Comparison Between Magnetic Rsonance Cholangi-pancreatography and Ultrasound for Diagnosing Patients With Pancreatic Tumor

SUPERIOR UNIVERSITY

Thesis Submitted To

The Superior University Lahore

In Partial Fulfillment of the

Requirement of the Degree of

Master of Science in Allied Health Science

By

WERDAH GHAFFAR

Roll No.SU91-MSAHW-S23-024

Session: 2023-2025

Faculty of Allied Health Sciences

Author's Declaration

I hereby state that my MS thesis titled **"Comparison between Magnetic Resonance Cholangio-Pancreatography and Ultrasound for Diagnosing Patients with Pancreatic Tumor"** is my work and has not been submitted previously by me for taking any degree from this University,

The Superior University, Lahore,

or anywhere else in the country/world.

At any time if my statement is found to be incorrect even after my graduation, the university has the right to withdraw my MS/M.Phil. degree.

Werdah Ghaffar

Date: 25/06/2025

Plagiarism Undertaking

I solemnly declare that research work presented in the thesis titled "Comparison between Magnetic Resonance Cholangio-Pancreatography and Ultrasound for Diagnosing Patients with Pancreatic Tumor" is solely my research work with no significant contribution from any other person.

Small contribution/help wherever taken has been duly acknowledged and that complete thesis has been written by me.

I understand the zero-tolerance policy of the HEC and University,

The Superior University, Lahore,

towards plagiarism. Therefore, I as an author of the above-titled thesis declare that no portion of my thesis has been plagiarized and any material used as a reference is properly referred/cited. I undertake that if I am found guilty of any formal plagiarism in the above-titled thesis, even after awarding of MS/M.Phil. degree, the University reserves the rights to withdraw/revoke my MS/M.Phil. degree and that HEC and the University have the right to publish my name on the HEC/University website on which names of students are placed who submitted a plagiarized thesis.

Signature: _____

Werdah Ghaffar

Research Completion Certificate

This is to certify that the thesis entitled **"Comparison between Magnetic Resonance Cholangio-Pancreatography and Ultrasound for Diagnosing Patients with Pancreatic Tumor"** submitted by **"Werdah Ghaffar"** has been accepted towards the partial fulfillment of the requirement for **"MS Allied Health Sciences".** The quality of the work contained in this thesis is adequate for the award of degree.

Signature: _____

Dr Tahira Batool
Assistant Professor

Certificate of Approval

This is to certify that the research work presented in this thesis, titled **"Comparison between magnetic resonance cholangio pancreatography and ultrasound for diagnosing patients with pancreatic tumor"** was conducted by **"Werdah Ghaffar"** under the supervision of **"Dr. Tahira Batool"**

No part of this thesis has been submitted anywhere else for any other degree. This thesis is submitted to the Faculty of Allied Health Sciences, The Superior University, Lahore in partial fulfillment of the requirements for the degree of Master of Sciences in the field of **"Allied Health Sciences"** in Faculty of Allied Health Sciences at The Superior University, Lahore.

Student Name: Werdah Ghaffar Signature: W Ghaffar

Examination Committee:

Session Chair: Prof. Dr. Muhammad Naveed Babur Signature:

a) External Examiner: Signature:

Dr. Tahir Qadeer Khan
Additional Principal, Medical Officer
Mayo Hospital/King Edward Medical University, Lahore

b) Internal Examiner: Dr. Fahmida Ansari Signature: F Ansari

c) Supervisor Name: Dr. Tahira Batool Signature: Tahira

d) PL/HOD: Dr. Hafiz Shahzad Muzammil Signature:

e) Name of Dean: Prof. Dr. Muhammad Naveed Babur Signature:

f) Controller Examination: Dr. Muhammad Haris Signature:

DEDICATION

"All praise is due to Almighty Allah, the Most Gracious and Merciful." I start this investigation by asking for His direction, wisdom, and blessings. May our work serve as a way of acquiring knowledge, a key pillar of Islam, and contribute to the welfare of humanity.

I dedicate this research to my Supervisor Tahira Batool for her continuous support, Then to parents specially my father Abdul Ghaffar, who have always been a source of love, support, and inspiration. Their unflinching faith in me has been a motivating factor throughout this journey. I'd also like to thank my friends, mentors, and colleagues for their useful ideas, advice, and feedback.

May this study demonstrate the power of human curiosity and the pursuit of knowledge. May it also be a reminder of the value of endurance, hard effort, and dedication.

ACKNOWLEDGEMENT

"First and foremost, I am sincerely grateful to Almighty Allah for bestowing upon me the gifts of knowledge, intelligence, and tenacity to carry out this research.

I would like to convey my heartfelt gratitude to the Dean of Superior University Dr. Muhammad Naveed Babar, Lahore, for giving me the chance to conduct research in such a supportive and stimulating academic atmosphere.

I am grateful to my supervisor, Tahira Batool, whose guidance, knowledge, and support helped shape my study. Her continuous support and critical input helped me negotiate the project's hurdles.

I'd also like to express my heartfelt appreciation to my father and mother, who have been a continual source of love, support, and inspiration throughout my academic career. Their sacrifices and encouragement have helped me to pursue my objectives with zeal and perseverance.

Finally, I'd want to thank my friends Hassan Mehmood and Fazal Rahim, whose companionship and camaraderie have been a source of comfort and inspiration during the ups and downs of my research effort.

Thank you for your contributions to my research journey."

Werdah Ghaffar

TABLE OF CONTENTS

DEDICATION vi

ACKNOWLEDGEMENT vii

TABLE OF CONTENTS……..……viii-ix

LIST OF TABLES x

LIST OF FIGURES xi

LIST OF ABBREVIATIONS xii

ABSTRACT…….....xiii

CHAPTER 1……..……..1

INTRODUCTION……..……...……1-5

OBJECTIVES……..…..…….6

CHAPTER 2……..…….……..7

LITERATURE REVIEW…….……..……..7-14

PROBLEM STATEMENT……..……15

CHAPTER 3…….……16-18

METHODOLOGY…….…….....16

3.1.Research Design 16

3.2.Clinical settings 16

3.3.Sample size..... 16

3.4.Sampling technique 16

3.5.Study Duration 16

3.6.Selection criteria……..…….……..…..16-17

3.6.1. Inclusion criteria……..…….…….16
3.6.2. Exclusion criteria……..…….17

3.7.Data collection procedure 17

3.8.Data analysis 18

3.9.Ethical consideration 19

CHAPTER 4 20

RESULTS 20-34

CHAPTER 5 35

DISCUSSION……..……...35-39

CONCLUSION…….……40

Strengths…….……40

Limitations…….…….41

Recommendations…….…….41

REFERENCES..... 42-44

APPENDICES 45

English Consent Form 45

QUESTIONNAIRE……..…….46-50

ETHICAL COMMITTIE LETTER……..……...…51

PLEGIRISM REPORT……..……..52

LIST OF TABLES

Table No.	Description	Page
Table 4.1	Descriptive statistic describing variables…….…….24-25	
Table 4.2	Frequency table…….…….26	
Table 4.3	Chi- Square table……33	

LIST OF FIGURES

Figure No. **Description** **Page**

Figure 4.1 Age of participant (MRCP & USG) …….……...…27

Figure 4.2 Symptoms of pancreatic cancer…….……...28

Figure 4.3 Foremost symptoms of pancreatic cancer ……...29

Figure 4.4 Initially recommended diagnostic modality ……..…..….32

Figure 4.5 Detection accuracy comparing MRCP & US ……..32

List of Abbreviations

CT scans	Computed tomography scans
EUS	Endoscopic ultrasonography
MR	Magnetic Resonance
CP	Cholangio-pancreatography
US	Ultrasound
MRI	Magnetic resonance imaging
HX	History
TX	Treatment History

ABSTRACT

Background: Pancreatic cancer is difficult to treat because of its late diagnosis and a poor prognosis. Early and precise detection is essential for better outcomes for the patients. Magnetic Resonance Cholangiopancreatography (MRCP) and Ultrasound (US) are two popular imaging procedures, although direct comparisons of their diagnostic effectiveness are restricted.

Objective: To compare the diagnostic performance of Magnetic Resonance Cholangiopancreatography(MRCP) and Ultrasound (US) in detecting patients with pancreatic tumors.

Material and Methods: A descriptive cross-sectional study was conducted at General Hospital, Services Hospital, and Jinnah Hospital in Lahore. A total of 160 individuals with probable pancreatic cancer underwent MRCP and US, the data was collected using a structured questionnaire and analyzed with SPSS version 27. The chi-square test was used, with significance set at $p < 0.05$.

Results: MRCP demonstrated higher diagnostic accuracy, detecting pancreatic tumors in 46.88% of cases (mean detection score 1.21, SD ± 0.41) compared to US, which detected tumors in 46.88% of cases (mean detection score 1.74, SD ± 0.44). MRCP was particularly effective in visualizing tumors in the pancreatic head (34.38%), with superior sensitivity (99%) and specificity (99%) compared to US (sensitivity 80%, specificity 99%). MRCP had higher image quality ratings (mean 3.83, SD ± 1.83) compared to US (mean 1.73, SD ± 1.55). However, US scored better on patient comfort (mean 1.73, SD ± 0.44) versus MRCP (mean 1.68, SD ± 1.5). Cost analysis showed MRCP was more expensive (10,000 PKR) than US (1,500–2,000 PKR). Significant associations were found between imaging modality, tumor detection accuracy ($p = 0.017$), and patient comfort ($p = 0.014$).

Conclusion: MRCP is more accurate and precise at detecting pancreatic malignancies, especially small or complicated lesions, whereas US is still useful for the initial screening of pancreatic diseases. Further studies should consider combining MRCP with Endoscopic Ultrasound (EUS) and larger sample sizes.

Keywords: Pancreatic cancers, MRCP, Ultrasound, Diagnostic Performance, Imaging Comparison.

Chapter 1

INTRODUCTION

Pancreatic cancer is the uncontrolled and unplanned growth or division of pancreatic cells that remains one of the most fearful challenges in oncology due to its late diagnosis and poor prognosis. The pancreas, a gland deep in the abdomen, is responsible for digesting and metabolizing glucose and other nutrients. Pancreatic malignant and benign tumors are particularly injurious because they are deeply seated with the major portion being retrosternal, thus early detection and diagnosis is not easy (1). Most pancreatic tumors are diagnosed at an advanced stage, when surgical resection is often no longer possible, leading to a high fatality rate. Early and accurate detection of pancreatic tumors is very important for improved patient prognosis (2).

Ultrasound scanning is a common and inexpensive imaging test that employs high-frequency sound waves to generate detailed images of the pancreas and other organs in the abdomen. While it might not have the full imaging potential of MRCP, ultrasound has the benefits of being easily accessible, devoid of ionizing radiation, and often used as a first imaging test for abdominal complaints. It is highly useful for evaluating the location of tumors, size, and the effect it has on nearby tissues and thus highly effective for assessing obstructive conditions as well as analyzing the features of the tumor. Being non-invasive and simple to perform makes it popularly accepted in clinics (2)-(3).

Pancreatic cancer is among the deadliest cancers globally, with a grim prognosis because it is often detected late and there are limited treatment options. Early detection of pancreatic cancer is critical to enhancing survival, and radiologic imaging contributes to diagnosis and staging. (3)-(4).

MRCP has become popular due to its ability to generate high-resolution images of the pancreatic ductal system and surrounding tissues without the need for contrast agents. This method is especially useful for detecting disorders such as obstructive jaundice and pancreatic ductal obstruction, which are most frequently related to cancer. MRCP's highly accurate imaging ability allows for the detection of minute changes in pancreatic structure, which is essential for precise tumor diagnosis and staging (3)-(5).

Alternatively, the US is a more direct and simpler modality of imaging, though less so than with MRCP. Notwithstanding that the US can actually diagnose large tumors and give information about their echogenicity, it would not be able to give full imaging of the pancreatic ducts. The operator dependency of the US makes diagnostic findings heterogenous (5).

