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RESEARCH ARTICLE
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BEYOND THE BELLY: PANCREATIC LESIONS AND THEIR FORENSIC IMPLICATIONS

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Abstract—

Background:

The pancreas, owing to its deep retroperitoneal location and dual exocrine–endocrine function, can harbour a wide range of pathological lesions—ranging from inflammatory changes to aggressive malignancies. In both clinical and forensic practice, pancreatic pathology often remains an under-explored contributor to morbidity and mortality. Pancreatic lesions discovered incidentally at autopsy may explain sudden natural deaths, while in living patients, histopathology plays a pivotal role in guiding clinical and therapeutic decisions.

Objective:

To evaluate the histomorphological spectrum of pancreatic lesions encountered in a tertiary care centre and to elucidate their potential forensic significance in determining the cause and manner of death.

Materials & Methods:

A retrospective observational study of 67 pancreatic specimens (surgical and autopsy) examined histopathologically between July 2016 and July 2017 at the Department of Pathology, Stanley Medical College, Chennai. Routine H&E staining and relevant special stains or immunohistochemistry were employed. Clinical and forensic details were correlated where available.

Results:

Non-neoplastic lesions, predominantly chronic pancreatitis and pseudocysts, occurred mostly in the 20–40 year age group, often associated with alcohol use or prior trauma. Neoplastic lesions predominated in the 50–60 year age group and included serous cystadenoma, solid pseudopapillary neoplasm, intraductal tubulopapillary neoplasm with invasive carcinoma, acinar cell carcinoma, and ductal adenocarcinoma. Pancreatic ductal adenocarcinoma (PDAC) was the most common malignancy. Several lesions, particularly pancreatitis and PDAC, were identified incidentally at autopsy, underlining their medicolegal relevance.

Conclusion:

Pancreatic lesions, though often clinically silent, can carry significant forensic implications by contributing to sudden or unexplained natural deaths. Integrating histopathological assessment with clinical and autopsy findings is vital for accurate cause-of-death determination and medico-legal interpretation. Greater awareness of pancreatic pathology within forensic investigations can prevent diagnostic errors and enrich multidisciplinary understanding of these “hidden” diseases.

Keywords: Pancreas; Forensic pathology; Chronic pancreatitis; Pancreatic neoplasms; Sudden natural death; Histopathology; Autopsy.

I. INTRODUCTION

The pancreas, a retroperitoneal organ with both exocrine and endocrine roles, represents a unique site where inflammatory, cystic, and neoplastic lesions coexist. Owing to its concealed anatomic location and tendency toward late clinical manifestation, pancreatic pathology often remains undiagnosed until advanced stages—or until post-mortem discovery.[1]

From a forensic standpoint, pancreatic diseases can underlie sudden natural deaths, particularly in cases of acute haemorrhagic pancreatitis, pancreatic necrosis, or undiagnosed malignancy. In such scenarios, the pathologist's interpretation of histological changes becomes pivotal to distinguishing natural disease from trauma-related or toxin-induced injury, thereby influencing cause and manner of death determinations.

Advances in imaging and the 2022 WHO classification of pancreatic tumours have refined diagnostic criteria and molecular understanding of these lesions.[2] Yet, for the forensic pathologist, autolysis, limited sampling, and overlapping features between reactive and neoplastic processes continue to pose diagnostic challenges.

This study aims to present a comprehensive review of pancreatic lesions encountered in surgical and autopsy specimens from a tertiary care centre, analysing their histomorphological patterns and forensic implications. By bridging the disciplines of pathology and forensic medicine, the study highlights how careful histopathological evaluation of this "silent organ" can shed light on both clinical disease and unexpected causes of death.

Material and Methods

Study Design and Setting

This was a retrospective observational study conducted in the Department of Pathology, Stanley Medical College, Chennai, over a one-year period from July 2016 to July 2017. The study included both surgically resected pancreatic specimens and autopsy samples that displayed macroscopically visible pancreatic abnormalities.

Study Material

A total of 67 pancreatic specimens were analysed. Of these, 53 were surgical specimens received from clinical departments (gastroenterology, general surgery, oncology), while 14 were obtained from medico-legal autopsies in which pancreatic pathology was suspected or incidentally noted.

