of these, six were very mild, one had an urticarial rash, one lumbar pain, and one a severe rigor and temperature. The last reaction was traced to secondarily infected serum. The dose was 50 or 100 c.cm. of four-times-normal reconstituted serum.

More recently, dried serum from serum "pools" has been issued to many hospitals in Sectors I and II. With the serum a pro forma was circulated and observers were asked to note the occurrence of reactions, however mild. Through the co-operation of Drs. Kidd and Wilson (the Sector Transfusion Officers), and many medical officers in the sectors, sixty-seven forms have been returned to the Medical Research Council, including those of nine cases which had liquid plasma. Most of these transfusions were given to air-raid casualties and a few to cases of post-operative shock. The results are tabulated below. No preliminary grouping tests were performed in these cases.

	No. Transfused	Reactions	
Serum alone ..	58	6	400 c.cm. of N or 200 c.cm. of 2N serum
Plasma alone..	9	2	1-2 bottles

The reactions in both series were mild and consisted of a very slight rigor with a small rise in temperature.

Combining these results with those which we have obtained personally, records of 202 transfusions of dried serum are available, in which thirty-four reactions, practically all of them mild, have been observed, while in thirty plasma transfusions reactions occurred in eight instances.

Summary

Evidence is presented that serum prepared at the Medical Research Council serum drying unit at Cambridge is not toxic. Furthermore, the administration of this serum to cases of shock has been followed by successful results.

The reaction rate after a small series of plasma transfusions has been noted for comparison. Little difference between the two series is evident.

Our thanks are due to Drs. O. M. Solandt and Janet Vaughan for helpful criticism and to many members of the staffs of various hospitals in the S.W. and N.W. areas for putting cases at our disposal. We should also like to thank Drs. A. C. Dornhorst and D. H. G. MacQuaide for permission to include certain cases observed with their co-operation.

Thanks are due to many medical officers for their co-operation, which has enabled the additional information to be collected.

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M. Hoareau (*Thèse de Paris*, 1940, No. 243) states that benign tumours of the stomach, though rare, are not so exceptional as was once supposed. It is now generally agreed that they form from 0.5% to 2% of all gastric tumours. Both sexes are equally affected. The age of the patients is rarely below 50; in exceptional cases it may exceed 70. The symptoms are very variable and depend much more on the site of the tumour than on its histological nature. The most dangerous tumours are schwannoma and adenoma, owing to the likelihood of haemorrhage, and every form of benign tumour is liable to undergo a cancerous change. Early and extensive removal is the only curative treatment. When an operation is contraindicated by the patient's age or general condition, deep radiotherapy should be employed.

A CASE OF COMPLETE OBSTRUCTION OF THE INFERIOR VENA CAVA

BY

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There must be very few individuals who have survived such a drastic disturbance of the venous circulation as is presented by the obliteration of the whole length of the inferior vena cava from its starting-point at the level of the fifth lumbar vertebra to the groove in the liver where it is joined by the hepatic veins. The lesion, if produced suddenly, means the elimination of the venous return from the abdominal walls, from all the pelvic organs except the rectum, from both lower limbs, and, above all, from both kidneys and suprarenals. Although some of the venous blood from the abdominal walls and the upper parts of the thighs might find its way back to the heart via the superior epigastric and internal mammary veins, or via the ascending lumbar and azygos veins, the total arrest of the kidney circulation would lead to death in a short time.

An instance of the rare condition of complete obstruction of the inferior vena cava was discovered accidentally in a dissecting-room subject, a coloured man aged 71. There was nothing in the clinical history which gave any explanation of the causation of the venous thrombosis. The man was blind and had spent the last eleven years of his life at the Capetown Infirmary. He was not bedridden and could get about for walks. His last illness was a rather sudden collapse with pulmonary congestion; nothing abnormal was found in the abdomen or urine during the last few days before his death.

Following the usual procedure in the department, the limbs were first dissected. The group of students concerned had noticed an extensive varicosity of the right groin and right lower limb, to which no particular importance was attached; the left leg was free from varicosity. When the abdomen was dissected and the posterior abdominal wall exposed one found a hard rod-like structure about the size of a thick pencil in the interior and

FIG. 1.—Visceral surface of the liver.

occluding the inferior vena cava. The liver had been removed, and on examining the visceral surface of the organ the extraordinary condition illustrated in Fig. 1 was found. The inferior vena cava was completely blocked by a mass of fibrous tissue containing an inner core of calcified material. The diaphragmatic surface of the liver presented a striking contrast. Here the

inferior vena cava was widely open and received the usual number of large hepatic veins (Fig. 2). The opening for the inferior vena cava in the diaphragm had the normal dimensions.