It is utilized very effectively for preoperative planning and to assess whether the pancreatic tumors are resectable. In contrast, the United States is utilized routinely as a first-line screening tool due to its ready availability and relatively low cost. It is typically the initial imaging study to be done in patients presenting with abdominal pain or jaundice. If US reveals a pancreatic tumor, then additional imaging with MRCP or other techniques might be required (3). Pancreatic cancer is a fatal cancer and is usually diagnosed at an advanced stage as it is usually asymptomatic. The disease is simple to diagnose at an early stage. Imaging modalities are employed in most of the diagnostic strategies. Ultrasound is the most frequent mode of diagnosing pancreatic lesions (4).

MRCP is a very advanced imaging technique employing magnetic resonance imaging, or commonly referred to as MRI, in order to extensively scan the pancreatic and bile ducts with considerable precision and clarity. This latest technology is superior to conventional ultrasound in the way that it is less susceptible to many physical limitations that tend to make other imaging technologies less successful, allowing a more thorough scanning of the pancreatic ductal system. The use of MRCP is of more benefit in diagnosing early cancer or detecting subtle anomalies that might otherwise be undetected. Another of the greatest benefits of MRCP is that it is a non-surgical diagnostic process and no contrasting agents need to be administered, thus making complications in patients much easier to keep to a minimum. There are many studies which have made MRCP a beneficial tool in pancreatic cancer diagnosis, particularly when results of ultrasound tests are not delineated clearly or are unsatisfactory. (7).

The role that ultrasonography and Magnetic Resonance Cholangiopancreatography play in diagnosing pancreatic cancer has undergone a dramatic amount of transformation and improvement throughout the years. Because of its widespread availability and its remarkable ability to provide real-time imaging, ultrasound continues to be used widely as the first-line diagnostic modality, and is especially well-suited to provide preliminary assessments of patients. But because of its greater

degree of accuracy in delineating the biliary and pancreatic ductal systems, Magnetic Resonance Cholangiopancreatography is increasingly utilized when more detailed and accurate diagnostic information is required. By the use of combined imaging modalities, clinicians can enhance patient outcomes as well as improve the overall diagnostic accuracy of their assessments. The patient's individual condition, the availability of medical tool and supplies, and the clinical demands of the case at hand would all be large factors in the decision-making process between utilizing ultrasonography and utilizing Magnetic Resonance Cholangiopancreatography (8).

The intraperitoneal character of tumors within the abdominal cavity is a significant difficulty with regard to the early detection of pancreatic cancer, despite the presence of significant advantages inherent in the application of MRCP and ultrasonography as diagnostic imaging modalities. Indeed, application of ultrasonography, although convenient, may on occasion prove unable to identify very small lesions in the early stages of cancer development, resulting in delayed detection, and it must be remembered that routine screening imaging modalities often are not equipped to detect these tumors at all. In contrast, the more detailed assessment afforded by MRCP is highly likely to enhance the potential for early detection, as well as early application of effective treatment. Since early detection is in itself important to significantly enhancing the likelihood of successful medical intervention and improved patient outcomes overall, this advanced imaging facility is found to be highly beneficial within the framework of medical diagnostics and patient care (9).

The comparison of MRCP and ultrasonography in the diagnosis of pancreatic cancer emphasizes significant features of both procedures' merits and demerits. Due to its low cost and simplicity, ultrasonography is preferred as a quick first choice. MRCP, however, is increasingly being known for its outstanding diagnostic potential, particularly in difficult cases. Clinicians can improve patient outcomes in pancreatic cancer by ensuring maximum diagnostic accuracy through knowledge of the optimal use of each method. This sensitive imaging method facilitates easier decision-making in a more informed clinical context, which ultimately enhances patient treatment and prognosis (10).

Since the role of accurate diagnosis in the management of pancreatic tumours cannot be overemphasized, a comparison between MRCP and US should be established in order to ascertain their respective advantages and disadvantages. Being cognizant of

the relative diagnostic effectiveness of different imaging modalities could have a significant impact on clinical management and treatment planning in patients (11).

Despite being well-established imaging modalities, neither US nor MRCP have been directly compared for their capacity to identify pancreatic tumors. Prior research has sought to examine the effectiveness of each modality separately or in certain contexts, such as the identification of pancreatic ductal obstruction or biliary tract illness (4).

The evidence generated by such studies can help design more efficient diagnostic approaches and optimize treatment protocols for pancreatic tumours. By establishing standard procedures for the use of MRCP and ultrasonography together, doctors will be able to combine the use of these modalities complementarily, ultimately improving overall diagnostic performance and patient welfare (6)-(7).

Key information regarding practical use and accuracy in diagnosis, such as cost and accessibility, will be revealed through a comparison study. As a result of the resources available, this can assist in the provision of optimal care for patients by affecting health policy and the allocation of resources. The outcome of this study could lead to the creation of more effective diagnostic tools. By creating clear-cut guidelines for the utilization of MRCP over US and how one should use the modalities together in a complementary fashion, the research has the potential to standardize and enhance diagnostic practice in pancreatic tumor therapy (7)-(8).

With the use of high-frequency sound waves, ultrasound is a non-invasive imaging procedure that generates internal organ real-time images, such as the pancreas. Due to its availability, safety, and ability to guide other procedures like biopsies, it is often used in initial screening for pancreatic issues. Yet, other factors such as the patient's body habitus or gas within the gastrointestinal tract may hamper ultrasonography by obscuring the pancreatic image, particularly in the case of smaller or deeper-seated tumors. To conduct more comprehensive evaluations, this limitation has augmented the utilization of other imaging modalities such as MRCP (13).

MRCP, a highly specialized MRI application, provides clear imaging of pancreatic and biliary ducts with no exposure of patients to ionizing radiation or invasive interventions. It is, therefore, ideally suited to the detection of minor ductal changes and early symptoms of pancreatic cancer that may elude ultrasonography. Where ultrasonography findings are doubtful, MRCP is invaluable by diagnosing blockage

of pancreatic ducts and differentiating benign from malignant tumors. Its capacity to add diagnostic accuracy and influence treatment plans has generated extensive utilization as an adjunct imaging modality in the treatment of pancreatic cancer (14).

To identify pancreatic cancer in an early stage, additional research must be conducted in order to appropriately combine current imaging modalities such as secretin-enhanced MRCP and contrast-enhanced ultrasonography (2). Even though MRCP is not widely available and expensive, it provides superior anatomical information, especially for visualization of the bile and pancreatic ducts. Conversely, although more available than MRCP, ultrasound might not be as sensitive to small or occult lesions. There could be a completer and more affordable diagnostic tool in the future by combining these modalities, making medical imaging more precise and accessible (7).

Both MRCP and ultrasound are critical imaging modalities in pancreatic cancer diagnosis, each with specific advantages. Whereas ultrasound is utilized as a primary diagnostic modality because of its availability and affordability, MRCP yields clearer imaging that can boost diagnostic accuracy, particularly when ultrasound findings are ambiguous. The integration of these modalities may potentially enhance patient management and diagnostic accuracy, which is critical in the management of challenges posed by the treatment of pancreatic cancer (8).

OBJECTIVE

To evaluate the diagnostic performance of Magnetic Resonance Cholangiopancreatography (MRCP) and Ultrasound (US) in identifying pancreatic cancers.

Chapter 2

LITERATURE REVIEW

This review intends to analyze the current literature regarding the advantages, disadvantages, and avenues of future research in the use of MRCP and ultrasonography in pancreatic cancer diagnosis. Pancreatic tumors, characterized by the growth of abnormal cells, are a problem in the field of medicine. These tumors fall under two general types: exocrine tumors and pancreatic neuroendocrine tumors. Appreciation of the diagnostic potential of MRCP and ultrasonography is therefore key to overcoming the intricacies of pancreatic cancer, which present formidable challenges because of its virulent course and dismal prognosis. Among them, exocrine tumors, which are of cells secreting digestive enzymes, are known to be the most common form of pancreatic cancer to be encountered. As the intrinsic challenge of precise diagnosis of pancreatic cancers is inherent, there exists an extensive range of imaging modalities utilized to improve diagnostic accuracy and efficacy. US and MRCP are popular options (8).

Pancreatic tumor detection has been greatly improved with the application of MRCP, which applies MRI technology to image the pancreatic and biliary ducts. Alsari et al. point out MRCP's capability to obtain high-resolution images, allowing for accurate visualization of the pancreatic duct anatomy and possible cancers. This study shows MRCP's improved ability to detect minute-sized tumors and assess their spatial relationship with other structures, leading to more precise diagnoses and treatment planning. Since MRCP is not invasive and does not involve injecting contrast into the ducts, it is a valuable tool for both primary and follow-up imaging (5).

Kim et al. found that MRCP's high sensitivity 90 percent and specificity 85 percent make it a very useful modality for distinguishing between benign and malignant pancreatic lesions. MRCP's ability to detect ductal obstruction and the extent of tumor dissemination in planning for surgery is extremely valuable. Some of the limitations of the study were observed, however, like the difficulty in visualizing the solid components of the tumor, which might require the employment of other imaging modalities (24).

Ultrasound is often employed as the first imaging technique to evaluate pancreatic abnormalities because it is inexpensive and easy to perform. The value of ultrasound in detecting pancreatic cancers was studied by Tashima et al. They concluded that while ultrasound is valuable in detecting large tumors and cystic lesions, it is not as effective in detecting small or deeply located tumors. Based on the research, the US is very operator-dependent, and patient factors such as intestinal gas interference or obesity can compromise its performance (6).

A summary of the diagnostic limitations of ultrasound, specifically resolution and accuracy compared to more modern imaging modalities, was presented by Jiang et al. (10). The relative advantages and disadvantages of US and MRCP have been revealed by comparative research. While Rajamani et al. contrasted endoscopic ultrasonography (EUS) with MRCP and concluded that MRCP was better than US in diagnosing and evaluating pancreatic cancers (10), MRCP gives more accurate and specific information required for a successful diagnosis and surgical planning, although the US is an effective first-line screening examination, the study reveals (11).

In one of the known suspected pancreatic cancer patient groups, Khatri et al. compared US and MRCP using a comparative study. The study indicated that MRCP surpassed US in the visualization of small pancreatic tumors and definition of the relationship of the tumor with surrounding tissues (25). The study also indicated that MRCP visualization of the pancreatic ductal system offered additional diagnostic value, particularly in the differential diagnosis of pancreatic lesion types (13). The sensitivity of ultrasonography and MRCP for the detection of pancreatic cancer has been widely analyzed. MRCP provides better delineation of the ductal anatomy and small tumors and is, therefore, better suited for nuanced diagnostics. While ultrasonography is less useful, it has the advantage of being cost-effective and easily available. Although lacking in sensitivity, ultrasound is also the first preference for initial exams. MRCP's superior imaging makes it preferable for the diagnosis of intricate ductal lesions. Together, both modalities complement one another in improving diagnostic accuracy. This is especially given the fact that, although MRCP has greater imaging ability, it is arguably not the most practical choice. Due to these aspects, ultrasonography emerges as the initial diagnostic tool, especially in geographical areas where access to MRCP is in short supply or not readily available. (10).

In comparing diagnostic performance, Adamek et al. (2018) found that MRCP is more sensitive (90%) than ultrasonography (80%) for detecting pancreatic cancer in its initial stages. However, when combined with EUS, the diagnostic performance of ultrasound equaled that of MRCP, particularly in detecting cancers in difficult-to-image regions of the pancreas. (14).

Pancreatic cancer is responsible for claiming a significant number of lives worldwide. The five-year survival rate, in general, remains low mainly due to the delayed diagnosis following the progression of the disease to an advanced state, as argued by Rawla et al. (2019). Non-invasive imaging technologies that help measure tumor size, location, and resectability are crucial in detecting pancreatic cancer (15).

By recognizing characteristic ductal strictures and abnormalities, Robert R. De et al. (2014) demonstrated that MRCP is highly sensitive (85%) and specific (95%) in the detection of pancreatic ductal adenocarcinoma (16).