Inclusion Criteria

- All pancreatic specimens showing any gross or microscopic lesion (inflammatory, cystic, or neoplastic).
- Autopsy cases where pancreatic pathology contributed to or was suspected in the cause of death.

Exclusion Criteria

- Autolyzed or decomposed tissues precluding histological interpretation.
- Inadequate tissue sampling or incomplete clinical/forensic data.

Histopathological Evaluation

All specimens were fixed in 10% neutral buffered formalin, processed routinely, and sections stained with hematoxylin and eosin (H&E). Special stains such as Periodic Acid–Schiff (PAS) and diastase digestion were used in cystic lesions. Immunohistochemistry (IHC) was performed selectively:

- β-catenin for solid pseudopapillary neoplasm (SPPN),
- Trypsin and chymotrypsin for acinar cell carcinoma,
- p53 and SMAD4 for pancreatic ductal adenocarcinoma (PDAC).

Data Correlation and Forensic Review

Clinical, radiological, and operative findings were retrieved from patient records. For autopsy specimens, forensic details such as age, sex, circumstances of death, toxicology findings, and associated injuries were recorded.

All findings were correlated to evaluate whether pancreatic lesions were incidental, contributory, or causal in the determination of death.

The study was approved by the Institutional Ethics Committee.

In autopsy cases, anonymity and confidentiality of medico-legal data were maintained in accordance with institutional and ethical standards.

Results:

Demographic Profile

A total of 67 cases of pancreatic lesions were evaluated during the study period. The age of patients ranged from 18 to 80 years, with a mean age of 52 years. The male-to-female ratio was 1.4 : 1, indicating a slight male predominance. Of the total cases, non-neoplastic lesions accounted for 38 cases (56.7%), while neoplastic lesions comprised 29 cases (43.3%).

Non-neoplastic lesions were most frequently encountered in the 20–40 year age group, often associated with alcohol consumption and chronic inflammatory changes. In contrast, neoplastic lesions were predominantly seen in the 50–60 year age group, reflecting the higher age-related risk for pancreatic neoplasia.

Morphological Findings

- Chronic pancreatitis: Lobular atrophy, perilobular fibrosis, ductal epithelial hyperplasia, and focal calcifications were common features.
- Pseudocyst: Cyst wall composed of granulation tissue without epithelial lining; frequently associated with chronic alcoholism or blunt abdominal trauma.
- Acute hemorrhagic pancreatitis: Areas of enzymatic fat necrosis, hemorrhage, and vascular thrombosis.
- Serous cystadenoma: Multiloculated cystic spaces lined by glycogen-rich cuboidal epithelium (PAS-positive, diastase-resistant).
- Solid pseudopapillary neoplasm (SPPN): Solid and pseudopapillary patterns composed of dyscohesive cells with eosinophilic cytoplasm and nuclear grooves; foamy macrophages and cholesterol clefts; β-catenin nuclear positivity on IHC.
- Intraductal tubulopapillary neoplasm (ITPN): Complex tubular and papillary epithelial proliferation with comedo-type necrosis and focal invasion into desmoplastic stroma.
- Acinar cell carcinoma: Cells arranged in acinar pattern with granular eosinophilic cytoplasm and single prominent nucleolus; trypsin/chymotrypsin positivity; focal perineural invasion.
- Pancreatic ductal adenocarcinoma (PDAC): Infiltrating malignant glands with pleomorphic, hyperchromatic nuclei, surrounded by desmoplastic stroma; perineural and lymphovascular invasion observed in several cases.

Forensic Correlation

Out of 67 cases, 14 specimens (20.9%) were obtained from medico-legal autopsies.

- Acute pancreatitis was identified in 6 cases (8.9%), presenting as sudden, unexpected deaths. Toxicology screens revealed elevated serum amylase levels; no external injuries were noted.
- Chronic pancreatitis with pseudocyst rupture was seen in 3 autopsy cases, resulting in intra-abdominal hemorrhage and peritonitis.
- Incidental pancreatic neoplasms were detected in 4 autopsies — including 2 cases of PDAC, 1 SPN, and 1 acinar cell carcinoma — which explained previously unexplained weight loss or cachexia.

In one case, fat necrosis of the pancreas following blunt abdominal trauma was misinterpreted clinically as splenic injury; histopathology confirmed post-traumatic pancreatitis.

