Dissertation on Impact of Intra operative ultra sonogram (IOUS) in drainage surgery for chronic pancreatitis

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CERTIFICATE

This is to certify that the dissertation entitled **"Impact of intra operative ultra sonogram (IOUS) in drainage surgery for chronic pancreatitis"** is the bonafide original work of **Dr. P. Saravana Bhoopathi** in partial fulfillment of the requirements for **M.Ch (Gastroenterology) BRANCH – VI** Examination of the Tamilnadu Dr. M.G.R. Medical University to be held in August 2009. The period of study was from Sep 2006 to Feb 2009.

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DECLARATION

I, **Dr.P.Saravana Bhoopathi,** solemnly declare that dissertation titled, **"Impact of intra operative ultra sonogram (IOUS) in drainage surgery for chronic pancreatitis "** is the bonafide work done by me at Govt. Stanley Medical College and Hospital during the period September 2006 to February 2009 under the expert guidance and supervision of **Prof.R.Surendran, M.S., M.N.A.M.S., M.Ch. Head of the Department,** Department of Surgical Gastroenterology, Stanley Medical College & Hospital, Chennai.

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CONTENTS

Introduction

Chronic pancreatitis is a benign inflammatory disease characterised by progressive & permanent destruction of pancreas parenchyma resulting in endocrine and exocrine insufficiency. Alcoholism is the common etiology in western population, other etiological factors include hereditary, autoimmune, tropical pancreatitis, malnutrition and idiopathic. Tropical pancreatitis is the commonest etiology in Indian population. Patients with chronic pancreatitis present with episodic, chronic abdominal pain. They can present with functional insufficiency such as steatorrhoea, weight loss or malnutrition and the development of diabetes mellitus. Most patients of chronic pancreatitis are managed medically, however up to 20% patients may require surgery. The main indication for surgery in the management of chronic pancreatitis is intractable pain. Other indications include biliary & pancreatic ductal obstruction , mass effect impinging on other organs or suspicion of malignancy. A number of surgical procedures have been developed in the 20th century. Literature review indicates maximum efficacy of any procedure is up to 85 to 90%. The surgical treatment is based on two main concepts – drainage procedure & resective procedure. Some procedures have combined both the concepts. Surgery for chronic pancreatitis is technically demanding. Localising the calculi, identification of duct, cystic lesion, assessment of associated mass lesion , relationship to vascular structures are sometimes difficult to assess because of

dense fibrosis. In recent years, the preoperative assessment of chronic pancreatitis has been significantly improved by use of imaging techniques. Imaging modalities such as ultra sonogram (USG), computerised tomography (CT), magnetic resonance imaging (MRI), endoscopic retrograde cholangio pancreaticogram (ERCP) & endosonogram (EUS) have greatly facilitated surgical care . Although such preoperative evaluation is key to surgical management, imaging can be used in the operating room to enable to enable the surgeon to attain further information about the clinical problem. To complement direct exploration, operating imaging has been applied to many fields of surgery. For the pancreas, a procedure that appears to be highly applicable for operating imaging is real time ultra sonogram. Intra operative ultra sonogram (IOUS) is a newer application used in surgery of chronic pancreatitis to define lesions, characterise them & delineate their anatomic relationship and influencing the surgical procedure.

Review of literature

Intra operative ultra sonogram (IOUS)

Intra operative ultra sonogram (IOUS) was first used by Dr. Bernard Sigel a general surgeon for intra operative diagnosis of biliary calculi. In the early 1980's IOUS was employed during neurosurgery, endocrine surgery & cardio vascular surgery. Later IOUS expanded to hepatobiliary, pancreatic & other abdominal surgery. IOUS of the pancreas was described in 1980 by 1980 by Lane & Glazer. Although there have been many advances in cross sectional imaging technologies, unparalleled special & contrast resolution of IOUS still makes it useful adjunct to pancreatic surgeons. It can be used to define lesions, characterise them, and delineate the anatomical relationship, and to evaluate pancreatic & biliary ductal system. IOUS was useful for surgery in chronic pancreatitis in 69% of patients. [1]

Choice of transducer:

IOUS of pancreas is performed best with an end fire transducer. [2] Typical frequencies used are 7.5 to 10 MHz, colour Doppler imaging is mandatory & pulsed wave Doppler can be extremely useful.

Indications for IOUS

1 Acquisition of new information not otherwise available

2 As a compliment to or replacement of intra operative radiography

3 Confirmation of completion of operation

4 Guidance of surgical procedure

Intra operative scanning:

Normal pancreas is usually slightly hyperecchoic. The gland is lobulated in upto 20% of patients. The ecchogenicity of pancreatic tumours vary relative to the pancreas. Calculi are hyperecchoic with acoustic shadowing. The pancreatic duct is hypereccoic, when it is less than 1mm it appears as a ecchogenic line. Cystic lesions appear as hypoecchoic. Vascular anatomy of adjacent major vessels is clearly made out in IOUS using Doppler. Some difficulties encountered in IOUS include, fatty infiltration or lobulation can be misinterpreted as true lesion. Pseudocyst & pseudoaneursm can be confused if Doppler evaluation is not used.

IOUS in surgery for chronic pancreatitis:

IOUS can be used in many ways to assist surgeon as part of this procedure. The course of pancreatic duct, which is variable at the best of times and unpredictable in CP, is assessed by radiologist & a suitable point, where the duct is superficial is marked. If there are intraductal calculi, they can be removed or a point proximal to obstructing calculus can be used for drainage. The surgeon cuts down at this point to the duct, alternatively and preferably the duct can be cannulated with a needle under direct sonographic visualisation & can be cannulated with a wire. IOUS localisation of PD saves considerable operating room time because of rock hard fibrotic pancreas prevents accurate localisation by palpation. IOUS have a valuable role in identifying small pseudocyst and guiding the management. Chronic pancreatitis is associated with increased risk of pancreatic pancreatic cancer, IOUS guides in intraoperative FNA/biopsy from areas with abnormal ecchotexture there by altering the surgical procedure if the lesion is positive for malignancy.

Advantages & disadvantages of IOUS

IOUS has number of advantages including safety, speed, high accuracy, more imaging information & ability to guide procedure. It can be used repeatedly & results obtained immediately. IOUS can be completed in short

time. Size, shape of target lesions are imaged with IOUS precisely& relation to adjacent vascular structures are clearly assessed. Disadvantages include need for special instrument & prolonged learning curve. Lesions smaller than 3-5 mm are not detectable even with high resolution USG , when tumours are isoecchoic to surrounding parenchyma lesions will be difficult to detect. Finally IOUS is highly operator dependent.

Surgery for chronic pancreatitis:

Intractable pain of pancreatic origin represents the most important indication for surgical intervention. Surgery is also indicated to control complications related to adjacent organs, such as distal CBD stenosis & segmental duodenal obstruction, not permanently controlled pancreatic pseudocyst in conjunction with ductal pathology & conservatively not amenable internal pancreatic fistula. Occasionally the inability to exclude pancreatic cancer despite broad diagnostic work up also necessitates surgery. Goals of surgical treatment for chronic pancreatitis are as follows:

- Pain relief
- Control of pancreatitis – associated complications of adjacent organs.
- Preservation of endocrine & exocrine function.

- Social and occupational rehabilitation.
- Improvement of quality of life.

The ideal surgical procedure should be based not only on associated problems but also on the pathogenesis of pain in patients with chronic pancreatitis. Surgeries for chronic pancreatitis can be broadly classified as

1 Drainage procedure: Longitudinal Pancreatico Jejunostomy -Partington-Rochelle modification of Puestow procedure. (LPJ)

2 Resectional procedure: Pancreaticoduodenectomy- Whipple's (classic & pylorus preserving), Distal pancreatectomy, Total pancreatectomy with islet auto transplantation, Child's procedure, Beger's procedure.

3 Resection with extended drainage procedure: Frey's procedure, Long itudinal V-shaped excision of ventral pancreas (Izbicki).

