FAMINE *

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FIG. 6.—Albrecht Dürer, 'The Four Horsemen,' 1498.

*Based on a lecture given at the British Postgraduate Medical School, and later in Copenhagen.

The *Encyclopaedia Britannica* defines famine as 'An extreme or general scarcity of food, causing distress or deaths from starvation among the population of a district or country.' This, however, gives no idea of what a famine is really like and we shall do better to turn to the 'Chronicle of Novgorod,' which was written in A.D. 1215 'They bought . . . a load of turnips for two grivnas; people ate pine bark, and lime tree leaves and moss. O brothers, then there was trouble; they gave their children into slavery. They dug a public grave and filled it full. O, there was trouble! Corpses in the market place, corpses in the fields; the dogs could not eat up the men.' Even this is only half the story, for in the old days famine never came alone. It was always accompanied by pestilences and plagues. And why? In the Middle Ages and until very recently typhus, cholera, smallpox, plague, typhoid, dysentery, measles and scarlet fever were endemic all over Europe. Little epidemics were always taking place but they were kept within bounds because the population was relatively static. People became immune to their local diseases. Famine always led to mass movements of the population. The people moved from town to country in search of food and from country to town in search of employment—and with them they carried the diseases to which they were themselves immune, and spread them among the populations through which they passed.

A war was often the cause of all this misery and always made it worse. Consider the situation created by, say, the Thirty Years' War. Troops began moving about. They billeted themselves forcibly on the population; they lived off the country; they stole things, they may occasionally have bought things; they burned down houses accidentally and otherwise; they killed the men if they were their enemies, and they raped the women whether they were friend or foe—and then they moved on like locusts, merely perhaps to be replaced by troops of the opposite side, but in any case leaving behind them diseases to which that particular community was not immune, and an overcrowded population, often without adequate food. And there you have the dreaded triad—war, pestilence and famine.

Sieges were productive of even worse conditions, for once inside the ring there was no escape. Life in a besieged town must have been a nightmare—no shelter, no fires, no food, no sanitation. History and literature are full of these stories and every aspect, even the most grim, has been recorded over and over again.

Some of the greatest famines of history, however, have been due to failures of the harvest and have not been associated directly or indirectly with

Wars, and in a way they have been even more terrible, for the whole drama has been played out in a world at peace when the minds of the spectators were not hardened or embittered by war or inspired by a feeling of sacrifice or devotion to an ideal. Wherever there is a population greater than the land can comfortably support and a population which depends upon that land for its support, the stage is set for a famine, for anything which produces a bad harvest creates a food shortage. Those were the usual conditions in Europe till about 1850, and in Russia till quite recently. They are still the rule in India and China. Harvests may fail for many reasons. In India the cause is nearly always drought due to failure of the monsoon rains; in China it may be drought or floods; in Europe during the Middle Ages the cause was usually a cold, wet summer following a late spring. The two great Russian famines of 1892 and 1921 were both due to the absence of rain, and the trouble was exaggerated in 1921 by the reduced acreage under cultivation. There have been three famines in Ireland, all due to failure of the potato crop, and the last and best known one in 1845-46-47 was due to fungus disease of the plants. There was great misery and scarcity of food in Belgium and Northern Germany at the same time and for the same reason.

Scarcity raises prices. Every contemporary account of a famine emphasizes this, and consequently the poor always suffer most. In a siege it is true there is an absolute scarcity of food—no one has enough—but in many of the great famines of history there has been food to buy—often relatively cheaply—in the famine areas. In Russia, for instance, in 1892, bread could be bought in the heart of the famine area for $\frac{3}{4}$ d. per lb. But the poor people had not got a farthing and they were dying of starvation. It was the same in Ireland in 1846. The famine mainly affected the poor. It was possible to stay at the hotels and fare quite well at a time when families were dying of cold and hunger in hovels on the other side of the road, or people were dragging themselves from street to street in the towns begging for food and shelter till they could go no further and lay down for the last time on some more fortunate man's doorstep.

