BRITISH MEDICAL JOURNAL

LONDON SATURDAY AUGUST 7 1937

OBSTRUCTIONS OF THE COMMON BILE DUCT*

BY

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Obstructions of the common bile duct may be partial or complete; in either case there is interference with the passage of bile, and therefore demonstrable jaundice. On the other hand jaundice, which has all the signs of the obstructive type, is not necessarily due to common duct obstruction. Complete or nearly complete obstruction is clearly revealed by clinical evidence which is too well known to need repetition here; partial obstruction, however, may be so slight that none of the ordinary clinical appearances are present; it is, in fact, latent—that is, bilirubin is in excess in the plasma, but has not reached the point at which it causes visible jaundice or exceeded the threshold of the kidneys. Fortunately in the van den Bergh test we have the means of detecting any degree of bilirubinaemia, and also whether it has arisen as a result of obstruction or not; though it cannot tell us with certainty whether the obstruction is intrahepatic or extrahepatic.

Causes of Obstruction of the Common Duct

The causes of obstruction are numerous, and many of them rare. I do not propose to enumerate them all. Those with which we have commonly to deal are: (1) stone and its complications, whether pathological or the result of surgical treatment; (2) pressure on the duct by pancreatic lesions, malignant or simple. I am prevented by lack of space from doing more than mention a presumed and possibly not uncommon cause due to spasm of the sphincter of Oddi. It is an interesting problem, and one on which a good deal of research is being carried out.

Diagnosis

The problem is usually one of determining the cause of jaundice of the obstructive type. In the main the difficulty is not great, the chief characteristics being:

Stone	Carcinoma of Pancreas	Chronic Pancreatitis
Painful Intermittent and varying	Painless Persistent and progressive	Usually some pain Variable
Short duration Not deep Often infection (intermittent hepatic fever) Gall-bladder not palpable	Long duration Deep Aseptic Gall-bladder usually palpable Rapid wasting	Long duration Fairly deep May be infection Gall-bladder often palpable Some wasting
Wasting variable (may be rapid)		

With these features, the history, and a positive prompt van den Bergh reaction there is usually no difficulty in deciding whether a stone is the obstructing agent or not; but it is often impossible even at operation to differentiate between malignant and simple lesions of the pancreas.

* Read in opening a discussion in the Section of Surgery at the Annual Meeting of the British Medical Association, Belfast, 1937.

Unusual cases occur not infrequently, and the difficulties may then be considerable. For example, in calculous obstruction there may be complete absence of pain, and jaundice, which as a rule is of short duration and not intense, may be deep and lasting. Carcinoma of the ampulla of Vater may ulcerate and permit bile to flow again after the customary deep jaundice and be associated with infection. Again, in the calculous cases sepsis varies, sometimes dominating the picture and at other times being altogether absent. Indeed, where there is infection without jaundice there is a risk of overlooking the biliary system as a possible source of the trouble.

Moreover, the difficulties in diagnosis arise not entirely in sorting out one cause of obstructive jaundice from another, but also in determining whether the jaundice is of intrahepatic or extrahepatic origin. Here are two such cases:

Case 1.—A man, aged 45, was referred to me by a consulting physician for carcinoma of the head of the pancreas. He had had deepening jaundice, painless, with all the criteria of the obstructive type (including a prompt direct strongly positive van den Bergh reaction) for three months, and rapid loss of weight. The liver was enlarged, the gall-bladder not definitely palpable. The urine was normal except for the presence of bile. Tetraiodophenolphthalein 2.5 grammes injected intravenously showed a 50 per cent. retention after half an hour. At operation no obstruction was found; the common duct was explored and drained. He died nine days later. At necropsy the pancreas was normal; the liver weighed 47 oz., and the cut section showed bile-stained swollen short bands of liver cells and areas suggesting recent granulations; microscopical sections revealed subacute yellow atrophy.

Case 2.—A woman aged 57, with a long history of flatulent indigestion, became jaundiced seven weeks before admission after an attack of pain in the right side and going through to the back. It was rather severe, but not of a colicky nature. The jaundice gradually deepened and was accompanied by itching and vomiting. It had all the characteristics of obstructive jaundice, with a prompt positive direct van den Bergh reaction, though the response had a biphasic element to some extent. Except for the presence of bile her urine was normal. It was thought she had a stone in her common duct, but at operation the duct was not dilated, the pancreas was normal, and there was no evidence of any obstruction of the duct at all. The liver was enlarged and cirrhotic, with a nodular surface. She gradually recovered and the jaundice slowly disappeared. It was not thought advisable to remove a section of liver, but I think there is no doubt this was a case of hepatitis with intrahepatic obstruction.

