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Role of Total Pancreatectomy in the Treatment of Necrotizing Pancreatitis

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The place of pancreatic resection in the treatment of acute pancreatitis is still much debated. Because of the bad results after insufficient resection, such as recurrence of extensive pancreatitis and infection, we decided to perform gastroduodenopancreatectomy (GDP) if more than 75% of the gland was necrotic.

We have performed 52 operations for acute necrotizing pancreatitis since 1972 in the Surgical Clinic of Broussais Hospital; of 20 GDP patients, 8 are still alive. All have easily controlled diabetes, 5 were able to resume work, and 3 retired. After study of the deaths of the other patients, we conclude that it is important to carry out operative excision early, resecting all areas of necrosis before the lesions become the focus of uncontrollable infection. Four categories of patients are described on the basis of creatinine level, blood culture, appearance of the pancreas, and spread of necrosis. According to the gravity of the lesions treated with this method (necrosis of more than 75% of the pancreas), the death rate is usually 90% or higher. We believe that GDP offers the possibility of improvement.

The poor results [1–2] obtained by all modes of treatment, medical or surgical, of extensive necrotizing pancreatitis led us to perform gastroduodenopancreatectomy (GDP) in such cases. We made this decision in 1972, after the failure of limited surgical treatment and even of near total pancreatectomy [3] because the disease recurred in the remaining pancreas. Our first patients were operated upon early, and the application of GDP provided encouraging results [4]. In the last 2 years, however, we have performed late operations on patients who were extremely ill and infected, and we have had more failures. We report here the critical retrospective analysis of the course of 20 GDP patients which allows us to estimate precisely the chances of success of this operation, and its place in the surgical treatment of acute pancreatitis. We propose a classification that delineates the cases in which GDP would provide the best chances of success.

Materials and Methods

This paper sums up 7 years of our experience (from 1972 to 1979) in the surgical treatment of necrotizing acute pancreatitis. During this period we performed 52 surgical procedures for severe necrotizing pancreatitis; 20 of them were GDP. Other operations also performed during the same period were: 1 near total pancreatectomy; 4 splenopancreatectomies; 12 sequestrectomies; 5 wide pancreatic drainages; 7 T tube drainages of the common bile duct associated with drains in the pancreatic bed; and 3 drainages of pseudocysts. The number and mortality rates of these operations are shown in Table 1.

Patient Population

The 20 patients who underwent GDP were seen at the time of their first attack of acute pancreatitis. Patients who had been followed for chronic relapsing pancreatitis or those presenting with an acute attack superimposed on chronic pancreatitis were excluded. Of these 20, 6 had previously undergone surgery at another hospital consisting of cholecystostomy in 2 patients, cholecystectomy with T tube drainage in 3, and drainage of the pancreatic bed in

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Table 1. Results of operations in patients with acute necrotizing pancreatitis from 1972 to 1979.

Procedure	Number of patients	Number of deaths
Drainage of pseudocyst	3	1
Wide pancreatic drainage and common bile duct drainage	7	1
Laparotomy and drainage	5	1
Sequestrectomy	12	6
Splenopancreatectomy	4	3
Near-total pancreatectomy	1	1
Total pancreatectomy	20	12
Total	52	25

Table 2. Clinical signs of severity in patients with necrotizing pancreatitis.

Signs	Number of patients
Constant acute pain	20
High fever	17
Jaundice	10
Diminished level of consciousness	5
Abdominal distention	5
Abdominal rigidity	10

Table 3. Laboratory signs of severity in patients with necrotizing pancreatitis.

Laboratory abnormality	Number of patients
Initial hyperamylasemia	14
Early hyperglycemia	12
Changes of hematocrit	10
Leukocytosis > 15,000/mm^3	12
Hypocalcemia < 85 mg/l	10
Creatinine > 120 mmog/ml in serum	10
Arterial oxygen tension < 60 mm Hg	5
Positive blood culture	12

1. There were 5 women and 15 men, and their ages ranged from 34 to 76 years, with a mean of 50 years.

Pancreatitis was associated with diseases of the biliary tract in 12 cases, of which 3 were associated with choledocholithiasis and 6 with alcoholism. Pancreatitis occurred postoperatively in 2 patients.