Overcrowding and undernutrition are not the prerogative of the great famine areas of the world. They were to be found in most European gaols during the 18th and early 19th centuries. The reasons are clear enough too. Costs had to be kept low and bad food was reckoned to be part of a prisoner's punishment. If, then, one thinks of the kind of men and women who made up the prison populations and the systems of administration which frequently pandered to the greed and dis-

honesty of their gaolers, it is easy to understand why the prisons were 'microclimates' of under-nutrition and disease. Life in the concentration camps and slave labour camps which were established by the Germans during the recent war resembled that in a beleaguered town in the Middle Ages. Overcrowding, starvation and disease produced their well-known and frequently-described effects. There was nothing new at Belsen or at Dachau.

Some of the recent European famines have struck a new note, for preventive medicine and the organization and socialization of modern states has tended to alter the well-known setting in several ways. Typhus and plague are no longer endemic in Western Europe and by 1914 the armies did not carry so much disease with them, nor did they beggar the country to the same extent, for they were so large that they had to be fed from their own commissariat. The introduction of rationing by the Germans, moreover, in the first world war did more than anything else could have done to stabilize the civilian population. These two developments allowed the greatest siege in history—the blockade of the Central Powers during the first world war—to be carried through without mass movements of the civilian population and without major epidemics of the usual types. The famine in Holland after the railway strike in 1944-45, severe though it was, was not associated with any pestilences. These triumphs of civilization and preventive medicine have uncovered all the metabolic effects of famine which till then had been obscured by the great famine diseases. One new pest, moreover, has been unmasked. Tuberculosis stands out as the modern famine disease if, indeed, there is anything modern about it. More probably it has taken its toll in all the famines of the past but, like so many of the metabolic effects, remained unrecognized in the presence of the more spectacular causes of death.

Famine always leads to a shortage of calories, but it may or may not lead to a shortage of vitamins. In the Far East signs of vitamin deficiencies tended to dominate the picture during the recent war, but in Europe such signs have generally been conspicuous by their absence, and the shortage has been one of calories alone or, perhaps, of calories and proteins. The effects of such shortages may be now described.

Loss of Weight

The life of the cell, or of the organism as a whole, depends upon the expenditure of energy derived from the oxidation of the food. The processes of oxidation are continuous, but the supply of foodstuffs may be intermittent, for all organisms tend to accumulate stores of oxidizable materials

when the supply exceeds their requirements. In the absence of all foodstuffs or if the supply is insufficient the expenditure of energy must still go on, and consequently some loss of weight is inevitable and its magnitude depends upon the metabolic rate. Thus a cold-blooded animal at a low temperature may lose weight extremely slowly when deprived of all food, whereas a small mammal like the rat loses 40 per cent. of its weight in a few days. The loss of body weight during starvation and undernutrition has been studied many times, and Chossat and other pioneer investigators early appreciated that they were not dealing with a simple phenomenon, for each organ of the body tends to lose weight at its own rate, which may differ considerably from that of other organs or of the body as a whole. Thus the muscular organs including the heart lose a great part of their weight during prolonged under-nutrition and some of the smaller organs also atrophy extensively. The bones lose very little weight. This is understandable since their rate of metabolism is so much slower than that of the rest of the body. But this is not the only explanation for a small loss of weight, because the kidneys also lose little if any of their original substance and the brain is stated to lose none at all. Both these organs have a high rate of metabolism.

