NATIONAL INSTITUTE FOR HEALTH AND CLINICAL EXCELLENCE

INTERVENTIONAL PROCEDURES PROGRAMME

Interventional procedure overview of percutaneous retroperitoneal endoscopic necrosectomy

Keyhole removal of dead tissue to treat pancreatic necrosis

The pancreas produces juices that contain substances (enzymes) that help to digest food. Sometimes these substances can attack the pancreas itself. This can happen if the tube that normally takes the juices to the gut becomes blocked. This can cause swelling of the pancreas and severe pain in the abdomen (acute pancreatitis). Some patients with acute pancreatitis develop a complication called necrosis, when part of the pancreas is destroyed. This is a serious condition with high risk of death, and removal of the dead tissue is required as part of the management.

The usual way of removing the destroyed part of the pancreas is by open surgery. Percutaneous retroperitoneal endoscopic necrosectomy is an alternative treatment option where a thin telescope, inserted through a small cut in the side above the hip, is used to wash out and remove the dead tissue.

Introduction

The National Institute for Health and Clinical Excellence (NICE) has prepared this overview to help members of the Interventional Procedures Advisory Committee (IPAC) make 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 September 2010.

Procedure name

Percutaneous retroperitoneal endoscopic necrosectomy

Specialty societies

• Association of Upper Gastrointestinal Surgeons of Great Britain and Ireland

IP overview: percutaneous retroperitoneal endoscopic necrosectomy Page 1 of 21

- Association of Laparoscopic Surgeons of Great Britain and Ireland
- The Pancreatic Society of Great Britain and Ireland

Description

Indications and current treatment

Pancreatic necrosis (also called necrotising pancreatitis) is a serious complication of acute pancreatitis that can occur in some patients (with or without the formation of a pseudocyst). It is a condition associated with significant morbidity, requiring prolonged hospitalisation, and it has a high mortality.

Traditionally pancreatic necrosis has been treated by open necrosectomy via laparotomy, but image guided drainage or laparoscopic drainage may also be used.

Disease severity instruments used in acute pancreatitis

As acute pancreatitis is associated with significant morbidity and mortality risks, different severity scores have been developed to aid prognosis.

One measure of severity of acute pancreatitis is the Ranson score which scores 11 criteria (higher scores worse).

At admission:

- age in years > 55 years
- white blood cell count > 16,000 cells/mm³
- blood glucose > 10 mmol/litre (200 mg/100 ml)
- serum aspartate aminotransferase (AST) > 250 IU/litre
- serum lactate dehydrogenase (LDH) > 350 IU/litre.

At 48 hours:

- serum calcium < 2.0 mmol/litre (8.0 mg/100 ml)
- haematocrit fall > 10%
- hypoxemia PO₂ < 60 mmHg
- blood urea nitrogen (BUN) increase of 1.8 mmol/litre (5 mg/100 ml) or more after intravenous fluid hydration
- base deficit (negative base excess) > 4 mEq/litre
- sequestration of fluids > 6 litres.

An alternative system is the Acute physiology and chronic health evaluation II (APACHE II) score, which is an assessment of disease severity based on 12 routine physiological measurements scored 0 to 71 (higher scores worse).

What the procedure involves

Percutaneous retroperitoneal endoscopic necrosectomy aims to remove necrotic tissue under direct vision. The procedure is less invasive and may improve prognosis compared with traditional open surgery

Under general anaesthesia an endoscope, which may be rigid or flexible, is inserted postero-laterally into the retroperitoneal space to visualise the necrosis. Dead tissue is removed for example, using suction, lavage or forceps, and necrotic tissue is debrided where necessary using forceps. This is done by inserting two or three ancillary ports or keyholes. Drains may be placed for irrigation of the cavity in the post-operative period. The procedure may be repeated if required.

Percutaneous retroperitoneal endoscopic necrosectomy may also allow more complete removal of necrotic tissue than percutaneous drainage alone because it is performed under direct vision, thus allowing collected pus to drain more freely.

Literature review

Rapid review of literature

The medical literature was searched to identify studies and reviews relevant to percutaneous retroperitoneal endoscopic necrosectomy. Searches were conducted of the following databases, covering the period from their commencement to 20 September 2010 and updated to 29 November 2010: 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). Relevant published studies identified during consultation or resolution that are published after this date may also be considered for inclusion.

The following selection criteria (table 1) were applied to the abstracts identified by the literature search. Where selection criteria could not be determined from the abstracts the full paper was retrieved.

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, or a laboratory or animal study.
	Conference abstracts were also excluded because of the difficulty of appraising study methodology, unless they reported specific adverse events that were not available in the published literature.
Patient	Patients with necrosis of the pancreas.
Intervention/test	Percutaneous retroperitoneal endoscopic necrosectomy
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.

Table 1 Inclusion criteria for identification of relevant studies

List of studies included in the overview

This overview is based on approximately 448 patients from 1 randomised controlled trial¹, and 4 non-randomised controlled studies^{2,3,4,5}.

Other studies that were considered to be relevant to the procedure but were not included in the main extraction table (table 2) have been listed in appendix A.

Table 2 Summary of key efficacy and safety findings on percutaneous retroperitoneal endoscopic necrosectomy

Abbreviations used: CI, confidence interval; CT, computed tomography; ICU, intensive care unit; NS, not significant;

