RECENT ALTERNATIVES
IN MANAGEMENT OF
RENAL AND UPPER URETERIC CALCULI

THESIS

Submitted in Partial Fulfilment for

the M.D. Degree in *Urology*

By

Sherif Salah El-Din A.A. Soliman

M.B., B.Ch., M. Sc. Urology

Supervised By

Prof. Dr. Aly Maged
Professor of Urology
Ain Shams University,
Cairo — Egypt

Prof. Dr. J. M. Dubernard
Professor of Urology
Edouard Herriot Hospital
Claude Bernard University
Lyon I — France

Prof. Dr. Abdel Wahab El-Kassaby
Professor of Urology
Ain Shams University,
Cairo — Egypt

Dr. A. Gelet
Department of Urology
and Transplantation
Edouard Herriot Hospital
Lyon I — France

Faculty of Medicine
Ain Shams University

1987

ACKNOWLEGEMENT

I wish to express my deepest gratitude to Professor Dr. ALY MAGED, Professor of Urology, Ain Shams University, for his continuous help, encouragement and most valuable advice and suggestions.

To Profesor Dr. ABDEL WAHAB EL-KASSABY, Profesor of Urology, Ain Shams University, I extend my profound appreciation for his valulable advice , constant support and his enthusiastic help.

I am deeply honoured to have the opportunity to express my great indebteness and gratitude to Prof. Dr. J.M. DUBERNARD , Prof. and Chief of Urology Department, Edouard Herriot Hospital, Claude Bernard University, for his great help, meticulous supervision and continuous encouragement, throughout this work with constructive criticism.

To Dr. A. GELET , Edouard Herriot Hospital , I wish to express my great appreciation for his kind supervision and valuable suggestions.

I am deeply grateful to Dr. X. MARTIN , Edouard Herriot Hospital, for his valuable advice and aid.

بسم الله الرحمن الرحيم

CONTENTS

INTRODUCTION

In the last few years a revolutionary change has occurred in treatment of urinary stones. The introduction of the endoscopic material and the advent of Extracorporeal Shock Wave Lithotripsy have significantly reduced the indications for open surgery. At persent renal stones are preferably treated by Extracorporeal shock wave Lithotripsy (ESWL), Percutaneous surgery or a combination of both. Upper ureteral stones still represent a controversial matter because many different therapeutical approaches are available, and none of them is quite satisfactory.

In our study we try to define the rational use of each technique now available for an effective treatment of renal and upper ureteral stones.

Anatomy

ANATOMY OF THE KIDNEY

Introduction

Knowledge gleaned from the standard anatomical texts is often inadequate, in that only static or morbid anatomical descriptions are given.

In the 19th Century the painstaking dissection work of the contemporary anatomists resulted in detailed topographical descriptions on which modern texts are based. Also a great deal has been learned about the position, variations and abnormalities of the kidneys and ureters by the extensive experience of modern renal surgery.

It is however, imaging techniques which have provided the first chance to study the renal position relative to posture, movement and compression in vivo. Radiology remains paramount in these methods. plain Abdominal X-ray, intravenous urography, angiography, Co_2 insufflation, X-ray screening, computerised axial tomography, ultrasound (B real time), nuclear magnetic resonance, radio-nucleotide investigations have been exploited in order to demonstrate the relevant features of percutaneous anatomy *(Wickham et al., 1984).*

Positions of the Kidneys Within the Body

The kidneys are paired retroperitoneal organs lying in close proximity to the spinal column immediately below the thoracic diaphragm in the shallow trough-like renal niche *(Olsson, 1986).*

The longitudinal axes of the kidneys are not straight. A degree of rotation is always seen. The upper poles of each kidney are more closely approximated than the lower poles. This can be appreciated clearly when the psoas muscle is inspected. This structure not only increases in bulk but also slopes forward in its caudal passage (cone shaped), thus creating the retro-peritoneal gutters which are correspondingly shallow in the cranial direction and deeper in the caudal direction. The kidney which lies on this muscle has an anterior surface which is directed laterally and forward and a posterior surface which is directed medially and backwards therefore the coronal planes of the kidneys lie 25° (30-50°) *(Clayman et al., 1984)* behind the coronal plane of the body (Fig. 1-1). In the embryo the pelvis is directed anteriorly, but medial rotation during development is responsible for its final adult position. Rotation of the pelvis in the antero-posterior plane is however extremely variable.

