Pylorus Preserving Kausch-Whipple Resection: The Successor of the Classical Kausch-Whipple in Chronic Pancreatitis

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Abstract

Chronic pancreatitis can be a debilitating disease. Resection for complicated disease and in those patients with intractable pain is a major component of therapy. There are potentially important physiological advantages with the pylorus preserving Kausch-Whipple (P-KW)compared to the standard Kausch-Whipple (KW) resection but further prospective studies are required to show this unequivocally. The Beger's operation also represents a significant theoretical advance. Indeed it permits resection in a proportion in whom a PP-KW or KW would not be possible technically because of severe fibrosis around the intra-pancreatic portal venous system. Although we have adopted the Beger's operation on our unit, large comparative studies are required against the KW and PP-KW procedures to properly establish its value. The hidden malignancy is an important issue, which undermines the routine use of the Beger's operation.
Key words: Chronic pancreatitis, Kausch Whipple, pylorus-preserving.

Introduction

Chronic pancreatitis particularly when it is associated with severe unremitting pain is a debilitating condition. In around 70% the cause is alcohol abuse, most of the remainder are idiopathic in which mutations of the CFTR gene may be implicated (1). Less than 1% have hereditary pancreatitis with mutations of the cationic trypsinogen gene (PSSR1) accounting for most families (2). Patients with hereditary pancreatitis (3) and those with longstanding chronic pancreatitis (4) are at increased risk of pancreatic carcinoma.

The course of the disease is extremely variable and many patients face years of continuing disability and pain. Affected patients often become addicted to opiate analgesics and surgery has an important role to play. Satisfactory results however depend on the correct selection of patients and surgical procedure, which in turn requires an understanding of the pathophysiology of this condition. Chronic inflammation within the gland leads to fibrosis, duct strictures, intraduct stone formation and parenchymal calcification. Once stricture formation has occurred ductal hypertension leads to continuing inflammation and glandular destruction ultimately leading to endocrine and exocrine insufficiency (5). Malabsorbtion leads to anemia, clotting disorders, poor wound healing, and susceptibility to infection. Diabetes mellitus may lead to accelerated atheroma, renal failure, and immunosuppression. During the active phase of the

Riassunto

La pancreatite cronica può essere una malattia debilitante. La resezione in casi di malattia complicata in quei pazienti con dolore intrattabile è una delle maggiori indicazioni terapeutiche. Potenzialmente esistono degli importanti vantaggi fisiologici dati dalla Pylorus Preserving Kaush/Whipple rispetto all'operazione standard di Kaush/Whipple, tuttavia, per affermare ciò in maniera definitiva sono necessari studi prospettici. L'operazione di Beger (cefalopancreasectomia con conservazione del duodeno) rappresenta un ulteriore significativo avanzamento sul piano teorico. In aggiunta essa permette la resezione in una percentuale di casi in cui la Pylorius Preserving Whipple o la Whipple tradizionale non sono fattibili tecnicamente a causa della fibrosi severa che circonda il sistema venoso portale intrapancreatico. Anche noi abbiamo adottato l'operazione di Beger nella nostra unità, ma studi comparativi più ampi sono richiesti per stabilire l'esatta indicazione delle varie tecniche chirurgiche. La potenziale malignità della patologia è un argomento importante e riduce l'uso routinario dell'operazione di Beger.
Parole chiave: Pancreatite cronica, Kausch-Whipple, conservazione del piloro.

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condition, which may last over a decade, severe pain is the predominant symptom in some patients, but other patients with marked radiological and pathological changes remain pain free; the reasons for this difference are not clear (5). Ductal hypertension secondary to main pancreatic duct strictures (MPD) or intraduct stones may lead to pain in a proportion of patients (6), however most patients do not have a dilated MPD. Analysis of pancreatic tissue resected from patients with chronic pancreatitis often reveals preservation of peripancreatic nerves but with neural sheath destruction and a marked peri-neural inflammatory infiltrate, an important likely determinant of pain (7). Chronic pancreatitis often produces a prominent fibrotic reaction and this can obstruct the duodenum, superior mesenteric vein, hepatic portal vein, splenic vein, and bile duct.

