Case Report

Cadaveric Findings in Polycystic Kidney Disease: Anatomical and Histopathological Insights: An ECE-Based Learning Experience

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Abstract

Background: Direct observation of end-stage polycystic kidney disease (PKD) in a cadaveric specimen provides a unique, three-dimensional perspective on its profound anatomical disruption, which is often only partially appreciated through clinical imaging. This case report aims to describe the incidental finding of advanced PKD during routine dissection, detail its gross and histopathological features, and discuss its value as a tool for Early Clinical Exposure (ECE) in undergraduate medical education. During the dissection of a 65-year-old male cadaver, both kidneys were found to be massively enlarged and distorted by numerous cysts ranging from 0.5 to 3.0 cm, effacing the normal parenchyma and architecture. Histopathological examination of sampled tissue revealed cystic dilatations of tubular origins lined by flattened epithelium, with intervening fibrosis and atrophy, consistent with end-stage PKD. This case serves as a powerful integrative teaching model, vividly linking foundational anatomical knowledge with pathological principles and clinical outcomes. It underscores the significant educational benefit of incorporating such real pathological specimens into ECE programs to enhance comprehension, retention, and clinical reasoning among first-year medical students.

Keywords: Polycystic Kidney Disease (PKD), Cadaveric Study, Renal Pathology, Histopathology, Anatomy, End-Stage Kidney Disease, Early Clinical Exposure (ECE).

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Introduction

Polycystic Kidney Disease (PKD) is a well-known renal disorder in which multiple cysts develop within the renal parenchyma and disrupt the normal functioning of the kidney.[1] Cadaveric studies of these types of cases provide a unique perspective on the disease's end-stage anatomical presentation. Cadaveric dissection not only enhances understanding of gross anatomy but also bridges the gap between structural and clinical sciences.[2]

The kidneys are paired, bean-shaped organs located in the posterior abdominal region, retroperitoneally. They lie within the extra-peritoneal connective tissue lateral to the vertebral column, extending from T12 to L3 vertebrae in the supine position. The right kidney is typically lower because of the liver. Each kidney has a medial hilum through which the renal artery, vein, lymphatics, and nerves enter and exit. Internally, the kidney is divided into an outer renal cortex and an inner renal medulla. The medulla contains pyramids that drain urine through the papilla into minor calyces. Multiple minor calyces unite to form major calyces, which converge into the renal pelvis—the funnel-shaped proximal end of the ureter.[3] In PKD, this fine architecture becomes grossly distorted by cyst formation, obliterating the normal corticomedullary distinction and compressing the pelvicalyceal system.[4]

The present case shows an incidental finding of advanced PKD during routine dissection, showing both anatomical and histopathological alterations. Moreover, it shows the value of Early Clinical Exposure (ECE) in medical education, where real cadaveric cases link textbook learning to clinical relevance for first-year MBBS students.

Case Observations

Specimen Details

Specimen was extracted from a 65-year-old male cadaver legally donated to the Department of Anatomy, Guru Gobind Singh Medical College & Hospital, Faridkot, Punjab, during routine abdominal dissection. Clinical history before donation was unavailable.

Initial Observation

Upon opening the peritoneal cavity, both kidneys were found to be markedly enlarged, palpable, and cystic. The kidneys occupied much of the posterior abdominal wall, extending from vertebral level T12 to L3. The right kidney was slightly lower than the left kidney, consistent with normal anatomy.

Gross Examination

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- Both kidneys appeared massively enlarged, lobulated, and asymmetrical.
- The normal renal contour was replaced by multiple variable-sized cysts ranging from 0.5 cm to over 3 cm, giving a characteristic "bunch of grapes" appearance.
- The cysts contained clear to straw-colored fluid.
- The renal parenchyma was almost completely replaced, leaving only thin remnants of normal renal cortex.
- The renal hilum was distorted, and adjacent structures—including the adrenal glands and major vessels—were mildly displaced due to mass effect.

Internal Sectioning

- Each kidney was coronally sectioned to evaluate internal architecture.
- Sections showed almost complete replacement of the cortex and medulla by multiple cysts, with minimal preservation of nephron structure.

