination under the same conditions as the graduates of Colombian medical schools.

PHENOLTETRACHLORPHTHALEIN TEST OF LIVER FUNCTION

IN A SERIES OF UNSELECTED CASES*

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In an endeavor to devise a reliable and convenient test of liver function, Rowntree, Hurwitz and Bloomfield¹ have suggested the use of the dye phenoltetrachlorphthalein, and have perfected a method for its administration and subsequent estimation in the feces. They report studies of this test in sixty-seven patients, thirty-seven of whom, including those with myocardial insufficiency, were classified as having pathologic livers. They state that the number of cases thus far observed is too small to warrant far-reaching deductions, but conclude that their studies "indicate that the excretion of tetrachlorphthalein will be useful in the estimation of the functional capacity of the liver."

Chesney, Marshall and Rowntree² studied this and other tests in forty-five cases. They express the opinion that the determination of phenoltetrachlorphthalein excretion is of decided value in revealing the presence of, and to a less degree the extent of, functional liver involvement.

Sisson³ studied phenoltetrachlorphthalein excretion in forty-one cases and reached no definite conclusion regarding its value as an index of liver function.

Whipple⁴ and his co-workers have made thorough and elaborate observations on the excretion of this dye under experimental conditions. Dogs were subjected to this test after liver injuries of various nature and extent. These authors show that in normal dogs the excretion is quite constant, and with definite liver injury is proportionately diminished. They state that simple circulatory changes will occasion diminished output and call attention to the fact that lowered functional capacity of the liver without demonstrable histologic change may cause decreased phthalein output.

In undertaking these studies of phenoltetrachlorphthalein excretion, it was our expectation for purposes of comparison, to carry out one or more other tests of similar intent, but in reviewing the voluminous literature of other functional liver tests, we were forced to the conclusion that none of these were suitable for this purpose.

The carbohydrate tests in their present form give untrustworthy results, and the fibrinogen, lipase and nitrogen partition estimations from a clinical standpoint seem to be of doubtful value.

Urobilin estimation as a means of determining liver efficiency would seem most rational. It certainly has much in its favor, yet there are serious difficulties in the way of its practical use. Wilbur and Addis⁵ point to the wide daily variations in the output of this sub-

* Read before the Section on Practice of Medicine at the Sixty-Sixth Annual Session of the American Medical Association, San Francisco, June, 1915.

1. Rowntree, Hurwitz, and Bloomfield: Bull. Johns Hopkins Hosp., 1913, 327.

2. Chesney, A. M.; Marshall, E. K., and Rowntree, L. G.: Studies in Liver Function, THE JOURNAL A. M. A., Oct. 31, 1914, p. 1533.

3. Sisson, Warren R., A Clinical Study of Two Hepatic Functional Tests, Arch. Int. Med., December, 1914, p. 804.

4. Whipple, Mason and Peightal: Bull. Johns Hopkins Hosp., 1913, xxiv, 207; Whipple, Peightal and Clark: Bull. Johns Hopkins Hosp., 1913, xxiv, 207; Whipple and Speed: Jour. Exper. Med., 1915, xxi, 193; Whipple: Jour. Exper. Med., 1914, xx, 297.

5. Wilbur, R. L., and Addis, Thomas: Urobilin: Its Clinical Significance, Arch. Int. Med., February, 1914, p. 235.

stance and state that to get an accurate measurement, estimations in each individual case should cover a period of two weeks—a circumstance which greatly reduces the clinical availability of urobilin estimations.

Since there is at hand no accurate yardstick, so to speak, by which we can measure the phenoltetrachlorophthalein test, it seemed to us less confusing to carry out this test alone and to compare its results with our clinical data and when possible with necropsy findings.

The method followed was that originally suggested by its authors.¹ The minor changes in dosage and technic recently suggested by Whipple,⁴ do not alter the principle of the test nor its clinical value, and we thought it best to adhere to the original directions.