The liver itself was of average size. It showed no abnormalities beyond a pedunculated tuber omentale, and the portal circulation had obviously been intact. A closer examination of the portion of the inferior vena cava at

FIG. 2.—Diagram of the collateral venous circulation viewed from behind.

the back of the liver showed that the vessel was replaced by a thick fibrous band for about two-thirds of the distance to the diaphragm. A central core of calcified matter occupied about one-fourth of the area of the cut surface (Fig. 1). At the point where the inferior vena cava was joined by the first hepatic vein from the right lobe of the liver there was a sudden transition to a large open vessel. Probing of the open portion revealed a complete shutting-off below, at the point where the fibrous part abutted against the first hepatic vein. In the middle portion of the inferior vena cava—i.e., the part just below the entrance of the renal veins—opposite the renal veins and for some distance above these vessels, the calcified thrombus filled the vein completely (Fig. 2); this portion measured approximately two inches.

The formation of a phlebolith is regarded as a rare sequel of thrombosis (Franklin, 1936). The more common calcified thrombi are in the form of hard spherical nodules with smooth surfaces lying in the vein and almost free of attachment. "Rarely the calcified thrombus in its original form is transformed into a stony cylinder" (Osler and McCrae, 1927).

Pathology of Thrombosis of Veins

Thrombosis of the inferior vena cava is rare, quite apart from phlebolith formation. In a discussion on the frequency of thrombosis in large veins the femoral vein, the superior mesenteric vein, the portal vein, and the lateral sinus are specially mentioned, but not the inferior vena cava (Franklin, 1936). In textbooks of medicine the two main diseases which are listed in connexion with thrombosis of veins are typhoid fever and pneumonia. Syphilis is mainly linked with diseases of the arteries, but may have had some bearing in this particular case, because the subject showed extensive scarring of the soft palate, indicating an old syphilitic lesion. The septic form of venous thrombosis is almost confined to the lateral sinus as a complication of middle-ear suppuration and to the portal system of veins following acute appendicitis. Theoretically a septic thrombosis in the inferior vena cava would be possible as a sequel to any form of sepsis in its territory of drainage or as a result of a suppurating lymph gland closely applied to its wall. The inferior vena cava may be injured in abdominal operations and become transformed into a fibrous cord as a result. Also it is quite possible that an acute pancreatitis, with the close anatomical relation of the head of the pancreas to the inferior vena cava, might sometimes lead to a thrombosis of this vessel.

Thrombosis of a renal vein may be due to the extension of a thrombus from the inferior vena cava. The immediate symptoms are an increase in the size of the kidney, pain, and haematuria. In patients who recover albuminuria may be present for two or three months. Bilateral thrombosis of the renal veins leads to anuria followed by death (Osler and McCrae, 1927). Therefore we must assume that the complete closure of both renal veins in the present instance was a gradual process.

Collateral Circulation

A dissection of the veins on the posterior abdominal wall behind the inferior vena cava revealed a very perfect collateral circulation. All the venous blood from the lower part of the body except that from the intestinal tract had been successfully short-circuited towards the superior vena cava. Fig. 2 shows that the right kidney drained by means of numerous perinephric veins which pierced the capsule of the kidney and joined a dilated right subcostal vein (Fig. 2, a). This vessel was so large that it may be said to have taken the place of the right renal vein. There was also a small anastomotic vein from the right kidney which passed behind the obstructed inferior vena cava and joined a vein which ascended on the vertebrae behind the aorta; the latter vein probably represented the "azygos line" of the embryonic circulation (Gray, 1938) (Fig. 2, e).

The left kidney was drained by a large vein which turned sharply backwards (Fig. 2, c), taking the course of the second left lumbar vein behind the psoas major, and ended by joining the beginning of the inferior hemiazygos vein (Fig. 2, d). A region near the upper pole of the left kidney was also drained by dilated perinephric veins. The suprarenal veins pierced the crura of the diaphragm and joined an extensive venous plexus around the aorta. Each ureter was accompanied by an exceptionally large vein which ended in the same plexus and undoubtedly helped in the venous drainage of the organs in the pelvis. The testicular veins were also considerably enlarged.

On the left side of the body the obstruction was less severe than on the right, chiefly on account of the open trunk already referred to (Fig. 2, e), which had allowed the distal part of the left common iliac vein to escape thrombosis or perhaps to become recanalized.

On the *right side* there was no "azygos line" in the lower part of the abdomen. The venous blood from the pelvis and lower limb had to find a new route to circumvent the obstructed common iliac vein. Fresh anastomotic channels were opened up in the direction of the deep circumflex iliac and ilio-lumbar veins (Fig. 2, f). Many large veins belonging to this group were found in the lateral and posterior parts of the abdominal wall, and these united to form the beginning of the right subcostal vein. The latter part of the collateral circulation had been more difficult to establish, as evidenced by the dilated superficial veins in the right groin and lower limb.

