Role of Computed Tomography scan in the diagnosis of pancreatic cystic lesions

A dissertation

Submitted to the Council of the College of Medicine / the Committee of Postgraduate Studies of University of Babylon as a part of requirements for the degree of Higher Diploma in field of Radiology

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بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

وَيَسْأَلُونَكَ عَنِ الرُّوحِ قُلِ الرُّوحُ مِنْ أَمْرِ رَبِّي وَمَا أُوتِيتُمْ مِنَ الْعِلْمِ إِلَّا قَلِيلًا

﴿ ٨٥ ﴾ سورة الأسراء

صَدَقَ اللَّهُ الْعَظِيمُ

Dedication

TO THE SPIRITS OF MY MOTHER AND
MY FATHER, TO MY HUSBAND AND
TO MY FAMILY AND ALL
COLLEAGUES WHO ASSISTED ME IN
EACH STEP TO ACCOMPLISH THIS
DISSERTATION

Najlaa 2022

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Dr. Kassim Amir Hadi Taj Al-Dean,

So many thanks for your valuable efforts and highly appreciated remarks that helped me to finish my thesis.

The success of my study could never happen without any support and useful advice of many people. I will recognize to every moment and every persons that share with me a valuable experience.

Supervisors' Certification

I certify that this dissertation was prepared under our supervision at Babylon University as partial fulfillment of the requirements for the degree of Diploma of Radiology.

Supervisor

Dr. Kassim Amir Hadi Taj Al-Dean
Professor of radiology

Committee Certification

We, the examining committee, certify that we have read the dissertation entitled (Role of CT scan in the diagnosis of pancreatic cystic lesions**) and have examined the student (**Najlaa Fakhri Hassan**) in its contents, and that, in our opinion, it is accepted as a thesis for the degree of Diploma of Radiology.**

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Recommendations of Dean of College of Medicine-Babylon University:

In view of the available recommendations, I forward this dissertation for the debate by the examining committee.

Professor

Dr.

Mohend Abbass Nori Alshalah

The Dean of College of Medicine

University of Babylon

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List of abbreviation

ACC	acinar cell carcinoma
CBD	Common bile duct
cc	cubic centimeter
CT	Computed Tomography
EUS-FNA	EUS-guided fine-needle aspiration
GIT	Gastro intestinal tract
IPMN	intraductal papillary mucinous neoplasms
ITPN	Intraductal tubulopapillary neoplasm of the pancreas
k	Inter-observer agreement Kappa
LVI	Lymphovascular invasion
MCN	mucinous cystic neoplasms
MDCT	multidetector CT
mm	Millimeter
MRI	Magnetic Resonance Imaging
n	Number
PET	positron emission tomography
PNET	pancreatic neuroendocrine tumors
s	Seconds
SCA	serous cystadenomas
SCN	serous cystic neoplasms
SD	Standard deviation
US	Ultrasonography
WHO	World Health Organization

ABSTRACT

Background: Cystic lesions of pancreas are common and raising challenge dilemma being difficult to detect, because the radiological technology quality improve the detection of asymptomatic pancreatic cysts is obviously to increase. Recently, there is no gold standard radiological imaging for diagnosis. Computed tomography (CT) is the best radiology tool for the primer evaluation and follow-up of pancreatic cysts.

Objectives: The study aimed to determine the roles of CT scan in the diagnosis of pancreatic cystic lesions, differentiate whether lesions are malignant or non-malignant and find-out the imaging features for detection of the benign and malignant cystic lesions of pancreas.

Methods: A prospective study with total of 58 patients were enrolled in the study during the period from 12th June 2021 to 20th May 2022. The study sample consisted of 19(32.8%) males and 39(67.2%) females. Participants data, including age, gender, and symptoms, and CT scan features include: lesion sites, parenchymal atrophy, number of cystic lesion, diameter of largest cyst, calcification, ductal dilation, solid components, cyst contour, contrast enhancement type of cyst, thickness of wall, lymphovascular invasion and communication. All the studied patients underwent for CT scan examination, which was done before any intervention. CT scan was performed utilizing the Siemens system (SOMATOM Definition AS VA44A; Siemens, Somaris/7 syngo CT 67002-2012B, Germany) and 64-slice (multi-detector) CT system (Philips) .

Results: The mean age was 41.59±11.9 years (median = 42 years). About, 19(32.8%) were males, and 39(67.2%) were females. The majority of cysts were situated in head of pancreas (21, 36.2%). Ten (17.2%) of lesions detected with parenchymal atrophy. About, 33(56.9%) of cases detected one cyst on CT scan, 11(19%) cases diagnosed with two-cysts, and 14(24.1%) cases diagnosed with more than three-cysts. The CT scan detected calcified cyst in 11 cases as 2(3.4%) parietal calcification, 3(5.2%) central calcification and 6(10.3%) peripheral calcification. However, 47(81.1%) of cysts were non-calcified. Only six-scan showed dilation of

duct. Only 6(10.3%) of cases had cyst with solid component. The cyst contour presented as round in 50(86.2%) of patients. All cysts were enhanced with contrast. The majority appear to be homogeneous in 45(77.6%), while the rest 13(23.4%) were heterogeneous in content. About 39(67.2%) cases detected with unilocular cyst. The results revealed 43(74.1%) cases with thin wall, while 15(25.9%) cases with thick wall. Kappa statistic of CT findings revealed that detection of cyst location (P= 0.036), number of cyst (P= 0.048), ductal dilation (P= 0.022), solid component (P= 0.003) and type of cyst (P= 0.013) had significantly perfect agreement signals. Solid components of cyst showed statistically significant difference in malignant pancreatic cyst more than benign cyst (P= 0.004). Furthermore, types of cyst in benign pancreatic tumor were detected significantly different from malignant tumor (P= 0.016).

Conclusions: MDCT scan is the easily applicable non-invasive tool of choice for assessment of cystic lesions of pancreas. The most common age group of detected pancreatic cyst is (41-50) years. Middle age women are mostly diagnosed with pancreas cystic lesions. Round, homogeneous enhancement, oligo-unilocular, non-calcified, non-dilated duct, non-solid and thin wall head cyst are the prevalent features detected by MDCT scan. The most common diameter measured of pancreatic cyst is more than 30 mm. Lymphovascular invasion, solid component and cyst-duct communication are mostly features of malignant lesions. Detection of cyst site, number, ductal dilation, solid component and type of cyst are significantly helpful to differentiat between malignant and benign pancreatic cysts. Pancreatic cysts sites, parenchymal atrophy, number, diameter of largest cyst, calcification, ductal dilation and diameter, contour, contents, enhancement, wall thickness, LVI and cyst-duct communication could be negatively impacted the CT scan results. Solid components of cyst and types of cyst could be positively implicated CT scan results.
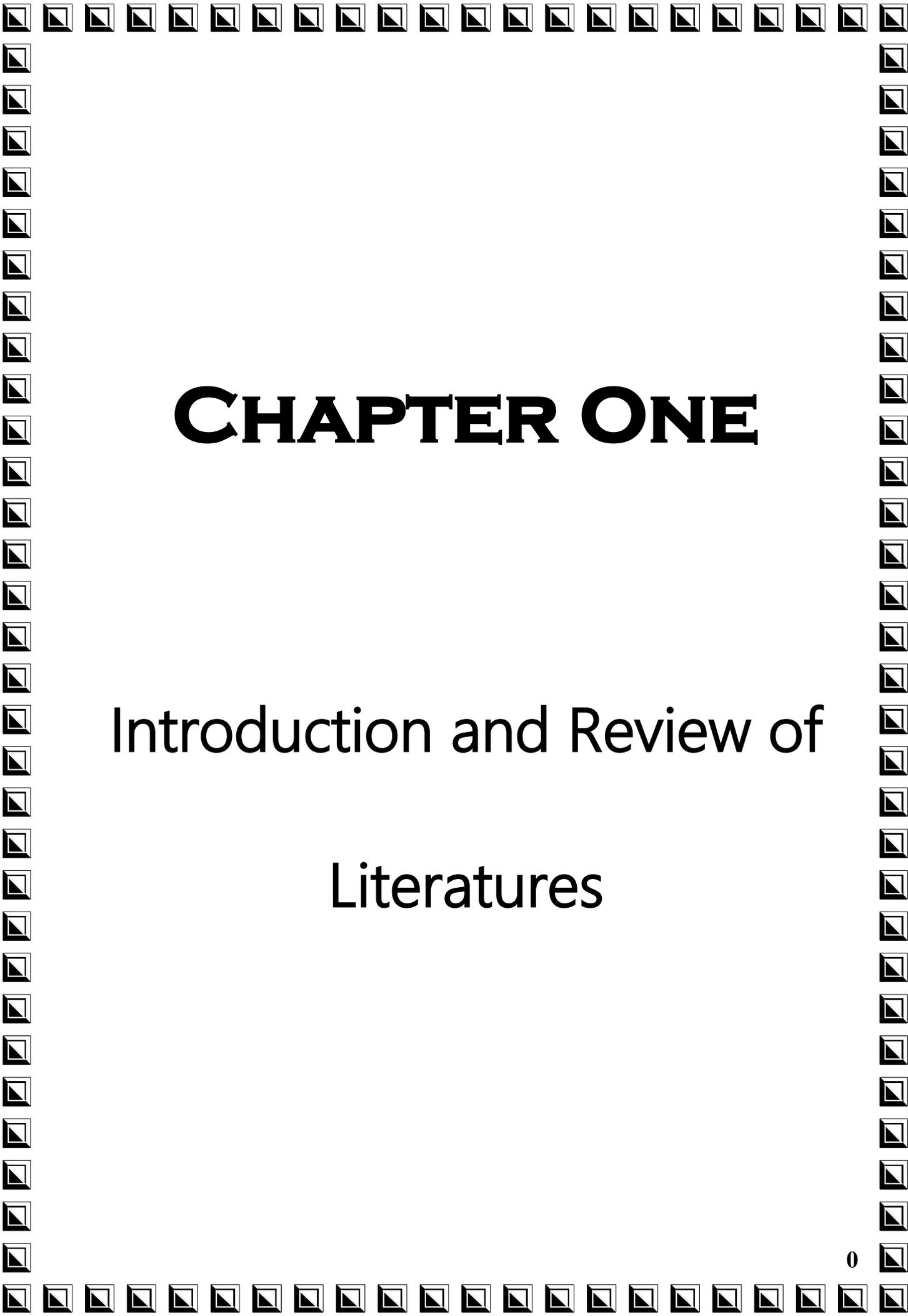
Chapter One

Introduction and Review of

Literatures

Introduction

1. Introduction

Pancreas cyst are very common and raising challenge delima of difficulty to investigation, because the quality of radiology techniques improve the detection of asymptomatic pancreatic cysts is increase [1]. The common detected lesions are pseudocysts, serous cystadenomas (SCA), mucinous cystic neoplasms (MCN), intraductal papillary mucinous neoplasms (IPMN) and solid pseudopapillary tumours. Almost all cysts may be pseudocysts, and all cysts require to diagnosed to be prove weather be malignant or pre-malignant [2]. Recently, there is no gold standard radiological tools for differentiation [3]. CT scan [4], PET scan [5], MRI, MR cholangiopancreatography, endoscopic ultrasound with fine needle aspiration (EUSFNA) [6], endoscopic retrograde cholangiopancreatography (ERCP) and cyst fluid tumor markers [2,7,8] have been used to diagnosed cysts which are demonstrated different degrees of sensitivity and specificity [3].

These cysts categorized into neoplastic and non-neoplastic. Neoplastic cystic lesions can transform to malignant. In addition, pseudocysts, lymphoepithelial cysts, and retention cysts are never transform to malignancy. The percent of diagnosed of cysts has been varied, ranging from 0.7- 36.7% [9, 10].

Early diagnosis of the cysts raised the dilemma of how to triage and treat cystic lesions [11, 12].

In recent studies, CT scan is the best radiology tool for the primer evaluation and follow-up of cysts [13-17]. Advantageous properties of available multi-slice CT scans are the high speed of acquisition with narrow collimation, large image resolution, multi-planar imaging and reformats using volume data [18]. Additionally, CT is widely available, easily accessible, less cost, high sensitive, high accurate, reproducible, and easy to read [18].

CT scan protocols vary in practice worldwide, and the commonly using is delay 40-50 sec and portal venous phase (delay of 60-70 sec) [14-16, 19, 20]. A monophasic

CT protocol after intravenous contrast administration is usually sufficient for the diagnosis, severity assessment, and monitoring the progression of AP [18].

In past two decades, several technological advances in imaging have significantly increased the detection and features of pancreatic cystic lesions [21-24]. Moreover, the challenge of managing incidentally discovered pancreatic cystic lesions are present. Indeed, the differential diagnosis of these cystic lesions ranges from benign to potentially or frankly malignant lesions [2, 11, 12, 22-24]. There were several professional societies proposed pancreatic cysts lesion management guidelines [25-33], this reflect how much the problems represent.