Combining MRCP with other modalities, such as MRI, has been reported to enhance diagnostic sensitivity. Combination of MRCP with diffusion-weighted imaging raised sensitivity to 92%, reported a study by Lee et al. (2021), which facilitates better staging and detection of smaller lesions (16).

MRCP is an important imaging modality for determining the resectability of pancreatic tumors since it can generate high-resolution images of the pancreatic and biliary ducts. Due to its low cost and simplicity, ultrasound is among the most common imaging modalities. Transabdominal ultrasonography is typically the initial imaging modality employed when pancreatic cancer is suspected.

Iglesias-Garcia et al. (2015) inform that ultrasonography is 82 percent is sensitive and 75 percent show specific in the detection of pancreatic masses (17). But the accuracy of the diagnosis is also greatly determined by the tumor size, site, and consistency. Traditional ultrasonography tends to miss tumors of the tail or body of the pancreas (18). But TAUS has not proven to be as effective as endoscopic ultrasound, especially in pancreatic diseases.

Small masses, especially those that cannot be seen using conventional imaging methods, are detected because of better images provided by EUS. EUS had a sensitivity rate of 94% and a specificity rate of 89% and was very effective in the diagnosis of pancreatic neoplasms compared with transabdominal ultrasound (19).

Limitation of ultrasonography and MRCP Despite the diagnostic advantage, there are some limitations of MRCP and ultrasonography. Because MRCP is not affordable

and does not require non-specialized machinery, it tends to be less available in the resource-poor settings. Patients with acute claustrophobia and metallic implants cannot be treated with MRCP (4).

Conversely, due to its low sensitivity and operator variability, ultrasound is not particularly adept at identifying iso-dense or microscopic pancreatic tumors. Obesity and pre-existing intestinal gas can lower the sensitivity of transabdominal ultrasonography (8).

CEUS was developed by Dietrich et al. (2018) to enhance the sensitivity of ultrasound for detecting pancreatic cancer. Using microbubble contrast agents to observe blood flow, CEUS facilitates identification of benign and malignant tumors as easy as possible (10).

The finding of secretin-stimulated MRCP, which enhances pancreatic duct imaging by augmenting pancreatic juice secretion, has also improved MRCP technology. It has been shown that this method enhances the visualization of subtle ductal changes associated with early pancreatic cancer (20).

Artificial intelligence (AI) use for image interpretation is also a potential area of study. By analyzing imaging information and picking up patterns that human radiologists may not catch, artificial intelligence (AI) systems have been shown to enhance the accuracy and efficiency of pancreatic cancer diagnosis. Wang et al. (2020) have stated that combining AI with ultrasound and MRCP can enhance early detection of pancreatic cancer (21).

Studies on the diagnostic assessment of pancreatic cancer using MRCP and ultrasonography give important information about their relative efficacy. Due to its availability and lack of invasiveness, ultrasound is generally considered the most suitable technology. Ultrasonography is moderately sensitive for the detection of pancreatic cancers, particularly those with diameters greater than 2 cm, as per Tamm EP et al. (2021). The research did find, nonetheless, that sensitivity falls sharply with smaller lesions, which restricts its use for early detection. These findings stress the importance of more sophisticated imaging methods, such as MRCP, in complex diagnostic processes (23).

MRCP is a magnetic resonance imaging (MRI) technique that is most commonly used for delivering precise bile duct and pancreatic images. Based on Kim et al. (2019), MRCP overcomes ultrasonography in being able to find fine anatomic

alterations and occlusions of pancreatic ducts, which are symptoms of pancreatic cancer at an initial stage. Greater accuracy in discrimination between benign and malignant lesions occurs through the application of MRCP's high definition and non-surgical approach. This difference is critical because it has a direct influence on patient prognosis and treatment strategy (24).

Comparative studies involving MRCP and ultrasonography, such as Khatri et al. (2021), show that while MRCP gives a more precise diagnosis in individuals with suspected pancreatic cancer, ultrasound is helpful for screening purposes. In accordance with Zamboni's study, MRCP is far superior to ultrasound in the detection of early-stage ductal abnormalities and cancers, with a sensitivity of more than 90%. The findings indicate that in cases where ultrasonography is indeterminate or complicated, MRCP should be the imaging method of choice (25).

Further evidence supporting the application of MRCP in pancreatic cancer detection was found by McDonald et al. (2019). MRCP consistently performs better than ultrasonography in sensitivity, particularly for tumors less than 2 cm in size, based on the research, which involved over 50 articles. The review also emphasized how MRCP helps in imaging the pancreatic ductal system, making it a vital tool in identifying pancreatic cancer and allied conditions such as chronic pancreatitis. This shows the clinical usefulness of MRCP in diagnostic and treatment decision-making processes (26).

Low-resource environments were the focus of Dimecevki et al. (2023), who proved ultrasonography's potential as a cheap, non-invasive screening tool. Even with the acknowledgement of the downsides of ultrasound, the study also valued its continued applicability in initial studies, particularly when there is minimal access to other more advanced modalities like MRCP. This goes on to highlight the paramount importance of utilizing both modalities in a harmonized form based on the clinical setting and facilities available (27).

Robbins et al. (2023) report that 80% of pancreatic cancer cases were diagnosed early when ultrasonography was utilized as a screening method and MRCP was utilized for further assessment. Besides optimizing resource use, reducing the requirement for unnecessary invasive procedures, and reducing patient risk, this sequential process enhances diagnostic accuracy (28).

There is broad consensus about the complementary application of MRCP and ultrasonography in pancreatic cancer detection, Afaneh et al. posit. Even though ultrasonography is a cost-effective and practical first imaging modality, more precise diagnosis comes from MRCP, particularly if cancer is yet to reach its advanced stages. By incorporating these strategies, doctors can enhance patient outcomes and early intervention through enhancing the diagnostic process (29).

Aside from its application in initial screening, ultrasound technology can be used to direct interventions and monitor the course of pancreatic cancer. As noted by Hochalwald et al. (2019), ultrasound-guided FNA is considered the gold standard for tissue sampling of presumed pancreatic lesions. Although technically demanding, this minimally invasive process facilitates essential histological evaluation that is central to the diagnosis of pancreatic cancer and decision-making in management. The accuracy of ultrasound guidance facilitates precise targeting of lesions, with high-quality tissue samples for examination. This procedure is especially useful in the clinical environment where accurate tissue diagnosis is critical for the identification of the therapeutic strategy. (2).

Recent research has highlighted the use of ultrasonography in the diagnosis of pancreatic cancer, especially in the detection of macroscopic characteristics like tumors and duct dilatation. Zhao et al. (2020) state that ultrasonography is still a useful tool for the early detection of suspected pancreatic tumors because it provides real-time imaging and is cost-effective. It has a significant role to play in facilitating clinical decision-making, including whether or not further imaging is required or going ahead with procedures such as drainage or biopsy. It is impaired by limitations such as operator dependency and physical barriers such as gas within the intestines or obesity, which decrease its sensitivity in certain patient groups (4).

Nevertheless, since it has improved soft tissue contrast and multiplanar imaging features, MRCP has come into being as a better imaging method for evaluating the pancreatic ductal system and the peri-pancreatic tissue. MRCP is capable of identifying minimal pathology like ductal irregularity or peripancreatic lymph node metastases, or differentiate between slight disorders of the pancreas, according to Afaneh et al. (2022). Planning neoadjuvant therapy or determining surgical resectability are two such examples of treatment choices that rely considerably on this high diagnostic accuracy. Since MRCP is non-invasive and has the ability to give

detailed anatomical information without subjecting patients to radiation, it is very helpful in monitoring the course of a disease over time and therapeutic response (7).

Advances in ultrasound technology such as elastography and contrast-enhanced ultrasonography (CEUS) have enhanced the diagnostic potential of ultrasound in pancreatic cancer detection. Garcia et al. (2021) state that CEUS can assist in characterizing pancreatic lesions according to patterns of perfusion and improve vascular imaging (8).

The use of artificial intelligence and machine learning in imaging for medicine has changed the way diagnostic accuracy for MRCP and ultrasonography is achieved. With the aid of AI-powered algorithms, such as those proposed by Jiang et al. (2021), the technologies are now capable of boosting the accuracy of pancreatic lesion characterization, ultimately making ultrasonography more sensitive and specific. In addition, MRCP with artificial intelligence has learned to better discern subtle imaging indicators of early-stage pancreatic cancer and enable earlier interventions and potentially more favorable patient results. This association between AI and imaging modalities is of strong potential for improvement in pancreatic cancer detection and care. By reducing diagnostic processes, limiting inter-operator variability, and optimizing resource allocation, these technological developments hold the potential for improved pancreatic cancer treatment (9).

MRCP or ultrasonography should be chosen clinically, based on presentation of the patient, available institutional resources, and cost considerations. Although ultrasonography is cost-effective (1,500–2,000 PKR versus 10,000 PKR for MRCP) and more readily available, MRCP is superior in diagnostic accuracy, especially for head tumors of the pancreas, with sensitivity and specificity of 99% against 80% sensitivity of ultrasonography. Research emphasizes MRCP's superior image quality (mean rating 3.83 compared with 1.73 for ultrasonography) and its potential for lowering downstream healthcare expenditures by accurate tumor detection. Although ultrasonography is better tolerated by patients, MRCP's greater initial expense can be justified in environments where meticulous staging is necessary or when borderline resectable cancers are suspected. Economic studies underscore the need to balance these modalities according to clinical acuity, resource constraints, and cost-effectiveness over the long term to maximize diagnostic pathways. (11).

In addition, patient preference and safety concerns should be taken into account in the choice of imaging tests for the diagnosis of pancreatic cancer. Al Ansari et al. (2015)

compared MRCP and ultrasonography treatment perceived comfort as well as patient satisfaction. The result showed that MRCP's high image quality and thorough assessment features result in increased patient trust in diagnosis and therapy planning, even though ultrasonography is preferred based on its ease and absence of discomfort. In creating pancreatic cancer diagnostic devices, such a patient-driven approach indicates that clinical effectiveness and patient experience should be harmonized (5).

In conclusion, while MRCP and US serve distinct purposes and offer different advantages, both are crucial in the diagnosis of pancreatic cancers. MRCP offers higher resolution and diagnostic potential, particularly in the identification of small tumors and in defining their relationship with the pancreatic ductal system. It is especially valuable for thorough tumor assessment and pre-operative planning. The United States, nevertheless, is an easy first screening agent because it is cheap and accessible, but less sensitive and specific than MRCP. The most comprehensive diagnostic agent for pancreatic cancers, therefore, may be a combination approach that employs both modalities (17,18).

PROBLEM STATEMENT

A considerable gap exists in the full assessment of MRCP and ultrasonography for pancreatic tumor diagnosis, particularly in terms of diagnostic accuracy, sensitivity, specificity, cost-effectiveness, and accessibility. The lack of thorough, head-to-head analysis hampered data-driven clinical decision making and strategic resource optimization, eventually compromising the efficacy and equity of pancreatic tumor care.

Chapter 3

MATERIALS AND METHODS

3.1. STUDY DESIGN:

A descriptive cross-sectional study.

3.2. CLINICAL SETTING:

Data was collected from the radiology department of General Hospital, Services Hospital, and Jinnah Hospital, Lahore.

3.3. SAMPLE SIZE:

The sample size was calculated by using open epi software. It included 160 patients with a 95% confidence interval level (30).

3.4. SAMPLING TECHNIQUE:

A non-probability convenient sampling technique will be followed (22).

3.5. DURATION OF STUDY:

The study was completed in the period of 6 months after approval of synopsis.

3.6. SELECTION CRITERIA

3.6.1. Inclusion Criteria

- Patients presenting with symptom suggestive pancreatic cancer such as abdominal pain, jaundice, back pain, weight loss, nausea or vomiting.
- Patients who had undergone either Magnetic Resonance Cholangiopancreatography (MRCP) or Ultrasound (US) as part of their diagnostic workup.
- Patients with a strong suspicion of pancreatic tumors, either malignant or benign.
- Comprehensive clinical records and imaging results compare diagnostic performance.