Briefly, the test is as follows: An accurately measured quantity of a freshly prepared solution of phenoltetrachlorophthalein, greatly diluted, is given intravenously; 30 to 45 per cent. of this dye is normally excreted by the liver and can be recovered in the feces. For this purpose the feces are collected for forty-eight hours. After the proper diluting, shaking and clarifying of the collected feces the phthalein of the resulting solution is estimated in a colorimeter and the output thus computed. The authors of this test believe that an output of less than 30 per cent. indicates liver disease, organic or functional.

Because of the well-known difficulties in obtaining forty-eight hour feces of a large number of patients, great pains were taken to insure the accuracy of our collections. The nature of the work was explained to the interns, nurses and orderlies, and as a reminder, a large red placard was hung on the bed of each patient whose feces were being collected.

To each patient it was explained that we were endeavoring to estimate the ability of his liver to do its work—an explanation which invariably appeals to

We wish to report our studies of 100 cases. Eleven of these represent primary liver disease and form Group I. Seventeen cases of myocardial insufficiency with consequent circulatory changes in the liver make Group II. In Group III we have placed the miscellaneous cases representing various disease processes. Each case here reported has been carefully studied for

TABLE 2.—GROUP II, MYOCARDIAL INSUFFICIENCY

Number	Name	Age	Extent of Decompensation	Liver Enlargement	Edema	Per Cent. in Feces	Remarks
12	A. McN.	44	Extreme	++	+	29	Marked arteriosclerosis
13	Mrs. H.	35	Slight	0	0	39	Wassermann positive
14	Mrs. H.	50	Slight	0	0	45	Wassermann positive
15	L. D. J.	31	Extreme	+++	++	23	Slight jaundice
16	J. K. H.	75	Slight	+	+	20	Wassermann positive
17	M. P.	30	Moderate	0	+	48	
18	J. L.	59	Moderate	0	+	42	Wassermann positive, chronic alcoholism
19	W. J.	24	Extreme	+	++	20	Died 3/8. Liver congested, weight 1,680 gm.
20	T. L.	24	Moderate	+	+	42	
21	A. J.	34	Extreme	++	++	65	Died 3/18
22	W. T.	56	Extreme	+++	+	10	
			One week later	+	0	10	Improvement
23	W. J.	54	Moderate	0	+	10	
			Eight days later			25	
24	D. L.	24	Extreme	+	+	29	Died 4/11. Marked anemia
25	G. A.	45	Moderate	+	+	40	Albumin and casts in urine
26	B. C.	31	Extreme	+	++	64	
27	L. M.	31	Slight	0	+	23	
28	R. P.	34	Moderate	++	+	48	Syphilis, malaria

clinical evidence of liver disease. All of Group III, including the six alcoholics, were negative in this regard.

We wish to escape the criticism so often offered, of giving insufficient clinical data; yet it is manifestly impossible to publish protocols of the entire series, and we content ourselves with appending notes containing all pertinent data regarding the liver cases in Group I.

REPORT OF CASES

CASE 1.—J. P., aged 47, a colored laborer and chronic alcoholic, with diagnosis of cirrhosis of the liver, had typhoid fever twelve years ago and malaria one year ago. The patient is obstinately constipated. For several months there has been a gradual enlargement of the abdomen. One week before his admission his abdomen was tapped, four liters of fluid being removed. When admitted he had considerable fluid in the abdomen; the abdominal organs could not be palpated. The liver on percussion seemed smaller than normal; the heart was negative; there was no edema and no jaundice. Leukocytes, 10,000. The urine and Wassermann were negative. When the abdomen was tapped, three liters of straw colored fluid were withdrawn. The phenoltetrachlorophthalein output in the feces was 40 per cent.; in the urine, none.