Pathogenesis of pain in chronic pancreatitis:-

Ductal and parenchymal hypertension:

The assumption that pain in patients with chronic pancreatitis is caused by ductal hypertension is based on three observations. First, many patients exhibit a ductal dilatation that can be verified by ultrasonography, computed tomography, or endoscopic retrograde pancreaticography. Second, increased

pressure in the pancreatic ductal system is observed [3]. Finally, decompression of the pancreatic duct leads to at least temporary pain relief [4,5]. Increased intraductal and intraparenchymatous pressure in patients with chronic pancreatitis were observed independently by several authors[3,6,7]. Interestingly, patients with the "small duct entity" of chronic pancreatitis also exhibited ductal and parenchymatous hypertension[8]. In addition, a strong correlation between intrapancreatic pressure and intensity of pain was shown[9,10]. Experimental studies relating to the pathogenesis of chronic pancreatitis led to the definition of a retroperitoneal compartment syndrome, indicating an intraparenchymatous hypertension[11,12], which resulted in reduced pancreatic blood flow and reduction of the intrapancreatic pH level, especially after stimulation of the exocrine pancreatic secretion, which normalized again after decompression of the pancreas [11,12]. These observations eventually led to the concept of decompression of the main pancreatic duct system by surgery

Perineural Alterations:

Other hypotheses on the pathogenesis of pain in patients with chronic pancreatitis are rather inadequately addressed by drainage operations alone. Chronic pancreatitis is regarded as chronic inflammation, characterized by

recurrent bouts of acute exacerbations, which eventually result in a defective restitution after acute pancreatitis [13,14]. This may lead to the generation of an inflammatory tumour, with a concomitant increase of the extracellular matrix and a loss of pancreatic parenchyma. At the same time, perineural inflammatory infiltrates arise, with a consecutive loss of the barrier functioning of the perineurium and concomitant neural sprouting [15]. Based on these findings, some centres favour resection as the therapeutic main principle in the treatment of patients with chronic pancreatitis [16,17].

Pancreatic duct drainage

Rational for drainage procedure s based on the assumption that pain in patients with chronic pancreatitis is caused by ductal hypertension. After the report by Duval in 1954, who described caudal pancreatojejunostomy with pancreatic tail resection, the technique for surgical decompression of the pancreatic ductal system in patients with CP was modified by Puestow and Gillesby in 1958. They described "retrograde" pancreatic ductal drainage involving a longitudinal anastomosis between the main pancreatic duct and a Roux-en-Y jejuna loop. Their original procedure also involved distal pancreatic tail resection and splenectomy to allow for long-segment pancreatojejunostomy.

In 1960, Partington and Rochelle [18] proposed a modification which primarily advocated the direct anastomosis of the anterior surface of the pancreas to the jejunum. This simplification not only allows preservation of the spleen but also reduces the amount of pancreatic mobilization that is required, thereby decreasing operation time and blood loss. They also described that the ductal decompression should encompass the whole length of the ductal from the tail of the pancreas to the pancreatic head; the advantage of this extended decompression is that the removal of pancreatic duct calculi is greatly facilitated. This modified Puestow procedure, longitudinal pancreaticojejunostomy (LPJ), addresses the multiple obstructions typically seen in these patients and remains the preferred ductal decompression procedure for CP [19]. LPJ should be considered for patients with CP and a dilated (≥ 7 mm) main pancreatic duct of Wirsung [20]. Operative technique includes wide exposure of the anterior aspect of the pancreas from head to tail by opening the gastrocolic ligament, hepatic flexure mobilization, and a Kocher manoeuvre [20,21,22]. The dilated pancreatic duct can often be identified by palpation, and the location of the pancreatic duct is confirmed by a needle to aspirate ductal fluid. Intraoperative ultrasound may be useful when the duct is not readily palpable. The duct is incised longitudinally as extensively as required and all pancreatic ductal calculi are extracted. A Roux en - Y jejunal limb is constructed about 30 cm distal to the ligament of Treitz and a side-to-side

Roux-en-Y retrocolic pancreatojejunostomy is then created. A review of numerous series with this procedure reports that LPJ relieves chronic abdominal pain in 65%-93% of patients[20,21]. Morbidity and mortality rates are generally low, averaging 20% and 2%, respectively. The largest series has been reported by Nealon and Matin[23] who reviewed the surgical treatment of 124 patients with CP who had undergone a modified LPJ. At a mean follow-up of 6.5 years, 106 of 124 patients experienced complete resolution of pain as defined by absence of narcotic use. Successful operation seems to be related to both technique and patient selection. Bradley has reported that ductal decompression of less than 6 cm is associated with inadequate relief of pain compared with greater than 6 cm of decompression. Furthermore, duct size greater than 7 mm also correlated with success.Finally, Tantia et al[24] and Kurian and Gagner[25] have reported the technical feasibility of laparoscopic LPJ. Despite these encouraging results, long-term follow-up of patients after LPJ reveals that up to 50% of patients develop recurrent symptoms and 10%-35%fail to obtain pain relief [26, 27].

Pancreatic resection:

Longmire's hypothesis that the pancreatic head is the "pacemaker" for pancreatic pain in CP[28], that neural inflammation is an important pathologic mechanism of pain, the intractable pain from head-dominant small-duct

disease[29], the high incidence of ductal alteration, and an inflammatory mass in the head of the pancreas[30,31] are the most common indications for pancreatic resection as the treatment of choice for patients with chronic pancreatitis.

Pancreatoduodenectomy (Whipple's procedure):

This procedure was originally described for resection of periampullary malignancies, but it also also been used in the surgical management of patients with CP. It is a safe procedure with a hospital mortality of 0%-5%, and a postoperative pain relief of 50%-75% at a long-term follow-up period.[32] associated with poor long-term results in patients with CP: poor postoperative digestive function including dumping, diarrhoea, peptic ulcer, dyspeptic complaints, and diabetes mellitus which is responsible for the late postoperative morbidity and mortality in these patients. The long-term surgical results, especially regarding quality of life of patients, are disappointing in some studies [33].

Pylorus-preserving pancreatoduodenectomy (PPPD):

This technique was described by Traverso and Longmire in 1978. They tried to minimize the derangements in gastrointestinal physiology observed in patients who had undergone a Whipple resection, including weight loss, diarrhoea, dumping, delayed gastric emptying, and marginal ulceration. A long-term follow-up has shown that there is a significantly reduced incidence of gastrointestinal disturbances after PPPD when compared with the Whipple's procedure[34], and a better quality of life after the PPPD[35]. One large retrospective study found comparable results in postoperative pancreatic function comparing these procedures, while Berberat et al reported that the maintenance of a near normal upper gastrointestinal tract was shown to reduce the incidence of post operative steatorrhoea and exocrine insufficiency when compared with the Whipple's procedure. However, Müller et al reported three major drawbacks of PPPD in patients with CP: the increased incidence of postoperative sequalae of transient delayed gastric emptying (30% to 50%), which often is associated with slower weight gain; the risk of cholangitis; and the long-term occurrence of exocrine and endocrine pancreatic insufficiency in more than 45% of patients.

Distal pancreatectomy (DP):

DP is a safe procedure, with a perioperative mortality of 0%-3.8% and a morbidity of 15%-31%, that may be performed with or without splenectomy Sawyer and Frey emphasized that DP should be utilized only in appropriate patients with CP: pancreatic duct <5 mm diameter, disease seen on CT and ERCP to be restricted to the pancreatic body, tail, or both, and they also found adequate pain relief in 90% of patients with distal disease at a mean follow-up of 4 years. Rattner et al on the other hand, reported good pain relief in only 31% of patients undergoing DP for distal CP. In two recent studies, DP with splenic preservation controlled pain in 72%-82% of patients with CP.[36] Hutchins et al reported on a series of 90 patients who had undergone a DP for CP. Forty eight of 84 patients available for follow-up had zero or minimal abdominal pain. 46% of these patients became diabetic at a median follow-up of 2 years. Similarly, Schoenberg et al [37] reported 74 patients undergoing DP for CP with a median follow-up of 58 months; 88% of patients had significantly less pain and 66% had an increase in median body weight, while diabetes mellitus occurred in 22% of patients.

Total pancreatectomy (TP) :

TP with duodenum and spleen preserving was carried out for benign disease that required removal of the whole gland. It was also indicated for patients with CP and disabling pain for whom the partial resection had failed[38], for those with total endocrine and exocrine pancreatic failure[39], and for those with hereditary pancreatitis or familial pancreatic cancer, as prophylaxis against cancer. The main contraindication for this procedure is the presence or suspicion of pancreatic malignancy. TP creates a significant postoperative morbidity in the form of insulin-dependent diabetes mellitus and exocrine insufficiency with malabsorption. However, the introduction of islet isolation and autotransplantation has led to renewed interest in TP as a treatment modality for end-stage CP.

