# A CONTRIBUTION TO THE SURGICAL SIGNIFICANCE OF ABERRANT HEPATIC DUCTS*

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IN SUBDIAPHRAGMATIC VAGOTOMY, as in the mobilization of the cardia and subcardiaphragmatic part of the esophagus, access to the esophagus is made easier by severing the fibrous appendix and left triangular ligament of the liver. Our own experience confirms the data of the international literature—that, in so doing, we mostly sever relatively avascular tissue which, in the majority of cases, requires at most coagulation of a few small, slightly bleeding, vessels. By severing the above structures we gain a better survey of the cardiac part of the stomach and also facilitate the mobilization of the cardia and the abdominal part of the esophagus. This unpretentious procedure facilitates the removal of the lymphatics round the cardia at the lesser curvature, allows a better survey of the invasion of the carcinoma of the cardia into the diaphragm, and guarantees a more complete control of bleeding.

The severing of the fibrous appendix and of the left lateral ligament of the liver does not, in any way, endanger the postoperative course in the majority of cases. However, our observation, so far isolated, proves that this is not universally the case.

## CASE REPORTS

**Case 1.**—A 51-year-old male patient, Joseph H., with extensive carcinoma of the stomach required total gastrectomy, which was performed on September 4, 1948, by Professor Rapant. A left oblique transrectal laparotomy determined the operability of the carcinoma. The laparotomy, after the costal arch was severed, was then extended to laparothoracotomy and the diaphragm was partly severed. At this stage we noted a whitish strip of 4 to 5 mm. in breadth, running subcapsularly along the convexity of the liver, which we assumed to end at the left lateral ligament of the fibrous appendix. This is an unusual observation to which we do not ascribe any importance, the nature of which we have no accurate idea, and which we consider to be without any practical consequence (Fig. 1). The fibrous appendix and left lateral ligament were transected with only slight bleeding, which was easily controlled by coagulation. We put towels over the mobilized left lobe of the liver and moved it to the right. Then the cardia was isolated and the severing of the diaphragm completed. The technically simple total gastrectomy was completed by an end-to-side anastomosis between the esophagus and jejunal loop, after Roux.

Before beginning the anastomosis between the esophagus and the jejunal loop, the towels were changed and we were surprised to notice bile stains. We ascribed this to an unobserved soiling by the duodenal or jejunal contents, which coulde have happened during the operation. After completion of the anastomosis and during the ensuing fixation of the jejunal loop to the margins of the opening in the mesocolon, we were greatly surprised by the intensive yellow coloring of the serosa of the mobilized jejunal loop, part of the mesocolon and posterior peritoneum. The reason for this staining was found in aberrant bile ducts in the fibrous appendix. These were closed by transfixing sutures.

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**Case 2.**—Soon after September, 1948, we made a similar discovery in another patient, 34 years old, F. V., suffering from peptic duodenal ulcer, in whom subdiaphragmatic vagotomy was carried out. In this case, a whitish strip of 3 to 4 mm. breadth appeared on the convex side of the left lobe of the liver about 6 mm. from the beginning of the fibrous appendix, into which it passed subcapsularly. Here it formed a small arch of 6 to 7 mm. in length and continued subcapsularly on the visceral side of the same lobe; there it gained a breadth of 2 to 3 mm. and a length of about 3 cm., and gradually disappeared in the parenchyma of the liver. A part of the fibrous appendix, together with the aberrant ducts, was resected for histological examination.

Microscopic examination of the tissue from the first patient disclosed subcapsular bile ducts in the whitish strips (Fig. 2). In the severed bile ducts aberrant hepatic vessels were observed (Fig. 3). In the resected parts from the second patient, islets of hepatic parenchyma were macroscopically visible, particularly after illumination and fixation in

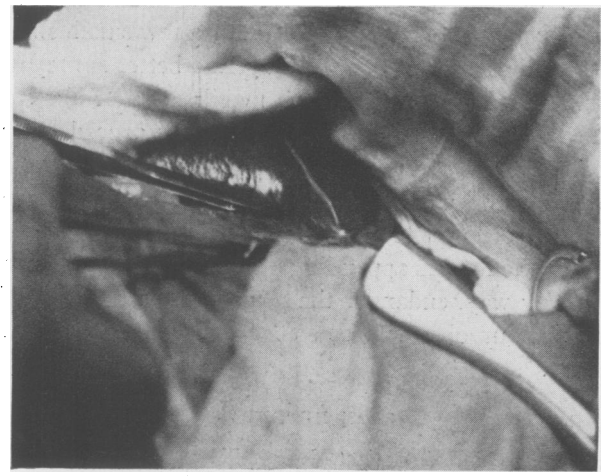

FIG. 1.—Left lobe of the liver with broad subcapsular bile duct. Fibrous appendix tied.

formaldehyde. These were ill defined against their surroundings and without relation to the strips coming from the liver.