In the forensic context, histopathological confirmation of natural pancreatic disease helped to exclude external trauma, poisoning, or medical negligence as the cause of death in all cases examined.

The pancreas was determined to be: Primary cause of death in 8 cases (11.9%), Contributory factor in 13 cases (19.4%), and Incidental finding in 46 cases (68.7%).

Representative Case Highlights

1. **Solid Pseudopapillary Neoplasm (SPPN)** – 29-year-old female; incidental autopsy finding; classic histology with β-catenin positivity; clinically silent tumour. Fig 2.
2. **Acinar Cell Carcinoma** – 64-year-old male; clinically misdiagnosed as chronic pancreatitis; histology confirmed malignant acinar differentiation. Fig 4.
3. **Ductal Adenocarcinoma (PDAC)** – 71-year-old male; undiagnosed during life; autopsy revealed obstructive jaundice and metastatic deposits. Fig 3.
4. **Acute Hemorrhagic Pancreatitis** – 45-year-old male with alcohol abuse history; histology showed extensive necrosis and enzymatic autodigestion; cause of death attributed to **shock secondary to pancreatitis**.

Discussion:

The present study underscores the wide morphological spectrum of pancreatic lesions encountered in both surgical pathology and medico-legal autopsies. The pancreas, though small and often overlooked during routine forensic examinations, can harbor lesions ranging from chronic pancreatitis and pseudocysts to aggressive adenocarcinomas. These conditions not only contribute to significant clinical morbidity but may also explain sudden or unexplained natural deaths at autopsy [1,2]. In our study, non-neoplastic lesions, particularly chronic pancreatitis, were the most frequent findings, commonly affecting individuals in the 20–40-year age group with a history of alcohol intake. Chronic alcohol use is a well-documented etiological factor leading to pancreatic fibrosis, ductal obstruction, and recurrent inflammation, which may culminate in acute exacerbation or pseudocyst rupture causing fatal intra-abdominal hemorrhage [3,4]. These findings correspond with prior reports emphasizing the need for careful clinicopathological correlation to differentiate chronic pancreatitis from well-differentiated adenocarcinoma, a diagnostic pitfall in both surgical and autopsy specimens [5,6].

Among neoplastic lesions, pancreatic ductal adenocarcinoma (PDAC) was the predominant malignancy, primarily affecting males over 50 years of age. Histologically, these tumors showed the classic infiltrating glandular pattern with desmoplastic stroma and perineural invasion, findings consistent with previous institutional and WHO-based studies [7,8,16]. The incidental detection of PDAC in several autopsies highlights its clinically silent progression and its potential to cause death through obstructive jaundice, cachexia, or metastasis. From a forensic viewpoint, recognition of such occult neoplasms is essential to avoid misclassification of natural deaths as unnatural, particularly in cases lacking obvious external cause [9]. Furthermore, the presence of PDAC emphasizes the continued need for early detection strategies and incorporation of molecular profiling (e.g., KRAS, SMAD4, TP53 mutations) to improve diagnostic and prognostic accuracy in pancreatic pathology [10,15].

Rare entities such as solid pseudopapillary neoplasm (SPPN) and acinar cell carcinoma were also observed, reaffirming the diagnostic diversity of pancreatic tumors. SPPN, predominantly affecting young females, exhibited solid–cystic architecture and nuclear β-catenin positivity, consistent with prior descriptions by Tang et al. [11, 13]. Although these neoplasms are of low malignant potential, their identification in autopsy specimens underscores the importance of meticulous grossing and histological evaluation to distinguish them from neuroendocrine or metastatic tumors. Acinar cell carcinoma, while uncommon, demonstrated granular cytoplasm and enzyme positivity, features characteristic of exocrine differentiation. Accurate histological classification in such cases not only ensures correct pathological diagnosis but also assists in forensic interpretation, particularly in the context of unexpected deaths or suspected medical negligence.

