Results

1-The first group

This group included 47 patients with 50 known staghorn stoes, their age distribution ranged from 33 years to 65 years (with a mean age 49.2 years). They were 26 males and 21 females.

Table (1): Age and sex distribution among the 47 studied patients.

			Sex			
Age group	Number	%	Male	%	Female	%
31-40 y	13	28	8	17%	5	11%
41-50 y	19	40	11	23%	8	17%
51-60 y	11	23	6	13%	5	10%
61-70 y	4	9	1	2%	3	7%
Total	47	100%	26	55%	21	45%

The appearance of urinary stones on KUB (Radio-opaque) stones depend on the chemical composition of the stones. However, some of the urinary stones are radiolucent.

Table (2): The appearance of urinary stones on KUB.

Number	%	
36	72%	Radio-opaque
14	28%	Radio-lucent
50	100%	Total

The composition of urinary stones put them in 2 main groups.

1. Calcium containing ⟶ Ca oxalate, Ca phosphate, Hydroxy apatite.
2. Non calcium containing ⟶ Uric a., struvite, L-cystine.

Table (3): The no. and percentage of the two main groups of urinary stones.

	Number	Percentage
Non Calcium containing stones	17	34%
Calcium containing stones	33	66%

Noncalcium containing stones include uric acid, struvite and L-cystine stones.

Table (4): Different types of noncalcium containing stones.

Type	Number	Percentage
Uric a.	14	82%
Struvite	1	6%
L-cystine	2	12%

The calcium containing stones include Ca oxalate monohydrate, Ca oxalate dihydrate, Ca phosphate, Ca urate and hydroxy apatite.Ca oxalate could be found separate or mixed while other types are mixed.

Table (5) : Different types of calcium containing stones.

Type	Number	Percentage
Ca oxalate	18	55%
Ca phosphate (with struvite)	4	12%
Mixed	11	33%
Total	33	100%

We studied 50 patients with urinary stone for their exact chemical composition and we divided them into groups according to their composition.

Table (6): Number and percentage of different types of urinary stones in our study.

GROUP	Number	%	Composition
Group 1	14	28	Uric acid stones
Group 2	5	10	Calcium oxalate monohydrate > 91%
Group 3	7	14	Calcium oxatate monohydcate 90-75%
Group 4	4	8	Struvite + calcium phosphate
Group 5	6	12	Calciumoxapate mono hydrate + uric acid
Group 6	11	22	Mixed
Group 7	2	4	Cystine
Group 8	1	2	Struvite
Total	50	100%	

N.B.: Group 7 and group 8 being less than 5% considered statistically insignificant.