Movement of the diaphragm in respiration causes the kidney to move downwards in inspiration and upwards in expiration. The amplitude of movement is very variable but it is in the order of 3 cm. The right kidney is more mobile than the left. Such movement is more pronounced in women than in men. Shifts of 8 to 9 cm have been reported in the literature when the recumbent patient becomes erect, 3 to 5 cm is the norm. *(Wickham et al., 1984).*

Factors Holding the Kidney into Position

Numerous factors have been cited. The enveloping renal fascia, vascular connections and intra-abdominal pressure are probably paramount. Within the renal fascia the surrounding perirenal fat allows a considerable range of movement in most people, despite the fact that it is somewhat denser than the fat in the rest of the body. The vessels are relatively short and rigidly anchored to their mid-line origin. The intra-abdominal pressure

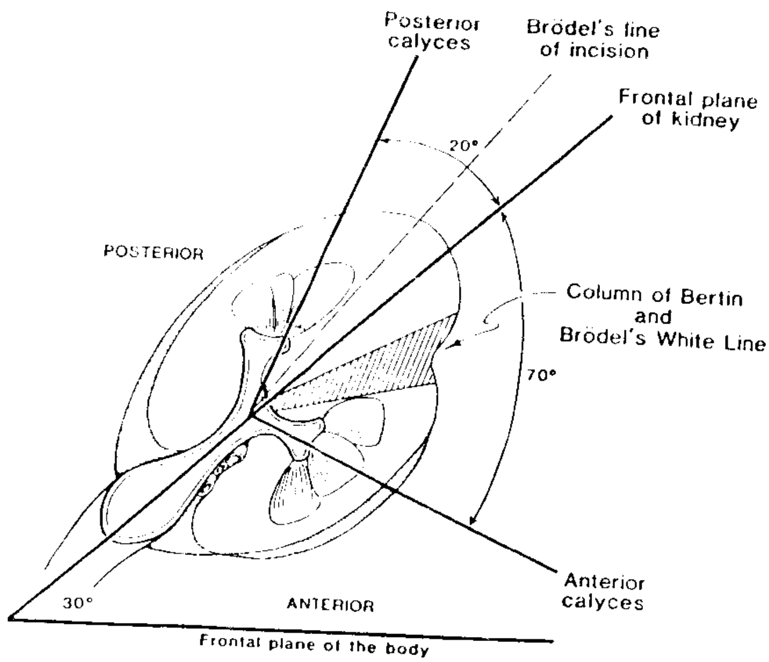

Fig. 1-1 Frontal plane of the kidney in relation to the frontal plane of the body.

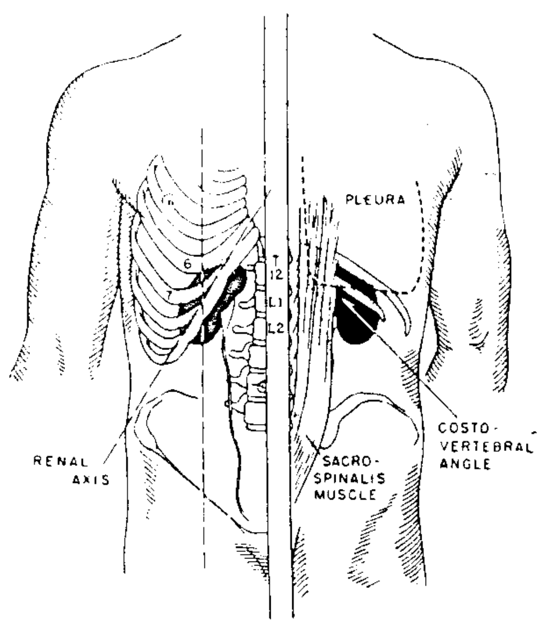

Fig. 1-2 The anteroposterior surface projection of the kidneys and ureters

generated by the tone of the anterior abdominal wall may well be one of the most important stabilising factors by virtue of the compressive forces applied to the surrounding viscera. When the patient is anaesthetised, the tone of the abdominal wall disappears and more extensive movements of the kidney are to be expected.