The Composition of the Body

When people become undernourished from a shortage of food the composition of the body changes in several ways. The fatty tissue disappears to a large extent. In sections of the skin or marrow fat cells can be seen to become smaller and more shrunken and spaces appear between them; ultimately all the fat may vanish. As the cells containing fat atrophy and disappear their place is taken by extracellular fluid. This is obvious in the peri-renal tissues, which look gelatinous and watery. The other changes in the composition of the body are more subtle and are difficult to understand without some knowledge of the composition of the cellular and extracellular fluids of the body. The cell fluid consists predominantly of protoplasm dispersed in a solution of potassium salts. The extracellular fluids of the body comprise the serum, lymph, C.S.F. and tissue fluids, and the intestinal fluids and the juices secreted by most of the glands of the body. Except for the serum and the juices of some of the digestive glands they contain very little protein and, although they contain some potassium, calcium and magnesium, they are essentially solutions of sodium salts. The amounts of total body water and of extracellular water in the body can be measured and Fig. 1 shows results which were obtained when this was done to a group of under-

FIG. 1.—Changes in the distribution of water in the body during rehabilitation after undernutrition.

nourished German men who had been prisoners-of-war in Russia. Measurements were made when they first returned and again later when they had been having as much as they wanted to eat for eight weeks. The left hand side of the diagram shows the change in weight and the change in body water in absolute units, and it will be seen that when the weight went up the total amount of water in the body also went up, but this increase was entirely an increase in cellular fluid. The volume of extracellular fluid actually decreased. When the same changes are expressed per 100 g. of body weight it may be seen from the right hand side of the diagram that rehabilitation greatly decreased the percentage of water in the body and that this decrease was entirely due to the decrease in extracellular fluid. The percentage of the body occupied by cells and cell water remained exactly the same.

The Skin

Undernutrition makes a great difference to a person's appearance. Apart from changes in the

contour and lines of the body there is nearly always a change in colour, and the normal complexion gives place to a dull yellowish pallor which has been described over and over again. *Tenebat igitur pallor et macilentia ora cunctorum* (Rodulfus Glaber, 1032).

The skin, especially of the extremities, feels cold and in some people it begins to separate in flakes which may be very fine or quite large (Fig. 2). This change is usually most obvious in the leg and is often accompanied by the development of hard keratinous spicules in the hair follicles which leads to atrophy of the hairs, and sometimes makes the skin feel almost like a rasp. There may, in addition, be exaggerated over-folding (Fig. 3). There may also be over-pigmentation of the skin, particularly over pressure areas (Fig. 4). This pigmentation is of the melanotic type and it may occasionally become much more extensive, and was probably the origin of the passage in the Bible 'Our skin was black . . . because of the terrible famine' (Lamentations, v, 10).

Lustreless hair of the head has been described

in undernourished persons and is almost certainly due to an extension of the hyperkeratosis pilaris to that part of the body. Chronic ulcers of the lower limbs are extremely common in undernourished persons. Many of the men who returned from camps for prisoners-of-war in Russia had the scars of eight or nine or even more of these ulcers on their legs.

The Blood Picture

All investigators are agreed that undernutrition, even if severe, does not lead to more than a mild degree of anaemia, and the pallor of the skin cannot be explained by a shortage of haemoglobin in the blood. The mild anaemia which has been noted by many observers is certainly not due to a deficiency of iron, and workers have actually noticed considerable deposits of iron in the livers of people who were very undernourished when they died. The serum proteins have been estimated many times and there is now a general consensus of opinion that there is no constant change in them. They may be considerably reduced and it has been stated that the albumen is much more reduced than the globulin, but many people in the

FIG. 2.—Desquamation of the skin of the leg of an undernourished person.

last stages of undernutrition have now been shown to have normal serum proteins. The concentration of both circulating haemoglobin and serum pro-

FIG. 3.—Hyperkeratosis of the skin of the buttock.

teins must depend to some extent upon the volume of the blood, particularly if this has recently undergone a change, and this will be discussed later. A discovery made by us in Germany is that cholinesterase, one of the enzymes normally present in the serum, tends to be very materially reduced in undernutrition. Fig. 5 demonstrates this. We have tried to raise the cholinesterase in undernourished people by giving them 200 g. fat per day for a week and also by very high protein diets for a similar length of time, but neither procedure made much difference to the level of cholinesterase. A good mixed diet for six or eight weeks, however, restored the cholinesterase to a normal value. Since, therefore, it is not possible to raise the level by forcing up the metabolism of fat or protein for a short period of time, we have come to the conclusion that the level in the plasma must be a reflection of the general plane of nutrition, and our work in Germany has led us to think that the determination of the serum cholinesterase

FIG. 4.—Pigmentation of the skin over the great trochanter.

