ENDOSCOPIC ULTRASONOGRAPHIC FINDINGS OF PANCREATIC PARENCHYMA AND DUCTAL SYSTEM IN PATIENT WITH CHRONIC PANCREATITIS

Roshan Kafle, Ramila Shrestha, Mukesh Sharma Paudel, Ajit Khanal, Dibas Khadka

Department of Gastroenterology, Bir Hospital, Kathmandu, Nepal

ABSTRACT

Chronic pancreatitis is a progressive inflammatory disorder characterized by irreversible morphological changes in the pancreas, leading to persistent abdominal pain, malabsorption, and diabetes mellitus due to endocrine and exocrine insufficiency. A total of 53 patients diagnosed with chronic pancreatitis were evaluated using endoscopic ultrasonography (EUS) at Bir Hospital focusing on both pancreatic parenchymal and ductal changes. Biliary abnormalities were also recorded. EUS revealed that increased parenchymal echogenicity was the most common finding, present in 69.8% of cases. Pancreatic atrophy was observed in 20.8%, while intra-parenchymal calcifications appeared in 30.2% of patients. Cystic collections were found in 24.5%, and hyperechoic strands without shadowing were noted in 35.8%. Hyperechoic foci without shadowing were seen in 5.7% of cases. Ductal findings were also prominent, with a dilated main pancreatic duct (MPD) in 58.5% of patients and intraductal stones present in 34.0%. Irregular MPD contours were noted in 15.1%, while dilated side branches were less common, found in only 1.9%. Additionally, biliary involvement was observed in a subset of patients, with dilated common bile duct (CBD) and CBD stones both present in 7.5% of cases, and distal CBD narrowing in 17.0%. EUS is an effective tool for evaluation of pancreatic parenchymal and ductal changes in chronic pancreatitis.

KEYWORDS

Chronic pancreatitis, EUS, pancreatic parenchyma, main pancreatic duct

***Received on**: November 25, 2024*
***Accepted for publication**: December 05, 2024*

CORRESPONDING AUTHOR

Dr. Roshan Kafle,
Associate Professor,
Department of Gastroenterology,
Bir Hospital, Kathmandu, Nepal
Email: dr.roshankafle2073@gmail.com
Orcid No: https://orcid.org/0009-0003-1014-1894
DOI: https://doi.org/10.3126/nmcj.v27i2.80535

INTRODUCTION

Chronic pancreatitis (CP) is a progressive inflammatory disorder that leads to irreversible morphological changes in the pancreas.[1,2] It is characterized by persistent abdominal pain, malabsorption, and diabetes mellitus resulting from both endocrine and exocrine insufficiency. The disease evolves over time, often manifesting with significant complications related to pancreatic function decline.[1]

Chronic pancreatitis continues to challenge clinicians, with its progression often difficult to control. The disease presents in various forms, leading to substantial adverse effects on patients' quality of life and significant societal costs due to healthcare expenses and reduced productivity.[3]

Imaging is essential for assessing pancreatic diseases. Ultrasound (US) and computed tomography (CT) are the primary modalities used, each offering distinct benefits and limitations.[1] Although transcutaneous ultrasound can visualize the pancreas, its accuracy is often hindered by factors such as obesity, reverberations, and bowel gas. In contrast, endoscopic ultrasonography (EUS) places the probe close to the pancreas, utilizing high-frequency ultrasound (5-12.5 MHz), which allows for the detection of subtle ductal and parenchymal changes.[2,4] Ductal features typically include calcifications, hyperechoic duct walls, duct dilation, and visible side ducts. Parenchymal alterations consist of lobulation (with or without honeycombing), hyperechoic areas, echogenic strands, and cysts.[4]

EUS imaging for chronic pancreatitis was first reported in 1986.[5] Linear EUS provides imaging in line with the endoscope's shaft, while radial EUS offers circumferential views perpendicular to the shaft.[6] There is limited data available on the characteristics of chronic pancreatitis in Nepal. This study aims to identify the EUS findings in chronic pancreatitis.