Typically patients will describe upper abdominal pain referred through to the back which is improved by leaning forward and aggravated by eating. The patient may describe increased stool frequency or obvious steatorrhoea. Patients with hereditary pancreatitis will present with recurrent attacks of acute pancreatitis or severe abdominal pain as young children or as teenagers (8). Patients with alcohol induced chronic pancreatitis give a history of either alcohol abuse in their early teenage years or more typically from the late teenage years. Typically there follows a period of five to 10 years of excessive alcohol intake. Alcohol addiction may follow which often combines with opiate addiction from increasing analgesic use. Loss of employment and family break-up are common. Patients who have an addictive personality which includes heavy tobacco smoking are the most difficult to treat. Clinically the patients often demonstrate marked weight loss and occasionally present with pancreatic ascites.

Erythema ab igne (on the back, front of abdomen or both) when present is a good indication of continuing severe pain. Jaundice suggests secondary biliary obstruction but may indicate an underlying malignancy (9). ERCP will demonstrate the site and nature of ductal abnormalities, a communicating pseudocyst or pancreatic ascites. CT will show dilated pancreatic and biliary ducts, calcification, the presence of an inflammatory mass, the degree of glandular involvement and venous occlusion. Pancreatic function tests such as the pancreato-lauryl test, or even better the secretin test, and an oral glucose tolerance test are important diagnostic tools in the absence of overt radiological signs (10).

Treatment overall

Abstinence from alcohol is essential. Patients with a history of alcohol abuse will require considerable medical and social support if they are to succeed. Malabsortion will be improved by administration of pancreatic enzyme supplements in sufficient dosage. Adequate nutritional intake should be encouraged including dietary fat intake. Treatment for diabetes mellitus almost invariably requires insulin. Using such intervention many patients can be satisfactorily managed without the need for further intervention (11). Non-steroidal anti-inflammatory agents are often required, but long-term opiate use must be avoided. Various strategies can be used to reduce pain (12), but coeliac axis blocks with sclerosing agents must be avoided since they are effective for a short time only (if at all) and create a severe fibrotic reaction which often precludes resection. Thoracoscopic sympathectomy can also provide relief but in our experience may be more suitable as a salvage procedure if there is relapse after pancreatic surgery (13). Duct dilatation to a point close to the ampulla of Vater is rare in our experience, usually representing senile idiopathic chronic pancreatitis. In some patients proximal duct stones are present and occasionally such patients can be managed endoscopically (14). Also unusual in our experience is chronic pancreatitis limited to the left side of the pancreas, in which case a spleen preserving left sided pancreatectomy is indicated (15).

The majority of patients who require surgical intervention have significant disease involving the head of the gland with distal duct obstruction but typically also have small duct disease. The pancreatic head has been likened to a pacemaker in chronic pancreatitis; it is often the main site of inflammation and also of duct obstruction (16). Treatment strategies that aim to drain a dilated pancreatic duct distally but ignore proximal disease are thus often unsuccessful. Over the last three decades resection of the head of the pancreas with drainage of the distal pancreatic remnant into the bowel has become a standard surgical treatment. A duodenum and spleen preserving total pancreatectomy is indicated if there is overt diabetes. In those who are not overtly diabetic however, it is best to preserve endocrine function as much as is possible since the morbidity related to post-pancreatectomy induced diabetes is considerable, particularly in patients who continue to drink (15, 17).

Tests of pulmonary and cardiac function are essential in a pre-operative work-up especially in patients with an alcohol and tobacco smoking history. The surgical approach in each patient must be tailored by a number of factors including their general fitness, the anatomical distribution of disease and the need to preserve endocrine function (15). The patient needs to be aware of the significant morbidity (40%) and risk of death (1% or less).

Surgical treatment

Kaush-Whipple (KW) resection versus pylorus preserving Kausch-Whipple (PP-KW) resection

Kausch reported the first successful pancreatectomy in 1912 (performed in 1909); this operation, which was for

ampullary cancer, was performed in two stages: an initial biliary bypass followed by a later resection. In 1934 Whipple described a two-stage procedure and five years later he performed a one-stage resection, which included a pancreatico-jejunal anastomosis. This was described in 1946, and is now known by his name (18). The morbidity and mortality following pancreatic resection during this period however was considerable and initially a Whipple's resection was used only for patients with malignant disease.