1.2. Anatomy

Anatomically speaking, the pancreas lies in the upper abdomen behind the stomach. It is a part of the GIT system that is responsible to secrete digestive enzymes into the intestine and it represent an endocrine organ that secretes hormones into the blood to control energy metabolism and storage throughout the body [18, 34]. Exocrine portion of the pancreas which makes and secretes digestive enzymes into the duodenum, include acinar and duct cells, which comprise more than 95%, while endocrine portions that make and secrete several hormones. Pancreas consists from three major parts head, body, and tail. The head nearest the duodenum and the tail extend to the hilum of the spleen [34].
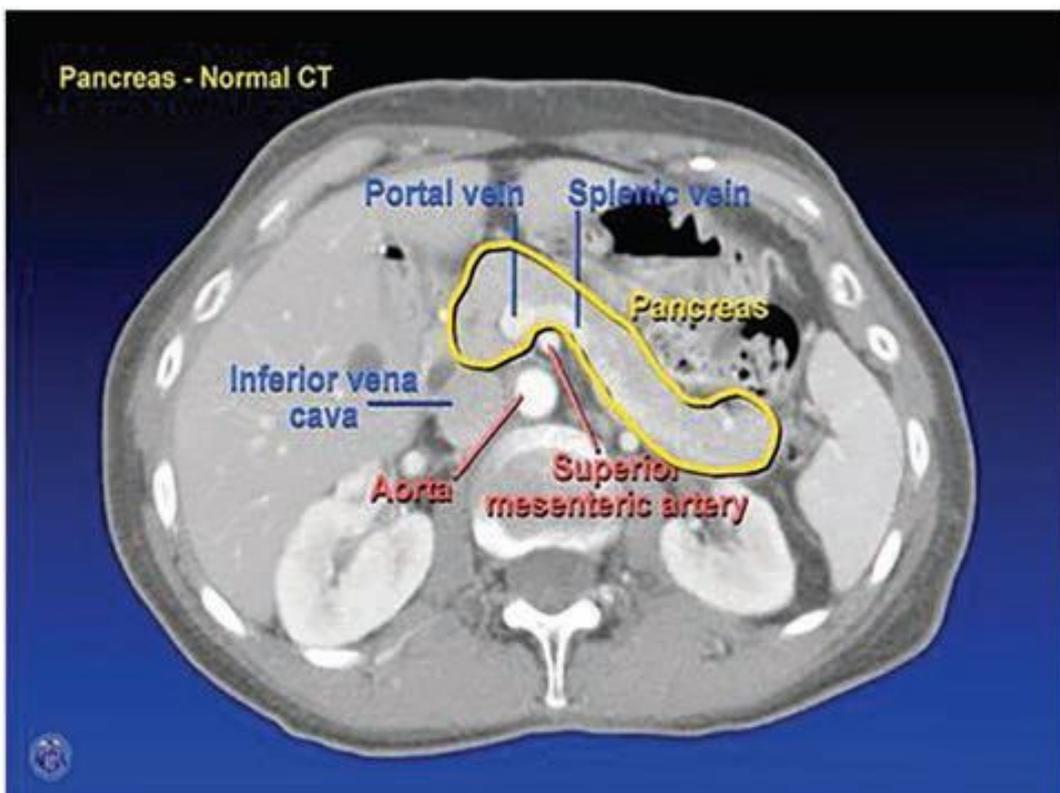
Figure 1.1. CT scan of the upper abdomen at the level of the Pancreas [34].

1.3. Pancreatic cystic lesions

In the pancreas, different types of benign or malignant cystic lesions can be observed. They are simple retention cysts, pseudocysts and neoplasm cysts [11]. Differentiation between the various cysts has an importance in prognosis and treatment implications. Cysts could be correlated to several systemic disorders like cystic fibrosis and VHL syndrome. Malignancy of pancreas can be detected in up to 80% of multiple endocrine tumor type 1 [11, 35, 36].

1.4. Non-neoplastic cysts

1.4.1. Pseudocysts
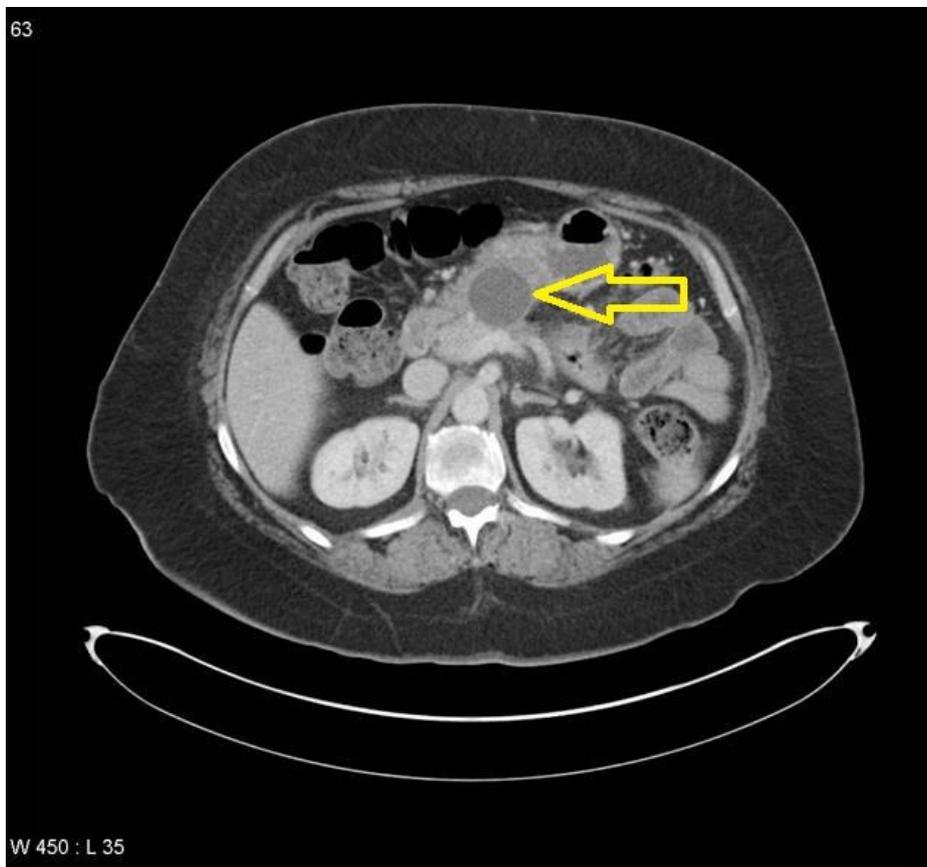
Figure 1.2. Pseudocysts of pancreas (arrow).
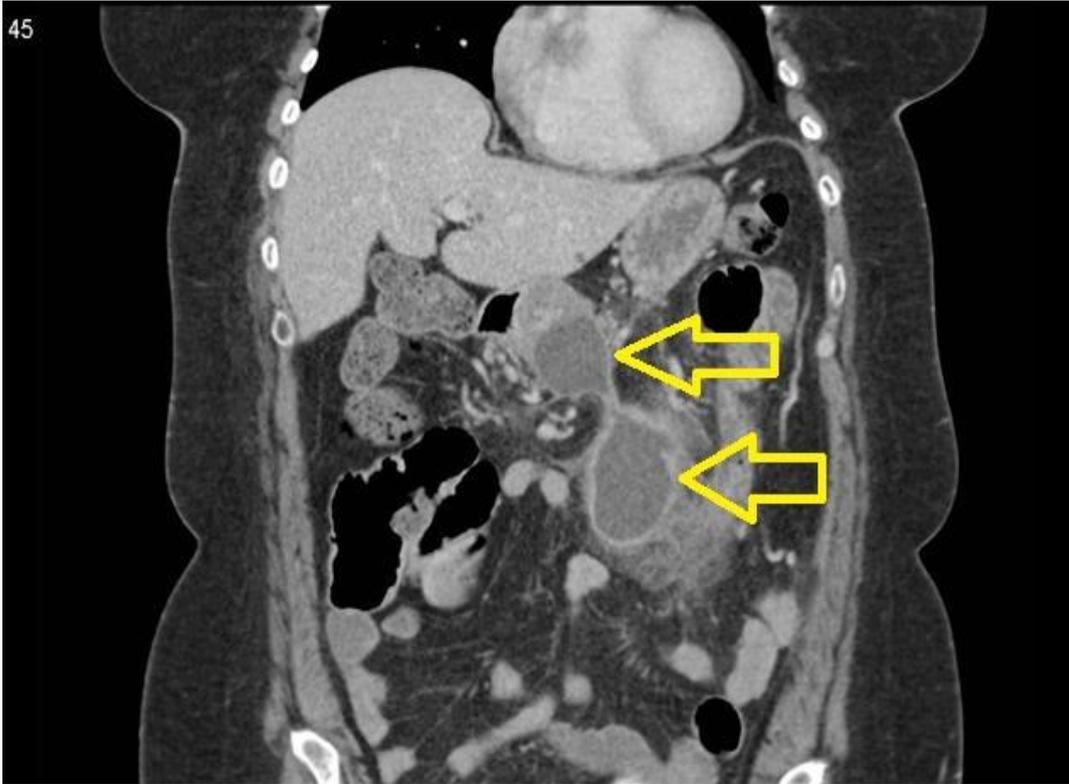
Figure 1.3. Pseudocysts of pancreas (arrow).

1.4.2. Retention cyst

Figure 1.4. Retention cyst (arrow) due to chronic pancreatitis caused by hydatid cysts.

1.4.3. Lymphoepithelial cyst (LECs)
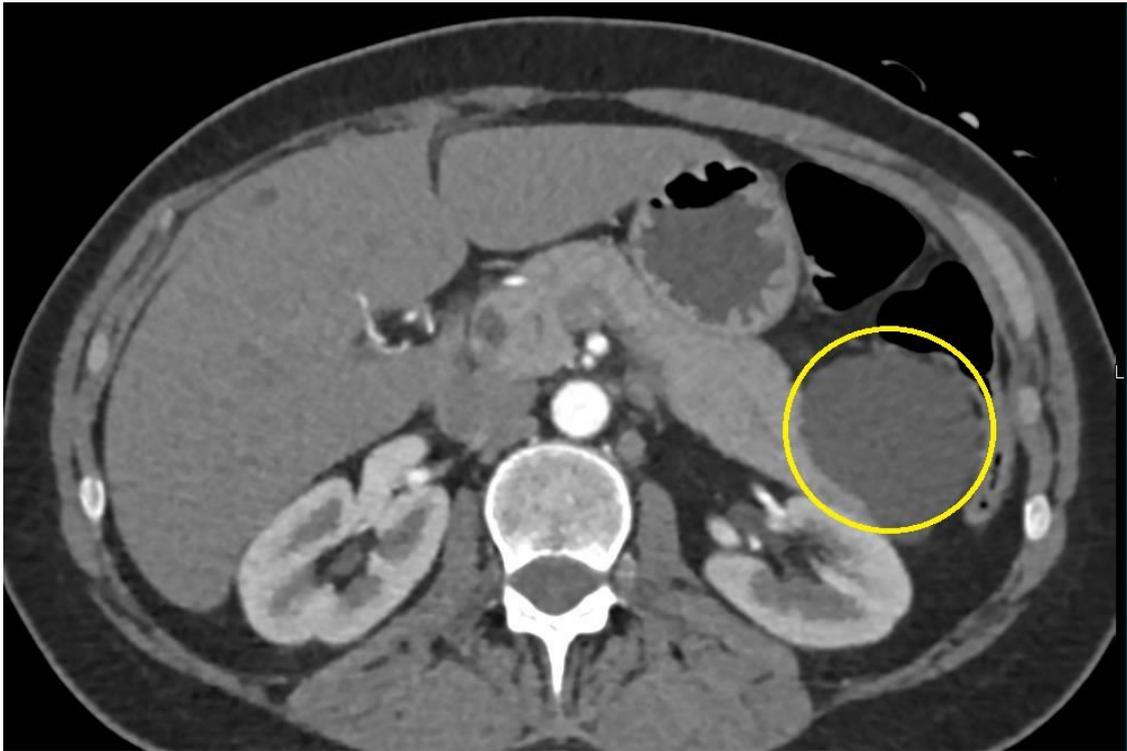
Figure 1.5. Lymphoepithelial cyst of the tail of pancreas (circle).

1.4.4. Cystic pancreatic lymphangioma
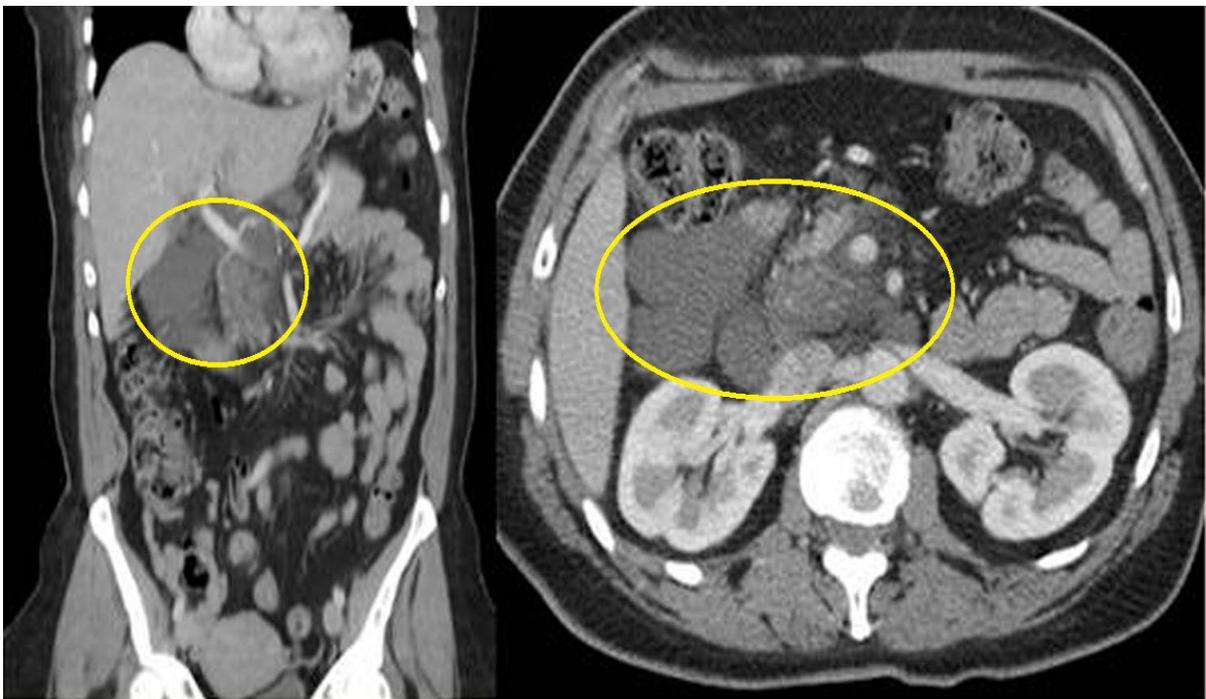
Figure 1.6. Large cystic pancreatic lymphangioma cyst involving the surrounding tissues and vessels (circle).