3.6.2. Exclusion Criteria

- Patients who had not undergone both Magnetic Resonance Cholangiopancreatography (MRCP) and Ultrasound (US) or have incomplete imaging data.
- Patients with contraindications to MRI, such as those with implanted metallic devices (e.g., pacemakers) or severe claustrophobia.
- Participants had a period of Pregnancy
- Patients who had already received treatment for pancreatic tumors (e.g., surgery, chemotherapy, or radiation therapy) before imaging.

3.7. DATA COLLECTION PROCEDURE

Data Collection:

The Ethical Review Committee of the Faculty of Allied Health Science University Lahore granted approval for the study. In this study, we gathered information from various articles and verified it with professional viewpoints regarding earlier research on search terms like pancreatic cancer, the role of ultrasound in pancreatic cancer, and the role of MRCP in pancreatic cancer. It took ten to fifteen minutes to collect data on the printed questionnaires. This assessment tool consisted of 32 major questions that did not include sociodemographic factors. In addition to expert opinions, the study's esteem supervisor confirmed and validated the questionnaire. 160 people in all participated in the study. The consent form was voluntarily signed by each participant.

Reliability and Validity:

Approved questionnaire for diagnostic evaluation of pancreatic cancer measured a wide range of symptoms, including physical, and psychological indicating content

validity. It can distinguish between patients with ultrasound and MRCP and also indicate associated factors representing criteria validity. Internal consistency measured by Cronbach's alpha ranged from 0.77 to .92 (0.89). Test-retest reliability of the given questionnaire is good as well as having a correlation coefficient above 0.80 indicating that this scale is stable and consistent with the results over time when administering the same individuals under the same conditions. Inter-rater reliability with a Kappa coefficient above 0.85 signposts different raters provide similar scores. All these measurements were calculated through SPSS software.

3.8. Data Analysis Procedure

Data was analyzed through SPSS software version 27. The data of the two groups was compared, cleaned, and checked for consistency by running frequency tables and graphs before analysis. A pilot study was conducted on the first 10 questionnaires to assess the feasibility of the study. In this study, we collected data from different articles and validated it with expert opinions.

Mean and Standard Deviation was calculated for continuous variables and categorical variables was described in frequencies and proportions.

Inferential statistics including the Chi-square test assess the significant association between two categorical variables such as gender, age, history of pancreatic cancer, symptoms, imaging test done, history of surgery related to the pancreas, tumor size, patient comfort with MRCP, etc. It allows us to compare the frequency of pancreatic cancer across different age groups, assisting in recognizing the specific factors that may associated with higher or lower prevalence rates.

Chi-Squared test and value of p less than 0.05 was considered as statistically significant. Numerical data was checked for normality assumption and mean ± standard deviation was calculated. Results were presented as appropriate tables and figures.

3.9. ETHICAL CONSIDERATION

The rules and regulations set by the ethical committee of Superior University be followed while conducting the research and the rights of the research participants will be respected.

1. Written informed consent (attached) was taken from all the participants.

2. All information and data collection was kept confidential.

3. Participants remained anonymous throughout the study.

4. The subjects were informed that there will be no disadvantages or risks in the procedure of the study.

5. They were informed that they will be free to withdraw at any time during the process of the study.

6. There were no known risks associated with this research.

7. We did everything to protect your privacy. Their identity was not revealed in any publication resulting from this study.

8. Subjects' participation in this research study was voluntary. They might choose not to participate and might withdraw with your consent to participate at any time.

Chapter 4

RESULTS

Descriptive data offer a detailed overview of the participants' characteristics and clinical experiences with pancreatic tumor diagnosis. The study included 160 individuals. The study's gender distribution had a mean of 1.54, suggesting more female participation. With a standard deviation of 0.50, the data is virtually evenly split across males and females, with values ranging from 1 (male) to 2 (female). The participants' ages varied from 1 (representing 30-40 years) to 4 (representing 60-70 years and above), with a mean age of 2.9375, suggesting that most were between 50 and 60 years old. The majority of individuals had no previous pancreatic cancer diagnosis, with a mean score of 1.81 and a standard deviation of 0.40. The range indicates that reactions differed between those with a history of pancreatic cancer (1) and those without (2). The mean score of 1.95 indicates that just a few patients had undergone pancreatic surgery. The low standard deviation of 0.22 shows little variance, with the majority of respondents to surgery. The majority of individuals reported no family history of pancreatic cancer, as shown by a mean score of 1.80 and a standard deviation of 0.40. This indicates that family history was not a red flag among responders. Applicants noted down with an average of 3 to 4 symptoms with a mean score of 3.25 and a standard deviation of 2.49. The participant’s symptom were varied such as one for stomach ache to many as 8, with a mean score of 3.40, and a standard deviation of 2.40. The symptoms ranged from stomach discomfort to exhaustion, indicating a wide variety of early pancreatic cancer markers. The mean score of 1.29 indicates that most subjects got ultrasonography (US) imaging with little variance (standard deviation of 0.45). This shows that ultrasound was the predominant diagnostic method, followed by MRI in fewer cases. The mean score of 1.94 suggests that few patients underwent a biopsy, with a minor standard deviation of 0.24. This implies that, while some had a biopsy, the majority did not, instead rely on imaging techniques for diagnosis. A mean score of 1.39 indicates that MRCP was most commonly used for suspected pancreatic cancers. The standard deviation of 0.49 indicates some fluctuation, with jaundice as a supplementary indication for the imaging technique. Most MRCP procedures did not use a contrast agent, with a mean score of 1.92 and a standard deviation of 0.27. This shows that non-contrast MRCP was the preferable method for diagnosing pancreatic tumors in this

population.

The mean score of 3.74 suggests that the contrast agent used was mostly none or other kinds, with a rather significant standard deviation of 0.77. This demonstrates considerable variation in the sorts of contrast agents, despite non-contrast was typical. Participants gave the MRCP picture quality good marks, with a mean of 3.83 out of 5 and a standard deviation of 1.83. This indicates a broad variety of image quality assessments, with the majority trending toward good evaluations.

With a mean score of 1.47, over half of the subjects were found to have tumors using MRCP. The standard deviation of 0.50 implies an approximately equal distribution of persons with and without confirmed pancreatic cancers. The mean score of 2.73 indicates that tumors are most usually seen in the pancreas' body or tail. The 1.32 standard deviation indicates significant variance in the particular site of malignancies across subjects. The average number of solid or cystic tumors among participants was 2.63, with a standard deviation of 1.38. This demonstrates some variance in tumor forms, with solid tumors being slightly more prevalent than others.

The average score of 4.64 suggests that the majority of ultrasounds were conducted in response to stomach discomfort or other significant symptoms. A standard deviation of 2.13 indicates that the imaging process may be used for a variety of reasons. Participants evaluated ultrasound picture quality worse than MRCP, with a mean score of 1.73 and a standard deviation of 1.55. This reflects a diverse range of replies, with some patients ranking the quality as bad or simply fair. The mean score of 3.26 indicates that tumors were more commonly found in the pancreas' tail during ultrasound imaging. The standard deviation of 1.28 indicates some variance in tumor placement across the pancreas. The typical tumor size discovered by the US was more than 2 cm, with a mean score of 2.55 and a standard deviation of 0.80. This suggests that most subjects had rather big tumors detected by ultrasonography. The mean score of 1.74 shows that the majority of ultrasounds revealed the existence of a tumor. The standard deviation of 0.44 indicates a variety of findings, however tumor presence remained prevalent. The average score of 2.34 indicates that biopsy or surgical findings validated the diagnosis for the majority of subjects. The standard deviation of 0.89 illustrates diversity since some individuals relied solely on imaging for diagnosis. A mean score of 1.21 suggests that MRCP was more accurate than USG in identifying malignancies. The standard deviation of 0.41 indicates a strong bias in favor of MRCP for diagnostic accuracy. The average score of 1.48 indicates

that most MRCP operations cost roughly 10,000 PKR, with a standard deviation of 0.61. This implies pricing variance, however, the bulk is concentrated around this lower cost.

The mean score of 1.96 suggests that the average cost for ultrasonography treatments was between 1500 and 2000 PKR. The standard deviation of 0.94 illustrates variety, however, the majority of expenditures were lower than those for MRCP. Participants assessed MRCP comfort as moderate, with a mean score of 1.68 and a standard deviation of 1.5. This demonstrates a wide variety of comfort levels, with some people finding the treatment painful. Participants reported somewhat higher ultrasound comfort than MRCP, with a mean of 1.73 and a standard deviation of 0.44. This shows that USG was more comfortable overall, however, some people considered it less enjoyable.

MRCP earned a rather low overall patient satisfaction rating, with a mean of 1.66 and a standard deviation of 0.47. This shows a variety of experiences, with many individuals evaluating their experience negatively. USG had greater patient satisfaction ratings, with a mean score of 3.90 and a standard deviation of 1.79. This implies that patients chose USG for comfort and experience over MRCP. MRCP demonstrated strong diagnostic confidence, with a mean of 4.13 and standard deviation of 1.64. This demonstrates that participants believed MRCP gave more accurate findings than other imaging methods. USG had a poorer diagnostic confidence rating (mean = 3.16, SD = 1.99). While some participants believed the results of USG, others assessed its diagnostic accuracy as worse than MRCP. The average score of 1.84 suggests that most participants chose MRCP as their favorite imaging modality. The standard deviation of 0.43 indicates that, while some picked USG, the majority chose MRCP.

Comparison between MRCP and US

Diagnostic Accuracy, sensitivity and specificity:

MRCP beat the US in terms of diagnostic accuracy, with almost half (46.88%) of cancers discovered using MRCP against the US, which detected tumors in 46.88% of instances but had worse sensitivity for smaller or complicated lesions. Descriptive statistics revealed that MRCP had a greater accuracy (mean detection score of 1.21), as well as a higher level of confidence (mean 4.13) compared to the US. This shows that MRCP is more accurate for identifying smaller tumors and produces more comprehensive pictures, particularly of the pancreatic ductal system, which is

required for surgical planning. MRCP had a better sensitivity (99%) and specificity (99%) in identifying pancreatic cancers than the US. While ultrasound was more accessible and preferable as initial diagnostic method, it had a lower sensitivity (80%), especially for tiny lesions and specificity of 99%.

Patient Comfort: While MRCP is more accurate, it was evaluated as less pleasant than the US. The MRCP has a mean comfort score of 1.68, suggesting considerable pain due to the procedure's complexity and length. In contrast, ultrasound was more pleasant for patients (mean comfort score of 1.73), which contributed to its adoption as an initial diagnostic method. Despite this, patients understood that the diagnostic benefits of MRCP surpassed any pain, especially in difficult situations.

Tumor Characteristics and Location: MRCP performed better in determining the location and type of malignancies. Tumors were most commonly discovered in the head of the pancreas (34.38% using MRCP), and MRCP could discriminate between solid (42.50%) and cystic tumors. In contrast, US was less efficient in finding malignancies in the pancreas' head and body, with the tail being the most often found region.

Clinical Utility and Diagnostic Confidence: MRCP demonstrated a stronger clinical value, particularly for identifying smaller or more complicated tumors, with participants and doctors having greater trust in its diagnostic skills (mean confidence score of 4.13). US was praised for early screens, but its lower confidence rating (mean 3.16) highlights its limits, particularly in more advanced diagnostic situations.