In a conventional KW resection the duodenum and distal stomach are removed with the operative specimen. A proportion of patients develop symptoms of dumping and diarrhoea similar to those seen following gastric resection, which can be quite debilitating (19). Preservation of the pyloric sphincter and the vagal nerve supply should allow for more controlled emptying of the upper gastrointestinal tract and may help to avoid such symptoms as well as reducing biliary reflux; further preservation of the duodenal pacemaker may reduce delayed gastric emptying and improve late gastrointestinal function.

Watson in 1944 was the first to describe a pylorus preserving resection (20). Klempa described quite a different pylorus preserving operation in 1975 (21). Both of these procedures were performed for malignant disease. Longmire and Traverso subsequently described the use of a PP-KW resection in two patients with chronic pancreatitis in 1978 (16, 22). They hoped that preservation of the pylorus and stomach would reduce the incidence of anastomotic ulceration, which was as high as 20% after the conventional KW resection. The PP-KW resection is now widely used for the treatment of chronic pancreatitis (23).

The use of a pylorus preserving resection for malignant disease was initially the subject of controversy as doubts were expressed about the increased risk of recurrence in the duodenal remnant (24). Thankfully this has turned out to be an unusual occurrence and several series have now documented similar operative mortality and longer-term survival following pylorus preserving resection in comparison to the pylorus resecting procedure in malignant disease (25-28). During this same period there has been a marked improvement in the postoperative mortality seen following resection of the pancreas that can be attributed largely to the development of high volume specialist units (29).

Whether PP-KW resection really does offer advantages over the conventional procedure is a matter of some debate. Although there are numerous published series in both benign and malignant disease, there are a lack of data from large prospective randomised studies comparing outcome with the two operations.

Warshaw and Torchiana were the first to suggest that gastric emptying was delayed following a PP-KW in comparison to a conventional resection (30). They studied a series of 18 patients, eight of whom underwent a KW and 10 a PP-KW resection. The mean time to introduction of solid feeding was 9.8 (range 4-1 7) days in the conventional resection group and 16 (range 6-22) days in the PP-KW group. Other studies have confirmed this finding (27, 31). Roder et al reported on a series of 110 patients with pancreatic or periampullary carcinoma undergoing resection (62 underwent KW and 48 PP-KW). Temporary delayed gastric emptying, undefined, occurred in nine (19%) of the patients who underwent a PP-KW resection and none of those who underwent a KW (27). Patel et al reported a series of 67 patients with malignant periampullary disease undergoing pancreatic head resection (52 KW and 15 PP-KW); delayed gastric emptying, defined as not tolerating oral liquids by seven days, was increased in the group undergoing a pylorus preserving procedure (9 out of 15 (61%) versus 21 out of 52 (41%)) (31).

Grace et al reveiwed the results of several published series of PP-KW resections and found that delayed gastric emptying was seen in 77 of 284 cases giving an overall rate of 27% and a figure not dissimilar to that seen after the conventional procedure (26). Other studies have found no difference in the rate of delayed gastric emptying following the two procedures (25, 32-34). In the study from Crist et al delayed gastric emptying, which was defined as gastric decompression required beyond the 10th day, occurred in 4 of 14 (29%) patients who underwent a PP-KW resection and 21 out of 74 (28%) who underwent a conventional resection (34). In the study from Williamson et al 36 patients were studied postoperatively (12 KW and 24 PP-KW) (32). Nasogastric suction was discontinued by eight days in 22 of the 24 patients who underwent a PP-KW resection and 11 of 12 patients who underwent a conventional resection. The definitions of delayed gastric emptying vary between studies and this creates problems when comparing different series. Hunt and Maclean have suggested that delayed gastric emptying in the early postoperative period is usually associated with another intra-abdominal complication and is not a consequence of the type of operation (35).

Administration of erythromycin postoperatively may stimulate gastric motility and decrease the period of delayed gastric emptying. To test this hypothesis 118 patients undergoing pancreaticoduodenectomy were randomised to either 200 mg of intravenous erythromycin lactobionate every 6 hours (n = 58), or an identical volume of 0.9% saline (n = 60) from the third to tenth postoperative days. On the tenth postoperative day, a dual phase radionucleotide gastric emptying study was performed. The erythromycin group had a 37% reduction in the incidence of delayed gastric emptying (19% vs. 30%), a significantly reduced (p < 0.05) need to reinsert a nasogastric tube for delayed gastric emptying (6 vs. 15 patients), and a significantly reduced (p < 0.01) per cent retention of liquids at 30 minutes and solids at 30, 60, 90, and 120 minutes (36).

