NATIONAL INSTITUTE FOR HEALTH AND CLINICAL EXCELLENCE

INTERVENTIONAL PROCEDURES PROGRAMME

Interventional procedure overview of laparoscopic distal pancreatectomy

Laparoscopic distal pancreatectomy is the removal of the left part of the pancreas (an organ in the upper abdomen that is involved in digestion and produces insulin). The procedure is carried out through small cuts in the abdomen, using a fine telescope to see inside the body (also known as 'keyhole surgery').

Introduction

This overview has been prepared to assist members of the Interventional Procedures Advisory Committee (IPAC) in making recommendations about the safety and efficacy of an interventional procedure. It is based on a rapid review of the medical literature and specialist opinion. It should not be regarded as a definitive assessment of the procedure.

Date prepared

This overview was prepared in May 2006.

Procedure name

- Laparoscopic distal pancreatectomy

Specialty societies

- Association of Upper Gastrointestinal Surgeons of Great Britain and Ireland
- British Society of Gastroenterology
- Pancreatic Society of Great Britain and Ireland

Description

Indications

Neuroendocrine and cystic tumours of the pancreas, chronic pancreatitis, pancreatic pseudocysts.

Pancreatic neuroendocrine tumours and cystic tumours may be benign or malignant, and account for a small proportion of pancreatic cancer. The most common type of pancreatic neuroendocrine tumour is insulinoma, which is usually benign. In this condition, the tumour produces too much insulin and causes symptoms associated with low blood sugar, such as weakness, loss of energy, dizziness and drowsiness.

Chronic pancreatitis refers to long-term inflammation of the pancreas, which eventually causes irreversible damage to the tissue. Pseudocysts may develop, which are collections of pancreatic fluid resulting from blocked pancreatic ducts. The main symptom of chronic pancreatitis is abdominal pain, which may be mild or severe. Other symptoms include jaundice, steatorrhoea (fatty stools) and weight loss. Destruction of the cells that produce insulin may lead to diabetes. There is also an increased risk of pancreatic cancer. The most frequent causes of chronic pancreatitis are excessive alcohol consumption and congenital (familial) pancreatitis.

Current treatment and alternatives

The main treatment for cystic and neuroendocrine tumours is surgery, although chemotherapy may also be used for malignant tumours. Small benign insulinomas can be removed by enucleation (shelling out the tumour without removing any pancreatic tissue). Larger tumours in the body and tail of the pancreas or close to the pancreatic duct are usually removed by open distal pancreatectomy in which the body and tail of the pancreas are removed, leaving the head attached.

Current treatments for chronic pancreatitis include medication such as enzyme supplements and analgesics, and avoiding alcohol. In rare cases, surgery may be necessary if the patient has severe pain that is unresponsive to medication. Surgery may involve drainage of the pancreatic duct or pseudocyst, or removal of all or part of the pancreas.

What the procedure involves

Pre-operative imaging studies are usually done to localise the tumour. Laparoscopic pancreatectomy is performed under general anaesthesia. The peritoneal cavity is insufflated with carbon dioxide and a number of small incisions are made to provide access for the laparoscope and surgical instruments. Laparoscopic ultrasound may be used to visualise the tumour and determine resection margins. The pancreas is exposed and dissected to completely detach the body and tail from the retroperitoneum. The splenic vein and artery may be preserved or dissected and ligated. The pancreas is then divided along the transection line. The resected specimen is usually enclosed in a bag and removed through a small incision in the umbilical area. The spleen may be removed along with the pancreas or it may be preserved. A drain is often left in the bed of the pancreatic dissection and drawn through one of the port sites, and removed a few days after surgery.

Efficacy

The efficacy evidence presented in this overview relates to one review, including 15 studies describing a total of 282 laparoscopic distal pancreatectomies and 87 enucleations, and one non-randomised controlled trial. [1, 22]

The Specialist Advisors listed key efficacy outcomes as operative time, intraoperative blood loss, length of hospital stay, and long-term recurrence and survival for patients with malignant tumours.

Operative time
The review reported a mean operative time of 205 minutes.[1]

Length of hospital stay
The non-randomised, controlled trial of 30 cases reported a significantly shorter median postoperative hospital stay of 5 days for laparoscopic distal pancreatectomy compared with 8 days for open surgery ($p = 0.02$).[22] The review reported a mean hospital stay of 7.5 days.[1]

Recovery time
The non-randomised controlled trial of 30 cases reported that patients undergoing laparoscopic surgery felt they had returned to normal activity after 3 weeks (median), compared with 6 weeks for patients undergoing open surgery ($p = 0.03$).[22]

Safety

The safety evidence presented in this overview relates to one review, including 15 studies describing a total of 282 laparoscopic distal pancreatectomies and 87 enucleations.[2–4, 7, 22,23]

The Specialist Advisors stated that potential adverse effects of the procedure include haemorrhage, pancreatic fistula, anastomotic leakage and inadequate resection margins. They noted that there was a higher risk of complications with the Whipple procedure than for distal pancreatectomy and for enucleation.

