Study of variations in the pelvicalyceal system of kidney and its clinical importance

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ABSTRACT
Objective
The present study has been undertaken to study the variations in renal pelvicalyceal system, to compare them with previous studies and to find their clinical implications.

Materials and Methods
A total of 100 kidneys (from 50 cadavers) were included in this study. The following parameters were measured 1) Lower Infundibular length, 2) Infundibular Width – Lower Infundibular Width (LIW), Middle Infundibular Width (MIW), Upper Infundibular Width (UIW), 3) Number of minor calyces and 4) Number of major calyces.

Results
The obtained data showed that there were numerous variations not only in the numbers of calyces of kidneys but also in the infundibular length and width.

Conclusion
Developments in endourology, percutaneous nephrolithotomy and techniques for retrograde percutaneous nephrostomy have rekindled interest in the anatomy of the renal collecting system. To perform these procedures safely and efficiently it is essential to have a clear understanding of pelvicalyceal anatomy and its variations. Thus the in-depth knowledge of pelvicalyceal anatomy will be of immense value to the clinicians of related specialties.

Key words: calyces, Infundibular length, infundibular width, pelvicalyceal system.

Introduction
The variations of the renal collecting system and the developmental anomalies of kidney are numerous. The variations in the gross structure of the renal collecting system are probably as numerous as there are individuals and thus can be compared to fingerprints. The bilateral collecting systems present in any single individual are often similar but are rarely identical and not uncommonly, may be quite different even from one another.

Anatomy textbooks frequently divide calyces into major and minor components. The usual description states that three major calyceal systems arise from the renal pelvis, subdividing into three to five minor calyces. For
practical purpose all branches from the pelvis, whether single or multiple, are termed infundibula.¹

The knowledge of detailed calyceal anatomy is very essential for endourological procedures, for the selection of the best method of kidney stone treatment for a specific patient, for the better understanding and interpretation of standard Intravenous Urography.² The effect of pelvicalyceal anatomy on stone formation was not well evaluated up to date. If we consider that all the risk factors for stone formation are similar for both kidneys of a patient, it is very difficult to explain why a calculus is primarily formed in single calyx but not in other calyces of both kidneys, when metabolic factors are in operation. From this point of view, it is very logical to consider that different pelvicalyceal properties are the key factor for the lateralization of the stone and also constitute a risk factor for their etiology.³

The present study has been undertaken to study the variations in renal pelvicalyceal system, to compare them with previous studies and to find their clinical implications.

**Materials and methods**

A total of 100 kidneys (from 50 cadavers) were included in this study. In most of the previous studies Intravenous Urography (IVU) films were used for measuring the different parameters. In our present study the coronal section of each kidney was taken for measuring different parameters of the pelvicalyceal system.

The parameters measured were as follows

- Lower Infundibular length,
- Infundibular Width –
- Lower Infundibular Width (LIW),
- Middle Infundibular Width (MIW),
- Upper Infundibular Width (UIW),
- Number of minor calyces,
- Number of major calyces.

The parameters were measured as follows

**Lower Infundibular length (LIL)**

It was measured as a distance from the most distal point at the bottom of the lower calyx to the midpoint of lower lip of the renal pelvise as shown.

![Figure 1: Measurement of LIL](image1)

**Infundibular Width**

LIW, MIW & UIW were measured at the narrowest point along their respective infundibular axis.

![Figure 2: Measurement of UIW and LIW](image2)
Result
A total of 100 kidneys (from 50 cadavers) were studied. The results of infundibular measurements and of calyces are shown in graph 1 to 6 & and are discussed below.

Discussion
Lower Infundibular Length (LIL)
In our present study the LIL varies from 7 mm to 27.2 mm (the mean was 17.31 mm) and it was 10-15 mm
in 24% and 15-20 mm in 37%. (Graph no. 1). According to Sun Y. B. et al and Gupta N. P. et al the LIL was d" 30 mm in 60.87% & in 77% respectively. In similar studies, Madbouly K. et al found that the LIL was d" 30 mm in 54.6%. Srivastava A. et al found that in 54.55% the LIL was < 25 mm. Another study was conducted by Sorensen C. M. et al where they found that LIL was 21-30 mm in 48%, greater than 30 mm in 45%.

**Minor Calyces**

In present study the number of minor calyces varies from 5 to 11 and most often 8 minor calyces were present (Graph no. 5). Kaye K. W. stated that the numbers of minor calyces were 4 to 12 (most often 8). Sykes and David found that the number of minor calyces varies from 5 to 20 (average 8 to 9). Similarly Harrison reported that there were 8 to 9 minor calyces in kidney. Hollinshead and Dyson M. claimed that there were 7 to 8 minor calyces. Ningthoujam D. D. et al found that the numbers of minor calyces were 8 to 18.

**Major Calyces**

Fine and Keen reported the presence of two major calyces in majority of cases and also the presence of third major calyx in some cases. Ningthoujam D. D. et al reported that the number of major calyces varies from 2 to 3.

In present study the number of major calyces varies from 2 to 3. Two major calyces were present in 60%. (Graph no. 6).

**Conclusion**

The obtained data showed that there were numerous variations not only in the numbers of calyces of kidneys but also in the infundibular length and width. Developments in endourology, percutaneous nephrolithotomy and techniques for retrograde percutaneous nephrostomy have rekindled interest in the anatomy of the renal collecting system. To perform these procedures safely and efficiently it is essential to have a clear understanding of pelvicalyceal anatomy and its variations. Thus the in-depth knowledge of...
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References