1.4.5. Dermoid cyst (Epidermoid)
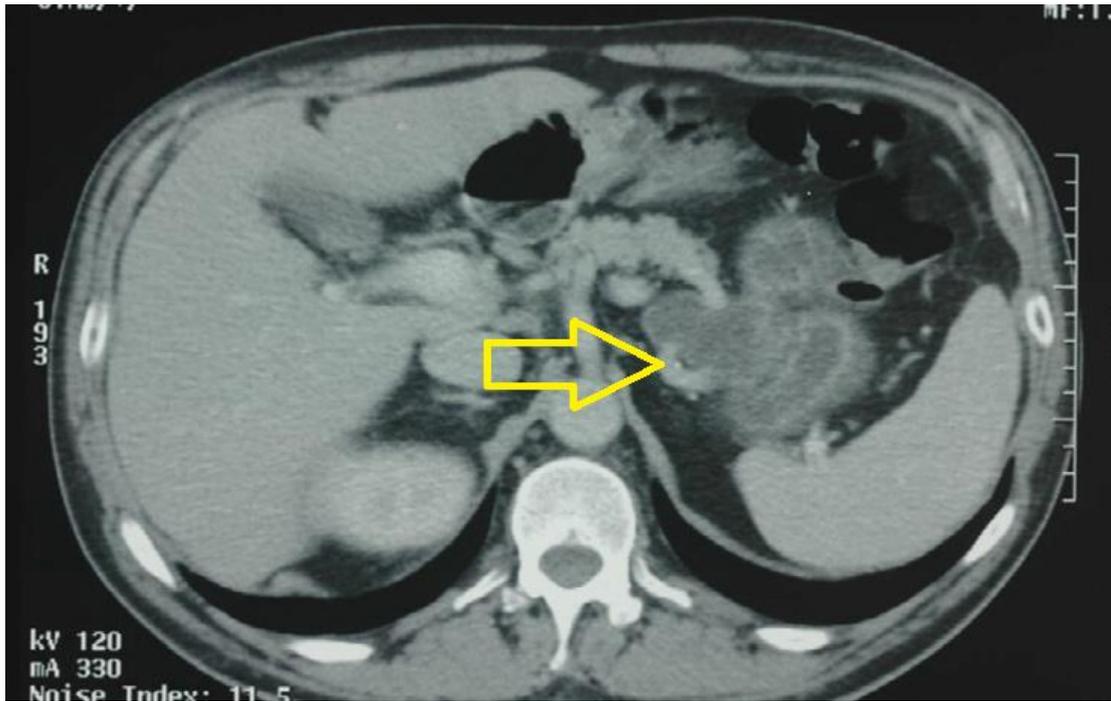
Figure 1.7. Teratoma (dermoid cyst) of pancreas (arrow).

1.4.6. Duplication cyst (Ciliated foregut)

Figure 1.8. Duplication cyst (Ciliated foregut) of the pancreas (arrows).

1.5. Neoplastic cysts (PANCREATIC CYSTIC NEOPLASMS)

1.5.1. Mucinous cystic lesions

1.5.1.1. Intra-ductal papillary mucinous neoplasm (IPMNs)
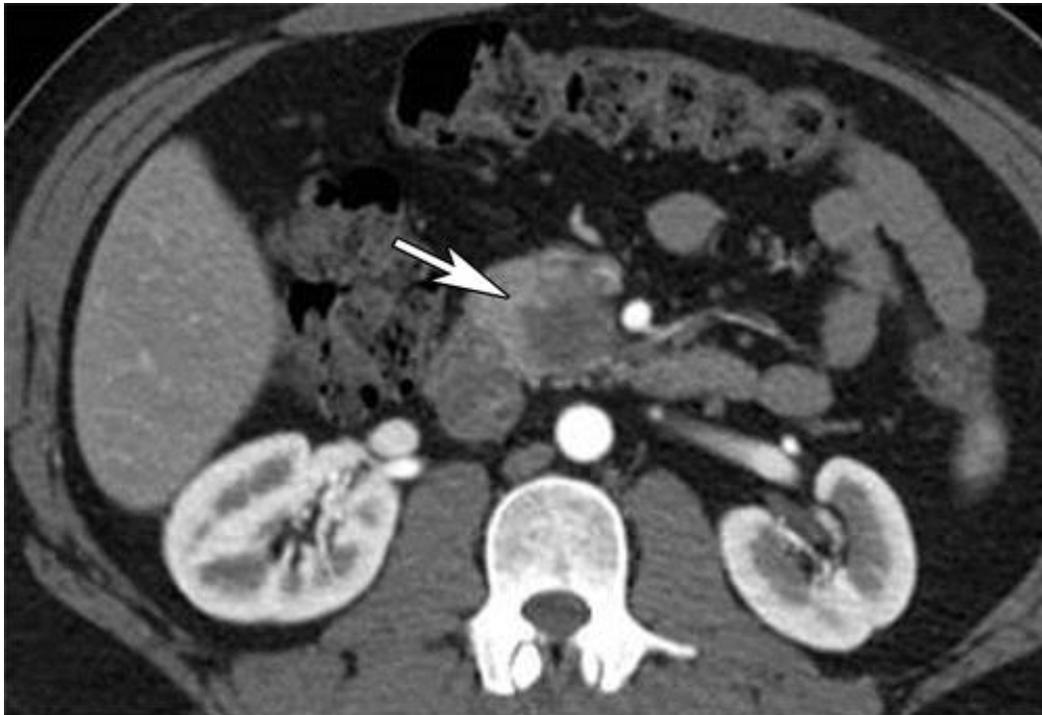
Figure 1.9. Familial polyposis syndrome in pancreas (arrow).

Figure 1.10. IPMN, the pancreas show diffuse dilatation of the main duct and its branches till the pancreatic head, with no evident underlying masses noted (rectangle).

1.5.1.2. Mucinous cystic neoplasm (MCNs)
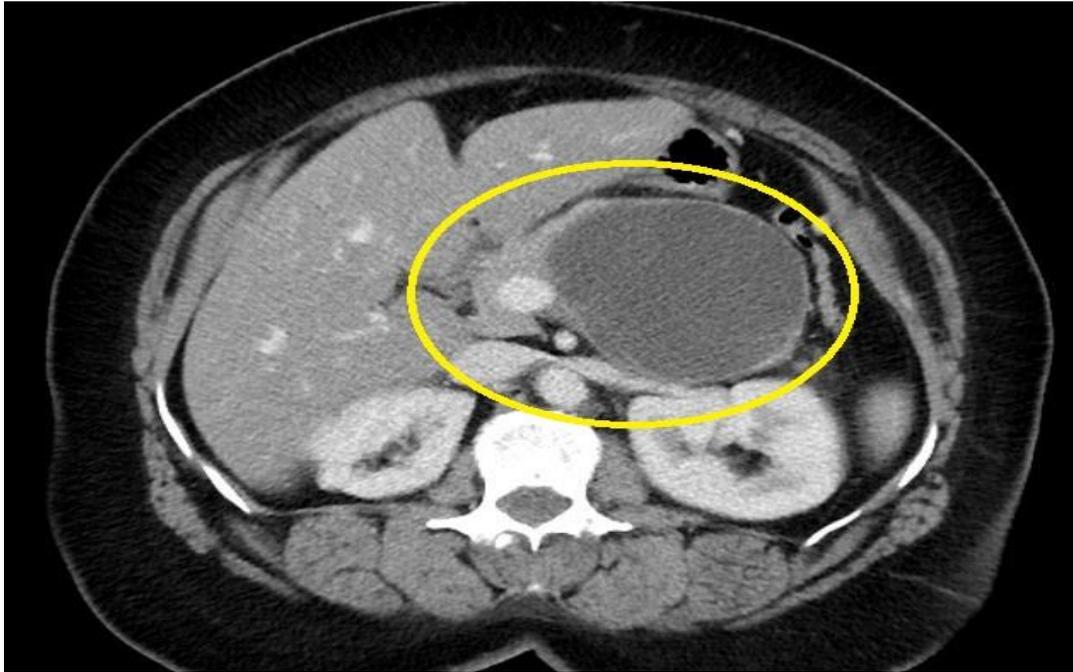
Figure 1.11. Mucinous cystic neoplasm of pancreas (circle).

1.5.2. Nonmucinous Cystic Neoplastic Lesions

1.5.2.1. Serous cystic neoplasm (SCNs)
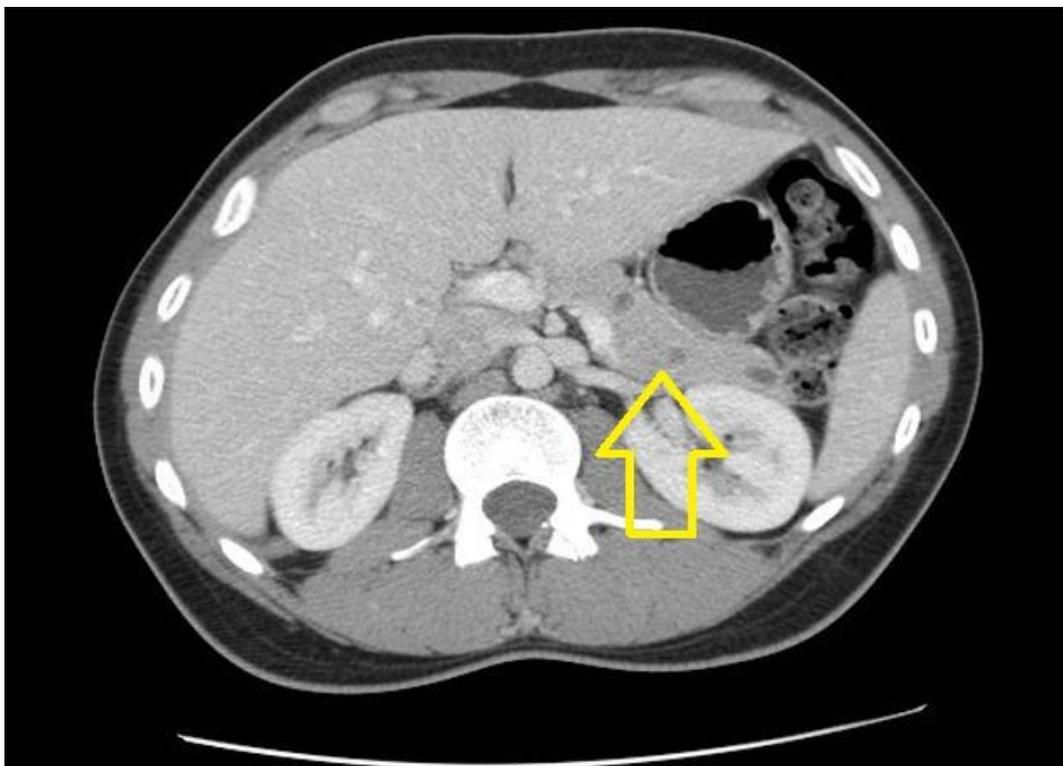
Figure 1.12. Von Hippel-Lindau (VHL) syndrome (arrow).
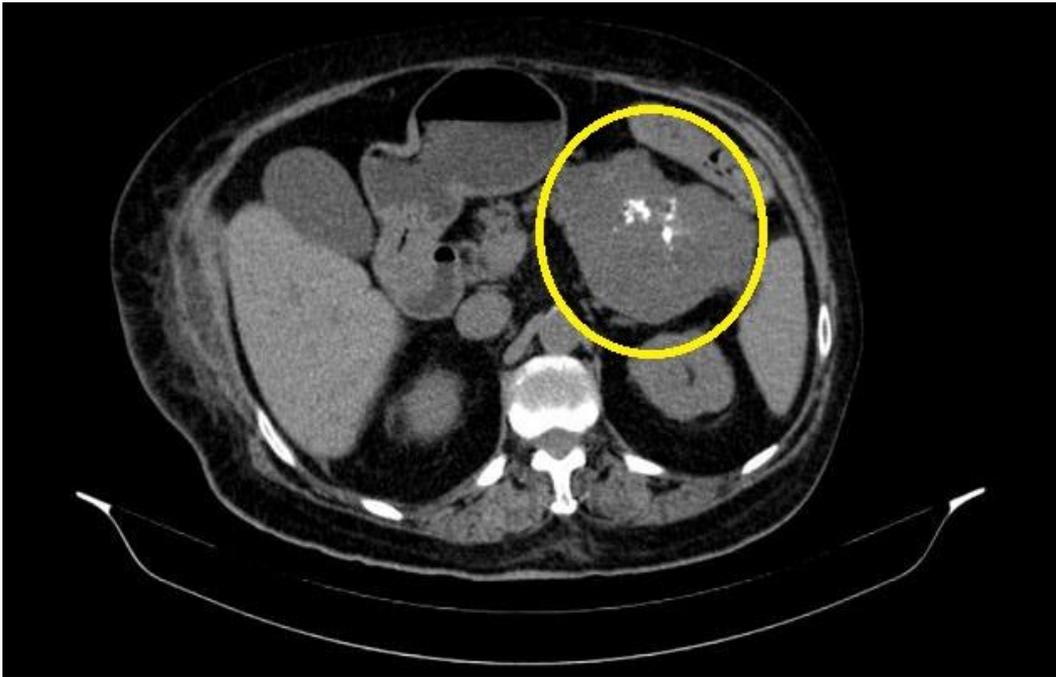
Figure 1.13. Serous cystadenoma of pancreas (circle).

1.5.2.2. Solid pseudopapillary neoplasm (SPNs)
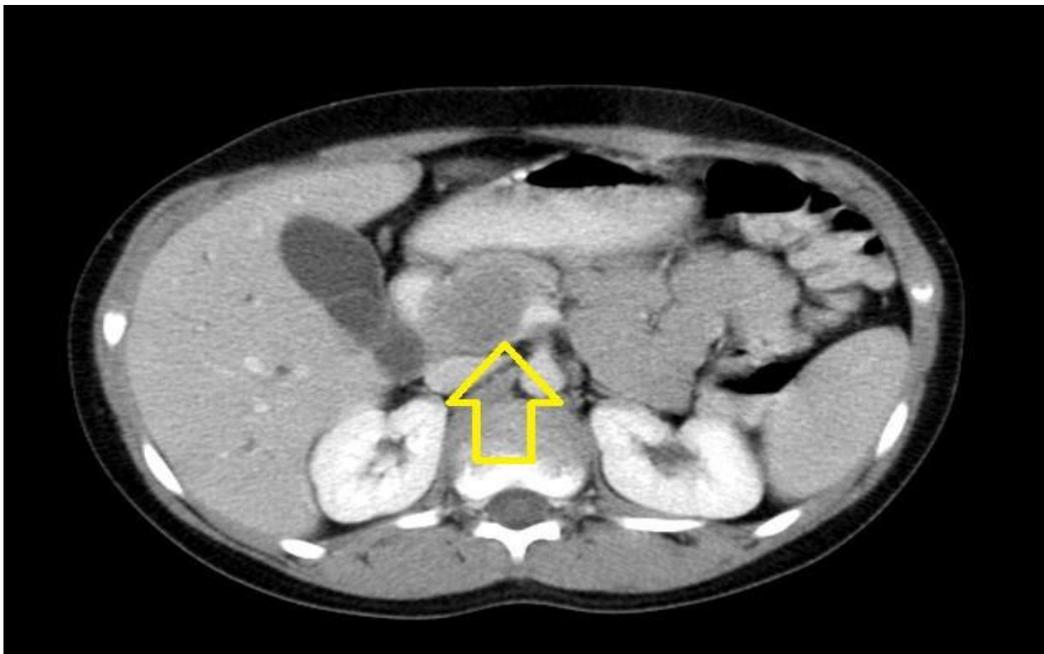
Figure 1.14. Solid pseudopapillary tumor (arrow), a well-marginated solid-appearing, centered at and expanding the head. The lesion is associated with dilatation of the main and accessory pancreatic ducts, moderate Intrahepatic biliary and CBD.

