The rate in 849 cases treated by chemotherapy plus serum was 13.8%.

The rate in 2,357 cases treated by chemotherapy alone was 9.2%.

In the five years 1936-40 there was a steady decline in the fatality of cerebrospinal fever, the annual rates per cent. being successively 63.8, 61.2, 50.6, 34.2, and 20.2. In a series of cases treated in the period 1931-4 with serum of improved quality and administered suitably the rate was 27.9, but a decrease of the rate for the whole country did not occur until the introduction of chemotherapy; with the wider employment since 1938 of the sulphonamide derivatives the decline has been dramatic. In 1941 the rate was 19.5%, and in the first half of 1942 it was 19.5, as against 19.9 in the corresponding periods in 1940 and 1941. It is possible, therefore, that 1942 will show only a slight further decrease.

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A RARE CAUSE OF SEVERE GASTRO-INTESTINAL HAEMORRHAGE

WITH A NOTE ON ANEURYSM OF THE HEPATIC ARTERY

BY

GORDON GORDON-TAYLOR, C.B., O.B.E.

Temporary Surgeon Rear-Admiral; Consulting Surgeon to the
Middlesex Hospital

The following case seems to merit publication as a rare cause of haematemesis: aneurysm of the hepatic arterial system is an infrequent condition, this instance constituting the 86th recorded. I am aware, however, of another case, still unpublished, in the National War Collection organized by the Medical Research Council. The present case appears to be the only instance in which anything except ligation of the parent artery has been attempted as a surgical measure. Subsequent bacteriological findings in the blood-clot of the aneurysm doubtless precluded any chance of final success from aneurysmorrhaphy in this particular patient, but in other aneurysms which have a non-infective cause the method can hardly yield results more disastrous than those attending ligation; the difficulties are by no means great, and the method is worth consideration by those who may be confronted with aneurysm of this blood vessel on laparotomy.

Clinical History of Case

A married woman aged 61 was admitted into Middlesex Hospital under my care on June 22, 1938. A history was obtained of two years' indigestion unrelieved by food; there were intermissions between the bouts of severe pain, but there had been continuous epigastric discomfort throughout the whole period. The last and final bout of pain had followed a wholesale dental extraction, and for a fortnight before the patient's admission to hospital there had been persistent severe melaena, punctuated by three sharp attacks of haematemesis, which had brought her haemoglobin at one time down to 30%. A continuous-drip blood transfusion had been employed on several occasions, and on her arrival at hospital her haemoglobin had risen again to 70%, and the red cells numbered 3.6 millions. For a week there was no pain or further haemorrhage; obvious melaena ceased, although the faeces still gave a very strongly positive benzidine and guaiacum reaction. The Wassermann reaction was negative.

On July 1, 1938, the patient was suddenly seized with most violent abdominal pain; she vomited blood and collapsed. A diagnosis of a perforated peptic ulcer and concomitant ulcer-haemorrhage was made, and the abdomen was opened under regional anaesthesia and intravenous skophedal; a blood transfusion was at once begun. No ulcer-perforation was found.

The liver, gall-bladder and pylorus were bound together into a pulsating mass; the gall-bladder was much distended and bluish in colour; the duodenum and small intestine contained much blood. The existence of an aneurysm in connexion with the hepatic arterial system was now discernible, but the precise nature of its origin and of any recent change in its condition was not at the moment apparent. A better exposure of the tumour was obtained by removal of the pyloric portion of the stomach and the careful separation of the distended gall-bladder from its hepatic bed, the organ being cautiously stripped downwards and mesially from fundus towards neck; this separation was facilitated by the injection of saline into the subserosa of the gall-bladder and between the wall of the latter and Glisson's capsule. The upper and lower boundaries of the pulsating tumour had now been defined and also mobilized.

The distended gall-bladder was next opened, and was ascertained to be filled with recent blood and also blood-clot; blood was indeed seen issuing into the gall-bladder cavity in a steady stream through a small opening on the mesial aspect of its wall. Bacteriological examination of the blood subsequently revealed the presence of streptococci and a scanty growth of *B. coli*. *Clostridia welchii* were not present in the gall-bladder contents.

The gall-bladder was now removed, with some recent soft clot on the anterior aspect of the pulsating tumour; a little laminated clot was also dissected away, some haemorrhage taking place the while from the opening in the aneurysm despite efforts to compress the hepatic arterial stem. A considerable "button" of aneurysmal wall was left on the artery and a reconstructive aneurysmorrhaphy was performed, the remains of the sac being sutured in layers. All haemorrhage having been arrested, the abdomen was closed without drainage. Next day the condition of the patient was satisfactory, with a pulse of 88; but she afterwards slowly sank and died 40 hours after operation. The post-mortem examination did not demonstrate any failure in operative technique as responsible for the patient's death.