Duodenum-preserving pancreatic head resection (Beger's procedure):

Duodenum-sparing resection of the pancreatic head was first described by Beger et al. Indications for this procedure include intractable abdominal pain, small duct CP, and head dominant disease. The Beger's procedure is contraindicated in circumstances in which pancreatic cancer is suspected. Surgical technique consists of ventral transection of the pancreatic neck and

subtotal head resection combined with Roux-en-Y loop of jejunum anastomosis to the distal pancreatic remnant and the rim of pancreatic tissue along the inner surface of the duodenum to restore gastrointestinal continuity. The goal of this technique is to treat only the enlarged pancreatic head, where the disease is mainly present, and to preserve the duodenum, which has a crucial role in the regulation of digestion and glucose metabolism. Beger et al[40] reported 26-year experience with this procedure in 504 patients with CP and pancreatic head inflammatory mass. A median follow-up of 5.7 years demonstrated that 91.3% of patients were pain free following the Beger's procedure, and that the hospital mortality was 0.8% and the late death rate was 8.9%-12.6%, compared to 20.8%-35% for patients]without surgery as reported. No data concerning the effect of this procedure on steatorrhea or pancreatic enzyme requirements were provided. A randomized trial of 20 patients per procedure, Beger's procedure versus Whipple's procedure, showed that patients undergoing Beger's procedure had significantly less pain, increased postoperative weight gain, and better glucose tolerance at a 6-month follow up [19].

Local head resection with longitudinal pancreatojejunostomy (Frey's procedure):

A modified Beger's procedure was described by Frey in 1987[31]. This procedure consists of a subtotal duodenum-sparing pancreatic head resection combined with LPJ. The resection in the head of the pancreas allows opening the main pancreatic duct as it courses posteriorly toward the duodenum and provides drainage of all pancreatic ducts by extending the Roux limb to the duodenum[41]. The operation is designed to avoid the more technically challenging aspects of the Beger's procedure, the division of the pancreatic neck, and the need for two separate pancreatic anastomosis. It is also described for patients who have "head-predominant" disease on the assumption that the pancreatic head, with fibrotic and obstructed ducts, is not adequately addressed by simply decompression of the main pancreatic duct with the Puestow procedure. It is also indicated for patients with small duct CP, and for patients with mild dilation and stricture of the proximal pancreatic duct[31]. The inability to exclude pancreatic malignancy is a contraindication to the performance of Frey's procedure. Operative results indicate that Frey's procedure has an operative mortality of 0% and a perioperative morbidity of 22%[42]. Excellent pain relief was achieved in 74.5% of patients in a mean follow-up of 37 months, while progression of endocrine (11%) and exocrine

(11%) insufficiency was noted to be minimal and less than that for other procedures. Frey's procedure was also compared with PPPD in a prospective randomized trial at the University of Hamburg[33]. The morbidity rate was 19.4% in the Frey group and 53.3% in the PPPD group; the pain score decreased after surgery by 94% and 95% respectively. A median follow-up of 2 years, showed that the global quality of life improved by 71% and 43%, respectively.In a prospective randomized trial by Izbicki et al[43] the Frey's procedure was compared with the Beger's procedure. At a mean follow-up of 1.5 years postoperatively, patients undergoing the Frey's or Beger's procedure demonstrated decreased pain scores of 94% and 95% respectively. Both patients groups had an increase of 67% in their overall quality of life indices, and there were no significant differences in postoperative endocrine and exocrine function. All types of pancreatic head resection are effective for the relief of pain from CP. The procedure of choice is pancreatoduodenectomy (Whipple's procedure or PPPD) if there is mass lesion in head of pancreas with any possibility of malignancy in the background of CP. For patients with head predominant disease with a normal sized pancreatic duct that is devoid of stricture, Beger's procedure is preferable. For patients with chain-of-lakes-type anatomy, the Frey's procedure is the best choice because it addresses these abnormalities via the pancreatojejunostomy. Distal pancreatectomy is highly effective for patients with benign-appearing left-sided pancreatic duct stricture

with upstream duct dilation, or duct disruption not amenable to pancreatojejunostomy and for those with complications of pancreatitis limited to the distal pancreas such as pseudocysts or associated splenic vein thrombosis.

Treatment of complications of CP:

Biliary stricture and duodenal obstruction which are well-known complications of CP occur in 6% and 1.2% of the patients, respectively[44]. For patients requiring an operation for CP, the incidence increases to 35% for biliary stricture and 12% for duodenal obstruction[45]. Most patients will present with an elevated alkaline phosphatase and/or bilirubin level, but the initial presentation with clinical jaundice, cholangitis, or biliary cirrhosis is rare. Surgery is indicated if patients develop jaundice which seems to be due to progressive chronic disease and fibrosis or have an episode of cholangitis. The procedure of choice in pain-free patients with isolated biliary stricture is Roux-en-Y choledochojejunostomy to bypass the obstructed intra-pancreatic portion of the common bile duct[46]. Choledochoduodenostomy and cholecystoenterostomy must be avoided whenever possible because they are associated with the high incidence of cholangitis[46]. Duodenal obstruction is usually found in patients with "head-predominant" version of chronic pancreatitis, in which the head is significantly enlarged (≥7 cm in diameter)[47].

Isolated duodenal obstruction in patients with CP is much less common than obstruction of the common bile duct. For patients with isolated duodenal obstruction, the procedure of choice is gastrojejunostomy[48], while combined duodenal and distal bile duct obstruction is effectively controlled by duodenal-preserving pancreatic head resection (DPPHR)[49], Pseudocyst complicates CP in 30% to 40% of patients[50]. Over the last several decades, several series have documented the feasibility of conservative treatment of asymptomatic pseudocysts. Based on these series, the current policy for patients with asymptomatic pseudocysts, regardless of size or duration, is nonoperative management. Treatment is reserved for patients with symptomatic pseudocysts, enlarging pseudocysts, or complications (infection, rupture, or pseudoaneurysm) related to the pseudocyst. Symptoms may include pain, early satiety, compression of the duodenum or stomach causing obstruction, and compression of the bile duct causing jaundice or abnormal liver function. If the pseudocyst is adherent to the posterior wall of the stomach, the preferred operation is a cyst-gastrostomy. If the pseudocyst is in the head of the pancreas, adherent to either the first or third portions of the duodenum, and away from the ampulla and common bile duct, Roux-en-Y cystjejunostomy is advisable. For smaller intra-pancreatic pseudocysts within the pancreatic head, a Whipple's procedure may be appropriate. If the pseudocyst is small and located in the tail of the pancreas, DP is recommended. Rosso et al reported the success rates of

cystduodenostomy, cyst-gastrostomy, and cyst-jejunostomy were 100%, 90%, and 92%, respectively. An increasing number of patients with CP are diagnosed with splenic vein thrombosis and secondary left-sided portal hypertension.[51] Heider et al[52] reported 55 patients with a diagnosis of CP and splenic vein thrombosis; 77% of patients developed gastrosplenic varices, while only 2 patients had gastric variceal bleeding and required splenectomy. Splenectomy is the treatment of choice for symptomatic patients with left-sided portal hypertension caused by splenic vein thrombosis. Asymptomatic patients should be treated expectantly, as prophylactic splenectomy is indicated for those patients with splenic vein obstruction who are operated on for other complications of CP. Finally, the last group of indications for surgery in patients with CP relates to complications of ruptured pancreatic duct or leaking pseudocysts and includes internal pancreatic fistula, and pancreatic ascites. Patients with a leaking pseudocyst or a disrupted pancreatic duct will be best treated, respectively, by a cyst or a pancreatic duct internal drainage, whereas DP should be indicated for those patients with a narrow disrupted duct.

Concomitant pancreatic cancer

There is an association between CP and an increased incidence of pancreatic cancer, especially in smokers.[53] The risk of pancreatic cancer in patients with CP varies from 2.3% to 26.7%,[54] whereas in patients with

hereditary pancreatitis it approaches almost 75% for patients with a paternal inheritance pattern.[55]. The association between chronic pancreatitis and cancer has been confirmed in a number of epidemiological studies. During the 1980s, two small case-control studies noted an increased yet insignificant number of pancreatic cancers among patients with chronic pancreatitis [56,57]. Between 1990 and 1993, three studies noted a small but significant increased risk of pancreatic cancer in patients with chronic pancreatitis[58,59,60]. In 1993, Lowenfels et al [61] published the results of the International Pancreatitis Study Group's multicenter historical cohort study of 2015 subjects with chronic pancreatitis. These subjects were recruited from clinical centers in six countries. A total of 56 cancers were identified among these patients during a mean follow-up of 7.4±6.2 years. For subjects with a minimum of 5 years of follow-up, the standardized incidence ratio was 14.4. The cumulative risk of pancreatic cancer in subjects with chronic pancreatitis for 10 and 20 years was 1.8% and 4.0%, respectively. Furthermore, the risk of pancreatic cancer was independent of the underlying cause of chronic pancreatitis. Thus, the risk of pancreatic cancer in patients with chronic pancreatitis appeared to far exceed any other known risk factor, including cigarette smoking (relative risk from 8 studies varied from 1.2 to 3.1) [62].