1.5.2.3. Cystic pancreatic pseuroendocrine tumor

Figure 1.15. Pancreatic peuroendocrine tumor (arrow).

1.5.2.4. Cystic acinar cell neoplasm
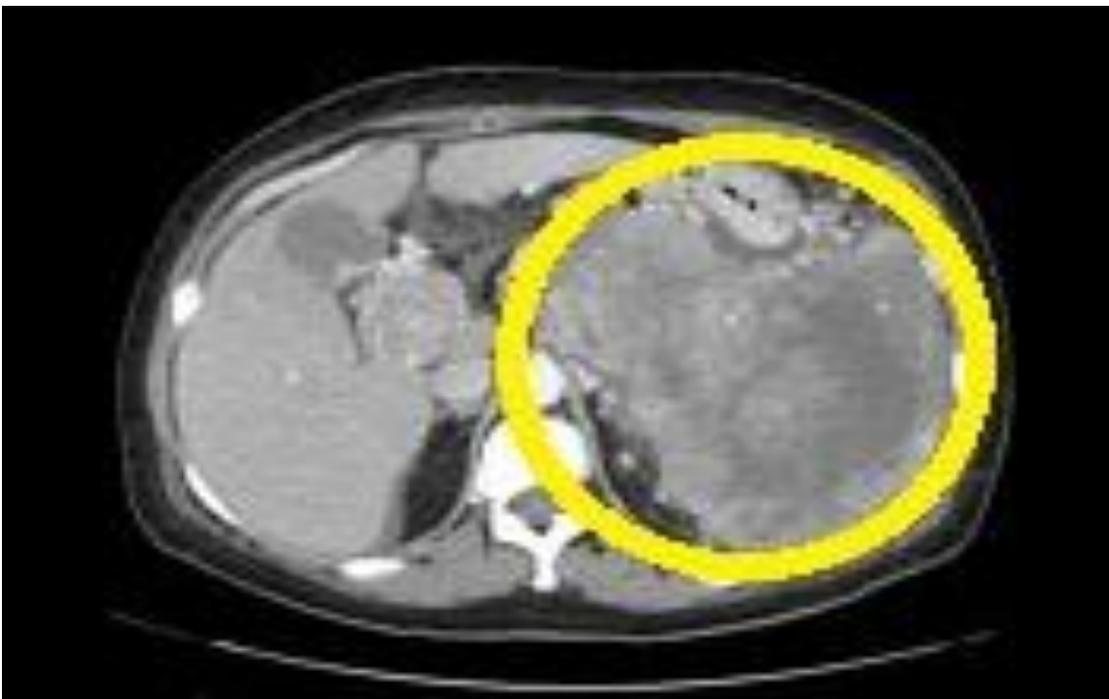
Figure 1.16. Cystic acinar cell neoplasm of pancreas (circle).

1.5.3. Others

1.5.3.1. Pancreatic ductal adenocarcinoma with cystic degeneration
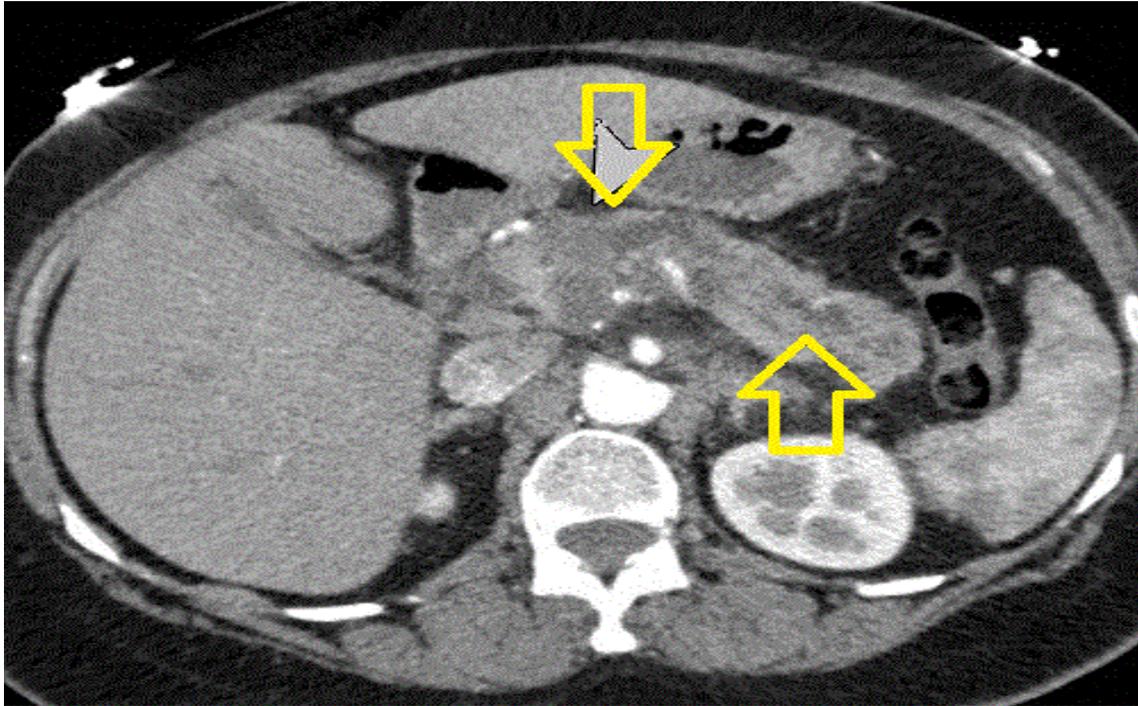
Figure 1.17. Pancreatic ductal adenocarcinoma with cystic degeneration (arrows).

1.5.3.2. Intra-ductal tubule-papillary neoplasm (ITPN)
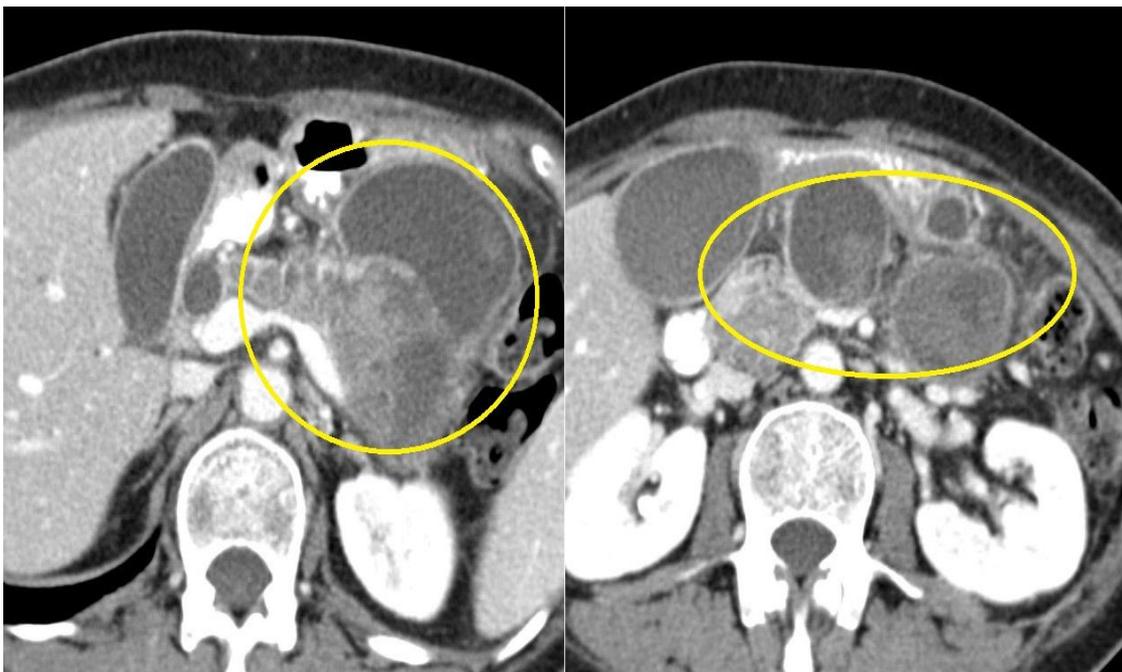
Figure 1.18. Intraductal tubulopapillary neoplasm of the pancreas (arrows).

1.6. The roles of Computed tomography scan (CT)

Multi-detector CT (MDCT) improves the spatial and temporal resolution and of significant impact on the ability to assess a cysts variety of pancreas with rising accuracy and sophistication [50, 52]. Cystic pancreatic tumors do have radiology findings that may permit to provide a specific and accurate diagnosis or, to narrow the differential diagnosis. Moreover, CT scan now serve as the primary tool to risk stratify cysts and determine which lesions can be safely treated conservatively plus follow-up [53]. The prevalence ranged from 1.2% [54], to 2.6 % [57].

Table 1.2Advantages and disadvantages of MDCT.

Advantage	Disadvantage	Implications
• Spatial resolution • Fast and short time of examination • Easy to read • Wider coverage scan • Relatively low cost than MRI • No artifact • No image degradation	• Exposure of Radiation • Time-consuming 3D • Reconstruction • Large volume of data • More side effects of contrast	• Invasion of adjacent • Vascular anatomy • Extrapancreatic diseases evaluation

1.6.1. Imaging Technique

Typically, cases are given 1500 cc of water immediately before CT scan to distend stomach and duodenum and to differentiate pancreatic cyst from a duodenal or gastric mass [53]. The administration of IV contrast is vital in the determination the architecture and morphology of cysts [58].

About 100–120 cc of non-ionic IV contrast intake in a rapid bolus (3–5 cc/s) for maximize the enhancement. The pancreatic cysts require a dual-phase acquisition, with arterial phase required at roughly 30 to 40 sec, while venous phase are required roughly 60 to70 sec [53, 58].

Recently in modern CT scan, images are taken with an extremely thin collimation plus a slice thickness of only 0.625 to 0.75 mm, then reconstructed into 3 to 5 mm axial sections [71, 70].

3-D reconstruction recently has now proven technique for the diagnosis of cyst lesions with two most commonly utilized include:

(1) maximum intensity projection (MIP) imaging

(2) volume rendering (VR)

MIP images are high-lighted the highest-attenuation voxels in the dataset and the project into a 3D display. They are helpful for assessing the vasculature and a vascularity related to lesions. Moreover, subtle peripheral Hyper-enhancement (SCNs and cystic neuroendocrine neoplasms) may be elevated in conspicuity with MIP [58].

Volume is a much more mathematically and a computationally the intensive process that assigning a color and transparency to different voxels depend on their attenuation values and then giving these data as an interactive three dimension display [58].

Raman and Fishman (2016), found this technique to be very helpful for cysts determination, assessment the internal architecture of cysts and demonstrating the association of a cyst to the neighboring duct [53].

Several researches in the past have shown that MDCT to be very accurate in the characterization of cysts, with accuracy was 56% to 85%, with accuracies as high as 79% for distinguishing benign from malignant cysts and as high as 85% for distinguishing mucinous type and non-mucinous types [64, 65, 69, 75].

Optimal photos of cysts require helical (spiral) CT or multi-detector CT (MDCT) , in addition to rapid administration of IV contrast. The helical scanning, axial images 5-mm collimation, 7-mm collimation, pitch 1.5 over the upper abdomen, and pitch 2 for the rest of the abdomen can be obtained. Acquisition start from the top of the diaphragm at approximately 60 sec. The MDCT scanner acquired a two-phase acquisition technique can be employed [98]. The phases are:

1.The first arterial dominant phase starts obtaining images at 40 sec over the pancreatic gland, from the top of the vertebral body thoracic-12 to the superior edge of the vertebral body lumber-4.

2.The second, portal dominant phase start at about 70 sec and acquire axial images, with a table speed of 15 mm.

3.The dual-phase pancreatic imaging, with data sets containing hundreds of images, the use of film has become impractical.

1.6.2. Limitations in the MDCT

- Motion artifacts.
- Loss of intro-abdominal fat.
- Lack of IV contrast administration.

1.7 Aims of the study

- To determine the roles of CT scan in the diagnosis of pancreatic cystic lesions.

- To differentiate whether lesions are malignant or benign.