Necropsy.—The lungs showed marked hypostatic congestion and in parts early bronchopneumonia. The pericardium contained 3 oz. of fluid. *Heart muscle* exhibited fatty fibrosis. The abdominal aorta and main arteries showed advanced atheroma; no evidence of syphilitic striation was observed. The kidneys were normal in size; the cortex was thinned, and there was patchy ischaemia, with obliteration of glomeruli. Histology: No changes indicative of a "transfusion kidney"; tubules in kidney rather dilated. Blood urea, 170 mg.; non-protein nitrogen, 125 mg. The spleen was packed with red blood cells. The liver showed toxic degeneration; portal vein and radicles were normal and healthy. The common bile duct

Diagram showing aneurysm of the hepatic artery which communicated with the gall-bladder.

was patent and healthy throughout its length. At the junction of the cystic artery and bifurcation of the hepatic artery, which was buried in a mass of laminated and more recent clot, there appeared a widening and a perforation of the arterial swelling.

The operation had not interfered with the patency of the arterial tree. The high blood urea and non-protein nitrogen suggested renal deficiency as at least a contributory cause of the fatal ending, and the fluid in the pericardium also supported this view. Nevertheless I have repeatedly stressed the disastrous results which attend operations for haematemesis from peptic ulcer undertaken after the first 36 hours; the necessity for operation was imposed upon me in this instance on account of a mistaken diagnosis of perforation. All these untoward circumstances combined to determine the fatal issue.

A NOTE ON HEPATIC ARTERY ANEURYSM

The age incidence of cases of aneurysm of the hepatic artery varies between 10 and 83, the average age in men being 36 and in women 42. Men are affected three times as often as women, and an extrahepatic situation of the aneurysm is also thrice as common as an intrahepatic locale. The tumour is almost always single, but there are 12 examples in the literature of multiple aneurysm of this vessel. In six cases 2 aneurysms coexisted; in three instances 3 aneurysms; in another patient 4; in still another 5 aneurysms. The aneurysmal sac has varied in size from a barley-corn (Rollan) or cherry to a full-term foetal head, the extrahepatic variety being usually larger than the intrahepatic form.

Artery of Origin.—In over 50% the hepatic artery itself was involved, and in one-third of the cases the right branch was implicated; in 10% the left branch was the site of origin. Right and left arteries were both aneurysmal in one patient; the cystic artery was implicated in 3 cases; in one patient (Drascke) an aneurysm was said to have developed on an accessory hepatic artery coming from the superior mesenteric.

Rupture of the Aneurysm.—Of aneurysms of the hepatic artery 80% have first come under observation for rupture, nearly half of these inundating the peritoneal cavity and one-third bursting into the main bile channel, especially the hepatic duct. Seven have eroded the duodenum and 7 the gall-bladder. Only one is said to have burst into the stomach, and one perforated the portal vein. In 4 cases a double rupture occurred, of which two burst into the duodenum and the abdominal cavity; one leaked into gall-bladder and coelom, and one perforated the hepatic as well as the common bile duct.

The clinical triad associated with aneurysm of the hepatic artery are pain, haemorrhage, and jaundice (Malloy and Jason, 1942). The case presented in this communication showed no jaundice, and post-mortem scrutiny failed to reveal any compression of the extrahepatic biliary tract, which indeed during life permitted a steady flow of blood into the duodenum. The blood-flow from the aneurysm along these natural channels must have been free, since no clotting occurred in the bile duct, although clot was present in the backwaters of the distended gall-bladder.

The cause of the aneurysm in this patient seems to have been an infective one; not only was the final illness with its haemorrhagic catastrophe initiated by wholesale dental extraction, but streptococci and a small growth of *B. coli* were obtained from the clot in the gall-bladder and that of the aneurysm wall. A mycotic origin is found to be the most frequent cause of hepatic artery aneurysm; trauma has been impugned in a few cases; syphilis has been found less often than atheroma in these patients. Atheroma was certainly present in the hepatic artery as well as in many other arteries in this present case, but the bacteriology appears to favour an infective origin. The case perhaps constitutes one more reminder of the danger attending wholesale dental extraction in oral sepsis at a single operation.