Close visualization Comparison Comparison <t< th=""><th>Study details</th><th>Key efficacy fi</th><th>ndinge</th><th>ity, 100, inte</th><th></th><th>annt, NO,</th><th>Kov safety fi</th><th>ndinge</th><th></th><th></th><th></th><th>Comments</th></t<>	Study details	Key efficacy fi	ndinge	ity, 100, inte		annt, NO,	Kov safety fi	ndinge				Comments
Value Control of parameters Invasive Sector of parameters Pointer of parameters Pointer of parameters Randomised controlled trial Holland Surgical parameters In the open group there was a median of 1 necrosectomy more additional paratomic frague: To 17, 42.2% (1974) of patients Complications Surgical parameters Surgical parameters During index treatment Surgical parameters		Number of rotion		dum _ 00 / 44			Rey salety infulings				a 40 mm	
Randomised controlled trial Holland Instruction particular supported to a support of the support accreating parcreating parcreating and support tissue. ICU at time of randomisation a 50%, 50% pancreatic necrosis = 32% Surgical parameters Complications Complications Support teams massive Support t	Van Santvoort H C (2010) PANTER	invasive. 45 or	ents analysed len)	n = 88 (4)	s minimally		'minimally in	vasive'	ction re l	use of the	e term	Analysis on intention-to-
Name Surgical parameters Complications Surgical parameters Surgical	Pandomisod controlled trial		,,									treat principle.
Induation In the open group there was a median of 1 necrosectomy, procedure (range: 1 to 7), 42.2% (1945) of patients with procedure (range: 1 to 7), 42.2% (1945) of patients with procedure (range: 1 to 7), 42.2% (1945) of patients with procedure (range: 1 to 7), 42.2% (1945) of patients with procedure (range: 1 to 7), 42.2% (1945) of patients with multiple (54.3) During index treatment 19 participating sites, some control with site sites with procedure (range: 1 to 7), 42.2% (1945) of patients with multiple (54.3) 0.200 0.201 10 participating sites, some control with site sites with multiple (54.3) 10 participating sites, some control with sites with multiple (54.3) 10 participating sites, some control with multiple	Holland	Surgical paran	neters				Complication	าร				Study design issues:
Returnent period. 2006 0 2006 procedure (range: 1 to 7). 42.2% (1945) of patients Outcome Minimally portage (range: 1 to 7). 42.2% (1945) of patients Outcome Minimally open (1946) Control to 42.2% Conto 12.2% Control to 42.2%	Recruitment period: 2005 to 2009	In the open arou	up there was	a median c	of 1 necrosed	ctomy	During index t	reatment				19 participating sites, some
Study population: patients with necrotising pancreatic sentences required one or more additional laparotomises for ongoing percutaneous drainage after laparotomy. required one or more additional additional daparotanties for ongoing percutaneous drainage after laparotomy. New onset 11.6% 42.2% 0.28 0.001 Als % (15/43) of patients in the step-up group did not randomisation = 50%, >50%, pencratic necrosis = 32% Als % (15/43) of patients in the step-up group did not randomisation of the devent endescence failure were deemed too unstable for surgery (both subsequently died). The remaining 60.5% (26/43) of subsequently died). The remaining for ongoing sepsis, complications, or both. Bleeding 16.3%, 22.2% 0.63 0.32 Bleeding 16.3%, 22.2% 0.63 0.32 Subsequently cherch invasive deprint adminimally invasive denotes the redoscopic drainage followed-up by sarequired minimally invasive denotes the redoscopic drainage followed-up by sarequired minimally invasive denotes the redoscopic drainage followed-up by sarequired minimally invasive Fisk ratio (95% (1) Fisk ratio (95% Pancreatic (27.9%, 37.8% 0.74 0.43 (11/45) (0.04 to 1.60) Other issues: Additional patients to those reported in vasive endoscopic drainage followed-up (frequired) by minimally invasive	Study appulation, action to with	procedure (rang	ge: 1 to 7). 42	2.2% (19/45) of patients		Outcome	Minimall	v Open	Risk ra	tio n=	centres might have
suspected for confirmed infected necrotic tissue. ICU at time of radomisation = 50%, >50% pancreatic necrosis = 32% sepsis, complications, or both. 33% required additional pancreatic necrosis = 32% New onset: 11.6% 42.2% 0.28 0.01 central study centre with stratification for site, and access route for drainage - retroperitoneal, transabdominal, or endoscopic transgastric Age: 57 years (mean) 34.8% (15/43) of patients in the step-up group did not subsequently died). The remaining 60.5% (26/43) of patients underwent endoscopic transgastric New onset: 11.6% 42.2% 0.28 0.01 central study centre with stratification for site, and access route for drainage - retroperitoneal, transabdominal, or endoscopic transgastric Age: 57 years (mean) Samedian of 1 vide-cassisted retroperitoneal debridement procedure (range: 0 o 3) were carried out, becating and the tables below, 'minimally invasive' denotes the support. No chronic pancreatitis previous exploratory drainage or surgery, pancreatitis du to addominal surgery, or acute intra- addominal surgery, acute intra- supported by a state grant. Netwonest to the s	necrotising pancreatitis and	required one or	more additio	onal laparoto	omies for one	going	0 0.000.000	invasive	, opo	(95% C))	small number of patients.
$ \begin{array}{c} \text{necrotic tissue. ICU at time of randomisation a 50\%, 50\% \\ \text{pancreatic necrosis = 32\% \\ \textbf{n} = 88 (43 \text{ minimally invasive, 45 \\ open) \\ \text{Age: 57 years (mean)} \\ \text{Sex: 73\% male} \\ Patient selection criteria: either positive culture of pancreatic necrosis correction (sample of the step-up arguine) and stable for surgery (both underwent necrosectomy at 10 days after transabating 60.5\% (26/43) of patients in the step-up (both underwent necrosectomy at 10 days after transabation 11 video-assistied retroperitoneal debridement procedure (range: 0 to 3) were carried out. 32.6\% (14/43) of patients required one or more additional (14/43) (10/45) (0.31to to endoscopic transgastric. There were no significant or endoscopic transgastric dirange or more additional (14/43) (14/43) (14/43) (14/43) of patients required one or more addition (14/43) (14/43) (14/45) (0.31to to endoscopic transgastric. The tables below, 'minimally invasive' denotes the 'step-up' arm, involving trial of percutaneous or endoscopic trainage followed-up by as required one or more additional surgery, or acute intra-abdominal event. Follow-up: for months (median) (2000 mediane (37.6\% (14/43) (11/45) (0.47 mediane $	suspected or confirmed infected	sepsis, complic	ations, or bo rainage after	th. 33% req lanarotom	uired additio	nai	New onset	11.6%	42.2%	0.28	0.001	Block randomisation at
$ \begin{array}{c} \mbox{ration} ra$	necrotic tissue. ICU at time of	34.8% (15/43) c	of natients in	the sten-un	aroun did n	ot	multiple	(5/43)	(19/45)	(0.11		central study centre with
particition by particular of particular production invasivecomplicationsconstraints <thc< td=""><td>randomisation = 50%, $>50\%$</td><td>require necrose</td><td>ctomy, and 2</td><td>2 patients w</td><td>ith multiple c</td><td>organ</td><td>organ failure</td><td></td><td></td><td>to 0.67)</td><td></td><td>stratification for site, and</td></thc<>	randomisation = 50% , $>50\%$	require necrose	ctomy, and 2	2 patients w	ith multiple c	organ	organ failure			to 0.67)		stratification for site, and
age: 7 years (mean)Bleeding (1/43)16.3% (1/443)22.2% (1/443)0.73 (1/443)0.48 (1/443)transbominal. or endoscopic transgastric.Sex: 73% maleSex: 73% maleBleeding (1/443)16.3% (1/443)22.2% (1/443)0.73 (1/443)0.48 (1/443)transbominal. or endoscopic transgastric.transbominal. or endoscopic transgastric.transbominal. or endoscopic transgastric.Sex: 73% malePatient selection criteria: either positive culture of pancreatic (1/443)of patients required one or more additional operations for ongoing sepsis, complications, or both.Size.9% (1/443)22.2% (1/443)0.63 (1/443)0.22 (1/443)0.63 (1/443)0.22 (1/443)0.32 (1/443)Not powered to demostrate improvement in mortality.Support. No chronic pancreatitis previous exploratory laparotomy during the current episode, previous drainage or surgery, pancreatitis due to abdominal surgery, or acute intra- abdominal event.Median length 50 days of stay (range)Open (1 to 287)Risk ratio (95% Cl)PPancreatic (1/43)7.0 (1/43)24.4% (1/443)0.23 (1/443)Technique: step-up approach with percutaneous or endoscopic drainage followed up (if required) by inimally invasiveOutcomeMinimally (1 to 287)Open (1 to 287)Risk ratio (95% Cl)PTechnique: step-up approach with percutaneous or endoscopic drainage followed up (if required) by inimallyOpen (1 to 287)Risk ratio (95% Cl)PTechnique: step-up approach with percutaneous or endoscopic dr	n = 88 (43 minimally invasive. 45	failure were dee	emed too uns	stable for su	rgery (both	-	complications	5		0.07)		retroperitoneal,