Histopathological Processing

- Sample Tissues: samples of cortex and medulla were collected and placed in 10% buffered formalin for a minimum of 48 hours.
- Samples, 1) Processed, and 2) stained with Hematoxylin and Eosin (H&E).

Microscopic Findings

- A large number of cystic dilatations bordered by flattened squamous to low cuboidal epithelium.
- The proximal convoluted tubules.
- Distal convoluted tubules
- Collecting ducts

The intervening tissue had the following:

- Tubular atrophy
- Interstitial foci of fibrosis.
- Such characteristics were in line with a developed stage of polycystic kidney disease (PKD).

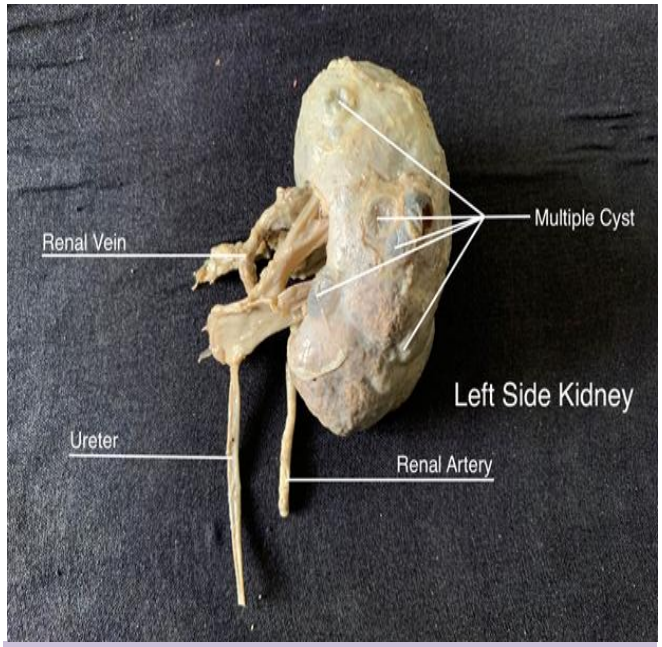

Figure 1: Gross Anterior view of Left Kidney, showing multiple cysts (white arrows).

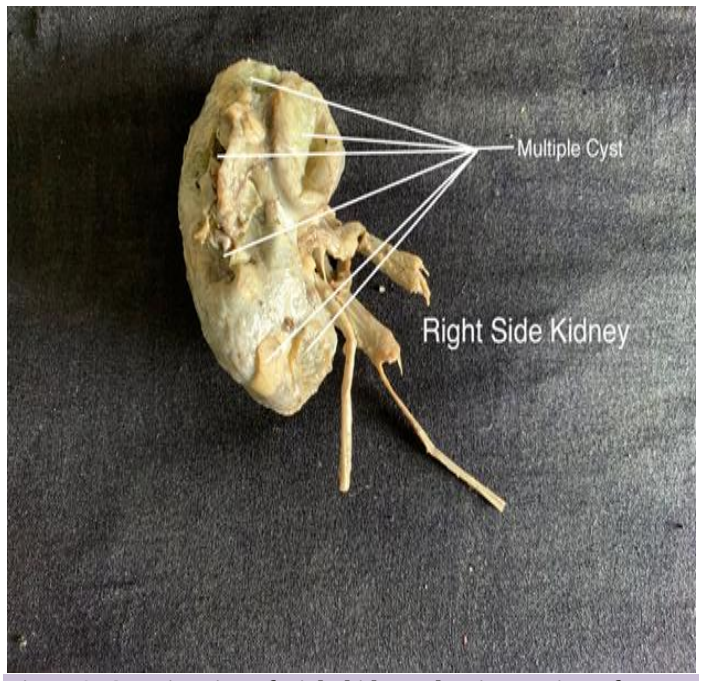

Figure 2: Anterior view of Right kidney, showing cystic surface.

