that patients might be distressed by a large gastric air-bubble. He thought an aggravating feature might be failure of the cardia to relax and allow belching, an *aérophagie bloquée* being more troublesome than an *aérophagie libre*. The condition he described as *aérophagie* included *aérogastrie* and *aérocolie*, for he pointed out that most swallowed air which is not belched back must pass on into the lower bowel. His attractive and logical writings used to be quoted by Hurst, who described imprisonment of the gastric air-bubble in oesophageal ulcer (Hurst, 1934) (incidentally, the published films of his main case show a cascade stomach), and believed that "wind round the heart" also occurred (Hurst, 1938, 1942) if the gastric cardia was dislocated by an excess of gas in the left colic flexure; then the vicious circle might be broken by an injection of vasopressin.

Sometimes, both in cases in the literature and in others we have come across ourselves, epigastric or low chest pain has radiated to the neck, jaws, arms, and hands. The mimicry of ischaemic heart pain is striking and misleading, though a recurrent tendency may exclude coronary occlusion, while there is not the constant relation to exertion which one expects in angina of effort. Similar radiation of pain is sometimes seen in hiatus hernia and high lesser-curve gastric ulcer. It is hardly surprising, for there are communications between the sympathetic nerve supplies to heart and gullet (Kuntz, 1946). It is also possible, as Roemheld (1931) suggested might happen in his "gastro-cardiac syndrome," that the heart is embarrassed by upper abdominal distension. It is interesting that Dworken *et al.* (1952) should describe pain like that of cardiac ischaemia in their "splenic flexure syndrome."

It is usually unnecessary to mention the abnormal form of stomach to these patients, and most of them require no treatment. If abdominal distension is troublesome they should be advised against gulping food or drink, and it should be explained that unconscious air-swallowing often accompanies attempts to belch. It may be helpful for them to avoid greens, and to take a level teaspoonful of charcoal three times daily after food. We have not yet used vasopressin regularly in any case. We have instructed one patient (not in this series) in the use of a fine stomach-tube, after showing him the relief it could give, but he did not carry on with it: it is stated that in some cases with severe rotation a fine stomach-tube, or even a large one, cannot be passed. More troublesome recurrent attacks may rarely justify surgery, such as partial gastrectomy or gastropepy (either simple or by means of gastrostomy with later closure); Anagnostidis (1935) has reviewed the operations for gastric volvulus done up to the time of his report. The treatment of acute gastric volvulus is usually surgical, with parenteral replacement of fluid and electrolytes. But cascade stomach and gastric rotation and twisting are usually unimportant incidental findings, and the greatest harm they are in most cases likely to do is to interest a physician or surgeon who does not recognize this fact.

When laparotomy is considered for any reason in a patient with one of these deformities the risk of severe post-operative distension should be borne in mind: 3 out of 44 patients in this series had burst abdomens before or after they were here.

Summary and Conclusions

Kinking, rotation, and twisting of the stomach are usually incidental x-ray findings. There is, however, an association with pneumatosis of the stomach and of the left colic flexure. Patients may complain of discomfort and distension in the upper abdomen, and there is a risk of burst abdomen after laparotomy. Pain may occur with similar radiation to that seen in cardiac ischaemia.

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DIAGNOSIS AND RESULTS OF TREATMENT OF CANCER OF THE PANCREAS AND AMPULLA OF VATER

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In spite of many statements to the contrary (Robson and Moynihan, 1902), there is a widespread impression that carcinoma of the pancreas produces painless progressive jaundice. The case histories of 190 patients have been studied, the majority of whom have been under the care of one or other of us, the remainder being under the care of colleagues at St. George's or St. Mary's Hospitals. As a result of this study we have come to the conclusion that most of the standard textbook descriptions of this disease are incorrect. In this paper we discuss the symptoms and signs of carcinoma of the pancreas in an effort to make the diagnosis easier, and we present the results of treatment, which show that diagnosis at an operable stage has been of value.

