Original Article

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Pathology Section

The Gamut of Renal Lesions on Autopsy: A Two-year Cross-sectional Study from North Eastern Odisha, India

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ABSTRACT

Introduction: Kidney diseases have shown a rising upward trend in the last few decades due to the increase in incidence of associated chronic diseases like diabetes, hypertension. However the frequency and spectrum of renal pathology in autopsy specimens is not well documented or overlooked by physicians as well as pathologists.

Aim: To analyse the spectrum of various types of renal pathologies, based on the histopathological analysis of renal tissue where autopsies were performed routinely with no history of renal diseases.

Materials and Methods: This cross-sectional study was carried out over a period of two years from June 2021 to June 2023 in the Department of Pathology of SCB Medical College and Hospital, Cuttack, Odisha, India, and consisted of 84 cases of well-preserved renal autopsies. The autopsy samples were routinely processed and stained by Haematoxylin and Eosin (H&E) and then reported. Special stain of Periodic Acid Schiff (PAS) was done. Gross and microscopic findings were studied. The study was compared with other relevant studies. The data was analysed using Microsoft Excel 2019.

Results: A total of 84 cases were included in the study. The male:female ratio was 1.27:1. The age group with the highest number of cases (35 cases) was 21-40 years. Among the 84 cases the commonest pathology was seen in tubules (40 cases, 47.62%) and glomeruli (7 cases, 8.33%), followed by vascular pathologies (5 cases, 5.95%) and interstitial lesions (4 cases, 4.76%). Renal cell carcinoma was incidentally detected in two cases and Wilms tumour in one case. Five cases had normal histology.

Conclusion: The study illuminates the various renal lesions on autopsy and showed tubular lesions were more common than glomerular lesions in renal autopsy. Renal lesions are more common in males. The focus should be to develop more effective diagnostic methods for renal lesions so that intervention can be fast and sharp resulting in less mortality.

Keywords: Glomeruli, Renal cell carcinoma, Tubules, Wilms tumour

INTRODUCTION

Autopsy is the most coveted legal procedure in all medicolegal deaths and is the gold standard for determining the cause of death. It is derived from the Greek word autopsia, means “to see for oneself”. It serves as an important tool for retrospective quality assessment of the clinical diagnosis and aids as an educational tool to the clinician [1]. Sometimes the lesions are diagnosed at autopsy only as they do not cause any symptoms or functional changes in the patient.

Chronic Kidney Disease (CKD) is a major global public health problem with an estimated prevalence of 8-16% worldwide [2]. Kidney disease is consistently reported as the 9th leading cause of death in the United States [3]. Histopathologic evaluation of autopsy of kidneys may be the only opportunity to identify kidney diseases as usually kidney biopsy is avoided in critically ill patients. This is important as these findings may have implications for the surviving family members, particularly for kidney diseases with a gene involvement. The prevalence of kidney diseases is increasing as a consequence of the accumulation of multifactorial risk factors such as hypertension, diabetes, dyslipidaemia and obesity [4]. Incidence of biopsy/autopsy proven cases of renal pathology in population varies in different parts of the world [5].

Autopsies in hospital deaths help to know about the complications occurring in intensive care unit and add to information about existing co-morbidities of the patient that could have resulted in death or affected the response to treatment. The spectrum of renal pathology in adult autopsies is very wide and it includes glomerulonephritis, acute tubular necrosis, chronic pyelonephritis, vasculitis, amyloidosis, diabetic nephropathy, thrombotic microangiopathy, light chain cast nephropathy, membranous nephropathy, focal segmental glomerulosclerosis, atheroembolic disease, infections like polyomavirus nephropathy, bile cast nephropathy, oxalosis, nephrocalcinosis, and urate nephropathy [6]. This study was done to find out the spectrum of kidney diseases in autopsy specimens in the State and compare their distribution according to age, sex and histopathological findings. This study covers the North Eastern Odisha population which has not been done before.

MATERIALS AND METHODS

This was a cross-sectional study carried out over a period of two years from June 2021 to June 2023 in the Department of Pathology of SCB Medical College and Hospital, Cuttack, Odisha, India. The kidneys of medicolegal autopsies performed during these years were included in the study after taking due approval from Institutional Ethics Committee (Ref. No.53/7th IEC Meeting).

