Results and Data Analysis

Patients were selected according to pre-determined parameters considering age and presenting symptoms. The overall number of examined patients was 100; 22 males (22%) and 78 females (78%). Age ranged from 4 months to 16 years and mean age was 3.3.

Tables (1-3-4-5-6-7) are descriptive for all the data of the included cases namely age, sex, onset of disease, symptoms, recurrence rate of UTI per year, organism detected in 3 samples taken at 3 active attacks, blood pressure, creatinine and B.U.N.

The tables also describe the Imaging Findings (ultrasound, IVP, VCUG, DMSA and DTPA), when indicated in the included cases (accordingly).

Table (2) illustrates the right and left renal lengths every 6 months for each patient determined by ultrasound.

Analysis of these findings is presented as:

I-   **Group Characteristics:** *(as illustrated in the descriptive table (1):*

This study included 100 patients suffering recurrent urinary tract infection which started early in their life and were followed up for 2 years.

A. Age Distribution:

The age of children varied between 4 months and 16 years with a mean = 3.3 and a standard deviation = 0.33 years, 34 cases (34%) showed the onset of the 1st infection below 2 years and 66% showed the onset of the 1st infection above 2 years.

B- Sex Distribution:

Patients were 22 males (22%) and 78 females (78%) with a male to female ratio = 2:7.

C. Recurrence Rate:

The rate of recurrence of the disease as reported by mothers, varied between 4 and 10 times / year with a mean = 5.9±1.1 times (Table 8).

13	Female
14	male
15	male
16	Female
17	male
18	Female
19	male
20	male
21	Female
22	Female
23	male
24	Female
25	male
26	Female
27	Female
28	Female
29	male
30	Female
31	Female
32	Female
33	Female
34	Female
35	Female
36	Female
37	Female
38	Female
39	Female
40	Female
41	male
42	male
43	Female
44	Female
45	male
46	Female
47	male
48	Female
49	male
50	Female
51	Female
52	Female

Table (2): Ultrasound Renal Length Follow up Every 6 months of the included cases

No.	Right Kidney				Left Kidney			
	L1	L2	L3	L4	L1	L2	L3	L4
1	7.2	8.3	8.7	9	5.9	6.6	6.9	6.1
2	5.5	6.3	6.3	6.3	5.5	6.4	6.4	6.6
3	8.9	9.1	9.3	-	5	4.7	4.1	-
4	7.5	6.9	6.2	-	7.2	7.5	8.5	-
5	5.7	5.7	5.9	-	5.6	5.6	5.7	-
6	10.5	10.5	11	-	10.2	10.4	10.8	-
7	-	-	-	-	7.8	8.2	8.6	-
8	7.8	7.5	7.3	-	8.6	9.1	9.3	-
9	8.7	9.2	9.4	-	6.2	6	5.7	-
10	4.2	4.2	4.4	-	5.2	5.2	5.4	-
11	8.9	9.1	9.4	-	5.6	5.5	5	-
12	6.2	6.6	6.6	6.8	7.5	8.4	9.1	9.3
13	7.5	8	8.5	-	5.6	6	6.5	-
14	6.2	6.3	6.4	-	7.4	7.6	7.9	-
15	8.4	8.6	8.9	-	5.5	5.8	6	-
16	7	7.3	7.5	7.9	7.4	7.4	7.7	8.2
17	8.4	8.7	9.2	9.4	8.7	8.7	8.9	9.1
18	7.6	7.9	8.1	-	8	6.9	6.5	-
19	6.7	6.7	6.5	-	8.1	8.3	8.4	-
20	13.2	13	10.2	-	13.3	13.3	10.2	-
21	7.4	7.7	8	-	7.6	7.7	8.1	-
22	7.8	8.1	8.3	-	8.1	8.5	8.7	-
23	11.6	12	12.3	-	11.5	12	12.3	-
24	6.3	7	7.4	-	7.3	8	9	-
25	7.4	7.7	7.9	-	8	8.2	8.4	-
26	7.6	8	8.2	-	7.6	7.8	8.1	-
27	8.4	8.7	9	-	8.7	9.2	9.4	-
28	7.9	8.3	8.5	-	8	8.5	8.8	-
29	7.4	7.9	8.6	-	7.8	8.3	8.6	-
30	6.3	6.7	7.1	-	6.8	6.9	7.2	-
31	7	7.5	8	8.4	7.1	7.2	7.8	8.2
32	6.5	6.7	6.9	-	6.5	6.8	7	-
33	6.4	6.6	6.9	-	6.6	6.7	7	-
34	7	7.5	7.8	-	6.9	7.2	7.5	-
35	6.6	7.3	8	-	7.6	8.2	8.8	-
36	7	7.4	7.8	-	6.1	6.4	6.8	-
37	6.5	7.1	7.6	8	7.4	7.8	7.8	8.4
38	8.3	8.7	9.1	-	8.1	8.6	9.3	-
39	7.6	7.9	8.1	-	7.4	7.7	8.2	-
40	12	10	9.5	-	11.2	9.9	9.5	-
41	6.6	7.4	7.7	-	7.1	7.1	7.4	-
42	6.7	6.9	7	-	8.1	8.4	9	-
43	6.6	7.1	7.4	7.8	6.5	6.7	7	7.5
44	8.5	8.9	9.1	-	4	3.7	3.2	-
45	7.4	7.7	8	-	7.8	8	8.4	-
46	9.3	9.5	9.6	-	7.4	7.7	7.9	-
47	7.7	8	8.5	-	8.1	8.3	8.7	-
48	6.1	6.6	7.1	-	6.6	6.6	7.1	-
49	5.6	6.1	6.6	-	5.9	6.4	6.7	-
50	8.3	8.6	8.8	9.1	8.5	8.7	8.6	9.1
51	7.7	8.1	8.3	8.4	8	8.1	8.3	8.5
52	8.2	8.5	8.7	9	7.7	7.9	8.3	8.9
53	8.4	8.6	8.8	9	7.9	8.5	8.5	8.7
54	6	6.2	7	7.3	6.5	6.5	7	7.4

Table (2): Ultrasound Renal Length Follow up Every 6 months of the included cases (Cont).

No.								
55	6.8	7.1	7.3	-	7	7.2	7.5	-
56	7.1	7.5	7.5	-	6.8	7	7.2	-
57	7	7.3	7.5	-	6.9	7.1	7.4	-
58	9	9.1	9.4	-	9.2	9.5	9.7	-
59	7	7	7.2	7.4	7	7.4	7.5	7.7
60	5.3	6.3	6.5	6.9	5.8	6.3	7	7.4
61	7.7	8	8	8.2	8	8.1	8.2	8.4
62	6.4	6.7	7	-	6.5	6.8	7.1	-
63	6.8	7.1	7.7	7.9	6.8	7.5	7.8	8.3
64	8.1	8.3	8.6	-	8.2	8.4	8.7	-
65	6.2	6.5	6.8	-	6.6	6.7	6.9	-
66	8	8.1	8.3	8.5	7.8	7.8	8	8.3
67	5.6	6.4	6.7	6.8	5.9	6.4	6.9	7.1
68	5	5.7	6.4	6.7	5.2	5.6	6.4	6.7
69	8	8.3	8.5	-	7.4	7.8	8.1	-
70	6.1	6.7	6.8	7.2	6.4	6.7	7	7.5
71	6.9	7.1	7.3	-	7	7.3	7.5	-
72	6.4	6.6	6.8	-	6.1	6.6	6.7	-
73	7.7	8	8.2	-	8	8.2	8.5	-
74	7.4	7.6	7.9	-	7.8	8	8.2	-
75	8.2	8.3	8.5	-	8.8	9	9.1	-
76	8.1	8.3	8.5	-	7.9	8.3	8.6	-
77	7.4	7.7	8.5	-	7.9	8.1	8.6	-
78	5.4	5.7	6	-	5.9	6.2	6.5	-
79	7	7.2	7.5	-	6.2	6.5	6.9	-
80	6.2	6.6	6.8	-	7.1	7.3	7.4	-
81	8	8.2	8.5	-	7.4	7.7	7.9	-
82	8.2	8.5	8.7	-	8.2	8.6	8.9	-
83	6.7	6.9	7	-	6.8	7.2	7.6	-
84	7.3	7.5	7.8	7.3	7.5	7.7	8	7.8
85	6.5	7	7.2	-	6.7	7.1	7.3	-
86	8.1	8.3	8.6	-	7.6	8	8.3	-
87	8	8.2	8.5	-	8	8.3	8.6	-
88	6.7	7	7.4	-	7	7.2	7.5	-
89	7.3	7.5	7.9	-	7.1	7.4	7.5	-
90	6.8	7.2	7.9	-	7.1	7.6	8.2	-
91	6.5	6.7	7	-	6.9	7.2	7.5	-
92	8.3	8.5	8.8	-	8.8	9.1	9.4	-
93	7	7.5	8.4	-	7.6	8	8.5	-
94	7.8	8	8.2	-	6.8	7.3	7.7	-
95	6.5	6.7	6.9	-	6.7	7	7.2	-
96	8.4	8.6	9	-	8.7	8.9	9.2	-
97	9.5	9.7	9.9	-	9.7	9.9	10	-
98	7.6	7.7	8	-	7.7	8	8.3	-
99	6.9	7.1	7.4	-	6.3	6.7	7	-
100	8.3	8.5	8.7	-	8.6	8.8	9	-

Table (4): I.V P Findings of the indicated cases (49 cases)

Cases	Renal Size		Power of contrast & excretion		Renal scar		Congenital anomalies		Pelvicalyceal system		Ureters		Renal stones		Residual urine	Bladder stone
	R.T	L.T	R.T	L.T	R.T	L.T	R.T	L.T	R.T	L.T	R.T	L.T	R.T	L.T		
1	normal	small	normal	normal	no	no	No	normal	normal	dilated pelvis	normal	normal	normal	no	-	-
2	normal	normal	normal	normal	no	no	normal	normal	normal	normal	normal	no excretion of dye	normal	no excretion of dye	-	-
3	large	non func.	normal	non func.	no	no	duplex	non func.	normal	normal	duplex	normal	normal	no	-	-
4	small	normal	normal	normal	no	no	duplex	normal	dil. pelvicalyc	normal	normal	normal	normal	no	-	-
5	small	large	normal	normal	no	no	horse-shoe	horse-shoe	normal	normal	normal	normal	normal	no	+	-
6	large	small	delayed	normal	no	no	poly cystic	poly cystic	normal	normal	normal	normal	no excretion of dye	no	+	-
7	non func.	normal	non func.	delayed	non func.	no	non func.	normal	dil. pelvicalyc	normal	dilated	dilated	normal	no	-	-
8	large	normal	normal	normal	no	no	normal	normal	dil. pelvicalyc	dil. pelvicalyc	normal	normal	normal	no	-	-
9	normal	small	normal	delayed	no	no	horse-shoe	horse-shoe	dilated pelvis	dilated pelvis	normal	no excretion of dye	normal	no excretion of dye	-	-
10	small	small	normal	normal	no	no	No	No	normal	normal	normal	normal	normal	no	-	-
11	normal	non func.	normal	non func.	no	non func.	No	No	dilated pelvis	normal	normal	normal	normal	no	-	-
12	normal	small	normal	normal	no	no	normal	normal	dil. pelvicalyc	normal	dilated	normal	normal	no	-	-
13	normal	small	normal	normal	no	no	normal	normal	normal	normal	normal	normal	normal	no	-	-
14	normal	normal	normal	normal	no	no	normal	ectopic	normal	dilated	normal	dilated	normal	no	-	-
15	large	small	normal	normal	no	no	normal	normal	dil. pelvis	dilated pelvis	normal	dilated	normal	no	-	-
16	normal	normal	normal	normal	no	no	normal	normal	normal	dilated pelvicalyceal	normal	dilated	normal	no	-	-
17	normal	large	normal	normal	no	no	normal	normal	normal	dilated pelvicalyceal	normal	normal	normal	no	-	-
18	normal	normal	normal	delayed	scar	no	normal	normal	no excretion of dye	normal	no excretion of dye	normal	no excretion of dye	no excretion of dye	-	-
19	small	normal	normal	normal	non func.	non func.	non func.	non func.	normal	normal	normal	normal	normal	no	-	-
20	non func.	non func.	non func.	non func.	non func.	no	normal	normal	normal	normal	normal	normal	normal	no	-	-
21	normal	normal	normal	normal	no	no	normal	normal	normal	normal	normal	normal	normal	multiple	-	-
22	large	large	normal	normal	no	no	poly cystic	poly cystic	normal	normal	normal	normal	normal matrix	no	+	+
23	normal	normal	delayed	delayed	no	no	normal	normal	dilated pelvicalyceal	dilated pelvicalyc	normal	normal	renal multiple	pelvic	+	-
24	normal	normal	delayed	delayed	no	no	normal	normal	normal	normal	normal	normal	normal	no	+	-
25	normal	normal	normal	normal	no	no	normal	normal	dil. pelvicalyc	normal	normal	normal	normal	no	-	-
26	normal	normal	normal	normal	no	no	normal	normal	normal	normal	normal	normal	normal	no	-	-
27	normal	normal	normal	normal	no	no	normal	normal	normal	normal	normal	normal	normal	no	+	-
28	normal	normal	normal	normal	no	no	normal	normal	normal	normal	normal	normal	normal	no	-	-
29	normal	normal	normal	normal	no	no	normal	normal	normal	normal	normal	normal	normal	no	+	-
30	normal	normal	normal	normal	no	no	normal	normal	normal	normal	normal	normal	normal	no	+	-
31	normal	normal	normal	normal	no	no	normal	normal	normal	normal	normal	normal	normal	no	+	-
32	normal	normal	normal	normal	no	no	normal	normal	normal	normal	normal	normal	normal	no	-	-
33	normal	normal	normal	normal	no	no	normal	normal	normal	normal	normal	normal	normal	no	+	-
34	normal	normal	normal	normal	no	no	normal	normal	normal	normal	normal	normal	normal	no	-	-
35	large	normal	normal	normal	no	no	normal	normal	normal	normal	normal	normal	normal	no	-	-
36	normal	normal	delayed	delayed	no	no	normal	normal	normal	normal	normal	normal	normal	no	-	-
37	normal	normal	normal	normal	no	no	normal	normal	dil. pelvicalyc	normal	normal	normal	normal	no	+	-
38	normal	normal	normal	normal	no	no	normal	normal	normal	normal	normal	dilated	normal	no	-	-
39	normal	large	normal	normal	no	no	normal	normal	pelvicalyc	normal	dil.	normal	normal	no	-	-
40	large	normal	delayed	delayed	no	no	normal	normal	normal	dil. pelvicalyc	dilated	normal	normal	no	-	-
41	normal	normal	delayed	normal	Scar	no	normal	normal	dil. pelvicalyc	normal	dilated	normal	normal	no	-	-
42	small	normal	normal	normal	no	no	normal	normal	normal	normal	normal	no excretion of dye	normal	no excretion of dye	-	-
43	normal	non func.	normal	non func.	no	non func.	non func.	non func.	no excretion of dye	normal	no excretion of dye	normal	normal	no	-	-
44	normal	non func.	non func.	non func.	no	no	normal	normal	normal	normal	normal	normal	normal	no	+	+
45	normal	normal	normal	normal	no	no	normal	normal	dil. Petvicalyc	normal	normal	normal	normal	no	-	-
46	normal	normal	normal	normal	no	no	normal	normal	normal	normal	normal	normal	normal	no	+	-
47	normal	normal	normal	normal	no	no	normal	normal	normal	normal	normal	normal	normal	no	+	+
79	normal	normal	normal	normal	no	no	normal	normal	normal	normal	normal	normal	normal	no	-	-
80	normal	normal	normal	normal	no	no	normal	normal	normal	normal	normal	normal	normal	no	-	-
100	normal	normal	normal	normal	no	no	normal	normal	normal	normal	normal	normal	normal	no	-	-

Table: (5): V.C U.G. Findings in the indicated cases (71 Cases)

Cases	Bladder Filling defect	V.U.R. R.T	V.U.R. L.T
1	No	No	grade III
2	No	grade I	No
3	No	No	grade III
4	No	grade III	No
7	No	No	grade IV
8	No	grade IV	No
12	No	No	No
13	No	No	No
14	No	grade III	No
15	No	No	grade III
16	No	grade II	grade III
17	No	No	grade IV
18	No	grade III	No
21	No	grade I	No
22	No	No	No
23	No	No	No
25	Stone	No	No
26	No	No	No
28	No	No	grade I
29	No	No	No
30	No	No	No
31	No	No	No
32	No	No	No
33	No	No	No
34	No	No	No
35	No	No	No
36	No	No	No
37	No	No	No
39	No	No	grade I
41	No	grade I	No
43	No	No	No
45	No	grade II	No
48	No	No	No
49	No	No	No
54	No	No	No
55	No	No	No
56	No	No	No
57	No	No	No
59	No	No	No
60	No	No	No
61	No	No	No
62	No	No	No
63	No	No	No
65	No	No	No
66	No	No	No
67	No	No	No
68	No	No	grade I
69	No	No	No
70	No	No	No
71	No	No	No
72	No	No	No
75	No	No	No
78	No	No	No
79	No	No	No
80	No	No	No
82	No	No	No
83	No	No	No
84	.No	No	No
85	No	No	No
86	No	No	No
87	No	No	No
88	No	No	No
89	No	No	No
90	No	No	No
91	No	No	No
93	No	No	No
94	No	No	No
95	No	No	No
96	No	No	No
98	No	No	No
99	No	No	No

Table (6): [

Cases	Renal size		Renal site		Renal Pattern		
	R.T	L.T	R.T	L.T	R.T	L.T	
1	average	small	normal	normal	normal	normal	
2	average	average	normal	normal	normal	normal	
3	large	atrophic	normal	normal	normal	normal	
4	small	average	normal	normal	normal	normal	
5	small	small	horse-shoe	horse-shoe	Poly cystic	Poly cystic	
6	large	large	normal	normal	Absent	normal	al
7	absent	large	absent	normal	normal	normal	
8	large	average	normal	normal	normal	normal	
9	average	average	normal	normal	normal	normal	
10	small	small	horse-shoe	horse-shoe	normal	normal	
11	average	atrophic	normal	normal	normal	normal	
12	small	average	normal	normal	normal	normal	
13	large	small	normal	normal	normal	normal	
14	average	average	normal	normal	normal	normal	
15	average	small	normal	ectopic	normal	normal	
16	average	average	normal	normal	normal	normal	
17	small	large	normal	normal	normal	normal	
18	average	large	normal	normal	normal	normal	
19	small	average	normal	normal	normal	normal	
20	large	large	normal	normal	normal	normal	
21	average	average	normal	normal	normal	normal	
22	average	average	normal	normal	Poly cystic	Poly cystic	
23	large	large	normal	normal	normal	normal	
24	small	average	normal	normal	normal	normal	
25	average	average	normal	normal	normal	normal	
26	average	average	normal	normal	normal	normal	
27	average	average	normal	normal	normal	normal	
28	average	average	normal	normal	normal	normal	
29	average	average	normal	normal	normal	normal	
30	average	average	normal	normal	normal	normal	
31	average	average	normal	normal	normal	normal	
32	average	average	normal	normal	normal	normal	
33	average	average	normal	normal	normal	normal	
34	average	average	normal	normal	normal	normal	
35	average	average	normal	normal	normal	normal	
36	average	average	normal	normal	normal	normal	
37	average	average	normal	normal	normal	normal	
38	average	average	normal	normal	normal	normal	
39	average	average	normal	normal	normal	normal	
40	large	large	normal	normal	normal	normal	
41	average	average	normal	normal	normal	normal	
42	small	average	normal	normal	normal	normal	
43	average	average	normal	normal	normal	normal	
44	average	atrophy	normal	normal	normal	normal	
45	average	average	normal	normal	normal	normal	
46	average	large	normal	normal	normal	normal	
47	average	average	normal	normal	normal	normal	
48	average	average	normal	normal	normal	normal	
49	average	average	normal	normal	normal	normal	
50	average	average	normal	normal	normal	normal	
51	average	average	normal	normal	normal	normal	
52	average	average	normal	normal	normal	normal	
53	average	average	normal	normal	normal	normal	
54	average	average	normal	normal	normal	normal	
55	average	average	normal	normal	normal	normal	
56	average	average	normal	normal	normal	normal	
57	average	average	normal	normal	normal	normal	
58	average	average	normal	normal	normal	normal	
59	average	average	normal	normal	normal	normal	
60	average	average	normal	normal	normal	normal	
61	average	average	normal	normal	normal	normal	
62	average	average	normal	normal	normal	normal	
63	average	average	normal	normal	normal	normal	
64	average	average	normal	normal	normal	normal	
65	average	average	normal	normal	normal	normal	
66	average	average	normal	normal	normal	normal	
67	average	average	normal	normal	normal	normal	
68	average	average	normal	normal	normal	normal	
69	average	average	normal	normal	normal	normal	
70	average	average	normal	normal	normal	normal	
71	average	average	normal	normal	normal	normal	
72	average	average	normal	normal	normal	normal	
73	average	average	normal	normal	normal	normal	
74	average	average	normal	normal	normal	normal	
75	average	average	normal	normal	normal	normal	
76	average	average	normal	normal	normal	normal	
77	average	average	normal	normal	normal	normal	
79	average	average	normal	normal	normal	normal	
80	average	average	normal	normal	normal	normal	
95	average	average	normal	normal	normal	normal	
97	average	average	normal	normal	normal	normal	
100	average	average	normal				