Mechanical obstruction and cholangitis can produce similar liver changes, as these two cases show:

Case 3.—A woman, aged 63, had had attacks of biliary colic off and on for three years, with jaundice in the last attack; this had steadily increased and become very deep. At opera-

tion the gall-bladder, which contained several stones, was drained, and also the common duct, which held a large stone and much debris. She died three days later in a comatose condition. Sections of the liver showed atrophy and advanced necrosis with collections of polymorphs.

Case 4.—A woman, aged 59, had had during a long period many attacks of cholecystitis with tenderness over the gall-bladder accompanied by shivering and jaundice. She was admitted in a critical condition, and died next day without operation. The post-mortem examination revealed a slightly enlarged gall-bladder containing mucus and three faceted stones, one of which was impacted in the neck. There was no stone in the dilated common duct, but some muddy bile; the pancreas was distinctly fibrotic. The liver showed a thickened capsule with grossly distorted surface, and on section there was extensive fibrosis enclosing small islets of intensely bile-stained fat with some liver tissue surviving in widely separated areas.

Cases like the first two do not often occur in one's practice, but when they do they present a major problem in diagnosis. Distinctive urinary changes are frequently absent, and one has to rely on less specific evidence. For example, if a patient develops jaundice without pain the presence of bile in the duodenal contents suggests that the condition is one of intrahepatic origin, and jaundice so arising is usually distinctly yellow, and generally unaccompanied by much itching, whereas if the condition is an extrahepatic one jaundice is of a dark greenish tinge with marked itching. My experience of intravenous injection of tetraiodophenolphthalein, though limited, leads me to think that marked retention of the dye is more likely in the case which does not owe its liver changes to extrahepatic obstruction. This test, however, is not without danger.

It seems inevitable, then, that if one makes it a rule to advise operation in all cases of suspected obstructive jaundice (as I think one should) an unnecessary operation occasionally will be performed; but against this some patients will be rescued by finding a stone in a supposed case of malignant obstruction. Even in the case which seems undoubtedly to be malignant a palliative operation can be done which will make the patient reasonably comfortable and prolong life a little, and occasionally indefinitely, since the assumed malignant disease may after all be chronic pancreatitis. In a series of 100 cases of obstruction of the common duct by pancreatic lesions the chances are that 20 per cent. will be simple, and in many of these it is only the subsequent long survival of the patient that will establish the diagnosis.

Effects of Obstruction on the Common Duct

The extrahepatic and intrahepatic ducts are dilated. When obstruction is due to pressure on the duct from without it has a bluish colour and as a rule contains dark inspissated bile because the gall-bladder is usually normal and carries on with its concentrating function. Where stone is the cause infection in the duct is common and the gall-bladder is more or less functionless; the bile is thin and yellow, or muddy with possibly a faecal odour; and the wall of the duct is thick and has a pinkish-yellow hue.

In about 5 per cent. of cases of common duct obstruction the duct is filled with "white bile"; experimentally white bile occurs only in those cases where the gall-bladder has been disconnected from the obstructed duct; clinically it is most often seen when obstruction is due to stone and where the gall-bladder has been more or less destroyed by inflammation. The ducts are filled with a mucoid secretion derived from their walls. There is still some doubt about the explanation of this state of affairs,

but it indicates very serious hepatic injury, and is therefore a signal to the surgeon for the least operative intervention compatible with efficiency at the time.

Of great practical importance from the point of view of the patient's safety are the hepatic changes resulting from obstruction; some degree of injury is always present, varying from mild central necrosis to acute atrophy, and slight periportal fibrosis to definite cirrhosis. It is not known why one patient should present minimal changes and another gross damage, nor have we the means of accurate determination as we have in the case of the kidney. The best guide, I think, is the bilirubin content of the serum. In many respects bilirubinaemia and high blood urea have a similar meaning as regards the respective organs. Both result from back pressure and functional insufficiency; neither in itself is harmful in the circulation, and in both cases the variations in the blood are detectable by reasonably easy and accurate tests. In the case of the kidney, however, we have other tests by which the significance of blood-urea readings can be assessed, whereas for the liver there are no comparable tests either in reliability or in consistency. Nevertheless the behaviour of the serum bilirubin curve does give considerable information. For example, we know that obstructive jaundice is associated with a tendency to bleed and with a prolonged coagulation time (it may be twenty minutes or more, compared with the normal four minutes or so); these are undoubtedly due to hepatic injury, and not to the mere presence of bilirubin in the blood, though roughly they run parallel; yet we know that this haemorrhagic tendency may occur in cases with little or no jaundice.