CASE 2.—B. F. N., aged 41, a white carpenter, with diagnosis of cirrhosis of the liver, had tertian malaria in 1905, and smallpox in 1906; for twenty years he had been a steady and excessive user of alcohol and tobacco. For several months, a loss of weight and constant enlargement of abdomen had been noted. He became too weak to work, and very much emaciated. A moderate edema of lower extremities and scrotum existed. The abdomen was greatly distended, the superficial abdominal veins being dilated and tortuous. The peripheral arteries were soft, the heart and lungs negative. Systolic pressure was 115, diastolic 90. The temperature was normal. There was no jaundice and the Wassermann was negative. The urine showed a small quantity of albumin and a few hyaline casts. The abdomen, tapped March 7, yielded 8 liters; April 3, 7½ liters; April 12, 16 liters; April

TABLE 1.—GROUP I, DISEASE CONDITIONS OF LIVER

Case No.	Name	Age	Diagnosis	Phenoltetrachlorophthalein Percentage in		Remarks
				Feces	Urine	
1	J. P.	47	Cirrhosis....	40	0	
2	B. F. N.	41	Cirrhosis....	45	0	
				34	Lost	Six days later
				18		Twenty days later
				27	11	Twenty-five days later
3	W. H.	40	Cirrhosis....	25		Twenty-one days before death
				42		Wassermann positive
4	C. F. E.	60	Cirrhosis....	25-30	0	Wassermann positive
5	W. B.	34	Cirrhosis....	30-35	0	Wassermann positive
6	R. Y.	30	Abscess.....	26	1	Three days after operation
7	C. H. T.	28	Abscess.....	35-40	1	Wassermann positive
8	J. L.	26	Sarcoma.....	35	0	Extensive involvement
9	G. T.	6	Syphilitic(?) hepatitis	40	0	
10	M. P.	43	Partial biliary obstruction, adhesions	52	0	Jaundice for 33 years
			Biliary obstruction, tumor	38		
11	J. C. M.	45		0	15	Cancer of liver

the patient and gains his cooperation. In certain cases of exceptional interest a special nurse was provided whose sole duty it was to care for the patient and collect the feces.

We believe we have detected the few mistakes which, despite these precautions, did occur, and we have excluded these cases.

A water-driven machine was used for shaking the feces which were worked up always by the same individual (F). Colorimetric readings in most instances were made by both of us.

17, 6 liters; April 27, 15 liters; May 5, 12 liters; May 14, 12 liters; May 21, 13 liters.

The edema of the feet and scrotum disappeared after the first tapping. The phenoltetrachlorophthalein output in the feces February 26 was 45 per cent.; March 2, 34 per cent.; March 22, 18 per cent.; April 17, 27 per cent.; with the urine 11 per cent.

CASE 3.—W. H., aged 40, a colored coal miner, with diagnosis of cirrhosis of liver, had had his abdomen tapped