Discussion

In the absence of a clinical history we must assume that the man had a severe illness of unknown aetiology many years ago. There was no record of any serious disturbance in health during the last eleven years of his life, while an inmate of the Capetown Infirmary. If the deposit of calcium salts can be looked upon as a remote or terminal result of the fibrous organization of a thrombus one may argue that the original lesion in the inferior vena cava began at a level just above the entrance of the two renal veins. It was in the nature of a spreading thrombosis and could not have caused a total blockage of both renal veins at once, as this would have been incompatible with life. The extreme resiliency of the venous system in compensating for the obstruction would perhaps justify a further assumption—namely, that the original illness occurred when the patient was a young man or perhaps even in childhood: only young tissues could have shown this wonderful adaptability. The kidneys, both of normal size, had recovered completely from their extraordinary handicap, and the man lived to the ripe age of 71.

It is an interesting point whether the condition could have been diagnosed during life. The varicosities on the right side pointed in the direction of a venous thrombosis. A collateral circulation which had caused an enlargement of the deeply situated azygos system of veins cannot be discovered clinically. A normal urine, once compensation was established, would hardly have allowed one to suspect a complete blockage of both renal veins. A radiograph of the posterior abdominal wall was taken in the department, but the inferior vena cava outline could hardly be seen. Evidently the condensation of calcium salts in the fibrosed vein was not dense enough to show up with any distinctness against the shadow of the vertebral column.

BEARING ON DECAPSULATION OF THE KIDNEYS

The most remarkable feature of the collateral circulation was the enlargement of the veins in the perinephric fatty capsule of the kidneys. These formed large bunches of veins surrounding the kidney and piercing its fibrous capsule. The perinephric fat belongs to the extra-peritoneal tissue, and one of the functions of this important layer is "to establish, through its vascular plexus, communications between the parietal vessels and those distributed to the abdominal viscera" (Cunningham, 1937). This function could not have been illustrated in a more striking manner.

The operation of decapsulation of the kidneys was originally proposed by Edebohl (1901). It was thought that the thickened fibrous capsule of the kidney prevented the establishment of a collateral circulation. More recent literature on the subject shows that the original theory finds few supporters. When the renal veins are free the anastomotic channels do not establish themselves easily, and the fibrous capsule which forms after the operation is often thicker and firmer than the first one. The operation is still recommended in chronic Bright's disease and in certain forms of acute nephritis, but the

most striking successes occur in puerperal eclampsia (Thomson-Walker, 1936). It has been suggested that the success of the operation is not connected with the collateral circulation at all, but has to do with the removal of the sympathetic renal plexuses which ramify in the capsule (Sen, 1936). It is stated that the blood flow through the kidney substance improves because the vaso-constricting influence of the sympathetic is removed.

After seeing the extraordinary development of the venous circulation in the perinephric fat and through the fibrous capsule of the kidney in the present case it is clear that there is a strong anatomical justification for operations planned to establish new blood channels. It suggests that the original explanation of the successes claimed for decapsulation of the kidney—i.e., one based on collateral circulation—remains the correct one.

Summary

A short account is given of the anatomy of a case that demonstrates the remarkable potentialities of the body for establishing circulatory anastomoses.

From this case it appears to be possible to establish a complete collateral circulation for the drainage of both kidneys.

These findings may prove to be important clinically.

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IMPERFECT STERILIZATION OF DRESSINGS AS A PROBABLE CAUSE OF POST-OPERATIVE TETANUS

BY

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When recording the results of experiments on the sterilization of dressings (Hayes, 1937) I ventured to express the opinion that imperfect sterilization could be the cause of unexplained post-operative tetanus. The present paper is concerned with experiments conducted to indicate the viability of tetanus spores inserted in the centre of dressings and sterilized under certain conditions. Unfortunately, owing to the onset of war, it was not possible to complete the full range of experiments desired.

Catgut as a Cause of Post-operative Tetanus

Imperfectly sterilized catgut has for many years been considered to be the chief cause of post-operative tetanus. Evidence is, however, accumulating which indicates that it does not play the important part previously accepted. There is considerable disagreement amongst authorities as to whether catgut is the chief cause. Fildes (1929) believes that it is, but also states that positive evidence is meagre. Mackie (1928) and Mackie, McLachlan, and Anderson (1929), agreeing with Fildes, point out the "peculiar relationship of post-operative tetanus to abdominal and gynaecological operations." Bulloch (Bulloch, Lampitt, and Bushill, 1929), on the other hand, in his classical work and with years of experience following his special study of the subject, after reviewing all evidence available, concludes: "There may be a suspicion against catgut. It remains for the present only a suspicion." Pulvertaft (1937), discussing catgut tetanus, says: "There are indeed