Table (7) DTPA of the indicated cases of the study (26 cases)

Cases	Renal Perfusion		Renal Acumulation		Renal excretion		Glom. filtration rate	
	R.T	L.T	R.T	L.T	R.T	L.T	R.T	L.T
1	Normal	Decreased	Normal	Decreased	Normal	delayed	68.50%	31.50%
3	Normal	Decreased	Normal	No accumulation	Normal	delayed	100%	%
4	Decreased	Normal	Decreased	Normal	delayed	Normal	48.90%	51.10%
5	Normal	Normal	Normal	Normal	Normal	Normal	48.00%	51%
6	Decreased	Decreased	Decreased	Decreased	Normal	Normal	3.40%	6.73%
7	No perfusion	Normal	No accumulation	Normal	No excretion	Normal	0.01%	99.99%
8	Decreased	Decreased	Decreased	Decreased	delayed	delayed	37%	63.10%
9	Normal	Normal	Normal	Normal	Normal	delayed	61%	38.40%
10	Normal	Normal	Normal	Decreased	delayed	delayed	48%	51%
11	Normal	Decreased	Normal	Normal	Normal	delayed	89%	11%
12	Decreased	Normal	Decreased	Normal	delayed	Normal	41%	59%
13	Normal	Decreased	Normal	Normal	Normal	delayed	66.90%	34%
14	Decreased	Normal	Decreased	Decreased	delayed	Normal	4%	90%
15	Normal	Normal	Normal	Normal	Normal	Normal	54%	46%
17	Normal	Normal	Normal	Decreased	Normal	delayed	54%	46%
18	Normal	Decreased	Normal	Decreased	Normal	delayed	70%	30%
19	Decreased	Normal	Decreased	Normal	delayed	Normal	39%	61%
20	Decreased	Decreased	Decreased	Decreased	delayed	delayed	57%	41%
23	Decreased	Decreased	Decreased	Decreased	Normal	Normal	49%	49%
24	Decreased	Decreased	Decreased	Normal	delayed	delayed	41%	58%
26	Normal	Normal	Normal	Normal	delayed	Normal	50%	51%
40	Decreased	Decreased	Decreased	Decreased	Normal	Normal	48.60%	52%
41	Decreased	Decreased	Decreased	Decreased	Normal	delayed	48%	52%
42	Decreased	Normal	Decreased	Normal	delayed	Normal	27%	72%
44	Normal	No perfusion	Normal	No accumulation	delayed	No excretion	100%	0%
46	Normal	Decreased	Normal	Normal	Normal	delayed	60%	40%

Table (8): Rate of recurrence of disease / year (symptoms and signs of urinary tract infection as mentioned by the mother among 100 patients suffering from recurrent UTI at the 1st presentation.

Rate / year	Frequency
4	6
5	34
6	37
7	14
8	8
9	0
10	1

Mean = 5.88   S.D. = 1.09.

D- Symptomatology: (Table 9).

As shown in table (9) **upper urinary tract symptoms** were present in 54 children = 54%. These symptoms were fever in 45 children and flank pain in 27 children. Fever was presented alone in 27 patients, flank pain was presented alone in 9 patients. Both fever and flank pain were presented in 18 patients.

Lower urinary tract symptoms were reported by all children = 100%. The most frequent symptom was dysuria, reported by 87 children followed by turbid urine in 75 children, frequency of micturition in 74 children, nocturnal enuresis in 59 children, suprapubic pain in 31 children, day enuresis in 14 children. Red urine was the least frequent symptom, reported by 11 children only.

Both upper and lower symptoms were present in 54% of cases.

Table (9): Frequency of different symptoms of urinary tract infection reported by mothers of 100 children included in the study.

Symptoms	Frequency
Upper UTI:	
None	46
Fever	45
Flank pain	27
Lower UTI:	
None	0
Dysuria	87
Turbid urine	75
Frequency of micturition	74
Nocturnal enuresis	59
Suprapubic pain	31
Day enuresis	14
Red urine	11
Others	18

E. Blood Pressure:

4 cases (4%) had elevated blood pressure and were on effective antihypertensive therapy.

F. Previous Investigations:

Some of the patients included in this study were previously investigated during the preceding episodes of infection where they performed ultrasound, MCUG and or IVP.

G. Previous Treatment:

The whole patients of the study were treated previously by chemotherapeutics and antibiotics according to culture and sensitivity results. This included nitrofurantoin, nalidixic acid or trimethaprim sulphamethoxazole.

II- Results:

→ Bacteriological study.

→ Imaging Studies.

1- *Bacteriological Study:*

Table (10)): Frequency of isolation Gram negative and Gram positive organisms and its type of recurrence in urine culture of 100 children with recurrent urinary tract infection followed up for 2 years.

Organism	Frequency	Same	Changed
★ Gram (-ve):			
E. coli	99	63	36
Proteus	15	0	15
Klebsiella	4	0	4
Pseudomonas	4	0	4
Absent	1 case	-	-
★ Gram (+ve):			
Staph aureus	13	1	12
Streptococcus	3	0	3
Absent	84	-	-

Table (11): The type of recurrence of the organism in 100 patients with recurrent urinary tract infection followed up for 2 years.

Recurrent Organism	Frequency
Same	64
Changed	36

The results of the bacteriological study are shown in tables (10) and (11) with a ratio of 6:1 Gram negative to Gram positive organisms respectively.

Organisms were the same in 64 patients and changeable in 36 patients (table 11).

Gram negative organisms were more frequently detected than Gram positive organisms (99 and 16 respectively).

The most common Gram negative organism was E. coli (99 children). It was the same in 63 children and changeable in 36 children then Proteus, Klebsiella and Pseudomonas which were detected in 15, 4 and 4 cases respectively and they were mostly of mixed type.

As regard **gram positive organisms**, Staphylococcus aureus was detected in 13 cases, it was the same in one case and changeable in 12 cases.

Lastly streptococcus which was detected in 3 cases only and it was changeable in them.

2) Imaging Results:

A- Ultrasound finding.

B- IVP finding.

C- VCUG finding.

D- DMSA finding.

E- DTPA finding.

(Tables from 12 to 19).

A- Ultrasound Findings: (Table 12 - Figure 1).

Findings in Rt. and Lt. kidneys of 100 children (200 kidneys) of the study are shown in table (12) (Figure 1). These were **according to the size** 6 large (6%). Rt. kidneys, 13 small (13%), Rt. kidney and one absent right kidney (1%). Otherwise 80 normal sized Rt. kidney 80%.

For the left kidney there were 6 large (6%), 9 small (9%) and 3 atrophic (3%), Lt. kidney respectively with 82 (82%) normal sized Lt. kidneys.

★ As regard obstruction:

There were 6 Rt. kidneys with mild back pressure 6%, 2 with moderate back pressure 2% and 3 with advanced back pressure 3%, so 11% were obstructed right kidneys.

There were 3 left kidneys with mild back pressure, one with moderate back pressure and 6 with advanced back pressure changes so there were 10% obstructed Lt. kidneys.

★ Renal stones:

There were one right renal pelvic stone 1% and one 1% right renal multiple calyceal stones. Two left kidneys (2%) showed multiple calyceal stones.

★ Congenital Anomalies:

According to congenital anomalies these included 8 cases out of 100 children. 1 case with left ectopic kidney (1%), 2 cases with horse-shoe kidneys (bilaterally 2%), 2 cases with polycystic kidneys bilaterally (2%), 2 cases with Rt. duplex kidney 2% and one absent Rt. kidney (1%).

★ Acute Glomerulonephritis:
These were only 2 cases out of 100 cases (2%).

★ Urinary bladder findings are showed in table (13) and Figure (2):

These were 9 cases out of 100 examined cases showed residual urine (9%), 7 cases with thickened bladder wall (> 3 mms distended UB), i.e. chronic cysts (7%) and lastly 2 cases with urinary bladder stone (2%).

B- IVP Findings: (Table 14, 15) (Figs. 3,4)

Table (14) depicts IVP findings for the indicated cases of the study (49 cases - 98 kidneys).

★ *Power of Contrast Concentration and Excretion:*

There were delayed power of contrast and excretion in 4 Rt. kidneys (8.2%) and in 5 left kidneys (10.2%). Non functioning, two right kidneys (4.1%) and 4 left kidneys (8.2%) with normal power of contrast and excretion in 43 Rt. kidneys 87.8% and in 40 Lt. kidneys 81.6%.

★ *Renal scar:*

2 Rt. kidneys showed scar = 4.1%.

★ *Pelvicalyceal System (Obstruction):*

- Dilated pelvis was detected in 3 Rt. kidneys (6.1%) and in 3 Lt. kidneys (6.1%).
- Dilated pelvicalyceal system was detected in 7 Rt. kidneys (14.3%) and in 6 Lt. kidneys (12.2%).

★ *Ureters:*

- There were dilated 4 Rt. ureters (8.2%) and 5 Lt. ureters (10.2%).
- There were 2 duplex Rt. ureters (4.1%).

★ *Renal Stones:*

2 Rt. kidneys showed multiple calyceal stones (4.1%) and 2 Lt. kidneys showed also multiple calyceal stones (4.1%).

★ *Congenital anomalies:*

These were duplex anomaly in 2 right kidneys (4.08%), polycystic kidneys bilaterally (both Rt. and Lt. kidneys in 2 cases (4.08%), horse-shoe kidneys bilaterally (both Rt. and Rt. kidneys) in 2 cases (4.08%), one left ectopic kidney 2.04% and one of the 2 non functioning Rt. kidney was absent congenitally (2.04%).

★ Frequency of IVP findings of the urinary bladder of cases with abnormal ultrasonography (49 cases) Table (15) - Figure (4).

C- VCUG Findings: From (Table 16 and Fig. 5).

★ *Vesicoureteric reflux:*
Out of 71 cases (142 kidneys) there were:
- **Grade I VUR** in 3 right sided kidney (4.23%) and 3 left sided kidney.
- **Grade II reflux** in 2 Rt. sided kidney (2.82%) and one Lt. kidney (1.41%).
- **Grade III reflux** in 3 Rt. sided kidney (4.23%) and in 4 Lt. sided kidney (5.63%).
- **Grade IV reflux** was detected in 1 right kidney 1.41% and 2 Lt. kidney (2.82%).

- **% of refluxers:** 13 cases (18.3%) out of 71 cases, 5 of them were bilateral and 8 were unilateral.
- Sum-up of VUR in both kidneys: (Fig. 5).
- **Grade I reflux** = 4.2%.
- **Grade II reflux** = 2.1%.
- **Grade III reflux** = 4.9%.
- **Grade IV reflux** = 2.1%.

Table (17), frequency of bladder findings in VCUG, there were 2 cases 2.8% out of 71 cases showed bladder filling defect (stone).

5 cases (39%) of the 13 refluxing cases proved to have scar by DMSA and 8 of them had no scar.

E- DMSA Findings: Table (18) and Fig. (6).

Findings in Rt. and Lt. kidneys were:

- **According to renal size,** there were 7 large Rt. kidneys (8.5%) and 8 large Lt. kidneys (9.8%). Small 8 Rt. kidneys (9.8%0 and small 5 Lt. kidneys (6.15). There were one absent Rt. kidney (1.2%) and atrophic 3 Lt. kidneys (3.7%).

- **Renal site:** one ectopic Lt. kidney (1.2%) was detected, one absent Rt. kidney (1.2%) and 2 horse-shoe kidneys (on both sides Rt. and Lt) 2.4%.

- **Renal pattern:** 2 cases out of 82 cases showed bilateral polycystic kidneys (2.4%).

- **Renal scar:**
  The right kidney showed 2 cases with upper pole scar 3 cases with lower pole scar and 3 cases with multiple outer wall scar (scarred Rt. kidneys were = 9.7%).
  The left kidney showed 1 case with upper pole scar, 1 case with lower pole scar and 1 case with multiple outer wall scar. So scarred Lt. kidneys were 7.3%.

- **Renal filling defect:** Multiple stones could be detected in one Rt. kidney (1.2%) and in one Lt. kidney (1.2%)

- **Dilated pelvicalyceal system:** Mild dilated pelvicalyceal system was detected in 2 Rt. kidneys out of 82 and 2 Lt. kidneys out of 82 (2.4%).
  Moderately dilated pelvicalyceal system was detected in 4 Rt. kidney (4.9%), and in 2 Lt. kidney (2.4%).

- **Cortical tracer uptake:** There was no uptake of one Rt. kidney and decreased uptake of 10 Rt. kidney (12.2%), the left kidney showed decreased uptake in 14 cases out of 82 cases (17.1%).

F- <u>DTPA Findings</u>: Table (9), Fig. (7).

Findings in Rt. and Lt. kidneys were:

- **Renal perfusion:** It was decreased in 12 Rt. kidneys (46.2%) and in 12 Lt. kidneys (46.1%).

- **Renal accumulation:** It was decreased in 12 Rt. kidneys (46.2%) and in 12 Lt. kidneys (46.1%).

- **Renal excretion (obstruction)**: Decreased in 11 Rt. kidneys (42.3%) and 12 Lt. kidneys (46.1%). There were one case with complete loss of right renal function, and 2 cases with complete loss of left renal function [no perfusion, no accumulation or excretion].

- **Functional changes:** The GFR was diminished below 42.0% in 8 Rt. kidneys (30.76%) and in 10 left kidney (38.46%). Split GFR is considered normal at the range of (42-45%).

Table 12: Frequency of ultrasound findings in right and left kidneys of 100 children (200 kidneys) with early recurrent UTI.

US. Findings	Frequency (%)	
	Rt. kidney (n=100)	Lt. kidney (n=100)
★ **Size of kidneys:**		
Normal	80.0	82.0
Large	6.0	6.0
Small	13.0	9.0
Atrophic	0.0	3.0
Absent	1.0	0.0
★ **Obstruction:**		
Back pressure:		
No	88.0	90.0
Mild	6.0	3.0
Moderate	2.0	1.0
Advanced	3.0	6.0
Absent kidney	1.0	0.0
★ **Renal Stones:**		
No	97.0	98.0
Pelvic stone	1.0	0.0
Multiple calyceal stones	1.0	2.0
Absent kidney	1.0	0.0
★ **Congenital anomalies:**		
No	93.0	95.0
Ectopic kidney	0.00	1.0
Horse-shoe kidney	2.0	2.0
Polycystic kidney	2.0	2.0
Duplex kidney	2.0	0.0
Absent kidney	1.0	0.0

Table 13: Frequency of urinary bladder ultrasonic findings of included children in the study (100 cases).

US. Findings	No. of cases	Frequency %
★ Residual urine volume: Present Absent	9 91	9.0 91.0
★ Bladder wall thickness: Thickened Normal	7.0 93.0	7.0 93.0
★ Bladder stone: Present Absent	2.0 98.0	2.0 98.0

Table 14: Frequency of IVP findings of Rt. and Lt. kidneys of cases with abnormal ultrasonography of the study (49 cases, 98 kidneys).

IVP Findings	Rt. kidney (No. 49)	Freq. %	Lt. kidney (No. 49)	Freq. %
★ Power of contrast concentration and excretion:			40	81.6
Normal	43	87.8	5	10.2
Delayed	4	8.2	4	8.2
* Non functioning kidney	2	4.1		
★ Renal scar:			45	91.8
No scar	45	91.8	0	
Scar	2	4.1	4	8.2
* Non functioning kidney	2	4.1		
★ Pelvicalyceal system:			36	73.5
Normal	37	75.5	3	6.1
Dilated pelvis	3	6.1	6	12.2
Dilated pelvicalyceal	7	14.3	4	8.2
* No excretion of dye	2	4.1		
★ Ureters:			40	81.6
Normal	41	83.6	5	10.2
Dilated	4	8.2	0	0.0
Duplex	2	4.1	4	8.2
* No excretion of dye	2	4.1		
★ Renal stones:			43	87.7
No	45	91.8	0	0.0
One stone	0	0.0	2	4.1
Multiple stones	2	4.1	4	8.2
* No excretion of dye	2	4.1		
★ Congenital anomalies:			0	0.0
Duplex	2	4.08	2	4.08
Polycystic kidneys	2	4.08	2	4.08
Horse-shoe	2	4.08	1	2.04
Ectopic kidney	0	0.0	4	4.08
* Non-functioning kidney	2	4.08	40	81.63
None (normal)	41	83.67		

* One of them was absent kidney.

Table (15): Frequency of IVP findings of the urinary bladder of cases with abnormal ultrasonography (49 cases).

IVP Findings	Incidence	Frequency %
★ Post voiding cystogram:		
Present	8	16.3
Absent	41	83.7
★ Vesical stone:		
Present	2	4.1
Absent	47	95.9

Table (16): Frequency of VCUG findings in children below 6 years age of the study suffering from early recurrent UTI (total cases 71 cases, 142 kidneys).

VCUG Findings	Rt. kidney (No. 71) Freq. %		Lt. kidney (No. 71) Freq. %	
★ Vesico-Ureteric Reflux (VUR):				
Grade I	3	4.2	3	4.2
Grade II	2	2.8	1	1.4
Grade III	3	4.2	4	5.6
Grade IV.	1	1.4	2	2.8
None	62	87.4	61	86.0

Sum-up of V.U.R. in both kidneys: (Figure 5).

Grade I: 4.2
Grade II: 2.1
Grade III: 4.9
Grade IV: 2.1
None: 87.6.

Table 17: Frequency of bladder findings in VCUG in cases below 6 years age of the study (71 cases).

VCUG Findings	No. of cases	Frequency
★ Bladder filling defect (stone): Present Absent	2 69	2.8 97.2

Table 18:   Frequency of DMSA findings in 82 cases (164 kidneys) suffering from early recurrent UTI followed up for 2 years.

DMSA Findings	Rt. kidney (No. 82)	Freq. %	Lt. kidney (No. 82)	Freq. %
★ Renal size: *(19.5%)				
Average	66	80.5	66	80.4
Large	7	8.5	8	9.8
●Small	8	9.8	5	6.1
Atrophic kidney	0	0.0	3	3.7
Absent kidney	1	1.2	0	0.0
★ Renal site: * (3.7%)				
Normal	79	96.4	79	96.4
Ectopic	0	0.0	1	1.2
Horse-shoe	2	2.4	2	2.4
Absent	1	1.2	0	
★ Renal pattern: *(8.5%)				
Homogenous	79	96.4	80	97.6
Polycystic kidneys	2	2.4	2	2.4
(heterogenous)				
Absent kidney	1	1	0	0.0
★ Renal scar: *(8.5%)				
Upper pole scar	2	2.4	1	1.2
Lower pole scar	3	3.7	1	1.2
Multiple outerwall	3	3.7	1	1.2
scar				
Atrophic	0	0.0	3	3.7
Absent	1	1.2	0	0.0
Kidney	73	89.02	76	92.7

★ Renal filling defect (stone): *(1.8)				
No stone	80	97.6	81	98.8
Multiple stones	1	1.2	1	1.2
Absent kidney	1	1.2	0	0.0
★ Dilated pelvicalyceal system: *(6.1%)				
Not	75	91.5	78	95.2
Mild	2	2.4	2	2.4
Moderate	4	4.9	2	2.4
Absent kidney	1	1.2	0	
★ Cortical tracer uptake *(15.2%):				
Average	71	86.6	68	82.9
Decreased	10	12.2	14	17.1
No uptake	1	1.2	0	0.0

N.B.   Percent labelled with (*) represent percent of positive cases in both kidneys.

● One of the 5 small sized Lt. kidneys was hypoplastic kidney.

Table (19):   Frequency of DTPA findings of 26 children with (+ve)
              DMSA.

DTPA Findings	Rt. kidney (No. 26)	Freq. %	Lt. kidney (No. 26)	Freq. %
★ Renal perfusion:				
Average	13	50.0	12	46.2
decreased	12	46.2	12	46.1
No perfusion	1	3.8	2	7.7
★ Renal accumulation:				
Average	13	50.0	12	46.2
decreased	12	46.2	12	46.1
No accumulation	1	3.8	2	7.7
★ Renal excretion:				
Average	14	53.8	12	46.1
Delayed	11	42.3	12	46.1
No excretion	1	3.8	2	7.7
★ G.F.R.:				
<42.0%	8	30.76	10	38.46
≥42.0%	18	69.23	16	61.53

Sensitivity and specificity of different imaging findings:
Ultrasound versus IVP (as Gold Standard) for detection of congenital anomalies.