Out of total 96 cases, 12 cases of autolysed tissues were excluded from the study and 84 cases of well-preserved renal medicolegal autopsies were included in the study to reduce false positive cases. Data pertaining to age, gender, Medicolegal case number, clinical and postmortem findings were recorded from deceased postmortem papers. Thorough gross examination including weight dimensions, colour was recorded and then tissue was fixed in 10% neutral buffered formalin. After processing in autoprocessor, H&E stain was done in autostainer and then mounted carefully. A minimum of two sections per kidney specimen were studied. One section to cover all the minute details in four compartments based on anatomical site namely, glomerular, tubular, interstitial, vascular and special stain like PAS was done on the other section. All the histological sections were examined microscopically by two experienced pathologists who were blinded and their findings were recorded. No interobserver variability was seen and the kappa value was 1.

STATISTICAL ANALYSIS

The data was collected and entered in a Microsoft Excel spreadsheet in tabulated form. Statistical parameters like the relative frequency of various renal lesions, the site of distribution and demographic data like the distribution of diseases with respect to age and sex were evaluated using Microsoft Excel 2019.

RESULTS

In the present study, males constituted 47 (55.95%) and females accounted for 37 (44.05%) cases. The male: female ratio was 1.27:1 [Table/Fig-1]. Highest percentage of females (19 cases, 22.61%) was found in the 21-40 years age group and highest percentage of males (22 cases, 26.2%) in 41-60 years age group. Overall, the age group with the highest number of cases was 21- 40 years (35 cases, 41.67%) [Table/Fig-2]. The youngest patient was eight-year-old and the oldest was 80-year-old. The most common cause of death in the study population was due to acute renal failure (21 cases, 25%) followed by acute myocardial infarction (15 cases,17.85%), congestive cardiac failure (14 cases,16.66%) and chronic renal failure (4 cases, 4.76%) [Table/Fig-3]. The other causes of death were chronic pyelonephritis, lobar pneumonia, acute respiratory distress syndrome, adenocarcinoma lung, acute lung injury, malignant hypertension, aortic stenosis, haemolytic crisis, cirrhosis, rheumatic heart disease. The least common causes of death were acute pyelonephritis, dilated cardiomyopathy, hypertrophic obstructive cardiomyopathy, emphysema, bronchopneumonia, interstitial pneumonia, polycystic kidney disease, tuberculosis lung, septic abortion, hepatitis.

Age group (years)	No. of males	No. of females
0-20	4 (4.76)	7 (8.33)
21-40	16 (19.05)	19 (22.62)
41-60	22 (26.19)	7 (8.33)
61-80	5 (5.95)	4 (4.76)

[Table/Fig-1]: Gender distribution of renal lesions.

S. no.	Histopathological finding	Number of cases	Percentage of cases (%)	Age incidence (years)			
				0-20	21-40	41-60	61-80
1.	Glomerular lesions:						
a	Glomerular sclerosis	6	7.14	0	3	3	0
b	Glomerulonephritis	1	1.19	0	0	1	0
2.	**Tubular lesions:**						
a	Acute tubular necrosis	36	42.86	8	15	9	4
b	Acute pyelonephritis	1	1.19	0	1	0	0
c	Chronic pyelonephritis	3	3.57	0	1	2	0
3.	**Interstitial lesions:**						
	Interstitial nephritis	4	4.76	0	1	2	1
4.	**Vascular lesions:**						
	Hyaline arteriosclerosis	5	5.95	0	2	2	1
5.	**Tumours**						
	Renal cell carcinoma	2	2.38	0	0	1	1
	Wilms tumour	1	1.19	1	0	0	0
6.	**Others:**						
	Simple cyst	1	1.19	0	1	0	0
	Polycystic kidney disease	1	1.19	0	0	1	0
	Hydropic change	1	1.19	0	0	1	0
	Congestion	17	20.24	2	8	5	2
7.	**Normal histology**	5	5.95	0	3	2	0

[Table/Fig-2]: Distribution of renal lesions.