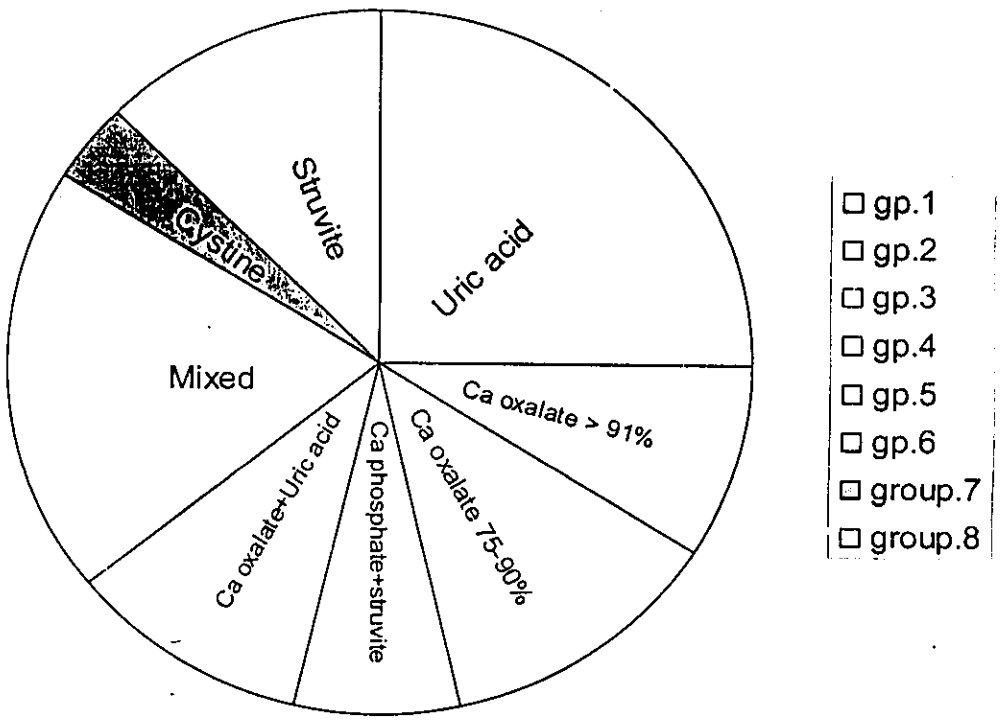

Fig (4): The 8 different stone groups in the study.

Table (7): The number, mean volume, mean density in HU and the standard deviation of different stone groups.

	V (Volume)	C1 (CT reading 1)	C2 (CT reading 2)	C3 (Ct reading 3)	CALL (average)
Group 1					
Mean	19.4166	448.6429	452.0714	462.00	454.24
N	14	14	14	14	14
SD	10.5845	58.5210	53.6276	64.0877	53.3
Group 2					
Mean	49.6960	1301.60	1265.20	1238.00	1268.27
N	5	5	5	5	5
SD	25.6623	123.4476	136.1165	169.7174	94.72
Group 3					
Mean	16.8757	1144.1429	1177.4286	1070.8571	1130.81
N	7	7	7	7	7
SD	14.5427	40.5973	56.5829	58.4991	38.08
Group 4					
Mean	41.1250	934.75	1013.2500	975.50	974.5
N	4	4	4	4	4
SD	21.5263	74.1996	67.9626	73.8489	71.69
Group 5					
Mean	30.1867	694.8333	706.8333	715.6667	705.87
N	6	6	6	6	6
SD	26.8118	78.9517	103.8353	132.5740	102.64
Group 6					
Mean	27.8673	899.5455	982.6364	989.2727	957.15
N	11	11	11	11	11
SD	25.5413	190.3485	224.3989	231.1091	206.46

N.B.: Groups 7 & 8 being statistically insignificant were excluded.

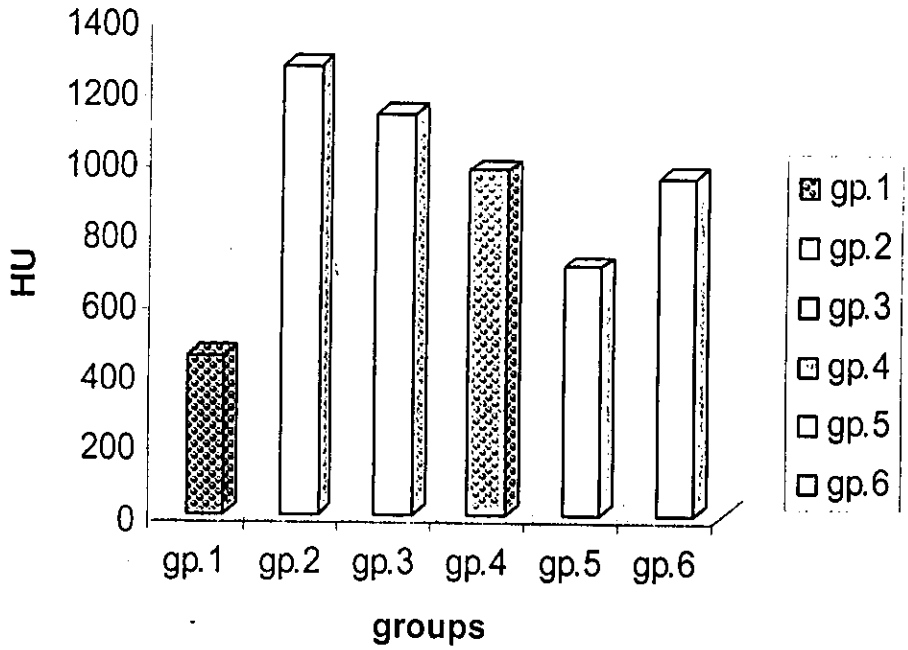

Fig (5): The mean HU of each of the main 6 groups.

