cases of "congenital porphyria" and "porphyric bullous dermatosis" in which the age of onset is recorded (see Table).

Age at Onset	No. of Cases	Age at Onset	No. of Cases
0–	16	30–	13
1–	8	40–	18
2–	48	50–	8
10–	21	60 +	1
20–	14	Total	147

The case of Schmidt La-Baume (1927) developed symptoms during the second year of life, and was described as "lupus mutilans" when seen after the first decade; that of Marcozzi (1929) passed red urine from birth, but did not develop dermatitis until 2 years old; while the three cases of May *et al.* (1948) all had red urine at birth, grew red teeth, but developed blisters only at the ages of 4, 3, and 1½ years.

We do not think that it is possible to establish reliable criteria by which congenital porphyria can be differentiated from porphyric bullous dermatosis, although the former is usually more mutilating. We suggest that the two are biological variants of a single disease process.

Acute Porphyria and Porphyric Bullous Dermatosis.—The combination of visceral and cutaneous symptoms of porphyria has hitherto been accepted as rare, Gray *et al.* (1948) accepting only 7 cases (Gottron and Ellinger, 1933, 1931; Urbach and Blöch, 1934; Hoerburger and Schulze, 1937; van den Bergh and Grotepass, 1937; Grotepass and Defalque, 1938; Nesbitt and Watkins, 1942; Berg, 1945; Merkelbach, 1943; Taylor *et al.*, 1946; Linas *et al.*, 1947). We have found at least 22 more cases recorded in the literature (Thiele, 1924; Berckel, 1926 (2 cases); Loewenstein, 1937; Borda, 1945 (3 cases); Kuske, 1946; Brunsting and Mason, 1949 (case 1); Calvy *et al.*, 1951 (4 cases observed, presumptive evidence of 3 more); Barnes, 1945, 1951 (at least 6 cases). These reports show that the dermatosis may either precede or follow the abdominal symptoms.

Conclusion

We suggest that the classification of the porphyrias could be simplified as follows:

1. Visceral porphyria, equivalent to Waldenström's acute porphyria and Watson's intermittent acute porphyria.

2. Cutaneous porphyria, a condition essentially congenital, but becoming manifest at any time from birth to death. Manifestation appears to depend on increase in blood porphyrin, and may be determined by biological or congenital factors, by some acquired factor such as hepatic dysfunction, or by some external factor such as excessive solar irradiation.

3. Mixed porphyria, in which symptoms of one form appear in a subject affected by the other.

Taking the scheme of Rimington (1952) as a basis, the cutaneous porphyrias would have deficiencies in the enzymes needed for the further metabolism of porphyrins *sensu stricto*, while the visceral porphyrias would have a defect in the enzyme system responsible for the building up of pyrrole units into porphyrins. Both enzyme systems might be affected by environmental factors, and might well share some essential component.

Summary

A case of porphyria cutanea tarda in which the patient developed constipation and abdominal pain and died with widespread paralysis is described.

It is suggested that no reliable criteria exist by which "congenital porphyria" can be differentiated from "porphyria cutanea tarda," and that the two are biological variants of a single disease process.

The classification of the porphyrias is reviewed, and it is suggested that the most satisfactory classification is into visceral, cutaneous, and mixed forms.

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PARTIAL HEPATECTOMY

OBSERVATIONS ON AN ILLUSTRATIVE CASE

BY

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The accepted indications for partial hepatectomy are not many. Apart from the local removal of portions of liver tissue for examination under the microscope, or to allow exposure of the main ducts in the neighbourhood of the hilum for the purpose of repairing injuries, the main indications for planned resection of portions of the liver are the removal of hydatid cysts and of innocent tumours, usually hepatic adenomata or angiomata. Partial hepatectomy for malignant disease can very rarely be justified. Primary cancer arises either in the gall-bladder and is not discovered until it has invaded the portal fissure and caused jaundice, or in the liver cells when it takes the form of a diffuse malignant infiltration of the whole organ. Secondary metastases are nearly always multiple, and it can be assumed that many further seeds of cancer, still impalpable, are scattered throughout the liver.