Conversion to open surgery
The rate of conversion to open surgery was reported to be approximately 14% (ranging from 0% to 40%).[1]

Pancreatic fistula
The review reported that the mean rate of pancreatic fistula was 13%.[1]

Re-operation
The mean rate of re-operation to treat complications was 8% (range 0% to 17%).[1]

Mortality
The 30-day mortality rate was reported to be 0.5% of patients.[1]

Literature review

Rapid review of literature

The medical literature was searched to identify studies and reviews relevant to laparoscopic pancreatectomy. Searches were conducted via the following databases, covering the period from their commencement to 2 May 2006: Medline, PreMedline, EMBASE, Cochrane Library and other databases. Trial registries and the Internet were also searched. No language restriction was applied to the searches. (See Appendix C for details of search strategy.) The following selection criteria (Table 1) were applied to the abstracts identified by the literature search. Where these criteria could not be determined from the abstracts, the full paper was retrieved.

Table 1 Inclusion criteria for identification of relevant studies

Characteristic	Criteria
Publication type	Clinical studies were included. Emphasis was placed on identifying good quality studies. Abstracts were excluded where no clinical outcomes were reported, or where the paper was a review, editorial, laboratory or animal study. Conference abstracts were also excluded because of the difficulty of appraising methodology.
Patient	Patients with chronic pancreatitis, pseudocysts, cystic or neuroendocrine tumours
Intervention/test	Laparoscopic distal pancreatectomy
Outcome	Articles were retrieved if the abstract contained information relevant to the safety and/or efficacy.
Language	Non-English-language articles were excluded unless they were thought to add substantively to the English-language evidence base.

List of studies included in the overview

This overview is based on one review, including 20 case series, one non-randomised controlled trial and one additional case series that was published after the review.[1, 22, 23] The four largest case series included in the review have been summarised separately in Table 2.[2, 3, 4, 7]

Other studies that were considered to be relevant to the procedure but were not included in the main extraction table (Table 2) are listed in Appendix A.

Existing reviews on this procedure

A review on minimally invasive pancreatic surgery was published in 2006.[1] The review identified 15 case series reporting on 10 or more procedures of laparoscopic distal pancreatectomy or enucleation and nine case series for laparoscopic pancreaticoduodenectomy. No randomised controlled trials were identified. The report concluded that laparoscopic distal pancreatectomy and laparoscopic enucleation of insulinomas are well-established procedures with lower morbidity and shorter postoperative hospital stays than with open surgery. The application of laparoscopic distal pancreatectomy for malignant

tumours and the role of laparoscopic pancreaticoduodenectomy remain debatable. This review is summarised in Table 2.

Related NICE guidance

There is no NICE guidance related to this procedure (Appendix B).

Table 2 Summary of key efficacy and safety findings on laparoscopic pancreatectomy

Abbreviations used: CT, computed tomography; LDP, laparoscopic distal pancreatectomy, LPD, laparoscopic pancreaticoduodenectomy

Study details	Key efficacy findings	Key safety findings	Comments
Ammori (2006)[1] **Review** Date of literature search not reported. Included studies: 15 studies with 10 patients or more undergoing LDP or enucleation were identified (total included 282 LDPs, 87 enucleations, 1 not known): Mabrut et al (2005)[2], n = 122, median age = 52 y Ayav et al (2005)[3], n = 34, mean age = 48 y Dulucq et al (2005)[4], n = 21, mean age = 58 y Lebedyev et al (2004)[5], n = 12, mean age = 59 y Fernandez-Cruz et al (2005)[6], n = 13, mean age = 40 y Edwin et al (2004)[7], n = 27, median age = 56 y Shimizu et al (2004)[8], n = 11, mean age = 56 y for distal pancreatectomy, 58 y for enucleation Fernandez-Cruz et al (2004)[9], n = 19, mean age = 55 y Fabre et al (2002)[10], n = 13, mean age = 60 y Park and Heniford (2002)[11], n = 25, mean age = 49 y Fernandez-Cruz et al (2002)[12], n = 18, mean age = 53 y Patterson et al (2001)[13], n = 19, mean age = 53 y Berends et al (2000)[14], n = 10, mean age = 42 y Cuschieri et al (1998)[15], n = 13, mean age = 49 y Gagner and Pomp (1997)[16], n = 13, mean age = 46.5 y **Mean follow-up = 27 months (57% of publications reported follow-up data)**	*LDP and enucleation (n = 370)* **Mean operating time = 205 min** **Mean blood loss = 290 ml** **Mean postoperative length of hospital stay = 7.5 days** **Tumour recurrence at follow-up = 5.7%** *LPD (n = 34)* **Mean operating time = 415 min** **Mean blood loss = 350 ml** **Mean postoperative length of hospital stay = 15.8 days** **Tumour recurrence at follow-up = 6.9% (2/29)**	*LPD and enucleation (n = 370)* **Conversion to open surgery = approximately 14% (range 0%–40%)** (the most common reason was inability to localise a neuroendocrine tumour) **Postoperative complications = 26%** **Mean rate of pancreatic fistula = 13%** **Re-operation to treat complications = 8% (range 0%–17%)** **30-day mortality = 0.5%** The review states that morbidity for open distal pancreatectomy ranges from 31% to 47% and mortality from 0.9% to 4%; morbidity for open pancreaticoduodenectomy ranges from 30% to 43% and mortality from 3% to 8%.	Only three databases were searched (Medline, Embase and Pre-Medline). Review only included English language articles. Reports on over 400 LDP and laparoscopic enucleation procedures were identified. Some cases were reported in more than one publication. Although the report only tabulates case series with 10 or more patients for LDP and enucleation, it is not explicit that analysis described in the text is also limited to these studies. The paper does not describe any statistical methods.