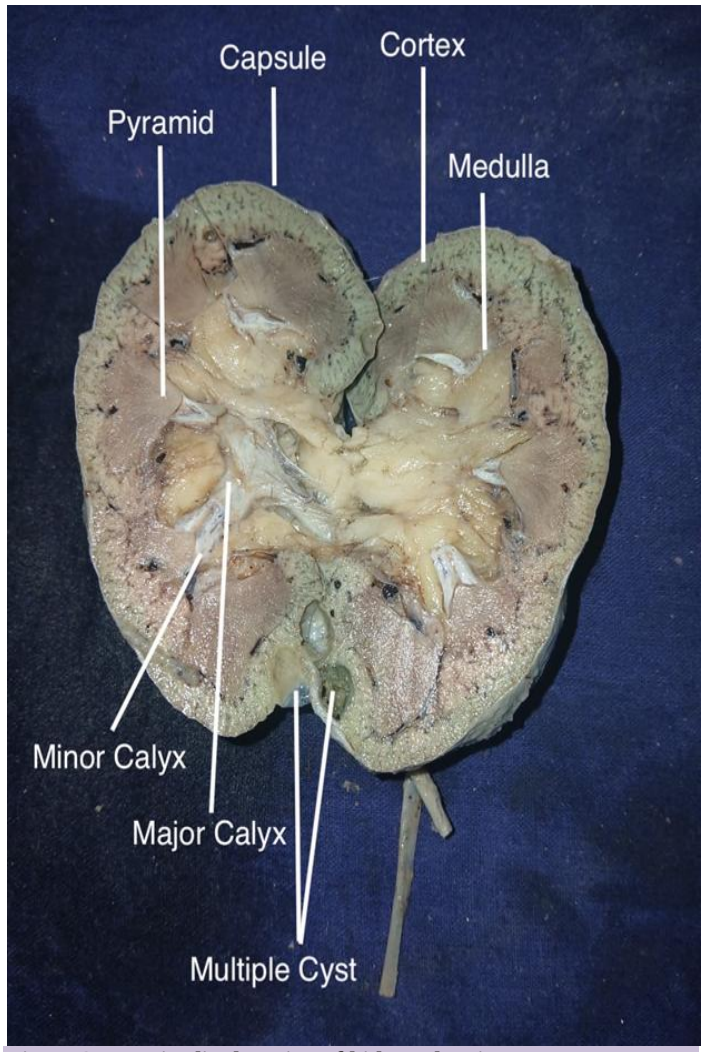

Figure 3: Longitudinal section of kidney showing cysts

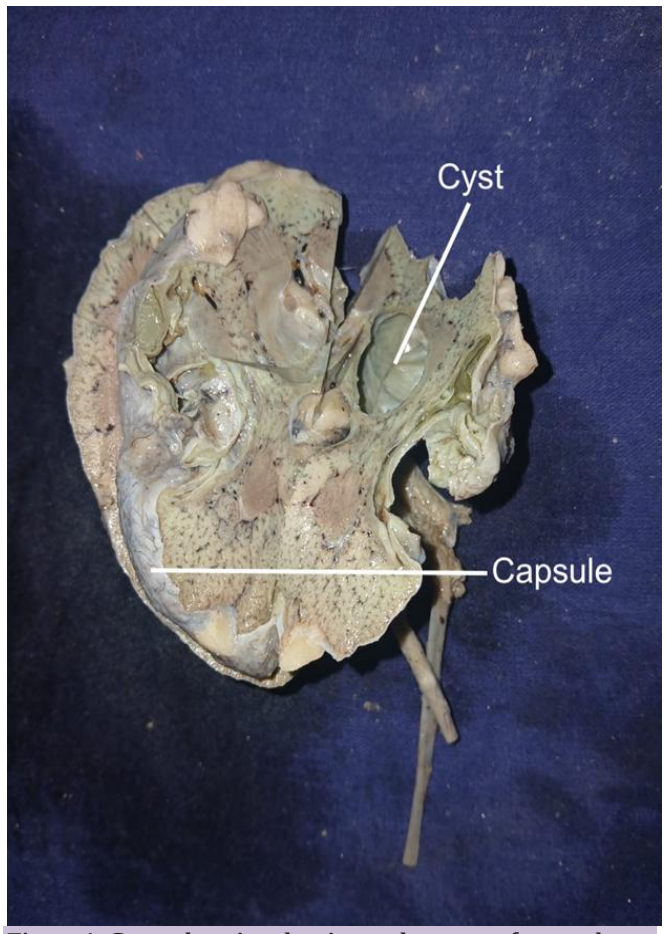

Figure 4: Coronal section showing replacement of parenchyma by cysts and distortion of the pelvicalyceal system