S. no.	Cause of death	n (%)
1	Acute renal failure	21 (25)
2	Chronic renal failure	4 (4.76)
3	Congestive cardiac failure	14 (16.66)
4	Acute myocardial infarction	15 (17.85)
5	Chronic pyelonephritis	2 (2.38)
6	Acute pyelonephritis	1 (1.19)
7	Dilated cardiomyopathy	1 (1.19)
8	Hypertrophic obstructive cardiomyopathy	1 (1.19)
9	Lobar pneumonia	2 (2.38)
10	Bronchopneumonia	1 (1.19)
11	Interstitial pneumonia	1 (1.19)
12	Acute respiratory distress syndrome	2 (2.38)
13	Adenocarcinoma lung	2 (2.38)
14	Acute lung injury	2 (2.38)
15	Malignant hypertension	2 (2.38)
16	Aortic stenosis	2 (2.38)
17	Haemolytic crisis	2 (2.38)
18	Cirrhosis	2 (2.38)
19	Emphysema	1 (1.19)
20	Polycystic kidney disease	1 (1.19)
21	Tuberculosis lung	1 (1.19)
22	Rheumatic heart disease	2 (2.38)
23	Septic abortion	1 (1.19)
24	Hepatitis	1 (1.19)

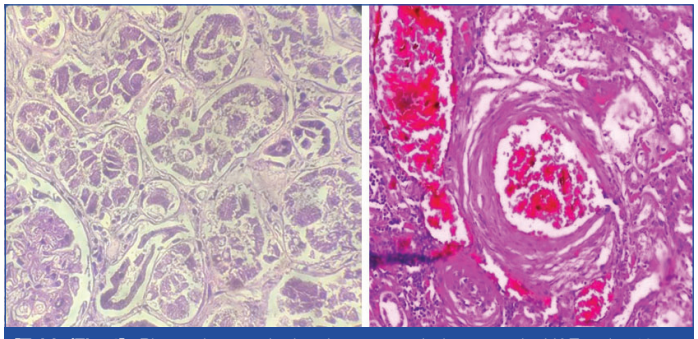
[Table/Fig-3a]: Causes of death.

S. no.	Histopathological finding	Number of cases	Cause of death	Number of cases
1	Glomerular lesions:			
a	Glomerular sclerosis	6	a. Hepatitis	1
			b. Chronic renal failure	3
			c. Rheumatic heart disease	1
			d. Cirrhosis	1
b	Glomerulonephritis	1	Rheumatic heart disease	1
2	Tubular lesions:			
a	Acute tubular necrosis	36	a. Septic abortion	1
			b. Acute renal failure	16
			c. Acute respiratory distress syndrome	2
			d. Acute myocardial infarction	11
			e. Aortic stenosis	1
			f. Haemolytic crisis	1
			g. Acute lung injury	2
			h. Lobar pneumonia	2
b	Acute pyelonephritis	1	Acute pyelonephritis	1
c	Chronic pyelonephritis	3	a. Chronic pyelonephritis	2
			b. Chronic renal failure	1
3	Interstitial lesions:			
	Interstitial nephritis	4	Acute renal failure	4
4	Vascular lesions:			
	Hyaline arteriosclerosis	5	a. Acute myocardial infarction	4
			b. Dilated cardiomyopathy	1
5	Tumours			
a	Renal cell carcinoma	2	Malignant hypertension	2
b	Wilms tumour	1	Congestive cardiac failure	1

6	Others:			
	Simple cyst	1	Interstitial pneumonia	1
	Polycystic kidney disease	1	Polycystic kidney disease	1
	Hydropic change	1	Acute renal failure	1
	Congestion	17	a. Congestive cardiac failure	13
			b. Bronchopneumonia	1
			c. Hypertrophic obstructive cardiomyopathy	1
			d. Adenocarcinoma lung	2
7	Normal histology	5	a. Aortic stenosis	1
			b. Haemolytic crisis	1
			c. Cirrhosis	1
			d. Emphysema	1
			e. Tuberculosis lung	1

[Table/Fig-3b]: Spectrum of renal lesions in various causes of death.