Abbreviations used: CT, computed tomography; LDP, laparoscopic distal pancreatectomy, LPD, laparoscopic pancreaticoduodenectomy

Study details	Key efficacy findings	Key safety findings	Comments
Ammori (2006) *cont.* 9 studies on LPD were identified (total number of patients = 34): Dulucq et al (2005)[4], n = 11, mean age = 63 y Mabrut et al (2005)[2], n = 3 Kimura et al (2005)[17], n =1, age = 65 y Staudacher et al (2005)[18], n = 7, mean age = 44 Ammori (2004)[19], n = 1, age = 62 y Ayav et al (2005)[3] n = 1 Gagner and Pomp (1997)[16], n = 10, mean age = 71 y Uyama et al (1996)[20], n = 1 Gagner and Pomp (1994)[21], n = 1, age = 30 y **Follow-up was reported in 85% (29/34) of patients. Mean follow-up = 16 months.** Indications: over 90% of distal pancreatectomies and enucleations were for benign disease. Malignant disease was the main indication for pancreaticoduodenectomy. Review search terms: 'laparoscopic', 'pancreatic', 'resection', 'enucleation', 'pancreatectomy', and 'pancreatoduodenectomy'. Conflict of interest: none stated		*LPD (n = 34)* **Conversion to open surgery = 26%** **Mean rate of postoperative complications = 23.5%** **Re-operation to treat complications 8.8%** **30-day mortality = 2.9%** The review states that morbidity for open pancreaticoduodenectomy ranges from 30% to 43% and mortality from 3% to 8%.	

Abbreviations used: CT, computed tomography; LDP, laparoscopic distal pancreatectomy, LPD, laparoscopic pancreaticoduodenectomy

Study details	Key efficacy findings	Key safety findings	Comments
Mabrut JY (2005)[2] **Case series (retrospective multicentre study)** Belgium, Luxembourg, Spain, Italy, France (25 centres) Study period: 1995–2002 n = 127 (98 LDP, 24 enucleations, 3 LPD, 1 laparoscopic medial pancreatectomy, 1 laparoscopic cyst excision) Population: 16 patients with malignant disease and 111 patients with benign pancreatic disease (47 cystic tumour, 22 insulinoma, 20 neuroendocrine tumour, 11 chronic pancreatitis, 4 pseudocyst, 7 other). 89% (116/131) lesions were located in the body or tail of the pancreas. Median age = 52 years (range 8–80) Indications: inclusion and exclusion criteria not stated. Technique: The spleen was preserved in 62% (61/98) LDPs. Laparoscopic intraoperative ultrasonography was performed in 44% (56/127) patients.	**Median operative time for laparoscopically successful operations = 190 minutes (range 65–400)** **Median postoperative length of hospital stay** • Overall: 7 days (range 3–67) • Laparoscopically successful procedures: 7 days (range 3–67) • Conversion to open surgery: 11 days (range 6–28) p < 0.0021 Malignant disease: in 13 patients who underwent radical resection of pancreatic malignancies, 23% presented with recurrence during a median follow-up of 15 months (range 3–47). No recurrence at the trocar site was identified. Benign disease: all patients operated on for benign pancreatic diseases were alive without recurrence at follow-up.	**Conversion to open surgery = 13% (17/127)** (6 were converted after initial exploration because of obvious macroscopic lymph node invasion, tumour contact with main pancreatic duct, occult neoplasm or unsuspected portal hypertension. After resection started, 8 were converted because of difficult exposure or dissection, 2 because of bleeding and 1 because of surgical margin invasion) **Intraoperative blood loss exceeding 300 ml = 23% (29/127)** **Blood transfusion = 5% (6/127)** **Perioperative mortality = 0% (0/127)** **Pancreatic fistula** • Enucleation = 8% (2/24) • LDP = 16% (16/98) **Peripancreatic collections** • Enucleation = 8% (2/24) • LDP = 15% (15/98) **Both pancreatic fistula and peripancreatic collections** • Enucleation = 12.5% (3/24) • LDP = 1% (1/98) (In 8 patients, the peripancreatic collection was asymptomatic; 7 of these resolved spontaneously after 1–10 months.)	This study is included in the review (Ammori and Baghdadi, 2006). The annual median experience per centre was 3 patients (range 1–29) with only 4 centres treating more than 10 patients. Conversion to open laparotomy before the resection was started was required in 6 patients. Five patients had presumed benign lesions that turned out to be malignant at final pathological examination. The authors state that 89% (113/127) patients were at high risk of developing complications, with a pancreas of soft and friable consistency. 3% (4/127) of patients were lost to follow-up. The paper states conversion rate as 14% rather than 13%.

