



ISSN Print: 2394-7500  
ISSN Online: 2394-5869  
Impact Factor: 5.2  
IJAR 2019; 5(2): 163-166  
www.allresearchjournal.com  
Received: 03-12-2018  
Accepted: 08-01-2019

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## Histomorphologic analysis of non-neoplastic lesions in nephrectomy specimens

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### Abstract

**Background and Objectives:** Kidneys can be involved in various pathological processes, some of which require its surgical removal- Nephrectomy. A detailed histopathological analysis of renal lesions is mandatory for proper diagnosis. The present study aimed to analyze the histomorphological spectrum of non-neoplastic lesions in nephrectomy specimens received in our institution.

**Materials and Methods:** A total of 80 nephrectomy specimens removed for non-neoplastic lesions were analyzed and a descriptive analysis was done.

**Results:** We observed a male predominance in our study with a sex ratio of 1.16:1. Most cases affected were among the third decade with a mean age of presentation of 38.4 years. Maximum cases were pyelonephritis (PN) (86.4%), among which chronic pyelonephritis (CPN) with hydronephrosis (HDN) (23.8%) predominated, followed by infective, traumatic, cystic and developmental lesions.

**Conclusion:** Wide diversity and overlapping features in renal diseases calls for a thorough evaluation of morphological parameters, for planning therapy and predicting disease outcome.

**Keywords:** Chronic pyelonephritis, Hydronephrosis, nephrectomy

### Introduction

Renal diseases are responsible for a great deal of morbidity and mortality. The functional reserve of the kidney is large, and much damage would occur before there is evident functional impairment. The kidneys can be involved in various pathological processes, some of which may require its surgical removal- Nephrectomy [1, 2]. Common non-neoplastic conditions where nephrectomy is performed include Chronic Pyelonephritis (CPN), Obstructive Nephropathy, Hydro nephrosis (HDN), Calculus disease or severe traumatic injury. It may also be performed for treatment of renovascular hypertension from non-correctable renal artery disease. Vesicoureteric reflux is the leading cause of nephrectomy in children [3, 4]. The approach to renal histopathological analysis is to identify the relevant pathologic features in the different compartments i.e. glomeruli, tubules, interstitium and blood vessels [1]. Accurate pathological evaluation is essential for proper diagnosis and establishing treatment protocols [5]. Hence the present study was undertaken to analyze the histomorphological spectrum of non-neoplastic lesions in nephrectomy specimens.

### Materials and Methods

This hospital based cross-sectional study from July 2009 to June 2018 analyzed 80 consecutive nephrectomy specimens removed for non-neoplastic pathologies. For the retrospective period, slides were reviewed from the Archives of Pathology department and observations recorded. For the prospective period, grossing of the formalin fixed nephrectomy specimens was done. Macroscopic details were noted and sections were taken from representative areas. Tissue was subjected to routine processing. Sections were stained with Haematoxylin and Eosin stain and observations recorded. Non-neoplastic diseases were assessed based on changes in glomeruli, tubules, interstitium and blood vessels. A descriptive statistical analysis of the data was done.

### Results

80 nephrectomy specimens were analyzed. The mean age of presentation was 38.4 years (range 30-40 years). Among these, males were 53.75% (43) and females were 46.25% (37) with a sex ratio of 1.16:1.

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Out of the 80 non-neoplastic cases, 69 (86.4%) were inflammatory lesions, among which chronic pyelonephritis with hydronephrosis (19 cases= 23.8%), was the most

common diagnosis. It was followed by infective, traumatic, Cystic and developmental lesions comprising of 6, 3, 1 and 1 case respectively. (Figure 1, Table1)