Out of the 49 cases done by ultrasound and I.V.P. There were 8 cases showed congenital anomalies which were detected all as (+ve) cases by both ultrasonography and I.V.P. with 41 cases detected as (-ve) by both ultrasound and I.V.P. indicating identical results of the 2 tests with a sensitivity and specificity = 100%.

Table (20):   **IVP versus DMSA (as Gold Standard) for detection of renal scars.**

DMSA (Gold standard) for detection of renal scars

		(+ve)	(-ve)	Total
Test (IVP)	+ve	2	0	2
	-ve	12	84	96
	Total	14	84	98

DMSA detected 14 scarred cases, of whom 2 were detected by IVP. DMSA detected 84 (-ve) cases, all of them were negative by IVP.

Indicating:

Sensitivity = 14.3%.

Specificity = 100.0%.

+ve predictive value = 100%.

-ve predictive value = 86%.

Table (21):   Sonar versus DMSA (as Gold Standard) for detection of renal scars:

DMSA (Gold standard) for detection of renal scars

		(+ve)	(-ve)	Total
Test Ultrasound	+ve	14	3	17
	-ve	0	147	147
	Total	14	150	164

DMSA detected 14 (+ve) cases, all of them were detected by sonar. DMSA detected 150 (-ve) cases, 147 cases of them were negative by sonar.

Indicating:

Sensitivity = 100%.

Specificity = 98.0%.

The predictive value of a (+ve) test = 82.4%.

The predictive value of a (-ve) test = 100%.

Table (22):   **Ultrasound versus DTPA (as Gold standard) for detection of obstruction.**

DTPA (Gold standard) for detection of obstruction

		(+ve)	(-ve)	Total
Test Ultrasound	+ve	14	0	14
	-ve	9	29	38
	Total	23	29	52

DTPA detected 23 obstructed kidneys (+ve cases) of whom, 14 were detected by ultrasonography.

DTPA detected 29 as (-ve) cases, all of them were detected as (-ve) cases also by ultrasonography. Indicating:

Sensitivity = 61%.

Specificity: 100%.

(+ve) predictive value = 100%.

(-ve) predictive value = 76.3%.

Table (23):   IVP versus DTPA (as Gold Standard) for detection of obstruction.

DTPA (Gold standard) for detection of obstruction

Test (IVP)		(+ve)	(-ve)	Total
	+ve	15	1	16
	-ve	8	28	36
	Total	23	29	52

DTPA detected 23 obstructed kidneys (+ve cases) of which 15 cases were detected by IVP.

DTPA detected 29 as (-ve) cases of whom 28 cases were detected as negative by IVP Indicating:

Sensitivity = 65%.

Specificity = 96.5%.

+ve predictive value of the test = 93.8%.

-ve predictive value of the test = 78%.

Evaluation Renal Growth in the Included Cases:

Follow-up of renal length by ultrasound were recorded in follow-up curves compared to a normal growth curve **(Rosenbaum et al., 1984)** (Graph No. 8). It was found that: 19 Rt. kidneys showed retarded growth in their curves (compared to normal) and 18 Lt. kidneys showed retarded growth in their follow-up curves.

Examples of these curves are illustrated in figures (No. 9 to 21).

In a trial to correlate the possible factors or causes related to retarded growth of these findings. Comparative statistical work was done, trying to find a relation between age at onset of 1st infection, urinary tract pathology as seen by imaging and presence or absence of scar in renal tissue (Tables No. 26,27,28,29).

Table (24):   Normal length of the kidney at different ages with the
               95% confidence limits.

Age (months)	Lower limit	Mean	Upper limit
0	3.91	4.89	5.85
2	4.24	5.29	6.40
6	4.58	5.89	7.19
10	5.12	6.34	7.57
18	5.60	6.75	7.89
30	6.31	7.12	8.27
42	6.41	7.86	8.65
54	6.65	7.77	8.89
66	6.76	7.93	9.10
78	6.90	8.08	9.26
90	6.91	8.35	9.76
102	7.28	8.81	10.34
114	7.36	9.09	10.82
128	7.75	9.32	10.90
140	8.18	9.73	11.28
152	8.43	9.94	11.44
164	8.59	10.09	11.58
176	8.84	10.26	11.68
188	9.15	10.34	11.83
200	8.80	10.51	12.17
212	8.52	10.46	12.38
224	8.61	10.67	12.72

(Rosenbaum et al., 1984)

Correlative Tables:

Table (25): Relation between size of right and left kidneys followed up by ultrasonography on renal growth curves.

Rt. kidney		Lt. kidney			
		Small	Normal	Large	Total
Small	R i g h t Kidney	7	12	0	19
Normal		10	6	1	75
Large		1	0	4	5
Absent		0	1	0	1
Total		18 / 18.00	77 / 77.00	5 / 5.00	100 / 100.00

Out of the 100 cases of the study, 64 patients showed normal size of both right and left kidneys. 7 cases with bilateral small kidneys, 22 cases with one small kidney, 1 case with one small and one large kidney, 4 cases with bilateral large kidneys. 1 case with one large kidney and lastly one case with absent Rt. kidney.

In other words; this table can be simplified as follows:

- Normal-size of both kidneys: 64
- Small-size of both kidneys: 7
- Large-size of both kidneys: 4

                                   75

- Normal-sized RT and small sized LT: 10
- Normal-sized RT and large-sized LT: 1
- Normal-sized RT and normal-sized LT: 12
- Large-sized RT and small-sized LT: 1
- Absent-sized RT and normal-sized LT: 1

                                            25

In summary:

- Equal size of both kidneys in 75%.
- Discrepancy in size in 25%.

Normal-size	RT 11%	LT 13%
Small-size	RT 12%	LT 11%
Large-size	RT 1%	LT 1%
Absent	RT 1%	LT 0%

In a trial to find a relation between the age of onset of 1st infection to the size of the kidney with retarded growth, it was found that out of the 36 cases with disturbed renal growth curve 30 cases presented with small kidney (retarded renal growth) which was unilateral in 22 cases and bilateral in 8 cases. The remaining 6 cases showed enlarged one or two kidneys due to either polycystic kidneys (2 cases), hydronephrosis (2 cases), acute glomerulonephritis and one case with absent right kidney.

In the 30 cases with retarded renal growth, it was found that 16 cases with the age of onset of 1st infection was below < 2 years (54%) and 14 cases with age of onset of infection was after > 2 years (46%).

So, there is a positive correlation between the early onset of 1st infection especially before 2 years age and the retarded renal growth.

Table (26):   Structural pathology in relation to the size of Rt. kidney in the 36 cases with disturbed renal growth curve.

Size of the right kidney					
Pathology	Small	Normal	Large	Absent	Total
Reflux	5 83.33	1 16.67	0 0.00	0 0.00	6
Obstruction	4 80.00	0 0.00	1 20.00	0 0.00	5
Congenital anomalies	2 33.33	1 16.67	2 33.33	1 16.67	6
Diffuse renal disease	0 0.00	0 0.00	1 100.00	0 0.00	1
Normal	3 23.08	9 69.23	1 7.69	0 0.00	13
Unknown	5 100.00	0 0.00	0 0.00	0 0.00	5
Total	19 52.78	11 30.56	5 13.89	1 2.78	36 100.00

Chi-square = 31.483,   D.F. = 15, $P < 0.001$ → Significant.

Analysis of data concerning patients with small and normal right kidney showed out of the 36 cases with disturbed renal growth curve, there were 19 cases with small sized Rt. kidney and 11 cases with normal sized right kidney. Reflux was present in 5 cases (83.33%) with small right kidney and in 1 case (16.67%), with normal Rt. kidney respectively.

Obstruction was found in 4 cases (80%) with small sized Rt. kidney but is not detected completely in cases with normal sized Rt. kidney. Congenital anomalies was found in 2 cases (33.33%) with small sized Rt. kidney and in one case only (16.67%) with normal sized Rt. kidney. 5 cases with small right kidney showed unknown pathology, 100% and no pathology was detected in 3 cases with small right kidney 23.08% and in 9 cases out of 11 cases with normal sized Rt. kidney 69.23%.

Only 5 cases showed enlarged right kidney (due to obstruction (1 case), polycystic kidneys (2 cases) and associated acute glomerulonephritis (1 case). Only 1 case showed absent right kidney.

Conclusion I:

Structural pathology has significant correlation to small size of Rt. kidney.

Table (27): Structural pathology in relation to the size of the left kidney in the 36 cases with disturbed renal growth curve.

Size of the left kidney				
Pathology	Small	Normal	Large	Total
Reflux	2 40.00	2 40.00	1 20.00	5
Obstruction	5 71.43	1 142.9	1 14.29	7
Anomalies	4 66.67	0 0.00	2 33.33	6
Diffuse renal disease	2 66.67	0 0.00	1 33.33	3
Normal	1 9.09	10 90.91	0 0.00	11
Unknown	4 100.00	0 0.00	0 0.00	4
Total	18 50.00	13 36.11	5 13.89	36 100.00

CHI-Square = 26.379,
$p < 0.001$ (Significant).

After exclusion of 5 cases with large left kidney because of (obstruction, polycystic kidneys, reflux and glomerulonephritis).

Analysis of 18 cases with small left kidney and 13 cases with normal left kidney showed: Reflux was present in 2 cases with small Lt. kidney (40.0%) and in 2 cases with normal Lt. kidney (40.00%), obstruction was found in 5 cases with small Lt. kidney (71.43%), and in only one case with normal Lt. kidney, 14.29%. Congenital anomalies were found in 4 cases with small Lt. kidney, 66.67%, and not present in cases with normal kidneys.

Diffuse renal disease were present in 2 cases with small Lt. kidney (66.87%), and not in cases with normal Lt. kidneys. Normal structure was present in (90.91%) in cases with normal sized Lt. kidney and in 9.09% in cases with small sized Lt. kidney.

Conclusion II:

Structural pathology has significant correlation to small size of Lt. kidney.

Comparison of I and II:

Pathology has significant correlation to delayed renal growth.

Table (28):   Relation between the size of the right kidney and scar presence in the 36 cases.

Scar				
Size of the Rt. kidney	No scar	Scar	Absent kidney	Total
Small	12 63.16	7 36.84	0 0.00	19
Normal	11 100.00	0 0.00	0 0.00	11
Large	5 100.00	0 0.00	0 0.00	5
Absent	0 0.00	0 0.00	1 100.00	1
Total	28 77.78	7 19.44	1 2.78	36 100.00

CHI-square = 43.579,
$P < 0.0001$ (significant).

Analysis of data concerning patients with small Rt. kidney, it was found that there were 19 cases out of 36 cases with small right kidney, 7 of them (36.84%) have scar and 12 cases have no scar 63.16%. Analysis of data concerning patients with normal Rt. kidney it was found that

there were 11 cases out of 36 cases with normal right kidney and all of them 100% don't have scar.

Conclusion I:

There is significant correlation between scars and small size right kidney.

Conclusion II:

There is high significant correlation between scar presence and small size left kidney.

From Conclusion I and II:

There is significant correlation between scar presence and delayed renal growth.

*R*_{esults}

Fig.(1): Frequency of US findings of both kidneys of 100 children with early recurrent UTI.

166
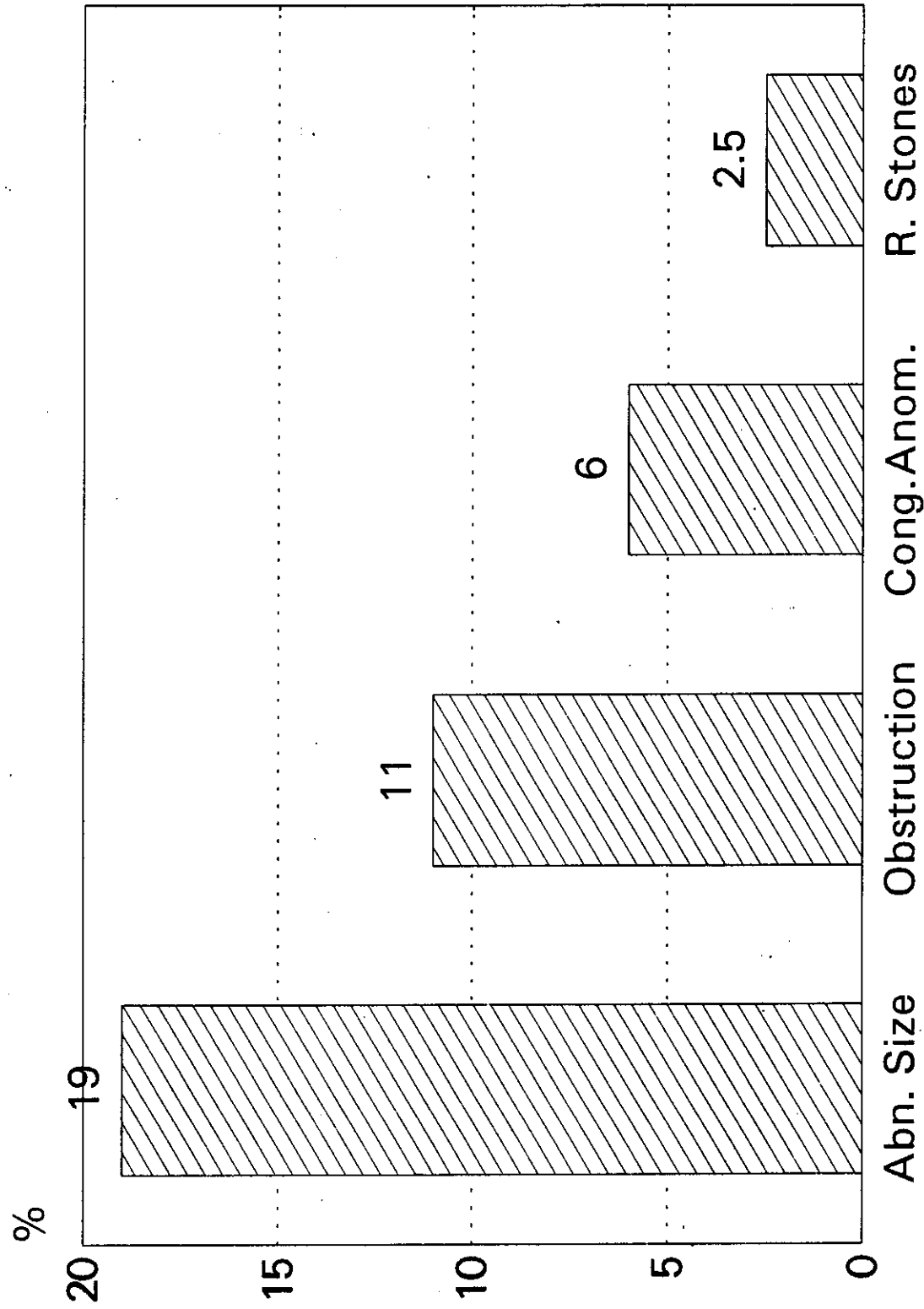
Fig. (3): Frequency of IVP findings of both kidneys of 49 children with +ve US findings.
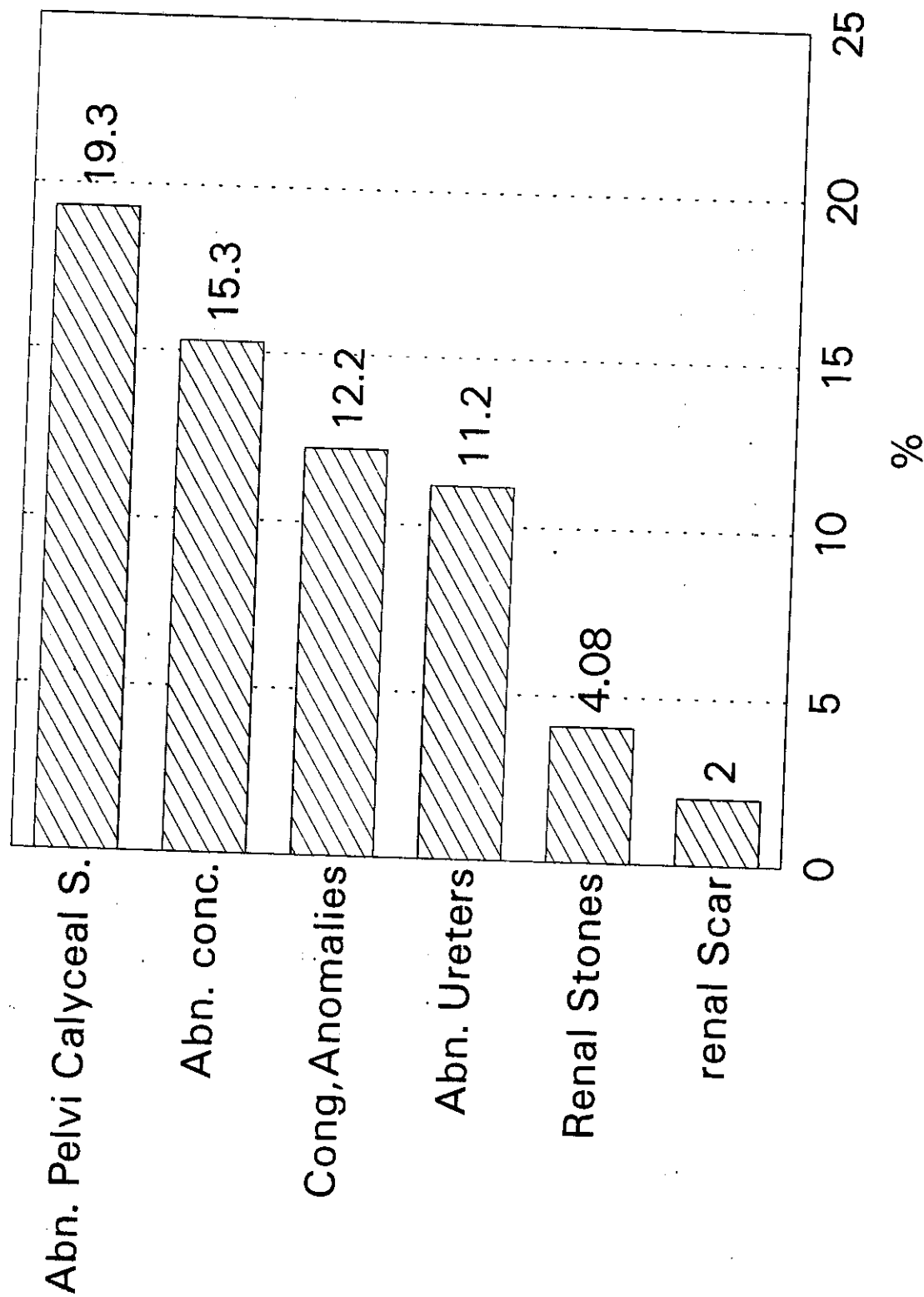
Fig. (4): Frequency of IVP findings of the bladder of 49 children with +ve US findings.

Present
4.1%

Present
16.3%

Absent
95.9%

Absent
83.7%

Vesical Stone

Post voiding cystogram

*R*_{esults}
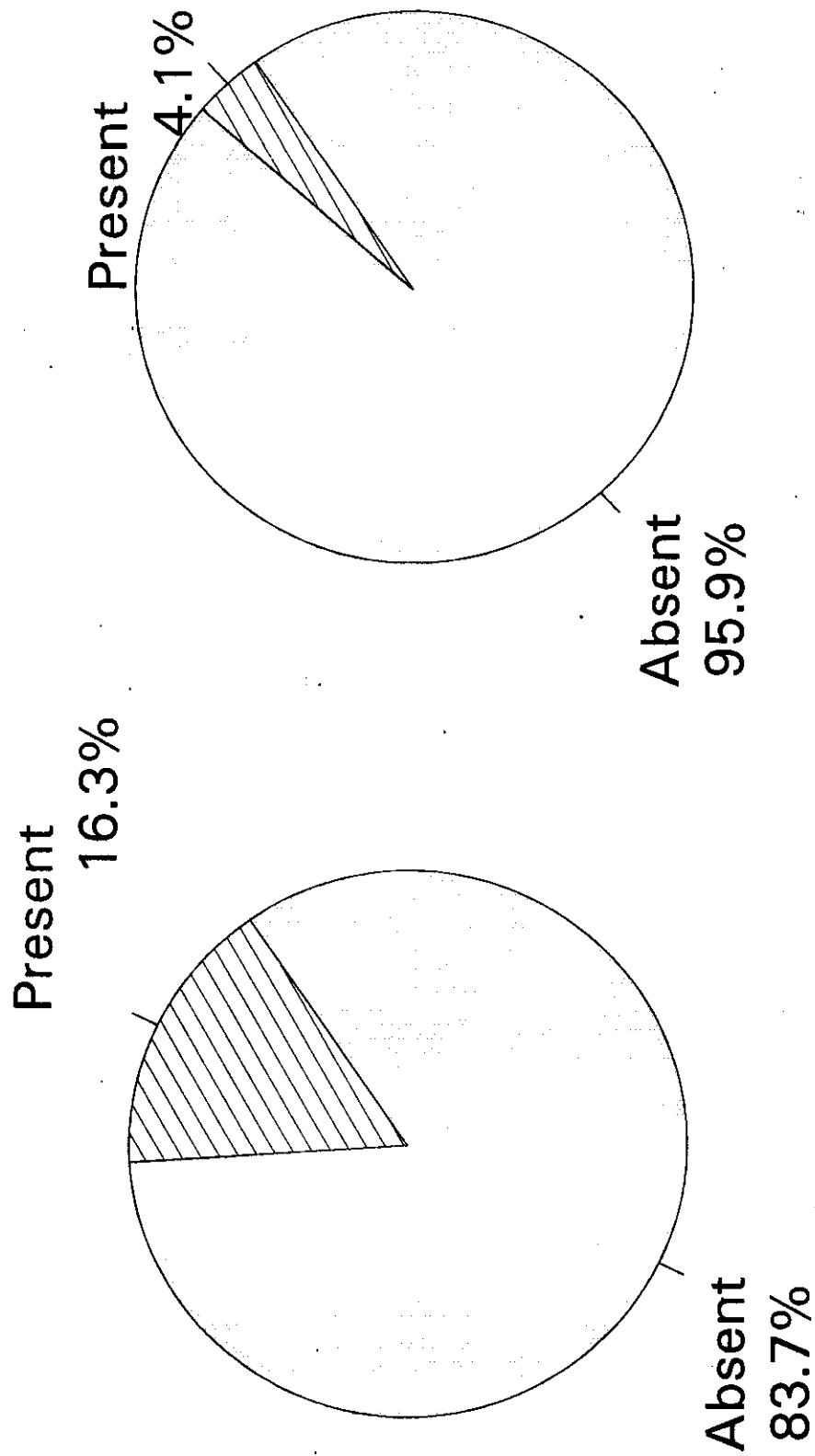
Fig. (5): Frequency of VCUG findings of both kidneys of 71 children with early recurrent UTI.

