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# RENAL CONGENITAL AND TUMOR ANOMALIES. – ANATOMIC AND IMAGISTIC STUDY –

**G. SECHEL[1] A. FLEANCU[1] L.L. ONISÂI[1]**
**O.G. DIMIENESCU[1] I.A. BANUTA[1]**

***Abstract:*** *The paper aims analyzing the frequency of reno-ureteral malformations, different tumor and some vascular malformations to the renal and urinary tract by correlating data obtained through dissection and imagistic methods.*

***Key words*****:** *kidney, congenital anomalies, carcinoma.*

## 1. Introduction

### I.a. Renal Congenital Anomalies

a.1. *Renal agenesis*: Bilateral renal agenesis as part of a syndrome of oligohydramnios, pulmonary hypoplasia, and extremity and facial anomalies. Unilateral agenesis is not uncommon and usually is accompanied by ureteral agenesis with absence of the ipsilateral trigone and urethral orifice.

a.2. *Autosomal* recessive polycystic kidney disease affects both kidneys and the liver. Kidneys are usually greatly enlarged and contain small cysts. The liver is enlarged and has periportal fibrosis, bile duct proliferation, and scattered cysts; the remainder of the hepatic parenchyma is normal [6].

a.3. *Duplication anomalies:* Supernumerary collecting systems may be unilateral or bilateral and may involve the renal pelvis and ureters (accessory renal pelvis, double or triple pelvis and ureter), calyx, or ureteral orifice. Duplex kidney, a single renal mass with > 1 collecting system, differs from a fused kidney, which involves fusion of 2 renal parenchyma masses.

a.4. *Fusion anomalies:*

- With fusion anomalies, the kidneys are joined, but the ureters enter the bladder on each side. These anomalies increase the risk of ureteropelvic junction obstruction, vesicoureteral reflux, congenital renal cystic.

Horseshoe kidney, the most common fusion anomaly, occurs when renal parenchyma on each side of the vertebral column is joined at the corresponding (usually lower) poles; an isthmus of renal parenchyma or fibrous tissue joins at the midline. The ureters course medially and anteriorly over this isthmus and generally drain well. Obstruction, if present, is usually secondary to insertion of the ureters high in the renal pelvis. Pyeloplasty relieves the obstruction and can be done without respecting the isthmus [1], [10].

- Crossed fused renal ectopia is the 2nd most common fusion anomaly. The renal parenchyma is on one side of the vertebral column. One of the ureters crosses the midline and enters the bladder on the side opposite the kidneys.

1 Faculty of Medicine, *Transilvania* University of Brasov.

- Fused pelvic kidney (pancake kidney) is much less common. 2 collecting systems and ureters serve a single pelvic kidney.

a.5. *Malrotation* is usually of little clinical significance. Ultrasonography often demonstrates hydronephrosis, but diagnosis is best made with IVU, which identifies an axis shift and defines the collecting system.

a.6. *Renal dysplasia* is a histological diagnosis, the renal vasculature, tubules, collecting ducts, or drainage apparatus develops abnormally. Diagnosis is by biopsy.

a.7. *Renal ectopia* - abnormal renal location, usually results when a kidney fails to ascend from its origin in the true pelvis; a rare exception occurs with a superiorly ascended (thoracic) kidney. Pelvic ectopia increases the incidence of ureteropelvic junction obstruction, vesicoureteral reflux, and multicystic renal dysplasia. Obstruction is corrected surgically. Severe reflux can be corrected surgically when indicated (if causing hypertension, recurrent infections, or renal growth retardation).

a.8. *Renal hypoplasia* usually occurs because inadequate ureteral bud branching causes an underdeveloped, small kidney with histological normal nephrons. If hypoplasia is segmental, hypertension can occur, and ablative surgery may be needed.

**I.b. Renal cell carcinomas** comprise up to 85% of solid renal masses, with a steadily increasing incidence of detection and smaller average size at diagnosis due, at least partially, to the increased use of cross-sectional imaging. In several large series, the majority of renal cell carcinomas was asymptomatic and found incidentally on noninvasive imaging performed for unrelated reasons or for screening. In fact, the classic Grawitz triad of flank pain, gross hematuria, and palpable mass is now uncommon and is indicative of advanced disease. Kidney cancer is among the 10 most common cancers in both men and women. Overall, the lifetime risk for developing kidney cancer is about 1 in 75 (1.34%). This risk is higher in men than in women [2], [5], [6].