In the case here reported the patient, a very fit young man of 30 who was about to be married, had a single large metastasis occupying the dome of his liver and

bulging up the diaphragm a short distance in front of the opening for the inferior vena cava. The primary tumour in the rectum had been removed. The secondary deposit in the liver had been known to be there for about two years, and had not increased greatly in size. Removal of this tumour with an adequate margin of surrounding liver tissue would in all probability remove the only malignant cells remaining in his body. The chance of turning the signals from red to green at the age of 30 seemed worth a considerable risk.

Case History

A man, 28 at the time, was operated on in 1949 at a hospital overseas for a small tumour the size of a cherry situated in the posterior wall of his rectum about three inches (7.5 cm.) above the ano-rectal ring. The surgeon took a piece of the tumour for section, which was reported as a carcinoma. He then did a laparotomy, at which he found a number of enlarged glands in the mesorectum, some nodules in the pancreas, and a single lump on the diaphragmatic surface of the right lobe of the liver. He removed a gland the size of a pigeon's egg from the hollow of the sacrum, and took a piece of the tumour in the liver for section. Both of these specimens were reported by the pathologist to contain deposits of the same nature as the tumour in the rectum. The surgeon gave the relatives, but not the patient, a hopeless prognosis.

A year later, in the summer of 1950, the young man came to Britain with his family to attend the Edinburgh Festival. He was still apparently well, but was persuaded to consult me by his brother, who meanwhile had given me the whole story. He walked into my consulting-room, one of the fittest athletes I have seen, tall, lean, muscular, bronzed, and bursting with vitality. He had had no symptoms, he had lost no weight. He had one discoverable abnormality only —a tumour the size of a cherry in the back wall of the rectum, of rubbery consistency and slightly fixed to the sacrum. I told the brother that I had been unable to find anything to justify a gloomy prognosis, but that I could not give a firm opinion until I had seen the sections.

A month later I received the sections and the blocks from which they had been made. Dr. de Navasquez reported that one showed an argentaffin tumour of the rectum, the second a lymph node infiltrated with argentaffin cells. As most London surgeons do when in difficulty, I consulted Dr. Cuthbert Dukes. He agreed with the diagnosis, and explained that, while most argentaffin tumours are innocent and remain local, some metastasize, but the metastases are usually few and scattered, and, like the primary tumour, grow very slowly. In view of Dr. Dukes's opinion, I advised the patient and his parents that an attempt should be made to remove the primary tumour and its extensions. He arranged to come to England the following year.

The removal involved four stages.

First Operation (May, 1951).—Laparotomy. A number of glands varying in size from a walnut to a pea could be felt in the mesorectum, and one was adherent to the left lateral wall of the pelvis near the ureter, but there were no palpable glands above the pelvic brim. The pancreas felt normal. A round lump the size of a billiard ball could be felt projecting upwards from the dome of the right lobe of the liver, but could not be brought into view. A transverse colostomy was done.

Second Operation (June, 1951).—The rectum with the lower half of the pelvic colon, the pelvic mesocolon, and all the tissue in the hollow of the sacrum were removed down to a level one inch (2.5 cm.) below the rectal tumour and two inches (5 cm.) above the ano-rectal ring. The enlarged glands were dissected off the left ureter with scissors. The pelvic colon was anastomosed end to end to the stump of the rectum under some tension, and the suture line later gave way in part.

Third Operation (August, 1951).—The metastasis in the liver was removed by the transthoracic transdiaphragmatic approach.

In all three operations I was helped by my colleague Mr. Guy Blackburn.

Fourth Operation.—Closure of colostomy performed in his home country in January, 1952. The parting of the anastomosis had left him with a pelvic fistula that took six months to heal, and, until it had healed, the colostomy had to remain open.