FIG. 5.—The effect of undernutrition and rehabilitation of the serum p-cholinesterase.

terase in a group of individuals is a good index of their nutritional level. In uncomplicated under-nutrition the blood sedimentation rate need not be raised, in fact should not be raised, at any rate in the early stages.

Haemodynamics

A low blood pressure and a slow pulse rate have come to be regarded as hallmarks of under-nutrition, but it is frequently forgotten that they are only found when the undernourished person is at rest. Exertion, even if very moderate, has been stated to raise the pulse rate to an unusual degree, and work which Dr. Glaser did in Germany has confirmed this.

There is no question that the weight of the heart may be greatly reduced by undernutrition, but the size of the heart during life is not reduced. Our experience in Germany was that the transverse diameter and area of the frontal heart silhouette measured radiographically agreed much more closely with those predicted from the subjects' previous weights than with those predicted from their actual weights, showing that undernutrition had not materially diminished these dimensions. The volume of the heart muscle together with the blood in its cavities had not therefore been reduced, and this indicates that the muscle fibres themselves must certainly have been thinner and possibly longer than before. Persons with slow pulse rates displayed large pulsations of the heart on the screen and in many cases the pulsations exceeded those seen in normal hearts. The output of the heart has been measured by several workers and has been found in most cases to be diminished. Dr. Howarth investigated the cardiac outputs of 20 undernourished German men, all of whom had or had recently had oedema, by means of cardiac catheterization. In them the resting cardiac output was variable, but usually somewhat subnormal. Right auricular pressure was raised in about half the subjects. The rise in auricular pressure produced by 800 to 1,000 cc. of intravenous fluid appeared to be greater than that usual in normal subjects. Intravenous infusions produced a very small rise in output considering the magnitude of the changes which they made in the filling pressure, and a secondary fall in cardiac output was observed if the infusion was continued. The administration of intravenous infusions to undernourished persons should therefore be undertaken with caution. Resting blood flows through the hand were found to be very low and forearm blood flows were also below normal. These latter findings seem to be in keeping with the observation which has frequently been made that the extremities of undernourished people are usually cold.

The circulation time has been measured by

several people and found to be greater than normal, but it is possible that the small blood flow through the periphery may have had something to do with this. If the circulation times had been measured from the renal vein to the tongue quite different results might have been obtained.

Alimentary Canal

People who are undergoing a complete fast are stated to lose their desire for food after two or three days, but this is certainly not the case when people are living on quantities of food which are insufficient for their needs. Under these conditions they are always ravenously hungry and this seems to be true whatever their age. When some undernourished men aged 80 were offered unlimited food by us in Germany, they ate between 5,000 and 6,000 calories per day throughout the two months during which they were under observation. In moderate undernutrition our evidence is that the transit time for barium from stomach to large intestine is appreciably prolonged, and many people show patterns of barium similar to those which have been described in sprue. Anatomical and post-mortem evidence has indicated that undernutrition leads to atrophy of the intestinal mucosa and also of the muscular layers of the gut. This has recently been demonstrated to follow a few days' starvation in adult rats. Extreme thinning of the intestinal walls has been described post-mortem in people who have died of starvation in concentration camps. Diarrhoea is almost inevitable in the later stages of under-nutrition. Even small quantities of food are passed rapidly through and are often excreted in an almost undigested form. The urgency of this diarrhoea often leads to incontinence and this may be one of the most distressing features of overcrowding in a starving community. In former times, when gastro-intestinal infections were prevalent in every famine area, it was very difficult to decide upon the cause or causes of this diarrhoea. It now seems certain that the diarrhoea may be very severe without the presence in the stools of any organisms known to be pathogenic and, furthermore, since normally nourished people have repeatedly been shown not to get diarrhoea when exposed to the same chances of infection, the diarrhoea of advanced starvation must be attributed to the anatomical changes which have just been described. The ingestion of large quantities of food by a person in the last stages of under-nutrition is very unwise, and has frequently proved fatal. This was very well described by Josephus in his history of the Jews, and has often been commented upon since that time. It might be supposed that protein hydrolysates with sugar added to them would be the best food with which