Evidence that tropical pancreatitis increases the risk of pancreatic cancer:

The link between TP and pancreatic cancer is strong. The incidence of pancreatic cancer among adult patients with TP is striking. In 1992 Augustine and Ramesh [63] reported 22 pancreatic cancers among 266 patients with TP over an 8-year period (8.3%). In this cohort, the risk was highest after age 40, and patients with TP often had features of dysplasia as well as cancer in resected pancreatic specimens. In 1994 Chari et al [64] reported that over a 4.5-year period 24 of 185 patients with TP died, and that 6 (25%) died of pancreatic cancer. The average age of onset was 45±7 years, and the relative risk compared with those without TP was 100. Other reports confirm these observations.[65] Thus, current evidence suggests that the risk of pancreatic cancer is very high in patients with long-standing TP

A high index of suspicion should be kept in mind, especially when there is an inflammatory mass in the pancreatic head associated with a dominant stricture of the pancreatic duct. Despite the adoption of sophisticated diagnostic tools (ERCP, CT, MRI, EUS, fine needle cytology) [66,67] in a high percentage of cases (up to 30%), it is impossible for the surgeon to say preoperatively whether a mass in the head of the pancreas is inflammatory or malignant.[68] This can be difficult even in the operating room using incisional biopsies,[69]

intra-operative ultrasonography[70], or pancreatic ductoscopy[71]. Therefore, when there is a strong suspicion of an underlying malignancy, a Whipple's procedure or a PPPD should be considered.

Measurement of pain

Pain is a personal, subjective experience influenced by cultural learning, the meaning of the situation, attention, and other physiological variables. Until recently, the methods that were used for pain measurement include the use of verbal rating scales (VRS), numerical rating scales (NRS), and visual analogue scales (VAS). VAS is a simple and sensitive assessment that is often used to measure and study a patient's pain .Its usefulness has been validated by several investigators. A VAS has been found to be superior to fixed interval scales, relative pain scales, and verbal reports of pain. Subjects simply place a mark on a 10cm line anchored with the terms describing the extremes of pain intensity. To quantify pain intensity more distinctly, a pain score comprising a visual analogue scale of pain, frequency of pain attacks, pain-related sick leave, and analgesic medication has recently been suggested and validated for use in patients suffering from chronic pancreatitis [72].

Endocrine and Exocrine insufficiency:

Nealon et al[21] reported that in patients with mild moderate chronic pancreatitis, operative decompression of pancreatic duct early in the course of the disease did not improve but halted the progressive loss of endocrine and exocrine functions. According to these authors high intra – ductal pressure may contribute to the ongoing loss of function and perhaps to an ongoing level of subacute inflammation, which restricts utilization of nutritional substrates.

Hammel et al[61] who, over a follow-up period of 15 year found that the prevalence of diabetes was 21% in 222 patients who had undergone surgery, in contrast to 33% in 224 patients managed conservatively

In alcoholic chronic pancreatitis, the results of decompression surgery have been inconsistent with regard to improvement in endocrine and exocrine functions. Adams et al[4] in a retrospective study of 85 patients with alcoholic chronic pancreatitis, showed that insulin use continued in 23% and that taking of pancreatic enzyme supplements persisted in 34% after the modified Puestow's procedure. The author suggested that pancreatic exocrine and endocrine functions worsened after drainage surgery.

In Amman's study[88] drainage surgery did not delay the development of exocrine or endocrine insufficiency in chronic alcoholic pancreatitis patients. The inconsistency of results in alcoholic chronic pancreatitis may reflect the

difference in the extent of pancreatic damage at the time of surgery and whether or not the patient has stopped drinking.

Ramesh and Augustine[91] reported that glucose tolerance improved in only 18% of their TP patients, while Sharma et al[89] noted that these was no significant change in insulin requirement after intervention.

The two most striking changes in tropical calcification pancreatitis are marked atrophy of exocrine pancreas but more involving the islets of Langerhan's instead the latter shown on consistent hypertrophy and hyperplasia. Further there is an unequivocal evidence of nesidioblastosis in tropical chronic pancreatitis.

The most striking findings in alcoholic chronic pancreatitis, on the other hand are ductal dilatation with protein plugs, fat necrosis, parenchymal necrosis, acute inflammatory reaction, and parenchymal calcification[90]. The ductoinsular changes such as islet hypotrophy/ hyperplasia and nesidioblastosis, characteristically seen in tropical chronic pancreatitis, as mentioned earlier are rarely seen in alcoholic pancreatitis. This difference is pathology may explain

the variable changes in pancreatic dysfunction after drainage surgery in alcoholic chronic pancreatitis as opposed to that in tropical chronic pancreatitis.

The possible explanation for the improvement in endocrine function after decompressive surgery in tropical chronic pancreatitis may lie in the fact that in this disease, the islet cells may be normal or even increased in number, in fact the K value (the slope of disappearance of glucose from the blood after intravenous injection) may be normal in patients with tropical chronic pancreatitis who have overt pancreatic diabetes. It is postulated that obstruction of the pancreatic duct, together with the dense intralobular and perilobular fibrosis, creates a compartment syndrome and that the insulin deficiency results from poor islet perfusion syndrome and the poor insulin absorption due to raised interstitial pressures.

Aim of study

The aim of study was to analyze the usefulness of intra operative ultra sonogram (IOUS) in surgery for chronic pancreatitis and its benefits in the outcome of drainage surgery for chronic pancreatitis.

Materials & Methods

Consecutive patients (n=52) with chronic pancreatitis who underwent drainage procedures (longitudinal pancreatico jejunostomy [LPJ] & Frey's procedure) between Sep 2006 and Feb 2009 constituted the study population. The diagnosis of chronic pancreatitis was made on the basis of history of typical abdominal pain & pancreatic parenchymal changes, ductal dilatation & calcification on imaging {Ultra sonogram [USG], computerised tomography [CT] & or magnetic resonance cholangio pancreatography [MRCP]}. None of the patients with an enlarged head underwent an Endoscopic ultrasound (EUS) evaluation, as the facility was not available in our deptartment.

Inclusion criteria were

1. Intractable pain not controlled with analgesics associated with a dilated main pancreatic duct (MPD > 7 mm) [73]
2. Inflammatory head mass with a dilated MPD
3. Coexisting complications from adjacent organs (Biliary stricture, Duodenal stenosis, Pseudoaneurysm)

Exclusion criteria were

1. Patients with pseudocyst without duct involvement
2. Intractable pain associated with small duct disease

3. Pancreatic fistula

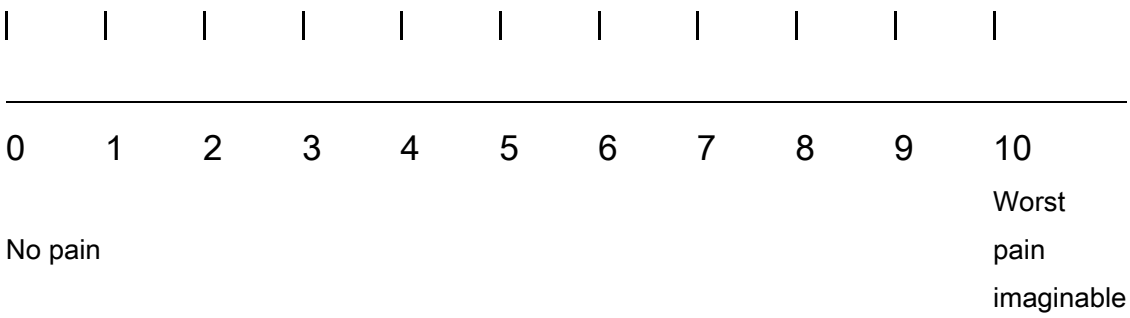
4. Portal vein thrombosis

5. Chronic pancreatitis associated with malignancy

Tropical pancreatitis was defined as chronic pancreatitis with younger age of onset, large intraductal calculi, with or without diabetes mellitus & steatorrhoea and without any evidence of other known etiolological factors. **Alcoholic pancreatitis** was defined as chronic pancreatitis associated with consumption of greater than 50 units of alcohol per week for at least 5 years. Consecutive patients were numbered, odd no's underwent IOUS, even no's did not undergo IOUS. Group I (n=26): where IOUS was used during surgery and Group II (n=26): where IOUS was not used. Surgical factors analysed are duration of surgery, blood loss in surgery, post operative hospital stay, morbidity, mortality and usefulness of IOUS. Factors analysed in outcome are

1. Pain relief after surgery. Pain was assessed using a visual analogue scale (VAS). Patients simply place a mark on a 10 cm line anchored with terms describing extremes of pain intensity. Pain relief was considered improved if VAS score was less than 5 compared to pre op VAS [49]. Pain relief was considered not present if difference between the pre operative & post operative VAS is less than 5 & if patient required hospital admission for pain relief after surgery.