Discussion

The only part of these operations that is relevant to the present communication is the removal of the hepatic metastasis. The laparotomy had made two things clear—that this tumour could not be brought into view or reached with instruments by a purely abdominal approach, and that it burrowed deeply into the liver substance, and must extend pretty close to the visceral surface and to the main branches of the portal vein and the bile ducts. An abdomino-thoracic approach had no advantages in this case over a purely thoracic one: after a fair trial I hold to-day that this approach is wrong, anyway. The wide combined incision cuts a lot of muscles that need not be cut; it divides unnecessarily a lot of vessels that must be clamped and ligated; it submits the patient to the physiological difficulties of an open thorax for a far longer time than is necessary; and it adds to those difficulties by casting off the moorings of the diaphragm and, indirectly, of the pericardium. Any operation that can be done through an abdomino-thoracic incision can be done better through an abdominal incision, which is closed when 90% of the job has been done, and finished off through a thoracotomy.

The thorax was opened by an incision through the whole length of the eighth rib bed, a rib spreader was inserted, and the lung was packed out of the way. The diaphragm was incised radially over the tumour for a length of seven or eight inches (17.5–20 cm.), allowing the liver to bulge through it. The tumour, covered by a layer of normal liver projected from its surface like a large blister. The diaphragmatic edges were retracted, allowing the liver to prolapse further, and acriflavine gauze was packed all round to prevent blood trickling down into the abdomen.

The question was—how much blood? Previous experience of the instructions of textbooks had left me unconvinced. A wedge biopsy of a cirrhotic liver is a straightforward affair; haemorrhage is moderate and suture of the gap is easy. A wedge removal of normal liver tissue varies from messy to alarming. The method of interlocking sutures of catgut passed through the liver with blunt needles parallel to the line of the proposed incision and tied before it is made—a method usually illustrated by the convincing drawings of a professional artist—just does not work. Normal liver has the consistency of cheese, and sutures cut through it long before they have been drawn tight enough to arrest haemorrhage. Fortunately the bleeding, alarming at first, stops when the sides of the wedge are brought together. It was quite clear that any wedge adequate to include this tumour would bisect the liver. I asked Guy, "What do we do now?" He replied, "I don't know what we do now, but in five minutes we shall be rushing him back to bed with a pint of blood running into each arm as fast as we can push it."

The first incision into liver outside the edge of the swelling produced an alarming gush of blood, which was soon seen to be coming from a divided vessel. In securing this vessel it was clear that the haemostat cut through liver tissue like butter, but met with a resistance that could be appreciated when it reached the firmer tissue of Glisson's capsule in which the bleeding vessel lay. Thereupon the knife was laid aside. A fine-pointed haemostat was used, closed, for cutting the liver substance by very slow and gentle strokes made parallel to and about a centimetre outside the margins of the tumour. The instrument cut through liver parenchyma almost bloodlessly. It gave a sense of slight resistance when-

ever it met a fibrous septum. It was thereupon clamped on the band, which was ligated and cut. The dissection went on slowly round the tumour, which was lifted up as it became free. Some of the bands encountered were tiny, some were of moderate size, but none were really large. When the tumour was finally removed the cavity left in the liver was like a tea-cup, oozing slightly from its whole surface, but not bleeding from any particular point. The total blood loss cannot have been more than three or four ounces (85–115 ml.).

It was clear that such a cavity could not be closed. A long forceps was therefore passed down between the diaphragm and the liver till its point could be seen bulging the abdominal wall at the costal margin. An incision was made over the point and a strip of corrugated rubber was drawn back and laid in the cavity. The diaphragm was repaired, the lung re-expanded, and the thoracotomy incision closed.

Dr. de Navasquez reported as follows on the specimen: "The specimen shows a spherical tumour 8 cm. in diameter which is an argentaffin tumour or 'carcinoid' of similar morphology to the tumour in the rectum. The excision appears to be complete, as the tumour is surrounded by normal liver."

The patient was slightly jaundiced for a few days after the operation, but his condition was never alarming. Drainage was maintained for about a week. He is now back at his work as a fruit farmer, playing games, and feeling well. He has gained 30 lb. (13.6 kg.) in weight. He has lost his fiancée, who was more upset by the series of operations than he was, and threw him over. Perhaps he has gained more by his ordeal than he realizes.

Conclusion

I cannot claim to be familiar with the literature of partial hepatectomy, nor have I consulted more than the standard textbooks of operative surgery. It would, in any case, be out of place to burden a clinical report of a single case with references to the experience of others.