**b.1 Signs and symptoms of kidney cancer**

Unfortunately, early kidney cancers do not usually cause any signs or symptoms, but larger ones may. Some possible signs and symptoms of kidney cancer include: blood in the urine, low back pain on one side, a mass or lump on the side or lower back, fatigue, unexplained weight loss, fever that is not caused by a cold or other infection and that doesn't go away after a few weeks, swelling of ankles and legs (edema).

**b.2 Staging**

The Robson modification of the Flocks and Kadesky system is uncomplicated and is used commonly in clinical practice. This system was employed to correlate stage at presentation with prognosis. The Robson staging system is as follows:

- Stage I - Tumor confined within capsule of kidney
- Stage II - Tumor invading perinephric fat but still contained within the Gerota fascia
- Stage III - Tumor invading the renal vein or inferior vena cava (A), or regional lymph-node involvement (B), or both (C)
- Stage IV - Tumor invading adjacent viscera (excluding ipsilateral adrenal) or distant metastases
- The tumor, nodes, and metastases (TNM) classification is endorsed by the American Joint Committee on Cancer (AJCC). The major advantage of the TNM system is that it clearly differentiates individuals with tumor thrombi from those with local nodal disease. In the Robson system, stage III inferior vena caval involvement (IIIA) is the same stage as local

lymph node metastases (IIIB). Although patients with Robson stage IIIB renal carcinoma have greatly decreased survival rates, the prognosis for patients with stage Robson IIIA renal carcinoma is not markedly different from that for patients with Robson stage I or II renal carcinoma. [9]. The TNM classification system is as follows:

- Primary tumor (T)
  - + TX - Primary tumor cannot be assessed
  - + T0 - No evidence of primary tumor
  - + T1 - Tumor 7 cm or smaller in greatest dimension, limited to the kidney
  - + T2 - Tumor larger than 7 cm in greatest dimension, limited to the kidney
  - + T3 - Tumor extends into major veins or invades adrenal gland or perinephric tissues but not beyond the Gerota fascia
  - + T3a - Tumor invades adrenal gland or perinephric tissues but not beyond the Gerota fascia
  - + T3b - Tumor grossly extends into the renal vein(s) or vena cava below the diaphragm
  - + T3c - Tumor grossly extends into the renal vein(s) or vena cava above the diaphragm
  - + T4 - Tumor invading beyond the Gerota fascia
- Regional lymph nodes (N) - Laterality does not affect the N classification
  - + NX - Regional lymph nodes cannot be assessed
  - + N0 - No regional lymph node metastasis
  - + N1 - Metastasis in a single regional lymph node
  - + N2 - Metastasis in more than 1 regional lymph node
- Distant metastasis (M)
  - + MX - Distant metastasis cannot be assessed
  - + M0 - No distant metastasis
  - + M1 - Distant metástasis

## 2. Objectives

The paper aims analyzing the frequency of reno-ureteral malformations, different tumor and some vascular malformations to the renal and urinary tract by correlating data obtained through dissection and imagistic methods.

## 3. Material and Method

The study has been done on 36 adults' bodies through dissection and macroscopic observation in the laboratories of the Medicine Faculty of Brasov during 2000-2008. Also, the retrospective study included 1631 patients that were examined at Rapid Diagnostic Polyclinic - Medis Brasov during January 2008 - January 2009. The investigations have been conducted using a Siemens Acusson X300 ultrasonograph, and a Siemens Somatom Emotion 6 Computer Tomograph.

## 4. Results

From the 1631 cases, 151 cases presented renal malformations (9.22%) and 205 cases presented processes that substitute the renal spaces (12.58 %).