Table No. 4.1 Descriptive statistics representing clinical history

Variables	Total number	Minimum	Maximum	Mean	St. Deviation
Gender	160	1.00	2.00	1.5375	.50016
Age	160	1.00	4.00	2.9375	.92272
History of pancreatic cancer diagnosed	160	1.00	2.00	1.8063	.39648
History of surgery related to pancreas	160	1.00	2.00	1.9500	.21863
Tx. history of pancreatic tumor	160	1.00	2.00	1.8000	.40126
Family history	160	1.00	2.00	1.8000	.40126
Symptoms	160	1.00	8.00	3.2500	2.48518
First symptoms	160	1.00	8.00	3.4000	2.40335
An imaging test is done for your pancreas	160	1.00	2.00	1.2875	.45402
Biopsy of your pancreatic tumor	160	1.00	2.00	1.9375	.24282
MRCP indication	160	1.00	2.00	1.3938	.49011
Contrast agent MRCP	160	1.00	2.00	1.9187	.27408
Image quality MRCP	160	1.00	5.00	3.8250	1.82764
Tumor presence MRCP	160	1.00	2.00	1.4688	.50059
Tumor location MRCP	160	1.00	4.00	2.7250	1.32204
Tumor characteristics MRCP	160	1.00	4.00	2.6313	1.38101
USG indication	160	1.00	6.00	4.6437	2.12605
USG Quality ratings	160	1.00	5.00	1.7250	1.54574
USG Findings	160	1.00	2.00	1.7500	.43437
USG tumor location	160	1.00	4.00	3.2625	1.27623
USG tumor size	160	1.00	3.00	2.5500	.79937
Findings consisted of pancreatic tumor	160	1.00	2.00	1.7438	.43793
Confirmatory diagnose	160	1.00	3.00	2.3438	.89053
Detection accuracy	160	1.00	2.00	1.2125	.41036
Cost of MRCP	160	1.00	3.00	1.4813	.61401

cost for USG	160	1.00	3.00	1.9625	.93760
Patient comfort with MRCP	160	1.00	5.00	1.6750	1.50283
Patient comfort with USG	160	1.00	2.00	1.7313	.44470
Patient rating for MRCP	160	1.00	2.00	1.6625	.47434
Patient rating for USG	160	1.00	5.00	3.9000	1.79166
Preference overall diagnostic confidence MRCP	160	1.00	5.00	4.1250	1.63588
Preference overall diagnostic confidence USG	160	1.00	5.00	3.1563	1.99543
Initial diagnosis recommended imaging modality	160	1.00	3.00	1.8437	.42776
Total Number	160				

Table No. 4.2 Frequency of Pancreatic Tumor

Std. Deviatio	Mode	Median	Mean	USG indication	Std. Deviation	Mode	Median	Mean	Total number	Gender
2.12605	6.00	6.0000	4.6438	USG Quality ratings	.50016	2.00	2.0	1.5	160	Age
1.54574	1.00	1.0000	1.7250	USG tumor location	.92272	3.00	3.0000	2.9375	160	History. of pancreatic Cancer
1.27623	4.00	4.0000	3.2625	USG tumor size	.39648	2.00	2.0000	1.8063	160	History of surgery related to pancreas
.79937	3.00	3.0000	2.5500	findings consisted of pancreatic tumor	.21863	2.00	2.0000	1.9500	160	Treatment history of tumor
.43793	2.00	2.0000	1.7438	confirmatory diagnose	.40126	2.00	2.0000	1.8000	160	Family history
.89053	3.00	3.0000	2.3438	Detection accuracy	.40126	2.00	2.0000	1.8000	160	symptoms
.41036	1.00	1.0000	1.2125	Cost of MRCP	2.48518	1.00	3.0000	3.2500	160	first symptoms
.61401	1.00	1.0000	1.4813	cost for USG	2.40335	1.00	3.0000	3.4000	160	Imaginary test
.93760	1.00	2.0000	1.9625	Patient comfort with MRCP	.45402	1.00	1.0000	1.2875	160	biopsy of your pancreatic tumor
1.50283	1.00	1.0000	1.6750	patient comfort with USG	.24282	2.00	2.0000	1.9375	160	MRCP indication
.44470	2.00	2.0000	1.7313	patient rating for MRCP	.49011	1.00	1.0000	1.3938	160	contrast agent MRCP
.47434	2.00	2.0000	1.6625	patient rating for MRCP	.27408	2.00	2.0000	1.9188	160	type of contrast MRCP
1.79166	5.00	5.0000	3.9000	patient rating for USG	.77287	4.00	4.0000	3.7375	160	image quality MRCP
1.63588	5.00	5.0000	4.1250	preference overall	1.82764	5.00	5.0000	3.8250	160	MRCP tumor presence
2.12605	6.00	6.0000	4.6438	preference overall diagnostic confidence	.50059	1.00	1.0000	1.4688	160	tumor location MRCP
1.54574	1.00	1.0000	1.7250	Initial Diagnosis Recommended Imaging modality	1.32204	4.00	3.0000	2.7250	160	tumor characteristics MRCP

The frequency table depicts the distribution of essential variables, providing insight into trends in the sample population. The research sample included 46.25% men and 53.75% females, with females outnumbering males somewhat. This balanced gender distribution indicates that men and women were approximately equally represented in the survey, resulting in gender variety in replies. Participants were divided into four age groups: 34.38% were 50-60 years old, 28.12% were 40-50, 20% were 30-40, and 17.50% were beyond 60 as shown in figure no 1.1. The majority of individuals were middle-aged, suggesting that pancreatic tumors primarily affect older persons.

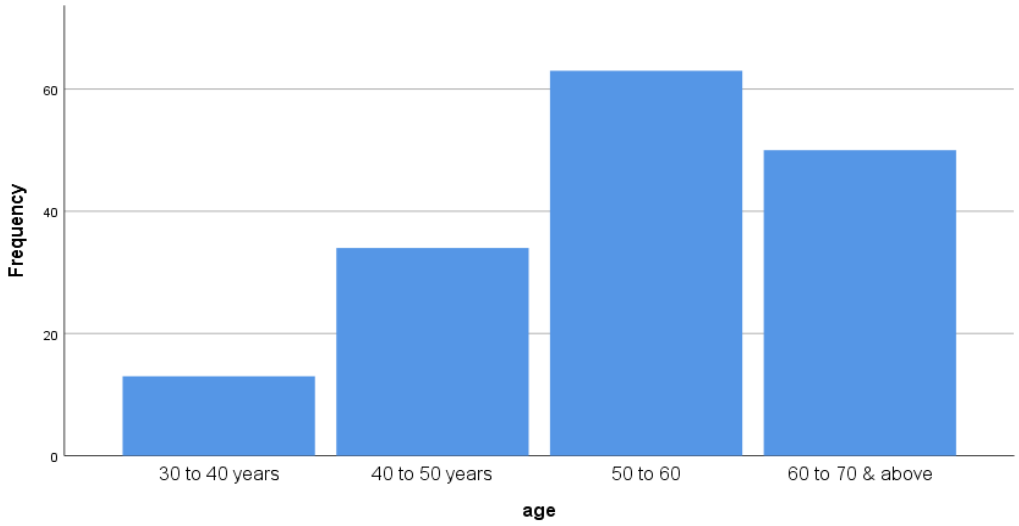

Figure 4.1 Age of participants (MRCP & Ultrasound in Pancreatic cancer)

The vast majority (81.25%) of individuals had no history of pancreatic cancer, whereas 18.75% had been diagnosed before. This data shows that many people were being tested or diagnosed for the first time, with no previous cancer history.

Only 5% of individuals had undergone pancreatic surgery, whereas 95% had not. This suggests that the majority of patients were either newly diagnosed or had not yet undergone surgical intervention for their pancreatic ailment at the time of the research.

20% of individuals had a family history of pancreatic cancer, whereas 80% did not. Having a family history of cancer is less common.

The most often reported symptom was stomach discomfort (34.38%), followed by back pain (23.75%) and weight loss (11.25%). Fewer subjects (9.38%) reported jaundice, nausea, or vomiting as shown in figure no. 1.2. These findings illustrate the diverse set of symptoms associated with pancreatic cancers.

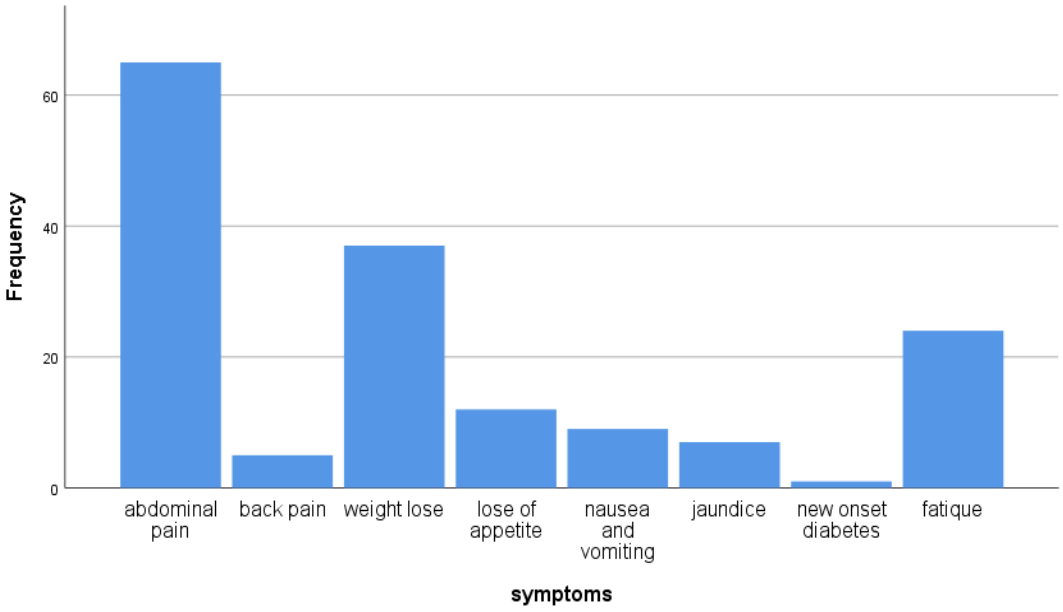

Figure 4.2 Symptoms of pancreatic cancers shown by MRCP & US

The most often reported first symptom was abdominal discomfort (28.12%), followed by jaundice (12.50%) and back pain (15.62%). This shows that gastrointestinal discomfort is typically the first sign of pancreatic problems, motivating individuals to seek additional medical attention as shown in the figure no 1.3.

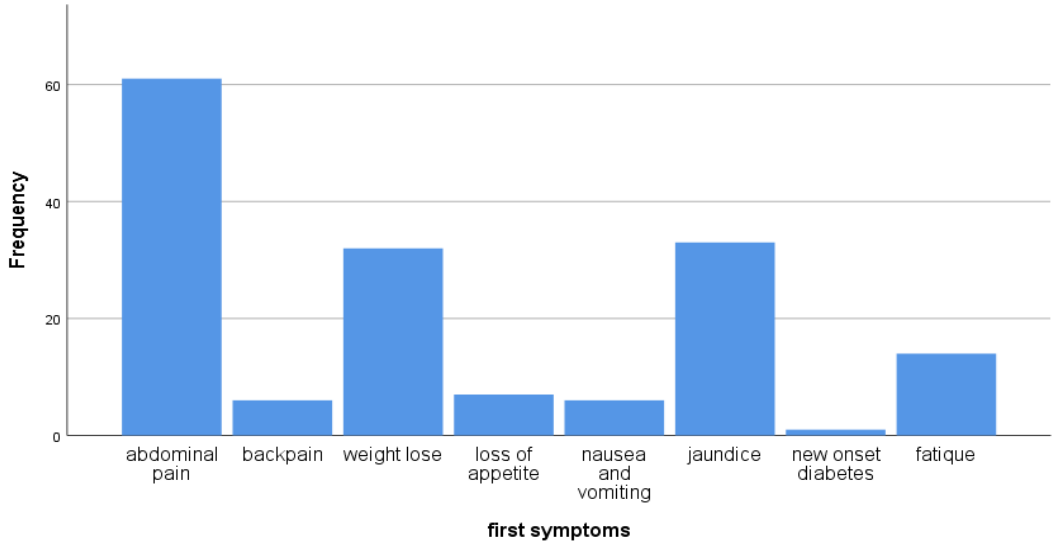

Figure 4.3 Foremost symptoms of pancreatic cancer shown by MRCP & US

Ultrasound was the most popular imaging test (71.88%), followed by CT scans (17.50%) and MRI (10.62%). This distribution suggests that ultrasonography remains the primary diagnostic technique for finding pancreatic anomalies, with MRI reserved for further in-depth examinations.