TABLE 3.—GROUP III, MISCELLANEOUS CASES

No.	Name	Age	Diagnosis	Per Cent. of Output
29	E. B. H.	52	Acute and chronic alcoholism.....	34
30	D. D. L.	50	Acute and chronic alcoholism.....	40
31	M. B.	54	Acute and chronic alcoholism.....	51
32	F. C.	33	Acute and chronic alcoholism, syphilis..	25
33	M. C.	45	Alcoholic dementia.....	30
34	M. Z.	28	Alcoholic gastritis.....	52
35	K. McC.	52	Chronic morphinism.....	0, 10
36	M. W.	56	Chronic morphinism.....	20, 20-30
37	M. R.	40	Tuberculosis of the hip.....	23
38	E. W.	38	Tumor of mediastinum (syphilis)?.....	45
39	N. H.	19	Venereal ulcer.....	28
40	G. L.	33	Secondary syphilis.....	23
41	W. E. D.	42	Syphilis, arteriosclerosis, hemiplegia...	14, 20
42	S. O.	27	Endarteritis obliterans, hemiplegia, syphilis.....	30
43	E. G. W.	62	Arteriosclerosis, cardiac hypertrophy....	14
44	D. G.	42	Aortic aneurysm.....	30
45	S. W. F.	24	Chronic parenchymatous nephritis.....	39, 40-50
46	M. B.	25	Pulmonary tuberculosis, syphilis.....	41
47	M. C.	30	Pulmonary tuberculosis (early).....	13
48	G. C.	14	Pulmonary tuberculosis (early).....	40
48	E. T. W.	62	Pulmonary tuberculosis.....	14
50	W. M.	56	Arteriosclerosis.....	40
51	W. B.	68	Pulmonary tuberculosis, arteriosclerosis, senility.....	10, 21
52	R. D.	48	Pulmonary tuberculosis, dilated aorta....	45
53	L. P.	36	Gonorrheal arthritis.....	37
54	F. M.	35	Gonorrheal arthritis.....	35
55	T. B.	25	Gonorrheal arthritis.....	32
56	J. L. I.	24	Gonorrheal arthritis.....	15-20
57	C. H. T.	29	Rheumatic fever.....	30
58	H. A.	48	Rheumatic fever.....	10
59	I. L. R.	28	Rheumatic fever.....	35
60	R. B.	23	Rheumatic fever, acute endocarditis....	32
61	M. H.	47	Multiple arthritis, pyorrhea alveolaris	40
62	J. K.	40	Influenza.....	15
63	M. J.	33	Influenza.....	32
64	J. Y.	23	Bronchitis.....	40
65	I. McC.	50	Bronchitis.....	30
65	M. H.	45	Tonsillitis.....	14
67	E. B.	47	Pernicious anemia.....	35-40, 50-55
68	M. C.	50	Pernicious anemia (?).....	35
69	G. W.	41	Tuberculosis, peritonitis.....	22
70	H. S.	36	Tuberculosis of hip.....	45
71	L. W.	58	Catarrhal pneumonia.....	20
72	J. M.	51	Catarrhal pneumonia, syphilis.....	50
73	J. E.	23	Convalescent pneumonia.....	45
74	S. B. W.	51	Convalescent pneumonia.....	23
75	F. A. M.	35	Convalescent pneumonia.....	37
76	D. M. C.	18	Convalescent pneumonia.....	35
77	A. H.	47	Convalescent pneumonia.....	21, 45
78	P. T.	23	Lobar pneumonia.....	35
79	C. R.	36	Convalescent pneumonia.....	42
80	M. D.	37	Acute otitis media.....	34
81	S. L.	46	Traumatic epilepsy.....	35
82	C. N.	17	Traumatic epilepsy.....	40
83	R. E. S.	54	Hypertrophy of prostate.....	40
84	M. W.	42	Diabetes mellitus.....	40
85	R. P. B.	30	Gastric ulcer.....	53
86	E. N.	33	Cholecystitis, perigastritis.....	45-50
87	M. F. F.	57	Urethral fistula.....	60-65
88	J. P.	50	Sarcoma of jaw.....	13
89	L. P.	57	Ovarian cyst.....	10
90	L. N.	50	Fibroid tumor of uterus.....	46
91	A. S.	25	Uterine fibroid tumor.....	12-15
92	M. McB.	25	Atonic constipation.....	47
93	T. W.	25	Variocose ulcer of leg.....	35
94	F. D. B.	47	Burns on legs.....	37
95	J. P. L.	56	Epithelioma of face.....	32
96	S. M.	19	Sacro-iliac strain.....	34
97	D. McD.	17	Fracture of femur.....	20
98	A. L.	25	Asthma, unknown cause.....	35
99	J. S.	40	Neurasthenia (?).....	29
100	M. E. P.	30	Neurasthenia (?).....	30

several times within the past two years. He was accustomed to the constant, though not excessive, use of alcohol. When admitted his abdomen was greatly distended with fluid. The edge of the liver could not be felt. The heart and lungs were negative. A week later the sclera were slightly tinged. This subsequently disappeared. The Wassermann was negative. The urine showed albumin and casts. The abdomen, tapped March 6, yielded 12 liters; March 18, 15 liters; March 25, 5 liters; April 2, 16 liters. The phenoltetrachlorophthalein output in the feces March 9, was 25 per cent.; in the urine none;

March 24, 42 per cent.; in the urine, none. The patient died April 13.

At necropsy the lungs showed a marked anthracosis and numerous pleural adhesions. The heart walls and valves were normal. There was no sclerosis of the aorta. The heart weighed 260 gm. The abdomen contained about 4 liters of fluid. There were numerous recent adhesions between the omentum, stomach, and colon. A thick peritoneal exudate was noted, but no tubercles. The liver was small, covered with fibrous adhesions, cut hard, and the cut surface was pale and granular. It measured 14 by 17 by 8 c.c. and weighed 865 gm. The spleen was enlarged, cut hard, and weighed 275 gm. The kidneys weighed 135 and 138 gm., respectively and showed a moderate degree of sclerosis.