Table (8): Comparison between group 1 and 2 including number, volume, HU and standard deviation.

	GROUP	N	Mean	SD
V (CC3)	1	14	19.4166	10.5845
	2	5	49.6960	26.6623
C all (HU)	1	14	454.24	53.30
	2	5	1268.27	94.72

Group 1 Uric acid

Group 2 Ca oxalate monohydrate >91%

Table (9): The significance of the variation in volume and C all difference between the group 1& 2.

	t-test for equality of means sig. (2-tailed)	
V		
Equal variances not assumed	.062	insignificant
C all		
Equal variances not assumed	.000	highly significant

Table (10): Comparison between group 1 and 3 including number, volume, HU and standard deviation.

	GROUP	N	Mean	SD
V (CC3)	1	14	19.4166	10.5845
	3	7	16.8757	14.5427
C all (HU)	1	14	454.24	53.30
	3	7	1130.81	38.08

Group 1 Uric acid

Group 3 Ca oxalate mono hydrate 90-75%

Table (11): The significance of the variation in volume and C all difference between the group 1& 3.

	t-test for equality of means sig. (2-tailed)	
V		
Equal variances not assumed	.690	insignificant
C all		
Equal variances not assumed	.000	highly significant

Table (12): Comparison between group 1 and 4 including number, volume, HU and standard deviation.

	GROUP	N	Mean	SD
V (CC3)	1	14	19.4166	10.5845
	4	4	41.1250	21.5263
C all (HU)	1	14	454.24	53.30
	4	4	974.5	51.69

Group 1 Uric acid

Group 4 Ca oxalate monohydrate + Struvite

Table (13): The significance of the variation in volume and C all difference between the group 1& 4.

	t-test for equality of means sig. (2-tailed)	
V		
Equal variances not assumed	.135	insignificant
Call		
Equal variances not assumed	.000	highly significant

Table (14): Comparison between group 1 and 5 including number, volume, HU and standard deviation.

	GROUP	N	Mean	SD
V (CC3)	1	14	19.4166	10.5845
	5	6	30.1867	26.8118
C all (HU)	1	14	454.24	53.30
	5	6	705.78	102.64

Group 1 Uric acid

Group 5 Ca oxalate mono hydrate 90-75%

Table (15): The significance of the variation in volume and C all difference between the group 1& 5.

	t-test for equality of means sig. (2-tailed)	
V		
Equal variances not assumed	.380	insignificant
Call		
Equal variances not assumed	.001	highly significant

Table (16): Comparison between group 1 and 6 including number, volume, HU and standard deviation.

	GROUP	N	Mean	SD
V (CC3)	1	14	19.4166	10.5845
	6	11	27.8673	25.5413
Call (HU)	1	14	454.24	53.30
	6	11	957.15	206.46

Group 1 Uric acid.

Group 6 Mixed stones.

Table (17): The significance of the variation in volume and C all difference between the group 1& 6.

	t-test for equality of means sig. (2-tailed)	
V Equal variances not assumed	.322	insignificant
Call Equal variances not assumed	.000	highly significant

Table (18): Comparison between group 2and 3 including number, volume, HU and standard deviation.

	GROUP	N	Mean	SD
V	2	5	49.690	26.6623
(CC3)	3	7	16.8757	14.5427
C all	2	5	1268.27	94.72
(HU)	3	7	1130.81	38.08

Table (19): The significance of the variation in volume and C all difference between the group 2& 3.

	t-test for equality of means sig. (2-tailed)	
V Equal variances not assumed	.094	insignificant
Call Equal variances not assumed	.028	highly significant

Table (20): Comparison between group 2and 4 including number, volume, HU and standard deviation.

	GROUP	N	Mean	SD
V (CC3)	2	5	49.690	26.6623
	4	4	41.1250	21.5263
C all (HU)	2	5	1268.27	94.72
	4	4	974.5	51.69

Table (21): The significance of the variation in volume and C all difference between the group 2& 3.

	t-test for equality of means sig. (2-tailed)	
V Equal variances not assumed	.610	insignificant
C all Equal variances not assumed	.001	highly significant

Table (22): Comparison between group 2and 5 including number, volume, HU and standard deviation.