Therapeutic Management

The 20 patients who ultimately underwent GDP were first submitted to medical treatment in our intensive care unit. The duration of preoperative medical treatment ranged from 1 to 23 days, with an average time of 6 days. Initial management consisted of nasogastric suction and intravenous fluids required in order to maintain normal blood pressure. Total parenteral nutrition was administered whenever the period of fasting exceeded 3 days. Antibiotics were administered systemically, though their benefit has been contested by many authors [5, 6].

We have established criteria which we use to evaluate the clinical and biological severity of the patient's condition during this initial period. These are shown in Tables 2 and 3.

The Time of Surgery

The time of surgery has never been chosen arbitrarily. In contrast to Edelmann and Boutelier [7] who operate on the eighth day and to Hollender [8] who operates on the second day, we performed the surgery when clinical signs of gravity made it imperative, especially signs of peritonitis with fever and jaundice associated with leukocytosis and 1 or 2 other grave clinical signs as reported by Mercadier in 1979 [9]. At the time of surgery, all patients presented more than 6 signs of severity. GDP was performed as the initial operation in 8 cases, as the second operation in 10 cases, and as the third in 2.

Operative Findings

The decision for resection was made after complete evaluation of the lesions at laparotomy. We carefully examined pancreatic and biliary lesions, extension of the necrosis to the mesentery, and involvement of other organs. We believe that it is necessary to expose the pancreas fully by taking down the flexures of the colon and by freeing the posterior attachments of the pancreas. We performed 16 GDP operations for necrotic lesions which involved the entire gland. In 4 cases, pancreatic destruction appeared to be almost total, but we found some areas in the operative specimen which were apparently little damaged. Histopathologic study revealed an interstitial pancreatitis.

In 2 cases, we had to deal with pure hemorrhagic necrosis which was removed in handfuls, and apparently consisted of nearly the entire organ. In 14 cases, there was a total glandular necrosis of soft consistency. When cut, the pancreas demonstrated necrosis associated with hemorrhagic suffusions and areas of abscesses.

In 4 cases, the pancreas appeared grossly homogenous, and greatly increased in volume with an anteroposterior diameter of over 5 cm. The parenchyma was firm and showed both a peripheral and a massive interstitial necrosis. Examination of sections of these 4 total pancreatectomies revealed a heterogenous pattern with zones of glandular necro-