Grade VI 2.1%

Grade III 4.9%

Grade II 2.1%

Grade I 4.2%

Absent 86.7%

Vesico-Ureteric Reflux
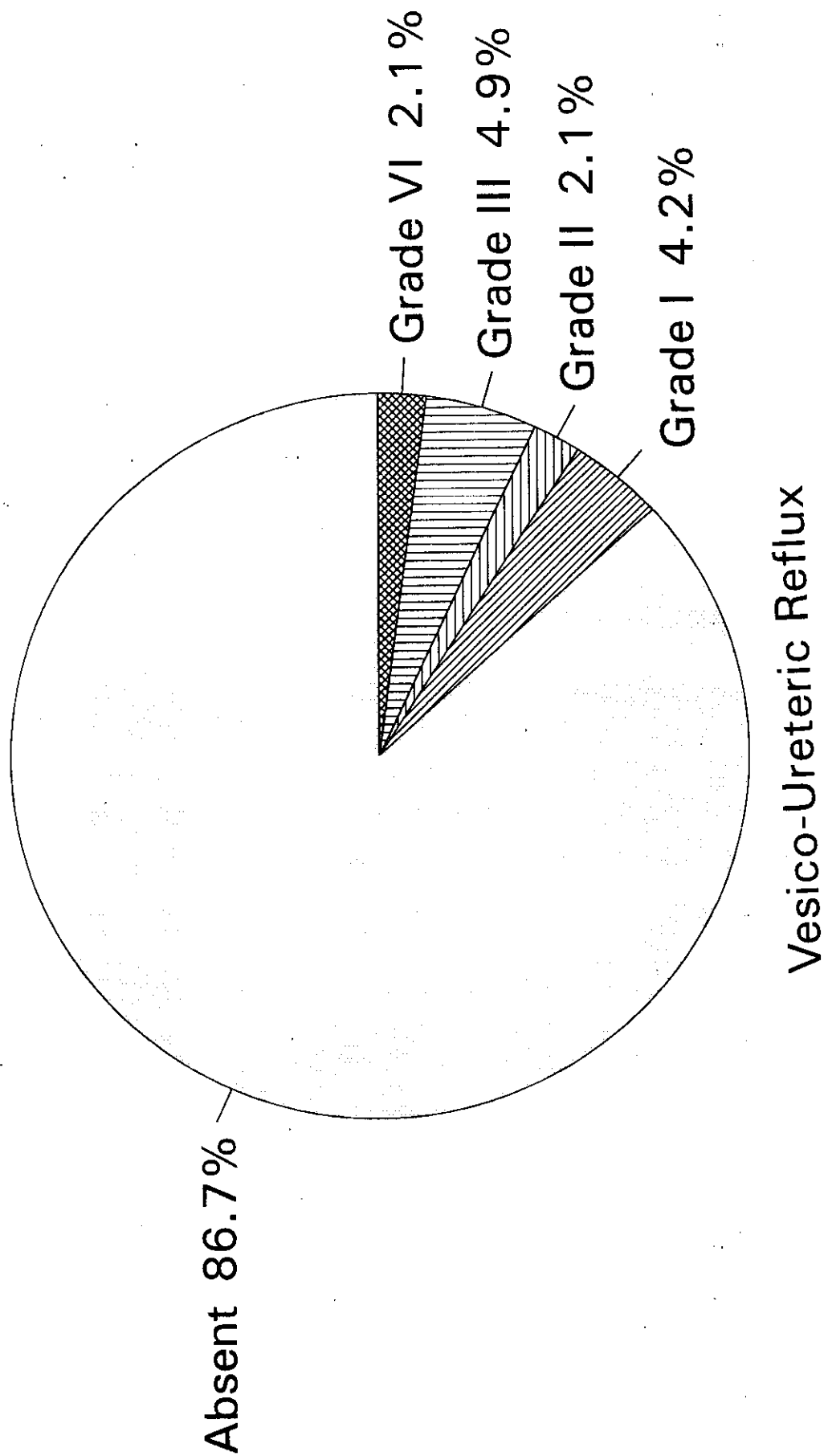
Fig. (6): Frequency of renal abnormalities detected by DMSA in 82 children with early recurrent UTI.
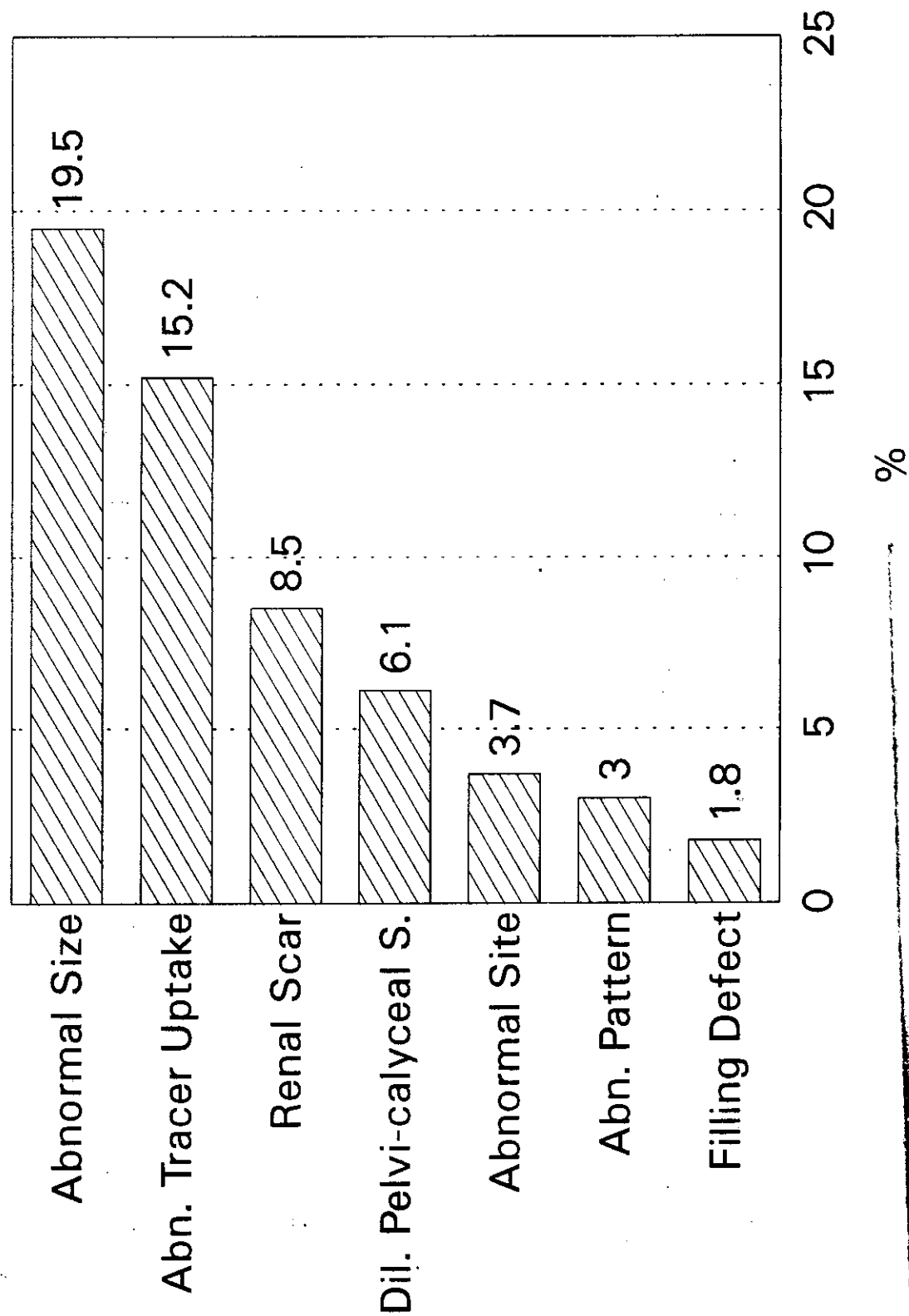
Fig. (7) Frequency of impairments detected by DTPA in 26 children with +ve DMSA.

170
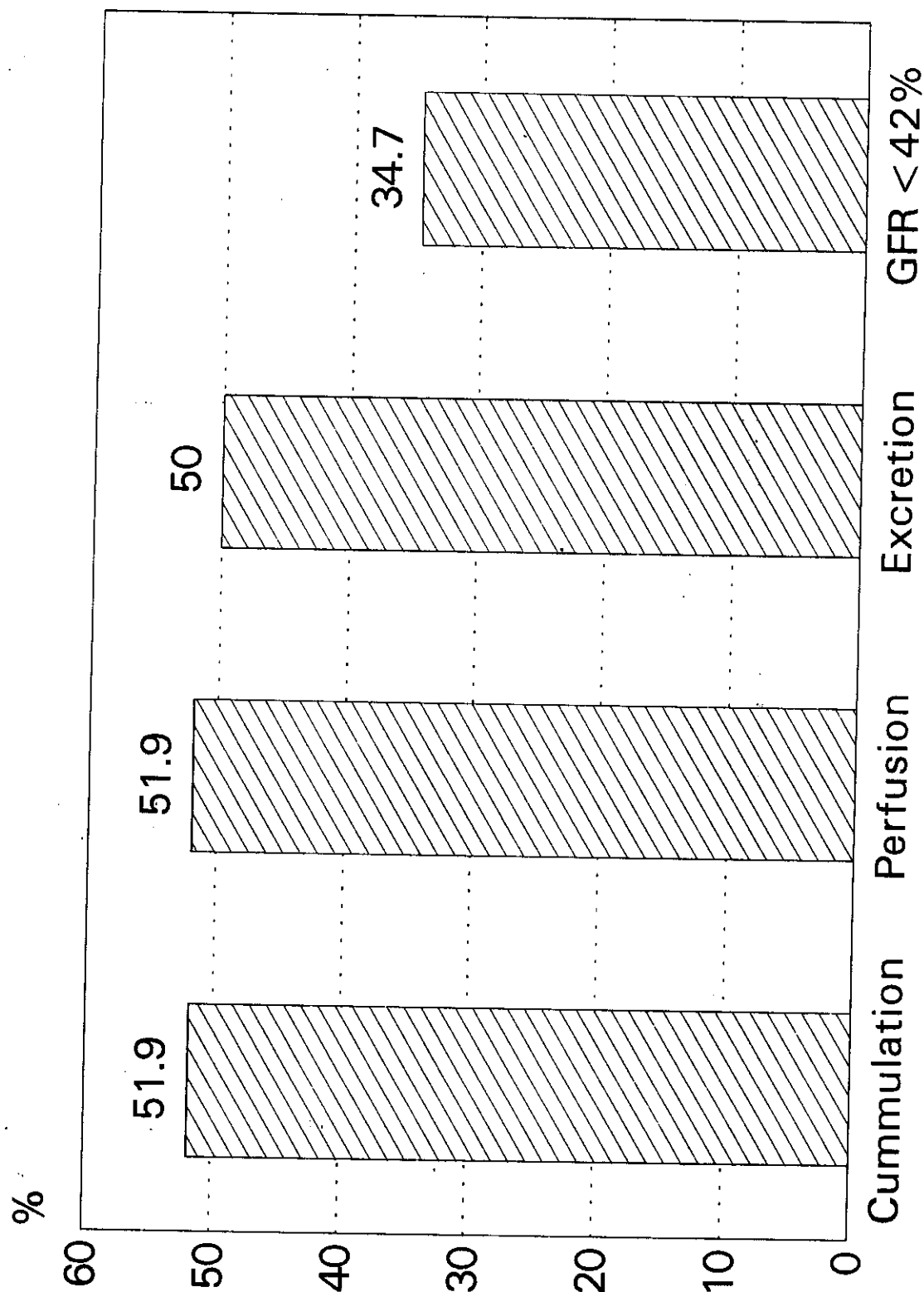
Fig. (8): Normal growth curve of the kidneys (mean length and upper and lower limits of the 95% confidence interval).

Length in cm

Age in months
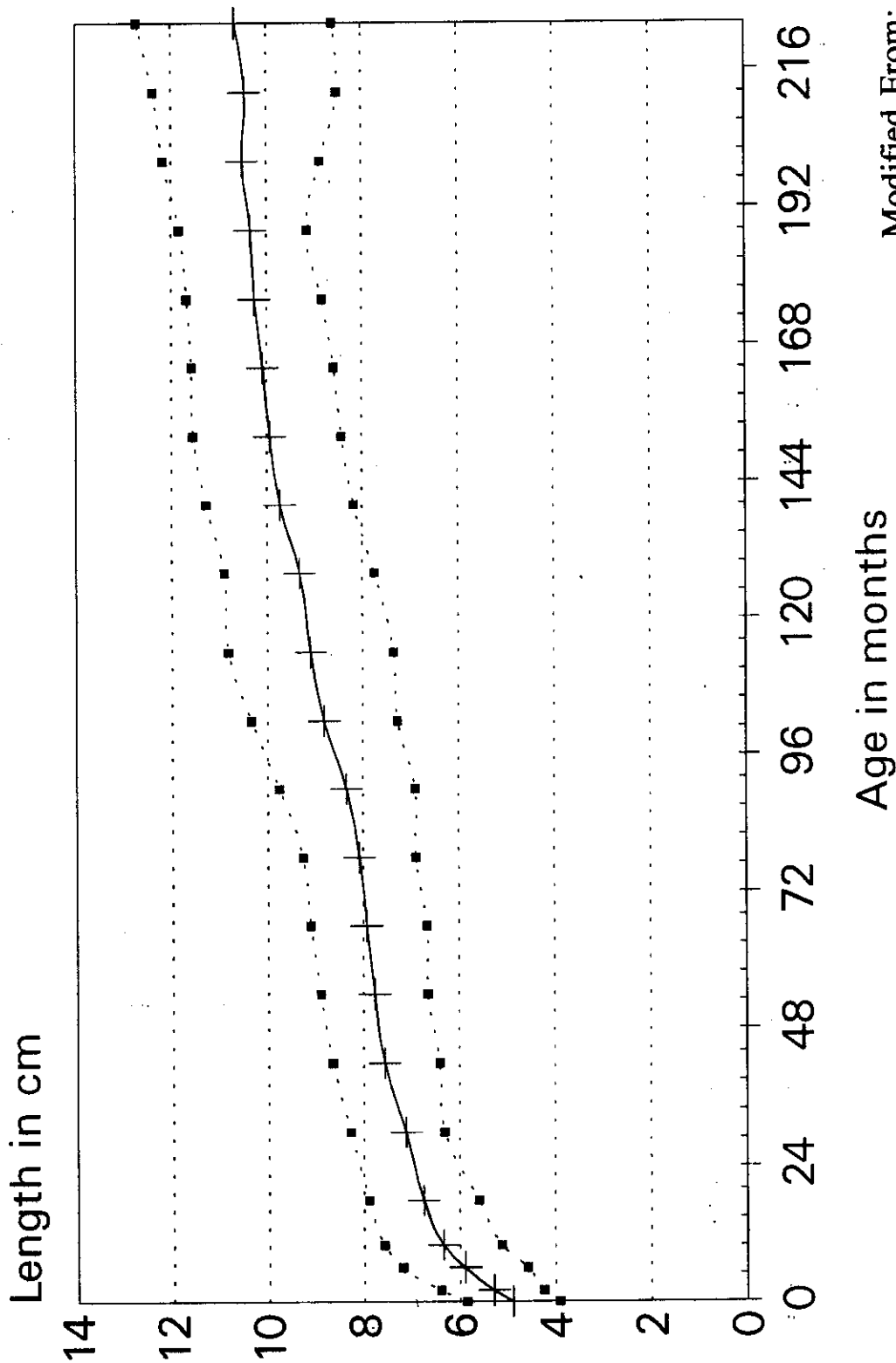
Modified From:
(Rosenbaum et al., 1984)

R_{esults}

Fig. (9): Size of right and left kidneys in relation to the normal growth curve (patient number 1).