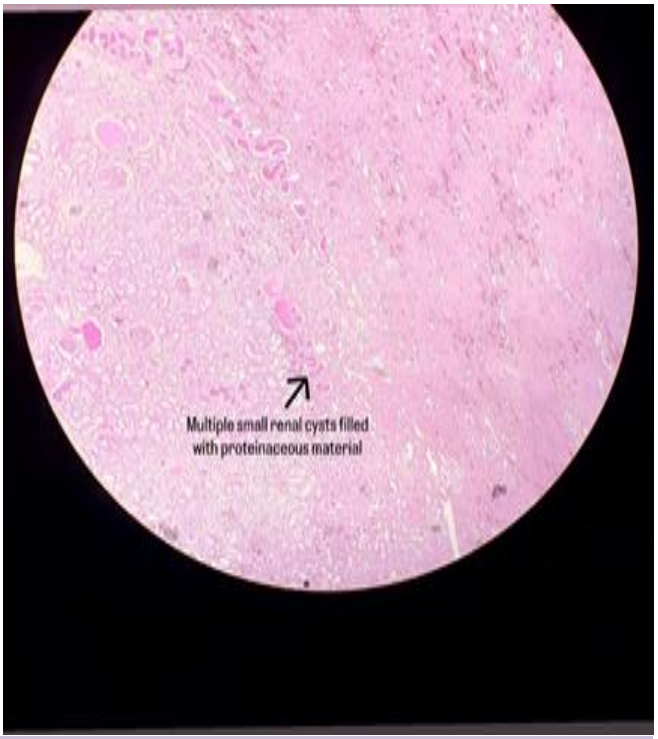

Figure 5: Low-power photomicrograph (H&E, 40x) showing multiple cysts

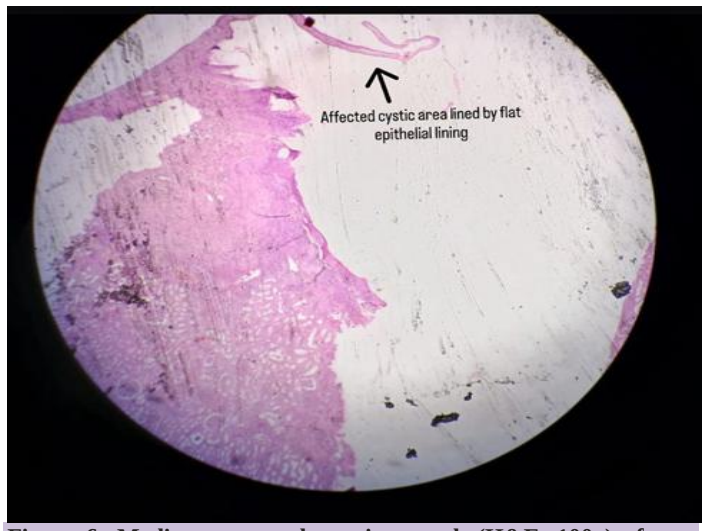

Figure 6: Medium-power photomicrograph (H&E, 100x) of cyst wall lined by flattened to cuboidal epithelium (arrow) with surrounding fibrosis.