Age: 57 years (mean) Sex: 73% maleSubscituting underwart necrosectomy at 10 days after drainage. A median of 1 video-assisted retroperitoneal debridement procedure (range: 0 to 3) were carried out. 32.6% (14/43) of patients required one or more additional operations for ongoing sepsis, complications, or both.(7/43)(10/45)(0.31 to (0.53)Inderwart necrosectomy at 10 days after interventionSubscitution criteria: either positive culture of parcreatic parceatic issue, or suspected infected necrosis with persistent sepsis or clinical deterioration despite maximal support. No chronic pancreatitis, previous exploratory laparotomy drainage or surgery, pancreatitis due to abdominal surgery, or acute intra- abdominal event.In the tables below, 'minimally invasive' denotes the minimally invasive retroperitoneal necrosectomy.At 6-month follow-up (12/43)(10/45)(0.31 to (0.53)Not powered to demonstrate improvement in mortality.Technique: step-up approach with percutaneous or endoscopic drainage followed up (if required) by minimally invasive entroperitoneal necrosectomy vs open necrosectomy.Maior Minimally invasiveOpen Risk ratio (95%Risk ratio (95%Pa ratio (12/43)Not (11/45)0.33 (11/45)Technique: step-up approach with percutaneous or endoscopic drainage followed up (if required) by minimally invasiveMaior (13/43)Open (15%)Risk ratio (95%Pa (11/45)New-onset (12/43)16.3% (11/45)0.43 (11/45)Other issues: Additional patients underwent necrosectomy.Technique: step-up approach with perside followed up (if required) by minimally invasive <td< td=""><td>open)</td><td>underwent endo</td><td>oscopic trans</td><td>gastric drai</td><td>nage; both % (26/43) of</td><td>f</td><td>Bleeding</td><td>16.3%</td><td>22.2%</td><td>0.73</td><td>0.48</td><td>transabdominal, or</td></td<>	open)	underwent endo	oscopic trans	gastric drai	nage; both % (26/43) of	f	Bleeding	16.3%	22.2%	0.73	0.48	transabdominal, or
Sex: 73% male Patient selection criteria: either positive culture of pancreatic / period ment procedure (range: 0 to 3) were carried out. 2.6% (14/43) of patients required one or more additional operations for ongoing sepsis, complications, or both. Intervention 32.6% (14/43) of patients required one or more additional operations for ongoing sepsis, complications, or both. Fistula or 32.6% (14/43) of patients required one or more additional operations for ongoing sepsis, complications, or both. Not powered to monstrate improvement in mortality. Persistent sepsis or clinical deterioration despite maximal support. No chronic pancreatitis due or surgery, pancreatitis due or surgery, pancreatitis due or surgery, pancreatitis due or surgery, pancreatitis due or discopic drainage followed-up byas required minimally invasive Mainmally invasive retroperitoneal minimally invasive retroperitoneal minimally invasive retroperitoneal minimally invasive Mainmally invasive retroperitoneal minimally invasive retroperitoneal minimally invasive retroperitoneal minimally invasive Not powered to monstrate improvement in mortality. Technique: step-up approach with percutaneous or endoscopic drainage followed up invasive retroperitoneal necrosectomy vs open necrosectomy vs open necrosectomy us popt. Follow-up: for monts (median) Other issues: Additional patients required on invasive or (95% Cl) Not on 27.9% (37.4% 0.43 0.43 0.29 0.03 Other issues: Additional patients required on invasive or clinical criteria at baseline. Technique: step-up approach with percutaneous or endoscopic drainage support. No congle support to by a state grant. Mainmally Open (95% Cl) Risk ra	Age: 57 years (mean)	patients underw	eu). me ren ent necrose	ctomy at 10	days after		requiring	(7/43)	(10/45)	(0.31to		endoscopic transgastric.
Patient selection criteria: either positive culture of pancreatic pancreatic pancreatic pancreatic sepsis or clinical deterioration despite maximal support. No chronic pancreatins, previous exploratory laparotomy during the current episode, previous drainage or surgery, pancreatins during to abdominal event.Her tables below, 'minimally invasive' denotes the invasive retroperitoneal necrosectomy.Fistula or a 22.2%22.2% (1/4/3)0.120 (1/4/3)Study population issues: Patients were assessed for randomisation by a panel of 8 experts.In the tables below, 'minimally invasive' retroperitoneal necrosectomy.In the tables below, 'minimally invasive' denotes the 'step-up' arm, involving trial of percutaneous or endoscopic drainage followed up (if required) by minimally invasiveAt 6-month follow-up OutcomeAt 6-month follow-upAt 6-month follow-upThere were no significant differences between the groups in terms of demographic or clinical criteria at baseline.Technique: step-up approach with necrosectomy vs open necrosectomy.OutcomeMinimally (1 to 287)Open (1 to 287)Risk ratio (95% Cl)Pancreatic (17/43)C.9,% (1/4/3)Other issues: Additional patients to those reported invasiveFollow-up: 6 months (median) conflict of interest/source of funding: supported by a state grant.Minimally (17/43)Open (31/45)Risk ratio (95% Cl)Pancreatic (27.9% (37.4%)0.03 (1/4/3)Other issues: Additional patients to those reported invasiveConflict of interest/source of funding: supported by a state grant.Minimally (17/43)Open (31/45)Risk ratio (95% Cl)Panc	Sex: 73% male	drainage. A me	dian of 1 vide	eo-assisted	retroperiton	eal	intervention	00 00 <i>(</i>	<u> </u>	1.75)		Not powered to
positive culture of pancreatic / peri- pancreatic necrotic tissue, or suspected infected necrosis with persistent sepsis or clinical deterioration despite maximal support. No chronic pancreatitis, previous exploratory laparotomy during the current episode, previous drainage or surgery, pancreatitis due to abdominal surgery, or acute intra- abdominal surgery, or acute intra- followed up (if required) by minimally In the tables below, 'minimally invasive' denotes the 'step-up' arm, involving trial of percutaneous or endoscopic drainage followed-up byas required minimally In the tables below, 'minimally invasive' denotes the 'step-up' arm, involving trial of percutaneous or endoscopic drainage followed up (if required) by minimally In the tables below, 'minimally invasive' denotes the 'step-up' arm, involving trial of percutaneous or endoscopic drainage followed up (if required) by minimally In the tables below, 'minimally invasive' denotes the 'step-up' arm, involving trial of percutaneous or endoscopic drainage followed up (if required) by minimally invasive retroperitoneal necrosectomy. Not 0.53 At 6-month follow-up (12/5% Cl) At 6-month follow-up (05% Cl) At 6-month follow-up (0.40 to 1.36) Other issues: Additional patients to those reported in van Santvoort (2007). Follow-up (10/2% Cl) Treatment success 60 days (11/45) Not 0.53 Pancreatic (12/43) 7.0 24.4% (11/45) 0.02 Other issues: Additional invasive Follow-up (supertrotaneous or endoscopic drainage followed	Patient selection criteria: either	debridement pro	ocedure (ran	ge: 0 to 3) v	vere carried	out.	Fistula or	32.6% (14/43)	22.2%	0.63	0.32	in mortality.
participation feeted necrosis with persistent sepsis or clinical deterioration despite maximal support. No chronic pancreatitis, previous exploratory laparotomy during the current episode, previous trainage or surgery, pancreatitis due to abdominal surgery, or acute intra- abdominal event. In the tables below, 'minimally invasive' denotes the 'step-up' arm, involving trial of percurateneous or endoscopic drainage followed-up byas returneed necrosectomy. At 6-month follow-up unimally invasive retropertoneal necrosectomy. At 6-month follow-up (95% CI) At 6-month follow-up (95% CI) There were no significant differences between the groups in terms of demographic or clinical criteria at baseline. Technique: step-up approach with percutaneous or endoscopic drainage followed up (if required) by minimally invasive retroperitoneal necrosectomy. Outcome Minimally invasive Open (95% CI) Pancreatic (95% CI) 27.9% (1 to 247) 37.8% (1/1/45) 0.74 (0.40 to 1.36) 0.33 (1/1/45) Other issues: Additional patients to those reported in vasive uncrosectomy. Follow-up: 6 months (median) Conflict of interest/source of funding: supported by a state grant. Major 0 39.5% (10/2) 39.5% (1/2/3) 0.5% (1/2/43) 0.24 (3/43) 0.43 (1/2/43) 0.24 (1/2/43) 0.002 (3/43) Deeth 18.6% 15.6% 1.20 (0.48 0.70 0.24 8 0.70 0.33 (3/43) 0.21 (1/5/5) 0.002 (3/43) 0.002 (3/43)	positive culture of pancreatic / peri-	operations for o	operations for ongoing sepsis, complications, or both				requiring to					Study population issues:
In the tables below, 'minimally invasive' denotes the deterioration despite maximal support. No chronic pancreatitis, previous exploratory laparotomy during the current episode, previous drainage or surgery, pancreatitis due abdominal event.In the tables below, 'minimally invasive' denotes the 'step-up' arm, involving trial of percutaneous or endoscopic drainage followed-up byas required minimally invasiveAt 6-month follow-up DutcomeAt 6-month follow-upIn the tables below, 'minimally invasive' denotes the 'step-up' arm, involving trial of percutaneous or endoscopic drainage followed up (if required) by minimally invasive retroperitoneal necrosectomy.In the tables below, 'minimally invasive' denotes the 'step-up' arm, involving trial of percutaneous or endoscopic drainage followed up (if required) by minimally invasive retroperitoneal necrosectomy vs open necrosectomy.In the tables below, 'minimally invasive' denotes the 'step-up' arm, involving trial of percutaneous or endoscopic drainage followed up (if required) by minimally invasive retroperitoneal necrosectomy vs open necrosectomy.In the tables below, 'minimally invasive' denotes the 'step-up' arm, involving trial of percutaneous or endoscopic drainage followed up (if required) by minimally invasive retroperitoneal necrosectomy vs open necrosectomy.In the tables below, 'minimally invasive' denotes the 'step-up' arm, involving trial of percutaneous or (95% Cl)At 6-month follow-up clAt 6-month follow-up clThere were no significant differences between the groups in terms of demographical (12/43)There were no significant (11/45)There were no significant differences between the groups in terms of demographical (12/43)At 6-month follow-upCo	pancreatic necrotic tissue, or suspected infected necrosis with	In the tables below, 'minimally invasive' denotes the					intervention 1.58)					Patients were assessed for