Bilirubin accumulates in the plasma even if the obstruction persists for months; bile salts, on the other hand, soon disappear from both the blood and the urine; the cholesterol content of the plasma rises by retention; the blood urea mounts and may be followed by casts and albuminuria and vomiting of altered blood. These indicate renal injury, and it is a practical point of the highest importance to keep in mind that the convoluted tubules of the kidney seem to be particularly vulnerable to something appearing in the blood as a result of hepatic injury.

Ascites and splenic enlargement may complicate common-duct obstruction if hepatic fibrosis is extensive, and a stone in the ampulla may cause dilatation of the pancreatic ducts with atrophy of the secretory cells from interlobular fibrosis: interacinar fibrosis is rare and thus true diabetes uncommon, though glycosuria is not infrequently seen with stone obstructing the common duct.

In addition to the plasma alterations already noted there is evidence furnished from the Mayo Clinic of changes in the haemoglobin of jaundiced patients. True anaemia may occur, but there may be also anoxaemia of the stagnant type—that is to say, the oxygen-carrying capacity of the haemoglobin is diminished. To some extent this may account for the central necrosis in the hepatic lobules, but anoxaemia has a profound effect on the tissue metabolism throughout the body. With this impoverishment in cellular environment one would expect the more elaborate processes to be carried on with greater difficulty than the simpler, which may account for the benefit derived from glucose therapy. It is generally agreed that a liver well stored with glycogen is less vulnerable than one not so provided; this is no doubt true, but in the sense that it shows there is more sugar in the body than is required by the tissues generally. If sugar is being provided in sufficient quantity parenterally, for example, over a period, I do not think it is

necessary that the liver should hold any excess as glycogen; at any rate that seems to be the evidence furnished by examination of liver sections which I have taken at operation.

Factors Affecting Mortality

1. WHEN TO OPERATE

The longer the disturbances initiated by common-duct obstruction last the more they pass from physiological dysfunction to structural and irreparable damage. Delay in treatment is therefore to be avoided, and as the obstruction is mechanical it can only be dealt with by surgery. Waiting a week or two is permissible; first, because if the obstruction is due to stone spontaneous relief will generally be observed in this time and the need for immediate surgery passes; and, secondly, because, whatever the cause of the obstruction, this period gives opportunity for pre-operative preparation, which I regard as imperative. It is in my opinion as essential a part of the treatment as is iodine, etc., in cases of toxic goitre.

2. PRE-OPERATIVE TREATMENT

So far as we know at present the chief needs of the patient are water, salt, sugar, and blood in order as far as possible to rectify disturbances produced by the disease and to prevent aggravation of them, which the impending operation will certainly do to some extent.

Water, Salt, and Sugar.—These are given in the form of normal saline or Ringer-Locke's solution with 5 to 10 per cent. glucose. Water is not retained in the body without an adequate salt concentration. Most patients take sparingly by mouth and often vomit, and probably under the influence of general toxic depression at best absorb slowly from the intestinal tract; the fluid therefore has usually to be given parenterally, and of these methods the continuous intravenous drip is certainly the best; it corrects dehydration, provides calories, and assists the functional capacity of the kidneys. Fluid can be administered in this way for several days, but intake and output must be closely watched, since there is no protein intake and water imbalance may arise. The only way to give intravenous protein is by blood transfusion.

Blood Transfusion.—Among the benefits conferred by blood are: (1) a rise in peripheral blood pressure—the proteins it contains tend to keep fluid in the vessels; (2) it diminishes the risk of post-operative bleeding; (3) in some cases it replaces blood which has been lost; (4) it supplies haemoglobin, which corrects in some degree anoxaemia and so improves metabolism generally. It is usual to give one or more transfusions at intervals, but probably a better way is to administer by continuous drip, the blood being oxygenated in its container.