From a forensic pathology standpoint, this study reinforces the critical role of histopathological examination in determining the cause and manner of death when pancreatic pathology is involved. Acute hemorrhagic pancreatitis, often precipitated by alcohol abuse, remains a recognized cause of

sudden natural death due to enzymatic autodigestion and vascular necrosis [12,14]. In our series, histopathology was pivotal in differentiating natural pancreatic disease from trauma-induced or toxin-mediated injury, thereby excluding foul play or malpractice. Ultimately, this "potpourri" of pancreatic pathology exemplifies the intersection between clinical pathology and forensic medicine. Effective multidisciplinary collaboration—involving pathologists, radiologists, clinicians, and forensic experts—is indispensable to achieve accurate diagnosis, death certification, and justice administration in cases where pancreatic disease plays a silent but decisive role.

Conclusion:-

Pancreatic lesions exhibit remarkable histopathological diversity, encompassing both inflammatory and neoplastic processes with significant forensic relevance. Chronic pancreatitis and pancreatic ductal adenocarcinoma were the most frequent and forensically significant findings in this study. Histopathological evaluation remains indispensable in distinguishing natural disease from trauma or toxin-induced injury, thereby guiding accurate cause-of-death determination. Strengthening collaboration between pathologists and forensic experts enhances diagnostic precision and ensures that the "silent pathology" of the pancreas does not escape medico-legal scrutiny.

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CONFLICTS OF INTERESTS : None

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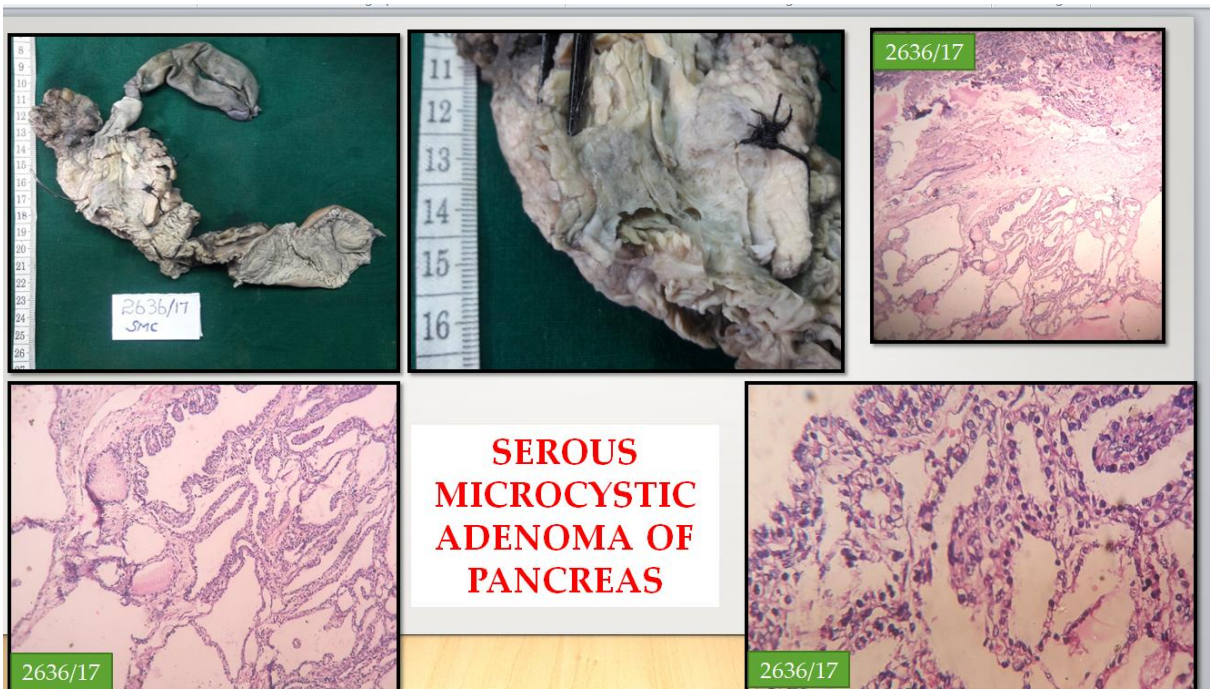