It is said that female patients are ten times more likely to have mobile kidneys. This could also be conceivably related to abdominal wall tone. The position of the liver on the right limits the cranial movement of the kidney on that side. The close application of the pancreas to the anterior aspect of the left kidney is said to be especially important in limiting the movement of that organ. The suprarenal attachments and ligaments to the liver and duodenum probably do not play an important role in holding renal position *(Wickham et al., 1984).*

Surface Anatomy

The normal kidney is rarely palpable in the corpulent patient, in the child and thin female it can often be felt bimanually and particularly on the right *(Wickham et al., 1984).*

The kidneys lie between the twelfth thoracic and second lumbar vertebrae and thus to a considerable extent within the thoracic cage. These organs occupy a more medial position than is usually realized. A vertical line placed perpendicular to the middle of Poupart's ligament cuts the kidneys longitudinally so that one third of the kidney lies laterally and two thirds remain medial to the land mark (Fig. 1-2).

Anteriorly, the kidneys may be localized as extending from the interchondral articulation of the sixth and seventh costal cartilages to approximately 2.5 cm above the umbilicus (Fig. 1-2).

Posteriorly, the 12th rib crosses the kidney at a 45° angle in such a way that one third or more lies above and is under cover of the last two ribs (Fig. 1-2). This is more pronounced on the left because of the lesser inferior hepatic displacement, but this position is modified further by the position and variable length of the 12 rib *(Olsson, 1986)*.

The hilum of the kidney is situated beneath the point where the lateral border of the sacrospinalis meets the 12 rib (the costovertebral or renal angle). The lower border is 2" or less above the highest point of the iliac crest. The projection of the right kidney is on the whole 1/2" lower *(Wickham et al., 1984)*.

The Significance of the 12th Rib

Wickham has reviewed 90 normal intravenous urograms in order to determine the position of the calyces relative to this rib. If the calyces lie under cover or above the 12th rib, puncture is either very difficult or hazardous as a supracostal or angled inferior approach would be required for access.

Numerous factors determine the relationship of the 12th rib to the calyces namely: the angle, the length and width of the rib as well as the position, rotation and size of the kidney. The 5 minute film of 90 intravenous urograms taken in the supine position in full expiration was used to evaluate this relationship. This was chosen as the hight of the kidney in full expiration when the patient is supine corresponds to the height of the kidney in the prone oblique position when an abdominal wedge is used. Percutaneous puncture is usually performed in mid-respiration in the prone oblique position, *(Wickham et al., 1984)*.

The male kidney is slightly larger than the female kidney and the left kidney is slightly larger than the right. Ttable (1-I) shows that the right kidney should theoretically be easier to puncture than the left as the calyces are inferior to the rib more frequently although the difference is marginal. The lower calyx is situated inferior to the rib in 80% on the Rt and 78% on the left. The middle 42% on the right and 31% on the left and the upper 20% on the right and 15% on the left. The sex difference is not generally significant with the exception of the middle calyces on the Rt which appear to be lower than the corresponding calyces on the left in females only the position of upper and middle calyces either above or under cover of the 12th rib in the majority of patients, clearly demonstrated the inability of the radiologist to puncture these calyces in most cases, especially when the calyces are not dilated. The lower calyces must be regarded as the most common route of access to the collecting system (80%). A significant number of patients (20%) have their lower calyx covered by the 12th rib. In these cases puncture may be possible by angling the needle upwards although this does cause considerable difficulty when only single plane fluoroscopy is used *(Wickham et al., 1984)*.

Calyceal Group	*M(56)*	*R.Kidney F(34)*	*T90*	*M(56)*	*L.Kidney F(34)*	*T90*
Upper	8	10	18	10	4	14
Middle	20	18	38	18	10	28
Lower	46	26	72	42	28	70
High Lying kidney therefore difficult to puncture	10	8	18	14	6	20

Table (1-I)

Renal Coverings

There are four coverings for the kidney: The true capsule, perirenal fat, renal (Gerota's) fascia and the pararenal fat (Fig. 1-3). The true capsule is a fibrous structure that is closely applied to the surface of the kidney because of the penetrating nephrocapsular capillaries and lymphatics, but it is not adherent.