Diagnosis

Carcinoma of the pancreas is a disease of middle and later life; in our series the youngest patient was aged 43 and the oldest 89. The majority of cases occurred in patients between 50 and 70 years of age. Table I gives the anatomical situation of the primary tumour within the pancreas. It will be seen that in 128 patients (67.3%) the carcinoma arose in the head of the pancreas or in the ampulla of Vater; in 51 patients (26.8%) it was placed in the tail and

body, or involved the whole gland; 8 patients (4.2%) presented with a carcinoma of the common bile duct—all of these suffered from gall-stones as well; and in two patients the primary tumour was considered to be a sarcoma and in one a cystadenocarcinoma.

TABLE I.—*Site of Primary Tumour in 190 Patients with Cancer of Pancreas or Distal Bile Duct*

Head of pancreas or ampulla of Vater	128
Common bile duct	8
Body and tail or the whole gland	51
Sarcoma	2
Cystadenocarcinoma	1

In this table a distinction has not been made between growths of the head of the pancreas proper and ampullary growths. It is recognized that such a distinction should be made where possible, on both diagnostic and therapeutic grounds, but the records of some of the earlier patients in the series did not describe the exact origin of the tumour with this particular distinction in mind. The 128 patients therefore include some undoubted tumours of true pancreatic origin and some in which the site of origin was uncertain. References later to points of difference between ampullary and pancreatic tumours are based upon those cases only in which the type of tumour was considered to be established.

Symptoms

Table II lists the first symptom in 184 of the 190 patients under review. The outstanding points in this table are that pain was the first complaint in 108 (58.7%) patients, that no patient with carcinoma of the body or tail of the gland became jaundiced until late in the course of the disease, and, above all, that in patients with carcinoma of the head

TABLE II.—*The First Symptom*

	Pain	Jaundice	Others
Carcinoma of head of pancreas or ampulla of Vater	59	54	14
Carcinoma of body or tail	49	0	8

of the pancreas or the ampulla of Vater pain was the first symptom on more occasions than jaundice. This latter point is a direct contradiction of the clinical picture given in most textbooks, where the supposed absence of pain in the early stages of this disease is stressed. That there is nothing new about this fact becomes obvious when one quotes from the writings of Robson and Moynihan (1902): "The earlier symptoms almost invariably refer to the digestive organs. . . . Pain in the epigastrium radiating round one or both sides of the back is sometimes excessive, wearing, almost intolerable. . . . In one-half of cases at least, the suffering is exquisite and is not infrequently worse at night."

The pain in the early stages of cancer of the pancreas takes two forms. Patients with a tumour in the head of the gland complain of a dull ache or discomfort in the epigastrium; occasionally it resembles biliary colic, but more often the upper alimentary tract is suspect and the patient is treated with an alkaline powder. On the other hand, patients with a tumour of the body or tail of the gland complain of pain in the epigastrium which radiates round to the back. This pain has a characteristic feature of considerable diagnostic value: it is worse when the patient lies down and better when standing or sitting up: as a result it is more severe at night; often these patients sleep sitting up.

Jaundice caused by pancreatic carcinoma, in addition to altering the colour of the skin, is invariably associated with pale stools and dark urine. Again, our findings have been the opposite to those in most of the textbooks: the jaundice is not necessarily progressive; in most patients with carcinoma of the ampulla of Vater and a few with a tumour of the head of the pancreas the degree of jaundice has fluctuated. Indeed, in one patient the jaundice completely cleared, yet exploration for a suspected gall-stone in the common bile duct revealed an ampullary carcinoma.

Pain and jaundice, considered together, may provide some evidence, though not conclusive, on which to base a distinction between ampullary and true pancreatic carcinomas, for, as might be expected, evidence does suggest that jaundice is more likely to precede pain in an ampullary than in a pancreatic tumour.

Twenty-two patients gave as their first symptom something other than pain or jaundice. The majority of these complained of vomiting. In some this was so severe that pyloric stenosis was diagnosed. These patients with severe vomiting had in every case a carcinomatous obstruction due to invasion of the stomach or duodenum. If the duodenal involvement was distal to the entrance of the common bile duct the vomit contained bile and pyloric stenosis could be excluded. In the others, even a barium meal failed on occasion to give the correct diagnosis.

