

Histomorphological Analysis of Renal Lesions in Autopsy Specimens

Likitha SR¹, Clement Wilfred D², Rashmi K³, Usha M⁴, Sridher HS⁵, Vijaya Viswanath Mysorekar⁶

How to cite this article:

Likitha SR, Clement Wilfred D, Rashmi K, et. al. Histomorphological Analysis of Renal Lesions in Autopsy Specimens. Indian J Forensic Med Pathol. 2020;13(3):411-417.

Abstract

Background: Autopsy is crucial to identify asymptomatic and often undiagnosed lesions. Renal diseases have high morbidity and mortality and the information provided by morphological evaluation of renal autopsy specimens is crucial to prevent renal disease that tends to be asymptomatic. Hence this study was undertaken to analyze the morphological features of kidney lesions in autopsy specimens.

Materials and methods: The study was conducted on renal specimens from routine autopsies, over duration of five years, at a south Indian tertiary health care center. The specimens were evaluated morphologically and histological sections were interpreted and classified into glomerular lesions, nonglomerular lesions and normal findings.

Results: A total of 570 specimens from 285 autopsies, with mean age of 38.8 years and male: female ratio of 3.4:1, were included in the study. The major cause of death was cardiorespiratory failure (36.4%). Normal histology was identified in 63.5% of the kidneys. Tubulointerstitial, glomerular, cystic, vascular and neoplastic lesions were identified in 22.8%, 5.6%, 3.9%, 3.5% and 0.4% of the kidneys, respectively.

Conclusion: The frequency of renal lesions encountered in autopsies was 36.5%. Nonglomerular lesions outnumbered glomerular lesions with male predominance. The commonest tubulointerstitial lesion was acute tubular necrosis. Chronic glomerulonephritis, benign nephrosclerosis and simple renal cysts were the major glomerular, vascular and cystic lesions identified, respectively. Thus, through autopsy, varied preventable renal lesions that tend to be asymptomatic can be discovered and this data is indispensable for further assessment of the disease trends.

Keywords: Autopsy; Glomerular lesions; Nonglomerular lesions; Renal lesions; Renal specimens.

Introduction

Autopsy provides an opportunity to correlate the morphological features of organs with clinical and

laboratory findings as well as helps to determine the possible cause of death and emphasize on the incidental findings and rare lesions.^{1,2}

Kidney specimen from autopsy are routinely sent to look for morphological changes in unnatural death and sudden death of unknown reason.³ Histologic evaluation of autopsy kidney may be the first opportunity to identify renal lesions wherein we can encounter a wide spectrum of renal pathology.⁴

Chronic kidney disease has been recognized as a major public health problem and is an independent risk factor for cardiovascular system.⁵

Authors Affiliation: ¹Final year Postgraduate Student, ^{2,5}Associate Professor, ^{3,4}Assistant Professor, ⁶Senior Professor, Department of Pathology, MS Ramaiah Medical College and Hospitals, MSRIT Post, MSR Nagar, Bangalore 560054, India.

Corresponding Author: Clement Wilfred D, Associate Professor, Department of Pathology, M S Ramaiah Medical College and Hospitals, MSRIT Post, MSR Nagar, Bangalore 560054, India.

E-mail: clement.wilfred@yahoo.com

Renal diseases are responsible for high morbidity and its histological evaluation might provide crucial information on pathological changes in general population for preventing chronic renal disease that tend to be asymptomatic and often go undiagnosed.^{1,3,6}

There have been numerous autopsy series elaborating renal pathology findings including patients with hematological malignancies, HIV / AIDS and hematopoietic stem cell transplants.⁷ But there are very few studies done on renal system for the lesions.

Hence this study was undertaken to determine the frequency of different pathological lesions encountered in routine renal autopsy specimens and to evaluate the varied histomorphological features of these lesions.

Materials and Methods

This was a single center study, conducted on all renal specimens from routine autopsies received at the autopsy section of the department of Pathology, M.S Ramaiah Medical College and Hospitals, Bengaluru, over a duration of five years (between January 2015 and December 2019).