deterioration despite maximal support. No chronic pancreatitis, previous exploratory laparotomy during the current episode, previous drainage or surgery, pancreatitis due to abdominal surgery, or acute intra- abdominal surgery, or acute intra- necrosectomy vs open necrosectomy.	persistent sepsis or clinical											randomisation by a panel of
support. No chronic pancreatitis, previous exploratory laparotomy during the current episode, previous drainage or surgery, pancreatitis due to abdominal surgery, or acute intra-abdominal event. endoscopic drainage followed-up by as required minimally invasive retroperitoneal necrosectomy. At 6-month follow-up Outcome Minimally Outcome Minimally invasive retroperitoneal necrosectomy. At 6-month follow-up Outcome Minimally Open invasive Risk ratio p= (95% CI) Outcome Minimally invasive Pancreatic 27.9% (12/43) 37.8% (17/45) 0.74 (0.40 to 1.36) 0.33 (0.40 to 1.36) Other issues: Additional patients to hose reported in van Santvoort (2007). Technique: step-up approach with percutaneous or endoscopic drainage followed up (if required) by minimally invasive retroperitoneal necrosectomy vs open necrosectomy. Minimally Open invasive Risk ratio p= (95% CI) Pancreatic (3/43) (11/45) 0.09 to 0.95) Other issues: Additional patients to hose reported in van Santvoort (2007). Of the patients randomised to minimally invasive increasectomy. Outcome Major 39.5% 68.9% 0.57 (0.38 0.006 New-onset invasive (7/43) (15/45) 0.02 to 0.93 Use of 7.0 33.3% 0.21 0.002 to 0.94 Use of 7.0 33.3% 0.21 0.002 to 0.94 Use of 7.0 33.3% 0.21 0.002 to 0.94 endoscopic transgastric. endoscopic transgastric.	deterioration despite maximal	'step-up' arm,	involving tr	ial of percu	taneous or							o expens.
Imminally invasive retroperious exploratory parceasitis due to abdominal surgery, or acute intra- abdominal event. Outcome Minimally Open (95% Cl) Risk ratio (95% Cl) Pancreatic 27.9% (12/43) Risk (17/45) 0.40 to (1.14/5) Other issues: Additional patients to those reported in vasive retroperioneal necrosectomy. Felow-up: 6 months (median) Conflict of interest/source of funding: supported by a state grant. Minimally Open (17/43) Risk ratio (95% Cl) Pancreatic (3/43) 0.74 0.33 Other issues: Additional patients to those reported in vasive reported in vasive reported in vasive retroperitoneal necrosectomy. Outcome Minimally Open (95% Cl) Pancreatic (3/43) 7.0 24.4% 0.29 0.03 Of the patients randomised to minimally invasive reported in vasive reported in vasive reported in vasive reported in vasive necrosectomy. Follow-up: 6 months (median) Outcome Minimally Open (95% Cl) Risk ratio (95% Cl) Pancreatic (3/43) 0.43 0.02 Of the patients randomised to minimally to minimally to minimally invasive necrosectomy. Follow-up: 6 months (median) Major (17/43) 0.31/45) 0.57 0.57 0.38 0.006 0.74 0.33 0.02 0.021 0.022 0.021 0.021 0.021 0.021 0.022 0.021	support. No chronic pancreatitis,	endoscopic dr	ainage follo	wed-up by	as required		At 6-month follow-up					differences between the
drainage or surgery, pancreatitis due to abdominal surgery, or acute intra- abdominal event.OutcomeMinimally invasiveOpen (95% CI)Risk ratio (95% CI)p=InvasiveInvasiveGenographic or clinical (95%)demographic or clinical criteria at baseline.Technique: step-up approach with percutaneous or endoscopic drainage followed up (if required) by minimally invasive retroperitoneal necrosectomy vs open necrosectomy.OutcomeMinimally invasiveOpen (1 to 287)Risk ratio (95% CI)p=Pancreatic fistula27.9% (12/43)37.8% (17/45)0.74 (0.40 to 1.36)0.33 (11/45)Other issues: Additional patients to those reported in van Santvoort (2007).Follow-up: 6 months (median) Conflict of interest/source of funding: supported by a state grant.Minimally invasiveOpen (17/43)Risk ratio (95% CI)P=New-onset (95% CI)16.3% (3/43)37.8% (11/45)0.43 (0.95)0.02 (11/45)Of the patients randomised to minmally invasive necrosectomy, 93% underwent retroperitoneal drainage, 2% transabdominal, and 5% endoscopic transgastric.	during the current episode, previous	IIIIIIIIIIaiiy iiiva	sive reliope	entonearne	crosectom	y.	Outcome	Minimally	Open	Risk	p=	groups in terms of
to abdominal surgery, or acute intra- abdominal event.OutcomeMinimally invasiveOpen (150 % Cl)Risk ratio (95% Cl)p=(100 m m m m m m m m m m m m m m m m m m	drainage or surgery, pancreatitis due	Outcomo	Minimally	Onen	Dick ratio	n		invasive		ratio (95%		demographic or clinical
Addominal event.Median length50 days of stay (range)60 days (1 to 287)Not (1 to 247)0.53 applicablePancreatic (12/43)27.9% (12/43)37.8% (17/45)0.74 (0.40 to 1.36)0.33 patients to those reported in van Santvoort (2007).Treatment successTreatment successIncisional invasive7.0 (3/43)24.4% (11/45)0.29 (0.95)0.03 (11/45)Other issues: Additional patients to those reported in van Santvoort (2007).Follow-up: 6 months (median) Conflict of interest/source of funding: supported by a state grant.Minimally invasiveOpen (17/43)Risk ratio (95% CI)p= (95% CI)New-onset (17/43)16.3% (17/43)37.8% (17/45)0.43 (0.20 to (17/45)0.02 (0.20 to (0.94)0.02 transabdominal, and 5% endoscopic transgastric.0.02 transabdominal, and 5% endoscopic transgastric.	to abdominal surgery, or acute intra-	Outcome	invasive	Open	(95% CI)	p=				(0070 CI)		criteria at baseline.
Technique: step-up approach with percutaneous or endoscopic drainage followed up (if required) by minimally invasive retroperitoneal necrosectomy vs open necrosectomy.of stay (range) (1 to 287) (1 to 247) applicablefistula(12/43) (17/45) (0.40 to 1.36)Out on 1.36)patients suces. Additional patients to those reported in van Santvoort (2007).Follow-up: 6 months (median) Conflict of interest/source of funding: supported by a state grant.Minimally (17/43)Open (17/43)Risk ratio (95% Cl)p= (95% Cl)New-onset (7/43)16.3% (17/43)37.8% (0.20 to (17/45)0.43 (0.20 to (0.94)0.02 (17/45)Outcome (17/43)Minimally (17/43)Open (17/43)Risk ratio (95% Cl)p= (95% Cl)New-onset (17/43)16.3% (17/43)37.8% (0.20 to (0.94)0.43 (0.20 to (0.94)0.02 (17/45)Outcome (0.20 to (0.94)Outcome (17/43)Major (17/43)39.5% (17/43)68.9% (17/43)0.57 (0.38 (0.87)0.006Use of (3/43)7.0 (3/43)33.3% 	abdominar event.	Median length	50 days	60 days	Not	0.53	Pancreatic	27.9%	37.8%	0.74	0.33	Other issues: Additional
Treatment successIncisional formation of the particulation of the pa	Technique: sten-up approach with	of stay (range)	(1 to 287)	(1 to 247)	applicable		fistula	(12/43)	(17/45)	(0.40 to		patients to those reported
followed up (if required) by minimally invasive retroperitoneal necrosectomy vs open necrosectomy.Treatment successIncisional (3/43)7.024.4% (0.29)0.03 (0.09 to 0.95)Of the patients randomised to minimally invasive necrosectomy, 93% underwent retroperitoneal supported by a state grant.Open invasiveRisk ratio (95% Cl)p= (95% Cl)New-onset (17/43)16.3% (17/43)37.8% (17/45)0.43 (0.20 to 0.94)Of the patients randomised to minimally invasive necrosectomy, 93% underwent retroperitoneal drainage, 2% transabdominal, and 5% endoscopic transgastric.Major or death39.5% (17/43)68.9% (31/45)0.57 (0.38 to 0.87)0.006 (0.87)Use of pancreatic (3/43)33.3% (15/45)0.21 (0.07 to o.67)0.002 endoscopic transgastric.	percutaneous or endoscopic drainage									1.36)		in van Santvoort (2007).
Invasive retroperitoneal necrosectomy vs open necrosectomy. Treatment success New-onset (95% Cl) 16.3% (95% Cl) 37.8% (17/43) 0.43 (0.20 to (17/43) 0.02 (17/45) to minimally invasive necrosectomy, 93% underwent retroperitoneal drainage, 2% transabdominal, and 5% Conflict of interest/source of funding: supported by a state grant. Major 39.5% 68.9% 0.57 (0.38 0.006 15.6% 1.20 (0.48 0.70 Use of enzymes 7.0 33.3% 0.21 0.002 endoscopic transgastric.	followed up (if required) by minimally						Incisional	7.0 (3/43)	24.4%	0.29 (0.09 to	0.03	Of the patients randomised
Follow-up: 6 months (median) Conflict of interest/source of funding: supported by a state grant.OutcomeMinimally invasiveOpen (95% Cl)Risk ratio (95% Cl)p= (95% Cl)New-onset (17/43)16.3% (17/43)37.8% (0.20 to 0.94)0.43 (0.20 to 0.94)0.02 underwent retroperitoneal drainage, 2% transabdominal, and 5% endoscopic transgastric.Wajor or death39.5% (17/43)68.9% (31/45)0.57 (0.38 to 0.87)0.006New-onset (17/43)16.3% (17/43)37.8% (0.20 to 0.94)0.43 (0.20 to 0.94)0.02 underwent retroperitoneal drainage, 2% transabdominal, and 5% endoscopic transgastric.	invasive retroperitoneal	Treatment suc	cess				norma	(0/40)	(11/40)	0.95)		to minimally invasive
Pollow-up: 0 months (median)invasive(95% Cl)diabetes(7/43)(17/45)(0.20 to 0.94)diabetes (rainage, 2%) transabdominal, and 5% endoscopic transgastric.Conflict of interest/source of funding: supported by a state grant.Major (17/43)39.5%68.9% (31/45)0.57 (0.38 0.006) to 0.87)Use of enzymes7.0 (3/43)33.3% (15/45)0.21 0.002 enzymesdrainage, 2% transabdominal, and 5% endoscopic transgastric.	Follow-up: 6 months (modian)	Outcome	Minimally	Open	Risk ratio	p=	New-onset	16.3%	37.8%	0.43	0.02	underwent retroperitoneal
Supported by a state grant. Major 39.5% 68.9% 0.57 (0.38 0.006 0.94) transabdominal, and 5% Supported by a state grant. (17/43) (31/45) to 0.87) Use of 7.0 33.3% 0.21 0.002 endoscopic transgastric. Or death Death 18.6% 15.6% 1.20 (0.48 0.70 enzymes 0.67) 0.67)	Conflict of interest/source of funding:		invasive		(95% CI)		diabetes	(7/43)	(17/45)	(0.20 to		drainage, 2%
Desth 18.6% 15.6% 1.20 (0.48 0.70 Use of 7.0 33.3% 0.21 0.002 endoscopic transgastric. Death 18.6% 15.6% 1.20 (0.48 0.70 enzymes 0.67) 0.67) 0.67)	supported by a state grant.	Major	39.5% (17/43)	68.9% (31/45)	0.57 (0.38 to 0.87)	0.006			00.00 <i>/</i>	0.94)		transabdominal, and 5%
Death 18.6% 15.6% 1.20 (0.48 0.70 enzymes 0.67)		or death	(17,40)	(01/40)	10 0.07		Use of	7.0 (3/43)	33.3%	0.21 (0.07 to	0.002	endoscopic transgastric.
		Death	18.6%	15.6%	1.20 (0.48	0.70	enzymes	(0/10)	(10/40)	0.67)		