Longmire and Traverso assessed late gastro-intestinal

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function in eight of their first 18 PP-KW resections (16). Laboratory tests, a 72-hour stool collection for faecal fat, and a radioactive trioctanoate test, in all patients demonstrated marked pancreatic insufficiency that required pancreatic enzyme replacement. Gastric emptying as assessed by pyloric fluoroscopy and gastric barium emptying was however within the normal range. Fink et al in a study of late gastro-intestinal function compared six long-term survivors of a KW resection (mean delay 4.7 years range 1-7) and six who had undergone a PP-KW resection (mean delay 3 years, range 1-7) (37). Gastric emptying was assessed with an isotopically labeled meal. Liquid gastric emptying was significantly prolonged in patients following KW resection (mean half time emptying was 98.3 ± 26.2 minutes) as compared to PP-KW resection (mean half time emptying was 37.5 ± 10.9 minutes) or normal controls (mean half time emptying was 33.1 ± 2.8 minutes) (37). In a similar study from Williamson et al gastric emptying, liquid and solid, was measured postoperatively (median delay 5 months, range 2-42 in the PP-KW group and median delay 7 months, range 2-60 in the KW group) by a double label radio-isotope technique (32). Median half time emptying for liquids was 65 (range 18-150) minutes in the PP-KW group as compared to 103 (range 4-200) minutes in the KW and median half time emptying for solids was 140 (range 48-391) minutes in the PP-KW group as compared to 180 (range 4-240) minutes in the KW group. None of these differences were significant (32).

One of the consequences of improved gastrointestinal function might be increased post-operative weight gain and it has been suggested that this is improved after PP-KW resection (38-39). In a recent study however of 125 patients with malignancy undergoing resection of the pancreatic head (56 KW and 69 PP-KW) who were followed up for a 15 month period post surgery improved weight gain was related to tumour resection margin status and recurrence and not the type of surgical procedure (28).

Preservation of the pylorus might be expected to reduce reflux of enteric contents into the stomach. In the study from Williamson described above 17 of 20 patients with an intact pylorus following PP-KW resection had either no or trivial reflux of bile into the stomach (32).

Use of PP-KW has been reported to shorten operative time and reduce blood loss in both benign and malignant disease in comparison to a KW resection (25, 40-41). In the study from Klinkenbijl et al 44 patients underwent a KW procedure and 47 a PP-KW (25). Median duration of the resection procedure and median blood loss in the PP-KW group were 210 minutes and 1800 ml, respectively. After a KW procedure, these figures were 255 minutes and 2500 ml, both significantly different as compared with PP-KW. Patients were of comparable TNM (tumour, nodes, and metastases) stage and all underwent a potentially curative resection. Hospital stay was also significantly (p = 0.02) shorter after PPKW;

median 14 days, compared with a median of 18 days after a KW procedure.

Pancreatic exocrine insufficiency is principally manifested by impaired digestion of fat. This has traditionally been treated by administration of pancreatic enzymes. Increasingly these are delivered as enteric-coated microspheres that dissolve if the pH rises above 5.5. This offers partial protection against the fast and irreversible inactivation of lipase by acid. Bruno et al studied the pharmacodynamics of enteric-coated microspheres in 12 patients (7 KW and 5 PP-KW) in comparison to a solid meal eaten at the same time. Gastric transit time was measured by a double label radio-isotope method. In patients who had undergone a KW resection gastric emptying of enteric-coated microspheres was not significantly different from that of the solid meal. In patients who underwent a PP-KW there was however a significant delay in the gastric transit of microspheres in comparison to the test meal. Indirect tests of pancreatic function during enzyme supplementation were significantly lower in patients who had undergone PP-KW than in normal controls (42).