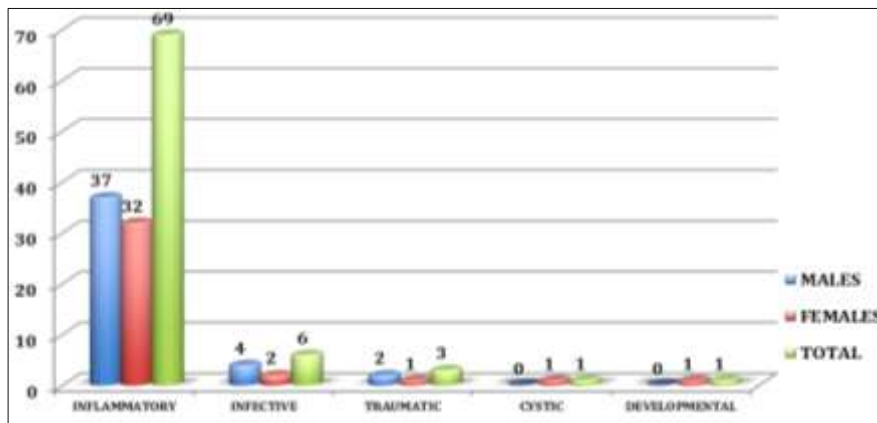


Fig 1: Gender Wise Distribution of Renal Diseases (N=80)

Table 1: Histopathological spectrum of non-neoplastic lesions.

| Categories                               |                                    | No. of cases | % of cases |
|--|------------------------------------|--------------|------------|
| Inflammatory (Pyelonephritis) 69 (86.4%) | CPN                                | 17           | 21.3       |
|  | CPN with HDN                       | 15           | 18.8       |
|  | CPN with nephrolithiasis           | 14           | 17.5       |
|  | CPN with pyonephrosis              | 09           | 11.3       |
|  | Xanthogranulomatous Pyelonephritis | 06           | 7.5        |
|  | CPN with HDN and nephrolithiasis   | 04           | 5.0        |
|  | Acute on CPN with pyonephrosis     | 04           | 5.0        |
| Infective 6 (7.4%)                       | Renal tuberculosis                 | 04           | 5.0        |
|  | Hydatid cyst                       | 01           | 1.2        |
|  | Mucormycosis                       | 01           | 1.2        |
| Traumatic 3 (3.8%)                       | Traumatic hematoma                 | 03           | 3.8        |
| Cystic 1 (1.2%)                          | Multicystic renal dysplasia        | 01           | 1.2        |
| Developmental 1 (1.2%)                   | Hypoplastic Renal parenchyma       | 01           | 1.2        |
| Total                                    |                                    | 80           | 100        |

**Pyelonephritis**

69 among the 80 cases were either acute, chronic, acute on chronic or Xanthogranulomatous pyelonephritis, associated with either hydronephrosis, pyonephrosis or nephrolithiasis. In 39/69 (56.6%) cases, the kidney was shrunken. An enlarged kidney was seen in 15 (21.7%) cases. This enlargement of the kidney could be due to obstructive uropathy caused by calculi, exudate/pus and vesicoureteric reflux. The outer surface was bosselated in 45/69 (65.2%) cases followed by hemorrhagic and scarred surface. In most cases, an overlapping of bosselated and hemorrhagic surface was noted. On cut, capsule was adherent in 57/69 (82.6%) cases. It was non-adherent (could be stripped off) in 7

(10.1%) cases and thickened in 5 (7.3%) cases. In majority of the cases, 63/69 (91.3%) the differentiation between cortex and medulla was absent. Pelvicalyceal system showed dilatation in 65/69 (94.2%) cases. (Figure 2)



Fig 2: (a) Shrunken kidney in chronic pyelonephritis (b) Dilated and thinned out pelvicalyceal system (c) Cystically dilated pelvicalyceal system with calculi in the calyx (nephrolithiasis), distorted architecture and bosselated surface

On microscopy, the most common glomerular change observed was periglomerular fibrosis in 39/69 (56.5%) cases. It was followed by sclerosis in 26 (37.7%) cases in which collagen deposition was noted, and hyalinization of the glomeruli in 17 (24.6%) cases. In majority of the cases, 63/69 (91.3%), tubular atrophy was observed. Thyroidization and dilatation of the tubules was noted in 35 (50.7%) and 16 (23.2%) cases respectively. In majority of the cases, both atrophy and thyroidization of the tubules was seen. All of the cases revealed lymphoplasmacytic infiltration, along with neutrophilic and eosinophilic inflammation in 12 (12.4%) and 8 (11.6%) cases respectively. Macrophages were seen in 6 (8.7%) cases of xanthogranulomatous pyelonephritis. Interstitial fibrosis and oedema was noted in 44 (63.8%) and 20 (30.0%) cases respectively. Blood vessels were thickened in 53/69 (76.8%) cases. (Figure 3)