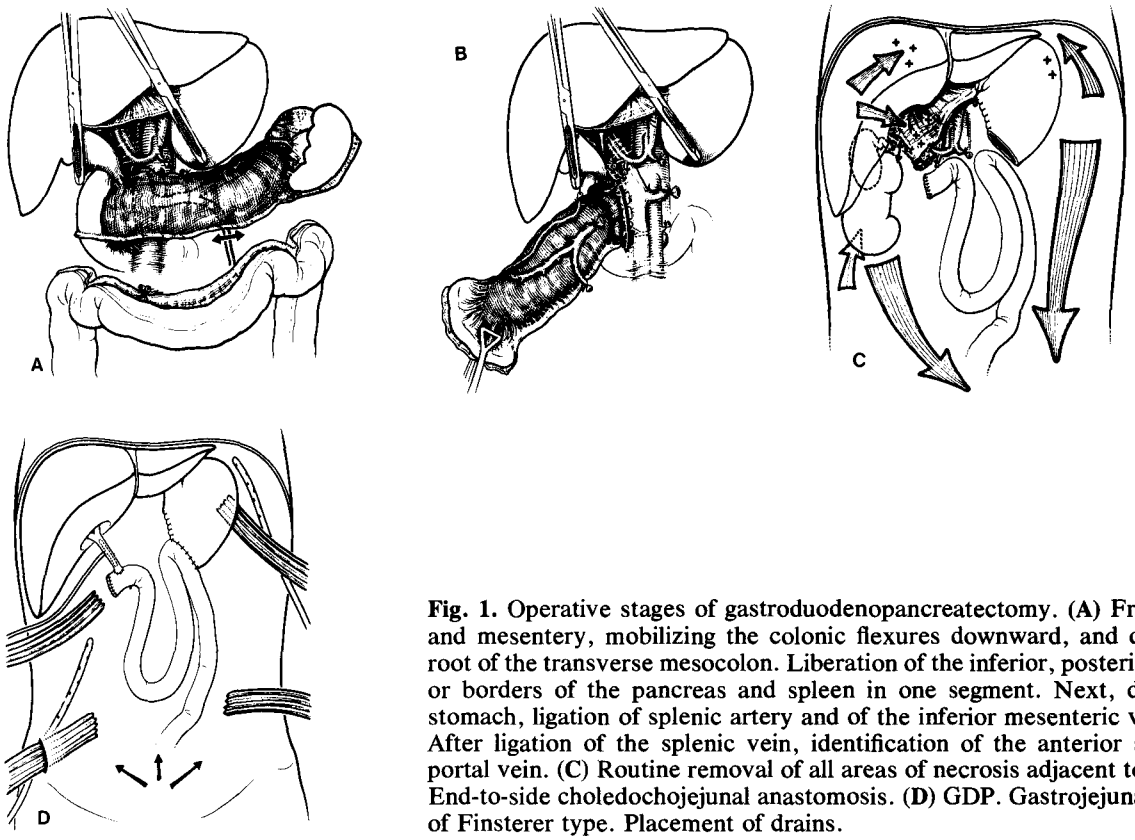

Fig. 1. Operative stages of gastroduodenopancreatectomy. (**A**) Freeing of colon and mesentery, mobilizing the colonic flexures downward, and division of the root of the transverse mesocolon. Liberation of the inferior, posterior, and superior borders of the pancreas and spleen in one segment. Next, division of the stomach, ligation of splenic artery and of the inferior mesenteric vein. (**B**) GDP. After ligation of the splenic vein, identification of the anterior surface of the portal vein. (**C**) Routine removal of all areas of necrosis adjacent to the stomach. End-to-side choledochojejunal anastomosis. (**D**) GDP. Gastrojejunal anastomosis of Finsterer type. Placement of drains.

sis alternating with zones of hemorrhagic suffusions involving the whole parenchyma.

Extension of the Lesions

The extension of the necrosis reached the transverse mesocolon in 15 patients, the mesentery in 12, the left mesocolon in 10, and the right mesocolon in 5. There were 7 instances of isolated colonic necrosis, 4 instances of necrotic lesions of the gallbladder, and 1 instance each of necrosis of the common bile duct, duodenum, and jejunoileum. Histologic study revealed that vesicular lesions were seromuscular rather than mucous. Extension of these lesions attests to the gravity of necrotizing pancreatitis.

Gastroduodenopancreatectomy

The operative procedure was described by us in a previous report [10]. It is important to note that we routinely performed ablation of the distal half of the stomach, the whole of the duodenum, the first loop of jejunum, the entire pancreas, and spleen. Colic resections were performed in 7 cases, 5 transverse colectomies, 1 right colectomy, and 1 subtotal colectomy. Colonic continuity was reestablished in 2 cases, and a double-barreled colostomy was performed in 5 cases.

The technique is shown in Fig. 1. All anastomoses were made immediately using T tube drains, as well as wide abdominal drainage. Mean operating time was 7 hours (range 6–10 hours). Intraoperative blood replacement ranged from 6 to 49 units with a mean of 21 units (10,000 ml).

We have always been able to perform GDP when it was deemed necessary, despite great difficulties. Only 2 anastomoses are necessary to reestablish gastrojejunal and choledochojejunal continuity. It is important not to leave any focus of necrosis and to check the tissue behind the mesocolon, the kidney periphery, and the mesentery, all of which are likely sites of infection and focal points of septicemia. Wide drainage is routinely carried out at the end of surgery.

Postoperative Management

The patients were placed on assisted ventilation in the intensive care unit. The bronchopulmonary con-

Table 4. Causes of death in the 12 patients who did not survive GDP.

Etiology of pancreatitis	Time of operation in days. Primary (I) or secondary (II) operative procedures	Causes of death	Time of death in days
1. Biliary	30 (II)	Septicemia	2
2. Biliary	15 (I)	Peritonitis	2
3. Biliary	3	Myocardial infarction	2
4. Alcohol	1 (I)	Septicemia	60
5. Alcohol	8 (II)	Bronchopneumonia and residual abscess	15
6. P. Op.	23 (II)	Hemorrhage	2
7. Biliary	3 (II)	Hemorrhage	2
8. Biliary	23 (II)	Septicemia	6
9. Alcohol	10 (II)	Septicemia	7
10. P. Op.	9 (I)	Hemorrhage and septicemia	11
11. Biliary	14 (II)	Multiple organ failure	5
12. Biliary	8 (II)	Multiple organ failure	21

Table 5. Classification of patients with necrotizing pancreatitis.