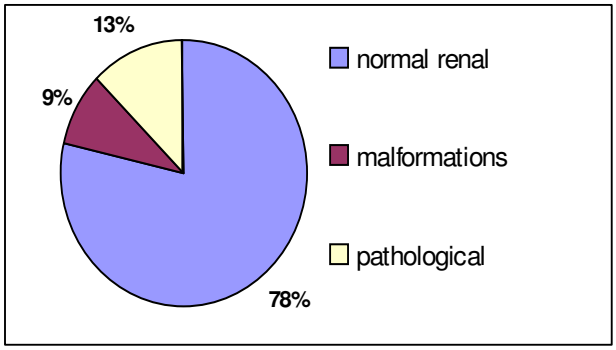



Fig. 1. *The distribution of cases according to pathology found*

From the 1631 cases, 205 presented processes that substitute the renal spaces (12.58%)

- 31.58% - benign pathology
- 68.42% - malign pathology

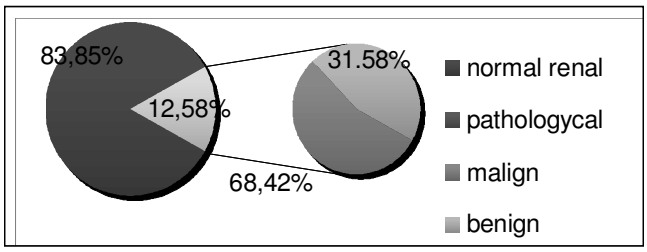



Fig. 2. *The distribution of cases of pathological tumor*

Benign tumor pathology was more frequent in male gender, included in the age group> 60 years, while the malignant was representative for the whole male sex, but the age group 20-40 years. Congenital anomalies have been highlighted in our study using both dissection method and imaging.

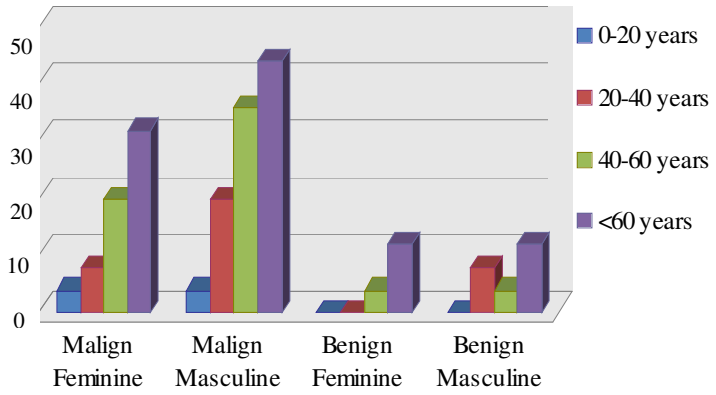
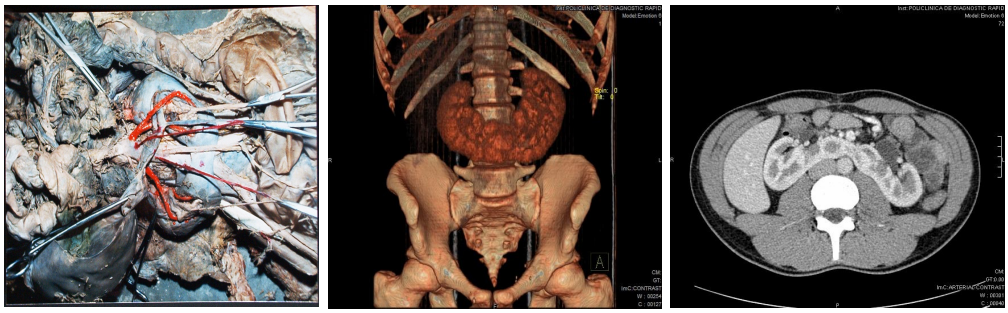



Fig. 3. *The prelevance of the malign and benign tumor on age groups at the feminine and masculine sex*

From the studied cases were found the following anomalies: polichistic kidney, ectopic kidney (the majority presented multiple vascular anomalies, megaureter, megabazinet, horseshoe kidney, single congenital kidney (agenesis).

2.38% from the cases presented malformations of fusion at the level of the kidney.