Microscopically, aberrant hepatic ducts of typical structure were observed in the subcapsular strips. The islets in the fibrous appendix were formed by an accumulation of hepatic cells, the nuclei of which were in the majority of cases stainable, but without formation of hepatic lobuli (Figs. 4 and 5). As compared with the first observation, the aberrant ducts were less developed; nevertheless, they were well defined. In addition, remnants of hepatic parenchyma were present in the form of not clearly limited islets in the fibrous appendix.

## COMMENTS

E. H. Weber,[21] in 1843 defined aberrant ducts as subcapsular networks of bile ducts outside the hepatic parenchyma. Bile ducts of this kind were, however, already known to Ferrein[6] in 1753, who observed them in the left lateral ligament, and to Kiernan,[11] who described them in 1833 as a rudimentary liver. Aberrant ducts were systematically studied by Toldt, Zuckerkandl[20] (1875)

and Engel[5] in 1911. The name aberrant vessels, or ducts, is not quite adequate, and it appears to be useful to add "bile," in order to distinguish them from blood vessels which regularly accompany them, as well as from the aberrant

FIG. 2

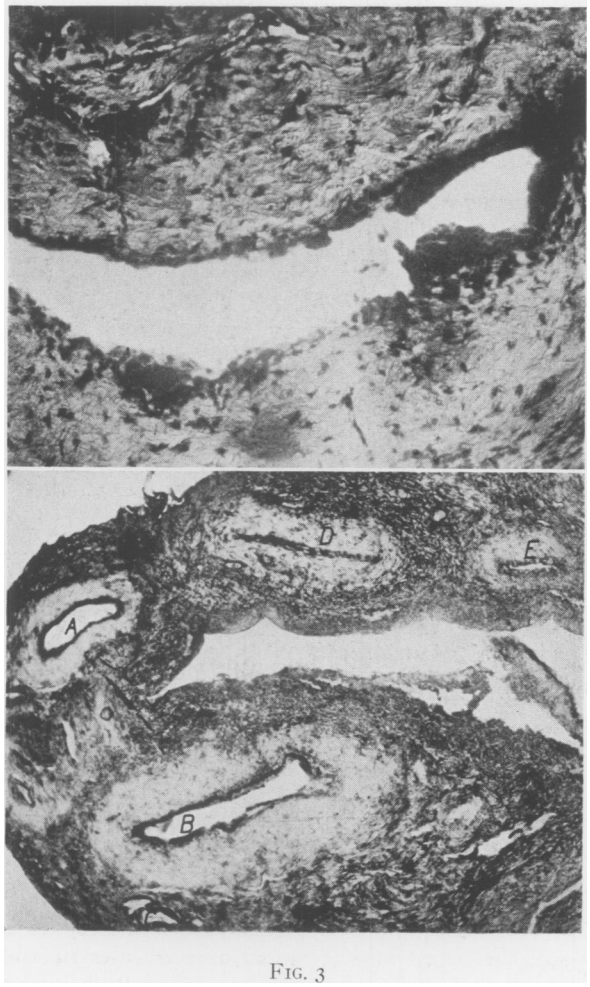


FIG. 3

FIG. 2.—Part of a section through the large subcapsular bile duct above the left hepatic lobe. The epithelium is preserved only in the corners of the duct.