Calcium.—It is customary to give calcium, usually as the chloride, intravenously, and I think it should be given; but whether it affects the tendency to bleed (which is the accepted reason for its introduction) directly I am not sure; my experience with its use in toxic jaundice suggests that it exercises its beneficial effect on the liver primarily, and experimental evidence points the same way, as it favours recovery of the liver poisoned by carbon tetrachloride.

3. OPERATIVE TREATMENT

I do not propose to do more under this heading than give a few principles:

(a) *Do the Least that is Necessary.*—Skilful judgement is very important here. In some cases the common duct should only be drained, the obstructive agent being left

for another time. In most cases the full operation can be completed, though in deeply jaundiced patients the gall-bladder should not be removed. The duct should be definitely cleared and the ampulla dilated with probes. An anastomosis between the dilated gall-bladder and stomach or duodenum relieves the pressure when due to pancreatic lesions. Should the gall-bladder have been removed at some previous operation the anastomosis would have to be done by using the hepatic duct. There is some danger, in suddenly relieving back pressure on the liver, from flooding the circulation with pent-up hepatic substances, or, more probably, by increasing for a time intrahepatic pressure owing to sudden congestion, as may occur after the relief of intracranial pressure or obstruction to renal secretion. Such patients may die two or three days after operation with hyperpyrexia; these are true liver deaths. Gradual decompression according to the method used in enlarged prostates is not possible here; the nearest approach is to aspirate the duct slowly before putting in a tube. Fortunately such cases are not often encountered. The more usual mode of death (often also called liver death) is seven or eight days after operation from a uraemic condition, and this can be prevented by adequate preparation.

(b) *Anaesthesia.*—I feel sure that spinal anaesthesia is of great value in biliary surgery, especially in the more serious cases. It takes a little courage to use it in these circumstances, since some fall of blood pressure is frequently seen, but with the use of icoral just before giving the spinal anaesthetic, and administering throughout the operation sufficient gas and oxygen to make the patient breathe more deeply, the fall is not serious. Otherwise the advantages are considerable: it makes for more gentle and quicker operating because of the complete relaxation, and so far as we know there is no toxic effect on the liver and kidneys, which cannot be said of ether, and these organs may be already working near the limit of their capacity.

(c) When no obstructing agent can be felt in the common duct it should nevertheless be opened and explored if: (i) dilated; (ii) altered in colour from a bluish hue to pinkish yellow; (iii) thickened; (iv) the pancreas is hardened or gritty.

(d) The stones removed from the common duct should be examined, as their composition may indicate their place of origin. Pure pigment stones form in the common duct, and so may recur after cholecystectomy has been done and the common duct cleared. Stones containing cholesterol alone or in combination with calcium are formed in the gall-bladder. Pigment stones may form in the liver as the result of excessive blood destruction; they are small, black, irregular, and friable. After dealing with the local condition splenectomy may be necessary to prevent recurrence. I remember a man who had four operations for biliary colic with jaundice. On each occasion a pigment stone (or stones) was found in the common duct and removed; the gall-bladder was also removed at the first operation. It was only at the fourth attempt that the spleen was found to be twice its normal size and was taken away. That was fifteen years ago, and there has been no recurrence since.

4. STONE IN THE HEPATIC DUCT

Obstruction of the hepatic ducts is not germane to this paper, but in so far as a stone which has caused obstruction of the common duct may be displaced into the hepatic duct, it is necessary to keep this in mind. The common duct must be cleared, but in addition one must

make sure that the hepatic ducts also are explored, otherwise there may be a recurrence of common-duct obstruction later; this I believe to be a not uncommon cause of such recurrence.

5. POST-OPERATIVE TREATMENT

The pre-operative technique should be carried on during and after operation. In addition 10 per cent. CO₂ in oxygen should be given until the patient takes four or five deep breaths, and repeated three or four times an hour during the first twenty-four hours or so. I think there is no doubt this lessens the incidence of post-operative atelectasis. Flatulence and vomiting are very seldom post-operative features when spinal anaesthesia has been used.

Conclusion

A collective investigation on stone in the common duct by the Association of Surgeons of Great Britain and Ireland in 1932 showed a mortality of 14.65 per cent. in 621 cases. The period to which these figures apply was for the most part before the importance of pre-operative preparation was fully realized. Since that date my figures show a mortality of 4.7 per cent. in eighty-four cases of stone in the common duct, and practically all these patients received the most careful preparation.