Neonatal and pediatric autopsy specimens and autolysed kidney specimens were excluded from the study.

Method of data collection

All the renal autopsy specimens received in the autopsy section were weighed and measurements noted. In every case the standard protocol for surgical grossing of specimens was followed. The specimens were fixed in 10% formalin and after a detailed gross examination, multiple representative bits were taken and processed as per standard protocol and paraffin embedded tissue blocks were made. Paraffin sections of 3-5 μ m were cut and stained with hematoxylin and eosin (H&E). All the histological sections were interpreted independently and blindly by two pathologists and classified into i) glomerular lesions; ii) tubulointerstitial lesions; iii) vascular lesions; iv) cystic lesions; v) neoplastic lesions; vi) nephrolithiasis and vii) No significant lesion / close to normal histology. The relevant details including age, sex, clinical findings and cause of death were retrieved from the deceased postmortem files.

Statistical analysis: Data was entered in Microsoft excel and SPSS Version 18.0 software was used

for analysis. All the continuous variables were expressed as mean and standard deviation and all the qualitative variables as proportion. The frequency and percentage of each type of renal lesion was computed.

Results

598 renal specimens from 299 sequential autopsies were received over duration of five years, of which 28 specimens, exhibiting extensive autolysis, were excluded. The remaining 570 specimens from 285 autopsies were included in the study. The age range of autopsies was 18 to 75 years with mean age of 38.8 \pm 13.4 and comprised of 77.2% males and 22.8% females with male: female ratio (M:F) of 3.4:1. The mean age of male deceased cases was 39.8 \pm 13.1 years (range: 19 to 75 years) and female cases was 34.6 \pm 13.9 years (range: 18 and 73 years). Fig. 1 shows the year wise gender distribution. Majority of the cases (53.33%; 152/285) were between 21 to 40 years age group with mean age of 35 \pm 10 years (Fig. 2).

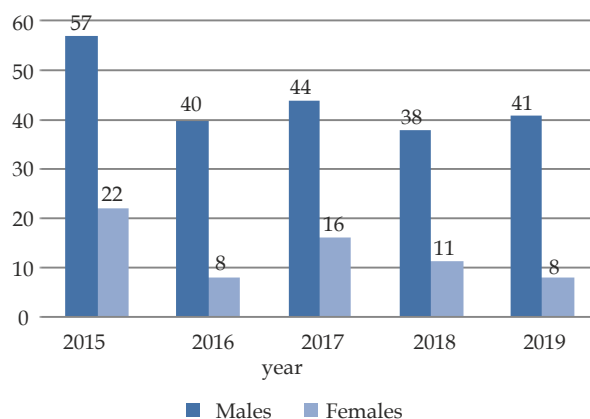


Fig. 1: Gender distribution of autopsy study.

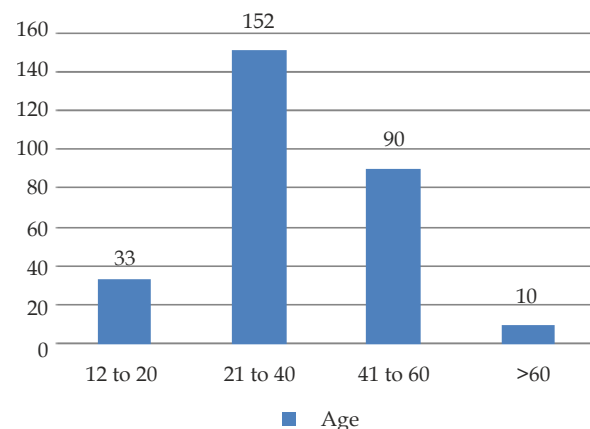


Fig. 2: Age distribution of autopsy cases.

Cause of death: The most common cause of death was cardiorespiratory failure (36.4%) followed by

unnatural death (26%) (Table 1). The latter included road traffic accidents, consumption of poisons, snake bite, burns, fall from height, hanging and drowning.

Table 1: Distribution of immediate causes of death.