FIG. 3.—Aberrant vessels in the fibrous appendix of the liver.
Ducts A, B, C—pervious.
Duct D—impervious.
Duct E—closing.

structures in other organs. According to the frequency of their occurrence in different parts of the liver, they can be grouped as follows, according to Engel: most frequently they are in the connective tissue round the inferior vena cava

(round ligament), then on the left margin of the liver (left lateral ligament, fibrous appendix), in the fissure for the gall bladder, in the umbilical groove, the duodenal impression, the esophageal groove, on the base of Spiegel's lobe, in the transverse fissure, in the right lateral ligament and the hepatogastric ligament. The aberrant ducts form mutually anastomosing networks which are situated at different planes and are usually connected with the intrahepatic bile ducts. In the fibrous appendix the marginal branches are frequently connected in an arched manner (Fig. 6). The single branches, which end blindly, issue from this junction. During chronic biliary obstructions, both benign and malignant, the aberrant vessels can be considerably dilated (Counseller, 1928).[3] In

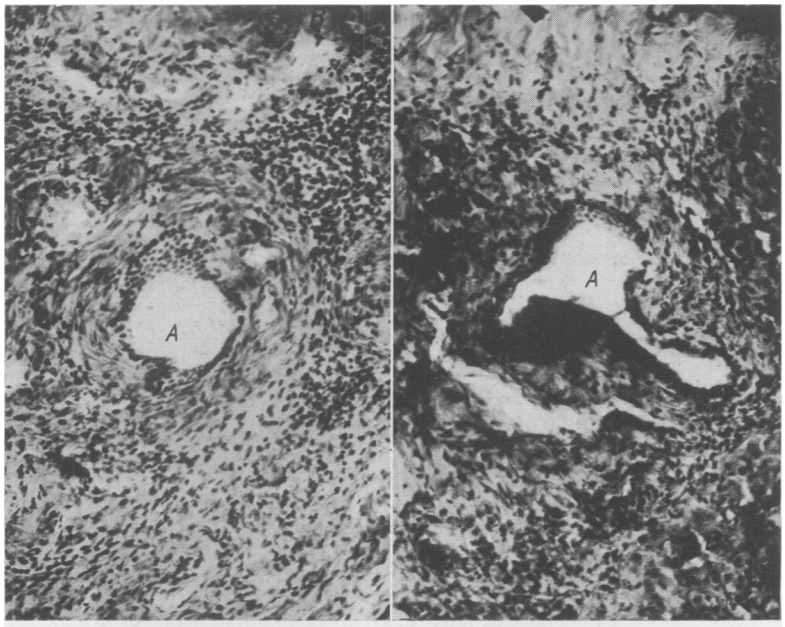


FIG. 4 FIG. 5

FIGS. 4 and 5.—(A) Aberrant duct of the liver.
(B) Islet-shaped remnants of hepatic parenchyma.

addition to patent aberrant ducts, there may also occur impervious ones in the form of solid strips, or semipervious vessels. This depends on the degree of their development and their distance from the hepatic parenchyma proper. They are found regularly in the adult, but not always developed to the same degree. During old age they increase in number. In the child and fetus they are missing or rare. The case of Severi,[19] who found aberrant ducts in the periportal connective tissue inside the hepatic capsule of a 23-day-old girl, is not quite convincing. The date of their origin, however, is certainly to be placed in the fetal period. Aberrant ducts can be demonstrated macroscopically by gentle injection of the bile ducts from the hepatic duct.

The structure of aberrant ducts is identical with the structure of the intrahepatic bile ducts: a fibrous wall with a small number of elastic fibers and perhaps scattered muscle fibers. In well-developed patent ducts the fibrous tissue is clearly separated from its environment. With increasing distance from the hepatic parenchyma, the well-defined border is lost and gradually merges with adjacent parts. The lining is formed by one layer of cuboidal-columnar epithelium. Toldt and Zuckerkandl note that the epithelium decreases with the increase of distance from the hepatic parenchyma, until it finally disappears. It is important to bear in mind the experience of Lutkens,[14] in 1926, who found that the epithelium of the extrahepatic bile ducts is preserved only for about one hour after death, so that he abstained from examining the epithelium at

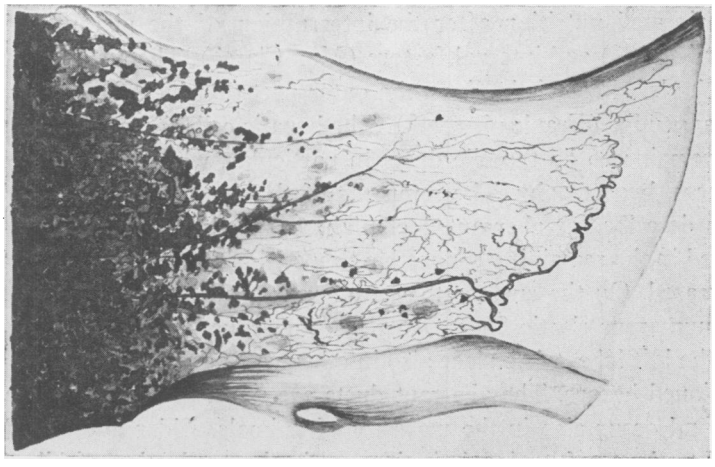

FIG. 6.—Fully developed network of aberrant ducts in the fibrous appendix (after Toldt-Zuckerkandl) accompanied by interstitial islets of hepatic tissue.