- To find-out the imaging features for detection of the benign and malignant cysts.
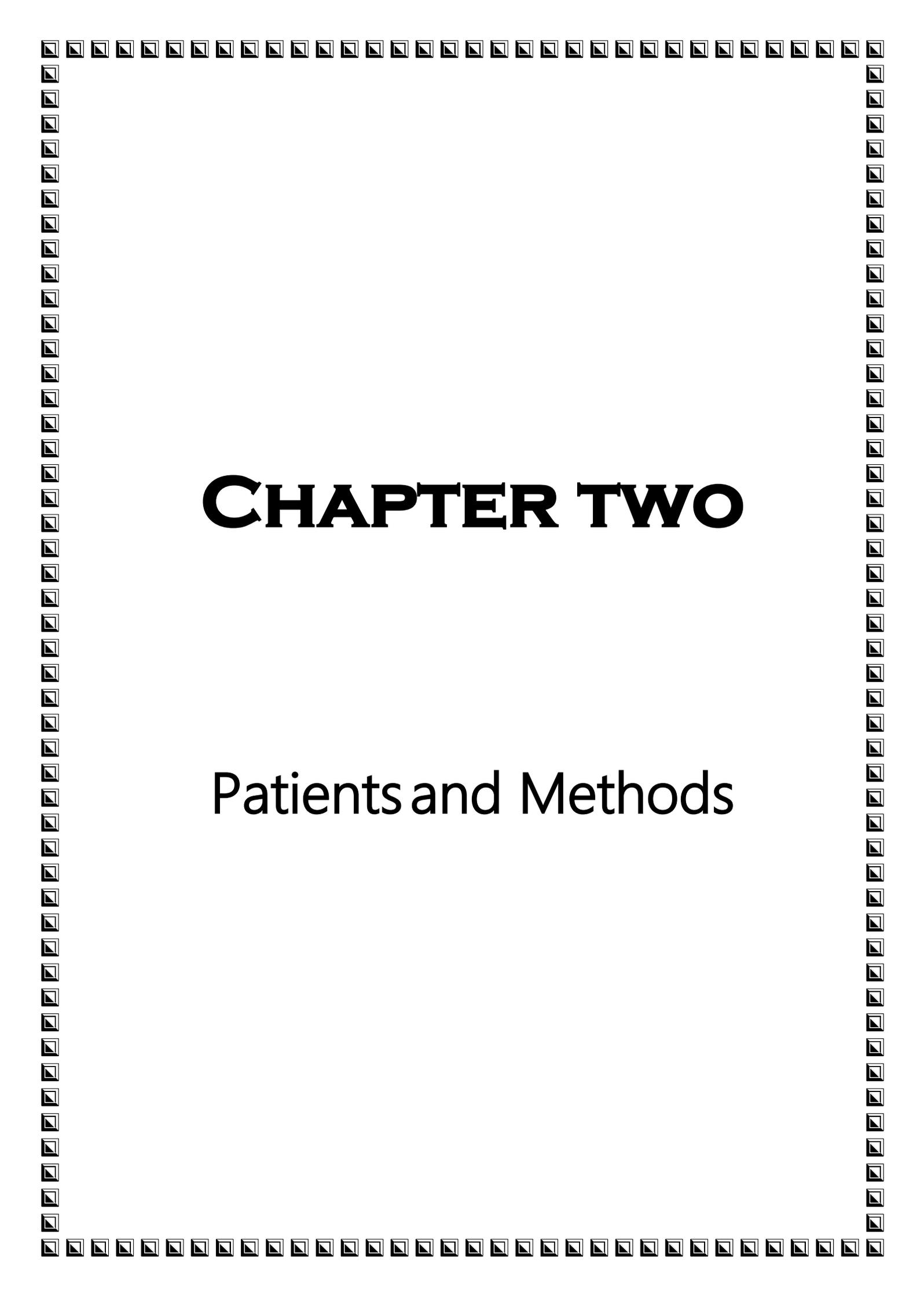
Chapter two

Patients and Methods

Patients and Methods

2.1. Study design and setting

A prospective study with total of 58 patients with central abdominal pain radiated to back were enrolled in the study during the period from 12th June 2021 to 20th May 2022. The study sample consisted of 19(32.8%) male and 39(67.2%) females, their median age, of 42 years (mean= 41.59±11.9 years).

2.2. Data collection

Participants data, including age, gender, and symptoms, and CT scan features include: lesion sites (head, neck, body, tail or multi sites), parenchymal atrophy (present or not), number of cystic lesion (1, 2 or 3 and more), diameter of largest cyst (<10mm, 10-30 mm and >30 mm), calcification (parietal, central and peripheral), ductal dilation (present or not), solid components (present or not), cyst contour (round, lobulated, and pseudopod), contrast enhancement (homogeneous and heterogeneous), cyst types (Uni-locular, Micro-multi-locular, Macro-multi-locular and Solid), thickness of wall (thin and thick), lymphovascular invasion (present or not) and communication (cyst-duct) (present or not). All the studied patients underwent CT scan examination, which was done before any intervention.

2.3. Exclusion Criteria

1. Any contraindication for CT scan examination (pregnancy, and allergy to contrast).
2. Patients unwilling to do the CT scan.
3. Patients with renal insufficiency.

2.4. CT scan protocols

CT scan was performed utilizing the Siemens system (SOMATOM Definition AS VA44A; Siemens, Somaris/7 syngo CT 67002-2012B, Germany) and 64-slice multi-detector) CT system (Philips).

The image quality checked according to following:

- Checked with the LINE tool that the diameter of large Acrylic pin is 50±1 mm.

- All resolution holes (7 rows) in the Acrylic pin should be visible.

- Five to six low contrast pins in the Aculon body be detectable.

The measurement scan parameter of 64 SLICE are:

- Collimation …………………..16 x 2.5

- Thickness……………………..5

- Increment……………………..0

- Rot time……………………….0.75

- Voltage………………………..120

- mAs/slico……………………..250

- Resolution…………………….Std

- Scan Angle……………………360º

2.5.   Technique of MDCT scan

- CT scan was performed using (64-slice multi-detector) CT system (Philips) of (kV 120) and (MAS 100).

- Scan done prior and after IV contrast taken. Water used as oral contrast given five min before each CT scan. Non-contrast CT images taken with five mm collimation. Omnipaque is used as IV contrast medium, then injected at rate of five ml/sec.

- The CT scans are taken after initiation of contrast at 30 sec, 50 sec, 65 sec, to assess the arterial, pancreatic and venous images, respectively.

- Slice thickness is 2mm slice, reconstruction of pancreatic images are at 1mm.
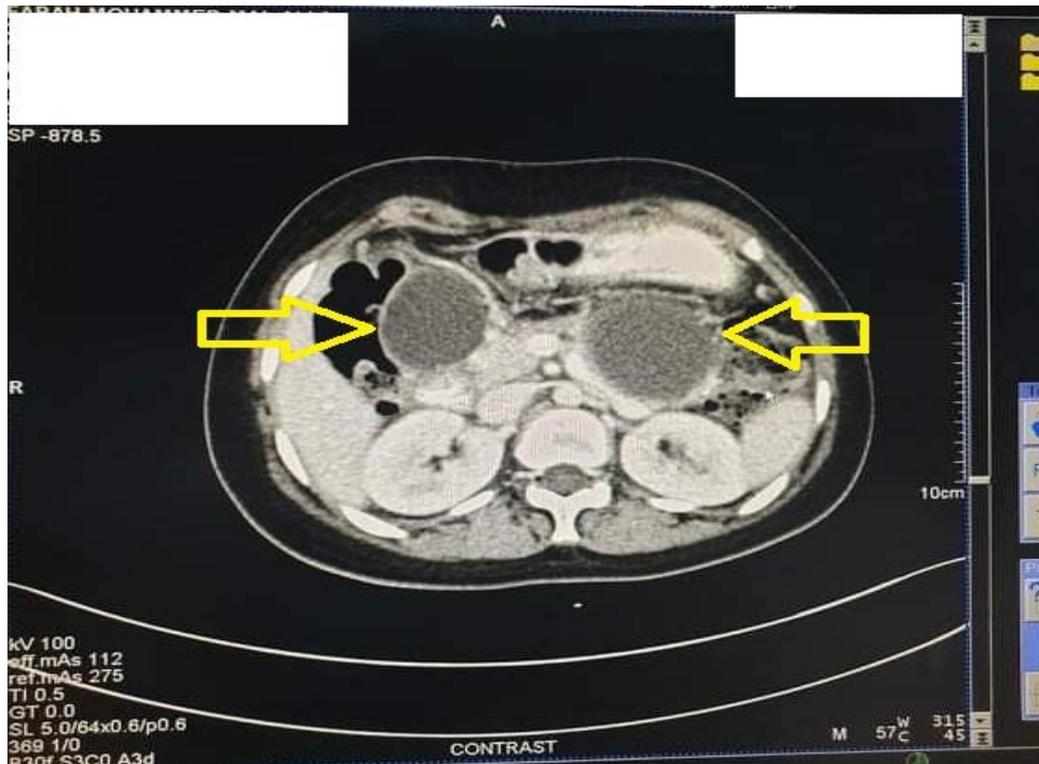
Figure 2.1. A 12-years-old female with abdominal pain and vomiting: Axial MDCT scan after contrast showed multiple cystic lesion (head and tail), largest cyst (> 30mm), peripheral enhancement homogenous round in shape with thick wall, and there are no calcification, ductal dilation, solid component, LVI or communication.

2.6. Ethical considerations

Written informed consent was obtained from the patients for participating in this research. The study was approved by The Medical Ethical Committee of College of Medicine, Babylon University.

2.7. Statistical analysis

Statistical package for social science (SPSS version 24.0, Chicago: SPSS, Inc.) was used. Results were described in the form of frequencies and percentage for qualitative data and (mean, and SD) calculation for quantitative data. Pearson's correlation test was used to detect the relationship between continuous variables. Inter-observer kappa agreement was assessed. A one-sided P value of 0.05 or less was considered statistically significant.
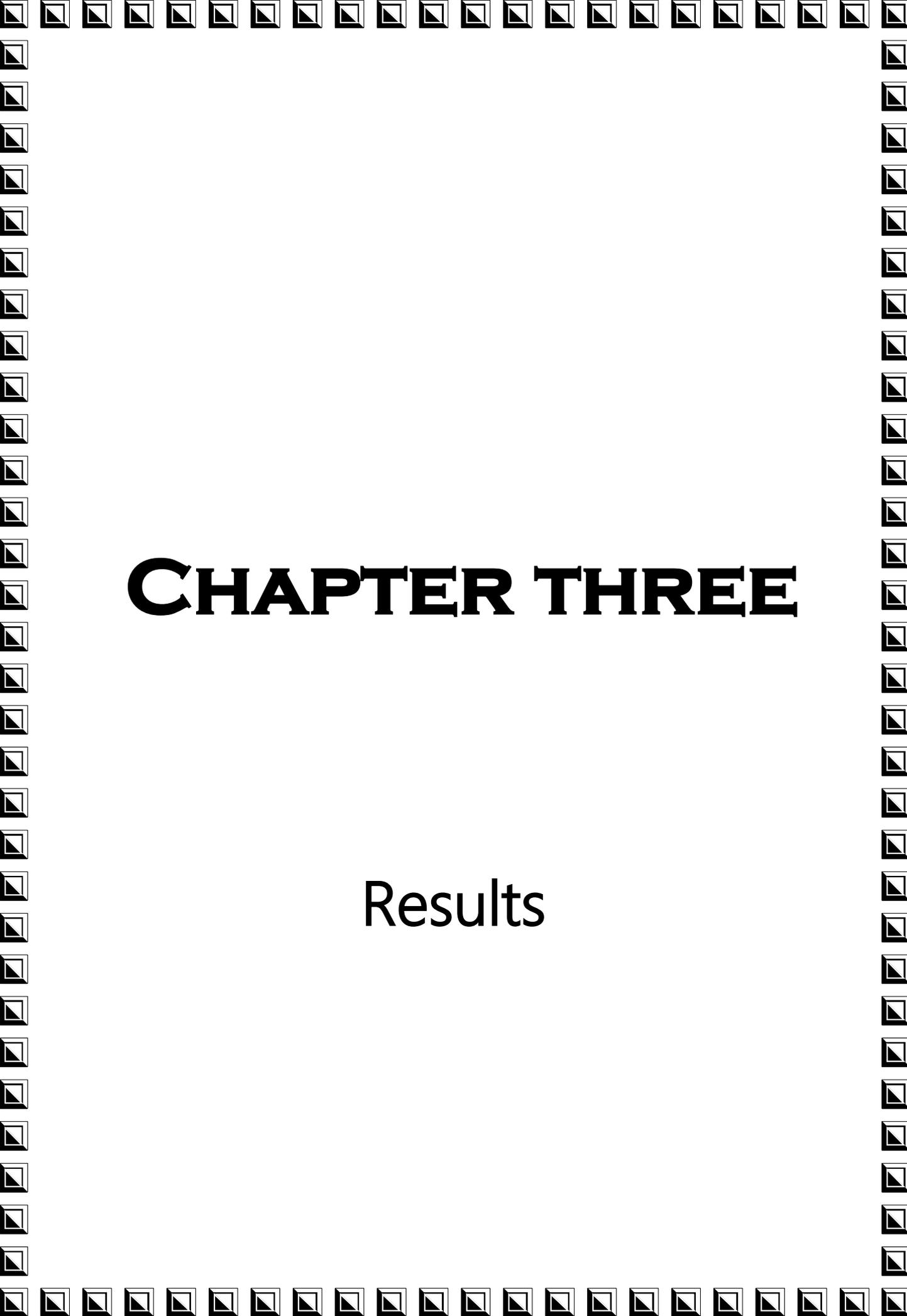
CHAPTER THREE

Results

Results

3.1. General findings

The most commonly recorded age group was (41-50) years in 19(32.8%). The mean age was 41.59±11.9 years with median equal to 42 years.

In relation to gender, 19(32.8%) were males, and 39(67.2%) were females.

Symptomatically speaking, 19(32.8%) patients presented with pancreatic symptoms, 27(46.6%) patients laboratory detected, and 12(20.6%) patients diagnosed by other symptom as abdominal pain, nausea and vomiting. (Table 3.1.).

Table 3.1. Patients demographic distribution of this study.

Characteristics		No.	%
Age (years)	12-20	2	3.4
Mean±SD (Median)=	21-30	11	18.9
41.59±11.9 (42)	31-40	14	24.2
	41-50	19	32.8
	51-60	10	17.2
	>60	2	3.4
	Total	58	100
Gender	M	19	32.8
	F	39	67.2
	Total	58	100
Symptoms	Pancreatic	19	32.8
	Lab	27	46.6
	Other	12	20.6
	Total	58	100

3.2. CT scan findings

Regarding the sites of pancreatic cyst, the majority of cysts were situated in head of pancreas (21, 36.2%). Twelve (20.6%) cases were located in neck, 12(20.6%) cases were located in multi-site, 8(13.8%) cases situated in body, and 5(8.6%) cases located in tail of pancreas, as showed in figure 3.1.
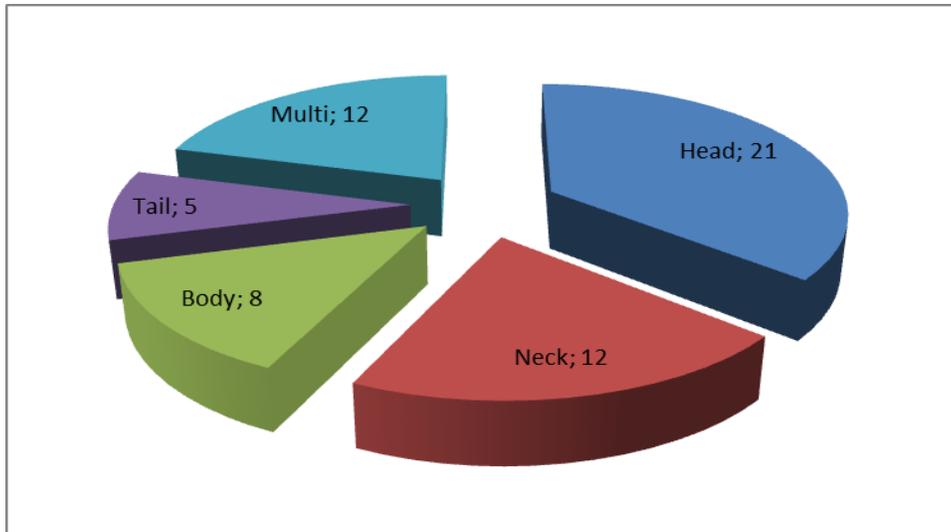
Figure 3.1. CT scan findings according to cyst location.