Cause of death	No. of specimens	%
Cardiorespiratory cause	103	36.4
Unnatural death	74	26
Unknown	34	11.9
Neurologic injury/Stroke	25	8.8
Infection/ Sepsis	23	8.1
Decompensated cirrhosis	22	7.7
Renal failure	04	1.4
Total	285	100

Renal lesions: In 362 (63.5%) kidneys there was no significant lesion, with the gross and microscopic morphology being normal or close to normal histology with mild interstitial edema and congestion. Remaining 208 (36.5%) kidneys had pathological findings. Table 2 summarizes the various renal lesions in renal autopsies. The percentage of tubulointerstitial lesions (22.8%) was higher as compared to that of glomerular lesions (5.6%), followed by cystic lesions (3.9%) and vascular lesions (3.50%). We noted a male preponderance in the distribution of renal lesions (Table 2).

Tubulointerstitial lesions: The commonest lesion identified was acute tubular necrosis (ATN), accounting for 48.1% of all lesions (100/208). These lesions showed patchy involvement of the tubules with varying severity of epithelial necrosis,

tubulorrhesis, epithelial simplification, attenuation of brush border, cytoplasmic vacuolation and patchy epithelial sloughing into lumina (Fig. 3). Chronic pyelonephritis was the second commonest diagnosis, comprising of 12% of renal lesions (25/208). Grossly the kidneys showed irregular coarse corticomedullary scarring overlying deformed calyces (Fig. 4) and on microscopy tubular atrophy, thyroidization and simplification were noted along with variable interstitial chronic inflammation and fibrosis and vascular intimal sclerosis (Fig. 5). Ten of these lesions exhibited superimposed hydronephrosis which, in addition, showed dilation of pelvicalyceal system. Tuberculous pyelonephritis was present in 5 specimens, characterized by caseating granulomatous inflammation (Fig. 6).

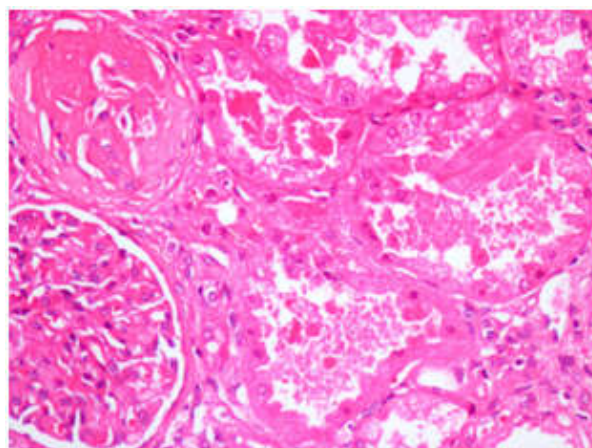


Fig. 3: Acute tubular necrosis with tubules showing degenerative changes and luminal necrotic epithelial cells and debris. (H&E, 20x).

Table 2: Distribution of various renal lesions in autopsy study.

	Renal lesions	No. of cases	% of cases	% of Male	% of Female	Mean age distribution
I	Glomerular lesions	32	5.6			
	1. Chronic glomerulonephritis	16	2.8	77.7	22.2	50.2±8.5
	2. Focal segmental glomerulosclerosis	02	0.4	100	0	33
	3. Diabetic nephropathy	14	2.5	71.4	28.5	39.2±15.6
II	Tubulointerstitial lesions	130	22.8			
	1. Acute tubular necrosis	100	17.5	71.5	28.5	38.1±12.9
	2. Chronic pyelonephritis	25	4.4	64	36	46.1±12.8
III	3. Tuberculosis pyelonephritis	05	0.9	60	40	28.3±18.9
	Vascular lesions	20	3.5			
	1. Benign Nephrosclerosis	14	2.5	78.6	21.4	52.8±4.6
IV	2. Focal infarction	06	1.1	83.3	16.7	55.1±3.2
	Cystic lesions	22	3.9			
V	1. Simple cysts	20	3.5	75	25	59.1±10.5
	2. Polycystic kidney disease	02	0.4	0	100	54
VI	Neoplasms	02	0.4			
	1. Tubular adenoma	01	0.2	100	0	33
VII	2. Renal cell carcinoma	01	0.2	0	100	50
	Nephrolithiasis	02	0.4	100	0	55±1
VIII	Normal /close to normal histology	362	63.5	76.4	23.6	37.5±12.7



Fig. 4: Gross specimen of chronic pyelonephritis with cut surface exhibiting discrete corticomedullary scars overlying deformed calyces.