Fig. 1 Serous Cystadenoma of Pancreas

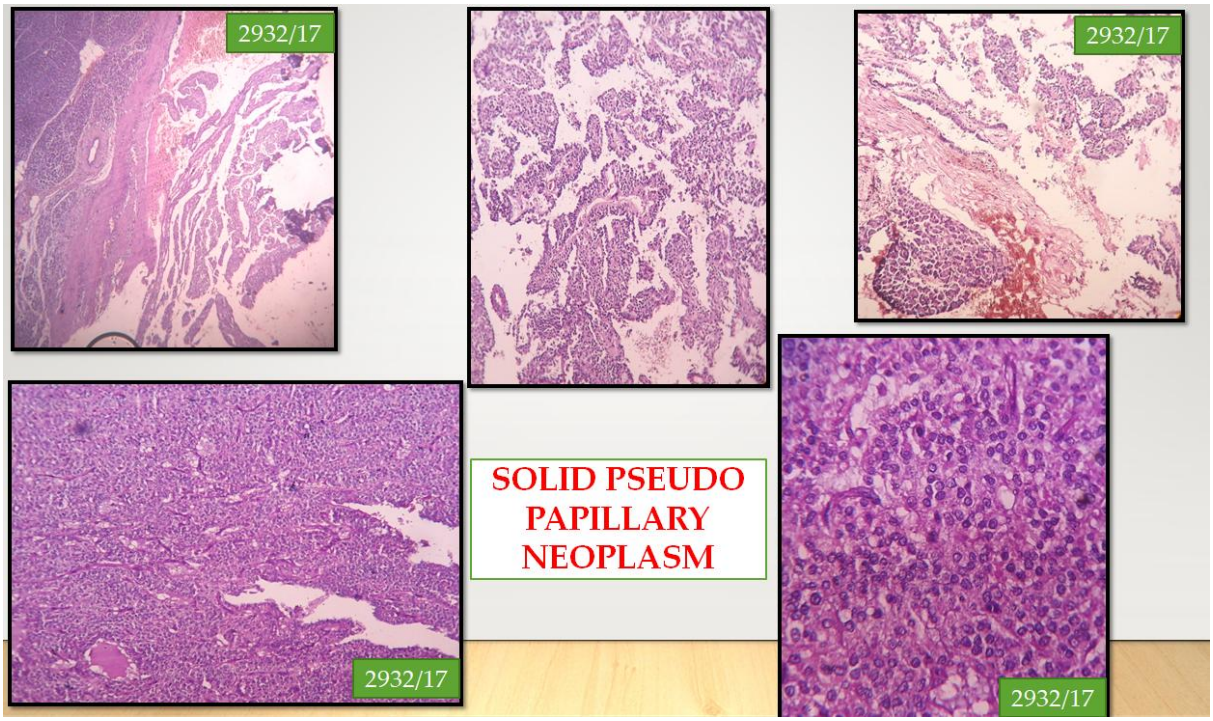

Fig. 2 Solid Psuedopapillary Neoplasm of Pancreas

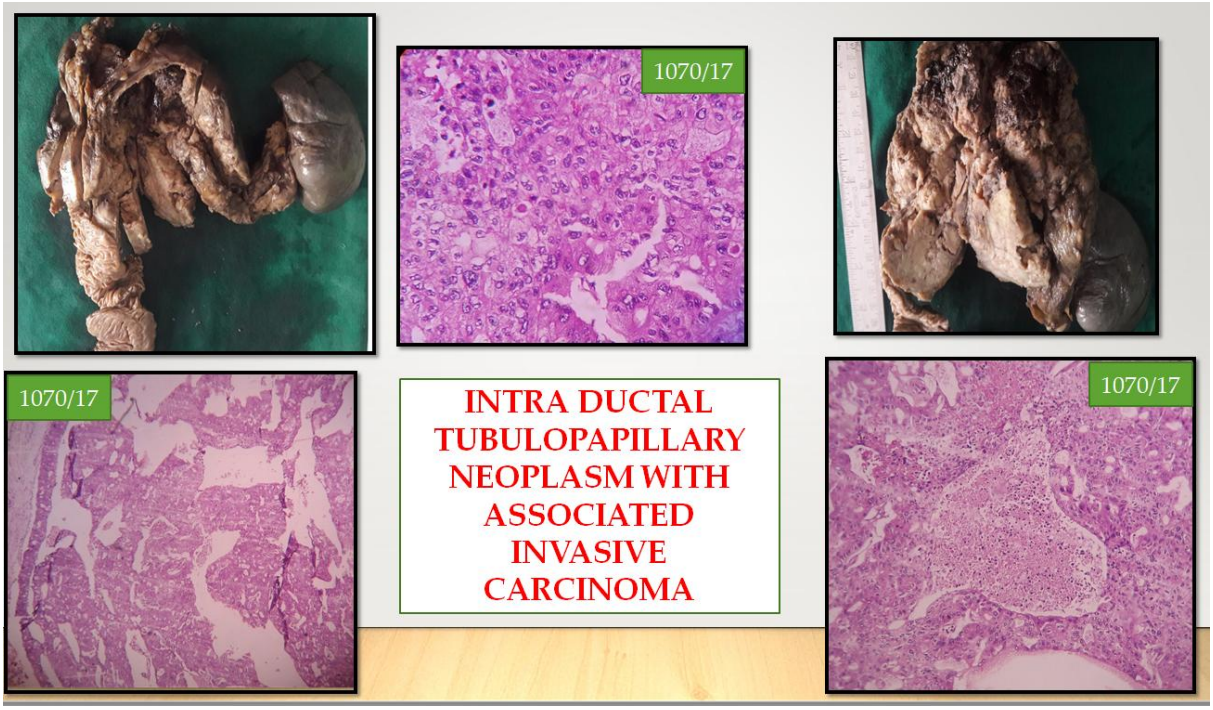