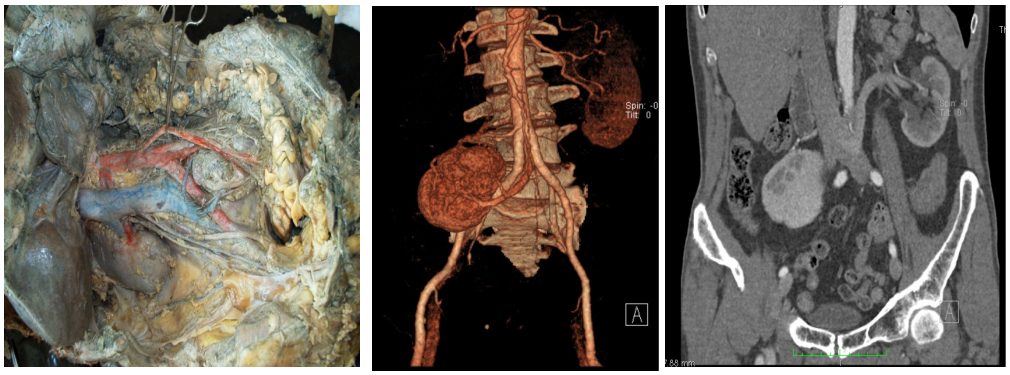
a) b) c)

Fig. 4. *Horseshoe kidney:*

a*) Horseshoe kidney, anterior position of the renal pelvis–dissection material*

b) *CT exam - VRT reconstruction*

c) *CT exam with contrast substance –axial section*



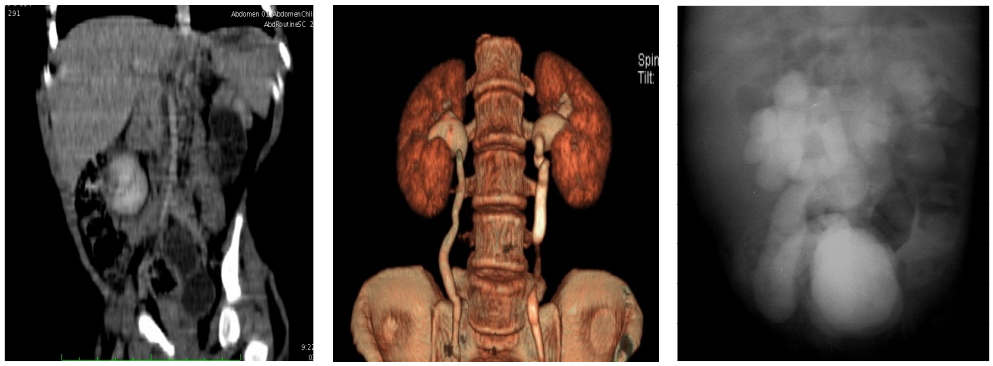
a) b) c)

Fig. 5. *Ectopic kidney:*

a) *Pelvic right kidney– dissection material*

b) *CT exam -VRT reconstruction*

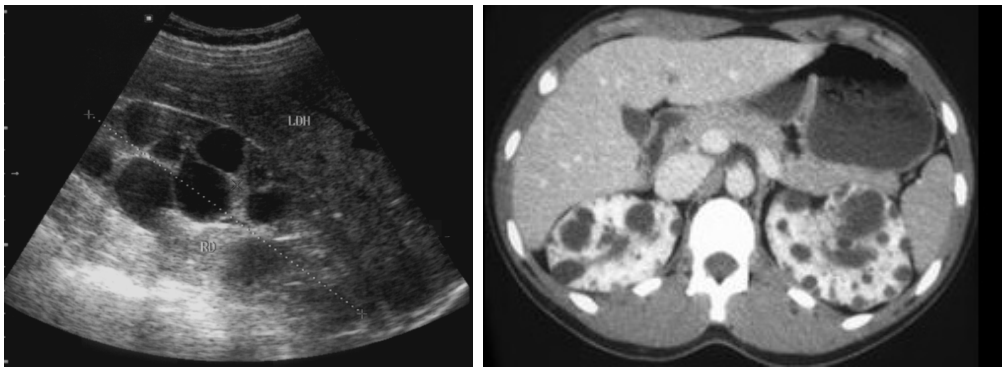
c) *CT exam with contrast substance MPR reconstruction, coronal plan*



a) b) c)

Fig. 6. *Megaureter*:
a) *CT exam with contrast substance MPR reconstruction coronal plan*;
b) *VRT reconstruction - megabazinet with megaureters;*
c) *Congenital single kidney with megaureter, urographyc footage.*

90.48% cystic lesions, frequent unilateral (2/3 from cases). The frequent localization was at cortical level, bigger at the superior pole and anterior valve, and less pielical and corticopielical. It was pointed out 2 cases of renal polycystic and one of them presented multiple hepatic cysts.




a) b)