There were five cases without any remarkable pathology in kidney tissue. Congestion in renal tissue was seen in 20.23% of cases. But this is a very non specific finding found in autopsies of various organs. Among the four renal compartments, the commonest pathology was that of the tubular compartment (45.23%). A total of 36 cases had acute tubular necrosis [Table/Fig-4]. There were five cases only with hyaline arteriosclerosis [Table/Fig-5]. One case showed hydropic change. In glomerular lesions, one case of crescentic glomerulonephritis, five cases of focal glomerulosclerosis [Table/Fig-6], one case of global glomerulosclerosis [Table/Fig-7], one case of chronic glomerulonephritis [Table/Fig-8] was detected. One case of simple renal cyst and one case of polycystic kidney disease [Table/Fig-9] contributed to cystic lesions of kidney. There was one case of acute pyelonephritis and three cases of chronic pyelonephritis [Table/Fig-10a-c]. A total of 4.76% cases of interstitial nephritis were diagnosed. Renal cell carcinoma was incidentally detected in two cases (2.38%) [Table/Fig-11] and Wilms tumour [Table/Fig-12a,b] in one case (1.19%). Acute tubular necrosis was most common in 21-40 years age group (15 cases) while glomerular lesions was equally distributed in 21-40 and 41-60 years age group (3 cases each) [Table/Fig-2].

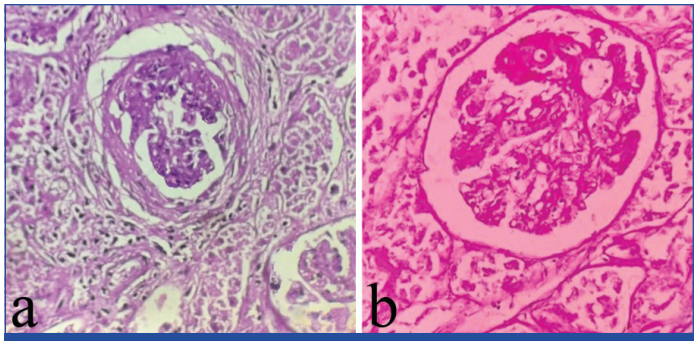


[Table/Fig-4]: Photomicrograph showing acute tubular necrosis, H&E stain, 40x. **[Table/Fig-5]:** Photomicrograph showing hyaline arteriosclerosis in the vessel, H&E stain, 40x. (Images from left to right).

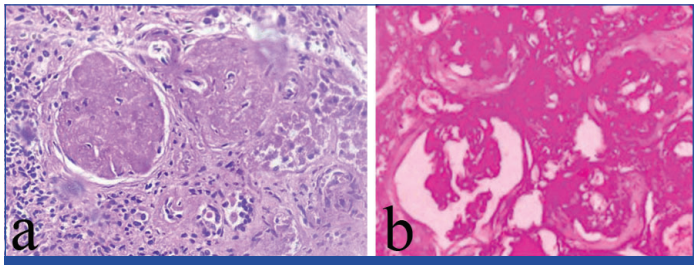
DISCUSSION

Autopsies throw light on the cause of death which otherwise would have remained unexplored. It specially helps in those cases where there is sudden death or where the cause remains questionable [6]. This study had 55.95% males and 44.05% females. Larsen ST and Lynnerup N also reported male preponderance with 68.39% males and 31.61% females [7]. Several authors have similar male dominance in their studies [8-10]. Pelemo OE et al., and Kakadiya J et al., reported 67% males, while Mulay PS reported 68% males. However, Perrone ME et al., differed and reported 46% males and 54% females [11] as their study was a specially designed clinical autopsy series to explore renal diseases that remain unrecognised.

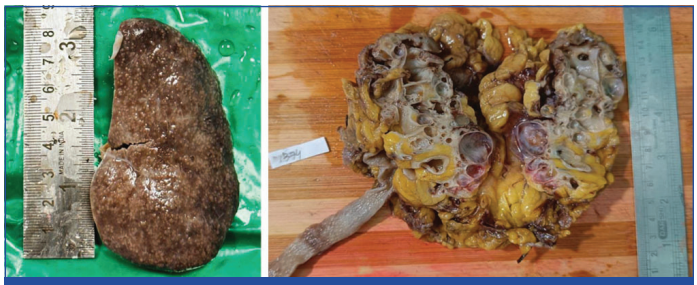
The maximum number of cases (41.67%) belonged to the age group 21-40 years followed by 41-60 years (34.52%) in the