Visual analog scale



2. Exocrine function was assessed by presence of steatorrhoea, defined as frequency of more than three stools per day, foul smelling, greasy and pale stools[74].

3. Endocrine function – presence of diabetes mellitus defined as blood glucose level more than 200 mg/dl two hours after an oral glucose load of 75 gm.

4. Weight after surgery – considered significant when change was more than 5 kg either loss /gain of preoperative weight[75].

Choice of surgery:

All the surgeries in both the group of patients were performed by two experienced surgeons or under their supervision. Frey's procedure was done when there was an associated head was enlarged & longitudinal pancreatico jejunostomy (Partington & Rochelle modification of Peustow procedure) was done in a normal sized head of pancreas. Head of pancreas was considered to be enlarged when its maximum diameter was more than 35 mm [76]. IOUS was done using an end fire transducer with 10 MHz probe with Doppler facility. Sterilisation was done as prescribed by manufacturer. IOUS was done by a scrubbed interventional radiologist attached to our department. IOUS was initially done after complete mobilisation & exposure of pancreas and later after ductal exploration before anastomosis. IOUS was considered beneficial during surgery for chronic pancreatitis when it was able to identify/locate/guide:

1. Main pancreatic duct, which could not be identified
2. Pseudoaneurysm,
3. An undrained cystic lesion
4. FNAC from mass lesions suspicious of malignancy
5. Calculi which needed removal after surgical exploration

Data collection:

Data was obtained during the hospital admission as well as during follow-up at outpatient department by face to face interview or telephonic interview. Follow up period ranged from 2 to 29 months.

Statistical analysis:

Data were reported as mean ± SD .Continuous variables such as duration of surgery, blood loss in surgery & pain score were analysed using student T test. Categorical variables such as weight, diabetic status, steatorrheoa were analysed using chi square test. The data were analysed using a statistical software package (SPSS 14 version for windows). A P-value of less than or equal to 0.05 was considered statistically significant.

Results

Fifty two patients were enrolled in the study. Preoperative details of patients are shown in Table 1. Both patient groups were comparable in terms of demography, etiology & pancreatic morphology. In the IOUS group, 21 patients had an enlarged head. On IOUS, 2 out of these 21 patients had a suspicious mass lesion in the head which was un-identified by previous imaging modalities. An IOUS guided FNA was done from the mass lesion and an immediate cytological diagnosis was obtained. One patient had an inflammatory pathology and one patient had a positive cytology for malignancy. Whipple's procedure performed for the patient with cytology positive for malignancy. The patient was excluded from the study for further analysis.

Tropical pancreatitis was the etiology for 18 (72%) patients in IOUS group and for 17(65%) patients in non- IOUS group. Alcoholic pancreatitis was the etiology in 7(38%) & 9(35%) patients respective groups. Mean age of TP patients in IOUS group was 28±12.64 & 30.47±10.39 in non IOUS group. Mean age of AP patients in IOUS group was 38.71±7.78 & 41.22±7.29 in non IOUS group. Mean duration of symptom was 4.08 yrs in IOUS group & 4.38 in non IOUS group. 9 (36%) patients were diabetic in IOUS group & 11 (42%) patients in non IOUS group. Steatorrhoea was present in 6 (24%) patients in IOUS

group & 7(27%)in non IOUS group. Frey procedure was performed in 20(80%) IOUS group & 19(73%) in non IOUS group; 5(20%) patients underwent LPJ in IOUS group & 7(27%) in non IOUS group. Mean diameter of MPD in IOUS group was 9.56±2.50 & 9.30±2.95 in non IOUS group (Table 1).

Table 1 Demography of IOUS & non IOUS group patients

	IOUS	Non IOUS
Total no patients	25	26
Male	17	18
Female	8	8
Tropical pancreatitis	18	17
Alcoholic pancreatitis	7	9
Age mean ± SD of TP	28 ± 12.64	30.47 ± 10.39
Age mean ± SD of AP	39 ± 7.78	41 ± 7.29
Diabetes Mellitus (%)	9(36%)	11(42%)
Steatorrhoea(%)	6(24%)	7(26%)
Pain duration yrs mean	4.08	4.38
Diameter MPD mean ± SD	9.56 ± 2.50	9.30 ± 2.95
Frey's procedure	20	19
LPJ	5	7
Post op stay mean ± SD	11.44 ± 3.5	12.92 ± 5.5
Follow up mean ± SD	15.04 ± 6.2	16.03 ± 6.48

Figure 2: Etiology of CP - IOUS & non IOUS group

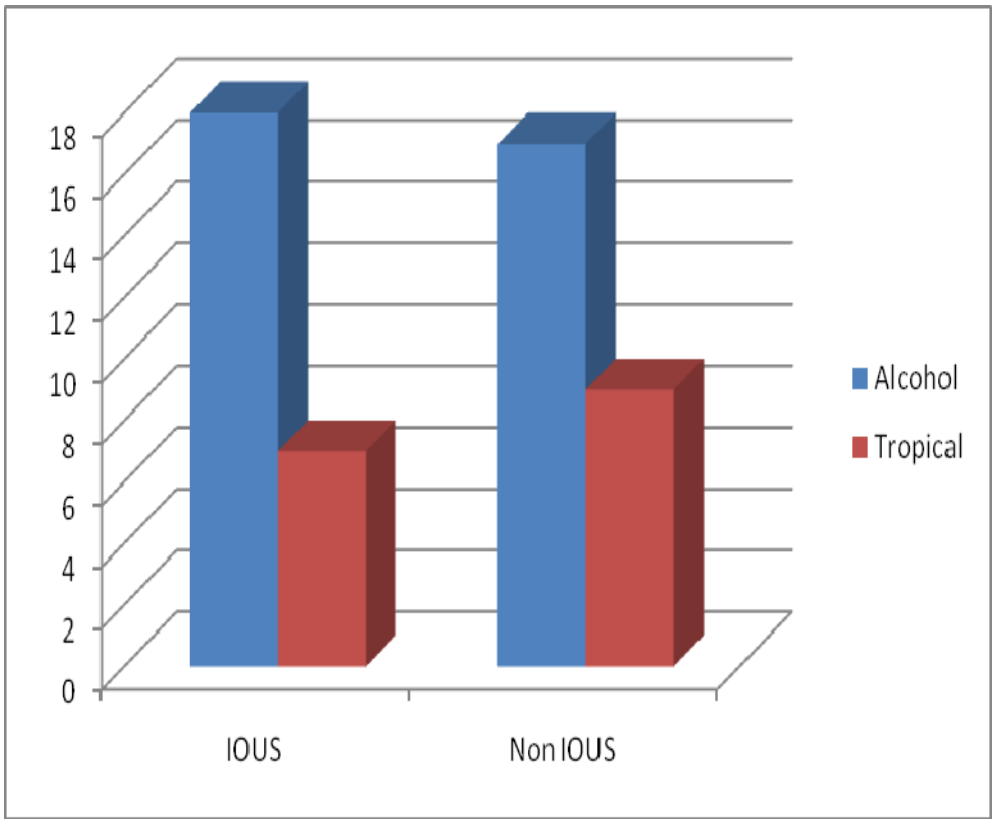
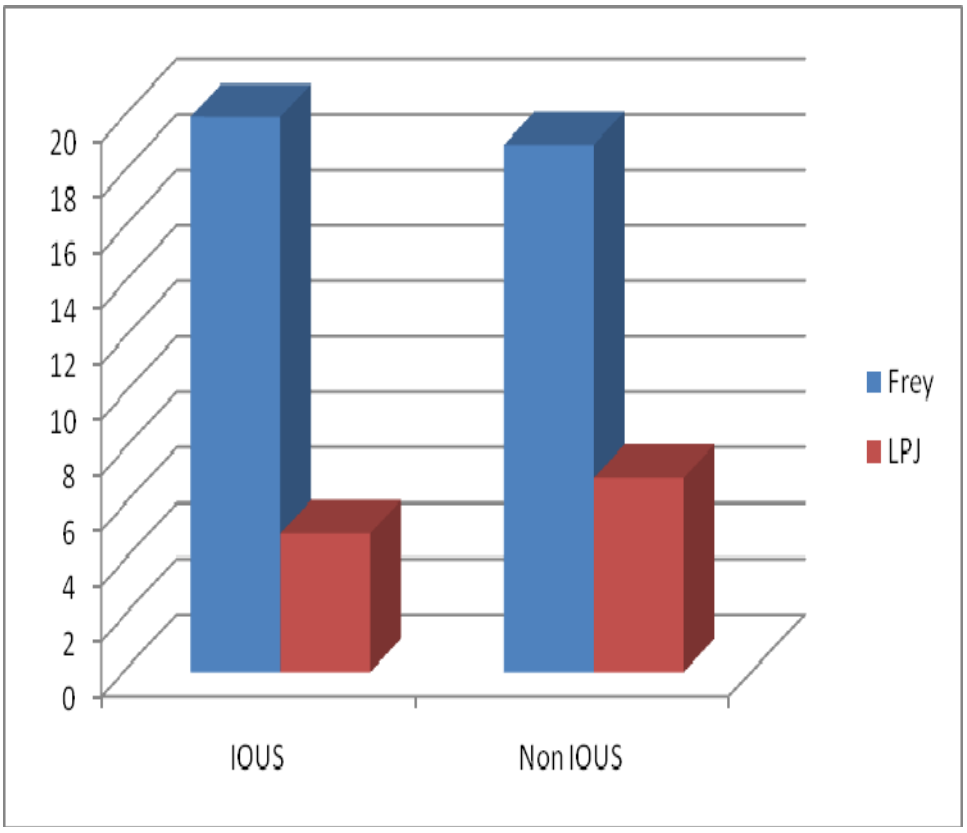