all. In our case, the epithelium is preserved in the majority of ducts with smaller lumina; in the biggest duct, which runs on the convex side of the left lobe, the epithelium is preserved only in the corners (Fig. 2). This can be explained by the damaging of the center of this duct by the hemostatic forceps during the ligature. The majority of authors describe bile duct glands in the walls of the ducts of the aberrant vessels. The glands can be atrophied, deformed or hypertrophied. In our case they occurred only in one part, which was not typical. This agrees with the observation that glands of the bile ducts of the parenchyma are present in the walls of major ducts only (Pfuhl,[16] Wolf[22]), and in the case of aberrant vessels the ducts are usually small.

The origin of aberrant ducts is explained in two ways: by a total reduction of the hepatic parenchyma in places where it occurred initially, with preservation of the bile ducts, or by cessation of the development of the bile ducts. Moschzowitz[15] is alone in his opinion that aberrant ducts are of teratogenic nature, the primitive endodermal tubuli not having formed hepatic cells as they

should. The progress of the reduction of the hepatic parenchyma was studied by Toldt and Zuckerkandl[20] on the left lobe of the liver. They found that, from the hepatic mass, at first strips of tissue remain, then gradually islets of normal tissue, later islets of tissue of indistinct structure, and finally only bile ducts with blood vessels. This process exactly corresponds to the developmental diminution of the left hepatic lobe. As is known, the lobes of the liver are initially symmetrical, and the left may even be bigger (Schaffer[17]) because of better arterial blood supply resulting from the opening of the umbilical vein, carrying arterial blood, into the left branch of the portal vein. Only secondarily the reduction of the parenchyma takes place. The pressure of the adjacently growing organs—mainly the stomach and the replaced physiologic umbilical hernia—is generally given as a reason for the reduction, as well as the deteriorated nutrition after the interruption of the placental circulation (Langer-Toldt[12]) and internal factors (Max Clara[2]). The result is the diminution of the left lobe of the liver, the outer part of which finally becomes the fibrous appendix (Frankenberger[7]). The hepatic cells disappear, but the blood vessels remain; so do the bile ducts in particular, which may, in certain circumstances, hypertrophy. The remnants of this hepatic tissue, the bile ducts, are then described as aberrant ducts. These, together with the blood vessels, are placed in the remaining connective tissue which, in the majority of cases, is not increased. On the surface they are surrounded by a fibrous capsule containing numerous elastic fibers. A process of reduction, similar to that occurring in the left lobe, takes place also in other parts of predilection in the liver, as mentioned before. The aberrant ducts are not a peculiarly human characteristic and occur also in the majority of animals. Elder authors (Weber[21]) ascribed to them a functional significance in the production of bile, but from the slight extent of these ducts, it may be assumed that their functional significance is negligible, if it exists at all.

## SUMMARY

From a practical point of view, only the significance of aberrant bile ducts in the gallbladder fissure was known—the so-called ducts of Luschka which, if opened during cholecystectomy, are the source of biliary drainage during the first postoperative days. Pathologico-anatomically, aberrant ducts used to be named in connection with cases of cysts (Hlava,[9] Aschoff[1]), cystadenoma (Domagh[4]) and cavernoma (Ludwig in Henke-Lubarsch[13]).

We have considered it useful and advantageous to draw attention to the existence of aberrant bile ducts in the fibrous appendix, the unintentional severing of which might cause grave postoperative complications, particularly in cases where not only the peritoneum (in subdiaphragmatic vagotomy), but also the pleura (in phrenothoracolaparotomy) is exposed to irritation by bile. We are aware of the relative rarity of this developmental anomaly, but it is not out of the question that, with the increasing number of operations upon the vagus nerve, the cardia and lower part of the esophagus, our observation may gain considerable practical significance.

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