	Class A	Class B	Class C	Class D
Level of creatinine mmol/ml	<120	<120	<120	>120
Blood cultures	Negative	Negative	Negative	Positive
Pancreas	Areas of disseminated, nonconfluent necrosis	Peripheral pancreatic necrosis	Pancreas en mass. Diameter A.P. > 5 cm with necrotic confluent areas	Suppurated necrosis
Spread of necrotic lesion	±	+	+	+ along with suppuration
Operation indicated	Sequestrectomy	Sequestrectomy	GDP	GDP

dition of 4 patients demanded a tracheotomy. Patients were at first administered parenteral nutrition; this was changed to a constant-infusion enteral nutrition after reestablishment of bowel function. Antibiotic therapy was adjusted to the organism found in cultured samples of blood, peritoneal liquid, and pancreatic tissue.

The diabetes resulting from pancreatectomy is responsible for the antipathy of many surgeons to the concept of total pancreatectomy. The control of the postoperative diabetes is similar to that in cases of total pancreatectomy for chronic pancreatitis or for cancer. The patients are very sensitive to insulin. We administer 20 U NPH insulin twice a day starting from the first postoperative day. Doses are adjusted according to the blood glucose levels, and regular insulin is added according to the urinary spillage of glucose. Insulin needs increase in case of residual suppuration. An increase in insulin requirements represents an excellent indication for surgical reintervention.

Results

Eight patients operated upon from 7 months to 7 years ago are alive. These patients lead a nearly normal life. They must maintain daily control of their diabetes, by 2 NPH injections, and they take regular supplementations of pancreatic extracts and

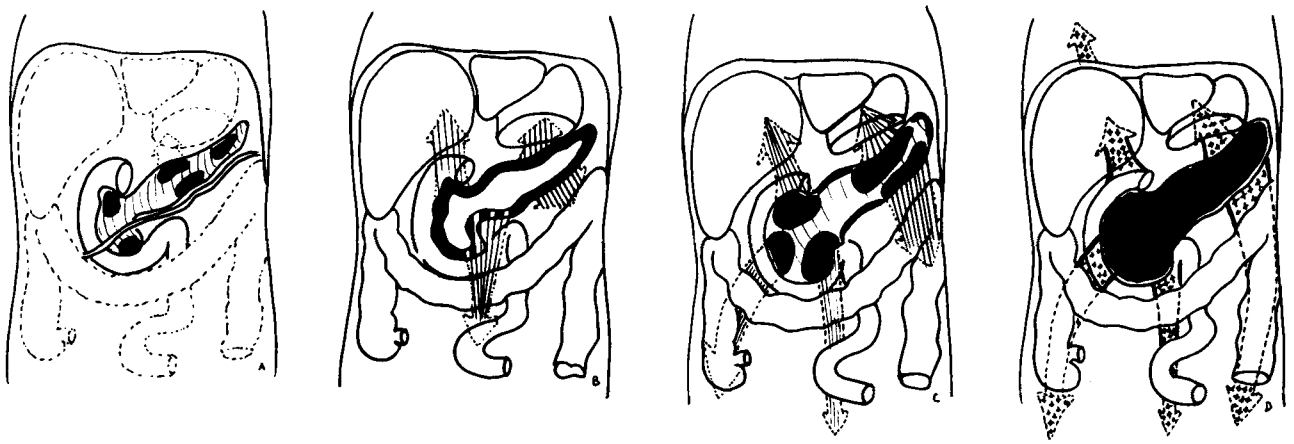

Fig. 2. Macroscopic pancreatic lesions, Classes A, B, C, and D. See text for description.

vitamin D. The usual diet consists of 200 g carbohydrate, 50 g protein, and 90 g fat. These patients were in the hospital from 2 to 120 days, with an average of 40 days.

Mortality

Twelve patients of the 20 died, 11 within the first 30 postoperative days, and one 2 months after surgery. Eleven patients were autopsied. The causes of death are shown in Table 4.