The kidney is surrounded, particularly posteriolateraly by an abundance of characteristically lemon-yellow perirenal or perinephric fat which in turn is confined by a relatively dense anteroposterior fibrous cap extending from the diaphragm for a variable distance down the ureter. This is known as the renal fascia of gerota. The renal fascia of gerota consists of an anterior (Toldt) and a posterior (Zukerkandle) layer formed by the condensation of the retroperitoneal tissue. There are conflicting opinions about the various arrangements of this fascia superiorly, medially and inferiorly, although an indefinite partition does exist between the kidney and suprarenal gland *(Olsson, 1986)*. Laterally the anterior and posterior layers fuse and remain as a distinct entity separate from the fascia transversalis. Medially, the posterior layer fuses with the fascia over the vertebral bodies, where as the anterior layer merges with the adventitia of the great vessels *(Clayman et al., 1984).*

It is well known that a perinephric collection of pus does not spread to the opposite side which means the perinephric spaces are not connected infront of the vertebral column *(Olsson, 1986). Clayman* noted that it is exceptionally unusual for any complications (e.g.: urinoma, perirenal abscess, hematoma) to involve the contralateral perirenal space.

Inferiorly, the renal fascia of gerota fuses around the ureter but this is a weak fusion allowing gas injected retroperitoneally to diffuse upward and delineate both perirenal and suprarenal spaces (Fig. 1-4).

Superiorly, gerota's fascia fuses with the infradiaphragmatic fascia. The caudal and cranial aspects of gerota's fascia are open ended. It can thus be immediately appreciated that extravasating fluid (e.g. irrigant) in the so called perirenal space of gerota can pass not only inferiorly to the pelvic extraperitoneal tissues but also across the midline to the opposite side *(Wickham et al., 1984).*

The perirenal or perinephric fat is traversed by fine, but relatively firm, fibrous fibrils extending from the renal capsule to gerota's fascia. These fibrils are particularly dense superiorly (toward the diaphragm). On the right the medial fibres form the duodenorenal ligament and on the left the lienorenal ligament.

Outside gerota's or the perinephric fascia a less marked layer of fat, the paranephric fat, is present *(Olsson, 1986).*

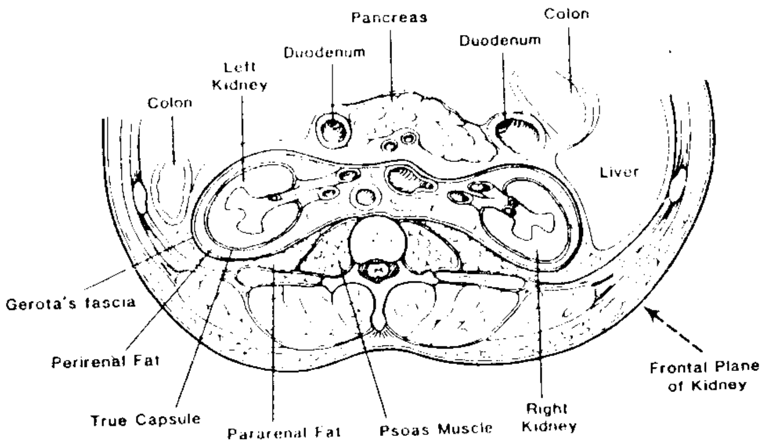

Fig. 1-3 Cross section of the body. (Renal coverings)

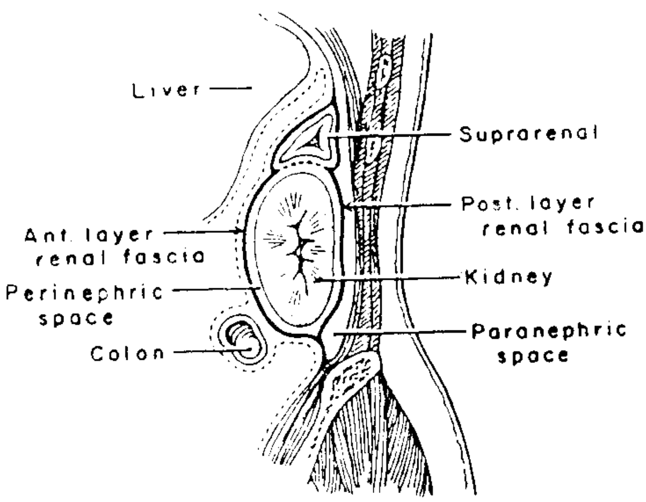

Fig. 1-4 Vertical section.