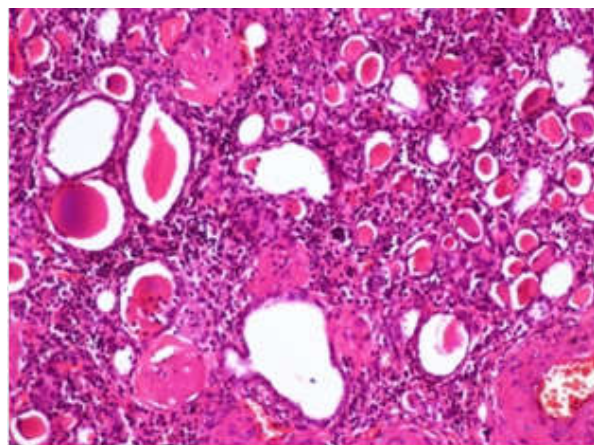


Fig. 5: Chronic pyelonephritis exhibiting interstitial fibrosis and chronic inflammation and tubular thyroidization. (H&E, 10x).

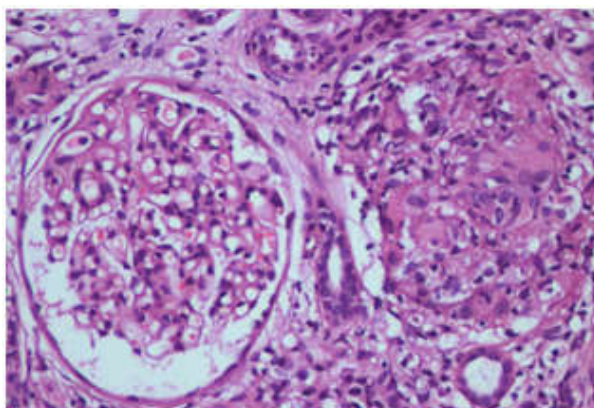


Fig. 6: Tuberculous pyelonephritis exhibiting chronic interstitial inflammation with epithelioid granulomas. (H&E, 20x).

Glomerular lesions: Chronic glomerulonephritis was identified in 16 specimens, all of which were grossly contracted with diffuse granular cortical scarring, cortical atrophy and loss of corticomedullary demarcation. On microscopy

there was diffuse global glomerulosclerosis with variable tubular atrophy, interstitial fibrosis and chronic inflammation and arteriosclerosis. In some of these cases the viable glomeruli showed increase in mesangial matrix and cellularity and basement membrane thickening. The histological diagnosis, in two kidneys, was focal segmental glomerulosclerosis, characterized by focal and segmental obliteration of tuft architecture with synechiae formation. Diabetic nephropathy was present in 14 renal specimen's from seven diabetic deceased patients. On microscopy these cases showed diffuse mesangial sclerosis or nodular glomerulosclerosis with glomerular capillary basement membrane thickening and hyaline arteriosclerosis. In addition four of these specimens showed superimposed acute interstitial nephritis, probably of infective etiology.

Vascular lesions: There were 14 specimens of benign nephrosclerosis which, on microscopy, showed hyaline arteriosclerosis of arterioles and small arteries and fibrointimal expansion and medial hypertrophy of the interlobular arteries. Infarcts were present in six specimens. Grossly these lesions were wedge shaped and yellowish white with ischemic coagulative necrosis on microscopy. The infarcts were solitary in two specimens and multiple in the rest.