Operative procedure

We use a bilateral sub-costal incision to gain access to the abdominal cavity and to optimize access a sternal retractor. Because the procedure is often prolonged great care is taken to limit blood loss. Initially the right colic flexure is mobilized obliquely to expose the duodenum. The greater omentum is then mobilised upwards from the colon to allow entry into the lesser sac and the transverse mesocolon is dissected away from the inferior head of the pancreas and the uncinate process. The duodenum is mobilised anteriorly from the inferior vena cava and the aorta. Dissection then proceeds above and below the pancreatic neck. The gastroduodenal artery is ligated and the hepatic portal vein is identified superiorly and the superior mesenteric vein inferiorly to the pancreatic neck. The gland may be inflamed, thickened, and fibrotic. Thrombosis of the splenic vein, which is often present, leads to large and friable collaterals along the upper and lower borders of the pancreatic tail and body, which often connect with the branches and tributaries of the gastroepiploic vessels.

We normally perform a cholecystectomy. The duodenum is then divided a few centimeters distal to the pylorus. Oedema at the site of the duodenostomy may be responsible for some cases of delayed gastric emptying. It is important to preserve the distal branches of the vagus nerve. The jejunum is divided proximally and the vessels feeding the bowel are ligated close to their entry point. The jejunum can then be passed through the transverse mesocolon. The neck of the pancreas is divided under
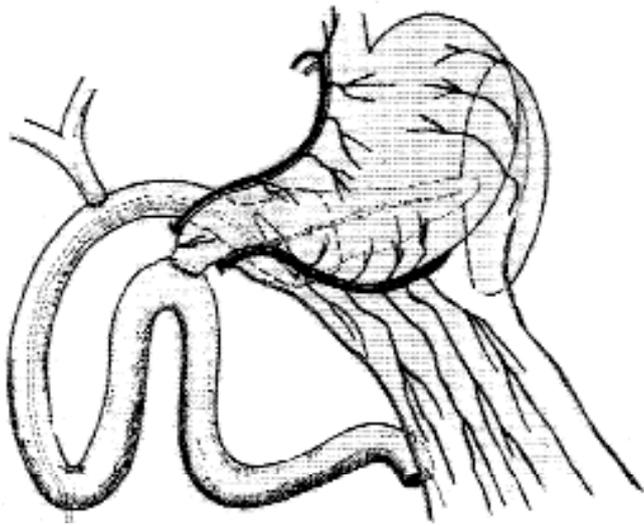
Fig. 1: Reconstruction following a pylorus preserving Kausch-Whipple resection.

direct vision. Finally the main bile duct is divided. The vessels within the fascia of Trietz extending from edge of the uncinate process to surround the superior mesenteric artery are divided and ligated under direct vision.

In chronic pancreatitis the gland is normally tough and fibrous making the pancreatic anastomosis technically easier to perform. Leakage from the pancreatic anastomosis however is still a major cause of early postoperative mortality and morbidity. We use an end to end jejunal pancreatic anastomosis with a "dunk technique" to try and reduce the incidence of postoperative fistula (43). An end to side bilioenteric anastomosis is constructed using interrupted absorbable monofilament (Figure 1). In a pylorus preserving resection preservation of the pyloric mechanism means that it is possible to perform an end-to-side gastrojejunal anastomosis. If the pylorus is resected a Roux en Y diversion should be constructed to prevent biliary reflux into the gastric remnant. Postoperative complications are reduced in patients who receive prophylactic octreotide which we use routinely (44).

Long term results

Proximal pancreatectomy achieves long term symptom relief in the majority of patients (9, 23, 45, 46) (Tab. I). Approximately 80% of patients remain pain free and many of these return to gainful employment. Because most series are retrospective and span many decades it is hard to detect differences between the conventional KW and the PP-KW although the results would appear to be broadly similar. Patients with alcohol-induced chronic pancreatitis who continue to drink do particularly badly (17).

Late mortality is high in many series; the mortality values shown in Table 1 are deaths from all causes. The majority of deaths reflect the life style of patients. In particular patients with alcohol induced chronic pancreatitis, are almost invariably heavy smokers, and have an addictive personality. Thus deaths are commonly due to cardiovascular and respiratory disease, other smoking related diseases and psychosocial problems including suicide and accidental death. A small proportion of patients develop diabetes mellitus immediately following resection. Late onset of diabetes mellitus occurs in a much larger proportion of patients and represents the natural progression of chronic pancreatitis in the remaining gland. Maintenance of adequate digestion, especially of fats is problematical after resectional surgery. Patients require close follow-up especially in the first year often requiring high doses of pancreatic enzyme supplements and acid suppression therapy (47).