Sections show advanced sclerotic changes, the portal canals are thickened and prominent and the normal lobular markings are greatly disturbed. Connective tissue trabeculae extend into the lobules and break them up into larger and smaller islands which usually show little trace of the normal architecture. The connective tissue of the portal canals and of the capsule is infiltrated by numerous lymphocytes and plasma cells. There is an occasional suggestion of hyaline masses within the liver cells such as are described by Mallory in alcoholic cirrhosis, but the poor preservation of the tissue will not allow of a positive statement in this particular. In other respects, however, the picture is typical of an alcoholic lesion. Diagnosis: (Late) alcoholic cirrhosis.

CASE 4.—C. E., aged 60, white, a lawyer, had a diagnosis of cirrhosis of the liver, arteriosclerosis, chronic interstitial nephritis and syphilis. His mother died of chronic nephritis. He had pneumonia at 17 years of age and syphilis fifteen years ago. He had had salvarsan treatment with mercury, the last treatment six months ago. Twelve years ago albumin was found in the urine and a beginning interstitial nephritis was suspected. The heart was normal at that time. For the past few months he has suffered from bulimia, loss of weight, pains and discomfort in epigastrium, and diarrhea. Three months ago abdominal distention was noted; edema of the feet appeared one month ago. The urine has been scanty for some time. Physical examination showed great emaciation. The lungs were negative; the heart apex was in the sixth interspace 1 inch outside the nipple line; its impulse transmitted shock to the entire left chest; a rough systolic murmur was heard everywhere, best at base. The abdomen was greatly distended, the superficial abdominal veins being very prominent. Neither spleen nor liver was palpable. The deep and superficial reflexes were normal. Systolic pressure was 160, diastolic 135. The peripheral arteries were hard and tortuous. The urine showed a large amount of albumin and many casts. The Wassermann was strongly positive. On May 7, 6½ liters of straw colored fluid was removed from the abdomen. May 15, 5 liters were removed. The phenoltetrachlorophthalein output in the feces was 25 to 30 per cent.; in the urine, none.

CASE 5.—W. B., aged 34, a colored laborer, with a diagnosis of cirrhosis of liver and syphilis, had malaria at the age of 12. For the past eight or nine years he has suffered indefinite pains in the abdomen and right lumbar region. For the past year he has had abdominal discomfort after eating and is obstinately constipated. He has lost 15 or 20 pounds. One month ago abdominal enlargement was noted. Two weeks ago hemorrhoids appeared. The temperature was normal. He was emaciated. The heart and lungs were negative. Systolic pressure was 125, diastolic 85. The abdomen was moderately distended with fluid. The edge of the liver was not felt and on percussion this organ appeared smaller than normal. The spleen was easily palpated. There was no edema. The urine showed little albumin and no casts. The Wassermann was strongly positive. The phenoltetrachlorophthalein output in the feces was 30 to 35 per cent.; in the urine, none.

CASE 6.—R. Y., aged 30, a colored laborer, with diagnosis of abscess of the liver, gave an indefinite history of dysentery several years ago. He was a well-nourished man. A smooth mass sensitive to pressure extended 4 fingers' breadth below the right costal margin. The right lower chest posteriorly

was very sensitive to percussion, and was more prominent than the left. The temperature was 100 to 101. Leukocytes 24,000. The urine was negative. At operation a large quantity of pus (said to be about 8 ounces) drained from the right lobe of the liver. The patient had a slow and uneventful recovery. The amount of phenoltetrachlorphthalein in feces after operation was 26 per cent.; in urine, 1 per cent.