Length in cm

Upper Limit

Mean

Lower Limit

Age in months

·· Lower Limit   + Mean   ·· Upper Limit   ▪ Rt.Kidney   ✳ Lt.Kidney
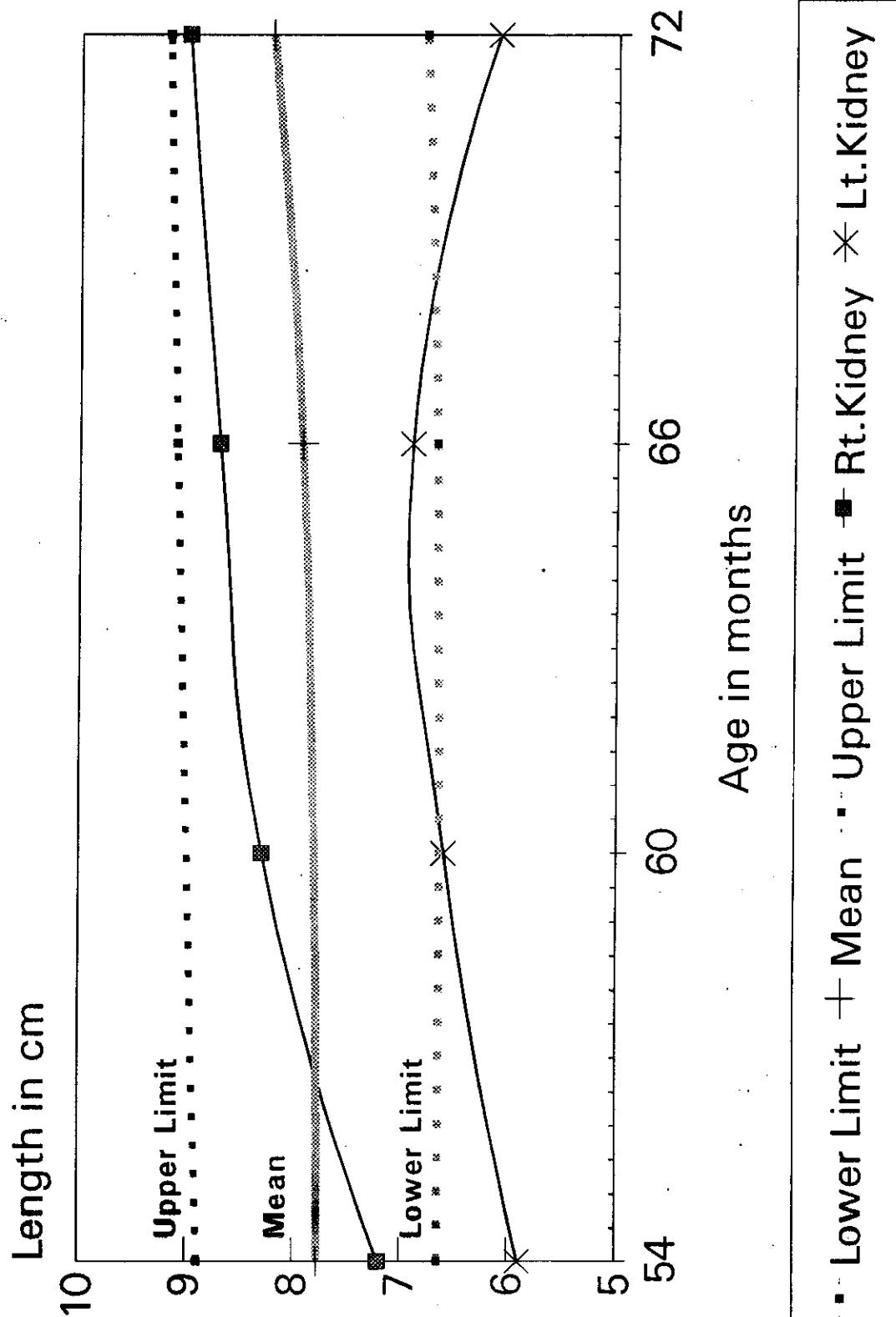
Fig. (10): Size of right and left kidneys in relation to the normal growth curve (patient number 2).
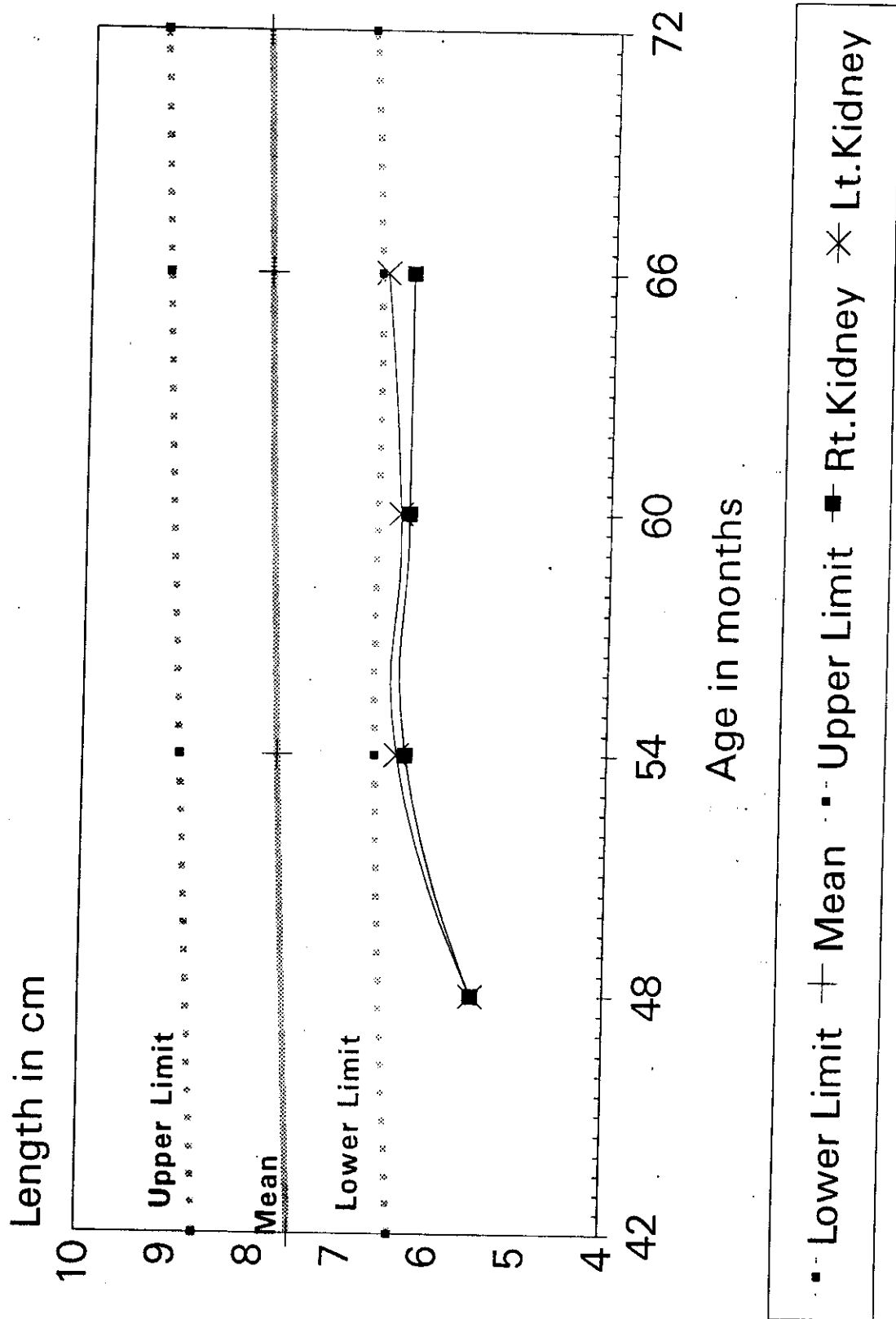
Fig. (11): Size of right and left kidneys in relation to the normal growth curve (patient number 3).

Length in cm

Upper Limit

Mean

Lower Limit

Age in months
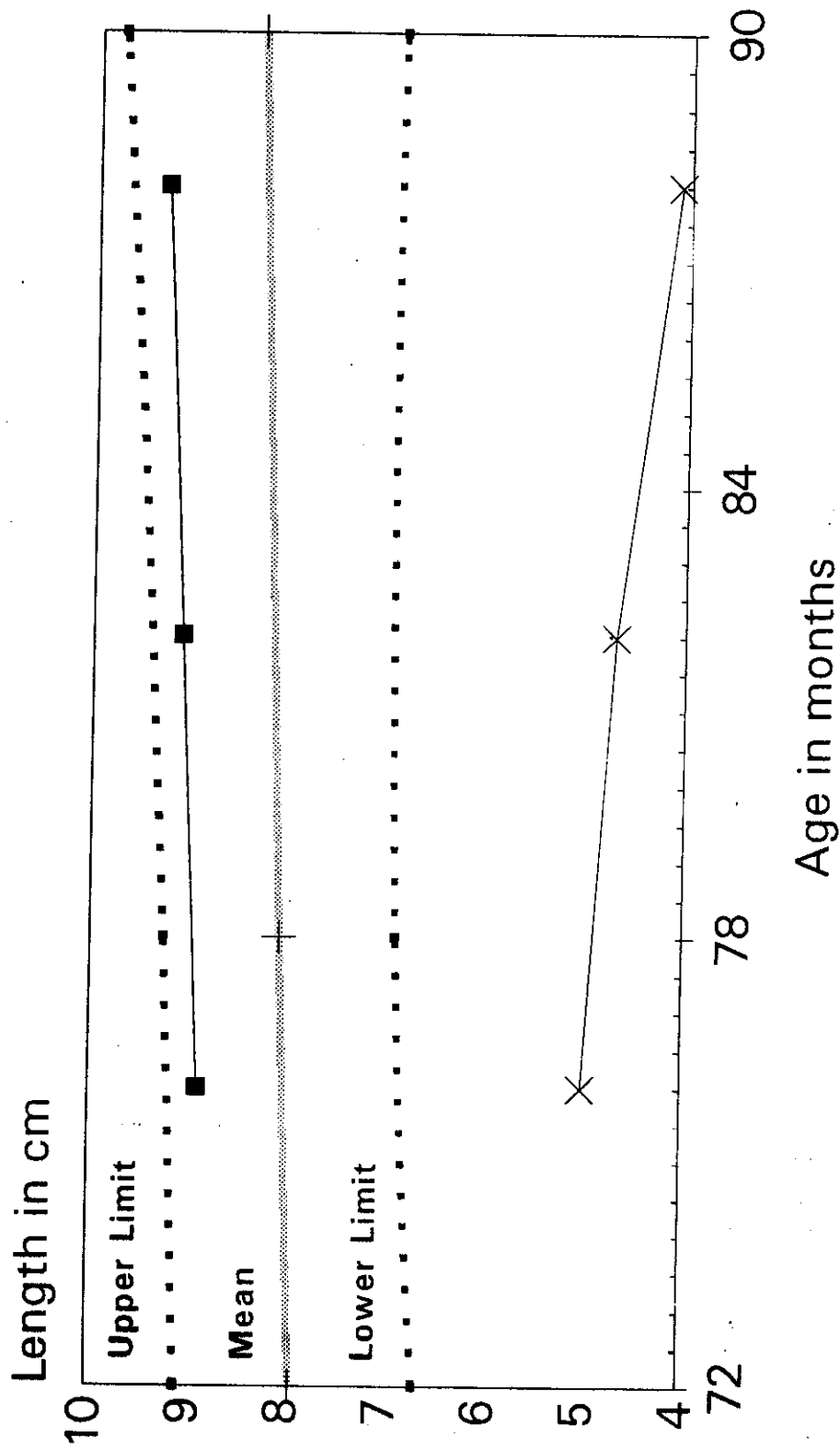
- ■ - Lower limit + Mean - ■ - Upperlimit ■ Rt.Kidney * Lt.Kidney

Fig. (12): Size of right and left kidneys in relation to the normal growth curve (patient number 4).
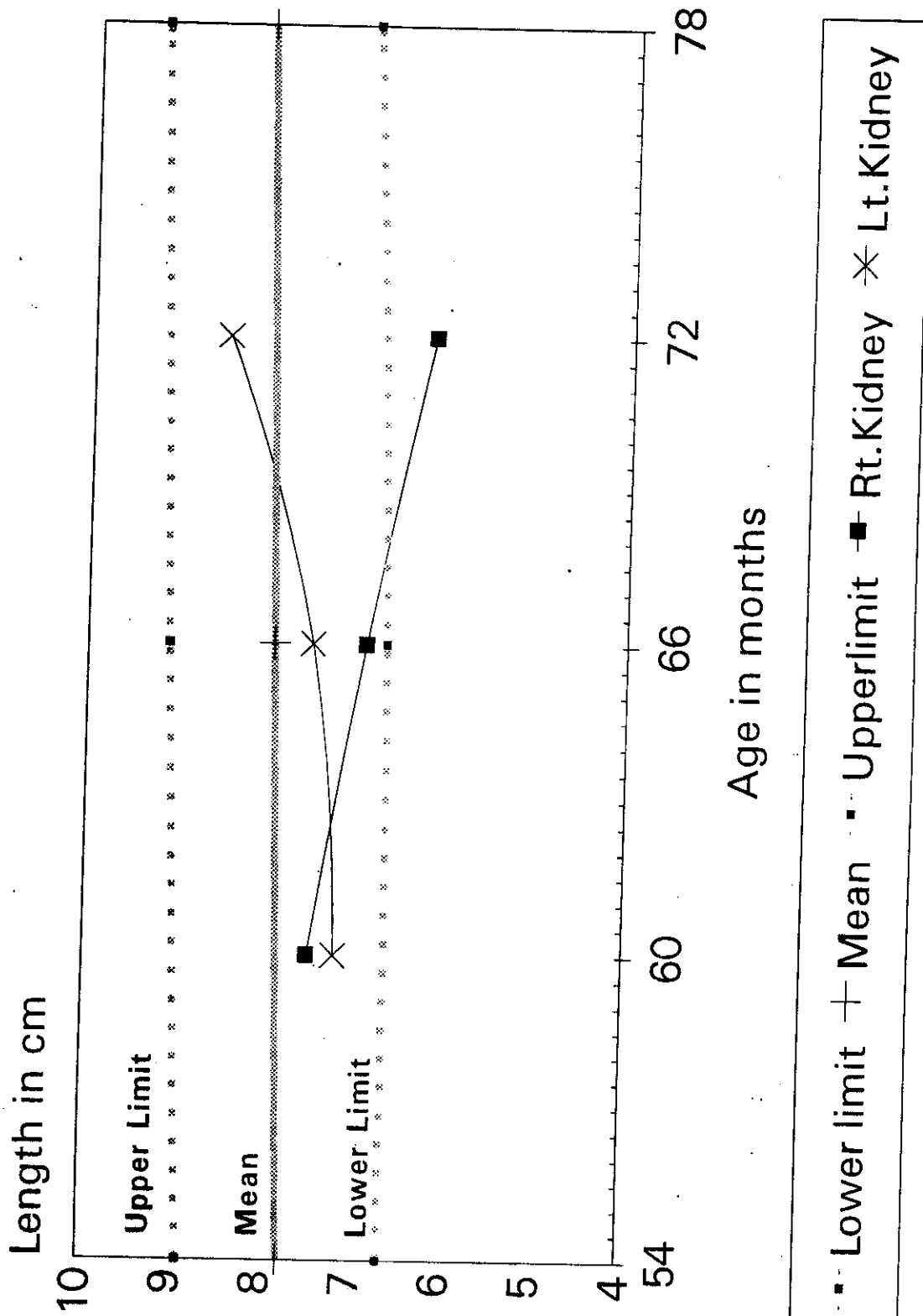
Fig.(13): Size of right and left kidneys in relation to the normal growth curve (patient number 5).

Length in cm

Age in months

Lower limit + Mean · Upperlimit ◆ Rt.Kidney ✳ Lt.Kidney

176
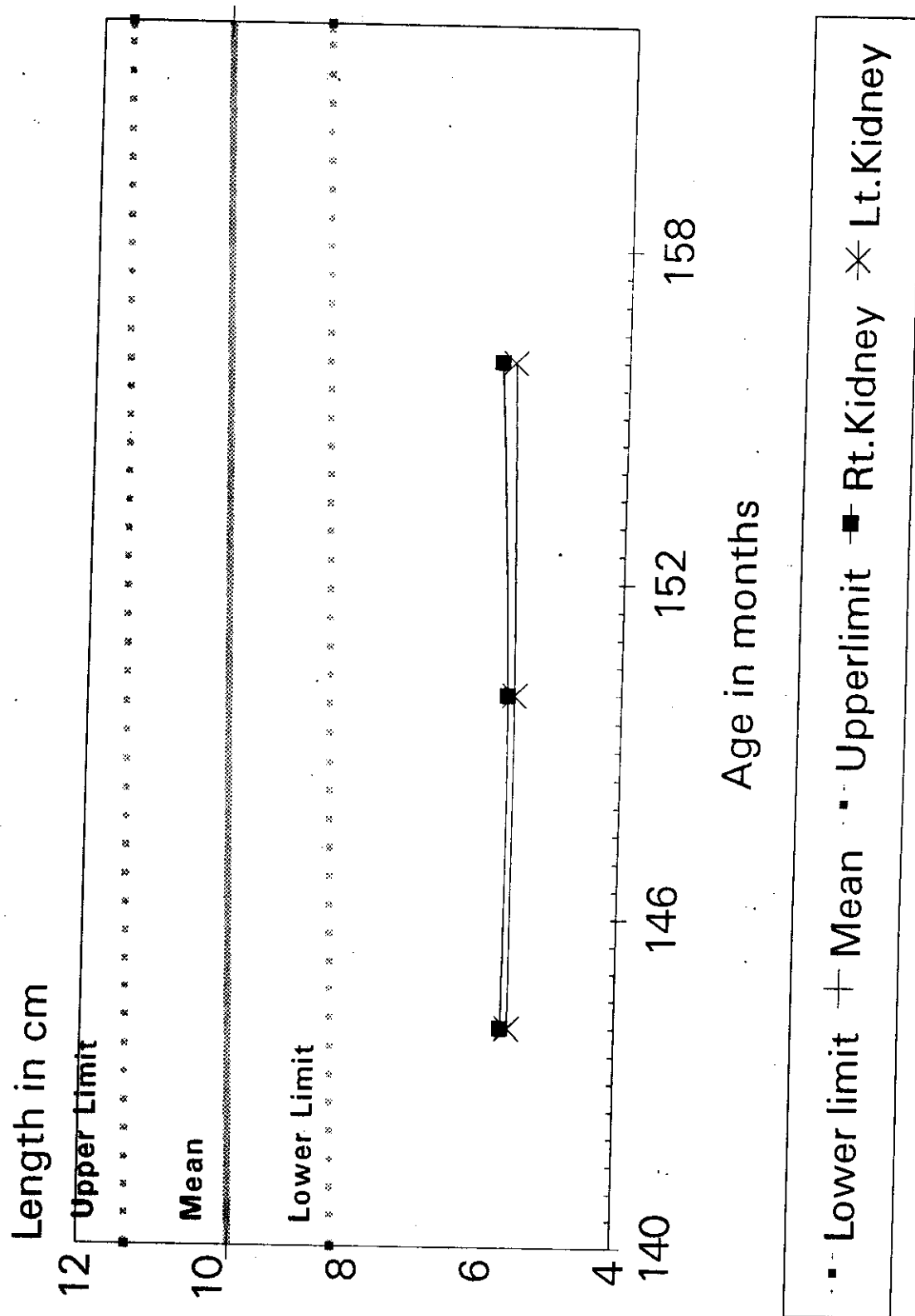
Fig. (14): Size of right and left kidneys in relation to the normal growth curve (patient number 6).

Fig. (15): Size of right and left kidneys in relation to the normal growth curve (patient number 7).

Fig. (15): Size of right and left kidneys in relation to the normal growth curve (patient number 7).

Length in cm

Upper Limit

Mean

Lower Limit

10				
9				
8				
7				
6				
5	54	60	66	72	78

Age in months
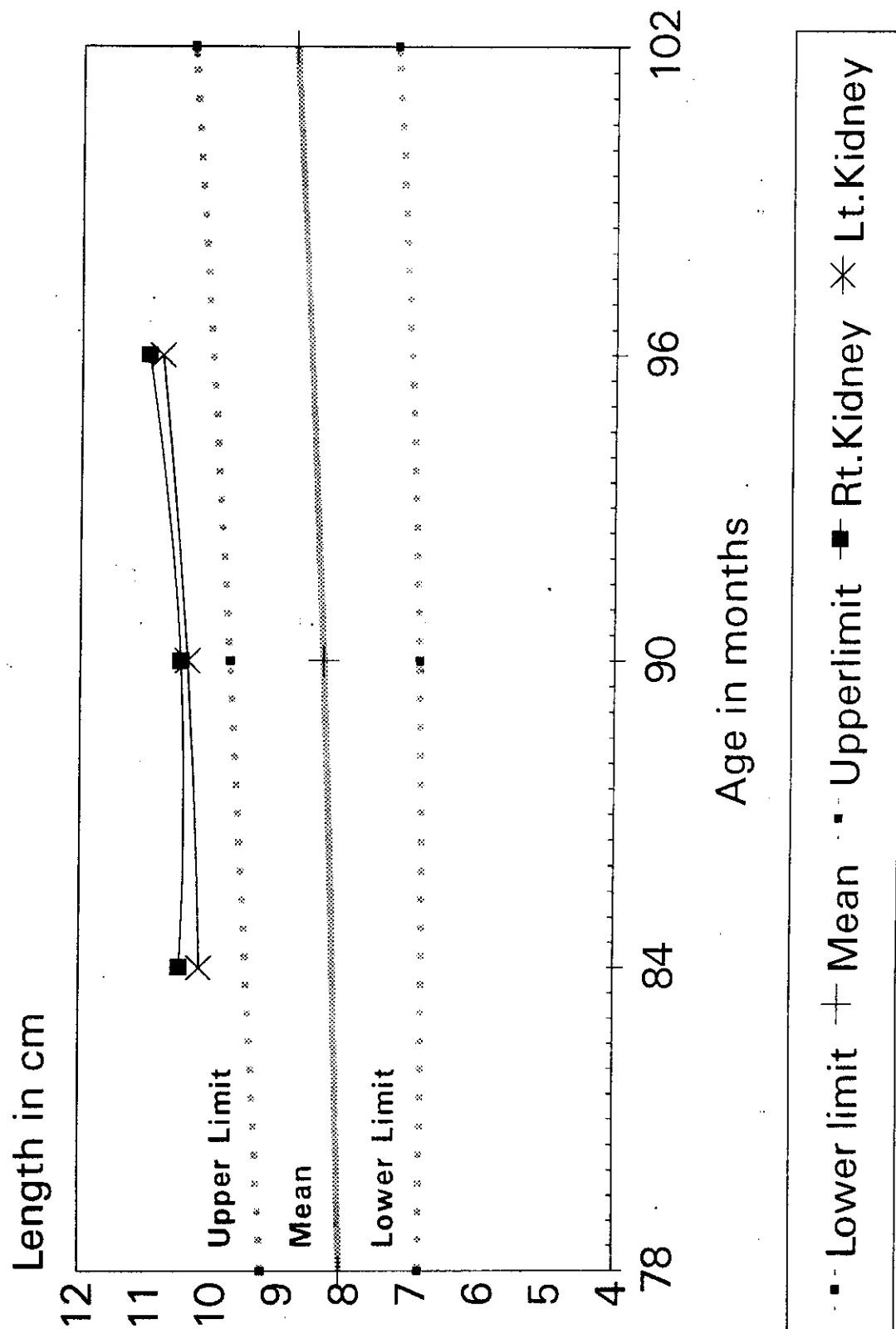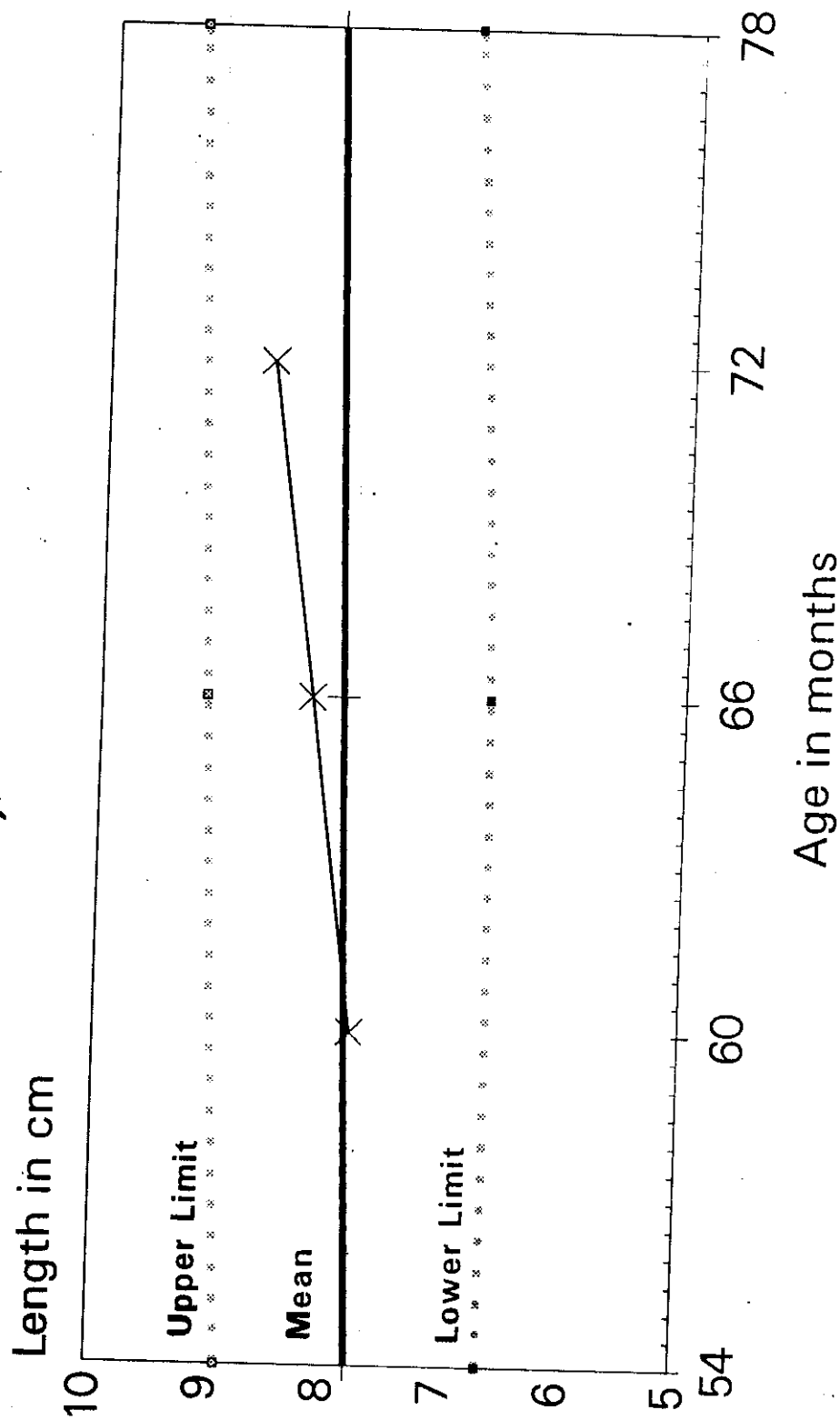
- Lower limit + Mean · Upperlimit ✕ Lt.Kidney