Fig. 7. *Ultrasound and CT exams*:
a) *Multiple cystic injuries on both kidneys –ultrasound sections*
b*) CT exam with contrast substance- mmultiple processes that substitute the renal spaces, unilateral and bilateral, that presents liquid density, homogenous, noniodofile*

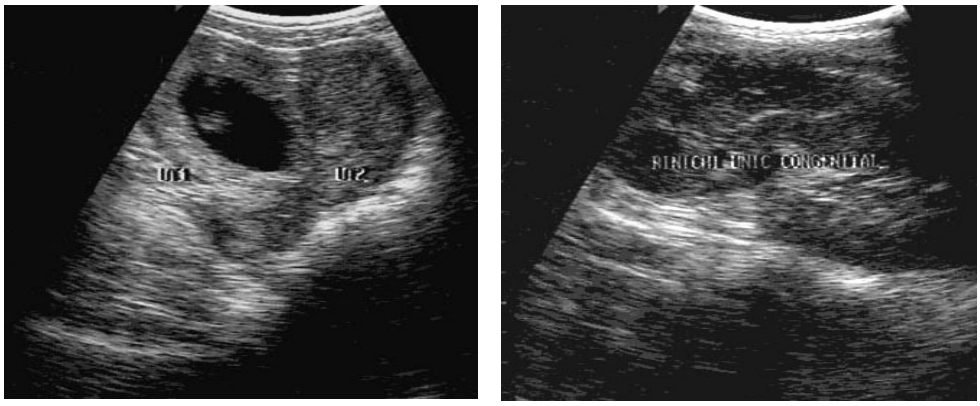



Fig. 8. *Unilateral agenesis associated with double uterus, 17 weeks pregnancy – ultrasound sections*

12.58% of the cases presented processes that substitute the renal space from which 68, 42% had malignant tumor pathology.

Most cases of renal tumors have been emphasized imaging in stage III and IV.

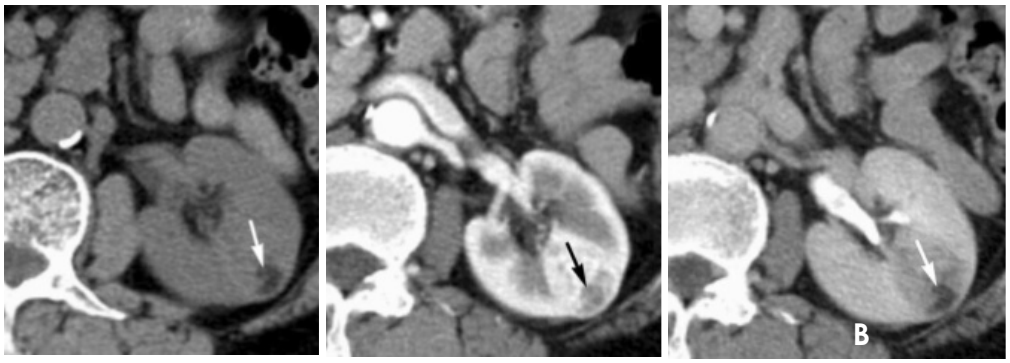



Fig. 9. *Patient aged 57 years, showed at the native CT examination a small nodular formation hipodense, that after the administration of contrast substance was noted as bigger, representing both peripheral contrast enhanced CT and central zone of necrosis*

Nodular protrusive formation, medium-renal shown on the native CT examination, the density was the same with renal parenchyma. After the administration of contrast substance can be observed a significant increase of the contrast tumor formation is scratchy, without being overcome renal capsules, stage T1.N0.V0. M0.