MATERIALS AND METHODS

This observational study included 53 patients with chronic pancreatitis, selected based on predefined inclusion and exclusion criteria. The study was conducted in the Department of Gastroenterology at Bir Hospital after approval from the Institutional Review Board (IRB) of Bir Hospital. Patients of age ≥18 years with classical history and radiological features of chronic pancreatitis undergoing endoscopic ultrasonography examination were included. Patients unwilling to abstain from alcohol, those not consenting, pregnant individuals were excluded.

EUS examination of the pancreas was be performed by using a echoendoscope (Fujifilm EG580UR / Fujifilm EG580UT, Japan). Hyperechoic foci with post-acoustic shadowing were defined as echogenic structures ≥2 mm in both length and width, producing a shadow.[5] Lobularity was defined as well-circumscribed, ≥5 mm structures with hyperechoic rims relative to their central areas, and when at least three lobules were contiguous, this was termed as "honeycombing" lobularity.[5] Hyperechoic, non-shadowing foci were echogenic structures ≥3 mm in length and width without shadowing.[5] Cysts were anechoic, rounded or elliptic structures measuring ≥2 mm in the short axis.[5] Strands were hyperechoic lines ≥3 mm in length seen in at least two different directions relative to the imaged plane.[5]

Main pancreatic duct (MPD) calculi were defined as echogenic structures with acoustic shadowing.[5] An irregular MPD contour was characterized by an uneven, ectatic course.[5] Dilated side branches were identified as three or more tubular anechoic structures, each >1 mm in width, communicating with the MPD.[5] The MPD was considered dilated if its diameter was ≥3.5 mm in the pancreatic body or >1.5 mm in the tail.[5] A hyperechoic MPD margin was defined as a relatively hyperechoic duct wall present in over 50.0% of the MPD in the body and tail.[5]

Statistical Analysis: Data were recorded in a Microsoft Excel spreadsheet and analyzed using SPSS-20. Categorical data were expressed as frequencies and proportions.

RESULTS

The study comprised 53 patients with a mean age of 43.6 years (SD 11.6), ranging from 21 to 68 years. Age distribution was as follows: 11.3% were aged 20-30, 28.3% were 30-40, 32.1% were 40-50, 17.0% were 50-60, and 11.3% were 60-70 years. In terms of sex distribution, 86.8% of patients were male and 13.2% were female.

Increased pancreatic parenchymal echogenicity was the most common finding, observed in 69.8% of cases, indicating a significant degree of chronic changes. Pancreatic atrophy, seen in 20.8%, suggests progressive tissue loss in a notable portion of patients. However, the bulky pancreas in 5.7% and hyperechoic strands with acoustic shadowing in 3.6% were uncommon.

Table 1: Key pancreatic parenchymal findings in EUS		
Key parenchymal finding	**Number of cases**	**% of cases**
Parenchymal calcification	16	30.2
Increased parenchymal echogenicity	37	69.8
Pancreatic atrophy	11	20.8
Bulky pancreas	3	5.7
Lobularity with honeycombing	3	5.7
Lobular pattern without honeycombing	18	34.0
Hyperechoic strands without acoustic shadowing	19	35.8
Hyperechoic strands with acoustic shadowing	2	3.6
Hyperechoic foci without shadowing	3	5.7
Stranding	2	3.8
Cystic collections	13	24.5