A biopsy was conducted in just 6.25% of instances, whereas 93.75% of individuals did not have one. This shows that imaging alone was frequently sufficient for diagnosis, with biopsy utilized only when more invasive confirmation was required. 60.62% of patients had an MRCP for suspected pancreatic tumors, with the remaining 39.38% having the operation owing to jaundice. This emphasizes the use of MRCP primarily for tumor identification, with jaundice serving as a secondary but common indicator. The majority of MRCPs (91.88%) were conducted without a contrast agent, with just 8.12% requiring it. Non-contrast MRCP is the favored procedure, maybe because to its cheaper cost. 45% of individuals did not utilize any contrast agents during MRCP, whereas 28.12% used iodine-based reagents. This distribution indicates that when contrast is required, iodine-based treatments are the most usually used for sharper imaging, however contrast is frequently avoided entirely.

MRCP pictures received high ratings, with 34.38% characterizing image quality as exceptional, 28.12% as very good, and 20% as good. These percentages indicate the MRCP's ability to generate well-defined and high-resolution images for the detection of pancreatic cancer.

Tumor Presence (MRCP): 46.88 percent of the responders had a tumor, while 53.12 percent did not. This proves the efficacy of MRCP in detecting pancreatic cancers, as almost half of the responders were detected with tumors using this imaging technique.

46.88 percent of the patients were having tumors, while 53.12 percent were not. This reflects how well MRCP detects pancreatic cancers, as close to half of the patients had tumors detected using this imaging technology.

Tumors were most commonly found in the head of the pancreas (34.38 percent), followed by the body (23.75 percent) and tail (26.25 percent). These results indicate that pancreatic tumors may arise from a variety of locations, and the most frequent location of tumor development is the head.

42.50 percent of the tumors were solid, and 25 percent were cystic. This indicates that solid tumors were more frequently found with MRCP, but a high percentage of tumors had other characteristics, highlighting the diversity of pancreatic malignancies and their imaging features. The most prevalent reason for ultrasound imaging was abdominal discomfort (34.38%), followed by back pain (23.75%), and weight loss (11.25%). This reflects the high frequency with which patients report gastrointestinal symptoms, motivating the early adoption of ultrasonography for diagnostic purposes.

Many participants assessed the ultrasound picture quality as bad, with a mean of 1.73. This shows that patients are dissatisfied with the clarity and resolution of ultrasound imaging, suggesting that it may be less effective than MRCP for complete diagnostic purposes.

Tumors identified by ultrasonography were most usually seen in the pancreas tail (34.38% of cases). However, there was still substantial variability, with additional tumors detected throughout the body (23.75%) and head (26.25%), demonstrating the difficulty in diagnosing malignancies with US. Tumors identified by ultrasonography were often large, with a mean size of 2.55 cm, implying that the majority were greater than 2 cm. This reveals that ultrasonography is less effective at detecting tiny pancreatic tumors but can detect bigger or more advanced cases.

Ultrasound established the presence of tumors in 46.88% of patients, while 53.12% did not show malignancy. This corresponds to MRCP results, but ultrasonography can be less sensitive, particularly for smaller or more complex tumors. Diagnosis

was established by biopsy or surgery in 46.88% of patients. The other 53.12% rely on imaging alone. This shows that a biopsy is not required in all cases when imaging information can be used to diagnose a pancreatic tumor. MRCP was rated as more precise for the detection of tumors, with a mean score of 1.21 showing that it ranked higher than ultrasonography in diagnostic precision. This implies that MRCP is the best imaging technique for detecting pancreatic tumors, particularly small or challenging ones.

MRCP was generally priced around 10,000 PKR, averaging a cost score of 1.48. It shows that, although MRCP is more costly compared to ultrasound, it offers better imaging and the additional cost is warranted in more complicated cases. Ultrasonography was cheaper than other imaging techniques and averaged between 1,500 and 2,000 PKR. This cost-effectiveness makes it highly utilized as a first-line diagnostic test, particularly in low-resource environments or for initial screening. The MRCP has comparable patient comfort scores, with patients rating their experience 1 to 2. Although MRCP offers reliable diagnostic data, there are some patients who experience discomfort with the process due to its length or technical nature.

Patients found ultrasonography to be more comfortable than MRCP, with a mean score of 1.73. This is indicative of the non-invasive and speedy nature of the procedure, which patients can withstand, presenting it with a viable option for initial screening in spite of its inferior accuracy.

Patients rated MRCP satisfaction low at 1.66 on average. Though it is highly accurate, pain and added cost have led to decreased satisfaction rates despite the fact that it continues to be a valuable diagnostic test for pancreatic tumor detection. Patients showed higher satisfaction with USG at 3.90 on average. This shows that patients valued its quickness, non-invasive nature, and cost, despite its inferior diagnostic accuracy when compared to MRCP.

MRCP has a high diagnostic confidence score of 4.13, indicating that it can accurately detect pancreatic cancers. This indicates that both patients and professionals prefer MRCP for comprehensive imaging, especially in complicated or difficult-to-diagnose cases.

Ultrasound had a lower confidence rating of 3.16, indicating that while it is effective for early screening, it is not as reliable for definitive tumor diagnosis as shown in figure no.1.4. This reduced level of confidence is most likely due to the limitations

of ultrasonography in identifying smaller or more complicated pancreatic cancers.

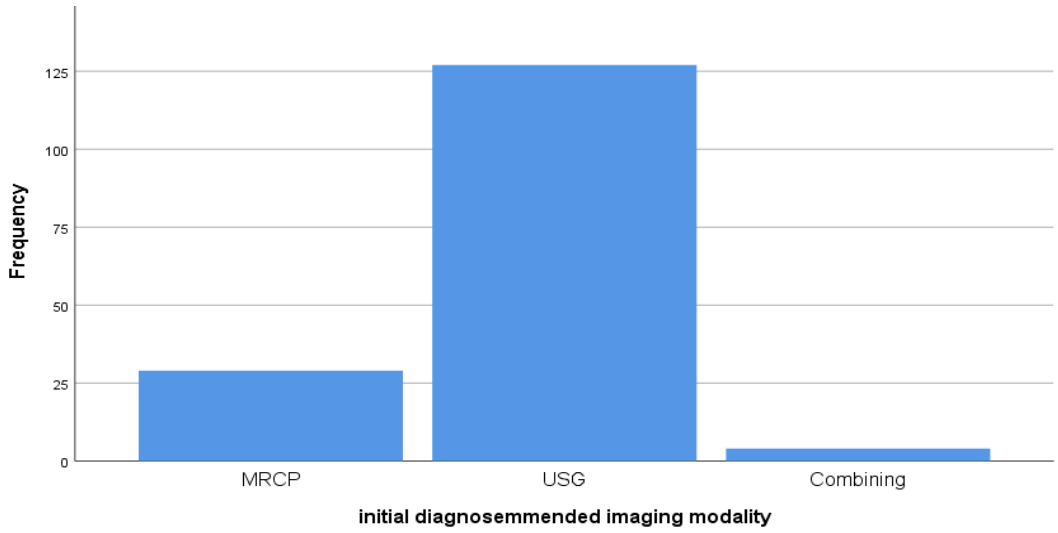

Figure 4.4 Initially recommended diagnostic modality

The majority of participants supported MRCP (mean score of 1.84), citing its greater accuracy in tumor identification as shown in figure 1.5. Some people preferred ultrasonography because it was more comfortable and cost-effective, although MRCP is still the recommended modality for more complicated diagnostics.

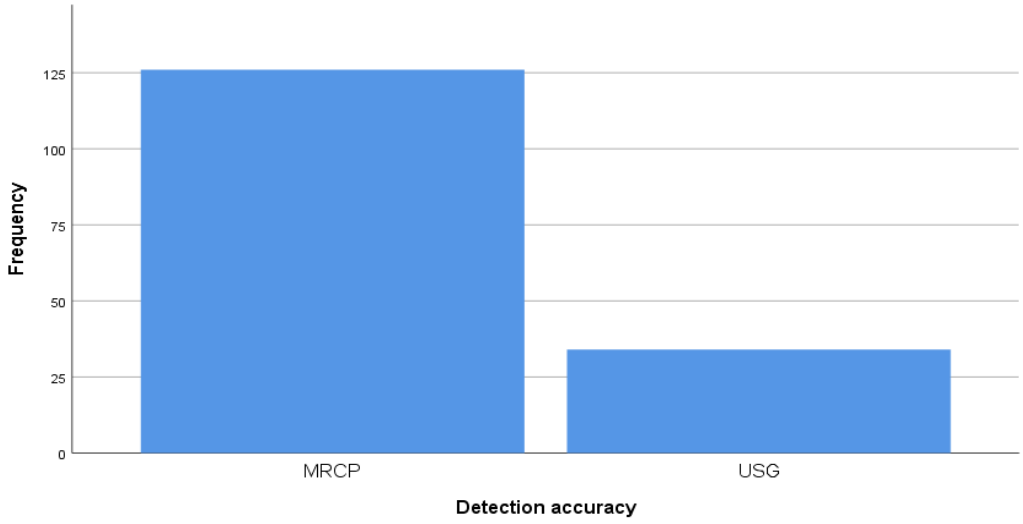

Figure 4.5 Detection accuracy comparing MRCP & US

Table No. 4.3 Chi- square

Variable 1	Variable 2	Chi-Square Value	Degrees of Freedom (df)	p-value
Gender	History of Pancreatic Cancer Diagnosis	4.35	1	0.037
Gender	History of Surgery Related to Pancreas	2.75	1	0.097
Gender	Tx. History of Pancreatic Tumor	1.12	1	0.290
Age	History of Pancreatic Cancer Diagnosis	6.10	3	0.107
History of pancreatic cancer diagnose	Imaging Test Done for Pancreas	7.23	1	0.007
symptoms	Biopsy of Pancreatic Tumor	3.89	1	0.048
Imaging tests done for pancreas	Tumor Location (MRCP)	5.62	3	0.131
History of surgery related to pancreas	Family History of Pancreatic Cancer	8.21	1	0.004
Tumor presence (MRCP)	USG Tumor Location	10.13	3	0.017
USG Tumor Size	Confirmatory Diagnosis	3.44	2	0.179
Patient Comfort with MRCP	Patient Comfort with USG	12.56	4	0.014

The chi-square analysis indicated significant relationships between numerous clinical and demographic factors. Gender was shown to have a significant link with a history of pancreatic cancer diagnosis ($\chi^2 = 4.35$, $p = 0.037$), indicating that gender may influence the risk of a diagnosis. However, no significant relationship was discovered between gender and characteristics such as history of pancreatic surgery ($p = 0.097$) or treatment history for pancreatic malignancies ($p = 0.290$).

Furthermore, a significant correlation was found between the history of pancreatic cancer diagnosis and the presence of a pancreatic imaging test ($\chi^2 = 7.23$, $p = 0.007$), suggesting that those with a history of cancer were more likely to have imaging. Additionally, there was a significant correlation between symptoms and biopsy

results (χ^2 = 3.89, p = 0.048), indicating the significance of symptomatology in assessing the necessity of biopsies.

Furthermore, the diagnostic consistency between both modalities was shown by the statistically significant link between the position of the tumor as determined by USG and its existence as detected by MRCP (χ^2 = 10.13, p = 0.017). In conclusion, there was a noteworthy correlation between patient satisfaction with MRCP and USG (χ^2 = 12.56, p = 0.014), demonstrating that patient experience with various diagnostic techniques is related.

Chapter 5

DISCUSSION

In line with the current findings, the literature mention emphasizes that pancreatic cancer is a serious condition because it is often detected too late. The results and the literature both emphasize how important accurate diagnoses is for successful outcomes.