Fig. (16): Size of right and left kidneys in relation to the normal growth curve (patient number 8).

Length in cm

Upper Limit

Mean

Lower Limit

Age in months

Lower limit + Mean ⋯ Upperlimit ■ Rt.Kidney ✳ Lt.Kidney

180
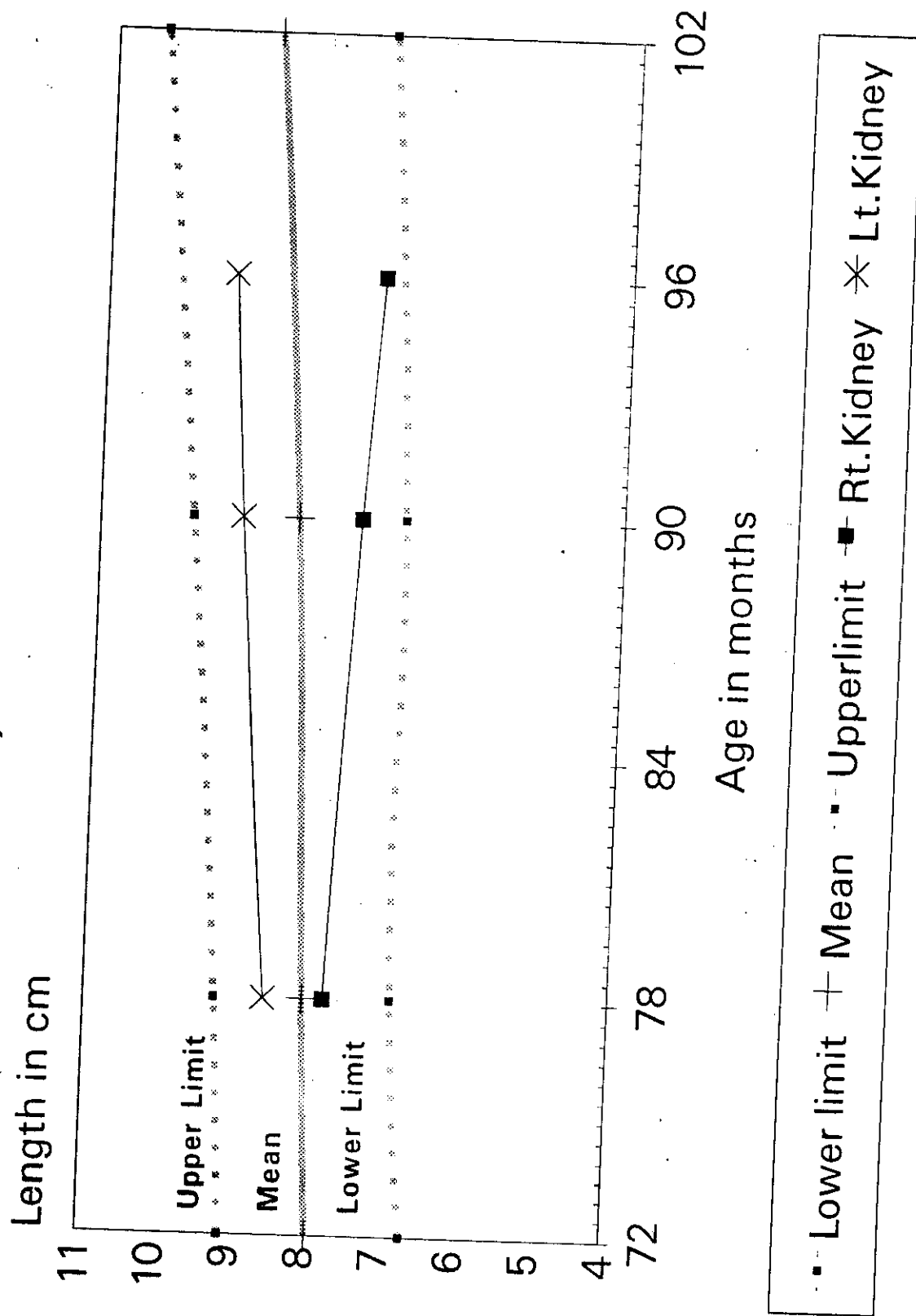
Fig. (17): Size of right and left kidneys in relation to the normal growth curve (patient number 15).

Length in cm

Upper Limit

Mean

Lower Limit

Age in months

- ∙ - Lower limit   + Mean   ∙ Upperlimit   ■ Rt.Kidney   ✕ Lt.Kidney
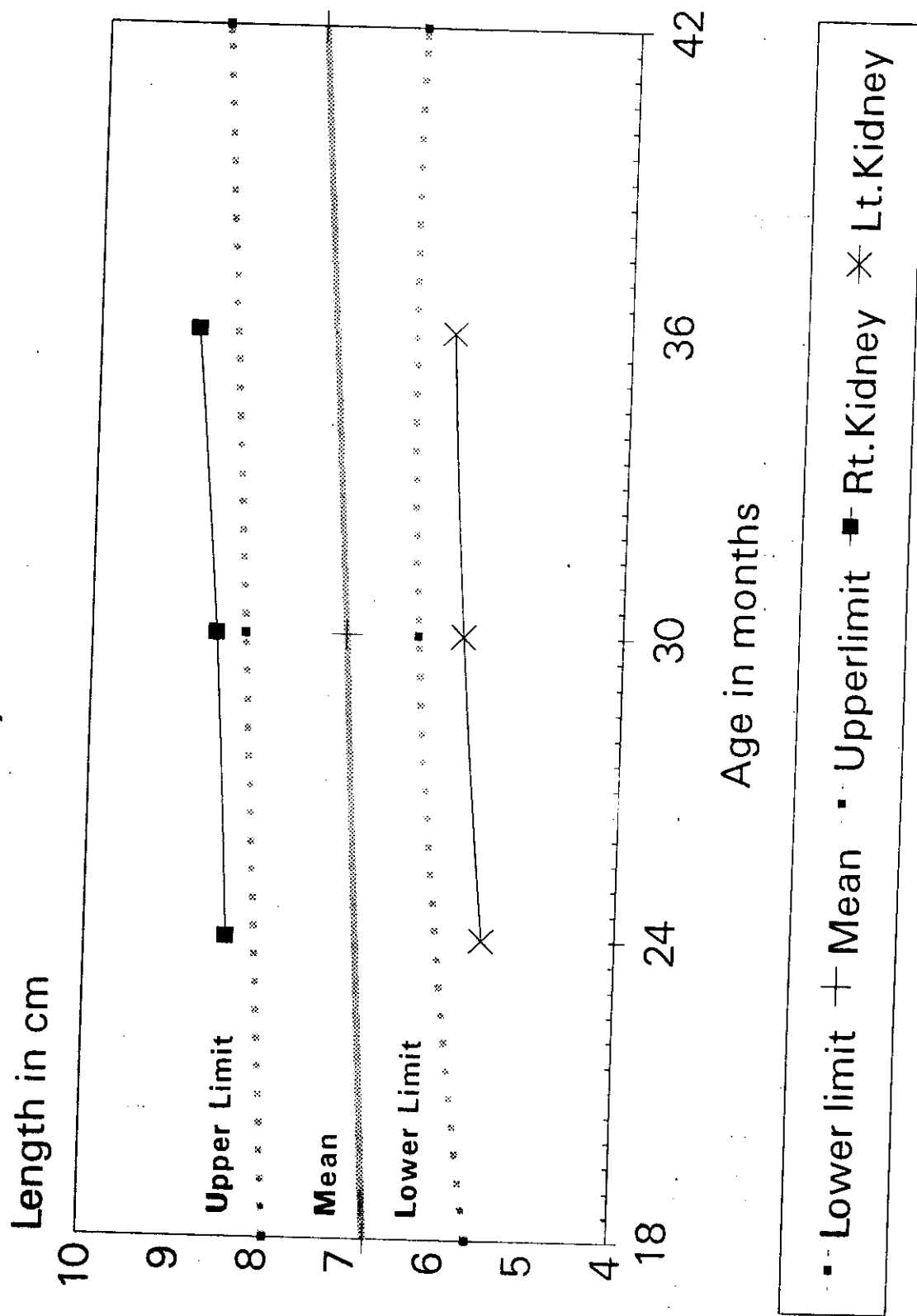
Fig. (18): Size of right and left kidneys in relation to the normal growth curve (Patient number 20).
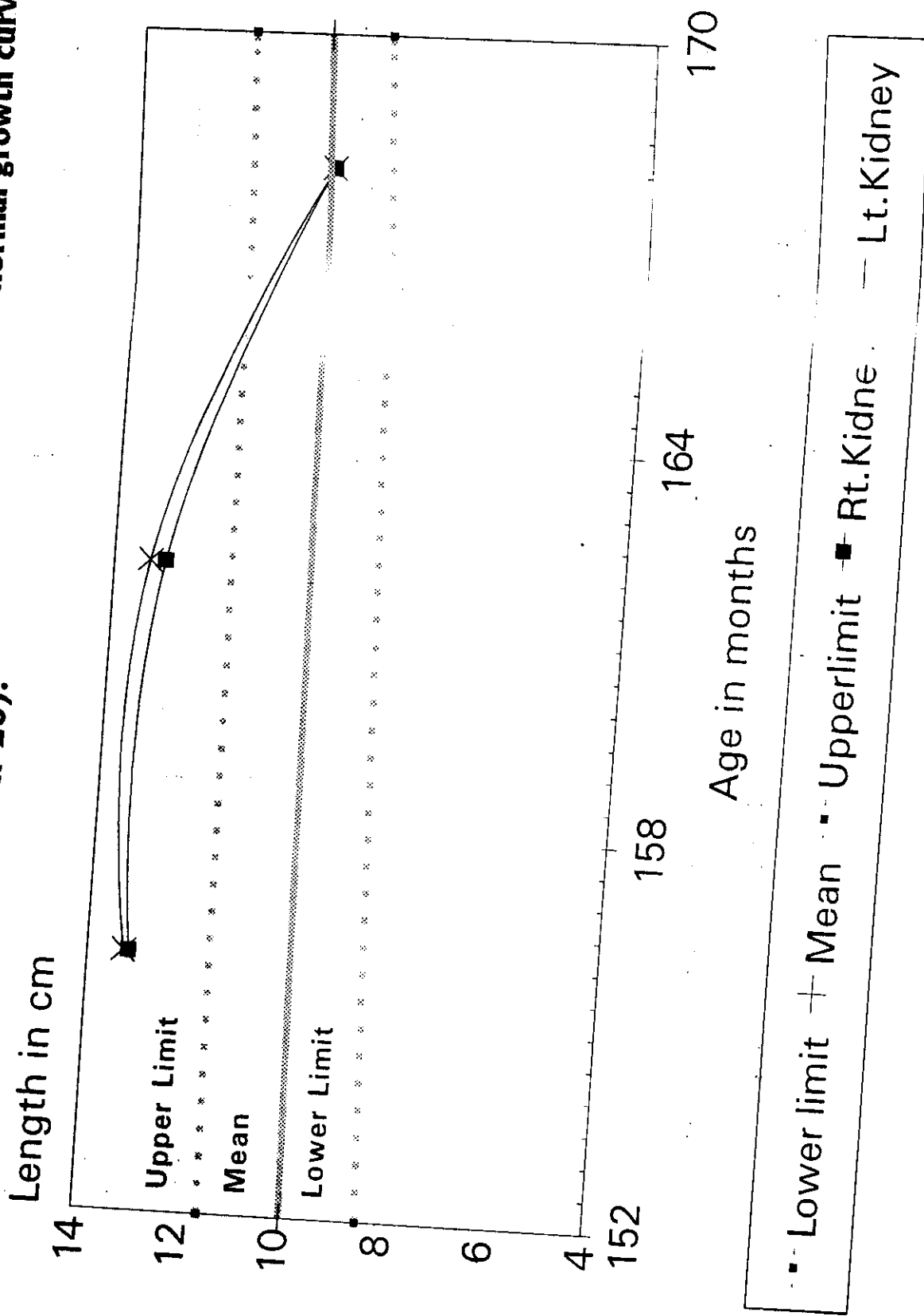
Fig. (19): Size of right and left kidneys in relation to the normal growth curve (Patient Number 51).

Age in months
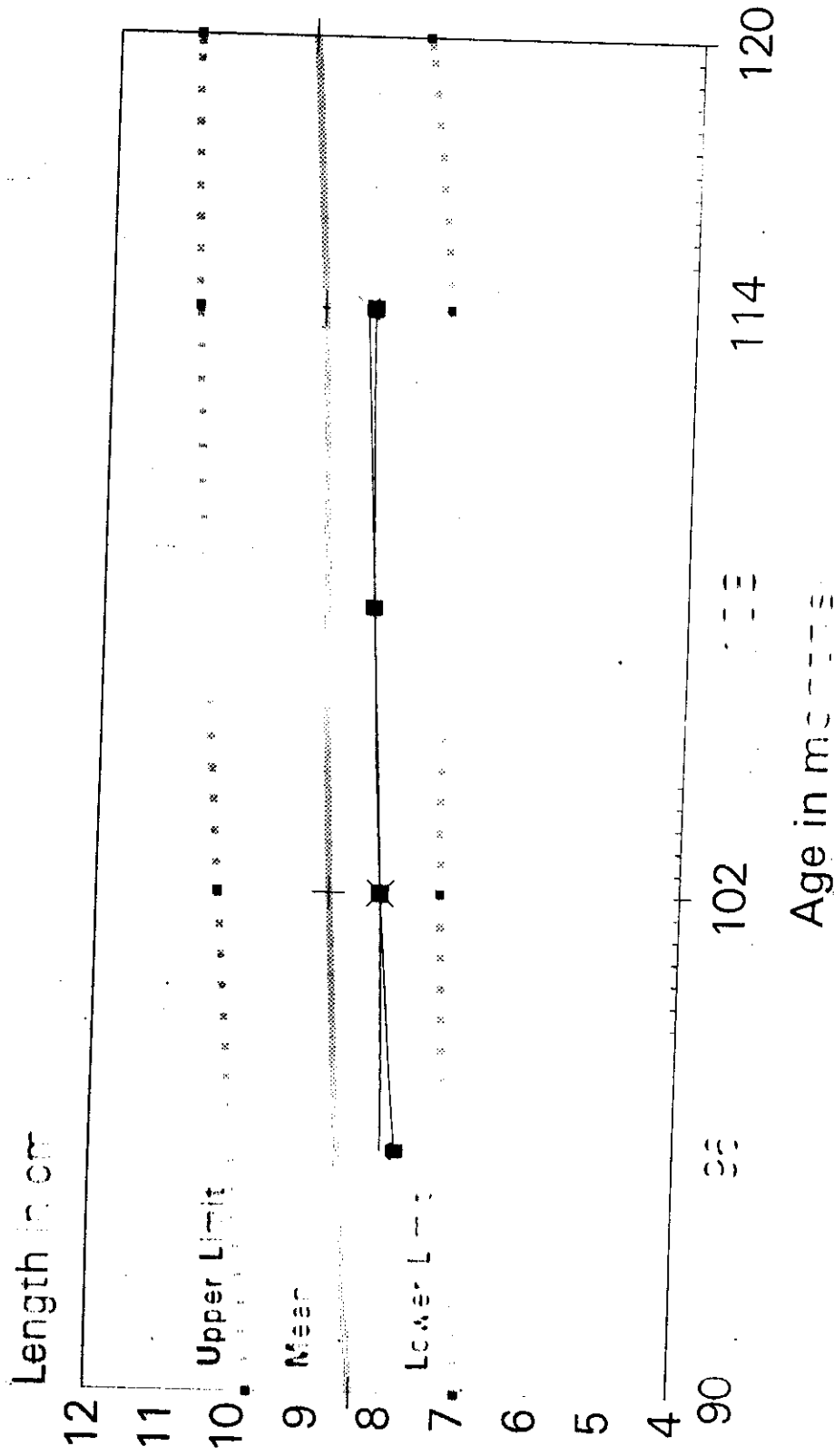
Lower limit — Mean ·· Upperlimit ■ Rt.Kidney ✳ Lt.Kidney

Fig. (20): Size of right and left kidneys in relation to the normal growth curve (patient number 54).
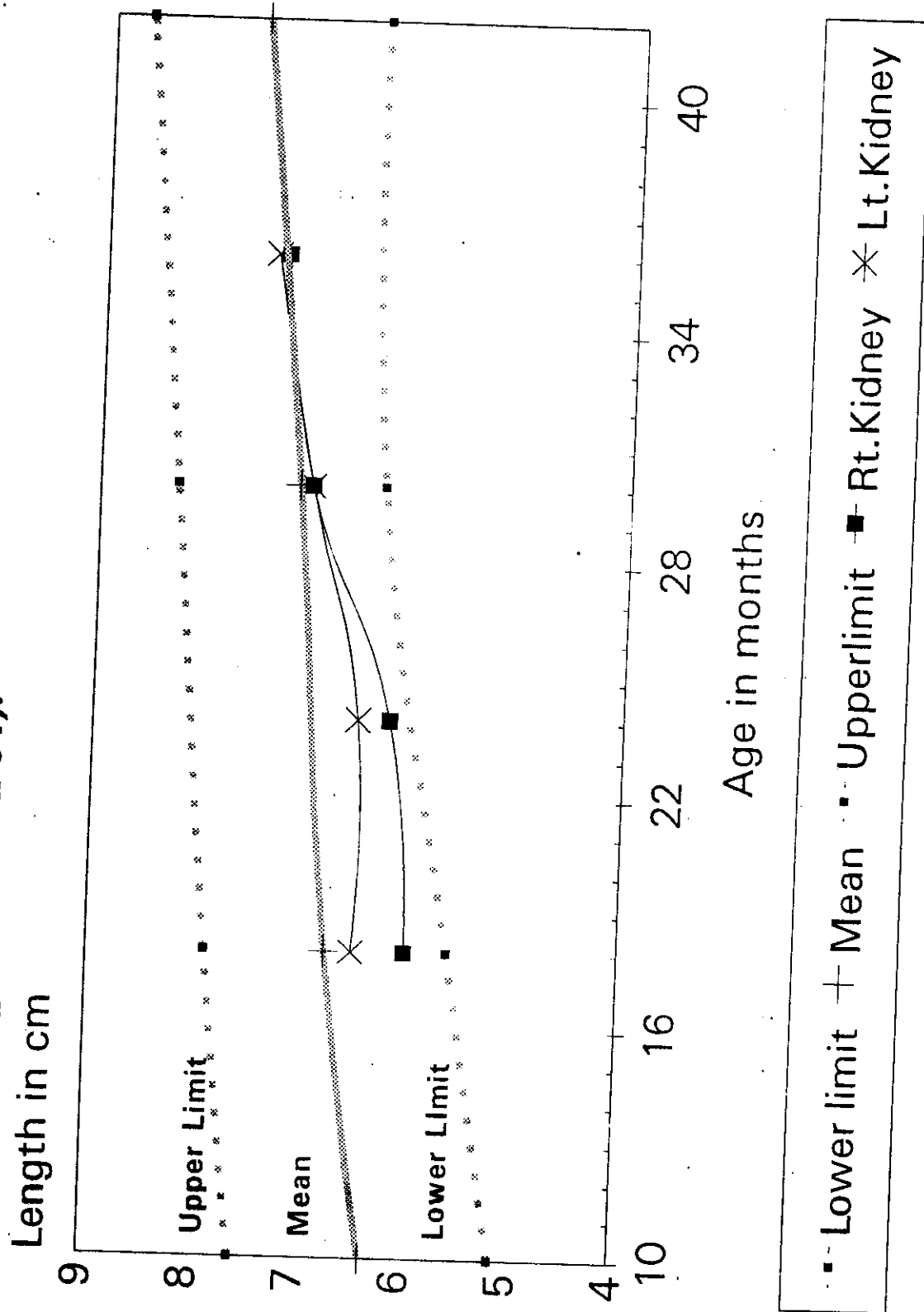
Length in cm

Age in months

- Lower limit + Mean · Upperlimit ■ Rt.Kidney ✳ Lt.Kidney

Fig. (21): Size of right and left kidneys in relation to the normal growth curve (patient number 67).