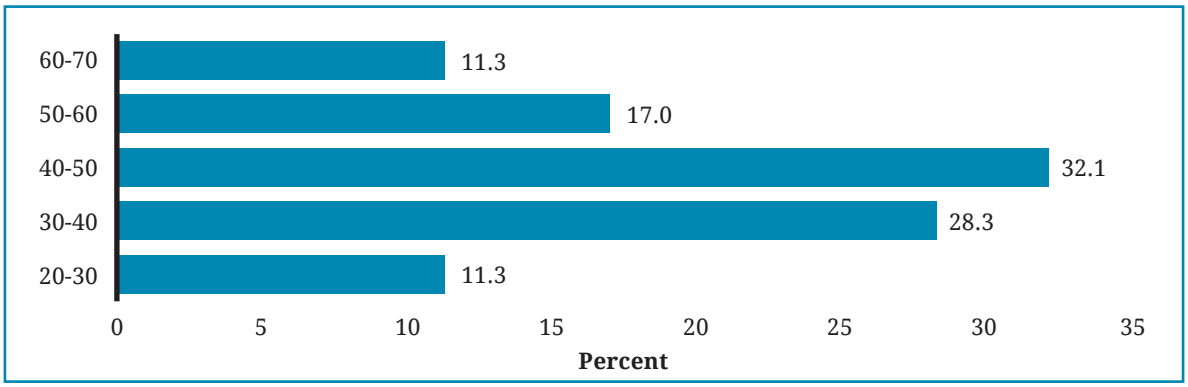

Fig. 1: Age Distribution across various age groups of patients

Table 2: Key pancreatic ductal system findings in EUS		
Key pancreatic duct findings	**Cases (n)**	**Cases (%)**
Dilated side branches	1	1.9
Irregular MPD	8	15.1
Hyperechoic MPD margins	1	1.9
Dilated MPD	31	58.5
Intraductal stones	18	34

Table 3: Key common bile duct findings in EUS		
Key CBD findings	**Cases (n)**	**Cases (%)**
CBD stones present	4	7.5
Dilated CBD	4	7.5
Distal CBD narrowing	9	17

Hyperechoic strands without acoustic shadowing were noted in 35.8% of cases, indicating a frequent feature of chronic pancreatitis, possibly linked to fibrosis. Lobularity with honeycombing was less common, observed in only 5.4%. Intra-parenchymal calcification appeared in 30.2% while the presence of lobular patterns without honeycombing was seen in 34.0%. Hyperechoic foci without shadowing in 5.7% were relatively rare,whereas cystic collections in 24.5% reflect fluid accumulation, potentially due to ductal

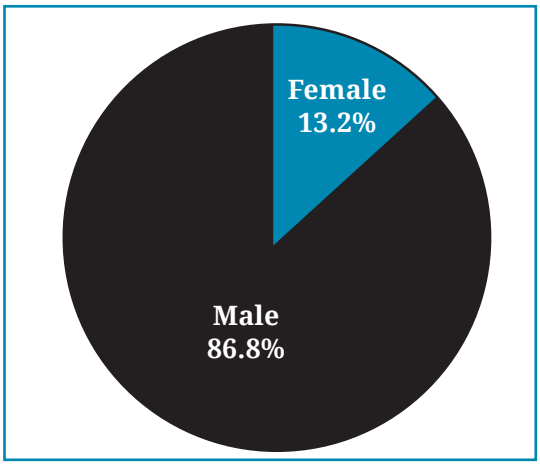

Fig. 2: Sex distribution of the patients

disruptions or pseudocyst formation. Stranding was observed in 3.8%. The variability in these findings illustrates the heterogeneity of chronic pancreatitis.

Intraductal stones were present in 34.0% of cases, highlighting a significant occurrence of stone formation within the pancreatic ducts. Dilated side branches and irregular MPD were relatively rare, with only 1.9% and 15.1% of cases, respectively, indicating that these findings are less common in our study population. However, dilated MPD was a prominent feature, observed in 58.5% of cases. Hyperechoic MPD margins were rare at 1.9%, pointing to limited evidence of ductal wall fibrosis or calcification in most cases. These findings collectively emphasize the structural alterations within the pancreatic duct system in chronic pancreatitis, with ductal dilation and intraductal stones being the most frequent abnormalities.

Dilated common bile duct (CBD) and CBD stones were both found in 7.5% of cases, indicating that biliary obstruction and stone formation are not predominant features in chronic pancreatitis but still occur in a subset of patients. Distal narrowing of the CBD was seen in 17.0%, suggesting a more frequent involvement of the bile duct by fibrosis or inflammation.

Our study highlights a spectrum of pancreatic abnormalities with varying prevalence. These results underscore the diverse manifestations of chronic pancreatitis in endoscopic ultrasound imaging.