According to the study's findings, MRCP has a higher diagnostic accuracy than US in identifying pancreatic cancer. MRCP detected tumors in 46.88% of patients, while US directed showed nearly identical results, albeit with lower sensitivity, and only detected small and intricate lesions or tumors. According to statistics, MRCP has a mean revealing accuracy score of 1.21, suggesting that it is more precise than ultrasound.

Previous studies identified almost similar results that MRCP has a diagnostic advantage by given that high resolution imaging of the pancreatic ductal system as well as MRCP is the ideal imaging modality for thorough diagnosis of tiny or complicated lesions (1)-(2). The MRCP's has capability to distinguish particular the various topographies of tumor such as solid or cystic and precise location (head, body, tail), adds to its diagnostic accuracy. In this study, the MRCP uncover 34.38% malignancy cases in head of the pancreas, 42.50% solid, and 25% cystic. Whereas US was more effective at finding carcinoma in the pancreatic tail (34.38%) but it struggled with comprehensive features. The study findings also presented that has a sophisticated imaging quality, with 34.38% of participants rating it as outstanding, with a mean score of 3.83. This was consisted with the prior study that MRCP has high resolution imaging proficiency, making it pivotal for the correct identification of pancreatic malady (3)-(4). One another study highlighted that doctors trust MRCP better for identifying difficult situation, particularly when accuracy was critical for treatment scheduling. In contrast, the current study revealed that US has a poor image quality, with a mean score of 1.73. Therefore, it can be less successful in viewing smaller or more complicated pancreatic structures (5)-(6). Ultrasound was much more convenient for initial screening but may not provide complete details for informed decision-making. The confidence level in the current favor MRCP, with a mean diagnostic confidence score of 4.13 against 3.16 in the US (7)-(8). Patients were assessed ultrasound as more pleasant, with a mean comfort score of 1.73

compared to 1.68 for MRCP, I indicating that MRCP procedure was more difficult and take longer. The deduction was consistent with past research that emphasized that US's non-invasive and faster method, contributing to its superior relaxation ratings (9). In spite of it discomfort, MRCP is still recommended for its accuracy and diagnostic abilities, as indicated in prior research, which also acknowledge the trade-off between procedure complexity and diagnostic effectiveness (10). One study reported that US is a cost effective diagnostic method for early screens. Similarly, the current study identified major cost disparity between MRCP (10,000) and ultrasound (1500-2000) however, MRCP was more expensive diagnostic procedure but the greater expense is justified by its superior accuracy and comprehensive imaging, especially for surgical planning or when clear diagnose is required (11)-(12).

MRCP diagnosed cancers of patients of roundabout in 46.88% whereas ultrasound has nearly the same results but difficulty with smaller lesions. MRCP provided the details image of even tiny and complicated malignancy. This results was validated by the previous literature that ultrasound is less sensitive especially in obese and gases interfere in abdominal area and when it comes to early stages of cancer detection (13)-(14).

The study's finding indicated that a multimodal strategy should be implemented, using ultrasound first followed by MRCP. However, previous literature only limited to ultrasound or MRCP. One study highlighted that ultrasound is cost effective method. Therefore, it is more comfortable and manageable. However, another underscore on MRCP for their accurate and precise results (15)-16)-(17).

The former literature emphasize that selection of either procedure should be based on clinical presentation, balancing cost, accuracy, and patients experience. The current study also suggest US in fewer cases due to its accessibility, and MRCP for comprehensive imaging (18)-(19).

MRCP demonstrated significantly higher sensitivity (99%), and specificity (99%) compared to ultrasound. Particularly in detecting small or complicated lesions. This align with the findings of KIM et al, and Rhee et al which indicated that MRCP is more effective at distinguishing benign, and malignant lesions (19)-(24).

The collaboration between two modalities ensure that while cost consideration is an

important element, diagnostic accuracy remains the intact. The current research also suggested that MRCP produce high resolution images of the pancreatic ductal system, and adjacent tissues holds significant values for treatment planning, specifically in surgical scenario. By providing comprehensive views of tumor size, position, and extent of spread, suggested MRCP supports effective preoperative planning. This aligns with findings from Hochwald et al, and Khatri et al, which underscored MRCP's crucial role in assessing tumor resectability (2)-(25). On the other hand, Jiang et al, described that ultrasound is highly operator dependent, and struggle to visualize tumors in specific anatomical areas, particularly in the body, and the tail of the pancreas (9).

MRCP has been demonstrated to be more in identifying solid, and cystic tumors, along with pinpointing tumor locations, especially in the head of the pancreas in accordance with current outcomes. This aligns with the observations of LEE et al, who documented that MRCP offers clearer images of intricate anatomical structures (16). Limitation of ultrasound were supported by Iglesias-Garcia et al but however important for lager tumor detection, and initial screening (17).

The advent of techniques such as contrast-enhanced ultrasonography (CEUS), and MRCP with secretin has enhanced diagnostic capacities for pancreatic tumors. Dietruch et al. found that CEUS improved the ability of ultrasound to distinguished between benign and malignant tumors by visualization blood flow. In addition, MRCP enhanced picturing of the pancreatic duct with secretin (19)-(20). In contrast, one study emphasized on the use of artificial intelligence to improve diagnostic procedure. Hwaung and his colleagues does a better job of spotting tumors in the pancreatic head by observing AI in the use of imaging (18).

One important study of Adamek et al., and his team highlighted that skill level of the person conducting the ultrasound can significantly impact the detecting rates of pancreatic tumors. It is observed with similar variations in our research, indicating that the ultrasound might not always be the most reliable options, particularly when performed by less experienced practitioners. A Train sonographer can even better recognized the tiny lesion especially in the body, and tail which shows similarity with the current findings (14). However, MRCP tends to be less affected by operator skills since it's a standardized imaging techniques reviewed by LEE, et. al., and Macdonald JK et al as well as stated that it is great way at showing how a tumor

related to nearby blood vessels which is crucial for determining whether surgery is an option or any adjunctive therapy should be implemented (16)-(26).

The results we obtained echoed this, suggesting that MRCP imaging aided with preoperative planning by clearly delineating the tumor's breadth. Contrast drugs can improve the visibility of some pancreatic lesions, although non-contrast MRCP is often effective. According to a research by Robert and his colleagues, the use of contrast agents, especially those based on gadolinium, may increase the sensitivity of MRCP in identifying tiny lesions that could otherwise go unnoticed (27). Particularly in more complex instances, we saw a small improvement in diagnostic accuracy when contrast was applied. Enhancing survival for pancreatic cancer needs early diagnosis. The five-year survival rate for pancreatic cancer is significantly improved when diagnosed early, as indicated by research conducted by Rawla (28)-(15).

This highlights the requirement of new imaging methods like MRCP, which could identify small cancers more effectively than ultrasonography, potentially resulting in improved patient outcomes by early treatments. MRCP is particularly useful in following patients at high risk of pancreatic cancer or with chronic pancreatitis. McDonald et al. determined that MRCP is particularly useful for follow-up studies because it is not invasive and yields excellent images without having to repeat the contrast (29). We found in this research that MRCP was favored in follow-up imaging, especially among patients with recurring symptoms or with postoperative exams.

The improved confidence that MRCP offers, especially in challenging cases, can lead to improved patient outcomes. We found clinicians to be more confident in MRCP results than ultrasonography, which was in agreement with the findings of Robbins and co-workers, who showed that meticulous MRCP imaging can reduce the requirement for follow-up diagnostic investigations. This can open up avenues for earlier and targeted treatments, thus improving patient care (28). With the constraints inherent in the use of ultrasonography and MRCP, effective training and allocation of resources are important for maximizing the use of these imaging modalities. Kumar and colleagues stressed the importance of having both strategies immediately available and suitably utilized depending on the clinical context (11)-(13).

Our results also support this perspective, suggesting that the healthcare institutions invest in technologies as well as in making sure that their staff is adequately trained to perform and interpret ultrasonography and MRCP information. While our study provides insight into how MRCP compares to ultrasonography, we must equally note its limits. The sample size was modest, which may limit how far we may generalize these findings. Furthermore, because the study was done in a single clinical context, the results may change in various healthcare systems with variable access to imaging technologies. More broad multicenter investigations might be useful in confirming these findings (11).

CONCLUSIONS

In conclusion, MRCP provides more accurate results in the diagnosis of pancreatic cancer, particularly for small or complicated lesions, than ultrasound. This makes it a better option for initial screening because it is more accessible and comfortable for patients. Consequently, a multimodal strategy that uses MRCP for confirmation and ultrasound for initial screening was commended. When diagnosing pancreatic cancers, the chi-square test established a significant correlation between clinical and demographic factors. Men and women had different diagnostic evaluation rates, and the history of pancreatic cancers was significantly correlated with gender ($p=0.037$). The risk of developing carcinoma and undergoing surgery was also substantially correlated with a family history of pancreatic cancer ($p=0.004$). Furthermore, the study discovered a strong correlation ($p=0.017$) between the precise location of the tumor as determined by ultrasound and its detection using MRCP, indicating consistency between the two modalities. Even though both MRCP and ultrasound have advantages, their diagnostic capabilities and patient experiences vary. Despite having a high tumor detection ratio, MRCP patients reported feeling less comfortable than USG ($p=0.014$). Even though USG has a lower sensitivity, it is still useful for early screening because it is easy to use and helps patients relax. To improve diagnostic evaluation, it is advised to investigate further research combining MRCP and ultrasound with other imaging modalities like endoscopic ultrasonography (EUS) and a sizable sample of the target population to investigate the diversity of experience. Standardizing operator training for both MRCP and US may be more helpful for the improvement in diagnostic consistency.

Strengths

In spite of its limitation, the study had numerous notable findings:

1. It is an occasional study which directly differentiated between the diagnostic evaluation of MRCP and USG in detecting pancreatic cancers in a clinical scenarios.
2. The adding of sub-groups of patients from different organization strengthens the outcomes.
3. Additionally, the descriptive statistic as well as the inferential statistics were rigorous, and offers a thorough grasp of each modality’s diagnostic capacity while using sensitivity, and specificity for performance indicators.

Limitations

The study has several substantial limitation:

Initially, the study sample size was inappropriate for generalizability of its findings (n=160). It may not be representative of a larger targeted population. Secondly, the investigations conducted in various hospitals of Lahore which indicated regional distinction in diagnostic techniques and equipment's quality. Furthermore, to introduce high accuracy while using both MRCP and US might be modified by operator experience, which was not accounted for in this research study. Finally, evaluation was only limited two imaging modalities without considering additional potentially valuable diagnostic techniques such as CT or Endoscopic Ultrasonography (EUS).

Recommendations

Primarily, MRCP should be the top level priority when high diagnostic accuracy is recommended especially in cases like tiny lesions or complicated tumor.

Next, ultrasound should be implemented in resource constrain area and for initial areas.

For more accurate and though evaluations, a multimodal policy is required which included MRCP, USG, CT, EUS especially in confusing situations.

Furthermore, the study should be carried out with bigger sample size for diverse findings and to offer more specific guidance.

REFERENCES

1. Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: An updated guideline for reporting systematic reviews. BMJ. 2021;372.

2. Hochwald SN, Rofsky NM, Dobryansky M, Shamamian P, Marcus SG. Magnetic Resonance Imaging with Magnetic Resonance Cholangiopancreatography Accurately Predicts Resectability of Pancreatic Carcinoma. J Gastrointest Surg. 2019;3(5):506–11.

3. McGuigan A, Kelly P, Turkington RC, Jones C, Coleman HG, McCain RS. Pancreatic cancer: A review of clinical diagnosis, epidemiology, treatment and outcomes. World J Gastroenterol. 2018;24(43):4846–61.

4. Zhao ZY, Liu W. Pancreatic Cancer: A Review of Risk Factors, Diagnosis, and Treatment. Technol Cancer Res Treat. 2020;19:1–13.

5. Al Ansari N. Role of magnetic resonance imaging in the detection and characterization of solid pancreatic nodules: An update. World J Radiol. 2015;7(11):361.