	GRUOP	N	Mean	SD
V	2	5	49.690	26.6623
(CC3)	5	6	30.1867	26.8118
C all	2	5	1268.27	94.72
(HU)	5	6	705.78	102.64

Table (23): The significance of the variation in volume and C all difference between the group 2& 5.

	t-test for equality of means sig. (2-tailed)	
V Equal variances not assumed	.260	insignificant
C all Equal variances not assumed	.000	highly significant

Table (24): Comparison between group 2and 6 including number, volume, HU and standard deviation.

	GROUP	N	Mean	SD
V (CC3)	2	5	49.690	26.6623
	6	11	27.8673	25.5413
C all (HU)	2	5	1268.27	94.72
	6	11	957.15	206.46

Table (25): The significance of the variation in volume and C all difference between the group 2& 6.

	t-test for equality of means sig. (2-tailed)	
V		
Equal variances not assumed	.165	insignificant
Call		
Equal variances not assumed	.001	highly significant

Table (26): Comparison between group 3 and 4 including number, volume, HU and standard deviation.

	GROUP	N	Mean	SD
V	3	7	16.8757	14.5427
(CC3)	4	4	41.1250	21.5263
C all	3	7	1130.81	38.08
(HU)	4	4	974.5	51.69

Table (27): The significance of the variation in volume and C all difference between the group 3& 4.

	t-test for equality of means sig. (2-tailed)	
V Equal variances not assumed	.106	insignificant
C all Equal variances not assumed	.003	highly significant

Table (28): Comparison between group 3 and 5 including number, volume, HU and standard deviation.

	GROUP	N	Mean	SD
V (CC3)	3	7	16.8757	14.5427
	5	6	30.1867	26.8118
C all (HU)	3	7	1130.81	38.08
	5	6	705.78	102.64

Table (29): The significance of the variation in volume and C all difference between the group 3& 5.

	t-test for equality of means sig. (2-tailed)	
V Equal variances not assumed	.311	insignificant
C all Equal variances not assumed	.000	highly significant

Table (30): Comparison between group 3 and 6 including number, volume, HU and standard deviation.

	GROUP	N	Mean	SD
V	3	7	16.8757	14.5427
(CC3)	6	11	41.1250	25.5413
C all	3	7	1130.81	38.08
(HU)	6	11	957.15	206.46

Table (31): The significance of the variation in volume and C all difference between the group 3& 6.

	t-test for equality of means sig. (2-tailed)	
V		
Equal variances not assumed	.262	insignificant
C all		
Equal variances not assumed	.020	significant

Table (32): Comparison between group 4 and 5 including number, volume, HU and standard deviation.

	GROUP	N	Mean	SD
V (CC3)	4	4	41.1250	21.5263
	5	6	30.1867	26.8118
C all (HU)	4	4	974.5	51.69
	5	6	705.78	102.64

Table (33): The significance of the variation in volume and C all difference between the group 4& 5.

	t-test for equality of means sig. (2-tailed)	
V		
Equal variances not assumed	.498	insignificant
C all		
Equal variances not assumed	.001	highly significant

Table (34): Comparison between group 4and 6 including number, volume, HU and standard deviation.

	GROUP	N	Mean	SD
V	4	4	41.1250	21.5263
(CC3)	6	11	27.8673	25.5413
C all	4	4	974.5	51.69
(HU)	6	11	957.15	206.46

Table (35): The significance of the variation in volume and C all difference between the group 4& 6.

	t-test for equality of means sig. (2-tailed)	
V Equal variances not assumed	.353	insignificant
C all Equal variances not assumed	.301	insignificant

Table (36): Comparison between group 5 and 6 including number, volume, HU and standard deviation.

	GROUP	N	Mean	SD
V (CC3)	5	4	30.1867	26.8118
	6	6	27.8673	25.5413
C all (HU)	5	4	705.78	102.64
	6	6	957.15	206.46

Table (37): The significance of the variation in volume and C all difference between the group 5& 6.

	t-test for equality of means **sig. (2-tailed)**	
V		
Equal variances not assumed	.866	insignificant
C all		
Equal variances not assumed	.004	highly significant

As regard the volume measurement of 50 urinary stones, we found that NCHCT can accurately detect the volume of 48 stones (96% accuracy). Disagreement in measurement between preoperative and postoperative measurement our study ranged from 3.4 % to 4 %. (Table 38)

Table (38): The accuracy of volume measurement by spiral CT.