Ten (17.2%) of lesions detected with parenchymal atrophy, whereas 48(82.8%) of cysts weren't atrophied, as showed in figure 3.2.
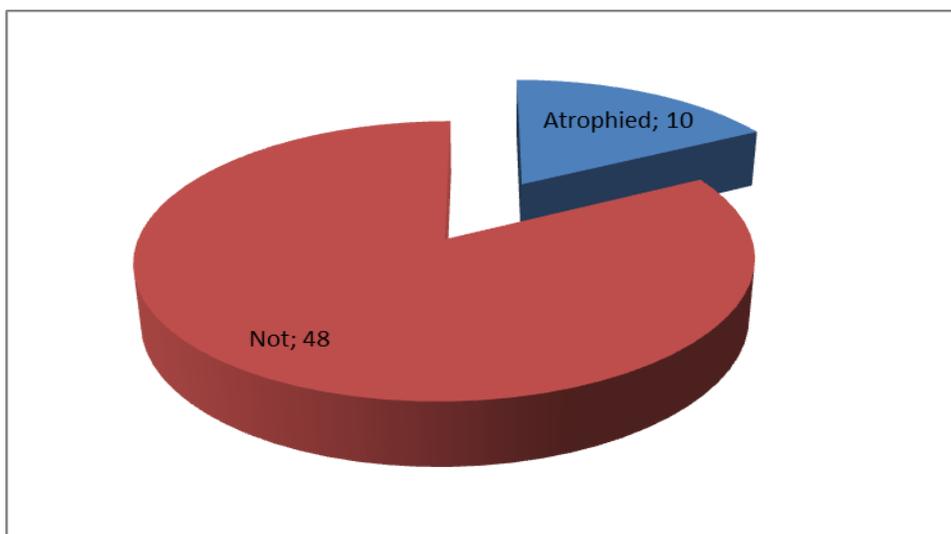
Figure 3.2. CT scan findings according to parenchymal atrophy.

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Regarding number of cyst, 33(56.9%) of cases detected one cyst on CT scan, 11(19%) cases diagnosed with two-cysts, and 14(24.1%) cases diagnosed with more than three-cysts, as showed in figure 3.3.
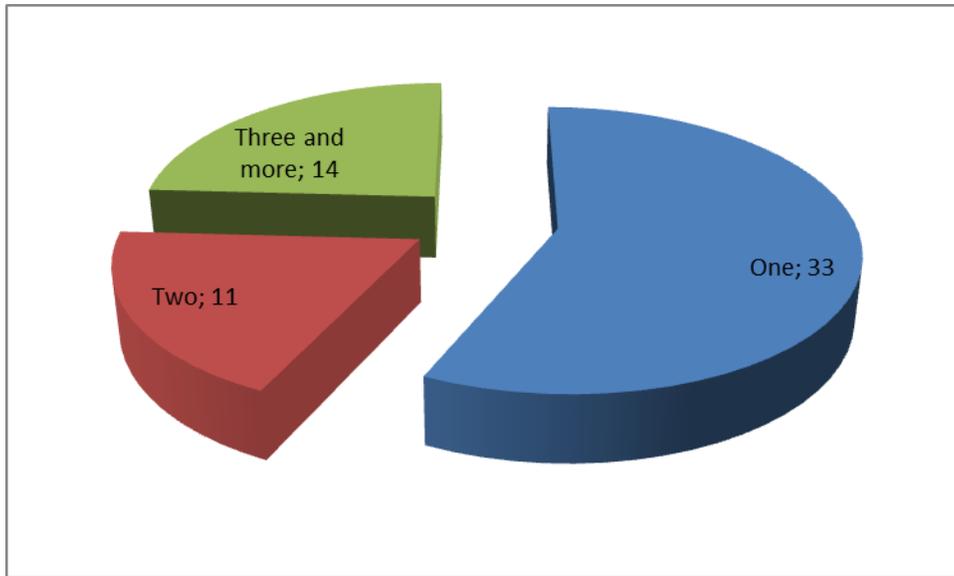
Figure 3.3. CT scan findings according to number of cyst.

In term of largest cyst, the cases categorized as group with diameter of cyst less than 10 mm, group of 10-30 mm, and group of more than 30 mm diameter. Four (6.9%) cases with group 1, 26(44.8%) cases with group 2, and 28(48.3%) cases with group 3, as showed in figure 3.4.
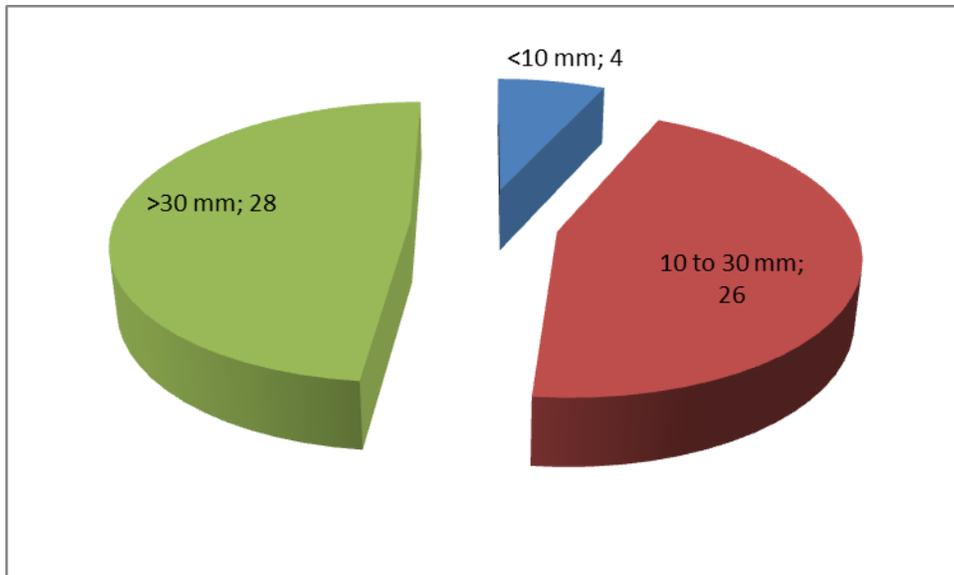
Figure 3.4. CT scan findings according to diameter of largest cyst.

The CT scan detected calcified cyst in 11 cases as 2(3.4%) parietal calcification, 3(5.2%) central calcification and 6(10.3%) peripheral calcification. However, 47(81.1%) of cysts are not calcified, as shown in figure 3.5.
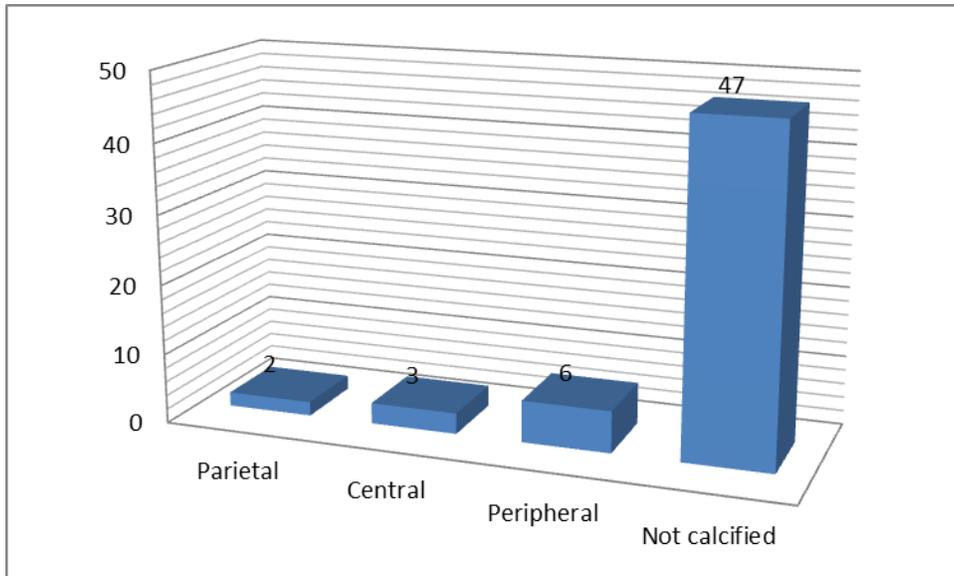
Figure 3.5. CT scan findings according to calcification.

In relation to ductal dilation, only six-scan showed dilation of duct, while 52(89.7%) scan were not showed any dilation, as shown in figure 3.6.
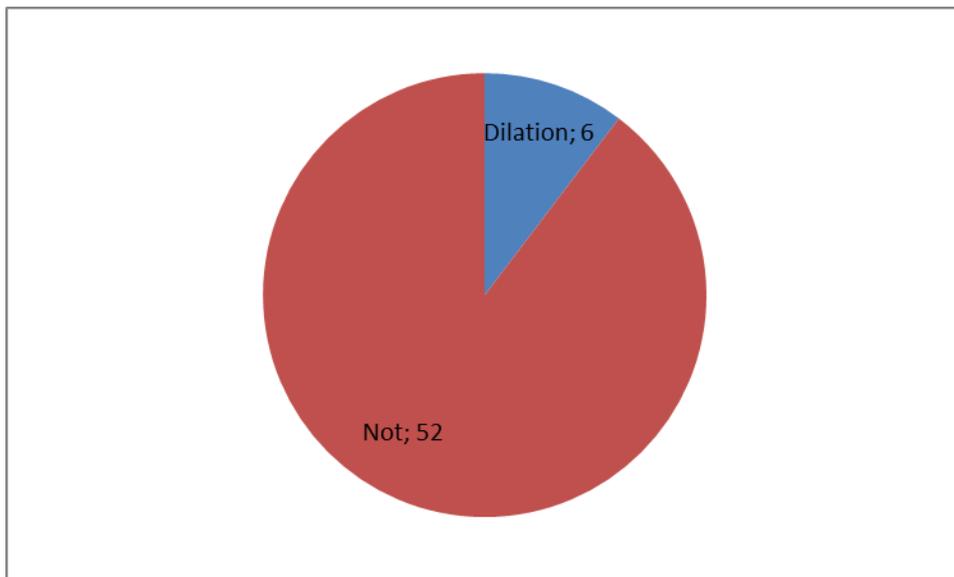
Figure 3.6. CT scan findings according to ductal dilation.

In relation to solid component of cyst, 6(10.3%) of cases had cyst with solid component, whereas 52(89.7%) cases detected without solid component, as shown in figure 3.7.
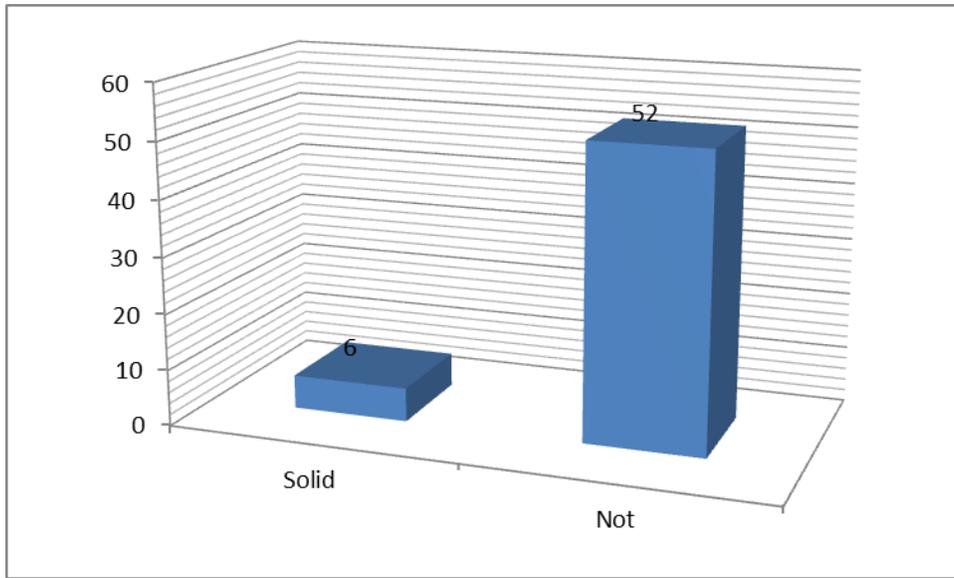
Figure 3.7. CT scan findings according to solid component.

The cyst contour presented as round (oval) in 50(86.2%) of patients, lobulated contour in 5(8.6%) cases, and pseudopod in 3(5.2%), (Table 3.2).

Table 3.2. Patients distribution according to cyst contour.

Cyst contour	No.	%
Round (oval)	50	86.2
Lobulated	5	8.6
Pseudopod	3	5.2
Total	58	100

All cysts were enhancement with contrast. The majority appear to be homogeneous in 45(77.6%), while the rest 13(23.4%) were heterogeneous in content, (Table 3.3).

Table 3.3. Patients distribution according to enhancement.

Content	No.	%
Homogeneous	45	77.6
Heterogeneous	13	23.4
Total	58	100

In relation to the type of cyst, 39(67.2%) cases detected with unilocular cyst, 6(10.3%) with micro-multilocular, 3(5.2%) with macro-multilocular, and 6(10.3%) with solid type. In addition, four cases were missed. (Table 3.4)

Table 3.4. Patients distribution according to type of cyst.