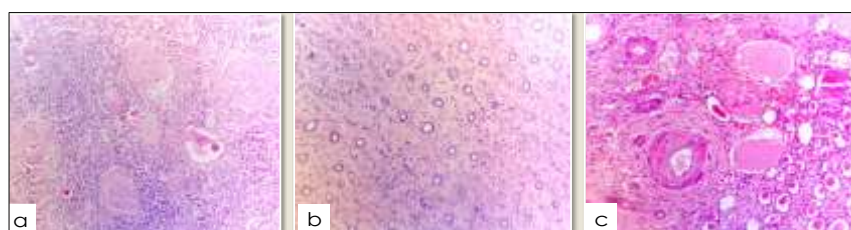
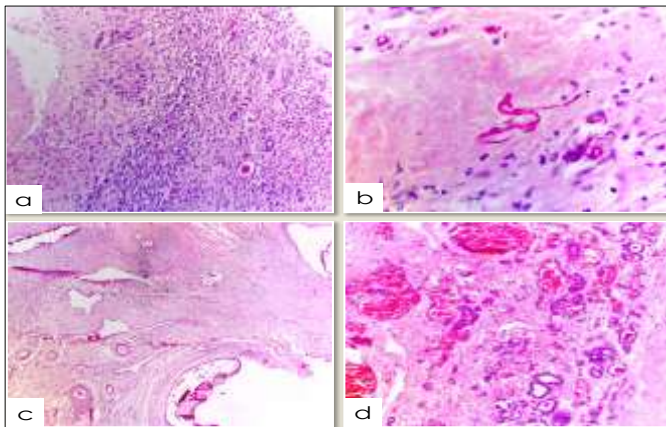


Fig 3: (a) Photomicrograph showing periglomerular fibrosis and glomerular sclerosis (H&E, X100) (b) Hyalinized stroma and atrophic tubules (H&E, X40) (c) Lymphoplasmacytic infiltration with thickened blood vessels, atrophic and thyroidization of tubules (H&E, X100)

6 out of 80 non-neoplastic cases (7.5%) were of infective etiology. These included 4/6 cases (66.7%) of renal tuberculosis and 1 case each (16.65%) of hydatid cyst and mucormycosis. 3 (3.75%) cases were of traumatic hematoma kidney, followed by one case each of multicystic renal dysplasia and hypoplastic kidney in a 5 year old female child. (Figure 4)



**Fig 4:** (a) Photomicrograph showing tubercular granuloma with epithelioid cells and lymphoplasmacytic inflammation in Renal tuberculosis (H&E, X40) (b) Fungal hyphae in Mucormycosis, necrosis and lymphoplasmacytic infiltrate in interstitium (H&E, X400) (c) Cystically dilated and atrophic tubules in Multicystic renal dysplasia (H&E, X100) (d) Atrophic and fetal type tubules in Hypoplastic kidney (H&E, X100)

**Discussion**

The present study was formulated to analyze the histopathological spectrum of non-neoplastic nephrectomy specimens. We encountered a slight male predominance in our study with a M: F ratio of 1.16:1 which was similar to that noted by Divyashree BN *et al.* [2] and Narang V *et al.* [5], 1.2:1 and 1.7:1 respectively. Also, studies conducted outside the Indian subcontinent by Ghalayini IF [6] and Anduaem D *et al.* [7] also showed a male predominance with a sex ratio of 1.29:1 and 1.2:1 respectively. All patients were categorized according to age groups. Most of the cases were reported in 3<sup>th</sup> to 4<sup>th</sup> decade with a mean age of 38.4 years. Out of the 80 cases, inflammatory pathology was seen in 86.25% (n=69) of the cases. 17 cases (24.6%) were diagnosed as chronic pyelonephritis. Chronic pyelonephritis with hydronephrosis was maximum in this category with 19 cases (27.5%). This was in concordance with studies by Vinay KS *et al.* [8] and Amin A *et al.* [9] where chronic pyelonephritis with hydro nephrosis was the commonest non-neoplastic lesion in their study with 32.39% (23 cases) and 15.7% (11 cases) respectively. Chronic pyelonephritis