Figure 3: Surgery detail in IOUS & non IOUS



IOUS was beneficial per-operatively in 19 (73%) of patients. As all the patients had a dilated MPD, it could be easily identified per-operatively without the added use of IOUS. However, it had added benefits (Table 2 & Figure 4).

IOUS altered the management plan in one patient. IOUS identified mass lesion in 2 patients which was not identified by preoperative imaging. It was useful to locate calculi in 16 patients, identified an undrained cyst in 3 patients, localised pseudoaneursym in 1 patient , in some patients it was useful for two different purposes. Mean duration of surgery in IOUS group 217.6 ± 28.10min and in non IOUS group 202 ± 23.92 min. Blood loss in IOUS & non IOUS group were 251 ± 79.27 ml and 285 ± 100.3 ml respectively. Mean follow up in IOUS group was 15.04±6.2 months, in non IOUS group it was 16.03±6.48 months. There was no hospital mortality in both the groups. Morbidity was observed in 5(20%) patients in IOUS group & 6(23%) patients in non IOUS group. Both group had minor pancreatic leak in one patient both were managed conservatively.

There was no hospital mortality in both the group of patients. Morbidity was 5(20%) in IOUS group & 6(23%) in non IOUS group. One patient in each group had minor pancreatic leak which were managed conservatively. Other complications were surgical site infection, pulmonary complication managed appropriately. Post op stay in IOUS group 11.44 ± 3.5 days and in non IOUS group 12.92 ± 5.5 days. One patient developed post op bleed from

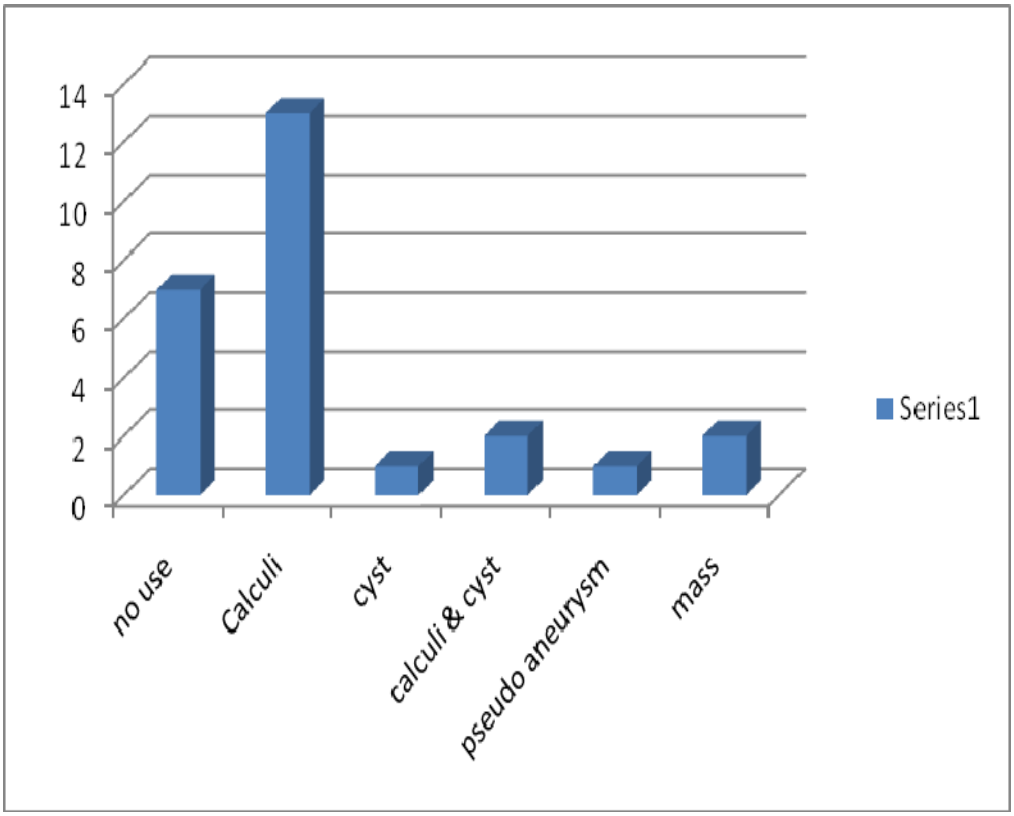
gastroduodenal artery, relaprotomy & suture ligation of the bleeding vessel was done in non IOUS group.

Of 9 patients with diabetes in IUOS group the status remained unchanged in 8; one patient became non diabetic after surgery, this was a TP patient who had DM 6 for month duration. One patient developed DM a year after surgery. In non IOUS group of 11 patients

Table 2: Benefits of IOUS in the IOUS group (26 patients)

Benefits of IOUS in the IOUS gr. (26 patients)	No of patients
Identify stones prior to anastomosis	13
Detected undrained cystic lesion	1
Detected both stones and undrained cystic lesion	2
Localised pseudoaneurysm	1
Detected mass lesion & guided FNA	2
Benign	1
Malignancy	1