to start feeding people in the last stages of starvation, but experience in the last war has shown that skimmed or whole milk is probably as satisfactory and infinitely more palatable.

Reproductive Organs

Advanced undernutrition leads to great reduction in the size of the testicles, and sexual desire also seems to disappear. In women amenorrhoea is the rule, but amenorrhoea is no index of undernutrition, for it is common in well-nourished women who are moved to unfamiliar surroundings. Nothing is known about ovulation in advanced human undernutrition.

Although partially undernourished communities appear to breed freely, it seems now to have been established conclusively that undernutrition in animals leads to a reduction in the weight of the young at birth, and this has been demonstrated also in man. In Wuppertal we were able to study this very satisfactorily, for the large maternity hospital there remained undamaged during the war and the same medical and nursing regime had continued uninterrupted from 1936 to 1949. Dr. Dean was able to show that the difficult times of 1945 and 1946 produced a significant decrease in the size of the babies at birth. In previous studies of the effect of undernutrition on the weights of babies it had always been hard to decide whether the reduction, if present, had been occasioned by a shortening of the gestation period. In Wuppertal this was not so, for the length of gestation, as reckoned from the last menstrual period to the birth of the child, was almost the same in 1945 as it had been in 1937.

It is well known that the ability of rats to feed their young is a much more searching test of nutrition than their ability to produce them. Lactation in the human species is a more complex process than in the rat, and subject to greater psychological direction. It is therefore difficult to dogmatize, but Dr. Dean found that the capacity of the women of Wuppertal to lactate was very much reduced in 1945/46 as compared with 1937. It is difficult to exclude psychological factors, but our feeling is that the poor lactation in 1945/46 was probably partly nutritional in origin. Its effect was to delay development of the newborn children so that their weights on the eighth or ninth day of life in 1945/46 were still further below their weights at corresponding ages in 1937 than they had been at birth.

The Kidney

All are agreed that uncomplicated undernutrition does not lead to albuminuria, and indeed the diagnosis of hunger oedema can only be made

after the renal causes of oedema have been excluded by ensuring that the urine is albumen-free. Quite early in undernutrition people begin to pass large volumes of urine, particularly at night. This is partly due to the large amount of soup which undernourished people tend to consume, but it is also attributable to the change in the composition of the body fluids which have just been described. It does not indicate any abnormality in the kidney. When undernutrition has become pronounced many people have described frequency and urgency to pass urine at short intervals, quite apart and altogether distinct from the passage of large volumes of urine. We did not encounter this frequency very much in Germany. A combination of urgency coupled with polyuria leads to great loss of sleep. Most investigators who have studied renal function by estimating the clearances of urea, inulin and diodone have found that they are, on the whole, normal, even in advanced undernutrition, and so have the people who have investigated the response to a test dose of water. There may be species differences in the response to this test during undernutrition, for it seems easy enough to demonstrate that undernourished rats excrete water less quickly and completely than normal animals. Govaerts has suggested that nutritional oedema is due to gravity having an exaggerated effect on the haemodynamics or renal function of undernourished people, but we were not able to substantiate this in Germany. The undernourished group of men whom we studied there responded in almost exactly the same way to gravity as Brun and others had found normal persons to do.