IP overview: percutaneous retroperitoneal endoscopic necrosectomy

Page 5 of 21

IP 103_2	2
----------	---

Abbreviations used: CI, confidence interval; CT, computed tomography; ICU, intensive care unit; NS, not significant;							
Study details	Key efficacy fir	ndings				Key safety findings	Comments
		(8/43)	(7/45)	to 3.01)			
	Median length	50 days	60 days	Not	0.53		
	of stay (range)	(1 to 287)	(1 to 247)	applicable			

Abbreviations used: CI, confidence interval; CT, computed tomography; ICU, intensive care unit; NS, not significant;									
Study details	Key efficacy fi	ndings			Key safety findings				Comments
Raraty M G T (2010) ⁵	Number of patie	ents analysed: n =	189 (137 minin	nally	Complications				Follow-up issues
	invasive, 52 op	ben)			Outcome	Minimally	Open	p=	Retrospective analysis of prospective database
Non-randomised controlled study	0					invasive	0.00/	0.400	
UK	Surgical paran	neters			Myocardial	2.9%	9.6% (5/52)	0.122	Intention to treat analysis
Recruitment period: 1997 to 2008	In the minimally	invasive group 13	3.9% (19/137) re an additional on	equired	Cerebrovascular	1 5%	3.8%	0.652	intention to treat analysis.
Study population: patients with	procedure. 6 pa	atients due to inabi	ility to place quic	dewire or	event	(2/137)	(2/52)	0.052	Study design issues
pancreatic necrosis >50% pancreatic	dilate the track,	4 for bleeding, 4 f	or remote collec	tions not	Pseudocyst	2.2%	9.6%	0.063	Selection criteria for open
Infected necrosis = 57% .	amenable to pe	rcutaneous draina	ige, 2 for second	dary		(3/137)	(5/52)		necrosectomy based on
	and 1 for coloni	c fistula	contis requiring i	resection,	Bleeding	11.7%	17.3%	0.436	lack of safe percutaneous
n = 189 (137 minimally invasive, 52	Group median ((and range)				(16/137)	(9/52)		other indication for open
open)	Outcome	Minimally	Open	n=	Biliary stricture	2.2%	9.6%	0.253	surgery.
Age: 58 years (mean)	Catoonio	invasive	opon	۲-	Demonstria	(3/137)	(5/52)	0 40 4	
Sex: 62% male	Length of stay	94.5 (16 to 300)	85 (8 to 222)	0.011	fistula	3.6% (5/137)	7.7% (4/52)	0.434	Study population issues:
	(days)				Enteric fistula	7.3%	9.6%	0 865	Prophylactic antibiotics not
Patient selection criteria: patients with	Time to	64 (15 to 272)	43 (5 to 158)	0.004		(10/137)	(5/52)	0.000	routinely used , number in
positive culture or extraintestinal sag	discharge post				Pulmonary	0.7%	1.9%	0.621	each group not reported.
on CT scan, or sterile necrosis with		13 1% (50/137)	76 0% (40/52)	~0.0001	embolus	(1/137)	(1/52)		No significant difference
conservative treatment for 3 to 4	Number of	43.1%(39/137)	10.3% (40/32)	<0.0001	Colonic necrosis	2.9%	5.8%	0.621	terms of demographics,
weeks.	procedures	3 (1 10 9)	1 (110 9)	<0.0001		(4/137)	(3/52)		aetiology, or clinical
	•				Vein thrombosis	5.1% (7/137)	7.7% (4/52)	0.741	characteristics at baseline.
Technique: under general anesthesia					Infection	2.0%	1 0%	0 803	APACHE II score which
with access via left flank and under					mection	(4/137)	(1/52)	0.095	was significantly lower in
removal of necrosis with forceps	Treatment suc	cess			Other	7.3%	15.4%	0.313	the minimally invasive
followed by insertion of an irrigating	Outcome	Minimally invasive	Open	p=		(10/137)	(8/52)		group (p=0.038).
drain vs. open necrosectomy.	Death	19.0% (26/137)	38.5% (20/52	. 0.009	Any	54.7%	82.7%	0.0007	
	Multisystem	31%	56%	<0.0001	complication	(75/137)	(43/52)		Other issues:
Follow-up: not reported	organ failure								postoperative multiple
	Patient age (p<	0.0001), baseline	multiple organ fa	ailure					organ failure do not resolve
Conflict of interest/source of funding:	(p<0.0001), and	d Minimally invasiv	e necrosectomy	/					with the numerators stated.
Official deal by a flational grant	(p=0.010) were	independent pred		ly.					