Postoperative Complications

Three patients had no postoperative complication. Five patients developed septicemia with renal insufficiency and bronchopneumonia. The organisms most commonly isolated were *Escherichia coli* and *Klebsiella* sp. *Proteus morgani* was found in 3 cases. Residual abscesses were found and treated on 3 occasions during reoperation. One patient developed a bronchopneumonia. One patient became unconscious because of hypoglycemia.

Discussion

Does the retrospective analysis of these patients make a case for GDP in patients with extended lesions of the pancreas? Analysis of other data proves beyond doubt that the death rate for such patients is at least 90% [11, 12]. Surgeons are faced with several problems in patients with extended necrotizing pancreatitis. Is it truly necrotizing or is it only superficial? Is the necrosis total [13]? If it is frank necrosis, it may be easy to decide to excise the gland, but most often, when examined early, the pancreas has an equivocal appearance, swollen, enveloped by necrosis, but still firm. Is it a necrotic pancreas which will be liquified within a few days, or is it an edematous pancreas susceptible of favorable resolution? We have had good results by considering as necrotic any pancreas appearing highly suspicious and proceeding to excision. The histology later confirmed the existence of extremely serious lesions.

Later, we had many failures. In 5 patients the pancreas appeared swollen, with an anteroposterior diameter of over 5 cm from head to tail, with an apparent necrosis all over the surface, with apparently healthy areas in some parts of the gland. We temporized, having to reoperate on the fourth, sixth, seventh, and eighth days. We found the situation changed greatly; the pancreas was totally necrotic and infected. GDP was nevertheless performed, but too late. We had 1 successful surgery out of 5. Histopathologic study of these swollen, highly suspicious glands proved that they contained extended areas of hemorrhagic and confluent necrosis.

It seems clear to us that, upon recognition of extended lesions, full resection of the pancreas is necessary. Based on experience with our patients, we have elaborated a classification of 4 types of lesions of necrotizing pancreatitis (Table 5, Fig. 2).

In this classification, Class A corresponds to patients without major kidney insufficiency, with a creatinine level under 120 mmol/ml; with negative blood cultures; with a pancreas which shows areas of disseminated, but not confluent necrosis; and ± spread of nonsuppurated necrosis. Class B corresponds to patients without major kidney insufficiency, with creatinine level under 120 mmol/ml; with predominantly peripheral pancreatic necrosis; and who do show spread of nonsuppurated necrosis. Class C corresponds to patients without major kidney insufficiency, with creatinine level un-

der 120 mmol/ml; with negative blood cultures; with a pancreas "en masse" with an anteroposterior diameter of over 5 cm, with necrotic confluent zones; and with spread of nonsuppurated necrosis. Class D corresponds to patients with creatinine levels over 120 mmol/ml; positive blood cultures; a totally necrotic, liquefied, and suppurating pancreas, with spread of suppurated necrosis.

GDP was performed only on Class C and D patients. Patients in Class A and B underwent sequestrectomy [14]. All 4 patients in Class C who underwent GDP survived. We regret not having performed GDP on 5 patients in Class C. Of those who underwent GDP in Class D, 12 of 16 died. Only a prospective study of Class C patients will be able to show the eventual advantage of GDP at this stage.

The interpretation that we have drawn from this retrospective study of performing early full excision of the necrotic pancreas is not changed in cases of pancreatitis with biliary etiology. We have recently made a study of the common bile duct in cases of necrotizing pancreatitis [15]. We found no functional disorder of the sphincter of Oddi, even in cases of microlithiasis. Our experience showed that radical treatment of cholecysto- or choledocholithiasis, as well as decompression of the common bile duct by T tube has not changed the unfavorable development of pancreatic disease. Ranson [16] also believes that in cases of severe pancreatitis, biliary surgery must be as simple and as expeditious as possible.

Failures of GDP can all be related to delay in performing surgery. In all cases, blood cultures were positive, and local and general infection had taken precedence over the pancreatitis. The crucial moment in the prognosis of necrotizing pancreatitis occurs whenever infection appears and spreads. Surgery should be performed before this stage, and reoperation is necessary at the least sign of suppuration [17]. We left the last 4 patients with an open abdomen, which allowed us to reoperate every 2 days to check for foci of necrosis and suppuration. This technique did not seem to change the results.