Abbreviations used: CT, computed tomography; LDP, laparoscopic distal pancreatectomy, LPD, laparoscopic pancreaticoduodenectomy

Study details	Key efficacy findings	Key safety findings	Comments
Mabrut JY (2005) *cont.* **Median follow-up: 14 months (range 2–77).** Conflict of interest: none stated		**Haematoma** • Enucleation = 0% (0/24) • LDP = 4% (4/98) **Bleeding** • Enucleation = 0% (0/24) • LDP = 3% (3/98) **Pleural effusion** • Enucleation = 0% (0/24) • LDP = 8% (8/98) **Pulmonary infection** • Enucleation = 4% (1/24) • LDP = 2% (2/98) **Urinary infection** • Enucleation = 0% (0/24) • LDP = 2% (2/98) 17% (21/127) patients required re-operation for complications. Other complications reported in one patient each were: arrhythmia, ileus, deep venous thrombosis, central venous pressure line infection, diabetes, perforated duodenal ulcer, splenic infarction. No postoperative complications were reported for LPD, medial pancreatectomy or cyst excision. Multivariate stepwise analysis identified chronic pancreatitis (p = 0.04), conversion to laparotomy (p = 0.03), laparoscopic closure of pancreatic stump (p = 0.02) and laparoscopic selective closure of the pancreatic duct as being independent predictive factors of pancreatic-related complications.	

Abbreviations used: CT, computed tomography; LDP, laparoscopic distal pancreatectomy, LPD, laparoscopic pancreaticoduodenectomy

Study details	Key efficacy findings	Key safety findings	Comments
Ayav A (2005)[3] **Case series (retrospective multicentre study)** France, Italy (11 centres) Study period: 1996–2003 **n = 36** (19 enucleations, 15 LDP, 1 LPD, 1 laparoscopic central pancreatectomy) Population: Patients with solitary pancreatic insulinoma, organic hyperinsulinism and symptoms of hypoglycaemia 75% (27/36) tumours were located in the body or tail of the pancreas Mean age = 48 years (range 20–77) Indications: inclusion and exclusion criteria not stated Technique: The spleen was preserved in 80% (12/15) LDPs. For LPD, the resection was performed laparoscopically but anastomosis required conversion to laparotomy. To decrease the risk of fistula, 9 patients had perioperative injection of octreotide; 8 had injection of octreotide and application of fibrin glue into the operating field and 2 had fibrin glue alone, Laparoscopic ultrasonography was performed in 22% (8/36) patients. **Mean follow-up: 26 months (range 2–87)** Conflict of interest: none stated	**Mean operative time** • Overall = 156 min (range 50–420) • Laparoscopical enucleation = 115 min (range 50–190) • LDP = 175 min (range 120–240) **Mean postoperative length of hospital stay** • Laparoscopically successful procedures = 11 days (range 5–32) • Conversion to open surgery = 14 days (range 7–39) p = 0.09 (not significant) **Proportion of patients symptom free postoperatively = 89% (32/36)** One patient with symptoms of hypoglycaemia underwent laparotomy and enucleation 2 months postoperatively. The patient was symptom free at follow-up. **Proportion of patients symptom-free at end of follow-up = 92% (33/36)** (the remaining 3 patients were lost to follow-up)	**Conversion to open surgery = 31% (11/36)** (7 because of inability to locate tumour during laparoscopic procedure) **Re-operation at postoperative day 1 = 6% (2/36)** (1 evisceration in procedure converted to laparotomy, 1 peritonitis related to gastric injury not seen during laparoscopic approach) **Intra-abdominal collection = 17% (6/36)** (2 were successfully treated with radiological drainage and 1 with surgical drainage) **Pancreaticocutaneous fistula = 14% (5/36)** Mean duration of fistula was 55 days (range 5–130); none required re-operation (82% (9/11) of these patients had perioperative treatment with octreotide and/or fibrin glue) Pancreas-specific complications by type of surgery: • Enucleation = 42% (8/19) • Pancreatic resection = 18% (3/17)	This study is included in the review (Ammori and Baghdadi, 2006). An additional two patients with multiple endocrine neoplasm syndrome type 1 (MENs-1) were excluded from the analysis. 8% (3/36) patients were lost to follow-up. Various pre-operative localisation tests were used, including CT (94% [34/36]), magnetic resonance imaging (44% [16/36]) and endoscopic ultrasonography (72% [26/36]).