CASE 7.—C. H. T., aged 28, a white convict guard, had a diagnosis of abscess of the liver and incipient pulmonary tuberculosis. His mother died of tuberculosis. He had pneumonia at the age of 10. Three years ago a small abscess was found in the lower right lobe of the liver and was drained. No amebas were found. One year later, the patient had an illness characterized by epigastric pain and fever. The symptoms subsided after three or four weeks in bed. He now complains of pain in the epigastrium. The temperature was irregular. Leukocytes, 17,000. The urine was negative. A smooth rounded mass, the size of a small orange, apparently part of left lobe of liver, could be felt just below the ensiform cartilage. Pressure produces intense pain at this point, but is negative elsewhere. There is no extension upward of the liver dulness. Fluoroscopic examination disclosed: "Excursion of diaphragm good. No area of rarefaction or excessive density. Liver enlarged." The physical examination disclosed a few râles at the apex of one lung. The phenoltetrachlorphthalein recovered in the feces was 35 to 40 per cent.; in the urine, none. The liver was subsequently incised and 1 ounce of pus evacuated.

CASE 8.—J. L., aged 26, a colored house servant, with a diagnosis of multiple melanotic sarcomas involving the liver, was admitted because of a growing pigmented mole on her forehead. The mole increased rapidly in size and numerous growths of similar nature appeared in various parts of the body. The liver became enlarged. The temperature was irregular. The Wassermann was positive. She was given intravenously, numerous doses of mercury succinimid without benefit. Two weeks before death a nodular abdominal mass, apparently of the liver, was noted, extending 2 inches below the umbilicus in the midline. The phenoltetrachlorphthalein output in the feces was 35 per cent.; in the urine, none (ten days before death). The patient died February 5.

Necropsy: A large pigmented tumor involved the entire right frontal and parietal regions of the scalp. The lymph nodes were extensively enlarged. Numerous pigmented moles slightly elevated and rough, were scattered over the skin of the entire body. The abdomen contained a large quantity of dark fluid, and an enormously enlarged liver reaching about half way to the symphysis pubis. The entire surface of the liver was covered with pigmented nodules measuring from 2 mm. to 4 c.c. These dark brown nodules almost entirely replaced the liver parenchyma—only occasionally on the cut surface could be seen apparently normal parenchyma running as trabeculae between the pigmented tumors. The liver weighed 4,800 gm.

The following microscopic report was made by Dr. G. S. Graham:

The liver is studded with larger and smaller nodular tumor masses made up of rounded to elongated cells heavily laden with granules of brown pigment. The nucleus is often completely obscured. The larger nodules sometimes show necrotic changes which in places have been followed by partial fibrosis. At the periphery of the nodules the tumor cells invade the sinusoids, cell cords and the connective tissue of the portal canals, completely replacing the normal structures. There are many microscopic collections of pigmented cells within the lobules and in the tissue of the portal canals. In the latter location the blood vessels are sometimes crowded with tumor cells. The sinusoids everywhere contain pigmented cells that occur singly or in small groups. Some of these are undoubtedly endothelial cells. The liver cells in the zone about the tumor nodules are often congested and atrophic. Only rare mitosis can be found in the tumor cells. Diagnosis: Melanotic sarcoma. Apparently a slow-growing metastatic tumor laid down in the liver as numberless microscopic and macroscopic nodules.

CASE 9.—G. T., aged 6, colored, had a diagnosis of syphilitic (?) hepatitis and pertussis. The family history was negative except that the mother had one miscarriage at six months. The patient was a normal baby, having had no former illnesses except mumps. Ten months before admission a gradual swelling of the abdomen and loss of weight, with night sweats and cough were noted. When admitted the patient showed moderate emaciation, general slight enlargement of lymph nodes, mild general bronchitis, and distended abdomen, the liver extending to within 1½ inches of the umbilicus. There was a bony enlargement on the humerus. The patient also had whooping cough of recent acquisition, with temperature range from 97 to 100. The Wassermann in the blood and spinal fluid was negative; the von Pirquet positive. The blood and urine negative. Mercury and potassium iodid were administered with marked improvement in general condition and reduction in size of liver, and the patient was discharged greatly improved. Three days previously phenoltetrachlorphthalein was given (one quarter the adult dose). The output in the feces was 40 per cent. of that given; in the urine, none.

CASE 10.—H. P., aged 43, white, an inmate of the Alabama Hospital for the Insane, was given the diagnosis of biliary obstruction. There was nothing suggestive in his family history. Until ten years of age he was apparently well. At that time he had an acute febrile attack with marked abdominal tenderness, became jaundiced and has remained so (thirty-three years).