Kausch-Whipple versus a Duodenum-Sparing Resection

The duodenum plays a central role in the post-prandial regulation of the digestive process (48). Localised resection of the pancreatic head, preservation of the pyloric mechanism, the duodenum, and drainage of the distal pancreatic remnant into a Roux en Y loop has been proposed as an alternative to proximal pancreatic resection and may improve postoperative gastrointestinal and endocrine function (49). A randomised controlled clinical trial from

Tab. I – LONG TERM RESULTS FOLLOWING KW OR PP-KW RESECTION FOR CHRONIC PANCREATITIS. (* FOLLOW UP FOR 5 YEARS)

Series	Stapleton and Williamson 1996 (9)	Martin et al 1996 (45)	Traverso and Kozarek 1997 (23)	Rossi et al 1987 (46)
Total nos in series	52	45	57	73
PP-KW	45	45	47	20
KW	7	0	0	53
Total pancreatectomy(PP)	0	0	10	0
Postoperative mortality	0/52 (0%)	1/45 (2%)	0/57 (0%)	2/73 (3%)
Late mortality (all cause)	10/52 (19%)	6/44 (14%)	8/56 (14%)	17/71 (24%)
Long term pain relief	37/47 (79%)	38/44 (86%)	42/56 (76%)	14/21 (67%*)
Late onset diabetes	14/35 (40%)	NA (47%)	8/37 (22%)	19/29 (66%*)
Follow-up, mean (range) months	54 (6-180)	63 (1-164)	42 (3-135)	58 (6-240)

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Tab. II – RESULTS FROM A RECENT RANDOMISED CONTROLLED TRIAL (BÜCHLER ET AL 1995) (51) COMPARING PP-KW AND A DUODENUM PRESERVING RESECTION

Outcome measures	Procedures	
	Beger's	PP-KW
Postoperative mortality	0/20 (0%)	0/20 (0%)
Pain free at six months	12/16 (75%)	6/15 (40%)
Weight gain at six months	14/16 (88%)	10/15 (67%)
Hospital readmission	2/16 (13%)	4/15 (27%)
Professional rehabilitation	12/15 (80%)	8/12 (67%)
Follow-up period	6 months	6 months

Ulm compared a duodenum sparing procedure to a PP-KW (50, 51). Twenty patients were randomised to each treatment arm of which 16 in the duodenum preserving group and 15 in the PP-KW group were reviewed at 6 months. The in-hospital mortality associated with the two procedures was zero and the in hospital morbidity was similar in the two groups: three patients in the duodenum preserving group and four in the PP-KW group suffered early complications. Significantly more patients in the duodenum-preserving group (12 out of 16) were pain free at six months compared to the PP-KW (6 out of 15). Although a similar proportion of patients in each group had put on weight at six months, the absolute weight gain was however significantly greater in the group who underwent the duodenum preserving procedure. At six months, glucose tolerance (as assessed following a glucose load) was also significantly better in those who underwent the duodenum preserving procedure. It is not clear however whether a duodenum preserving procedure will merely delay the onset of diabetes or prevent its occurrence.

Technically duodenum-sparing resections of the pancreatic head are as demanding as a conventional resection. Specific but rare complications that are not seen with conventional resection include duodenal necrosis with fistula formation and hemorrhage from the bed of the pancreatic head. The major disadvantage is the inability pre-operatively to completely exclude the presence of neoplastic disease in patients undergoing surgery since a significant proportion of patients who undergo resection for chronic pancreatitis turn out to have malignant disease (9, 52). In the small randomised study from Ulm above, one patient-undergoing duodenum preserving resection turned out to have a pancreatic malignancy. Although this was recognised at the time of surgery and a resection performed potentially a number of patients with tumours are likely to be inappropriately treated. In our own unit approximately 10% of patients with a mass in the head of the pancreas and no history of abdominal pain turn out to have chronic pancreatitis. On the other hand around 3% undergoing surgery for chronic pancreatitis are found to have a cancer. The problem cannot be overcome by any known radiological technique and clinically applicable developments in molecular diagnosis are required.

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