Abbreviations used: CT, computed tomography; LDP, laparoscopic distal pancreatectomy, LPD, laparoscopic pancreaticoduodenectomy			
Study details	**Key efficacy findings**	**Key safety findings**	**Comments**
Dulucq JL (2005)[4] **Case series (prospective)** France Study period: 1995–2003 **n = 32** (21 LDP, 11 LPD) Population: patients undergoing pancreatic resection for pancreatic cysts, lesions or chronic pancreatitis LDP (n = 21): 86% (18/21) cysts or lesions in body or tail (including 3 adenocarcinomas), 14% (3/21) chronic pancreatitis LPD (n =11): 73% (8/11) malignant tumours, 27% (3/11) chronic pancreatitis Mean age = 58 years (LDP), 63 years (LPD) Indications: inclusion and exclusion criteria not stated Technique: Laparoscopic intraoperative ultrasonography was performed as standard. For LPD, 6 patients had laparoscopic reconstruction. The spleen was preserved in 76% (16/21) LDPs. **Mean follow-up: LDP: 4 years, 2 months (range 2 months–9.75 years) for benign lesions and 19 months (range 2 months–3.8 years); LPD: 19 months (range 2–45)** Conflict of interest: none stated	*LDP* **Mean operating time = 154 min (range 110–240)** **Mean blood loss = 162 ml (range 50–700)** **Mean length of hospital stay = 10.8 days (range 6–15)** All patients with benign lesions were symptom-free at follow-up. All patients with malignant lesions were disease-free at follow-up. *LPD* **Mean operating time for completely laparoscopic procedure = 268 min (range 210–360)** **Mean operating time for laparoscopically assisted procedure = 286 min (range 270–300)** **Mean blood loss for completely laparoscopic procedure = 75 ml (range 50–150)** **Mean blood loss for laparoscopically assisted procedure = 83 ml (range 50–150)** **Mean length of hospital stay for completely laparoscopic procedure = 13.4 days (range 9–21)** **Mean length of hospital stay for laparoscopically assisted procedure = 14 days (range 10–25)** Two patients with adenocarcinoma died during follow-up, 1 patient had liver metastases and the remainder were disease free.	*LDP* **Conversion to open surgery = 5% (1/21)** (because of bleeding) **Perioperative mortality = 0% (0/21)** **Postoperative complications = 24% (5/21)** **Pancreatic fistula = 5% (1/21)** (contained with a drain and eliminated by postoperative week 3) **Intra-abdominal abscess = 9.5% (2/21)** **Eventration of extracted site = 5% (1/21)** **Bleeding = 5% (1/21)** **Re-operation = 9.5% (2/21)** *LPD* **Conversion to open surgery = 9% (1/11)** (because of pancreatic adhesion to portal vein) **Intraoperative mortality = 0% (0/11)** **Perioperative mortality = 9% (1/11)** (patient died 10 days postoperatively from a cardiac event after uncomplicated laparoscopy – death was considered to be unrelated to the surgery) **Bleeding = 18% (2/11)** **Small bowel obstruction = 9% (1/11)** **Jugular vein thrombosis = 9% (1/11)** **Re-operation = 9% (1/11)**	This study is included in the review (Ammori and Baghdadi, 2006). The paper states that the rate of complications and conversion to open surgery decreased with increasing experience.