Treatment

Statistics derived from operations on mankind afford slender grounds for the optimistic pronouncement of an Axis writer (Alessandri) that "when an aneurysm of the hepatic artery is present, we are justified in performing ligation of the trunk of the hepatic artery, with or without the slitting or removal of the sac." The results of ligation of the main artery for aneurysm, indeed, appear to be even worse than those attending ligation of the hepatic artery under other circumstances. The same writer collected 10 cases of ligation of the hepatic artery for conditions other than aneurysm and found a mortality rate of 60%.

On the other hand, 12 arterial ligation operations have been performed for aneurysm of the hepatic artery or its branches, and in 75% of these the patients succumbed; in 2 of the 3 surviving cases (Sudeck; Colmar) there was no certainty that any aneurysm was present. Kehr's case appears to be the only positive success in hepatic artery ligation for aneurysm. Alessandri also collected 18 cases of ligation of the right or left branch of the hepatic artery for non-aneurysmal conditions; the mortality was 40%, and the fatal cases almost always revealed necrosis of the corresponding liver lobe.

Any confidence in the successful issue of a ligature of the hepatic artery must be begotten of a pious hope that some aberrant hepatic artery may supply to some degree the denuded region. It is true that Henle reported a case in which three hepatic arteries were present: (a) from the left gastric, (b) the parent coeliac axis, (c) superior mesenteric. Rio Branco also described a triple arterial supply in another case: (a) a special artery from coeliac axis to the left lobe; (b) the usual origin and distribution from the coeliac axis; (c) a special branch from the superior mesenteric to the right lobe. The not infrequent derivation of the left hepatic artery from the coronary (left gastric) is vouched for by Quain, and this same indisputable authority affirms the occasional origin of the left hepatic from the superior mesenteric and its rare source from the splenic artery.

Quain also vouchsafes the information that accessory hepatic arteries are sometimes encountered, generally coming from the coronary; such a hepatico-coronary is said by Rabinovitch (1927) to occur in no less than 28%. According to Quain, an accessory hepatic artery comes less frequently from the superior mesenteric, aorta, right renal, or inferior mesenteric; Rabinovitch describes a hepatico-mesenteric in 18%. Thus, according to the German writer, an accessory vessel is present in nearly half the cases. Axis opinion hopefully states that since the topography of these accessory vessels is constant, their presence can easily be determined at operation (!). Tandler makes use of a less ambitious figure (32%) in relation to the frequency of an accessory artery.

In cases in which ligation of the hepatic artery is forced upon an unwilling operator gradual incomplete ligation in the manner of Halsted might be tried. There is also evidence, from animal experiment, in favour of anastomosis between the proximal segment of the ligated hepatic artery (Narath) and even of the distal segment (Ghiron) to the portal vein. Where there appears opportunity for a second intervention the omentum may also be attached to the liver at the first séance (Grunt); and an attempt may be made to produce adhesions between the liver and the diaphragm, parietes, etc. (Barch, Grunt, Bode).

There can be no manner of doubt that the anastomosis between the arterioles in the interior of the liver is infrequent and at best scanty; injection of barium in gelatin and radioscopy show that vascular communication between the two lobes is richest under Glisson's capsule and in the tissues of the portal fissure (Segall, 1923).

The anatomical findings of Continental observers and the results of experimental ligation of the hepatic arterial tree in animals other than man may afford hypnotic comfort to the surgeon confronted with the need for rapid decision, but it is an unpalatable truth that, in man, *ligature of the hepatic artery or its main branches is an operation fraught with peril to life*. The dangerous manner in which the right branch of the hepatic artery frequently clings to the cystic duct and almost defies the operator in his endeavours to separate the two "contacting" structures is familiar to every experienced surgeon. It is highly probable that many cholecystectomies performed by amateurs in which grave morbidity or death ensues owe their unfavourable course to the unfortunate inclusion of the right branch of the hepatic artery in a clamp or a mass ligature of the cystic duct and the contiguous artery.

For the accompanying sketch I am greatly indebted to my friend, Dr. C. P. Smith of Middlesex Hospital.

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M. Finland and his colleagues (*Arch. intern. Med.*, 1942, 70, 183) have observed that in patients with clinical influenza a staphylococcal pneumonia may occur and assume epidemic proportions in different places during an influenza epidemic. The authors state that the staphylococcal infection may vary from a simple tracheobronchitis to a fulminating, acute, and fatal haemorrhagic oedematous pneumonia. In such cases they recommend intensive treatment with sulphadiazine or sulphathiazole.