Abbreviations used: CI, confidence interval; CT, computed tomography; ICU, intensive care unit; NS, not significant;									
Study details	Key efficacy findings				Key safety findings				Comments
Connor S C (2005) ²	Number of patie invasive, 41 op	ents analysed: n = pen)	88 (47 minimally	,	Complications				Follow-up issues: Retrospective database
Non-randomised controlled study					Outcome	Minimally invasive	Open	p=	analysis.
Recruitment period: 1997 to 2003	Surgical param	neters			Overall	91.4%	95.1% (20/41)	NS	Study design issues: Selection criteria for
Study population: patients with pancreatic necrosis >50% pancreatic necrosis = 81%	In the minimally median of 3 pro the open necros	invasive necrosed cedures per patien sectomy group the	ctomy group there nt (range: 1 to 9), v re was a median o	was a while in of 1	Organ failure	(43/47) 42.6% (20/47)	(39/41) 58.6% (24/41)	NS	minimally invasive or open necrosectomy not reported.
n = 99 (47 minimally invasive 41)	procedure (rang reported).	e: 1 to 9) (measu	rement of significa	ince not	Cardiovascular	14.9% (7/47)	17.1% (7/41)	NS	Study population issues: 66 patients received
open)	Group median s Outcome	cores Minimally	Open	p=	Pulmonary	2.1% (1/47)	7.3% (3/41)	NS	prophylactic antibiotics, number in each group not reported
Sex: 61% male	ICU stay	invasive 0 days (0 to 66)	4 days (0 to 56)	<0.01	Bleeding	12.8% (6/47)	9.8% (4/41)	NS	Significantly more patients in the minimally invasive
Patient selection criteria: patients with	(range) Length of stay	64 days (15 to	50 days (5 to	0.04	Vein thrombosis	21.3% (10/47)	2.4% (1/41)	<0.01	group had >50% necrosis $(p = 0.03)$.
with persisting symptoms despite	(range)	272)	158)		Colonic necrosis	4.3% (2/47)	0% (0/41)	NS	Other issues:
	Treatment suc	cess			Gastrointestinal 4.3% 4.9% NS				Possibly some of the same
Technique: minimally invasive necrosectomy (not otherwise defined)	Group medians Outcome	and range or prop Minimally invasive	oortion of patients Open	p=	fistula Overall the rate of	(2/47) f complicatio	(2/41)		patients reported in Raraty (2010)
antibiotics in patients with proven infection in both groups.	Death Postoperative APACHE II	19.1% (9/47) 7 (0 to 22)	39.0% (16/41) 10 (0 to 21)	0.06 0.02	significantly lower 89.5% (17/19) tha 92.6% (63/68) (p	in patients w n in those w = 0.65).	with sterile r <i>i</i> ith infected	necrosis necrosis	
Follow-up: 29 months (median)	score								
Conflict of interest/source of funding: not reported.									

Abbreviations used: CI, confidence interval; CT, computed tomography; ICU, intensive care unit; NS, not significant;										
Study details	Key efficacy findings	i			Key safety finding	S		Comments		
Van Santvoort H C (2007) ³	Number of patients and 15 open)	alysed: n = 30 (15	5 percutaneous	s,	Complications Percutaneous gr	oup	Follow-up issues: Retrospective database			
Non-randomised controlled study Holland	Surgical parameters	Surgical parameters					26.7% (4/15) of patients required additional laparotomy during the postoperative course.			
Recruitment period: 1995 to 2005 Study population: patients with proven or suspected pancreatic and / or peripancreatic necrosis. Median time between admission and primary necrosectomy = 41 days.	Conversion to open su in the percutaneous gr laparotomy was requir group, where it was de approach was not feas	rgery was not req oup 0% (0/15). Ad ed in 1 patient in t remed that further ible.	uired in any pa dditional treatm the percutaneou debridement b	tients ent by us by this	Complication Total Bowel perforation	Percutaneous 53.3% (8/15) 6.7% (1/15)	Laparotomy 46.7% (7/15) 13.3% (2/15)	Pair-matched analysis. Overlapping recruitment period, percutaneous technique introduced in 2001. Possibility of confounding from a historical control was		
n = 30 (15 percutaneous vs 15	Treatment success				Colonic	26.7% (4/15)	6.7% (1/15) 6.7% (1/15)	assessed.		
open laparotomy) Age: 52 years median	Rate per patients treat Outcome	ed or Group medi Percutaneous	an (and range) Laparotomy	p=	necrosis	6 7% (1/15)	20.0% (3/15)	Matching of cases based on organ failure, infection,		
Sex: 44% male	Reintervention for postoperative	20.0% (3/15)	40.0% (6/15)	0.427	fistula	13.3% (2/15)	0% (0/15)	severity of condition on CT imaging.		
Patient selection criteria: not reported.	Reintervention for further necrosectomy	73.3% (11/15)	86.7% (13/15)	0.651	fistula Of the 4 bleeding	g events in the p	percutaneous	Surgical strategy was based on the surgeon's		
Technique: 5 cm incision.	Total necrosectomies	2 (1to 9)	2 (1 to 13)	0.624	procedures.		anaparotomy	Study population issues:		
retroperitoneal space entered. Debridement with forceps using a	Total surgical interventions	3 (1 to 11)	4 (1 -14)	0.345	There were no s	tatistically signif	icant	Patients were matched on all criteria used, and there		
'videoscope' and drains placed, vs laparotomy with blunt debridement	Postoperative multiple organ failure	13.3% (2/15)	66.7% (10/15)	0.008	differences betw follow-up of ever	een the groups.	Length of	were no differences between the groups in		
and continuous postoperative lavage.	Postoperative ICU admission	73.3% (11/15)	80.0% (12/15)	1.000		·		terms of sex, aetiology, organ failure, ICU		
Follow-up: to discharge Conflict of interest/source of funding:	Postoperative hospital stay	57 days (18 to 162)	54 days (20 to 150)	0.926				admission, white blood cell count, or APACHE II score.		
not reported.	(survivors) Length of stay (survivors)	110 days (45 to 240)	106 (46 to 231)	0.600				Preoperative percutaneous drainage was used in		
	In-hospital mortality	6.7% (1/15)	40.0% (6/15)	0.080				6 patients in the open group, and 22 patients in the percutaneous group.		