Cystic lesions: Solitary renal cysts were the commonest cystic lesion identified (91%; 20/22). These ranged in size from 0.5 cm to 4 cm and on microscopy were lined by focally denuded bland flattened epithelium. One autopsy case showed adult polycystic kidney disease, in which both the kidneys were enlarged and completely effaced by variably sized cysts.



Fig. 7: Renal cell carcinoma, specimen exhibiting a relatively circumscribed mass at the upper pole with variegated cut surface.

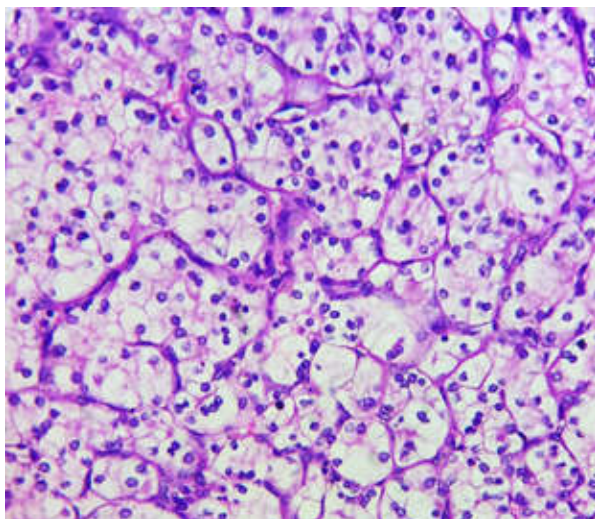


Fig. 8: Renal cell carcinoma, clear cell type with nests and islands of polygonal tumour cell exhibiting abundant clear cytoplasm. (H&E, 20x).

Neoplasms: Incidental renal masses accounted for 1% of all renal lesions (2/208) and composed of one tubular adenoma (1.5 cm in greatest dimension) in a 33 year male and one renal carcinoma, clear cell type (3 cm in greatest dimension) in a 50 year female (Fig. 7 and 8).

Nephrolithiasis: There was one specimen with staghorn calculus and another specimen with multiple irregular and spiky brownish stones reminiscent of calcium oxalate stones.

Discussion

The distribution pattern of renal lesions, at autopsy, varies according to age, gender, race, socio-economic conditions, environmental and nutritional factors and cause of death.¹ Similar studies conducted by Sandhu et. al. (M:F= 1.7:1), Patel et. al. (M:F= 1.5:1) and Yadav et. al. (M:F= 1.8:1) revealed male predominance of renal lesions.^{1,2,8,9} Similarly the current analysis revealed male predominance, however the proportion of renal lesions in males was more than the former studies (3.4:1), but less than that observed by Pandian et. al. (6.5:1).⁹

Studies conducted by Patel et. al. and Kaur et. al. revealed that maximum deaths occurred in the age group of 21–40 years which is in concordance with our study.^{2,10}

We identified that 36.4% cases show cardiorespiratory failure as the most common cause of death which is in agreement with the study done by Perrone ME et. al.⁷ The latter study stated that cardiorespiratory failure, which comprised 26% (36/140) of their cases, was the most common

immediate cause of death.

In the current analysis 63.5% (362/570) of all renal specimens exhibited normal histology/ close to normal histology, which is in concordance with study conducted by Yadav who did not find any renal pathology in 85.9% (422/ 491) of the autopsies studied.⁸ However studies conducted by Sandhu et. al., Kaur et. al. and Usta et. al. revealed greater proportion of renal pathology with normal histology only in 22.5%, 25% and 41% of the renal autopsies, respectively.^{1,10,11}

In the present study non-glomerular lesions (31%; 176/570) significantly outnumbered glomerular lesions (5.6%; 32/570). Similarly, majority of the studies on renal autopsy specimens revealed predominance of non-glomerular lesions.^{1,10,12} In the studies conducted by Kaur et. al. and Sandhu et. al. non-glomerular lesions accounted for 58% and 60.7% of the autopsy cases studies.^{1,10}