Vol.	No.	%	Accurate measurement	Disagreement
1-10 cc^3	7	14%	7	0
11-20 cc^3	12	24%	12	0
21-30 cc^3	14	28%	13	1
31-40 cc^3	11	22%	10	1
> 41 cc^3	6	12%	6	0
Total	50	100%	48	2

2- Group 2

UTP was used in imaging of urinary stones in patients with flank pain. In our study we found that UTP gives positive results in 25 of the 95 patients (26 %), with sensitivity of 55% and specificity of 57%.

In 44 of the 95 patients (46%) NCHCT was positive for urinary calculi including ureteral in 26 patients (59%), renal in 15 patients (34%) and both in 3 patients (7%). (table 39)

Table (39): Unenhanced helical CT findings of 95 patients with renal colic.

CT findings	No.	%
Positive	44	46
Negative	43	45
Indeterminate	8	9
Total	95	100%

In 43 patients (45%) no urinary stones were identified on CT images while in 8 patients (9%) the diagnosis of calculi were indeterminate. (table 40)

Table (40): Positive CT findings of the 44 patients with 47 urinary calculi.

	No.	%
Ureteral	26	59
Renal	15	34
Both	3	7
Total	44	100%

Within the 44 patients with 47 urinary calculi we found that 22 patients (47%) had spontaneous stone passage and patients catch them, 8 patients (17%) had improved symptoms after unnoticed stone passage (discovered during follow up CT). Urological intervention required in 14 patients (29%) either by ESWL or by surgical intervention while 3 patients (3%) were lost in follow up.

Table (41): Follow up results of patients with positive CT of urinary calculi.

Follow up results in CT positive patients	No.	%
Spontaneous passage	22	47
Unnoticed passage with improved symptoms	8	17
Required intervention	14	29
Lost follow up	3	7
Total	47	100%

Within the 43 patients with negative CT findings we found that 11 patients (35%) had other pathology, 30 patients (70%) no urinary or extraurinary cause and 2 patients (5%) had missed urinary stones.

Table (42): The results of patients with negative CT findings for urinary stones.

Results of CT negative patients	No.	%
No urinary or extraurinary causes	30	70
Other pathology	11	25
Missed urinary stones	2	5
Total	43	100%

In the 8 patients (9%) with indeterminate CT findings we found that it may be due to presence of distal ureteral stones in patients with multiple pelvic phleboli (2patients), no urinary stones or other pathology (6 patients).

In our study we found that NCHCT had a sensitivity of 96%, specificity of 95 % and overall accuracy of 96 %.

The rate of spontaneous stone passage depends upon the size and the position of the stone. The smaller the stone size the higher the incidence of spontaneous passage also, the distal stones are more liable to spontaneous passage than the proximal stones.

Table (43): The relation between stone size and its spontaneous passage.

Stones size	Number	Spontaneous passage	%
3-4 mm	8	6	75%
5-6 mm	13	8	61%
7-9 mm	14	6	42%
1 cm or more	12	2	17%
Total	47	22	47

Table (44): The relation between stone position and its spontaneous passage.

Stones position	Number	Spontaneous passage	%
Renal	18	6	33%
Proximal (lumbar) ureter	10	5	50%
Distal (iliac & pelvic) ureter	14	8	57%
Ureterovesical junction	5	3	60%
Total	47	22	47%

Signs of obstruction were noted in 22 patients in our study. We found that 8 patients had backpressure changes, 6 patients had perinephic tissue stranding, 5 patients had tissue rim sign and 3 patients had more than one sign.

Table (45): CT findings in patients with ureteral stones.

Signs of obstructing ureteral stones	Number	%
Backpressure changes	8	28
Perinephiac tissue stranding	6	20
Tissue rim sign (no obstruction)	5	16
More tha one sign.	3	12
No signs of obstruction.	7	24
Total	29	100%