Types	No.	%
Unilocular	39	67.2
Micro multilocular	6	10.3
Macromultilocular	3	5.2
Solid	6	10.3
Missed	4	6.9
Total	58	100

According to wall thickness of cyst, the results revealed 43(74.1%) cases with thin wall, while 15(25.9%) cases with thick wall. (Table 3.5)

Table 3.5. Patients distribution according to wall thickness.

Wall thickness	No.	%
Thin	43	74.1
Thick	15	25.9
Total	58	100

In relation to lymphovascular invasion, only four (6.9%) patients showed LVI, while 54(93.1%) cases recorded without LVI, as shown in figure 3.8.
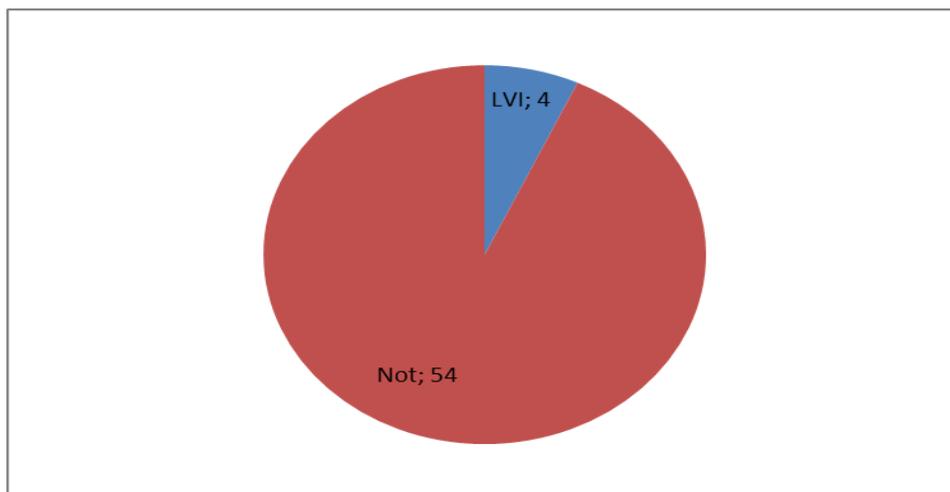
Figure 3.8. CT scan findings according to LVI.

Regarding communication (cyst-duct), this feature found in 6(10.3%) cases, and not visualized in 52(89.7%) cases, as shown in figure 3.9.
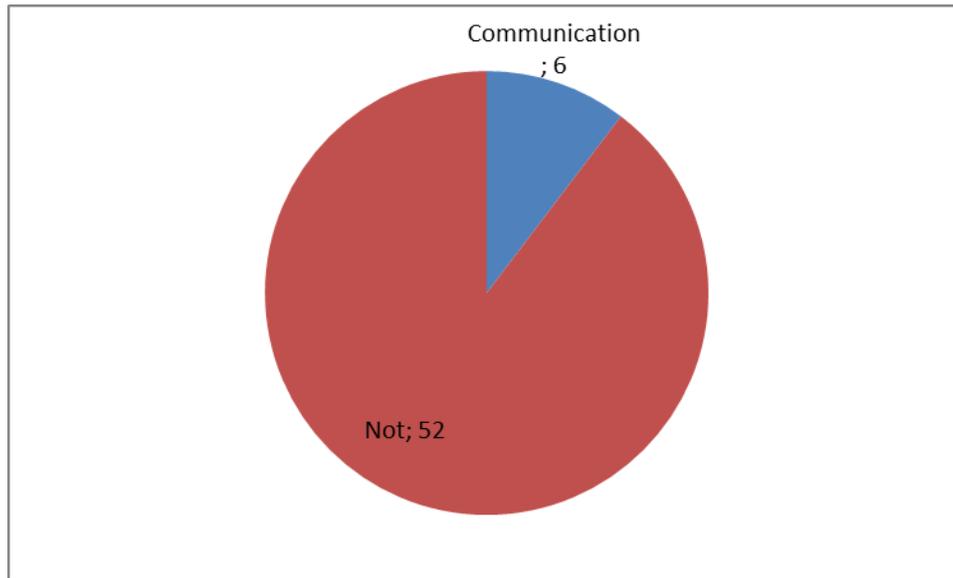
Figure 3.9. CT scan findings according to communication (cyst-duct).

Inter-observer agreement Kappa statistic of CT finding was revealed that detection of cyst location ($k= 6.8$; P= 0.036), number of cyst ($k= 2.1$; P= 0.048), ductal dilation ($k= 4.8$; P= 0.022), solid component ($k= 13.7$; P= 0.003) and type of cyst ($k= 12.2$; P= 0.013) had significantly perfect agreement signals. The rest signs were interpreted with fair agreement as followed; parenchymal atrophy ($k= -0.021$), diameter of largest cyst ($k= -0.28$), calcification ($k= 0.33$), diameter of ductal dilation ($k= 0.06$), contour of cyst ($k= -0.135$), content of cyst ($k= 0.245$), enhancement ($k= 0$), wall thickness ($k= -0.034$), LVI ($k= -0.016$), and communication ($k= 0.042$). (Table 3.6)

Table 3.6. Kappa value in each CT finding.

Sign	Kappa value	95%CI	P-value
Cyst location	6.8#	0.295-0.318	0.036
Parenchymal atrophy	-0.021-	-	1
Number of cyst	2.1#	0.474-0.5	0.048
Diameter of largest cyst	-0.28-	0.843-0.862	0.085
Calcification	0.33	-	1
Ductal dilation	4.8#	0.213-0.234	0.022
Diameter of ductal dilation	0.06	0.792-0.812	0.082
Solid component	13.7#	0.002-0.005	0.003
Contour of cyst	-0.135-	0.321-0.345	0.333
Type of cyst	12.2#	0.01-0.016	0.013
Content of cyst	0.245	0.08-0.096	0.088
Enhancement	0	-	1
Wall thickness	-0.034-	-	1
LVI	-0.016-	-	1
Communication	0.042	0.57-0.596	0.058

Inter-observer agreement Kappa statistic
fair agreement, 0.21-0.40
moderate agreement, 0.41-0.60
substantial agreement, 0.61-0.80
#perfect agreement, 0.81-1.0

Characteristic of CT scan findings in non-malignant and malignant lesions are listed in Table 3.7. Pancreatic cysts locations, parenchymal atrophy of cyst, number of cyst, diameter of largest cyst, calcification, ductal dilation and diameter, contour, contents, enhancement, wall thickness, LVI and cyst-duct communication were differ insignificantly (P= 0.752), (P= 1), (P= 0.621), (P= 0.882), (P= 1), (P= 0.231), (P= 1), (P= 0.452), (P= 0.082), (P= NA), (P= 1), (P= 0.5), and (P= 0.576), respectively, between benign and malignant tumors.

Additionally, solid components of cyst showed statistically significant difference in malignant pancreatic cyst more than benign cyst (P= 0.004).

Furthermore, types of cyst in benign pancreatic tumor were detected significantly different from malignant tumor (P= 0.016).

Table 3.7. CT scan findings in benign and malignant lesions.

Findings of CT scan		Benign	Malignant	P – value*
Cyst location	Head	16	5	0.752
	Neck	11	1	
	Body	7	1	
	Tail	4	1	
	Multi-sites	11	1	
Parenchymal atrophy	Yes	8	2	1
	No	41	7	
Number of cyst	1	27	6	0.621
	2	9	2	
	≥3	13	1	
Diameter of largest cyst	< 10 mm	3	1	0.882
	10-30 mm	23	3	
	>30 mm	23	5	
Calcification	Parietal	2	0	1
	Central	5	1	
	Peripheral	12	1	
Ductal dilation	Yes	4	2	0.231
	No	45	7	
Diameter of ductal (mean± SD)		10.75 ±2.22	9.5±2.12	1
Solid component	Yes	2	4	0.004
	No	47	5	
Contour	Round (oval)	41	9	0.452
	Lobulated	5	0	
	Pseudopod	3	0	
Type of cyst	Unilocular	35	4	0.016
	Micro multilocular	5	1	
	Macro multilocular	3	0	
	Solid	2	4	
Content of cyst	Homogeneous	40	5	0.082
	Heterogeneous	9	4	
Enhancement		49	9	NA
Wall thickness	Thin	36	7	1
	Thick	13	2	
LVI	Yes	3	1	0.5

	No	46	8		
Communication	Yes	6	0	0.576	
	No	43	9		

* Pearson Chi-Square
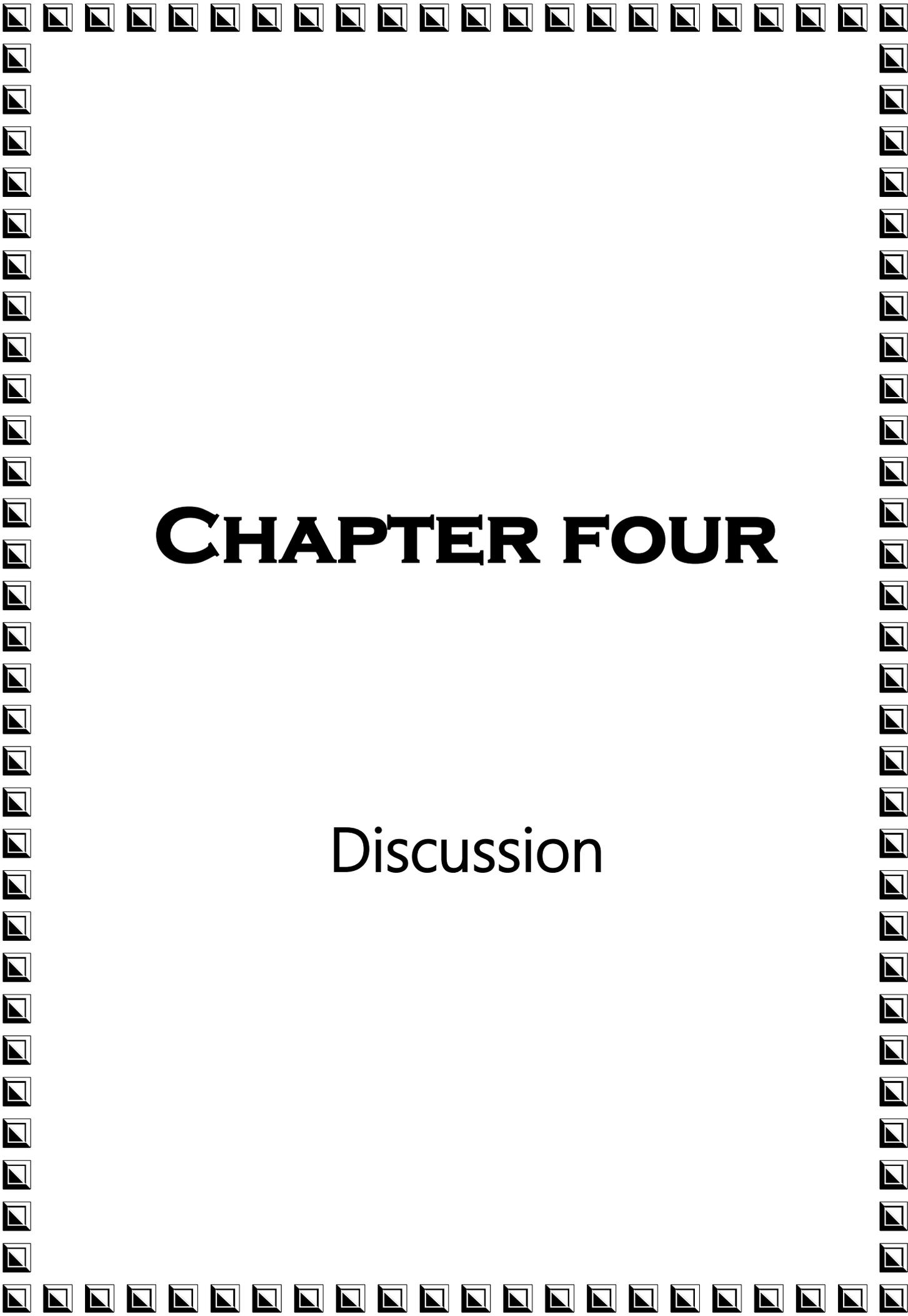
Chapter four

Discussion

Discussion

In this study, the most common age group (41-50) years in 19(32.8%), followed by group (31-40) years, whereas the least groups are (12-20 years) and (> 60 years), with mean age is 41.59±11.9 years (median = 42 years). These findings are dislike data from Pongpornsup et al., study [75], they studied cases have age ranged of 7-85 years and mean of 54 years. The age of patients with malignant pancreatic lesions (range: 54-80 years; mean : 64.67 years) was lower than age of benign pancreatic lesions (range: 71-78 years; mean: 74.75 years). In Egypt, a study by Tantawy et al., [70], mentioned that the age group mostly affected was (50-59) years with mean age of 55.6 years, which are more higher than results of the present study. A disagreement with Enass M. Khattab et al (2012), in their study on 39 patients, they found that males were affected more than females, and mean age of 58.3 years [103]. This is could be explained by different localities, different population life expectancy, early detection of pancreatic lesion and early awareness of patients complained of symptomatic manifestations.

In relation to gender, 19(32.8%) were males, and 39(67.2%) were females with M:F ratio of 1:2. Pongpornsup et al., study [75], dissimilar with this ratio, they estimated that M:F ratio was 1:1. Also. Parida and Biswal whom studied 62 patients of acute pancreatitis and found that out of 62 cases, 47 (76%) were males and 15 (24%) were females with a M: F ratio of 3.1.

Recently a study by Hossain et al., (2016), found that males are more affected than females and commonest age group amongst the patients was 56-65 years [73].

In the present study, 19(32.8%) patients presented with pancreatic symptoms as central abdominal pain, vomiting, nausea, and other GIT upset, 27(46.6%) patients laboratory detected as increases of pancreatic enzymes, disturbance of blood sugar, and abnormal LFT, and 12(20.6%) patients diagnosed by other symptom. Different findings reported by Pongpornsup et al., study [70] as the lesions were diagnosed with abdominal pain (n= 21), palpable mass (n= 8), cholestatic jaundice (n= 2), and chronic steatorrhea (n = 1).

In this study, the majority of pancreatic cysts were situated in head (21, 36.2%). Whereas, twelve (20.6%) cases were located in neck, 12(20.6%) cases were located as a multi-site, 8(13.8%) cases situated in body, and 5(8.6%) cases located in tail of pancreas. An agreement with Tantawy et al., [74] (head (n= 11), body (n= 2), tail (n= 4) and diffuse (n= 1)) and a disagreement with Pongpornsup et al., study [101] (head (n= 9), body (n= 6), tail (n= 10) and neck (n= 2)) were recorded.