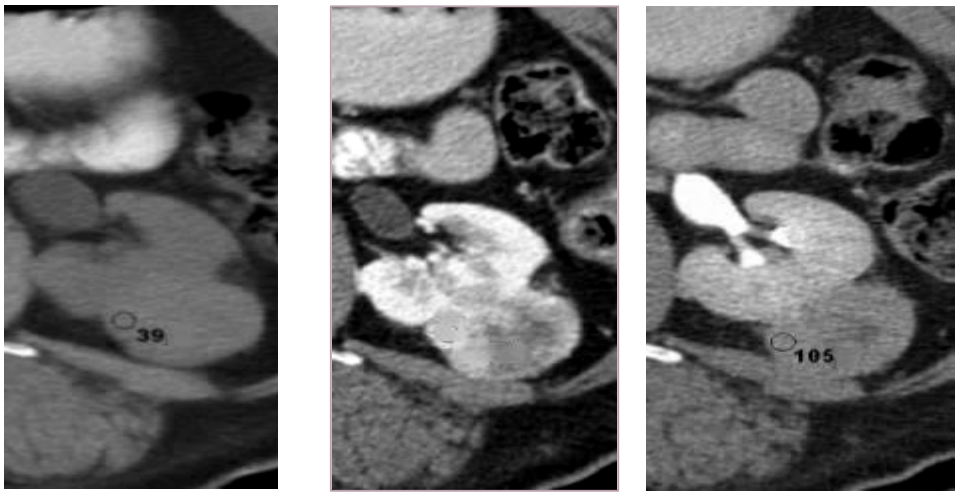



Fig. 10. *CT exam native and with contrast substance - nodular formation with tumor character*

The majority of the tumoral structures in stage IV presented areas of necrosis, invadation of the renal sinus, renal infiltration of the psoas muscle and presented frequently aortic lymph nodes. How are large tumor formations were noticed frequently thrombosis at renal veins, and collateral circulation cases fall in stage IV. On contrasted CT, the lesion was hipodense, heterogeneous, with solid areas and necrosis area that infiltrates all the left renal parenchyma, invades the renal sinus, perirenal space, surpass the Gerota fascia and infiltrates the psoas muscle (T4.N2.V1.Mx).

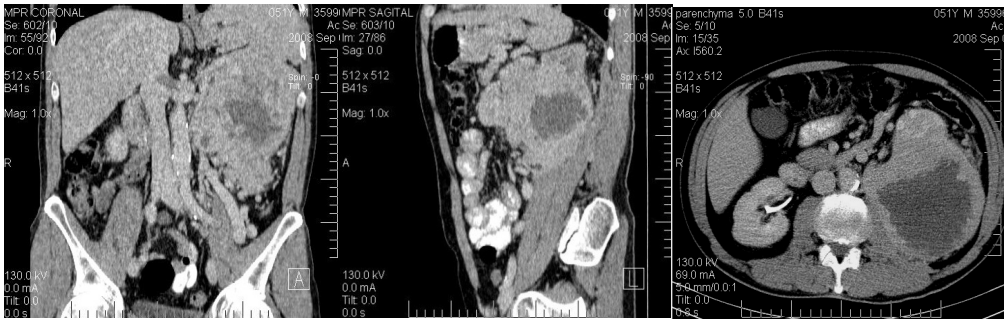



Fig. 12. *Renal cell carcinoma with caval invasion - native CT exam and contrasted, MPR reconstructions that are pointing out the cranio-caudal extension and in sagital plane of the tumor, the rapport with the vessels, and the collateral circulation at the patient aged 79 years. On contrasted CT, the infiltrating, low density, heterogeneous, central renal mass enlarges the left kidney with cortical margin disruption* (T4.N2.V2.Mx.)

Big process that substitute a renal space al the level of the left kidney, contrast enhanced CT, heterogeneous, with aspect of central necrosis and dorsal extension at the level of the lumbar wall, the presence of lumber aortic adenopathy, thrombosis of the left renal vein and VCI secondary pulmonary determinations (T4.N1.V2.M1).

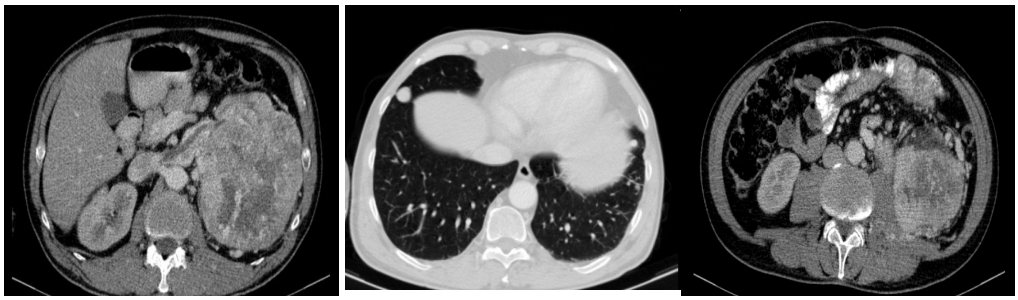


Fig. 13. *Renal cell carcinoma with metastasis to lung - CT exam with contrast substance. Have the case studies were highlighted and tumor formation predominantly cystic. Most of these cases were classified in stage 1 and stage 3 even without evidence of the adenophaties, without invasion of renal veins*