Figure 4: IOUS use in IOUS group



N=26

Figure 5 : IOUS picture showing ductal calculi

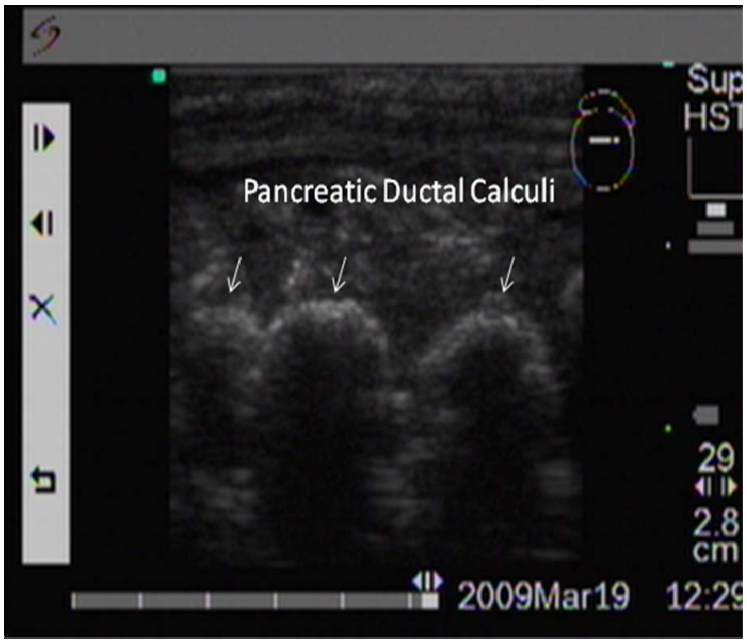


Figure 6 : IOUS picture showing parenchymal calculi

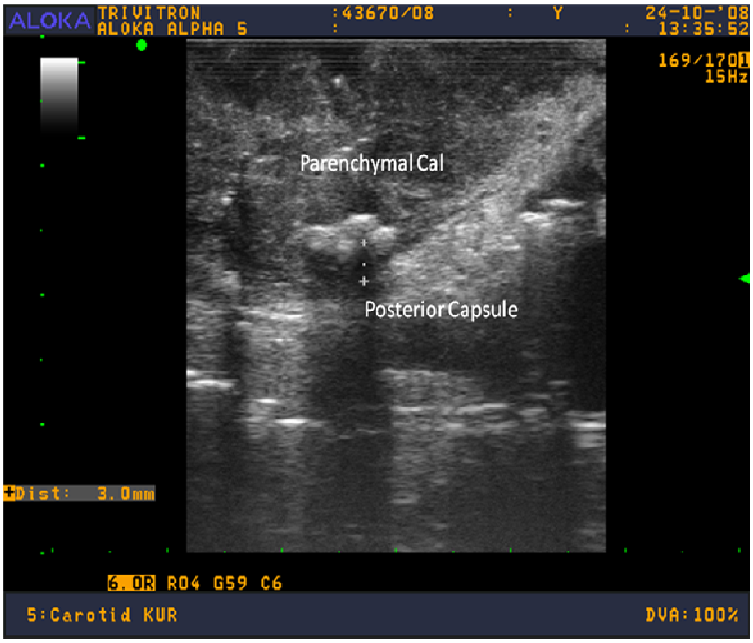


Figure 7 : IOUS picture showing dilated MPD

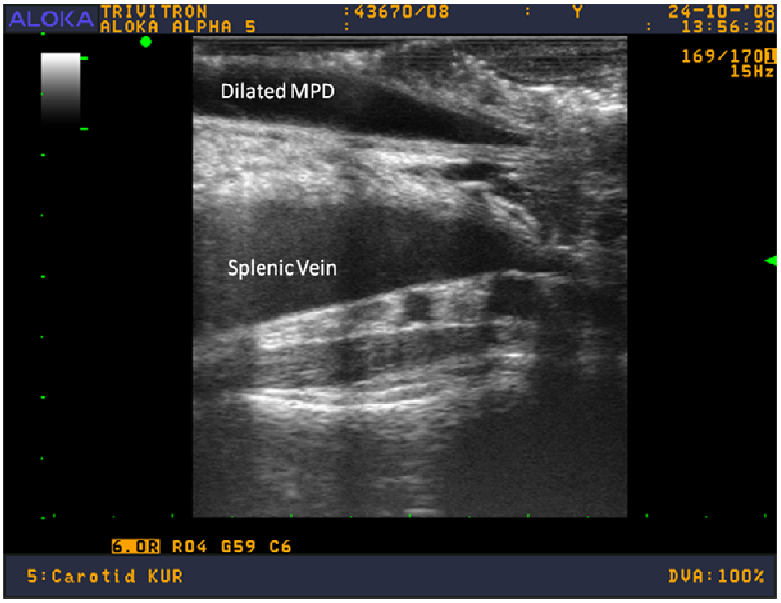
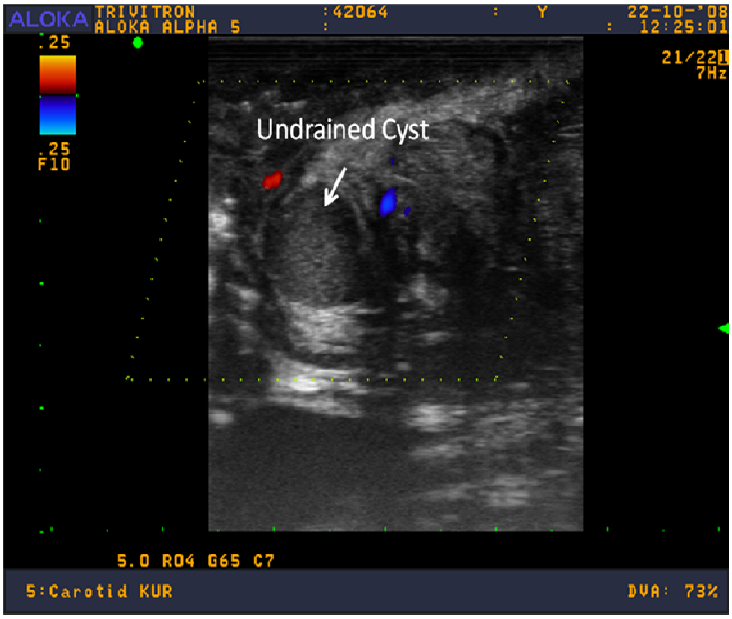


Figure 8 : IOUS picture showing undrained cyst



had DM, of them 9 patients remained diabetic, 2 patients became non diabetic, both were TP patients who underwent Frey procedure with duration of DM less than one year. One patient developed DM 18 months after surgery, this TP patient underwent LPJ.

In IOUS group 3 patients developed steatorrhoea after Frey procedure, two cases of TP, & one case of AP. In non IOUS group 5 patients developed steatorrhoea after surgery, all patients of TP, 3 had Frey procedure, 2 patients underwent LPJ.

Weight remained unchanged in 15 patients of IOUS group, 7 gained weight & 3 patients developed decrease in weight after surgery. In non IOUS group, weight remained unchanged in 11, weight gain in11 patients and weight loss in 4 patients.

Pain relief was seen in 21(84%) and 21(81%) patients in IOUS and non IOUS group respectively. 2 patients in IOUS & non IOUS group underwent celiac plexus block with relief of pain. Other three patients in each group continued take analgesics.

Table 3 Post OP variable analysis

Parameters	IOUS	Non IOUS	**P- value**
Duration of surgery (min) M±SD	202.11±28.92	217±28.10	Ns
Blood loss in surgery (ml) M± SD	251±79.27	285±100.3	Ns
No. of patients with pain relief	21(84%)	21(81%)	Ns
Diabetic status			Ns
Non DM - No change	15	14	
New onset	1	1	
Prev. DM - No change	8	9	
Prev. DM – non DM	1	2	
Stetorrhoea			Ns
No steat. – no change	16	14	
New onset steat.	3	5	
Prev. Steat. – no change	6	6	
Prev. steat. – non steat.	0	1	
Weight			Ns
Improved	7	11	
Same	15	11	
Decreased	3	4	

Discussion

Our mortality and morbidity rate associated with the procedures is well within the acceptable range. Major postoperative complications in the current series include pancreatic leakage and delayed arterial bleeding. Arterial bleeding is a major life threatening complication following head coring in the range of 2% to 3% [76]. Bleeding follows erosion of peripancreatic vessels by pancreatic fluid from an insufficient anastomosis or due to rupture of pseudoaneurysm [77]. One patient required relaparotomy and ligation of pancreaticoduodenal artery. Since the patient presented with severe intra abdominal bleeding, angiography and embolization was not considered in this patient.

IOUS beneficial for the surgery in 73% of our patients. It detected malignancy undetected by preoperative imaging in one patient, there by altering the management. The calculi detected in IOUS were mainly in head, uncinate process near the major vessels & from secondary ducts. With IOUS guidance the calculi were removed with minimal tissue destruction. Un drained cystic lesions: two in the uncinate process & one in the tail, were drained. The duration of surgery was not statistically different between the two groups. Blood loss during the surgery, though found to be less in the IOUS group, was not statistically significant.

The outcome of surgery in relation to pain relief, endocrine, exocrine insufficiency & weight, were not statistically significant between the two groups. We have not included small duct diseases where IOUS is very helpful in identifying MPD. Bernard Sigel et al had shown that IOUS was useful in 69% of operations for the complications of pancreatitis [78]. Kaczmarek B had reported that IOUS was helpful in 89% of patients with cystic lesions & inflammatory tumours of pancreas [80]. In our series, IOUS during surgery for pancreatitis was helpful in localizing un removed calculi, undrained cyst and localizing pseudoaneurysm. It facilitated the operation by reducing tissue traumatisation & blood loss. Machi et al had shown that previously planned procedures were changed because of OUS findings in 16.6% of 145 pancreatic operations for chronic pancreatitis [81].

Pain relief after surgery, including both the groups, is 82%. Following Frey's procedure 70% to 80% of the patients with varying follow-up had good pain relief [41,82]. In the current series, 82% of the patients had complete pain relief and confirmed the observation made by others. The cause of poor pain outcome following surgery for chronic pancreatitis are multi factorial and include inadequate drainage of head, neuropathic changes and unrecognized cancer [83]. An incidence of 10% to 20% of persistent recurrent symptoms has been reported following Frey's procedure [43]. Following LPJ, despite early postoperative pain relief observed in 80% of patients, recurrent pain developed

within 3 to 5 years in up to 30% of patients [84]. The recurrence of pain was often attributed to persistent or recurrent disease in the head of the pancreas [85].