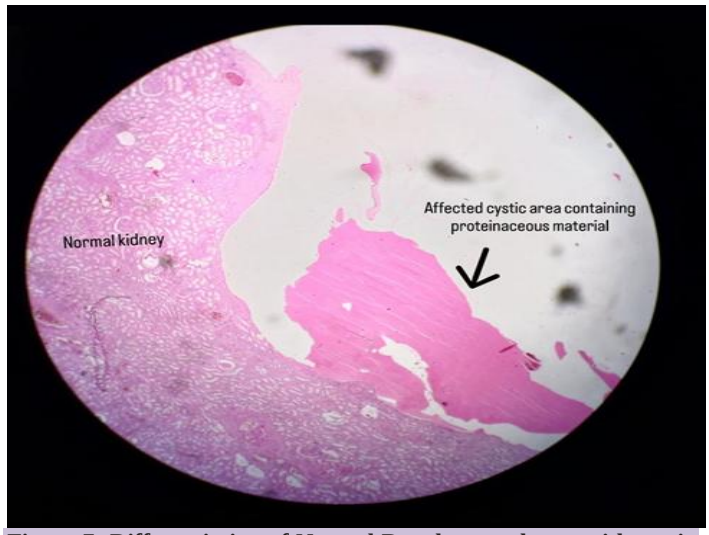

Figure 7: Differentiation of Normal Renal parenchyma with cystic area

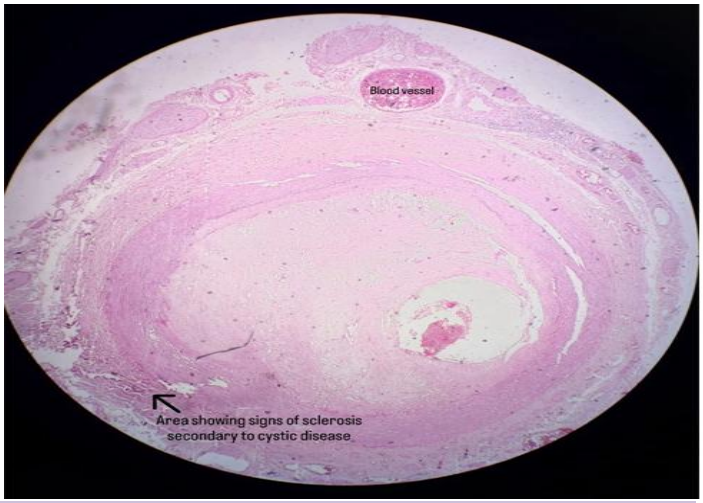

Figure 8: High-power photomicrograph (H&E, 400x) showing sign of sclerosis

Discussion

The end-stage anatomic and histological characteristics of PKD are acutely depicted in this case. Cadaveric reports of a similar nature have been reported in the anatomical literature, highlighting the intense deformation of the renal topography and the compression of the viscera.[5] According to previous studies,[6] PKD frequently results in large renal enlargement (3-4kg/kidney).

The cystic change is caused by the mutations in the PKD1 and PKD2 genes that lead to the maladaptive growth in proliferation and secretion of the tubular epithelial cells.[7] The gradual development of cysts leads to functional loss of nephrons and secondary hypertension, which would eventually result in renal failure. This advanced state is evident in the current cadaveric specimen, in which cysts largely replace the parenchyma.

The histologic status of the epithelial-lined cysts with interstitial fibrosis is correlatable with previous (Torres et al., 2015; Pei et al., 2019) histologic research findings that reported comparable microscopic degeneration in end-stage ADPKD.[8,9] These specimens offer a unique opportunity for students to directly relate histological changes to macroscopic pathology, which is often not evident in living patients and is only accessible via imaging.

Education Attitude: Early Clinical Exposure (ECE) Role: The case illustrates the integration of basic and clinical sciences in undergraduate medical training through Early Clinical Exposure (ECE). Among the first year MBBS students, exposure to this type of cadaveric material would offer a clinically applicable model of how microscopic alterations of organs become macroscopic (distortion and eventual clinical manifestations of hypertension, renal failure and abdominal mass, etc.). The discussion of such cadaveric observations in relation to imaging, case studies, and histological slides will foster an integrative, problem-based understanding of human disease. It restructures the use of dissection hall sessions beyond mere structural observation to a clinical learning experience that awakens curiosity, empathy, and clinical reasoning among trainees at early stages of training.[10]

Conclusion

This cadaveric study of severe polycystic kidney disease is a unique teaching case that is a transition point between the gastrointestinal anatomy, microscopic pathology and practical clinical issues. The results demonstrate the significant architectural deformation caused by cystic change and the need to compare anatomical and microscopic perspectives.

The importance of incorporating these real-life pathological cases into the Early Clinical Exposure (ECE) of first-year MBBS students would aid in understanding, retaining, and appreciating the functionality of anatomical sciences.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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