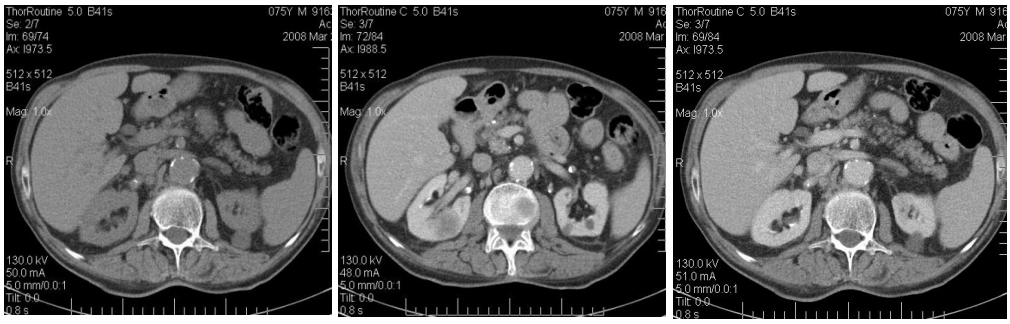
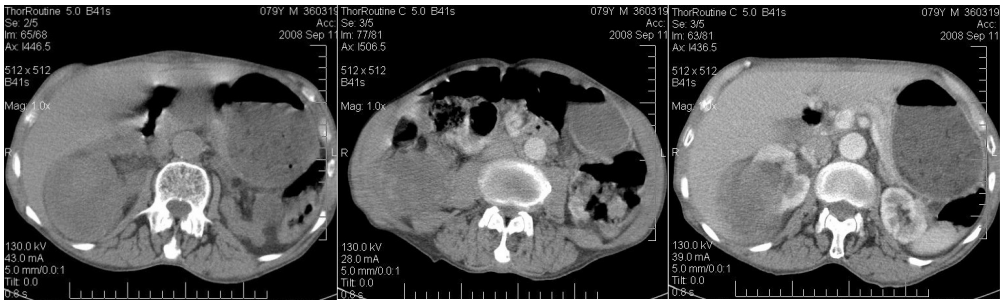



Fig. 14. *CT at a patient aged 51 years with hematuria and lumbar pain. Contrast CT shows a mildly hyperdense exophytic left renal cyst without perceptible wall or solid component but a small lesions was present to the right kidney – a small enhancing cortical mass is present* (T1.N0.V0.M0.)




Fig, 15. *Cystic renal carcinoma to the right kidney. On contrasted CT, cystic right renal mass has thickened wall and focal enhancing to the solid mass within the cyst wall. This finding suggests a high likelihood of malignancy, necessitating surgical management* (T3a.N0.V0.M0)

3D VRT reconstructions have allowed the evidence of the collateral circulation, evidence of tumor extension in all plans and also the relations with neighboring vessels and organs.