Surgical procedures for chronic pancreatitis fail for several reasons: (1) the disease progresses in the head or another area of the gland; (2) an anastomotic stricture develops that no longer decompresses an obstructed duct; and (3) when pain is the major problem, irrespective of the surgical procedure performed, the perception of pain and the pain pathway persists. Confirmatory evidence shows that, if bouts of pancreatitis recur and enzymes are elevated, the pancreas is the source. If pain recurs and the presumption is recurrent pancreatitis, then duct and parenchymal studies are repeated. The decision to perform surgery involves similar thought processes as for an initial surgical procedure. The choices for surgical treatment depend on what was done previously. A failed drainage procedure usually is followed by a pancreatic resection; a failed resection, by total pancreatectomy; and a total pancreatectomy, by nerve ablation or nerve block. Success rates increase by only 15% to 20% for secondary surgical procedures.

The preoperative incidence of diabetes in our series 39%. Frey reported 11% of new onset of diabetes in his series of 50 patients followed over a period of 91 months [42] Prinz et al reorted of endocrine insufficiency rate of 50% in 86 patients following LPJ followed up over a period of 24 years in 1981[5].

Adams reported 23% incidence in1994 [4] & Bassi reported 11% in 1997 following LPJ. Incidence of new onset diabetes after surgery is 4% in our series. This is less compared to literature evidence probably because of short duration of follow up.

Preoperative incidence of exocrine insufficiency in our series of patients is 25%. New onset of exocrine insuffiency following surgery was 16%. Frey reported 11% of new onset of steatorrhoea in his series of 50 patients followed over a period of 91 months.[42]. Izbicki et al reported incidence of 3% & 6% in his series in 1997 [86] & 1998[33] following LPJ-LHEP. Prinz et al reorted of exocrine insufficiency rate of 34% in 86 patients following LPJ followed up over a period of 24 years in 1981[4]. Adams reported 34% incidence in1994 following LPJ. Our incidence is 15.7% following surgery this is comparable to literature evidence, but the follow up duration is very less.

After surgery weight improved in 35% of our patients, it remained the same in 51% & decreased in 14%. Frey reported 64% weight gain, 33% lost weight & 1% remained unchanged in his series of 50 patients followed over a period of 91 months.[42]. Izbicki et al reported incidence of 78% & 81% increase in body weight his series in 1997[86] & 1998[33] following LPJ-LHEP.

Duration of surgery & blood loss during surgery are comparable to other centres.

Strength & limitation:

No study has been exclusively done for utility of IOUS in surgery for chronic pancreatitis. Study population is acceptable to consider for an uncommon surgery. Both the groups are comparable in demography, etiology & pancreatic morphology.

Randomization was not a good method.

Pain reflects only one aspect of the sensitive and functional aspects of day-to-day living. Assessment of the quality of life by standardized psychometric measures, first introduced in the evaluation of outcome in cancer treatment, seems to be mandatory in the evaluation of therapeutic strategies in patients with chronic pancreatitis [87]. Assessment of pain by VAS alone is not sufficient to assess the outcome of surgery.

Conclusion

Intra operative ultra sonogram (IOUS) detected malignancy in one patient, there by altering the management.

IOUS was useful in 73% of our patients. IOUS enabled us to obtain more complete information & was useful in the complete evaluation of chronic pancreatitis to provide greater assurance that all structures that require drainage have been identified & managed.

Pain relief though was slightly better in IUOS group, was not found to be statistically significant.

Duration of surgery was longer in IOUS group. Peroperative blood loss was lower in IOUS group, but was not statistically significant.

Morbidity was similar in both groups.

Short term outcome of weight gain, endocrine & endocrine insufficiency were not significantly altered by IOUS.

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Abbreviations :-

1. AP : Alcoholic Pancreatitis
2. CECT : Contrast Enhanced Computed Tomography
3. CP : chronic pancreatitis
4. DP : Distal Pancreatectomy
5. DPPHR : Duodenum-preserving pancreatic head resection
6. EUS : Endo ultra sonogram
7. FHA : Fine Needle Aspiration
8. IOUS : Intra operative ultrasonogram
9. LPJ : Longitudinal Pancreatico Jejunostomy
10. LRLPJ : Local resection of the head with lateral pancreaticojejunostomy
11. MPD : Main Pancreatic duct
12. MRCP : Magnetic ResonanceCholangioPancreatography
13. PD : Pancreaticoduodenectomy
14. PPPD : Pylorus preserving pancreaticoduodenectomy
15. PPPD : Pylorus Preserving Pancreatico Duodenectomy
16. TP : Total Pancreatectomy
17. TP : Tropical Pancreatitis
18. USG : Ultrasonogram
19. VAS : Visual Analog Scale

Master chart code

Diagnosis : 1- TP 2- AP;

Surgery : 1- Frey's 2- LPJ

VAS – pain score;

DM- 1 – diabetic 2 – non diabetic

Steatorrhoea : 1- yes 2- no;

Weight loss : 1 – yes 2 – no

Indication for surg : 1- pain 2 – bleed

Mass head: 1- yes 2 – no

IOUS : 1 – useful 2 – not useful

Ious use

1- Identified MPD
2- Located calculi
3- Identified undrained cyst
4- Detected calculi & cyst
5- Located pseudoaneursym
6- Detected mass

Morbidity :1-yes 2- no;

Pain relief: 1 – yes 2- no

DM post op

0- Non Dm no change
1- New onset DM
2- Pre op DM – same
3- Pre op DM – non DM

Wt post op

1 – Improved
2- Same
3– Decreased

Steatorrhoea post op

0 – no steat no change
1- New onset
2- Pre op steat – same
3- Pre op steat – non steat.

NON-IOUS GROUP											
study no	age	sex	diag	surgery	pain dur yrs	vas	dm	steat	wt loss	mass head	mpd mm
1	35	f	1	2	1	8	1	2	2	2	10
2	20	m	1	2	15	10	2	2	2	2	12
3	26	f	1	2	1	10	2	2	1	2	8
4	13	f	1	1	8	10	2	2	2	1	9
5	57	m	1	1	10	8	2	1	1	1	20
6	41	m	2	1	4	10	2	2	2	1	7
7	41	m	2	1	10	10	1	1	1	1	7
8	33	m	1	2	2	9	2	2	1	2	8
9	27	m	1	1	6	10	2	2	2	1	11
10	35	m	2	2	1	10	2	2	1	2	8
11	52	m	2	1	2	9	2	2	1	1	15
12	29	m	2	1	10	10	2	2	2	1	7
13	38	m	1	1	4	10	1	2	2	1	9
14	39	m	1	1	8	9	1	1	1	1	12
15	42	f	1	1	5	9	1	2	2	1	7
16	20	m	1	1	1	9	2	1	1	1	8
17	44	m	2	1	1	9	2	1	2	1	9
18	37	f	1	1	1	10	1	2	2	1	7
19	30	f	1	1	2	9	2	2	2	1	10
20	35	m	2	1	1	9	1	1	2	1	8
21	49	m	2	1	5	9	2	1	2	1	11
22	22	f	1	1	3	9	1	2	1	1	7
23	45	m	2	1	10	9	1	2	2	1	9
24	29	f	1	2	1	9	2	2	2	2	8
25	26	m	1	2	1	10	1	2	2	2	7
26	24	m	1	1	1	8	1	2	2	1	8

NON-IOUS GROUP											
study no	dur surg min	bl loss ml	p op stay days	morbidity	fol dur months	post op pain VAS	pain relief	dm post op	wt post op	steat post op	
1	210	180	11	2	27	6	2	2	3	0	
2	170	300	11	2	24	0	1	1	1	0	
3	180	200	11	2	23	2	1	0	1	1	
4	180	200	8	2	22	0	1	0	1	0	
5	240	350	9	2	22	0	1	0	2	2	
6	205	250	12	2	23	1	1	0	1	0	
7	200	280	9	2	20	2	1	2	3	3	
8	170	180	13	2	20	3	1	0	2	0	
9	210	310	11	2	20	1	1	0	1	0	
10	200	210	10	2	20	4	1	0	2	0	
11	190	310	11	2	19	5	2	0	2	0	
12	215	320	9	2	18	0	1	0	1	0	
13	240	250	11	2	17	0	1	3	3	1	
14	240	600	17	1	10	9	2	2	3	2	
15	230	210	7	2	16	5	2	2	2	0	
16	195	300	19	1	11	2	1	0	2	2	
17	230	550	17	1	12	0	1	0	3	2	
18	220	310	13	2	16	0	1	2	2	1	
19	195	250	13	2	9	1	1	0	2	0	
20	190	350	13	2	15	2	1	2	2	2	
21	240	300	14	2	14	2	1	0	1	2	
22	190	200	25	1	3	0	1	2	1	1	
23	180	275	32	1	13	0	1	2	1	0	
24	195	225	9	2	1	9	2	0	1	0	
25	160	300	13	1	7	4	1	2	2	1	
26	180	200	8	2	15	0	1	3	1	0	