Abbreviations used: CT, computed tomography; LDP, laparoscopic distal pancreatectomy, LPD, laparoscopic pancreaticoduodenectomy

Study details	Key efficacy findings	Key safety findings	Comments
Edwin B (2004)[7] **Case series** Norway Study period: 1997–2002 **n = 32** (17 LDP, of which 12 included splenectomy, 7 enucleation, 5 conversions to open surgery, 3 exploration only. Population: Patients with pancreatic disease, undergoing surgery Pre-operative diagnoses: 41% (13/32) neuroendocrine tumours, 34% (11/32) unspecified tumours, 6% (2/32) cysts, 6% (2/32) idiopathic thrombocytopaenia purpura with ectopic spleen, 3% (1/32) annular pancreas, 3% (1/32) trauma, 3% (1/32) aneurysm of the splenic artery and 3% (1/32 adenocarcinoma. Mean age = 56 years (range 21–81) Indications: inclusion and exclusion criteria not stated Technique: Laparoscopic intraoperative ultrasonography was performed as standard. **Mean follow-up: not stated** Conflict of interest: none stated	*All laparoscopic resections (n = 24)* **Median operating time = 205 min (range 60–332)** **Median blood loss = 300 ml (range 100–1500)** **Median number of postoperative days with administration of opioids = 2 days (range 0–13)** **Median time to oral intake = 0 days (range 0–1)** **Median length of hospital stay = 5.5 days (range 2–22)** **Tumour tissue in resection margin = 8.3% (2/24)** 2 out of 3 patients with adenocarcinoma who underwent laparoscopic resection died 12 and 13 months after postoperatively. The third patient was alive 13 months postoperatively and was disease-free at 11 months postoperatively.	**Conversion to open surgery = 13% (4/32)** (one tumour not defined, one tumour located in pancreatic head, one bleeding from pseudoaneurysm of the splenic artery, one injury to portal vein) *All laparoscopic resections (n = 24)* **Mortality = 8.3% (2/24)** (one due to sepsis and multi-organ failure 19 days postoperatively after conversion to open surgery to remove adenocarcinoma, one due to myocardial infarction 8 days postoperatively in a patient with metastases from previous renal cancer) **Postoperative complications = 38% (9/24)** **Postoperative blood transfusion = 12.5% (3/24)** **Fever (treated with antibiotics) = 8% (2/24)** **Fistula and intra-abdominal abscess = 4% (1/24)** **Re-operation = 4% (1/24)** **Pneumonia = 4% (1/24)** **Urinary tract infection = 4% (1/24)** **Pleural fluid (drained) = 4% (1/24)** **Readmission for unspecified abdominal pain = 4% (1/24)**	This study is included in the review (Ammori and Baghdadi, 2006). It is not clear whether the five conversions to open surgery listed in the types of procedure were included in further analysis. The paper later states that four procedures were converted to open surgery and one to a hand-assisted resection. One of the deaths reported was of a patient whose procedure was converted to open surgery because of bleeding; the denominator used to calculate mortality, however, was the number of laparoscopic resections performed as planned (24). Paper states that blood loss may be overestimated because it included irrigation fluid used during surgery.

Abbreviations used: CT, computed tomography; LDP, laparoscopic distal pancreatectomy, LPD, laparoscopic pancreaticoduodenectomy

Study details	Key efficacy findings	Key safety findings	Comments
Velanovich V (2006)[22] **Non-randomised controlled trial (retrospective)** USA Study period: October 2003 onwards for laparoscopic pancreatectomy, October 2006 onwards for open procedure **n = 30** (all LDP combined with splenectomy) Population: 15 patients who had laparoscopic procedures (3 ductal or cystic adenocarcinoma, 8 benign or indeterminate cystic neoplasm, 2 neuroendocrine tumour, 2 chronic pancreatitis) were matched with 15 open surgery controls Indications: inclusion and exclusion criteria were not stated Technique: LDP with splenectomy – all operations were performed by the same surgeon **Follow-up: not stated** Conflict of interest: none stated	**Median length of hospital stay** • Laparoscopic surgery = 5 days (range 3–9) • Open surgery = 8 days (range 6–23) p = 0.02 **Median length of time to when patients felt that they had returned to normal activities** • Laparoscopic = 3 weeks (range 2–7) • Open surgery = 6 weeks (range 4–8) p = 0.03	**Conversion to open surgery = 20% (3/15)** (1 because of bleeding, 2 because of retroperitoneal tumour adherence) **Pancreatic leak** • Laparoscopic = 13% (2/15) • Open = 13% (2/15) **Wound infection** • Laparoscopic = 13% (2/15) • Open = 13% (2/15) **Urinary tract infection** • Laparoscopic = 7% (1/15) • Open = 0% (0/15) **Pneumonia** • Laparoscopic = 0% (0/15) • Open = 7% (1/15) **Intra-abdominal abscess** • Laparoscopic = 0% (0/15) • Open = 7% (1/15)	A total of 41 patients were treated with open distal pancreatectomy since October 1996 – 15 controls were selected from this group. Patients who had laparoscopic procedures were matched to controls based on age, sex and pancreatic pathology. The three patients who required conversion to open laparotomy remained in the laparoscopic group for analysis. All three conversions were in patients with pancreatic adenocarcinoma. Small sample size The authors comment that laparoscopy may reveal peritoneal or liver metastases that were missed by CT scan and help to identify unresectable tumours before laparotomy. Changes in discharge planning and supportive care may have affected length of hospital stay in more recent years. Length of time to normal activities may be subject to recall bias.