Oedema

Hunger oedema leapt into prominence following its description by Polish and German doctors in 1915, and the German literature of the next few years was studded with papers dealing with this subject. One need hardly say that hunger oedema had been described many times before in connection with undernutrition. It was, for instance, well described by Josephus, many times in the Middle Ages and in 1846, 1847 and 1848 both in Ireland and Belgium. The Germans indeed put the scientific clock back, so to speak, by over-emphasizing the significance of oedema and trying to establish it as the outstanding characteristic of undernutrition. This is by no means the case, and people in the last stages of undernutrition may have no oedema at all. The fourth horseman in Albrecht Dürer's beautiful woodcut is not represented as oedematous (Fig. 6), and he surely would have been if oedema was the rule in people who were dying of starvation. Owing to the German work the importance of oedema in under-

nutrition has been grossly over-emphasized in the last 30 years and it seems worth while to discuss some of its characteristics and causes. In an undernourished community oedema is usually observed first in men over 40. It appears in the ankles towards evening and at first disappears overnight, but later it collects during the day faster than it disappears during the night, and the fluid accumulates in the legs until they may become so swollen that movement is seriously curtailed. The oedema generally disappears after a few days' rest in bed, and the fluid which is mobilized from the limbs may be excreted in the urine. As the state of nutrition of the community gets worse, oedema may appear in younger men, in women and in children, but in the terminal stages oedema is not common, and one of the reasons is that at this stage diarrhoea so often supervenes and leads to such large losses of extracellular fluid that the oedema disappears. The cause of the oedema has been debated many times. It was suggested in the middle of the last century that a lowering of the plasma proteins might be responsible, and all the work which has been done since that time has gone to show that the concentration of proteins in the serum, particularly of the albumen, is very important in regulating the passage of fluid between the blood vessels and the tissue spaces. There is no doubt that if the serum proteins are sufficiently low, oedema becomes almost inevitable. If, therefore, undernutrition and protein starvation lead to a fall in the serum proteins, this is likely to increase the amount of extracellular fluids in the body and consequently the tendency to the formation of oedema. But many undernourished people may have much too much extracellular fluid and extensive oedema with normal serum proteins. A much more reasonable explanation for the oedema is provided by a reconsideration of the composition of the body in undernutrition. Fig. 1 showed that undernutrition led to a great increase in the volume of the extracellular fluids, so that they came to occupy a very abnormal proportion of the total weight of the body. There are a number of reasons why this may happen and the simplest is perhaps that the process merely represents a replacement of fatty and cellular tissue as these atrophy and disappear. The quantity of extracellular fluid in the body may rise by 10 or 20 l. in undernutrition without any pitting oedema being observed at all, and if the volume of fluid which collects in oedematous legs is measured it is found to be a very small volume relative to this. In other words, the swelling which pits on pressure and which we call oedema is only an unimportant part of the total volume of extracellular fluid which accumulates in the body of an undernourished

person. It would be wiser to give up speaking of oedema in undernutrition and to think in terms of extracellular space. The problem is not why some people get pitting oedema of the legs, but why all undernourished people do not.

Bone

Earlier it was pointed out that the bones were one of the tissues which lost very little weight in undernutrition, but in certain circumstances they have been observed to become extensively decalcified. World attention was drawn to this by the work which was done in Vienna after the first world war. This decalcification of the bones may be a sign of vitamin D deficiency and can very largely be prevented by big enough doses of this vitamin, but a deficiency of vitamin D is not the only reason why the bones become decalcified in this way in an undernourished community. Such people are generally short not only of food as a whole, but particularly of milk and cheese, which are the foods which provide most of the calcium in the diet. Furthermore they subsist largely upon very coarse wholemeal bread which contains a great deal of phytic acid. This substance forms an insoluble calcium salt, and by precipitating the metal in this way in the intestine prevents even the small amount in the food from being absorbed. Curiously enough, few examples of this aspect of undernutrition were observed in the second world war. One or two cases were described in Holland and there may have been some in Germany, but we did not see any although we were very much on the look out for them.