Length in cm

Upper Limit

Mean

Lower Limit

Age in months

··■·· Lower limit ┼ Mean ·■· Upperlimit ■ Rt.Kidney ✳ Lt.Kidney
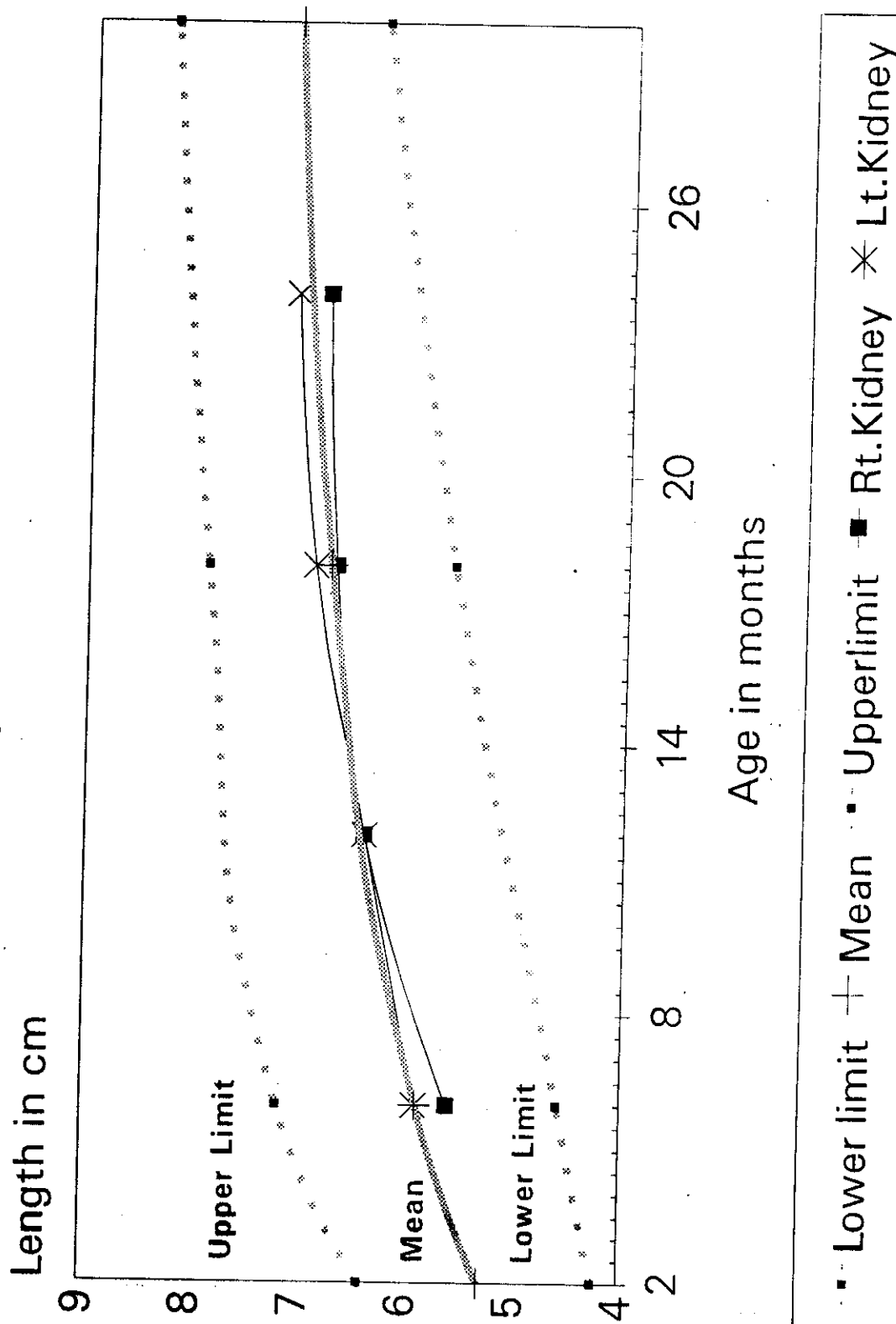
Fig. (22): Frequency of different types of pathology detected in 37 small kidneys.

Others
33%

Anomalies
18%

Obstruction
27%

Reflux
21%

Present
89%

Absent
11%
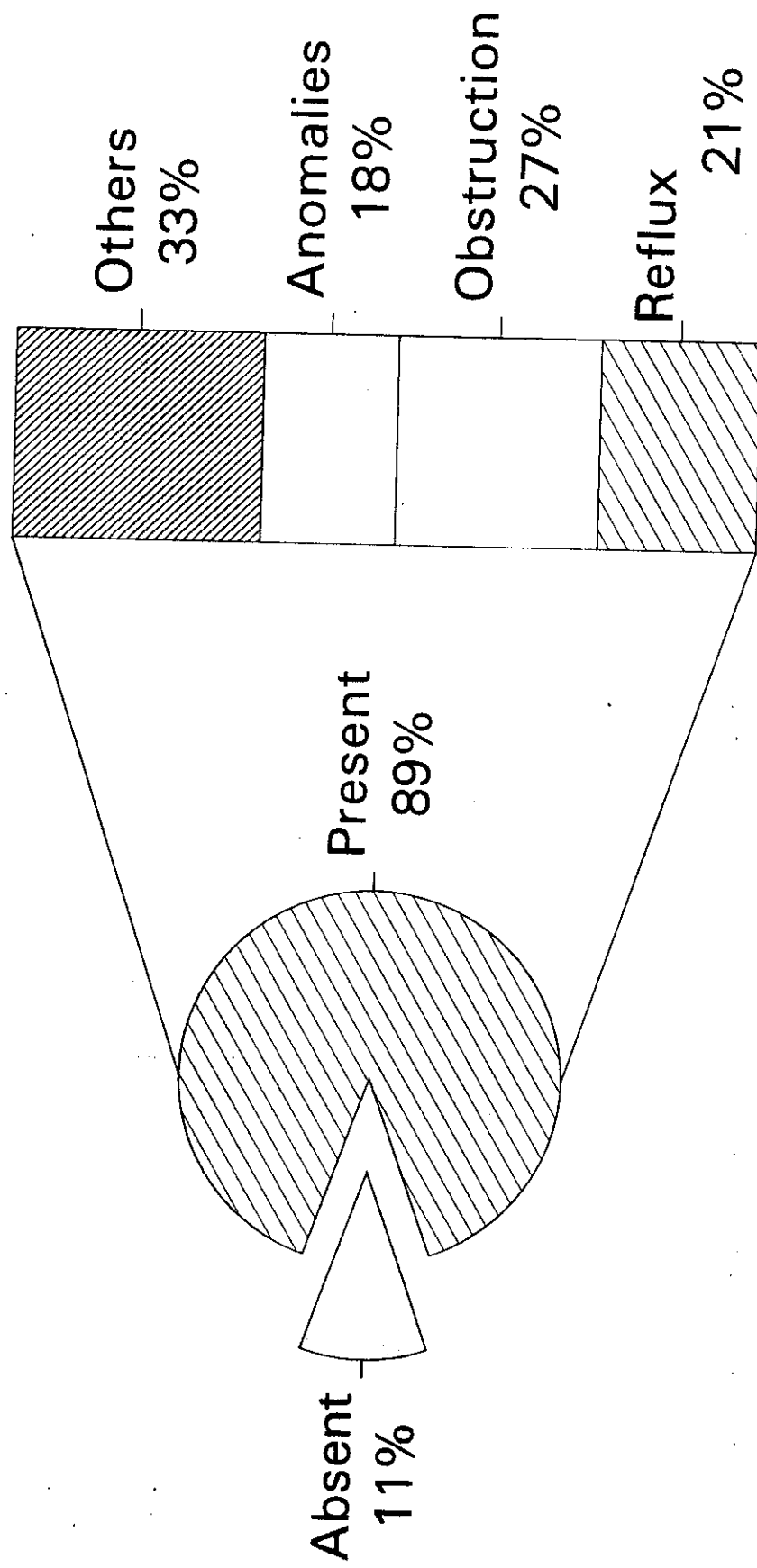
Diagnosis

Pathology

*R*esults

Fig. (23): Frequency of different types of pathology detected in 24 normal sized kidneys.

Others
13%

Anomalies
25%

Obstruction
25%

Reflux
38%

Present
21%

Absent
79%
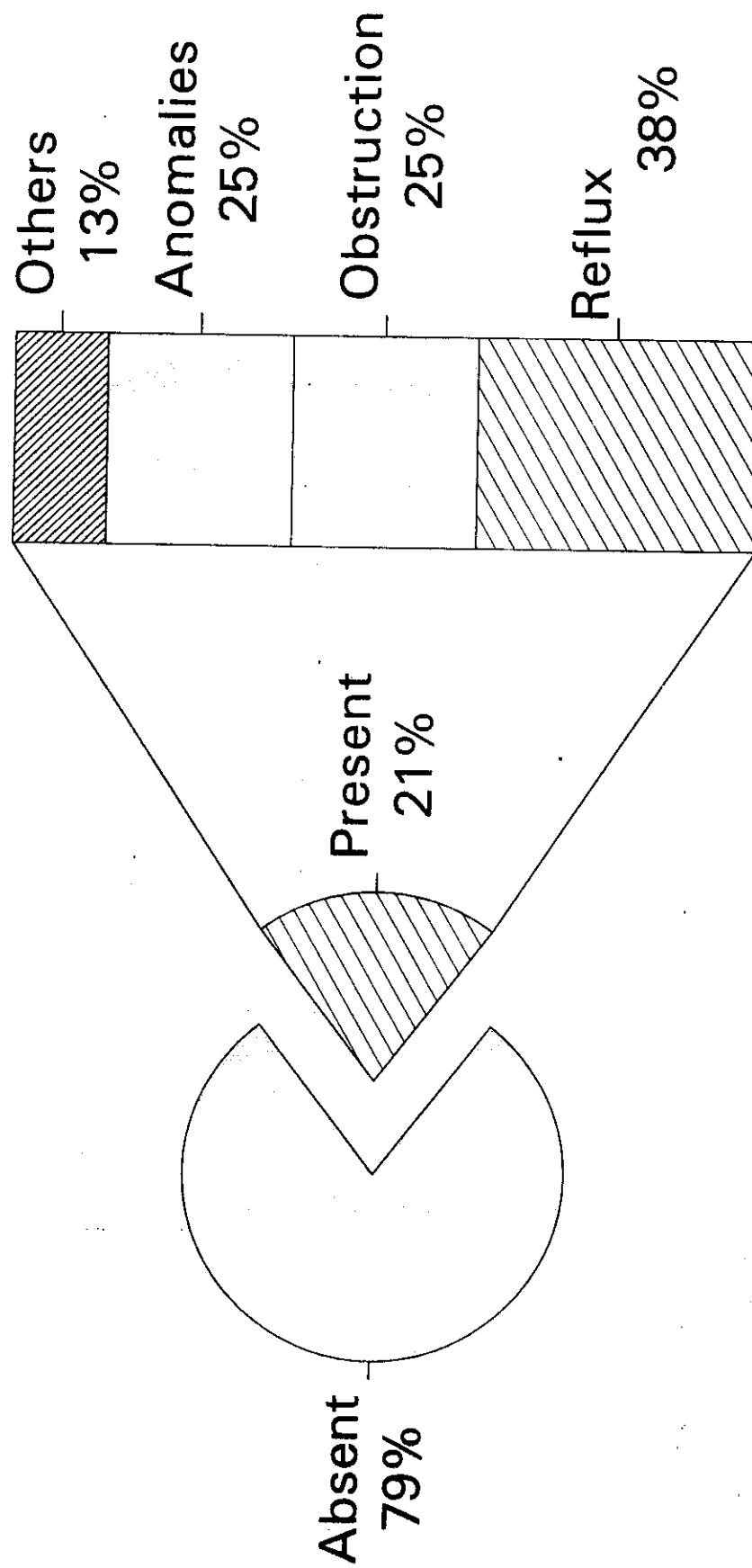
Diagnosis

Pathology

Case Presentation (1)

(A)
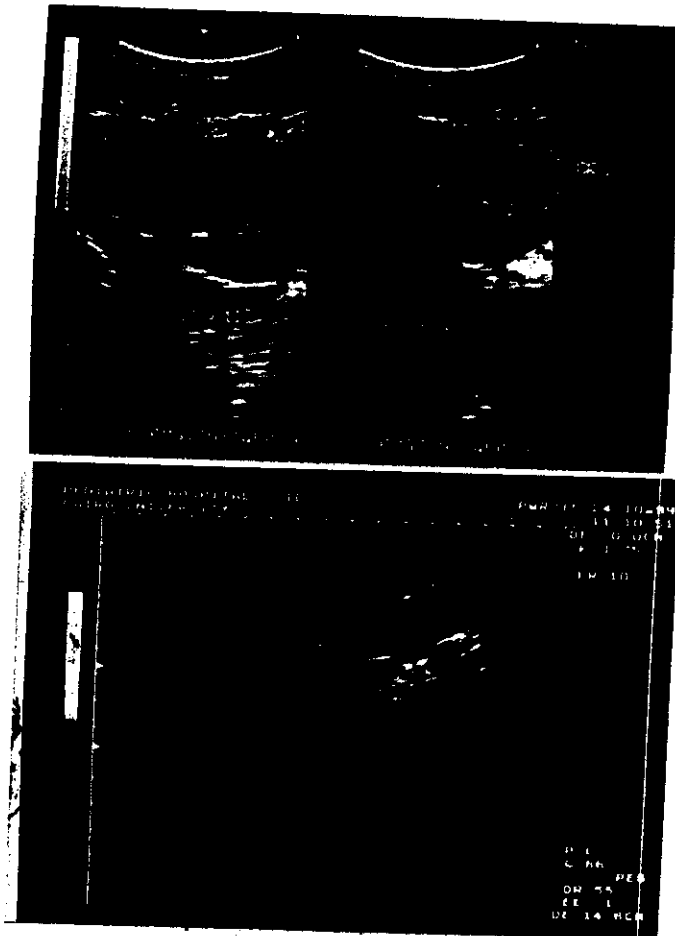
(B)
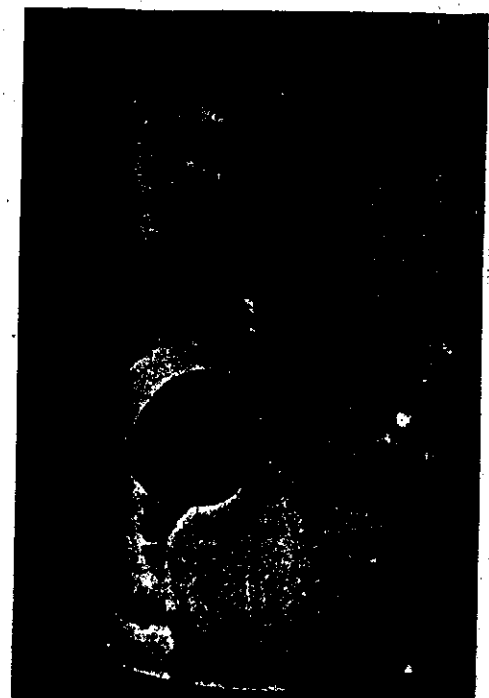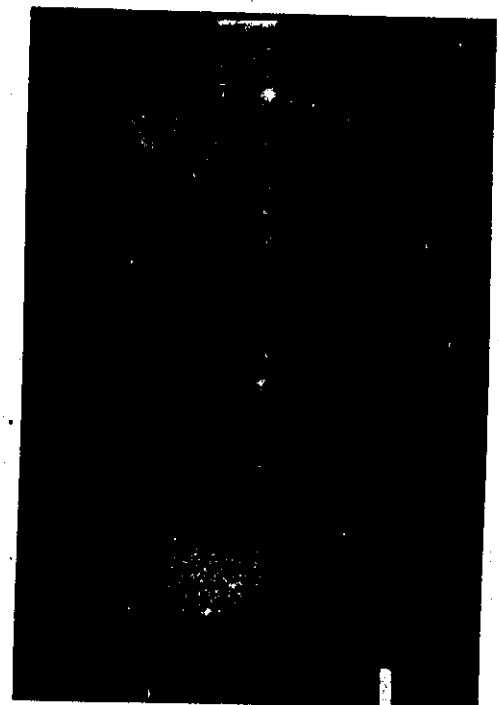
Patient No. 1 of the study: 4.5 years old ♀
with recurrent UTI 5 times/year. The onset
of 1st infection at age of 3.8 years.
A) US showing the discrepancy in size
between both kidneys with smaller Lt.
kidney - prominent left renal pelvis.
B) IVP showing mild dilated left pelvi-
calyceal system.
C) VCUG: showing grade III V.U.R.
reaching up to the Lt. pelvicalyceal.

Case Presentation (1)

(D)   (E)
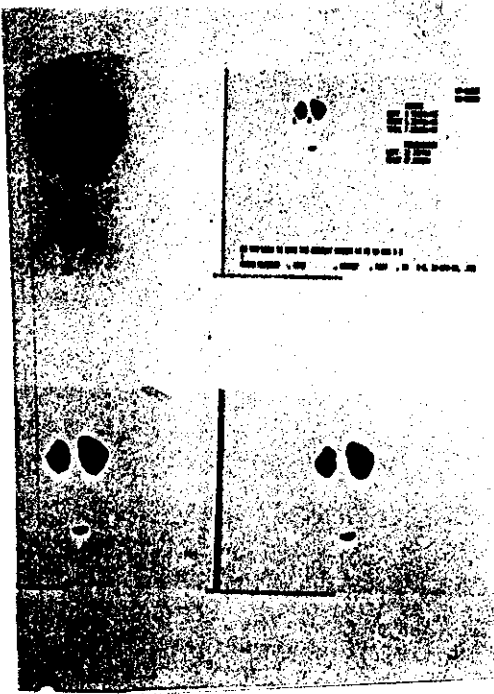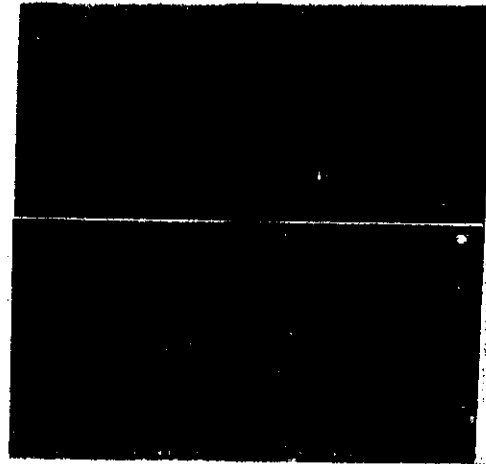
(D) ^{99m}Tc-DMSA scan posterior view showing relatively smaller Lt.
        kidney. Lt. kidney with upper pole scar and compromised function.