Abbreviations used: CT, computed tomography; LDP, laparoscopic distal pancreatectomy, LPD, laparoscopic pancreaticoduodenectomy

Study details	Key efficacy findings	Key safety findings	Comments
D'Angelica M (2006)[23] **Case series** USA Study period: 2002–2004 **n = 17** (all LDP) Population: patients with benign and malignant pancreatic disease, undergoing LDP Pre-operative diagnoses: 41% (7/17) cystic neoplasms, 35% (6/17) solid tumours, 18% (3/17) neuroendocrine tumours, 6% (1/17) chronic pancreatitis Median age = 60 years (range 29–85) Indications: inclusion and exclusion criteria not stated Technique: Hand-assisted LDP. Drains were not routinely placed. **Median follow-up: 3.8 months (range 5–14)** Conflict of interest: none stated.	One tumour was judged to be locally unresectable because of celiac artery involvement. **Median operating time = 196 min (range 128–235)** **Median blood loss = 125 ml (range 50–1250)** **Median time to oral analgesics = 3 days (range 2–9)** **Median time to a regular diet = 3.5 days (range 2–9)** **Median length of hospital stay = 5.5 days (range 4–18)** There were no local recurrences at follow-up. Two patients had recurrence of malignant disease at distant sites.	**Conversion to open surgery = 12.5% (2/16)** (one because of bleeding and one because of poor exposure) **Postoperative mortality = 0% (0/16)** **Postoperative morbidity = 25% (4/16)** **Pancreatic leak/fistula requiring drainage = 19% (3/16)** (one required re-operation) **Wound infection = 6% (1/16)** **Fever = 6% (1/16)**	One tumour was reported to be locally unresectable and was not discussed further. The analysis was based on 16 resections.

Validity and generalisability of the studies

- Most studies included patients with both benign and malignant disease; the majority of patients with malignant disease had pancreatic tumours other than adenocarcinoma.
- None of the studies included a randomised control group.
- The single non-randomised comparative study is small, with only 15 patients in each arm.[22]
- Fistula rates may not be directly comparable between studies because definitions vary. Asymptomatic cases may not be identified.
- There are several variations of the technique, including preservation of the spleen or splenic vessels, treatment of the pancreatic stump and duct, and use of intraoperative ultrasonography. The methods used varied within and between the studies. One study only included hand-assisted laparoscopic distal pancreatectomy procedures.[23]
- The review includes some cases that have been reported in more than one publication.
- None of the studies report long-term follow-up for patients with malignant lesions.

Specialist advisors' opinions

Specialist advice was sought from consultants who have been nominated or ratified by their Specialist Society or Royal College.

Mr I Beckingham, Mr R Charnley, Professor M Larvin, Professor M McMahon, Mr M Midwinter, Mr R Parks

- Laparoscopic distal pancreatectomy and enucleation could be considered minor variations of an existing procedure. However, laparoscopic pancreaticoduodenectomy is novel and of uncertain safety and efficacy.
- The procedure should only be carried out in specialist pancreatic units and by surgeons experienced in open pancreatic surgery and requires training in advanced laparoscopic surgery.
- The Whipple procedure is considerably more demanding; it requires extensive dissection and reconstruction and there are greater concerns regarding the safety and efficacy than for laparoscopic distal pancreatectomy.
- The pancreas cannot be palpated, unless a hand-assisted approach is used, which may make it more difficult to find small localised tumours. The use of intraoperative ultrasonography may help to overcome this problem.
- There is concern regarding the adequacy of resection for malignant tumours.
- The procedure is likely to have a minor-to-moderate impact on the NHS, in terms of numbers of patients eligible for treatment and use of resources.

Issues for consideration by IPAC

- The majority of evidence relates to laparoscopic distal pancreatectomy and enucleation rather than laparoscopic pancreaticoduodenectomy. Several specialist advisors suggested that these procedures should be considered separately.
- Most of the studies included a small proportion of patients with malignant tumours, some of which were adenocarcinoma. The original notification only included cystic and neuroendocrine tumours, pancreatic pseudocysts and chronic pancreatitis.