Mental Changes

The physical changes which have been discussed are bad enough, but the mental changes are undoubtedly worse. Novels and military accounts of sieges tend to emphasize the best points of the defence; the heroic are singled out for mention and unselfishness is glorified. There is no doubt at all that every situation produces its leaders, and the most unexpected people came forward to take charge of the resistance movements in the occupied countries and, in Holland, as organizers of little clubs for collecting food in the country round about or for making the most of what was available. On the whole, however, undernutrition leads to a degeneration of morals and thieving becomes very common. At first any food which is obtained is divided among the family or feeding group to which the individual belongs, and such food is jealously guarded from other units. This was the state of affairs throughout Germany when we were there in 1946, but in the later stages of undernutrition even this loyalty is lost and every man fends for himself. 'Brother had no sympathy with

brother nor father with son nor mother with daughter, nor would neighbour break bread with neighbour. There was no kindness among us, but misery and unhappiness. In the streets unkindness one to another; at home anguish, seeing children crying for bread and others dying' ('Chronicle of Novgorod,' A.D. 1230). In the Irish famine in the middle of the last century Donovan described a father engaging in a life and death struggle with his son for the sake of a potato. Loss of all the normal standards of morality under the impact of undernutrition has been described again and again in history, and there is no reason to suppose it would be any different today.

The population of the world is increasing at an

alarming rate. India and China are on the verge of starvation today, and countries such as England, with a population greater than the land can possibly support, may be called upon at any time through war or even through the operation of the normal laws of economics to face a period of undernutrition and perhaps worse. Mankind has the knowledge and ability to prevent all this, but will he do it? Those horsemen of the Apocalypse are grim figures and they are galloping round the world just as furiously today as they were at the end of the 15th century. They have lived longer than the saints and we can only hope that as they sweep on they will not be allowed to ravage and destroy as they would like to do.

NEOPLASMS OF THE EXTRA HEPATIC BILE DUCTS

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The object of this communication is to draw attention to certain neoplasms occurring in the extra-hepatic biliary duct system, and it is based on a small series of cases treated with varying results. The anatomical region involved is shown in Fig. 1, to which is appended the relative frequency of occurrence at each site as noted by Rolleston and McNee (1929). Neoplasms of the gall bladder itself are not discussed, neither are those tumours referred to as carcinomata of the ampulla of Vater, although there is good evidence to suggest that many of these cancers have their origin in the lower end of the common bile duct. The neoplasms under discussion are frequently very small and localized, and may not be recognized during a laparotomy for obstructive jaundice unless the surgeon is aware of their occurrence.

Anatomical Considerations

The hepatic ducts issue from the liver and unite to form the common hepatic duct often only a few millimetres from the liver substance, so that neoplasms arising from them involve the liver at an early stage and early become inoperable.

The common hepatic duct usually has a separate existence for 2 to 3 cm. before being joined by the cystic duct to form the common bile duct, so that it is possible that a small neoplasm could be excised with restoration of duct continuity. It will be seen (Fig. 1) that the greatest proportion of tumours arise at the junction of the cystic and common hepatic ducts and would require at least a cholecystectomy and partial choledochotomy.

The common bile duct is approximately 7 cm. long and consists of an easily accessible supra-duodenal portion and a retroduodenal part, which may or may not be embedded in the substance of the pancreatic head. Tumours of the supra-duodenal portion could be treated by local excision, but removal of a retroduodenal one would probably necessitate a wedge pancreatectomy or preferably a radical pancreatoduodenectomy.

The lymphatics of the bile ducts drain into the hepatic glands related to the stem of the hepatic artery and extending into the porta hepatis. The cystic duct lymphatics drain into the cystic gland near the neck of the gall bladder, though this gland may also drain the other biliary channels as