Abbreviations used: CI, confidence interval; CT, computed tomography; ICU, intensive care unit; NS, not significant;							
Study details	Key efficacy findings	Key safety findings	Comments				
Gambiez L P (1998) ⁴	Number of patients analysed: 53 (20 percutaneous)	Complications	This study was included in the original overview.				
Non-randomised controlled study France Recruitment period: 1990 to 1995	Survival (follow-up period not reported): 100% (14/14) with supportive therapy 80.0% (8/10) with percutaneous drainage 90.0% (18/20) with PPN 66.7% (6/9) with open necrosectomy	Percutaneous drainage: Incisional hernia 10.0% (1/10) PPN: Colonic fistula 5.0% (1/20)	Follow-up issues: Single study centre retrospective analysis.				
Study population: Patients with acute necrotising pancreatitis, mean Ranson score 3.3 points. Cause alcohol (n = 24), Gallstones (n = 17), Other (n = 12). n = 53 (20 PPN) Age: 49 years (mean)	Mortality was significantly higher in patients with infected necrosis 31.8% (7/22) than in those with sterile collections 0% (0/17) ($p < 0.05$). Length of stay Group mean (standard deviation) inpatient stay: 23 (± 9) days with supportive therapy	Splenic bleed 5.0% (1/20) Subsequent laparotomy 10% (2/20) Pancreatic fistula to skin 10% (2/20) Incisional hernia 10% (2/20) Open necrosectomy: Incisional hernia 22.2% (2/9)	Patients received one of the four different management strategies according to their clinical features, including severity of disease.				
Patient selection criteria: pancreatic necrosis demonstrated on CT scan, and microbiologic examination.	89 (\pm 24) days with percutaneous drainage 62 (\pm 21) days with PPN 86 (\pm 32) days with open necrosectomy The mean hospital length of stay was significantly shorter in the PPN group than the percutaneous drainage, or the open necrosectomy groups (p < 0.05).		Patients who had PPN are likely to differ in prognostic factors from people who had open necrosectomy or percutaneous drainage. AGE, Ranson score, CT				
Technique: Endoscopic retroperitoneal necrosectomy by retroperitoneal approach through a short lumbotomy using a direct vision endoscope. Necrotic tissue and collections removed by blunt			clinical features were significantly different between the groups at baseline.				
tube that was also equipped for electrocoagulation. After debridement, a drain allowing continuous irrigation was left in the retroperitoneal space.			Other issues: Operator experience with the four treatment types is not reported.				
Follow-up: to discharge Conflict of interest/source of funding: not reported.							

Efficacy

Mortality

A randomised controlled trial of 88 patients reported that there was no statistically significant difference in the rate of mortality between patients treated by a step-up protocol with minimally invasive retroperitoneal necrosectomy where percutaneous drainage failed (19% [8/43]) and those treated by open necrosectomy (16% [7/45]) (p = 0.70); length of follow-up for this specific outcome is not explicitly reported, but patients in the study were followed-up for up to 6 months from hospital discharge¹. In this study 60% (26/43) of patients underwent percutaneous retroperitoneal endoscopic necrosectomy, 35% (15/43) of patients required drainage alone and 5% (2/43) of patients with multiple organ failure were too unstable for surgery. A non-randomised controlled study of 189 patients reported mortality in 19% (26/137) of patients treated by minimally invasive pancreatic necrosectomy and 38% (20/52) of patients undergoing open necrosectomy (p=0.009) (follow up not reported)⁵. A non-randomised controlled study of 30 patients reported that there was no statistically significant difference in the rate of in-hospital mortality between patients treated by percutaneous retroperitoneal endoscopic necrosectomy (7% [1/15]) and those receiving open necrosectomy (40% [6/15]) (p = 0.08)³.

A non-randomised controlled study of 53 patients reported a survival rate of 90% (18/20) following percutaneous retroperitoneal endoscopic necrosectomy, 80% (8/10) following percutaneous drainage alone, and 67% (6/9) following open necrosectomy (measurement of significance not reported); follow-up to discharge⁴.

Clinical outcome

The non-randomised controlled study of 30 patients reported that there was significantly less postoperative multiple organ failure following percutaneous retroperitoneal endoscopic necrosectomy (13% [2/15]) than following open necrosectomy via laparotomy (67% [10/15]) (p = 0.008)³.

Composite endpoint

The randomised controlled trial of 88 patients reported that the rate of major complication or death was significantly lower in patients treated by a step-up protocol with minimally invasive retroperitoneal necrosectomy where percutaneous drainage failed (40% [17/43]) than in patients undergoing open necrosectomy (69% [31/45]) (p = 0.006); length of follow up not reported¹.

Safety

Fistula / perforation IP overview: percutaneous retroperitoneal endoscopic necrosectomy Page 11 of 21 The randomised controlled trial of 88 patients reported that there was no statistically significant difference in the rate of fistula formation or perforation requiring intervention between patients treated by a step-up protocol with minimally invasive retroperitoneal necrosectomy where percutaneous drainage failed (33% [14/43]) and those treated by open necrosectomy (22% [10/45]) (p = 0.32); length of follow-up not reported¹. A non-randomised controlled trial of 30 patients reported that bowel perforation occurred in 7% (1/15) of patients treated by percutaneous retroperitoneal endoscopic necrosectomy and in 13% (2/15) of matched patients treated by open necrosectomy (p = not significant); follow-up to discharge³. In the same study, the rate of pancreatic fistula was 13% (2/15) and 0% (0/15) respectively (p = not significant).

Bleeding

The randomised controlled trial of 88 patients reported that bleeding requiring intervention occurred in 16% (7/43) of patients treated by a step-up protocol with minimally invasive retroperitoneal necrosectomy, and in 22% (10/45) of patients treated by open necrosectomy (p = 0.48); length of follow-up not reported¹. A non randomised controlled study of 189 patients reported that bleeding occurred in 12% (16/137) patients treated by minimally invasive pancreatic necrosectomy and 17% (9/52) undergoing open necrosectomy (p=0.44) (follow up not reported)⁵.

Other

The randomised controlled trial of 88 patients reported that new-onset diabetes occurred in 16% (7/43) of patients treated by a step-up protocol with minimally invasive retroperitoneal necrosectomy where percutaneous drainage failed and in 38% (17/45) of those treated by open necrosectomy (p = 0.02) at a median 6-month follow-up¹.

A non-randomised controlled study of 88 patients reported that portal vein or splenic vein thrombosis occurred significantly more often in patients treated by percutaneous retroperitoneal endoscopic necrosectomy (21% [10/47]) than in patients treated by open necrosectomy (2% [1/41]) (p < 0.01); median follow-up of 29 months².

Validity and generalisability of the studies

• The available evidence reports on a range of minimally invasive techniques,

some with endoscopic visualisation alone, some with transgastric laparoscopy

and some with purely external imaging. This makes comparison of studies difficult.

- Follow-up is not well reported in the studies available, and is only usually to the time of discharge.
- No randomised comparative data are available that compare percutaneous retroperitoneal endoscopic necrosectomy with open necrosectomy.
- The degree of dissection and lavage employed during the procedure varied within and between the studies.
- The indications for patients included in the studies available varied within and between studies. Some had infected pancreatic necrosis and some noninfected necrosis but with progressive organ failure. This makes comparison of outcomes difficult.

Existing assessments of this procedure

There were no published assessments from other organisations identified at the time of the literature search.

Related NICE guidance

Interventional procedures

• Percutaneous pancreatic necrosectomy. NICE interventional procedures guidance 33 (2003). Available from www.nice.org.uk/guidance/IPG33.

Specialist Advisers' opinions

Specialist advice was sought from consultants who have been nominated or ratified by their Specialist Society or Royal College. The advice received is their individual opinion and does not represent the view of the society.

Mr D Berry (Association of Laparoscopic Surgeons of Great Britain and Ireland), Mr R Carter, Mr A Siriwardena and Mr M Deakin (Pancreatic Society of Great Britain and Ireland), Mr M Raraty (Association of Upper Gastrointestinal Surgeons of Great Britain and Ireland)

• Four out of five of the specialist advisors categorised the procedure as established and no longer new.

- The procedure is also known as minimal access retroperitoneal pancreatic necrosectomy.
- The main comparators are open necrosectomy, percutaneous drainage or other minimally invasive techniques such as endoscopic debridement or laparoscopic debridement.
- Adverse events reported following the procedure include bleeding, incomplete drainage / sepsis control, intraperitoneal rupture, colonic fistula, gastric fistula, iatrogenic injury to kidney or spleen, venous thrombosis, colonic necrosis, pseudocyst formation and death.
- Theoretical adverse events might include post-procedural multiple organ dysfunction
- It is a relatively simple procedure for hepato-pancreato-biliary (HPB) surgical trainees to learn. Training should be undertaken in units with sufficient pancreatic throughput to see numbers of patients with infected necrosis.
- The key efficacy outcomes for this procedure are mortality, requirement for ICU post-op, reduction in morbidity, number of interventions required and length of hospital stay.
- All the Specialist Advisors thought that if found to be safe and efficacious it is likely to be made available at a minority of UK hospitals but at least ten.
- The procedure requires a long hospital stay and often multiple operative procedures are needed. Patients with severe acute pancreatitis are among the most expensive for the NHS to treat due to a high requirement for sometimes prolonged critical care.