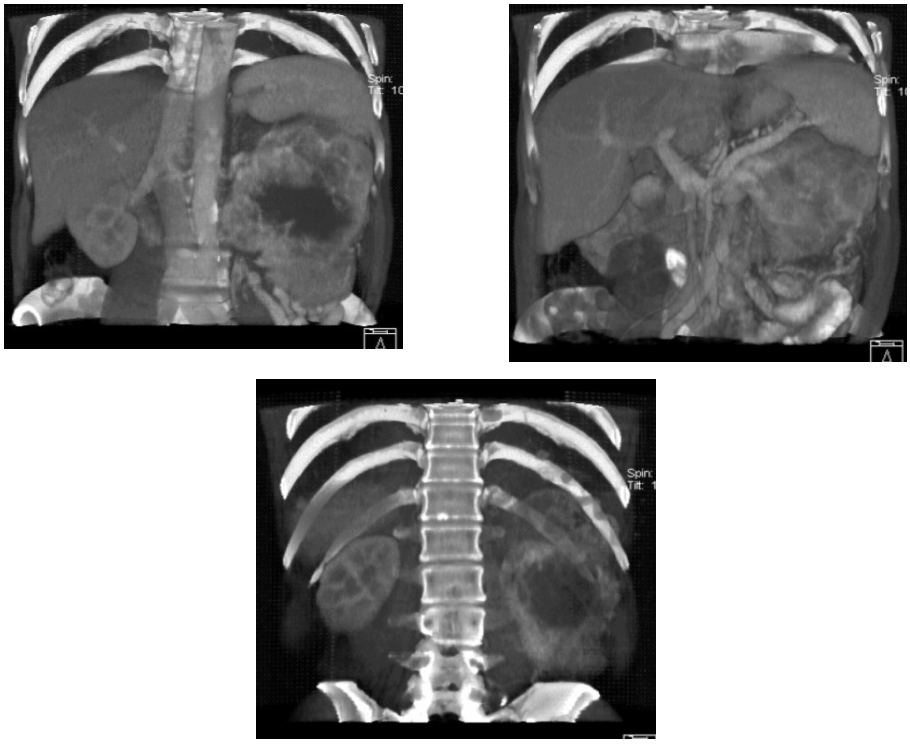


Fig. 16. *Left renal tumor - T4.N2.V2.M1 – VRT reconstructions have alloewed the evidence of the tumor, evidence of tumor extension in all plans, the various vessels of neoformation peritumoral and the closed rapports of the tumoral system with the vassels and organs neighbouring*

It were highlighted also cases of thrombosis with invasion of renal inferior cave vein (VCI), even to cases of small tumor formations without the presence of distance metastases.

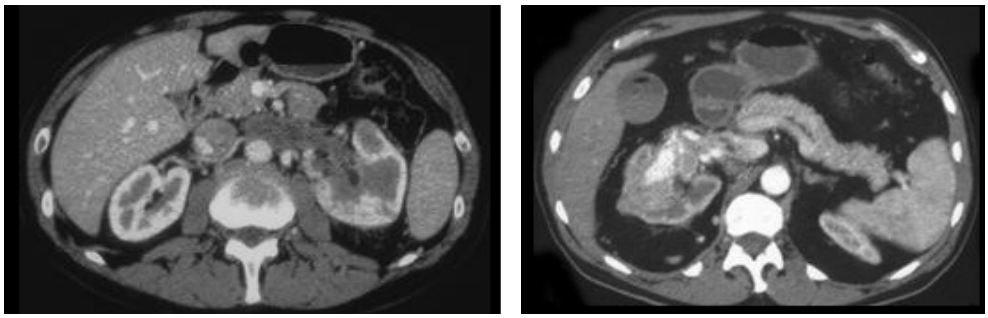


Fig. 17. *Renal cell carcinoma - T3b.N1.V2.Mx - CT exam with contrast substance:*
a*) Left renal tumor with thrombosis of left renal vein and VCI;*
b*) Right renal tumor with thrombosis of right renal vein and VCI*

## 5. Conclusions

1. For a large number of cases there have been discovered different anatomic variations of origin and distribution regarding renal arteries. The thesis points out the variability of number, way and distribution in renal visualization and the clinic utility of the thesis is important in the knowledge of the distribution of renal vascularisation in the surgery of the kidney.
2. The renal congenital anomalies and tumoral pathology hold a middle place as a frequency amongst the total number of 9.22%.
3. The malformations discovered by dissection and imagistic methods (87.42%) were: renal ectopy, polycystic kidney, horseshoes kidney, unique congenital kidney, megaureteral, and megabazinet.
4. Ultrasound can helpful in determining if a kidney mass is solid of filled with fluid, different echo patterns also can distinguish some types of benign and malignant kidney tumors from one another.
5. CT scanning is one of the most useful tests for finding mass inside kidney, also will provide information about the tumor, creates detailed images of the soft tissue in the body and can help find enlarged lymph nodes that might contain cancer.
6. It was pointed out processes that substitute the renal spaces in 12.58% of the examined cases (whereby 31.58% presented benign pathology and 68.42% malign pathology). The majority of pathological cases where of masculine sex and were framed in the group of age > 60 years. From the malign tumor cases prevalent was the necrosis form.
7. 12.58% of the cases presented processes that substitute the renal space from which 68.42% had malignant tumor pathology. Most cases of renal tumors have been emphasized imaging in stage III and IV.
8. In a few cases the tumor formation was predominantly cystic. Most of them were classified in stage I and stage III.

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