Invasion of the duodenum does not necessarily indicate a bad prognosis, because the portal vein is sometimes free from growth and resection is possible after adequate pre-operative preparation. The remainder of these 22 patients presented with symptoms of an entirely different nature: one patient who had an ampullary carcinoma presented as a case of severe anaemia due to bleeding into her alimentary tract; her haemoglobin on admission was 30% (4.5 g.). And in two patients the first symptom was caused by a metastasis: one had an enlarged cervical lymph node and the other an enlarged femoral lymph node which was thought at first to be an irreducible femoral hernia.

Apart from the first symptom, patients with pancreatic tumours soon develop other clinical abnormalities. Table III lists the frequency of the main symptoms in the patients of this series. As will be seen, jaundice developed before death in every patient with an ampullary carcinoma, in 94% of those with a carcinoma of the head of the pancreas, but in less than 5% of those with a tumour of the body or tail of the gland. Loss of weight was a prominent feature, often appearing fairly early in the course of the disease. Diarrhoea and vomiting were both frequent symptoms, but all 16 patients who complained of a palpable mass were inoperable by the time they reached the surgeon.

TABLE III.—*Frequency of Main Symptoms*

Symptoms	No. of patients	Comment
Pain	131	Present in 50% of ampullary carcinoma, 90% of carcinoma of head, and 100% with carcinoma of body or tail
Jaundice	128	Present in every case of ampullary carcinoma and 94% with carcinoma of head of pancreas
Loss of weight	165	
Lassitude and anorexia	84	
Diarrhoea	61	
Itching	58	
Vomiting	43	
Tumour noticed by patient	16	
Palpable lymph nodes	9	

Clinical examination of these patients may show widespread abnormalities due to jaundice, liver failure, or metastases; but in the diagnosis of pancreatic carcinoma abdominal inspection and palpation have been a valuable source of abnormal physical signs. Table IV gives some of the

TABLE IV.—*Abdominal Palpation*

Palpable gall-bladder	72	{ Ampullary carcinoma 46%
		{ Carcinoma of the head 58%
Palpable tumour	37	{ Carcinoma of the head 2.5%
		{ Carcinoma of the body or tail 60%

information obtained from this examination. It is of interest that the gall-bladder was palpable in only 72 patients, or 56% of those who were jaundiced; in nearly every patient the gall-bladder was enlarged, but the liver was enlarged as well, which shielded the gall-bladder from the hand of the clinician. The other interesting fact which emerges from this study is that the tumour was palpable in 60% of patients with carcinoma of the body or tail of

the pancreas, but by this time these tumours are nearly always inoperable and the fact that they are palpable usually means that the diagnosis has been delayed.

Investigations

X-ray and other investigations have been of help in some patients. All those with jaundice showed the characteristic abnormalities of liver function associated with post-hepatic or obstructive jaundice. Occult blood was present in the stools of 11 out of 15 (73%) patients with carcinoma of the ampulla of Vater; this test is of value in these patients. Table V also gives the results of barium-meal examination; in 18 out of 70 patients positive evidence of cancer of the pancreas or ampulla was obtained by this investigation.

TABLE V.—Results of Investigations

Barium meal	In 18 out of 70 patients positive evidence obtained
Occult blood in stools .. .	Positive in 11 out of 15 patients with an ampullary carcinoma
Biochemical tests for obstructive jaundice .. .	Positive, whenever done in a jaundiced patient
Examination of duodenal aspiration .. .	Unreliable
Examination of stools for unsplit fat or meat fibres .. .	

Radiological evidence of malignant obstruction of the terminal common bile duct may also be obtained by injecting radio-opaque substances directly into the dilated intra-hepatic duct system, as shown recently by Nurick, Patey, and Whiteside (1953), and Rodney Smith (1954). This trans-hepatic cholangiography, under local analgesia, can demonstrate very clearly the dilated common bile duct and the exact site of an obstruction. Moreover, the irregular shape of an obstruction by a carcinoma can be distinguished from the rounded filling defect of an impacted gall-stone. There are, however, disadvantages in the method, the chief of which is the risk of subsequent leakage of bile into the peritoneal cavity. Severe abdominal pain and shock may then call for urgent laparotomy if death from peritonitis is to be avoided.