(E) ^{99m}Tc-DTPA scan showing markedly decreased perfusion-slow rate
        of radiotracer uptake and delayed excretion on the left side (G.F.R.
        on the Lt. side = 31.5%, on the right side 68.5%).

Case Presentation (2)
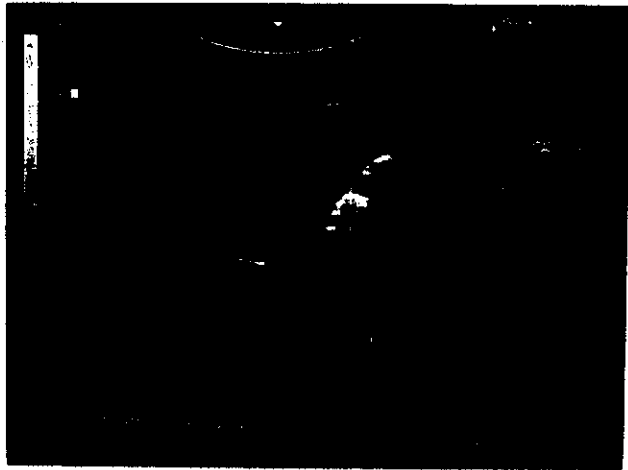
(A)   (B)
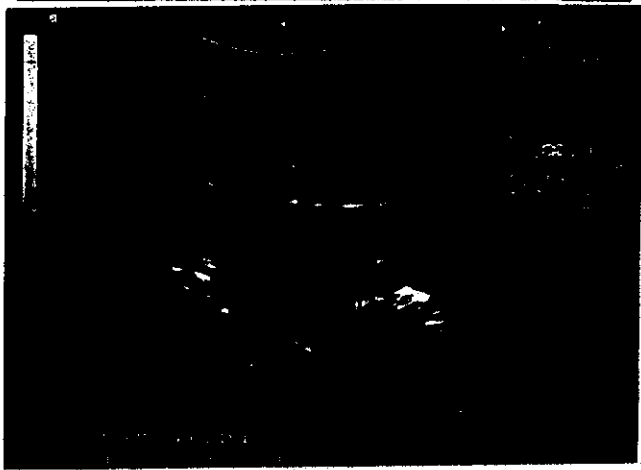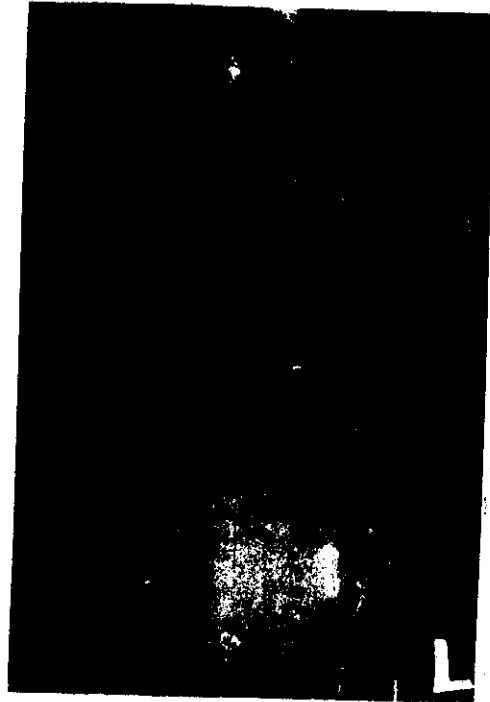
Patient No. 2 of the study 4 years old
female with recurrent UTI 5 times/year
and onset of 1st infection at age of 2
years.
(A) Abdominal US showing: Bilateral
smaller sized kidneys than expected
for age.
B) IVP: Normal.
C) VCUG: Slight irregular urinary
bladder wall with right VUR opacifying
lower part of Rt. ureter which exhibits
normal calibre.

Case Presentation (2)

(D)   **(E)**
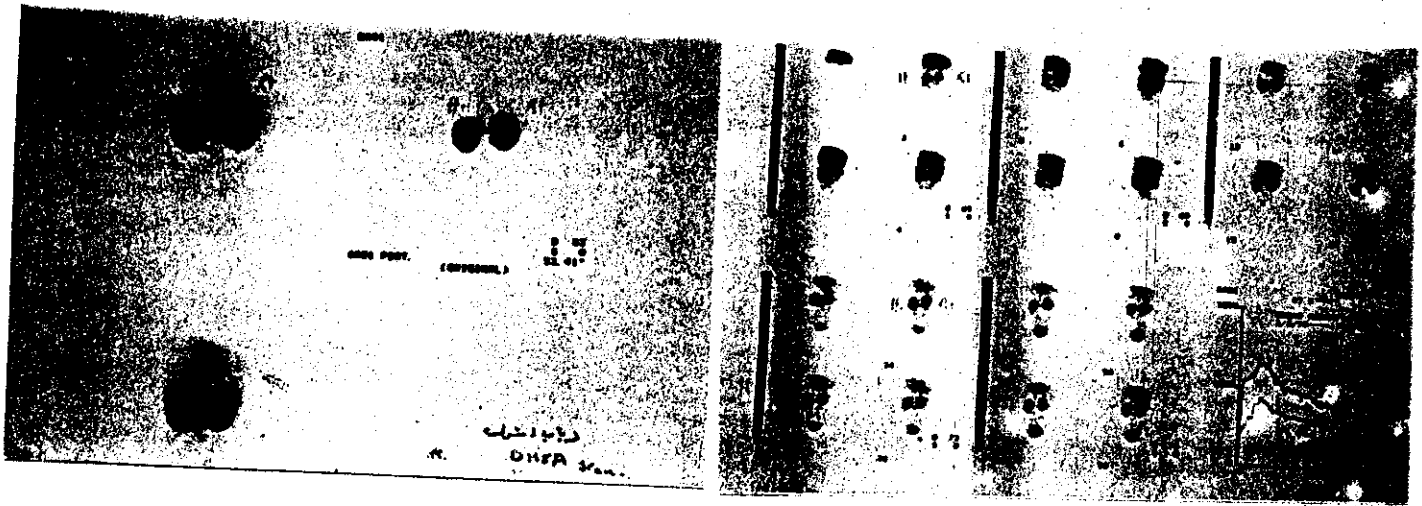
(D) ^{99m}Tc-DMSA scan posterior view showing bilateral normal kidneys with no evidence of scarring.

(E) ^{99m}Tc-DTPA scan showing normal function and morphology of both kidneys - low amplitude of the left kidney (average renal perfusion and excretion at both sides).

N.B.   The girl was found to be on the 15th percentile for her age on the growth curve.

Case Presentation (3)
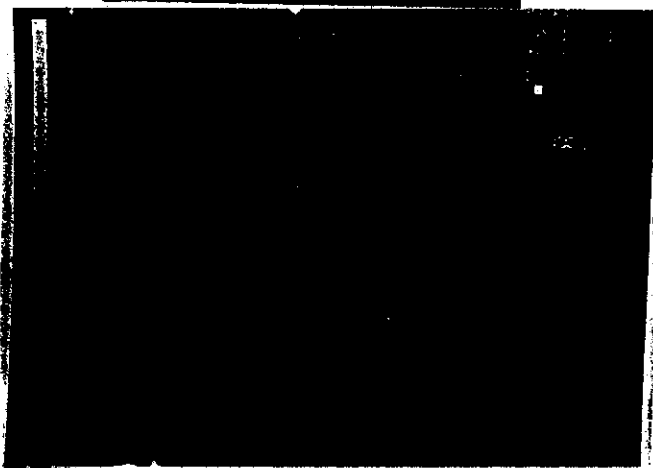
(A)   (B)

Patient No. 3 of the study: 6.33 years old female with recurrent UTI 6 times/year and onset of 1st infection at age of 2 years.

A) US showing: marked discrepancy in size between both kidneys, the left kidney being smaller. Rt. kidney: compensatory hypertrophy with partial duplex anomaly.

B) IVP showing right sided duplex anomaly with no evidence of dilatation of the pelvicalyceal system.

C) ^{99m}Tc-DMSA scan posterior view showing No cortical tracer uptake at the left side (atrophic kidney) with mildly enlarged right kidney.

Case Presentation (4)

(A)

(B)
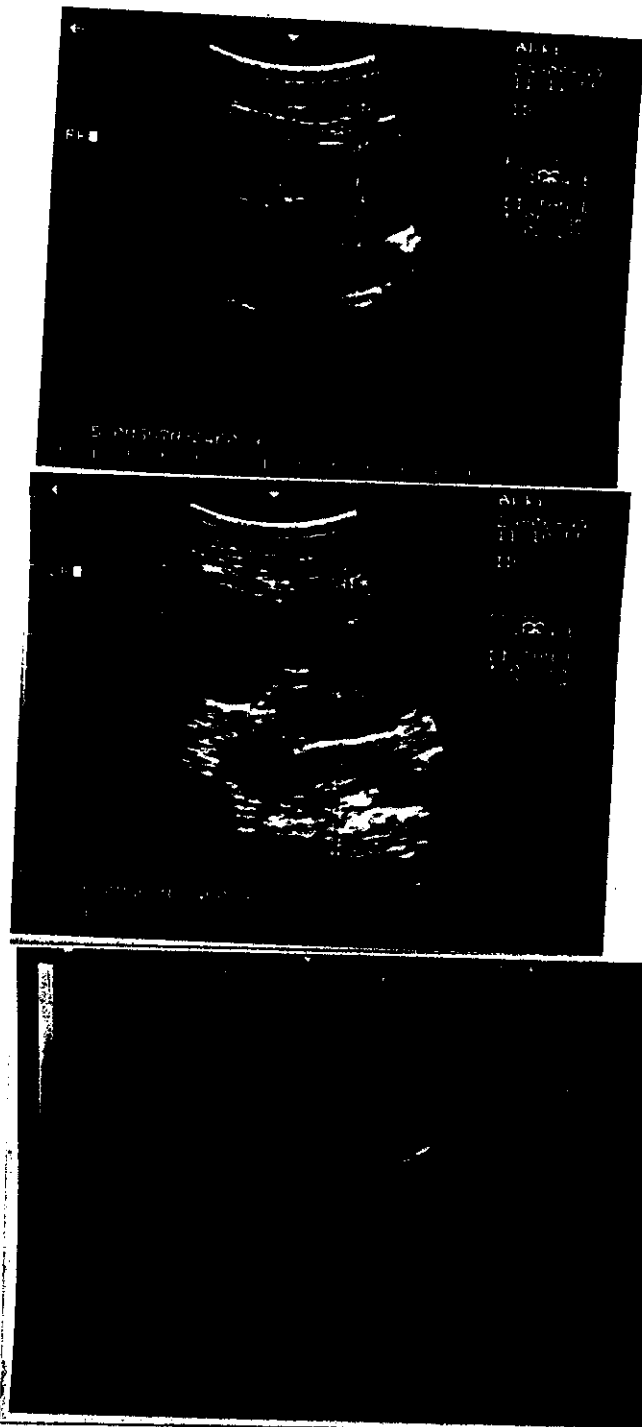
Patient No. 4 of the study 5 years old female with recurrent UTI 6 times / year with the onset of 1st infection at age of 4 years.

(A) US showing discrepancy in size between Rt. and Lt. kidneys with smaller right kidney. Partial duplex Rt. kidney with dilated pelvis of the lower renal moiety.

(B) IVP showing right sided duplex anomaly with hydronephrotic lower renal moiety.

(C)
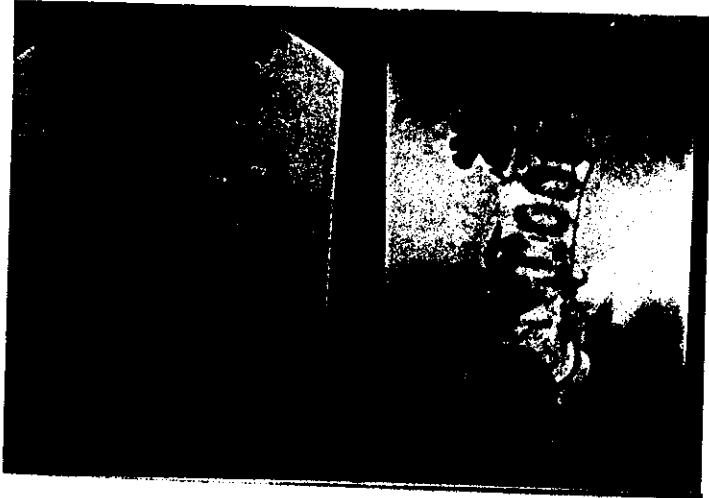
(C) VCUG showing bilateral
V.U.R. reaching both
pelvicalyceal systems. Rt.
side: Hydroureter + hydro-
nephrosis + 2 ureters on Rt
side.

(D)

(D) ^{99m}Tc-DMSA scan
posterior view showing small
right kidney with multiple
peripheral scars-medial
photopenic area of dilated
right pelvis.

(E) ^{99m}Tc-DTPA scan
showing decreased tracer
uptake-decreased perfusion
and excretion at the right side
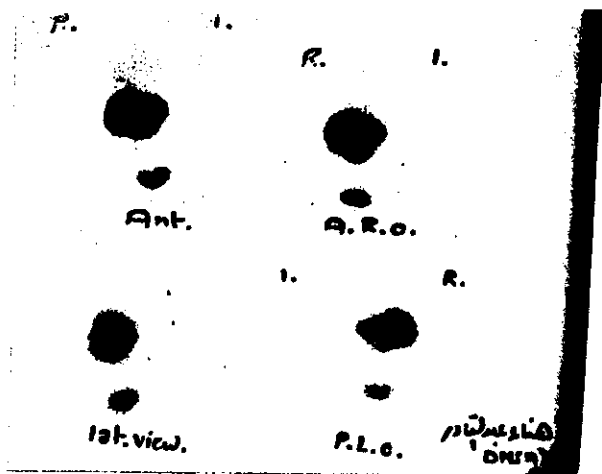with slow right descending
renogram.
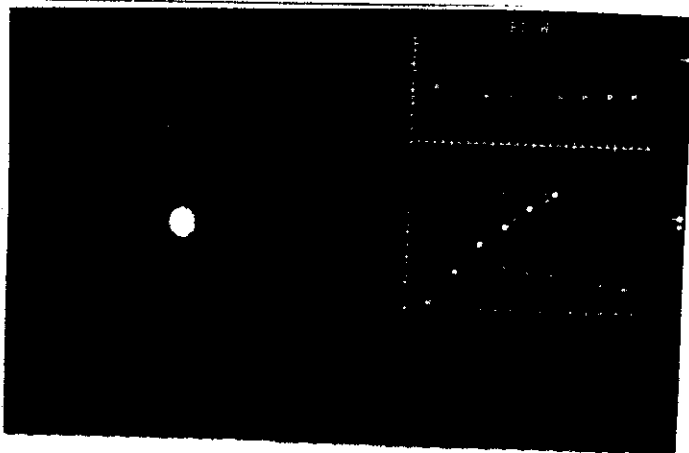
Case Presentation (5)

Patient No. 5 of the study, 12 years old female with recurrent UTI, 4 times / year and the age of onset of 1st infection was 9 years.

(A) US showing ectopic Lt. kidney with the upper pole joined to the upper pole of the right kidney at the region of the midline giving horse-shoe kidney.
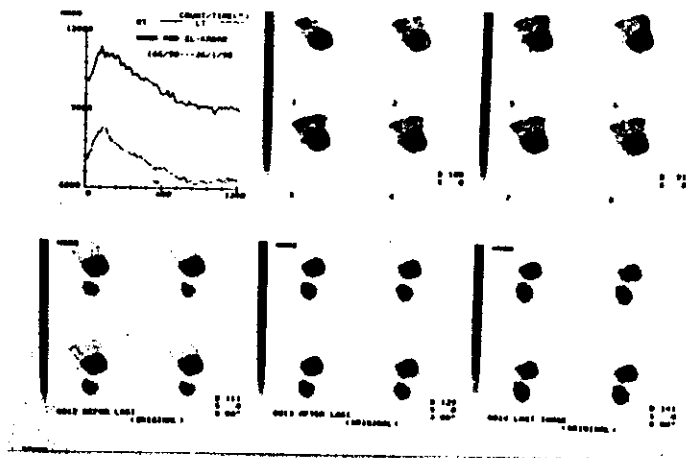
Case Presentation (5)

(B)

(B) ^{99m}Tc-DMSA scan post view showing ectopic horse shoe kidney with no evidence of scarring.
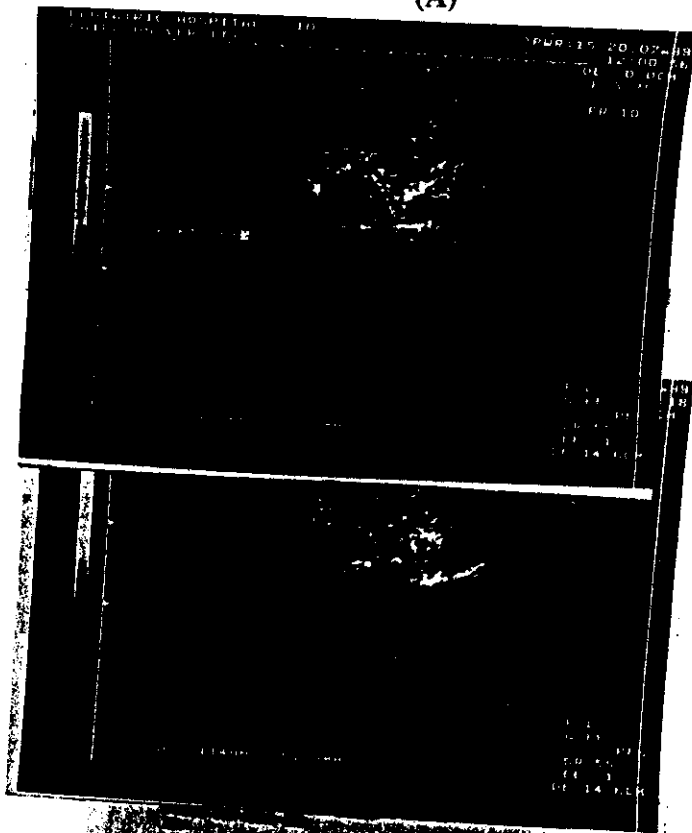
(C)

(C) ^{99m}Tc-DTPA showing average perfusion and excretion with proper parenchymal function and normal renogram.

Case Presentation (6)

(A)

Patient No. 6 of the study: 7 years old ♂ with recurrent UTI 4 times / year and the age of onset of 1st infection was 6 months.

(A) US showing enlarged Rt. and Lt. kidneys with increased echogenicity and scattered irregular small cysts (bilateral polycystic kidneys, recessive type.

(B) ^{99m}Tc-DMSA scan post-view showing bilateral enlarged kidneys with heterogeneous pattern.
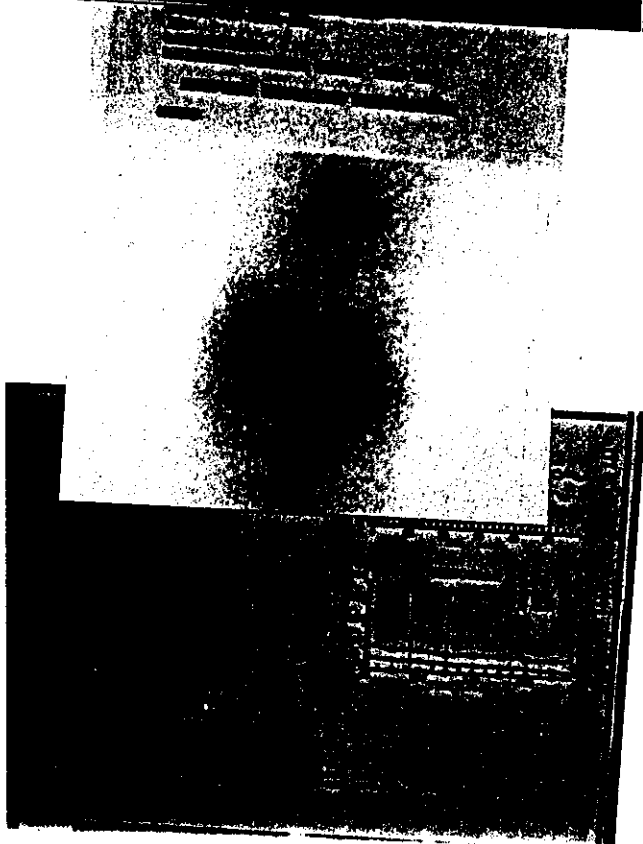
(C) ^{99m}Tc-DTPA scan showing decreased perfusion and excretion with marked impaired function.

G.F.R.   Rt. = 3.42%.

               Lt. = 6.73%.