References

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10. Fabre JM, Dulucq JL, Vacher C et al. (2002) Is laparoscopic left pancreatic resection justified? *Surgical Endoscopy* 16: 1358–61.
11. Park AE, Heniford BT.(2002)Therapeutic laparoscopy of the pancreas. *Annals of Surgery* 236: 149–58.
12. Fernandez-Cruz L, Saenz A, Astudillo E et al. (2002) Outcome of laparoscopic pancreatic surgery: endocrine and nonendocrine tumors. *World Journal of Surgery* 26: 1057–65.
13. Patterson EJ, Gagner M, Salky B et al. (2001) Laparoscopic pancreatic resection: single-institution experience of 19 patients. *Journal of the American College of Surgeons* 193: 281–7.
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22. Velanovich V (2006) Case-control comparison of laparoscopic versus open distal pancreatectomy. *Journal of Gastrointestinal Surgery* 10: 95–8.
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Appendix A: Additional papers on laparoscopic pancreatectomy not included in summary Table 2

The following table outlines the studies that are considered potentially relevant to the overview but were not included in the main data extraction table (Table 2). It is by no means an exhaustive list of potentially relevant studies.

Article title	Number of patients/ follow-up	Direction of conclusions	Reasons for non-inclusion in Table 2
Assalia A, Gagner M. (2004) Laparoscopic pancreatic surgery for islet cell tumors of the pancreas. *World Journal of Surgery* 28: 1239–1247.	17 patients	Conversion to open surgery = 24% (4/17) Complications = 18% (3/17)	Larger and more recent case series are included.
Gagner M, Inabnet WB, Biertho L et al. (2004) Laparoscopic pancreatectomy: a series of 22 patients. *Annales de Chirurgie* 129: 2–7.	22 patients (17 left pancreatectomies, 5 enucleations)	Conversion to open surgery = 9% (2/22) 18% fistula Morbidity rate = 32% No mortality Median hospital stay = 6 days	Larger case series are included.
Mabrut JY, Boulez J, Peix JL et al. (2005) Laparoscopic pancreatic resection: a preliminary experience of 15 patients. *Hepato-Gastroenterology* 52: 230–232.	15 patients	20% fistula 13% peripancreatic collection Conversion to open surgery = 33% (5/15)	Larger study from same centre is included.
Masson B, Sa-Cunha A, Laurent C et al. (2003) Laparoscopic pancreatectomy: report of 22 cases. *Annales de Chirurgie* 128: 452–6.	22 patients (10 enucleations, 3 distal pancreatectomies, 4 left pancreatectomies and 1 total pancreatectomy)	Conversion to open surgery = 18% (4/22) No mortality Median length of hospital stay = 12 days	Larger case series are included.
Matsumoto T, Hirano S, Yada K et al. (2005) Safety and efficacy of laparoscopic distal pancreatectomy for the treatment of pancreatic disease. *Journal of Hepato-Biliary-Pancreatic Surgery* 12: 65–70.	7 patients undergoing laparoscopic distal pancreatectomy	Conversion to open surgery = 14% (1/7) Median hospital stay = 12 days	Larger case series are included.
Root J, Nguyen N, Jones B et al. (2005) Laparoscopic distal pancreatic resection. *American Surgeon* 71: 744–749.	11 patients	Conversion to open surgery = 9% (1/11) Mean hospital stay = 5 days	Larger case series are included.

Appendix B: Related published NICE guidance for laparoscopic pancreatectomy

Guidance programme	Recommendation
Interventional procedures	None applicable
Technology appraisals	None applicable
Clinical guidelines	None applicable
Public health	None applicable

Appendix C: Literature search for laparoscopic pancreatectomy

Procedure number: 315	Procedure Name: Laparoscopic pancreatectomy	
Databases	**Version searched (if applicable)**	**Date searched**
The Cochrane Library	2005 Issue 2	5.5.2005
CRD	April 2005	6.5.2005
Embase	1980 to 2005 Week 18	5.5.2005
Medline	1966 to April Week 4 2005	5.5.2005
Premedline	May 4, 2005	5.5.2005
CINAHL	1982- current	6.5.2005
British Library Inside Conferences (limited to current year only)	Current year	6.5.2005
National Research Register	2005 Issue 2	6.5.2005
Controlled Trials Registry	N/A	6.5.2005

NB. The search was updated on 2 May 2006.

The following search strategy was used to identify papers in Medline. A similar strategy was used to identify papers in other databases.

1 exp Laparoscopy/
2 exp LAPAROSCOPES/
3 exp LAPAROTOMY/
4 Surgical Procedures, Minimally Invasive/
5 (laparo$ or telescop$).tw.
6 or/1-5
7 exp PANCREATECTOMY/
8 pancreatectomy.tw.
9 7 or 8
10 6 and 9
11 exp PANCREATITIS/
12 exp Pancreatic Neoplasms/
13 (pancrea$ adj3 (cancer$ or neoplasm$ or tumour$ or tumor$ or malignant or sarcoma$ or gastrinoma$ or insulinoma$ or somatostatinoma$ or VIPoma$ or glucagonoma$)).tw.
14 or/11-13
15 10 and 14
16 limit 15 to humans
17 limit 16 to yr=1990-2005