At operation numerous adhesions in the region of the gallbladder were found, but no stones. The gallbladder was drained and ten days later it was reported that the patient's skin had cleared up markedly. Two tests, one week apart and both prior to operation, were done. The phenoltetrachlorphthalein output in the feces was 52 and 38 per cent., respectively; in the urine, none. Drainage of the wound prevented a repetition of the test. (Kindness of Dr. L. W. Grove.)

CASE 11.—J. C. McL., aged 45, a colored laborer, with the diagnosis of carcinoma of the liver and gallbladder and biliary obstruction, had had loss of weight and "weak feeling" for the past six months. Three weeks previous to admission he first experienced pain in the epigastrium appearing immediately after eating and lasting two or three hours. The pain persisted. When admitted the patient was a fairly well-nourished man, deeply jaundiced. The lungs and heart were negative; the abdomen was rigid and difficult to palpate. The liver was nodular, slightly enlarged, with a mass indistinctly felt in the right hypochondrium. The stomach contents showed achlorhydria. The Wassermann was negative. Leukocytes 9,500. At operation a tumor, evidently cancer, was found involving the liver and gallbladder.

The patient died a few days after the operation. A necropsy was refused, but the abdominal incision was opened and the common bile duct was found to be completely occluded by this tumor. A specimen of tissue removed proved to be carcinoma. Phenoltetrachlorphthalein was given a few days prior to the operation. The output in the feces was none; in the urine, 15 per cent.

SUMMARY

In Group I are five cases of cirrhosis—four advanced and typical; one (Case 5) is less advanced and is perhaps open to question. Each of the five gave a normal phenoltetrachlorphthalein output at some time during the patient's stay in the hospital. One of them (Case 3) showed a slightly diminished output at first; but again twenty-one days before the patient's death, with a liver weighing one half the normal, the phenoltetrachlorphthalein output was well within normal limits.

Another patient (Case 2), on entering the hospital three months ago, in grave distress, gave an output which reached the upper limits of normal. His second test showed a low output, but a third gave an almost normal percentage—this, when the man appears to have at best only a few weeks of life ahead.

The average output of the five cirrhosis cases was normal.

A case of multiple sarcoma of the liver gave a normal output. At necropsy almost no true liver parenchyma could be found.

The absence of phenoltetrachlorphthalein in the feces in Case 11 was evidently due to complete occlusion of the common bile duct.

Group II presents some rather bizarre results. Certain of the cases showing marked liver engorgement and low phenoltetrachlorphthalein output would encourage one to believe that here we have a means of measuring liver injury. On the other hand, some of the most extreme cases in this group gave a normal amount of phenoltetrachlorphthalein in the feces. Taking this group as a whole, we cannot read in it any close relationship between liver engorgement and phenoltetrachlorphthalein output.

In Group III are seen wide variations in phthalein output for which we can offer no explanation.

CONCLUSION

In the consideration of our cases and in view of the inconclusive results reached by the authors quoted, one naturally asks: Does the output of phenoltetrachlorphthalein necessarily depend on the functional capacity of the organ which excretes it?

Since such a large part of the phenoltetrachlorphthalein introduced is oxidized or otherwise destroyed in the body, is it not possible that this unknown destructive process is itself the variable factor and that on it depends the amount of phenoltetrachlorphthalein which reaches the liver for excretion?

We conclude that the phenoltetrachlorphthalein test of liver function taken alone in its present form is of no clinical value.

ABSTRACT OF DISCUSSION

DR. GEORGE H. WHIPPLE, San Francisco: I know but little about the clinical application of this test. However, I would like to speak to you of its application to animals with disease experimentally produced, in which the studies can be better controlled than in clinical cases. If the functional activity of the liver is altered by changes in the blood supply, this test shows it. If the liver is injured, as by the introduction of poisons, this test shows it. If the liver is stimulated by small doses of poison, this test gives evidence of hypersecretion. If the functional activity of the liver is impaired by exsecting certain ductless glands, this test shows that the action of the liver has been affected. So from the physiologic standpoint, it has been shown that this test is of very great value in that it gives an index as to the functional activity of the liver cells.