DISCUSSION

The diagnosis of chronic pancreatitis (CP) remains challenging. EUS is now considered the preferred technique for the morphological assessment of these pancreatic changes.[2] In recent years EUS has become an essential tool in both the diagnosis and treatment of pancreatic diseases. Initially developed as a diagnostic imaging modality, EUS has evolved to support tissue diagnosis through fine-needle aspiration (FNA) and fine-needle biopsy (FNB). Its ability to produce high-resolution images and its minimally invasive nature offer significant advantages over conventional cross-sectional imaging techniques.[7]

EUS demonstrates a high sensitivity (81%; 95% CI: 70%-89%) for detecting pancreatic abnormalities, which is comparable to the sensitivity of ERCP (82%) and higher than that of MRI (78%), CT (75%), and abdominal ultrasonography (US) (67%).[8] EUS shows a specificity of 90% (95% CI: 82%-95%), which is comparable to CT (91%) and only slightly lower than MRI (96%) and ERCP (94%) for diagnosis of chronic pancreatitis.[8]

In this study mean age of the patient was 43.6 ± 11.6 years.The mean age of the patients is quite similar to the study by Thapa *et al*,[9] where it was 35.75 ± 11.43 years. In Sharma *et al*[10] study the mean age of patients was 58.18 years, which is significantly higher compared to both our study and Thapa *et al*[9] study.

In our study, the proportion of male patients is slightly higher at 86.8%. Thapa *et al*[9] study also demonstrate similar male predominance, with the female population making up a small proportion of the total patients. Similar male predominance was also noted in Sharma *et al*[10] study. Male predominance in studies from Nepal reflects the higher rates of alcohol and smoking habits among men in this part of the world, aligning with global data that identify these factors as significant contributors to chronic pancreatitis.[9,10]

In our study, 58.5% of cases showed a dilated main pancreatic duct (MPD), whereas Sharma *et al*[10] in their study done in Eastern Nepal reported a 100% occurrence of ductal dilation in both ultrasound and CT imaging, indicating a much higher prevalence of this feature in their population. Intraductal stones were also more common in Sharma *et al*,[10] where 83.6% of patients had intraductal calculi, compared to only 34% in our study. MPD calculi was noted only in 18.1 % in Sisman *et al*[11] study.

In our study, pancreatic atrophy was observed in 20.8% of cases, while calcifications were present in 30.2%, and pancreatic cysts in 24.5%. In comparison, the Copete *et al*[12] study reported pancreatic atrophy in 41.7% of cases, calcifications in 66.7%, and pancreatic cysts in 25.0%. These variations underline the heterogeneity in the progression of chronic pancreatitis, with parenchymal damage manifesting differently depending on disease severity and patient characteristics.

In our study, 7.5% of patients were found to have common bile duct (CBD) dilatation, highlighting some degree of biliary involvement in chronic pancreatitis. In contrast, Sharma *et al*[10] reported 0% cases of CBD dilatation, with no patients exhibiting this finding on imaging.

Pungpapong *et al*[13] compared findings obtained using EUS and MRCP in CP. The sensitivity of EUS was higher than that of MRCP, although the specificities of EUS and MRCP were similar. Furthermore, they reported a sensitivity of

98% when either EUS or MRCP was abnormal, and reported a specificity of 100% when both were abnormal.

Although promising, several issues are associated with using EUS features to diagnose chronic pancreatitis. Factors such as aging, smoking, obesity, and chronic alcohol consumption can produce similar EUS changes in the pancreas. Additionally, there is significant interobserver variability, which further complicates the accuracy of EUS-based diagnoses.[14] While studies show ductal dilation and lobularity have the highest agreement, variability remains across criteria. Calcifications and pancreatic duct dilation showed the best agreement, while lobularity without honeycombing had the poorest. The Rosemont classification did not improve interobserver agreement, and echoendoscope type had no significant effect.[2]

This hospital-based study was limited by the availability of resources for investigating genetic risk factors. While there is increasing awareness of chronic pancreatitis and its complications within Nepalese medical community, larger population-based studies are needed to fully understand the true extent and impact of this often-overlooked condition.

In conclusion, endoscopic ultrasound is evolving development in Nepal to diagnose parenchymal and ductal changes in patients with chronic pancreatitis.