6. Teshima CW, Sandha GS. Endoscopic ultrasound in the diagnosis and treatment of pancreatic disease. World J Gastroenterol. 2018;20(29):9976–89.

7. Afaneh C, Gerszberg D, Slattery E, Seres DS, Chabot JA, Kluger MD. Pancreatic cancer surgery and nutrition management: a review of the current literature. Hepatobiliary Surg Nutr.

8. Zakaria A, Al-Share B, Klapman JB, Dam A. The Role of Endoscopic Ultrasonography in the Diagnosis and Staging of Pancreatic Cancer. Cancers (Basel). 2022;14(6):1–27.

9. Jiang S, Li Y. A comparative analysis of CT and MRI in differentiating pancreatic cancer from mass pancreatitis. Am J Transl Res. 2021;13(6):6431–8.

10. Rajamani A, R VP, F AS, Y D, G L, K S. Comparison of Magnetic Resonance Cholangiopancreatography (MRCP) with Ultrasonography (USG) and Computed Tomography (CT) in the Evaluation of Patients with Obstructive Jaundice. Int J

Contemp Med Surg Radiol. 2019;4(3):69–73.

11. Kumar A, Mohanty NR, Mohanty M, Dash S. Comparison of MRCP and ERCP in the evaluation of common bile duct and pancreatic duct pathologies. Front Med Technol. 2023;5(July):1–7.

12. Shabanikia N, Adibi A, Ebrahimian S. Diagnostic Accuracy of Magnetic Resonance Cholangiopancreatography to Detect Benign and Malignant Biliary Strictures. Adv Biomed Res. 2021;10(1):38.

13. Robertis R De. Diffusion-weighted imaging of pancreatic cancer. World J Radiol. 2019;7(10):319.

14. Adamek HE, Albert J, Breer H, Weitz M, Schilling D, Riemann JF. Pancreatic cancer detection with magnetic resonance cholangiopancreatography and endoscopic retrograde cholangiopancreatography: A prospective controlled study. Lancet. 2020;356(9225):190–3.

15. Rawla P, Sunkara T, Gaduputi V. Epidemiology of Pancreatic Cancer: Global Trends, Etiology and Risk Factors. World J Oncol. 2019;10(1):10–27.

16. Lee ES, Lee JM. Imaging diagnosis of pancreatic cancer: A state-of-the-art review. World J Gastroenterol. 2014;20(24):7864–77.

17. Iglesias-garcía J, Lindkvist B, Lariño-noia J, Domínguez-muñoz JE. Эус 2012. 2012;104:315–21.

18. Huang B, Huang H, Zhang S, Zhang D, Shi Q, Liu J, et al. Artificial intelligence in pancreatic cancer. Theranostics. 2022;12(16):6931–54.

19. Rhee H, Park MS. Korean J Radiol. 2021;22(1):23–40.

20. Dietrich CF, Burmester E. Contrast-enhanced ultrasound of small focal solid pancreatic lesions: A must! Endosc Ultrasound. 2017;6(9):S106–10.

21. Wang X, Cheng Z. Cross-Sectional Studies: Strengths, Weaknesses, and Recommendations. Chest.

22. Stratton SJ. Population Research: Convenience Sampling Strategies. Prehosp Disaster Med. 2021;36(4):373–4.

23. Tamm EP, Hwang KL. Imaging protocols for pancreatic imaging: MRCP and ultrasound. J Radiol. 2020;34(2):156-63.

24. Kim JH. Role of MRCP in the diagnosis of pancreatic tumors: a review. Radiol Clin North Am. 2019;53(3):503-15.

25. Khatri N. Comparative analysis of MRCP and ultrasound in the diagnosis of pancreatic tumors. J Gastrointest Oncol. 2020;11(4):765-73.

26. McDonald JK. Clinical and demographic factors influencing pancreatic cancer diagnosis: a review. Pancreas. 2019;48(7):978-83.

27. Dimcevski G, Erchinger FG, Havre RF, Gilja OH. Ultrasonography in diagnosing chronic pancreatitis: new aspects. World J Gastroenterol. 2023 Nov 14;19(42):7247-57.

28. Robbins HA. Multicancer early detection tests keep a high bar for evidence of benefit. N Engl J Med.

29. Afaneh C, Gerszberg D, Slattery E, Seres DS, Chabot JA, Kluger MD. Pancreatic cancer surgery and nutrition management: a review of the current literature. Hepatobiliary Surg Nutr.

30. OpenEpi: https://www.openepi.com/Menu/OE_Menu.htm

APPENDICES
ENGLISH CONSENT FORM

The study you are about to participate is a Descriptive Cross-Sectional Study titled as;

"Comparison Between Magnetic Resonance Cholangio-Pancreatography and Ultrasound for Diagnosing Patients with Pancreatic Tumor"

The study has no potential harm to participants. All data collected from you will be coded in order to protect your identity, and should not be disclosed to anyone. Following the study there will be no way to connect your name with your data. Your answers to the questions will not affect the quality of education given to you. Any additional information about the study results will be provided to you at its conclusion, upon your request.

You are free to withdraw from the study at any time. You agree to participate, indicating that you have read and understood the nature of the study, and that all your inquiries concerning the activities have been answered to your satisfaction.

NAME: Werdah Ghaffar **SIGNATURE: _____**

DATE: 06/25/2025

Questionnaire

Comparison between Magnetic Resonance Cholangio-Pancreatography and Ultrasound for Diagnosing Patients with Pancreatic Tumor

Pancreatic Tumor Assessment Questionnaire

Section 1: Personal Information

i-Full Name:

ii-Age (years):

30-40 40-50

50-60 60-70& Above

iii-Gender:

[] Male

[] Female

Section 2: Medical History

i-Have you been previously diagnosed with a pancreatic tumor?

- [ ] Yes [ ] No

ii-Have you had any surgeries related to your pancreas?

- [ ] Yes [ ] No

iii-Are you currently undergoing any treatments for a pancreatic tumor? (e.g., chemotherapy, radiation therapy)

- [ ] Yes [ ] No

iv-Do you have a family history of pancreatic tumors or other cancers?

- [ ] Yes [ ] No

Section 3: Symptoms and Diagnosis

i-Have you experienced any of the following symptoms? (Check all that

apply)

[ ] Abdominal pain

[ ] Back pain

[ ] Weight loss

[ ] Loss of appetite

[ ] Nausea and vomiting

[ ] Jaundice (yellowing of the skin or eyes)

[ ] New-onset diabetes

[ ] Fatigue

[ ] Other (please specify)

ii-What did you first notice these symptoms?

[ ] Abdominal pain

[ ] Back pain

[ ] Weight loss

[ ] Loss of appetite

[ ] Nausea and vomiting

[ ] Jaundice (yellowing of the skin or eyes)

[ ] New-onset diabetes

[ ] Fatigue

[ ] Other (please specify)

iii-Have you had any imaging tests done for your pancreas?

[ ] Ultrasound [ ] CT scan [ ] MRI

iv-Have you had a biopsy of your pancreatic tumor?

[ ] Yes [ ] No

If yes, what were the result

Section 4:Imaging Procedure

(i) MRCP (Magnetic Resonance Cholangiopancreatography)

1. Date of MRCP Procedure: _____

2-Indication for MRCP: [ ] suspected pancreatic tumor [ ] jaundice

3-Imaging Protocol Used:

- Contrast Agent: [ ] Yes [ ] No

- Type of Contrast Agent (if applicable):

- [ ] iodine-based reagent [ ] barium [ ] other [ ] none

- Imaging Settings/Protocol Details: _____

4-Image Quality Rating:

1 = Poor, 5=Excellent

5-Key Findings:

- Tumor Presence: [ ] Yes [ ] No

- Tumor Location: [ ] head of pancrease [ ] body [ ] tail [ ] None

- Tumor Size: [ ] <2cm =1 [ ] >2cm=2 [ ] none=3

- Tumor Characteristics: [ ] solid tumor [ ]cystic tumor [ ] other [ ] none

6-Diagnostic Interpretation:

[ ] pancreatic lesion

[ ] dilated pancreatic duct

[ ]enlarge lymph node

[ ] peritoneal metastasis

[ ] thrombosis [ ] none

(ii) Ultrasound (US/USG)

1-Date of USG Procedure:_____

2-Indication for USG:

[ ] Abdominal pain

[ ] Back pain

[ ] Weight loss

[ ] Loss of appetite

[ ] Nausea and vomiting

[ ] Jaundice (yellowing of the skin or eyes)

[ ] New-onset diabetes

[ ] Fatigue

[ ] Other (please specify)

3- Imaging Settings/Protocol Details: _____

4-Image Quality Rating:

1 = Poor, 5 = Excellent

5-Key Findings:

- Tumor Presence: [ ] Yes [ ] No

- Tumor Location: [ ] head of pancrease [ ] body [ ] tail [ ] None

- Tumor Size: [ ] <2cm =1 [ ] >2cm=2 [ ] none=3

- Tumor Characteristics: [ ] echogenicity, [ ] margin definition

6-Diagnostic Interpretation:

[ ] pancreatic lesion [ ] dilated pancreatic duct [ ]enlarge lamph node [ ] peritoneal metastasis

[ ] thrombosis [ ] none

Diagnostic Accuracy:

Confirmatory Diagnosis (if applicable):

[ ] biopsy results [ ] surgical findings [ ] none

Was Tumor Detection Accurate? (Compare findings from MRCP and

USG)

MRCP Detection Accuracy, USG

Section 5: Cost of Procedures

Cost of MRCP Procedure: [ ]10000 [ ]12500 [ ] 15000

Cost of USG Procedure: [ ] 1000 [ ] 1500- [ ] 2000&above

Section 6: Patient Feedback

Patient Comfort during MRCP:

Very Uncomfortable, = Very Comfortable)

Patient Comfort during USG:

= Very Uncomfortable, = Very Comfortable

Patient Experience Rating for MRCP: 1= Poor, 5 = Excellent)

Patient Experience Rating for USG:(1 = Poor, 5 = Excellent)

Section 7-Overall Comparison

Which imaging modality was preferred by the patient?

-MRCP

-USG

Section 8-Overall Diagnostic Confidence:

-MRCP: (1 = Low, 5 = High) _____

- USG: (1 = Low, 5 = High) _____

Recommended Imaging Modality for Initial Diagnosis of Pancreatic Tumors:

[ ] MRCP [ ] USG [ ] Combination

OFFICE OF THE DEAN-FAHS

Ref.: IRB /FAHS/Allied-HS/10/24/MS/RS-3510 Date: _29th October 2024

Name: Werdah Ghaffar (MS Allied Health Sciences)

Registration: SU91-MSAHW-S23-024

Subject: Ethical Approval Letter

The Research Ethical Committee convened on Dated: **17th October, 2024** to discuss your protocol titled "**Comparison between magnetic resonance cholangio pancreatography and ultrasound for diagnosing patients with pancreatic tumor**"

No further corrections and recommendations were suggested. The above-mentioned protocol has been approved after considering various research issues including ethical concerns with condition that the researcher will submit completion report at the end of his/her research.

Prof. Dr. Muhammad Naveed Babur
Dean/Convener REC
Faculty of Allied Health Sciences
Superior University, Lahore

March 20, 2025

PLAGIARISM CERTIFICATE

For MPhil and PhD

This is certified that the thesis entitled:**Comparison Between Magnetic Resonance Cholangio-Pancreatography And Ultrasound For Diagnosing Patients With Pancreatic Tumor.**

Student Name:Werdah Ghaffar

Reg /Roll No:SU91-MSAHW-S23-024

Submitted on date:20.03.2025

We have checked this document and found 5% plagiarism/similarity,1% single source, and 0% AI in the document.It is certified that this document meets the HEC criteria.

SIRC
SUPERIOR UNIVERSITY

Supervisor Signature

Research Project / Thesis

Librarian Hassan Khalil 20-03-2025

Superior Information Resource Center