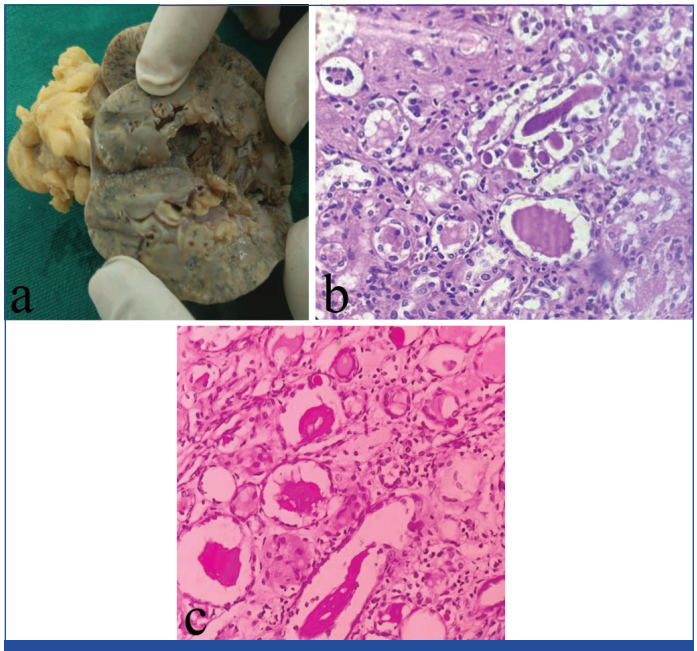
[Table/Fig-6]: a) Photomicrograph showing focal glomerulosclerosis, H&E stain, 40x. b) Photomicrograph of PAS stain showing thickening of the basement membrane and focal glomerulosclerosis, 40x.



[Table/Fig-7]: a) Photomicrograph showing global glomerulosclerosis, H&E stain, 40x; b) Photomicrograph of PAS stain showing global glomerulosclerosis, 40x.

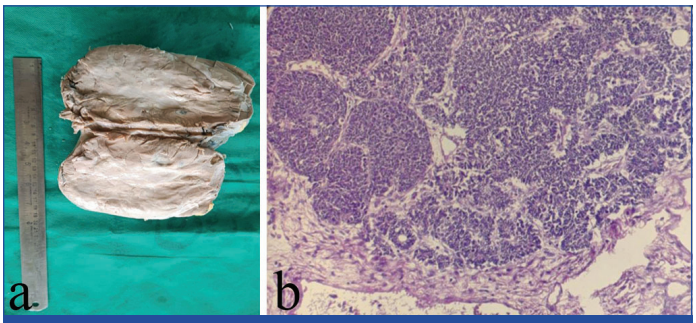


[Table/Fig-8]: Gross photograph of granular kidney in chronic pyelonephritis. **[Table/Fig-9]:** Gross photograph showing multiple cysts in polycystic kidney disease. (Images from left to right).



[Table/Fig-10]: a) Gross photograph of chronic pyelonephritis; b) Photomicrograph showing thyroidisation, interstitial inflammatory cell infiltrate in chronic pyelonephritis, H&E stain, 40x; c) Photomicrograph of PAS stain showing thyroidisation, interstitial inflammatory cell infiltrate in chronic pyelonephritis, 40x.

[Table/Fig-11]: Gross photograph of renal cell carcinoma with variegated areas.



[Table/Fig-12]: a) Gross photograph of Wilms Tumour; b) Photomicrograph showing Triphasic Wilms Tumour, H&E stain, 10x.

present study. This was in concordance with the study of Patel S et al., and Kaur A et al., in which maximum number of deaths with renal lesions occurred in 21-40 years of age [Table/Fig-13] [12,13]. Pelemo OE et al., also had similar age distribution with maximum number of cases of medicolegal autopsies (68.4%) in the age group of 20-49 years [8], But Larsen ST and Lynnerup N differed with the highest number of cases in the age group of 40-59 years (45%) followed by 20-39 years (23%) [7] due to higher elderly population in their demographic pattern.

S. no.	Study	Publication year	Place of Study	Age group (years)	Number of cases	Percentage of cases
1	Patel S et al., [12]	2016	Mysore	21-40	98	48.5
2	Kaur A et al., [13]	2018	Patiala	21-40	38	38
3	Pelemo OE et al., [8]	2014	Nigeria	20-49	81	45.2
4	Larsen ST and Lynnerup N [7]	2011	Denmark	40-59	648	45
5	Present study	2024	North Eastern Odisha	21-40	35	41.67

[Table/Fig-13]: Comparison with other studies [7,8,12,13].