Similar to our study, literature review revealed that tubulointerstitial pathology comprise the majority of all renal lesions as well as non-glomerular lesions.^{1,3,8,10} The major tubulointerstitial lesion identified in our study was ATN (17.5%;100/570), which is in synchrony with studies conducted by Sandhu et. al. (22.5%) and Chethan et. al. (35.7%).¹² In autopsy specimens, differentiating autolysis from ATN is a major challenge. ATN exhibits patchy involvement of the tubules with features of injury like cellular swelling and blebbing of cell membrane, attenuation of brush border, desquamation of necrotic cells, tubulorrhesis, presence of luminal casts with necrotic epithelial cells and interstitial inflammation and edema and features of regeneration like epithelial simplification, nuclear hyperchromasia and presence of mitotic activity. Whereas autolysis involves all tubular segments with diffuse detachment of the epithelium from the underlying tubular basement membranes and absence of features of injury and regeneration.^{4,13} Kocovski et. al. investigated the morphological characteristics that may differentiate between acute tubular necrosis (ATN) and autolysis in postmortem samples and concluded that tubular whorls, tubulorrhesis, proliferating tubular epithelial cells and presence of interstitial expansion are characteristic features of ATN when compared with autolysis.¹³

Similar to our study (4.4; 25/570), chronic pyelonephritis was the second commonest tubulointerstitial lesion in the study by Sandhu et. al. (6.6%; 8/120).¹ However, according to Yadav et. al., chronic pyelonephritis was the commonest lesion identified (6.1; 30/491).⁸

Renal tuberculosis is clinically silent and often

incidentally found in autopsy studies and develops in approximately 5% of patients with active tuberculosis.^{1,14} In the present study, the frequency of renal tuberculosis was low (0.9%). Sandhu et. al. found tuberculosis in 6 cases (5%) whereas Yadav et. al. did not report any case of renal tuberculosis.^{1,8}

Different studies have stated different percentages of glomerular and vascular lesions. The frequency of glomerular lesions ranged from 0.61 to 16.6% and that of vascular lesions ranged from 1.4% to 26%.^{1,8,10,12} In our study the frequency of glomerular and vascular lesions were 5.6% and 3.5% respectively with chronic glomerulonephritis being the major glomerular lesion and benign nephrosclerosis being the commonest vascular lesion. Such discrepant findings is probably due to varying sample size among studies, differing socio-economic and environmental conditions, different causes of death and varying frequencies of normal histology. According to Yadav et. al. the commonest glomerular and vascular lesions were nephrosclerosis and glomerulonephritis respectively.⁸ Whereas Sandhu et. al. reported focal global sclerosis and arteriosclerosis as the major glomerular and vascular lesion, respectively.¹

Most of the cystic lesions identified in the current study were simple cysts, which is in concordance with literature review that revealed that commonest renal cystic lesions are benign simple cysts.¹⁵

Renal neoplasms, detected incidentally at autopsy are rare. Our study revealed 2 incidental neoplasms (1 tubular adenoma and 1 clear cell renal carcinoma) accounting for 0.4% of all specimens. Sandhu et. al. encountered 1.6% (2/120) of neoplasm's, all of which were clear cell renal carcinomas.¹ Patel et. al., evaluated 269 autopsies and encountered 2 cases of renal cell carcinomas (0.7%).²

One of the limitation of the current analysis is that, it does not reflect the real incidence of the renal lesions in the population.

Conclusion

This study highlights the morphological spectrum of renal lesions detected in autopsies. Nonglomerular lesions outnumbered glomerular lesions with male predominance of renal lesions, which is in concordance with other Indian studies. The frequency of pathological renal lesions encountered in routine autopsies was 36.5% with preponderance of tubulointerstitial lesions. The commonest tubulointerstitial lesion was ATN followed by chronic pyelonephritis. Chronic

glomerulonephritis, benign nephrosclerosis and simple renal cysts were the major glomerular, vascular and cystic lesions identified, respectively. The frequency of incidentally detected renal neoplasm was 0.4%. Thus, through autopsy, varied preventable renal lesions that tend to be asymptomatic and often go undiagnosed can be discovered and this data is indispensable for further assessment of the disease trends.

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