Conflict of interest: None

Source of research fund: None

REFERENCES

1. Hariharan M, Chail V, Mudda A, Modi P, Rangari M. A comparative study of ultrasound and computed tomography in evaluation of acute and chronic pancreatitis, associated complications and predicting severity and prognosis. *Asian J Pharm Clin Res* 2024; 17; 160–5. DOI: https://doi.org/10.22159/ajpcr.2024.v17i6.51657
2. Iglesias-García J, Lariño-Noia J, Lindkvist B, Domínguez-Muñoz JE. Endoscopic ultrasound in the diagnosis of chronic pancreatitis. *Rev Esp Enferm Dig* 2015; 107: 221–8.
3. Desai N, Kaura T, Singh M, Willingham FF, Rana S, Chawla S. Epidemiology and characteristics of chronic pancreatitis-do the east and west meet? *Gastro Hep Adv* 2022; 1: 942–9. DOI: https://doi.org/10.1016/j.gastha.2022.07.013
4. Dimcevski G. Ultrasonography in diagnosing chronic pancreatitis: New aspects. *World J Gastroenterol* 2013; 19: 7247. DOI: https://dx.doi.org/10.3748/wjg.v19.i42.7247
5. Catalano MF, Sahai A, Levy M *et al*. EUS-based criteria for the diagnosis of chronic pancreatitis: the Rosemont classification. *Gastrointest Endosc* 2009; 69: 1251–61. DOI: 10.1016/j.gie.2008.07.043
6. Yousaf MN, Chaudhary FS, Ehsan A *et al*. Endoscopic ultrasound (EUS) and the management of pancreatic cancer. *BMJ Open Gastroenterol* 2020; 7: e000408. DOI: 10.1136/bmjgast-2020-000408
7. Dahiya DS, Shah YR, Ali H *et al*. Basic principles and role of endoscopic ultrasound in diagnosis and differentiation of pancreatic cancer from other pancreatic lesions: a comprehensive review of endoscopic ultrasound for pancreatic cancer. *J Clin Med* 2024; 13: 2599. DOI: 10.3390/jcm13092599
8. Issa Y, Kempeneers MA, Van Santvoort HC, Bollen TL, Bipat S, Boermeester MA. Diagnostic performance of imaging modalities in chronic pancreatitis: a systematic review and meta-analysis. *Eur Radiol* 2017; 27: 3820–44. DOI: 10.1007/s00330-016-4720-9
9. Thapa J, Shrestha R, Tamang RK, Baral S, Yadav B. Chronic pancreatitis: risk factors and clinico-radiological profile. *Nepal Med Coll J* 2021; 23: 153–8. DOI: 10.3126/nmcj.v23i2.38526
10. Sharma R, Pradhan B, Karki P, Subedi M. Clinical and epidemiologic profile of chronic pancreatitis, a retrospective study in Eastern Nepal. *J Adv Intern Med* 2018; 7: 30–3. DOI: 10.3126/jaim.v7i2.23487
11. Sisman G, Koroglu E, Erzin Y, Hatemi I, Tuncer M, Senturk H. Demographic characteristics of chronic pancreatitis patients in the era of endosonography: Experience of a single tertiary referral center in Turkey. *Turk J Gastroenterol* 2016; 27: 284–9. DOI: 10.5152/tjg.2016.15537
12. Sepúlveda-Copete M, Satizabal-Padridin N, Hidalgo-Cardona A *et al*. Descripción clínica y epidemiológica de pacientes con pancreatitis crónica en un hospital de alta complejidad en Cali, 2011 a 2017. *Rev Colomb Gastroenterol* 2021; 36: 30–8. DOI: 10.22516/25007440.568
13. Pungpapong S, Wallace MB, Woodward TA, Noh KW, Raimondo M. Accuracy of endoscopic ultrasonography and magnetic resonance cholangiopancreatography for the diagnosis of chronic pancreatitis: a prospective comparison study. *J Clin Gastroenterol* 2007; 41: 88–93. DOI: 10.1097/MCG.0b013e31802dfde6
14. Rana S and Vilmann P. Endoscopic ultrasound features of chronic pancreatitis: a pictorial review. *Endosc Ultrasound* 2015; 4: 10. DOI: 10.4103/2303-9027.151314