Functional activity and anatomic findings do not always harmonize. We are not justified in expecting that this test will diagnose scars in the liver. But to determine whether or not the liver cells are functioning properly can be done only by a functional test. We may not have at the present time sufficient knowledge to interpret this test. Workers in Baltimore, who were carrying on clinical work at the time we were carrying on the physiologic experimental work with this test, found that it is of some value. Animal experimentation has shown that it is apparently of value. In clinical work, it would seem better to make a careful comparison of several of these tests, and we would then probably find that the readings would be instructive, particularly when compared with the necropsy findings. If phthalein escapes with the urine, it means that there is an obstruction to the escape of the phthalein or injury of the liver cells. That is at least something indicated by the test. The fact that the speaker found that it appeared in the urine in association with liver abscess, is instructive. Then, too, there are

other tests of value both experimentally and clinically. First we might mention the estimation of fibrinogen in the blood, which apparently is maintained at a normal level by the liver, and only when the liver is in bad straits does it fail to keep the fibrinogen at a proper level. When it falls, this indicates very poor liver function. The observation of a fibrolytic ferment is also of value. It would be well to try those two tests with the phenoltetrachlorphthalein test. I would protest against a hasty conclusion that this test is of no value. We should not too readily put aside the work on animals because of evidence collected from patients, where there may be many factors that we do not now understand and cannot control. Many factors must be carefully controlled, especially that of purgation. It would be safer to say that we must be careful in drawing conclusions regarding the meaning of the tetrachlorphthalein test.

DR. T. ADDIS, San Francisco: Dr. McLester stated in connection with the urobilinogen and urobilin test of liver efficiency that he understood from the work of Wilbur and Addis that daily estimations of the total excretion in the urine and stools over a period of two weeks were required before any decision could be made as to the presence or absence of hepatic insufficiency. This is not what these authors intended to convey. On the contrary, the demonstration of large amounts of urobilinogen and urobilin even in one specimen of urine is valuable evidence of defective liver action in those patients in whom there is no clinical evidence of increased rapidity of blood destruction. It is true that it is not conclusive evidence, because increased blood destruction may occur without obvious signs other than that obtained from a determination of the amount of urobilinogen and urobilin excretion in the stools. Daily observations for at least a week are required definitely to determine that point. In purely clinical work this is not always possible. Yet this does not make the test useless. After all, it is doubtful whether any of our clinical functional tests can be regarded as in themselves decisive. In this particular instance, we maintain that the estimation of urobilinogen and urobilin in the urine—an extremely simple procedure which need not take more than ten minutes—may give very strong evidence of the presence of a generalized disorganization of liver function.

DR. JAMES S. McLESTER, Birmingham, Ala.: Dr. Whipple's work with animals would lead one to rely on this test; yet clinical investigations thus far reported, together with our own work, point, to my mind at least, in the opposite direction. This can be explained by the fact that the results of animal experimentation cannot always be unreservedly applied to clinical medicine. Regarding our failure to compare this with other tests of liver function, we felt that to measure this test by others, themselves of doubtful value, would result merely in confusion.

Limiting Emporiums for Liquor Selling.—The province of Quebec has recently put into operation a plan for reducing the number of places in which liquor is sold. It provides, for instance, that the number of such places in the city of Quebec shall be limited to fifty after May 1, 1915, and accordingly on that date forty-seven licenses were abolished and the owners of the places run under them were each paid \$3,000 in the way of indemnity. The amount of the indemnity paid is to be recouped by increasing the license fee of the other dealers, and inasmuch as their trade will presumably be increased to some extent, they can probably well afford to pay the additional fee. In Montreal, where there have been 470 such places, the number is to be reduced gradually, a certain number being abolished each year. The amount of indemnity is to be greatest the first year and will decrease in amount each year, and the license fee of the remaining places will be increased each year. It is probable that limiting the number of places and the ease with which liquor can be procured will have a material effect in decreasing consumption, and as a step toward practical prohibition has much to commend it.