Patient Commentators' opinions

NICE's Patient and Public Involvement Programme was unable to gather patient opinion for this procedure.

Issues for consideration by IPAC

- Most patients included in the studies had failed previous percutaneous drainage.
- Existing IP guidance states that: 'The Association of Upper Gastrointestinal Surgeons of Great Britain and Ireland has agreed to set up a registry for the procedure. All patients undergoing this procedure should be entered into the registry.' No such registry was established and therefore no data are available.
- No issues relating to equality and diversity were raised during the scoping process.
- A large number of small case series are listed in appendix A.

References

- 1 van Santvoort HC, Besselink MG, Bakker OJ et al. (2010) A step-up approach or open necrosectomy for necrotizing pancreatitis. New England Journal of Medicine 362:1491-1502.
- 2 Connor S, Alexakis N, Raraty MG et al. (2005) Early and late complications after pancreatic necrosectomy. Surgery 137:499-505.
- 3 van Santvoort HC, Besselink MG, Bollen TL et al. (2007) Case-matched comparison of the retroperitoneal approach with laparotomy for necrotizing pancreatitis. World Journal of Surgery 31:1635-1642.
- 4 Gambiez LP, Denimal FA, Porte HL et al. (1998) Retroperitoneal approach and endoscopic management of peripancreatic necrosis collections. Arch Surg 133:66-72.
- 5 Raraty MGT, Halloran CM, Dodd S et al (2010) Minimal access retroperitoneal pancreatic necrosectomy. Improvement in morbidity and mortality with a less invasive approach. Annals of Surgery 251: 787-793

Appendix A: Additional papers on percutaneous retroperitoneal endoscopic necrosectomy

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	Number of patients/follow-up	Direction of conclusions	Reasons for non- inclusion in table 2
Bruennler, T., Langgartner, J., Lang, S., et al (1008) Percutaneous necrosectomy in patients with acute, necrotizing pancreatitis. European Radiology 18 (8) 1604-1610	n = 18 Follow-up = not reported	Percutaneous minimally invasive necrosectomy can be regarded as a safe and effective complementary treatment modality in patients with necrotising pancreatitis.	Larger studies are included in table 2
Cheung, MT., Ho, C. N. S., Siu, KW et al (2005) Percutaneous drainage and necrosectomy in the management of pancreatic necrosis. ANZ Journal of Surgery 75 (4) 204-207.	n = 8 Follow-up = to discharge	Those patients who had 'organized necrosis' after the acute episode of pancreatitis could receive benefit from percutaneous necrosectomy. The persistent symptoms could be alleviated after the removal of the residual necrotic material.	Larger studies are included in table 2
Connor, S., Ghaneh, P., Raraty, M (2003) Minimally invasive retroperitoneal pancreatic necrosectomy. Digestive Surgery 20 (4) 270-277	n = 24 Follow-up = to discharge	A new technique that has shown promising results, and could be preferable to open pancreatic necrosectomy in selected patients.	Larger studies are included in table 2 Potentially some of the same patients are reported in Connor (2005) in table 2
Cuschieri SA, Jakimowicz JJ, Stultiens G. Laparoscopic infracolic approach for complications of acute pancreatitis. Semin Laparosc Surg 1998;5:189- 194	n = 3 Follow-up = not reported	The infracolic laparoscopic approach seems to be a useful technique for internal drainage of pancreatic pseudocysts. Its use for necrosectomy, drainage, and irrigation of the lesser sac merits further evaluation.	Larger studies are included in table 2
el Yassini AE, Hoebeke Y, Keuleneer RD. Laparoscopic treatment of secondary infected pancreatic collections after an acute pancreatitis: two cases. Act Chirurg Belg 1996; 96:226-228	n = 1 Follow-up = not reported	The treatment consisted of a necrosectomy and the installation of a system of drainage and lavage.	Larger studies are included in table 2
Endlicher, E., Volk, M., Feuerbach, S., Scholmerich, J., et al (2003) Long-term follow-up of patients with necrotizing pancreatitis treated by percutaneous necrosectomy.	n = 9 Follow up = 30 months	Percutaneous drainage of infected necrotising pancreatitis has given good long-term results with regard to quality of life, endocrine and exocrine pancreatic function, and	Larger studies are included in table 2

Hepato-Gastroenterology 50 (54) 2225-2228.		may be an alternative to surgical treatment.	
Gagner M. Laparoscopic treatment of acute necrotizing pancreatitis. Semin Laparosc Surg 1996;3:21-28	n = 8 Follow-up = not reported	No local complications described.	Larger studies are included in table 2
Oria A, Ocampo C, Zandalazini H, et al. Internal drainage of giant acute pseudocysts: the role of video-assisted pancreatic necrosectomy. Arch Surg 2000;135:136-140.	n = 10 Follow-up = not reported	Depending on appropriate surgical timing, video- assisted necrosectomy is a feasible and safe procedure.	Larger studies are included in table 2
Risse, O., Auguste, T., Delannoy, P et al (2004) Percutaneous video- assisted necrosectomy for infected pancreatic necrosis. Gastroenterologie Clinique et Biologique 28 (10:Pt 1) t- 71.	n = 6 Follow-up = 7 months	Early experience in 6 patients has shown that percutaneous video- assisted necrosectomy is feasible, safe and efficient.	Larger studies are included in table 2
Zorger, N., Hamer, O. W., Feuerbach, S et al (2004) Percutaneous treatment of a patient with infected necrotizing pancreatitis. Nature Clinical Practice Gastroenterology & Hepatology 2 (1) 54-57.	n = 1 Follow-up = 3 years	Interventional treatment using large-bore percutaneous catheters to perform percutaneous necrosectomy, fragmentation of necrotic pancreatic tissue with a snare catheter and dormia basket, and aspiration.	Larger studies are included in table 2

Appendix B: Related NICE guidance for percutaneous retroperitoneal endoscopic necrosectomy

There is currently no NICE guidance related to this procedure.

Appendix C: Literature search for percutaneous

retroperitoneal endoscopic necrosectomy

Database	Date searched	Version/files
Cochrane Database of Systematic Reviews – CDSR (Cochrane Library)	20/09/2010	September 2010
Database of Abstracts of Reviews of Effects – DARE (CRD website)	20/09/2010	-
HTA database (CRD website)	20/09/2010	-
Cochrane Central Database of Controlled Trials – CENTRAL (Cochrane Library)	20/09/2010	September 2010
MEDLINE (Ovid)	20/09/2010	1950 to September Week 1 2010
MEDLINE In-Process (Ovid)	20/09/2010	September 17, 2010
EMBASE (Ovid)	20/09/2010	1980 to 2010 Week 37
CINAHL (NLH Search)	20/09/2010	-
Zetoc	20/09/2010	-
BLIC (Dialog DataStar)	04/03/2009	-

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

1	Pancreatitis, Acute Necrotizing/
2	(acute adj3 pancreatitis).tw.
3	or/1-2
4	(pancrea\$ or peripancreatic or peri-pancreatic).tw.
5	Necrosis/
6	(necrosis or nectroti?ing).tw.
7	5 or 6
8	Infection/
9	infect\$.tw.

IP overview: percutaneous retroperitoneal endoscopic necrosectomy Page 20 of 21

10	or/8-9
11	4 and 7 and 10
12	3 or 11
13	percutaneous.tw.
14	retroperitone\$.tw.
15	Endoscopes/
16	endoscop\$.tw.
17	Surgical Procedures, Minimally Invasive/
18	(minimally invasive adj3 (surgery or technique or procedure)).tw.
19	Laparoscopes/
20	laparoscop\$.tw.
21	nephroscop\$.tw.
22	Video-Assisted Surgery/
23	((video-assist\$ or video assist\$) adj3 (surgery or technique or
	procedure)).tw.
24	Debridement/
25	debridement.tw.
26	lavage.tw.
27	or/13-26
28	necrosectomy.tw.
29	27 and 28
30	PPN.tw.
31	29 or 30
32	12 and 31
33	Animals/ not Humans/
34	32 not 33