According to other CT scan findings in this study, ten (17.2%) cases with pancreatic lesions have parenchymal atrophy, 33(56.9%) of cases have one cyst, 11(19%) cases diagnosed with two-cysts, and 14(24.1%) cases diagnosed with more than three-cysts. Pongpornsup et al., study [101] showed that polycystic lesions was common. Multi-cystic pattern (multiple microcyst < 2 cm) are common presented in up to 70% of cases which is a morphologic patterns of SCNs, besides, honeycomb and oligo-cystic [75].

Also, the cases with diameter of cyst less than 10 mm, were 4(6.9%) cases, 26(44.8%) cases with (10-30 mm), and 28(48.3%) cases with more than 30 mm. Pongpornsup et al., study [101] revealed range of diameter from 7.2 mm to 14.7 mm. The calcified cyst presented in 11(18.9%) of cases, however, 47(81.1%) of cysts were not calcified, whereas Pongpornsup et al., study [71] reported 9 cases with calcification and 24 cases without. Calcified cysts were seen on CT scan in 30% of cases which is specific and pathgnomonic for SCNs [72].

Atypical manifestations of SCNs include giant tumors with ductal dilatation, intra-tumoral hemorrhages, uni-locular lesions, solid variants, and a spreading form [110]. SCNs are generally considered as benign, however, about three percent have high malignant potential with regional invasion and distant spreading [60, 61]. Heneidy et al., (2017) stated that cystic lesions has been estimated to range from 2.4% to 24% in CT scan imaging [65], Galanis et al., stated that serous cystadenoma accounts for only 1-2% of all pancreatic neoplasm [44].

Only six-scan showed dilation of duct, while 52(89.7%) scan were not showing any dilation, while Pongpornsup et al., study [70] reported dilation of cyst in 11 cases.

Approximately, 6(10.3%) of cases had cyst with solid component. Round (oval) cyst contour detected in 50(86.2%), lobulated contour in 5(8.6%), and pseudopod in 3(5.2%). Pongpornsup et al., study [71] revealed (21) cysts were round, (9) lobulated and (3) pseudopod.

All pancreatic cysts in this study are enhanced with contrast. Authors said the enhancement of ductal nodule and large main duct dilatation are more common in the malignancy [60, 61], whereas other not described such relation [101].

The majority appear to be homogeneous in 45(77.6%), while the rest 13(23.4%) were heterogeneous in content. Also, in Pongpornsup et al., study [101], the majority of cysts were homogeneous (n= 26), and the rest were heterogeneous (n= 7).

About, 39(67.2%) cases detected with unilocular cyst, 6(10.3%) with micro-multilocular, 3(5.2%) with macro-multilocular, and 6(10.3%) with solid type. The results of this study similar to that described by Kim et al., [69]. According to the present findings, cyst types (uni-locular, multi-locular micro-cystic, multi-locular macr-ocystic and solid component) can be used for distinguishing between benign and malignant lesions of pancreas. However, the overlapping is usually observed [70].

The results revealed 43(74.1%) cases with thin wall, while 15(25.9%) cases with thick wall. Pongpornsup et al., study [70] revealed 14 cases with thin wall and 17 cases with thick wall.

Only 4(6.9%) lesions showed LVI, while 54(93.1%) cases recorded without LVI, whereas Pongpornsup et al., study [70] mentioned that only nine case detected with vascular involvement, which contrast to the prior CT scan study that reported up to 65% lesions with LVI [65]. MCNs can be differentiated from intra-ductal papillary mucinous tumor by its lack of cyst-duct communication. It can be divided as adenoma, borderline, non-invasive, and invasive tumors. The papillary projection and intramural nodules are presenting in the malignant category [70, 68].

In their study, Egorov et al., found vascular involvement of patients with pancreatic carcinoma ranges between (21%- 64%), most often with involvement of SMA, due to its location [59].

Regarding communication (cyst-duct), this feature found in 6(10.3%) cases, and not visualized in 52(89.7%) cases. Pongpornsup et al., study [71] showed only 6 cases with cyst-duct communication.

Solid cystic appearance with heterogeneous enhance is recorded as malignancy, which could be distinguished from solid pseudopapillary neoplasm, mucinous cyst-adenocarcinoma and cystic change in neuroendocrine malignancy [71]. Degenerative cystic changes are common in solid pseudopapillary epithelial neoplasms due to less blood supply. As a result pathological findings of malignancy are solid, hyper-vascular regions without gland formation, cellular, and degenerative pseudo-papillae [52].

Statistically speaking, the inter-observer agreement Kappa statistic of CT scan finding revealed that detection of cyst location (k= 6.8; P= 0.036), number of cyst (k= 2.1; P= 0.048), ductal dilation (k= 4.8; P= 0.022), solid component (k= 13.7; P= 0.003) and type of cyst (k= 12.2; P= 0.013) had significantly perfect agreement signals to differentiated between malignant and benign pancreatic lesions. The rest signs were interpreted with fair agreement. Moreover, the favorable agreement (k= 0.705), is agree with a study of Pongpornsup et al., (k= 0.716) [55].

In correlation between benign and malignant in this study, the results showed that pancreatic cysts locations, parenchymal atrophy of cyst, number of cyst, diameter of largest cyst, calcification, ductal dilation and diameter, contour, contents, enhancement, wall thickness, LVI and cyst-duct communication were differ insignificantly (P> 0.05). Additionally, solid components of cyst showed statistically significant difference in malignant pancreatic cyst more than benign cyst (P= 0.004). Furthermore, types of cyst in benign pancreatic tumor were detected significantly different from malignant tumor (P= 0.016).

Crippa et al., recorded that MCNs documented 25% of all cystic malignancies and IPMNs were 50% [65].

Another series of 851 cases from 1978 to 2011 showed that IPMNs assumed for 38% of cysts, MCNs for 23%, SCNs for 16%, and solid pseudo-papillary tumors for 3% [70]. This mis-guidance can be diminished with a multi-disciplinary team approach to study these cysts with incorporation of the clinical, radiologic, and pathologic findings before reaching a definite diagnosis [71].

Conclusions
and
Recommendations

5.1. Conclusions:

1. MDCT scan is the easily applicable non-invasive tool of choice for evaluation pancreatic cysts.
2. The most common age group of detected pancreatic cyst is (41-50) years.
3. Middle age women are mostly diagnosed with pancreas cystic lesions.
4. Round, homogeneous enhancement, oligo-unilocular, non-calcified, non-dilated duct, non-solid and thin wall head cyst are the prevalent features detected by MDCT scan.
5. The most common diameter measured of pancreatic cyst is more than 30 mm.
6. Lymphovascular invasion, solid component and communicated cyst-duct are mostly features of malignant lesions.
7. Detection of cyst site, number, ductal dilation, solid component and type of cyst are significantly helpful to differentiat between malignant and benign pancreatic cysts.
8. Pancreatic cysts sites, parenchymal atrophy, number, diameter of largest cyst, calcification, ductal dilation and diameter, contour, contents, enhancement, wall thickness, LVI and cyst-duct communication could negatively impact the CT scan results.
9. Solid components of cyst and types of cyst could be positively implicated CT scan results.

5.2. Recommendations

1. Using the history, radiology imaging, and endoscopic ultrasound-guided fine-needle aspiration (EUS-FNA) cytology, in coboration will classify, diagnose, and manage pancreatic cysts more appropriately.
2. Large number of cases, in future studies is preferable and required.
3. Longer duration and studying each entity individually are recommend.
4. In combination with other imaging modalities give better evaluation of any suspicious patients with pancreatic cystic lesion.
5. Accurate detection and differentiation between benign and malignant lesions lead to reduction of the hazards of unnecessary surgical interventions.

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دور الأشعة المقطعية المفراس في تشخيص آفات البنكرياس الكيسي

رسالة

مقدمه الى مجلس كلية الطب / جامعة بابل كجزء من متطلبات الحصول على درجة الدبلوم العالي في مجال الاشعة التشخيصية

مقدمه من قبل الطالبه

نجلاء فخري حسن

بكالوريوس طب و جراحة عامة

بإشراف الاستاذ الدكتور

قاسم امير هادي تاج الدين

استشاري الاشعة التشخيصية

1444 هـ   2022 م

ملخص البحث

خلفية البحث:

الآفات الكيسية في البنكرياس شائعة جداً ومعضلة التحدي المتزايدة تكون أكثر صعوبة في الكشف عنها ، لأن جودة تكنولوجيا التصوير الإشعاعي تحسن اكتشاف أكياس البنكرياس بدون أعراض. في الآونة الأخيرة ، لا يوجد معيار ذهبي للتصوير الإشعاعي للتشخيص. التصوير المقطعي المحوسب (CT) هو أفضل تقنية تصوير للتقييم الأولي ومتابعة مرضى تكيسات البنكرياس.

اهداف البحث:

دفت الدراسة إلى تحديد دور الأشعة المقطعية في تشخيص آفات البنكرياس الكيسي ، والتفريق بين آفات الطقس الخبيثة أو غير الخبيثة ، ومعرفة سمات التصوير لتشخيص الآفات الكيسية الحميدة أو الخبيثة في البنكرياس.

طرق البحث:

دراسة استباقية شملت 58 مريضاً تم تسجيلهم في الدراسة خلال الفترة من 12 يونيو 2021 إلى 20 مايو 2022. وتكونت عينة الدراسة من 19 (32.8٪) من الذكور و 39 (67.2٪) من الإناث. تتضمن بيانات المشاركين ، بما في ذلك العمر والجنس والأعراض ، بالإضافة إلى ميزات التصوير المقطعي المحوسب: مواقع الآفة ، وضمور متني ، وعدد الآفات الكيسية ، وقطر أكبر كيس ، والتكلس ، وتمدد الأقنية ، والمكونات الصلبة ، ومحيط الكيس ، ونوع تعزيز التباين كيس ، سمك الجدار ، غزو الأوعية اللمفاوية والتواصل. ذهب جميع المرضى الخاضعين للدراسة لفحص الأشعة المقطعية ، والذي تم إجراؤه قبل أي تدخل. تم إجراء فحص التصوير المقطعي المحوسب باستخدام نظام Siemens (تعريف SOMATOM AS VA44A ؛ سيمنز ، Somaris / 7 syngo CT 67002-2012B ، ألمانيا).

النتائج:

كان متوسط العمر 41.59 ± 11.9 سنة (الوسيط = 42 سنة). حوالي 19 (32.8٪) من الذكور و 39 (67.2٪) من الإناث. كانت غالبية الأكياس موجودة في رأس البنكرياس (21 ، 36.2٪). تم

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الكشف عن عشر (17.2٪) من الآفات مصحوبة بضمور متني. حوالي 33 (56.9٪) من الحالات اكتشفت كيسًا واحدًا في التصوير المقطعي المحوسب ، 11 (19٪) حالة تم تشخيصها باثنين من الكيسات ، و 14 (24.1٪) حالة تم تشخيصها بأكثر من ثلاثة أكياس. كشف الفحص بالأشعة المقطعية عن كيس متكلس في 11 حالة مثل 2 (3.4٪) تكلس جداري ، 3 (5.2٪) تكلس مركزي و 6 (10.3٪) تكلس طرفي. ومع ذلك ، فإن 47 (81.1٪) من الأكياس كانت غير متكلسة. أظهر ستة مسح فقط تمدد القناة. فقط 6 (10.3٪) من الحالات بها كيس يحتوي على مكونات صلبة. تم تقديم محيط الكيس على شكل دائري في 50 (86.2٪) من المرضى. تم تعزيز جميع الخراجات مع التباين. يبدو أن الغالبية متجانسة في 45 (77.6٪) ، بينما البقية 13 (23.4٪) كانت غير متجانسة في المحتوى. حوالي 39 حالة (67.2٪) تم اكتشافها مع كيس وحيدة العين. كشفت النتائج عن 43 (74.1٪) حالة رقيقة الجدار بينما 15 (25.9٪) حالة جدار سميك. تم الكشف عن إحصاء كابا لاكتشاف التصوير المقطعي المحوسب أن الكشف عن موقع الكيس (P = 0.036) ، وعدد الكيس (P = 0.048)، وتمدد الأقنية (P = 0.022) ، والمكون الصلب (P = 0.003) ونوع الكيس (P 0.013 =) لديها إشارات اتفاق مثالية بشكل ملحوظ. أظهرت المكونات الصلبة للكيس فرقًا ذات دلالة إحصائية في كيس البنكرياس الخبيث أكثر من الكيس الحميد (P = 0.004). علاوة على ذلك ، تم اكتشاف أنواع من الكيسات في ورم البنكرياس الحميد تختلف اختلافًا كبيرًا عن الورم الخبيث (P = 0.016).

الاستنتاجات:

مسح MDCT هو طريقة سهلة التطبيق غير جراحية لتقييم الآفات الكيسية البنكرياسية. الفئة العمرية الأكثر شيوعًا للكشف عن كيس البنكرياس هي (41-50) عامًا. يتم تشخيص النساء في منتصف العمر في الغالب بآفات البنكرياس الكيسية. التحسين المستدير والمتجانس والقليل أحادي العين وغير المتكلس وغير الموسع وكيس الرأس غير الصلب والجدار الرقيق هي السمات السائدة التي تم اكتشافها بواسطة مسح MDCT. القطر الأكثر شيوعًا لكيس البنكرياس هو أكثر من 30 ملم. الغزو اللمفاوي والأوعية الدموية والمكونات الصلبة والقناة الكيسية المتصلة هي في الغالب سمات الآفات

الخبيثة. إن الكشف عن موقع الكيس ، وعدده ، وتمدد الأقنية ، والمكون الصلب ونوع الكيس مفيد بشكل كبير في التمييز بين الخراجات البنكرياسية الخبيثة والحميدة. مواقع أكياس البنكرياس ، ضمور متني ، عدد ، قطر أكبر كيس ، تكلس ، تمدد وقطر الأقنية ، كفاف ، محتويات ، تعزيز ، سمك الجدار ، LVI واتصال قناة الكيس يمكن أن تتأثر سلبًا بنتائج الفحص المقطعي المحوسب. يمكن أن تكون المكونات الصلبة للكيس وأنواع الكيس متضمنة بشكل إيجابي في نتائج الفحص بالأشعة المقطعية.