I feel sure the biochemical considerations involved in this preparation are of the greatest importance, and indicate that in order to make patients safe the surgeon must be in possession of knowledge which carries him far beyond the limits of operative technique and skill, however excellent these may be.

NUTRITIONAL NEEDS IN PREGNANCY*

BY

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Last year, at the inaugural meeting of the Section of Nutrition in Oxford, I ventured to predict that the day was not far distant when, instead of one morning being devoted to its work it would rank with the Section of Medicine as a three-day fixture. To-day my prediction is two-thirds of the way towards fulfilment. And it is perhaps fitting that the Section of Obstetrics and Gynaecology should be the first to ally itself with that of Nutrition. By this alliance and by the application of the principles of nutrition to the mothers of our race and to their children we begin at the beginning to lay the foundations of a more healthful existence for our people—a finer structure of national health. For, as Carrell has recently reminded us, “nutrition is synonymous with existence”; synonymous, that is to say, with the act of living, with the exercise of the vital functions. To this I would add that faulty nutrition is synonymous with faulty existence, with the faulty exercise of the vital functions.

For the student of nutrition there is no more enlightening experience than to observe the behaviour of cells under cultural conditions *in vitro*. Soon he perceives that their growth, their reproduction, their structure, and their functions depend not only on the composition of the fluid medium in which they are immersed but on the removal from it of the waste products of their activities. So it

is with the human body: that vast aggregation of cells, living, moving, and having their being within the closed circuit of the blood stream. For them the continual purification of the fluid medium in which they live is as necessary to their well-being as its continual enrichment with essential nutrients. It is to these two ends that the processes involved in the function of nutrition are directed and co-ordinated. Inspiration, mastication, deglutition, digestion, absorption, and circulation: these are the supply services. Exhalation, perspiration, urinary excretion, and defaecation: these are the sanitary services. The central act—assimilation—in the series of processes involved in nutrition is a function of living matter, dependent on the efficiency of the supply services on the one hand and on that of the sanitary services on the other. To the cell belongs the task of nourishing itself; to us, as physicians, belongs the task of enabling it to do so by our supervision of the efficiency of these two services.

Nutrition, then, is the sum of the acts or processes by which the structure and functions of all organs and parts of the body—including, of course, those that subserve the function of reproduction—are established and maintained. It is, in short, that function of the body by which health is maintained: health, which implies the ability to produce and rear offspring fitted to live and efficiently to perform the functions of their species.

Continued Efficiency of the Function of Nutrition

It is customary to speak of nutrition in pregnancy as though it differed in some directions—in the supply of certain food essentials, for instance—from nutrition at other periods of life. Indeed, the very title of our subject suggests such a distinction. It is customary also to speak of pregnancy as though it involved an additional burden on the maternal organism, as, unfortunately, it often does. But I suggest to you that the nutritional needs in pregnancy are those necessary to the continued efficiency of the function of nutrition throughout life. For in this efficiency the efficiency of that other fundamental function of the body—reproduction—is inherent. As well might we regard the taking of a steep hill as a feat additional to the normal function of a motor car as regard the making of a seven-pound baby as a feat additional to the normal function of woman. The properly constructed car, the properly adjusted, oiled, greased, fuelled, and tended car takes the hill in its stride; the properly constructed, adjusted, fuelled, and tended woman takes pregnancy in hers. It is this construction, this adjusting, this fuelling, this tending, that, in the perfection of its operation, the function of nutrition effects. But the case is different with the ill-constructed, the ill-adjusted, the ill-tended woman, in whom the function of nutrition from infancy onwards has been faulty. Then, indeed, pregnancy becomes a feat to which some succumb and from which many emerge with some weakness exposed, some permanent damage incurred. It is not, however, with the ill-constructed, the ill-adjusted, the ill-nourished, the ill-conditioned that I am here concerned, but with the Rolls-Royce of womanhood, or for that matter with the dependable Baby Austin or Morris Minor. It is to the production of these—aye, to their mass-production—that we must direct our energies, though the salvaging, the patching-up, of wrecks must still remain our portion.

The nutritional needs in pregnancy are, I repeat, those necessary to the efficiency of the function of nutrition. Their satisfaction must begin not with conception but with the ante-natal life of the mothers of our race. It

* Read in opening a discussion at a joint meeting of the Sections of Nutrition and Obstetrics and Gynaecology at the Annual Meeting of the British Medical Association, Belfast, 1937.