Having used this method of investigation and studied the results of others, we feel that the evidence obtainable, while of some value, does not outweigh this grave disadvantage. If leakage does occur, not only may the patient lose his life, but even if this is prevented by early laparotomy it may well be found that the peritoneum and cellular planes are sodden with bile and that the general condition of the patient forces the surgeon to be satisfied with a palliative short-circuit instead of attempting resection.

Comment

The symptoms and clinical signs present in this series of 190 patients indicate that most sufferers from carcinoma of the pancreas are between 50 and 70 years of age and exhibit one of the two main clinical pictures. Unusual cases sometimes occur. The first picture is that seen in patients with carcinoma of the head of the pancreas or ampulla of Vater; in these patients the most frequent symptom is epigastric pain resembling peptic ulceration or cholecystitis, followed after a variable interval by jaundice. The second picture occurs in patients with tumours of the body or tail; they complain of a different type of pain which starts in the epigastrium and passes round one or both sides to the back; this pain is worse when the patient lies down, and better when sitting up or standing. These patients are not jaundiced until later in the course of the disease.

Of the unusual cases the most important are those in which the duodenum is invaded and symptoms similar to those seen in pyloric stenosis are produced. This occurs in about 5% of patients.

Treatment

Early diagnosis would be only of academic interest if treatment failed to influence the course of the disease. Table VI gives the result of treatment in the patients of this series. It will be seen that the average survival after excision

TABLE VI.—Results of Treatment

Treatment	No. of Patients	Average Survival
Nothing surgical	44	7 weeks
Exploratory only	59	13 "
Short circuit (cholecyst-gastrostomy, 21; cholecyst-jejunostomy, 44) .. .	65	23 "
Excision	22	17 months

Including operation deaths

was nearly ten times that of those patients who received no active treatment and three times that of a short-circuit operation. In addition the longest survival after excision has been 5½ years, whilst, with one exception, no patient has lived for more than 12 months after a short-circuit operation. It appears, therefore, that excision is worth while in selected patients. We feel that radical surgery should be limited to those cases in which the growth is without doubt operable. The operative mortality has been 5 out of 32 (15.6%) patients, and all but three were one-stage procedures (Table VII).

TABLE VII.—Pancreatic Resection for Cancer: Operative Mortality (Including Several Recent Cases not Included in the 190 Subjected to Clinical Analysis)

	Resections	Deaths	Percentage Mortality
Radical pancreato-duodenectomy .. .	30	4	13.3
Cystadenocarcinoma of body and tail .. .	1	0	0
Sarcoma of body (gastro-colo-pancreaticectomy) .. .	1	0	0
Total .. .	32	4	11.5

The main reasons why excision was not carried out in 156 of our cases were: 16 patients had domestic or other reasons—in several the war was responsible; 29 were unfit for major surgery; 58 had widespread metastases; and 53 were considered to be inoperable on account of fixation to the portal vein or some other important structure. We feel very strongly that it is a mistake to attempt the removal of a tumour which is adherent to these structures. Such surgery carries a high mortality and rarely, if ever, does good.

Summary

The clinical findings of 190 patients with cancer of the pancreas and distal bile duct have been analysed.

The clinical features of this disease resemble the picture painted by Robson and Moynihan in 1902 more closely than that given in most undergraduate textbooks.

The results of treatment in this series indicate that diagnosis and surgical treatment whilst the tumour is still operable has been an advantage.

We wish to thank those of our colleagues who have given us permission to quote from their case histories, and particularly Professor C. A. Pannett, who was one of the pioneers of pancreatic surgery.

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Food Composition Tables—Minerals and Vitamins, for International Use has been prepared by CHARLOTTE CHATFIELD for the Food and Agriculture Organization, United Nations. It gives the figures for vitamin A, ascorbic acid, thiamine, riboflavine, niacin, calcium, and iron content of foodstuffs. These are all nutrients of importance to humans and are also among the nutrients in which human diets are often deficient. A bibliography of 539 items is appended to the tables. The publication is No. 11 of the F.A.O. Nutritional Studies series, and may be obtained from Her Majesty's Stationery Office, price 5s.