In the present study five cases (5.95%) had no remarkable pathology in renal tissue. This was in concordance with study done by Kaur A et al., (25%) cases and Sandu VK et al., (22.5% cases) showing normal histology [13,14].

In this study, glomerular lesions comprising sclerosis and glomerulonephritis were identified in 9.52% of cases, aligning with findings from Hailemariam S et al., autopsy study on 237 cases, which reported glomerular or vascular pathology in 28% [15]. Notably, 33% of cases exhibited non glomerular lesions, while 29% demonstrated combined lesions. Mulay PS study showed glomerular lesions, specifically glomerular sclerosis and glomerulonephritis, in 14.17% of cases [9]. The commonest lesion was chronic pyelonephritis, followed by glomerulosclerosis and glomerulonephritis in a study by Kakadiya J et al., examining the tubular compartment, involvement was observed in 45.25% of cases, potentially attributed to factors such as snake bites, drug overdoses, and poisoning [10]. This finding was consistent with Sandu VK et al., study [14]. Acute tubular necrosis was identified in 36 cases in the present study, while Mulay PS reported tubular and interstitial lesions in 30.90% of cases, encompassing acute tubular necrosis, chronic pyelonephritis, tubular haemorrhages, and interstitial nephritis [9]. Neha S et al., study had 7.6% cases of pyelonephritis [16]. Present study found only 1.19% cases of acute and 3.57% cases of chronic pyelonephritis. Lower incidence of pyelonephritis may be explained by as the included autopsy cases were not suffering from obvious renal diseases. These were only incidental findings or unnoticed medical condition. Interstitial nephritis was observed in 4.76% cases consistent with cases of Mulay PS and Verma AA and Murmu R in 6.4% and 5.7% respectively [9,17].

Various forms of changes in renal vessels like thickening of tunica media and intima and hyalinisation of wall with luminal narrowing were observed in (5.95%) cases in the present study. Other studies had shown the prevalence of hyaline arteriosclerosis in elderly age group due to age related changes in the vessel wall [5,18]. But present study observed hyalinisation of renal vessels in 21-60 years most as compared to more than 60 years. This variation in observation may be due to shorter life span in this population of Northern-East region, but yet to be established. Mulay PS study had renal arteriosclerosis in 125 (22.7%) cases. This difference can be possibly attributed to a higher prevalence of hypertension in their patient population. Renal cell carcinoma was detected in 2.38% of cases, closely aligning with the observations made by Kozlowska J and Okon K who reported a 2.76% incidence in their work [19]. These findings underscore the importance of comprehensive renal assessments, considering both glomerular and tubular involvement, as well as vascular and neoplastic conditions, in understanding renal pathology.

The commonest cause of death in present study was due to acute renal failure [Table/Fig-3] followed by acute myocardial infarction and congestive cardiac failure. In non renal causes of death like lobar pneumonia, aortic stenosis, congestive cardiac failure the spectrum of renal lesions was diverse. The cause of death varied among different authors. Patel S et al., found the commonest cause of death was pulmonary oedema in their study [12]. Hypertensive heart disease (64.4% cases) was the commonest cause of death according to Pelemo OE et al., [8]. This could be due to the higher prevalence of cardiovascular diseases in their population.

Limitation(s)

Immunofluorescence could not be done due to lack of resources, which could have added to the diagnosis in a good number of cases.

CONCLUSION(S)

The study revealed a nuanced understanding of renal conditions, with tubular lesions emerging as more prevalent than glomerular lesions in renal autopsy cases. Acute renal failure emerged as the most common cause of death, followed by acute myocardial infarction and congestive cardiac failure. These findings underscore the need for a vigilant approach in case analysis. Autopsy materials emerged as invaluable in refining our understanding of disease progression and aetiology. Recognising autopsy as an irreplaceable treasure in pathology, authors emphasise the urgency of promptly transferring specimens to prevent autolysis. In conclusion, the present study enhances diagnostic capabilities and lays the foundation for nuanced interventions in patient care, aligning with the overarching goal of advancing healthcare outcomes through meticulous research.

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