Conclusion

The indications for GDP are still rare and subject to controversy. Careful study of the records of 20 patients who underwent GDP shows that the operation is feasible and should be undertaken whenever the necrotizing pancreatitis lesions extend beyond hope of resolution. The GDP operation should be performed before generalized infection renders it ineffective. Considering the high death rate (about 90%) in total necrotizing pancreatitis, survival of 8 patients out of 20 is encouraging therapeutic progress.

Résumé

La place de la résection totale du pancreas est très controversée.

Nous rapportons les résultats de 20 gastro-duodénopancréatectomies totales (GDPT) pratiquées pour pancréatites necrosantes. La GDPT à été réalisée après une période de traitement médical compris, selon les cas, entre 1 et 23 jours. La date de l'intervention a été décidée en fonction de signes cliniques et biologiques de gravité.

L'indication de la GDPT n'a été portée que lors de la laparotomie exploratrice et a été réalisée lorsque la nécrose était étendue à tout ou à plus de 75% de la glande et aux mesos et organes de voisinage. Elle n'a été taite comme première intervention que dans 8 cas.

L'étude anatomopathologique du pancréas a confirmé l'atteinte parenthymateuse de la totalité ou à presque totalité de la glande. Dans 70% des cas existaient des nécroses des organes voisins (mésocôlon, mésentère, côlon, duodénum). Douze patients sont décédés entre ke 2ème et le 60ème jour postoperatoire. Huit patients sont en vie avec un recul de 18 mois à 8 ans; les conditions de survie sont satisfaisantes avec un diabète bien équilibré.

Dans la littérature, les pancréatites nécrosantes globales reconnues et traitées par d'autres procédés ont une mortalité de plus de 90%. Notre taux de survie tend à 50%. Ces résultats peuvent à notre sens être améliorés par une meillure sélection des malades.

Nous proposons dans cet esprit une classification des malades en 4 groupes en se basant sur l'étude de la fonction rénale, sur les résultats des hémocultures et sur l'étendue des lésions. Les patients opérés avant que l'infection ne se généralise nous semblent être les meilleurs candidats à la GDPT. Ils concernent les pancréatites nécrosantes globales, les pancréatites nécrosantes presque totales avec nécrose des organes voisins, les pancréatites nécrosantes postopératoires.

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Invited Commentary

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One of the most bewildering features of acute pancreatitis is its erratic incidence and behavior. It varies greatly in frequency, not only geographically, but also within individual areas at different times. Even the cause appears variable. Most surgeons' experience with severe forms of the acute disease will thus be rather limited and we should all be grateful to Alexandre and Guerrieri for sharing their extensive experience in such an honest fashion.

Radical surgery of the pancreas is always a major procedure. When we reported our first experience in 1963, the editorial comment in the following Year Book of Surgery was "This is a radical approach to a very serious disease . . . the mortality rate in acute haemorrhagic pancreatitis usually exceeds 80% . . . any successful management deserves attention." We agree that the method is drastic, but we agree even more with the comment of Alexandre and Guerrieri that if surgery of this scale is to be performed, it must be done early and be radical. Late or piecemeal surgery is disastrous. At first, we believed this to be due to the polypeptides released, the kinins of some German authors, and expected great benefit from Trasylol. Like most others, we were disappointed in this drug. Experimental studies have shown that it is only really effective when given before pancreatitis has been induced. We are now more than ever convinced that early surgery is the only answer in severe cases. The difficulty lies in selection, although it is possibly wiser to err on the side of over-enthusiasm than the reverse. As these authors point out, the mortality of gross necrotizing pancreatic disease is exceedingly high, certainly over 90%, especially in hemorrhagic forms. Thus while an avoidable pancreatectomy is undesirable, its mortality rate in experienced hands is much lower than the disease.

What are the guidelines for surgery? Serum methemalbumin elevation occurs in the hemorrhagic type and in such cases the pancreas should always be resected. Serum amylase levels are in our experience particularly fallible. A level under 1,000 units is a sign of mild or doubtful pancreatitis, except in a small group of the severest type where the level is 40 units or less. Our belief is that general signs of circulatory disturbance are most useful, a low blood pressure, high pulse rate, and poor peripheral circulation. The other guide is, as the authors suggest, severe infection, which is usually associated with such circulatory failure or change. Pain is unreliable, especially if glucagon has been given. We use this routinely in all cases of acute pancreatitis; whether its benefit derives from pain relief alone (which is usually dramatic) or whether it also has a therapeutic effect is hard to say. Generally speak-