The surgeon to-day is confronted with the almost impossible task of keeping in touch with a literature that increases in volume every year. He can read most of that which concerns the small branch in which he is particularly interested. For the rest he must be content to let others do the hard work at the coal face, and get the knowledge from them, picked, assorted, graded, and delivered in clean sacks. The knowledge thus acquired gains in perspective from being unclogged by excessive detail, and it is laid down in the association centres of a mind clarified by idleness. What I have learned of surgery since taking my Fellowship has been gleaned from registrars, house-surgeons, dressers, and sisters; from meetings of the Association of Surgeons, the Royal Society of Medicine, and the Medical Society of London; from journeyings round Europe with the Surgical Travellers; and from the Colchester Surgical Group and those who visit them. At a recent Colchester meeting we were discussing the surgery of the liver, and I learned for the first time that the method that proved so useful to me in this case was not known to the majority. For that reason, because the information may prove useful to others faced with a similar predicament, I venture to put out this unscientific communication.

The use of radioactive phosphorus to study the movements of wild rodents over a long period has had promising results. Workers at the University of Wisconsin have found it possible, with the help of a Geiger counter, to trace the movements of a field-mouse, which had previously been injected with a harmless amount of radioactive phosphorus, by its radioactive excretions. These tests have shown that a field-mouse travelled at least 700 feet in a period of eight days, and ranged over an area of 120 feet long and 100 feet across. The method has also been used in tracing the movement of insects and birds.

PLASMA PROTEIN CONCENTRATION OF NORMAL ADULTS LIVING IN SINGAPORE

BY

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Wills and Bell (1951) and Holmes *et al.* (1951) found that coloured people living in the Tropics had higher plasma protein concentrations than white people living in the same climate. The present investigation was designed to show whether a racial difference in plasma protein concentration did exist under good social conditions and to show whether the plasma protein concentration of healthy people was the same in the Tropics as in a temperate climate.

Materials and Methods

The subjects were students, blood-donor volunteers, or members of the armed Forces, between 20 and 40 years old. All were apparently in good health, and in a state of adequate nutrition. There were 80 men, of whom 24 (30%) were Asian (Chinese, Eurasian, or Indian) and 56 (70%) European. There were 59 women, of whom 17 (29%) were Asian and 42 (71%) European.

Venous blood samples were collected with minimal stasis, and the oxalate mixture of Heller and Paul (1934) was used as an anticoagulant. The subjects were recumbent for a few minutes before and during the collection of the blood. The samples were kept in stoppered bottles and stored at about 4° C. until required. Estimations were made within a few hours of collection, except in a few instances in which there was a delay of 24 hours. Plasma was obtained by centrifuging the blood in stoppered tubes. Before transferring the blood to these tubes it was thoroughly mixed in the storage bottles.

Estimations of the specific gravity of the plasma were made by the method of Phillips *et al.* (1950) and the results converted to equivalent total protein concentration by the application of a suitable formula. It was necessary to determine which of the formulae suggested by previous investigators (Moore and Van Slyke, 1930; Kagan, 1938; Phillips *et al.*, 1945; etc.) was the most suitable in the present instance. Simultaneous estimations of the specific gravity and of the total nitrogen content were therefore made on 25 samples of plasma obtained from men and women. These were sometimes pooled if individual quantities were insufficient for analysis. The total nitrogen was estimated by the macro-Kjeldahl method and converted to the equivalent amount of total protein by multiplying by 6.25 (Hawk *et al.*, 1947). Duplicate and blank determinations were made in each instance. In making these estimations 1 ml. of plasma was treated with 20 ml. of concentrated sulphuric acid. A mixture of copper sulphate (0.1 to 0.2 g.) and potassium sulphate (5 to 10 g.) was added. Digestion was continued for four to five hours after the mixture became clear.

In a separate investigation it was found that the same results were obtained on prolonging the oxidation for 10 hours. The method was found accurate when applied to a standard solution of ammonium sulphate of known nitrogen content. Recovery experiments were also made, using preserved ox plasma to which known amounts of nitrogen from a standard ammonium sulphate solution were added. There was always a recovery of at least 87%.