Fig. 3 Intraductal Tubulopapillary Neoplasm with Associated Invasive Carcinoma

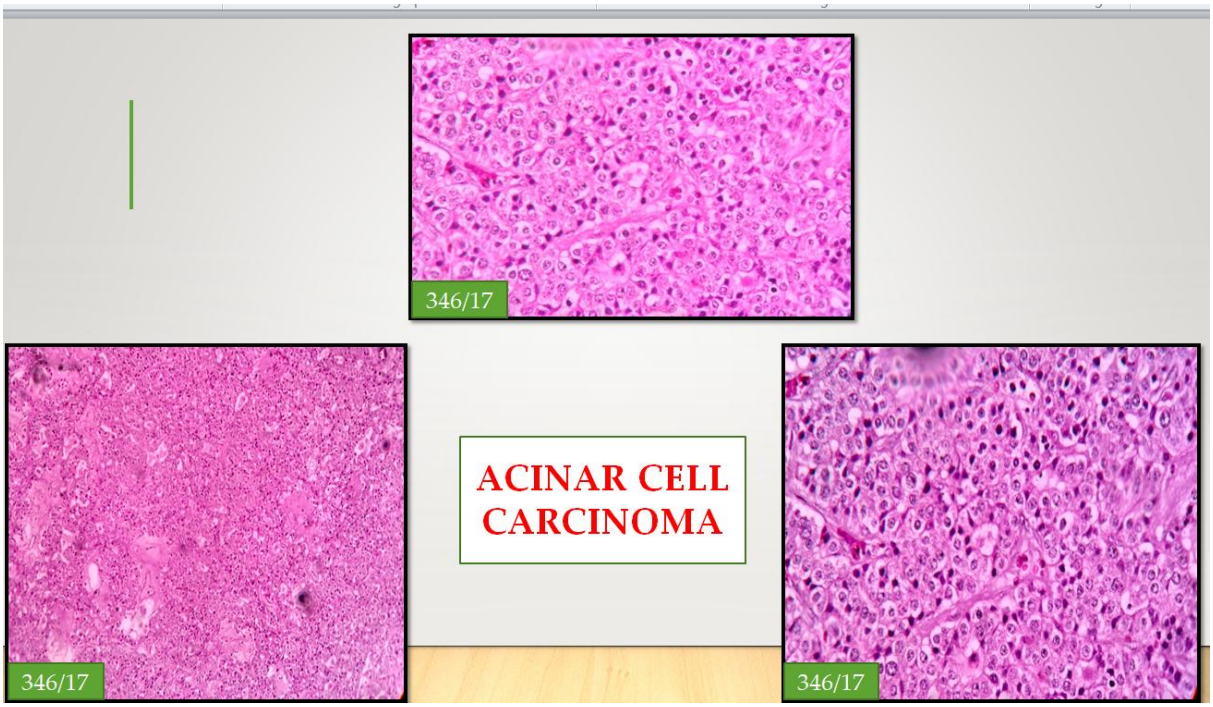

Fig. 4 Acinar Cell Carcinoma