with pyonephrosis and acute on chronic pyelonephritis was seen in 9 and 4 cases respectively. Nephrolithiasis was seen in 22.5% patients (18 cases). However in studies conducted by Anduaem D *et al.* [7] and Fadil E *et al.* [10] nephrectomies due to calculus leading to obstructive uropathy were the commonest with 51.2% (38 cases) and 37% (31 cases). They observed that this was due to consumption of hard drinking water in their region. The worldwide incidence of xanthogranulomatous pyelonephritis is 0.6-1% and shows a slight female preponderance [11]. In our study, we noted 7.5% patients (6 cases) in which females were affected in 4 cases. A study by Ghalayini IF [6] also encountered 8% patients (13 cases) of xanthogranulomatous pyelonephritis with female predominance in 11 cases. Infective pathology was encountered in 7.5% cases (6 cases), which included 4 cases of renal tuberculosis (5%). Anduaem D *et al.* [7] and Divyashree BN *et al.* [2] reported 3 cases (4.1%) and 5 cases (5.9%) respectively of renal tuberculosis. Also there was one case (1.2%) of hydatid cyst in our study. This uncommon renal involvement was also noted by Fadil E *et al.* [10] in 2 cases (2.3%) and Ghalayini IF [6] in 4 cases (1.3%). We also observed 1 case (1.25%) of mucormycosis. 3.8% (3 cases) of nephrectomies were performed due to traumatic hematoma. Nephrectomy remains the gold standard treatment for severely damaged and lacerated kidney. Divyashree BN *et al.* [2] and Aiman A *et al.* [4] reported 1 case and 4 cases of traumatic kidney respectively in their studies. One case of multicystic renal dysplasia with cystically dilated kidney was observed in a 26 year old female. Amin A *et al.* [9] also noted 7 cases (10%) of multicystic renal dysplasia with a female predominance in their study. A case of hypoplastic kidney was also reported in a 5 year old female child in our study. Grossly, the kidney was shrunken in majority of the cases, 56.6% (39 cases), followed by enlarged kidney in 21.7% (15 cases). Obstruction due to stone or exudate led to the increase in size. Similar findings were reported by Sreedhar VV *et al.* [12] in their study, where they observed that kidney was shrunken in 34 cases (75.5%) and enlarged in 6 cases (13.3%) out of 45 nephrectomies. In the present study, loss of corticomedullary differentiation and dilatation of pelvicalyceal system was noted in 70 (87.5%) and 72 cases (90%) respectively. Divyashree BN *et al.* [2] also observed 81 cases (96.4%) each in their study which lacked corticomedullary differentiation and had dilated pelvicalyceal system. The microscopic findings in our study were mostly similar to those observed by Divyashree BN *et al.* [2] (Table 2)

**Table 2:** Comparative analysis of microscopic findings in pyelonephritis.

| Microscopic findings      | Number of cases                    |                      |
|---------------------------|------------------------------------|----------------------|
|                           | Divyashree BN <i>et al.</i> (2014) | Present study (2018) |
| Periglomerular fibrosis   | 52 (61.9%)                         | 44 (55.0%)           |
| Glomerular sclerosis      | 52 (61.9%)                         | 27 (33.8%)           |
| Tubular atrophy           | 76 (90.4%)                         | 69 (86.3%)           |
| Thyroidization of tubules | 76 (90.4%)                         | 36 (45.0%)           |
| Interstitial inflammation |                                    |                      |
| ▪ Acute                   | 6 (7.1%)                           | 14 (17.5%)           |
| ▪ Chronic                 | 67 (79.7%)                         | 77 (96.3%)           |
| ▪ Foamy macrophages       | 2 (2.4%)                           | 8 (10.0%)            |
| ▪ Granulomas              | 8 (9.5%)                           | 4 (5%)               |
| Interstitial fibrosis     | 77 (91.6%)                         | 45 (56.3%)           |

## Conclusion

The study highlights the histomorphological patterns of non-neoplastic lesions in nephrectomy specimens received in our institution. In view of overlapping features and wide range of lesions, a detailed histopathological examination of each case is mandatory to ensure proper and prompt management and prognostication of lesions. However, some of these lesions can be managed conservatively if diagnosed in early stages and with the help of modern antibiotic therapy and clinico-radiological correlation.

**Financial Support and Sponsorship:** NIL

**Conflicts of Interest:** There are no conflicts of interest.

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