AN INTRODUCTION TO PERCUTANEOUS RENAL SURGERY

ESSAY

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BY

MELAD THABET YOUSSEF

M. B., B. Ch.

Under Supervision of

Prof. Dr. AWNI ATALLA
Professor of Urology

Prof. Dr. FAKHRY AMIN
Professor of Anatomy

Ain Shams University

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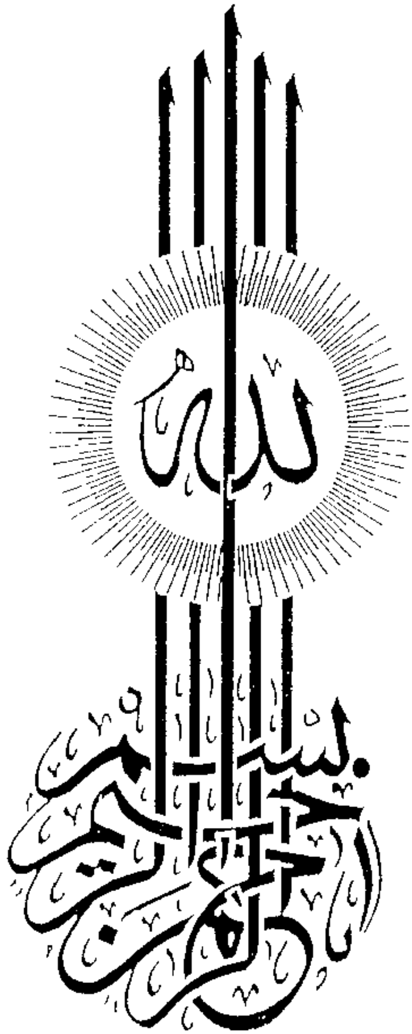
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CONTENTS

INTRODUCTION

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One of the most traumatic operations in surgery is the removal of a stone from the kidney. Conventional incisions cause considerable tissue damage in terms of direct muscular disruption and significant morbidity in terms of pain and prolonged postoperative discomfort for the patient.

When a calculus is large and renal function is markedly disturbed, then such means may justify the end, open operative calculus removal. However, when the stone or stones are relatively small, the gross surgical trauma required to remove a 0.5 -1.0 Cm calculus has been and still seems totally inappropriate. For some time attempts have been made to minimise this trauma, but it is only in the last 3 or 4 years, with the advent of more sophisticated methods of radiological renal intubation, that an opportunity has arisen to exploit these techinques as a valuable aid to stone extraction.

Not only is the surgery of stone disease on the point of radical evolution but the whole area of renal surgical disease is coming under rapid reapraisal. For instance pelvi - ureteric junction obstruction and transitional cell tumours of the upper urinary tract may well be fully amenable to treatment by percutaneous manipulation.

Looking even further a head with the development of non- invasive extracorporeal shock wave stone disintegration or the possibility of stone disruption in situ by laser impulse it seems no exaggeration to say that in 5 - 10 years conventional renal surgery through the grossly traumatic loin incisions of the past will be dead.

HISTORICAL REVIEW

The Arab physician Serapion should probably be accorded the title of the first percutaneous nephrolithotomist. In the latter half of the 10 th century he is said to have thrust a red hot iron through the lumbar region and subsequently extracted a renal stone. (Wolfangus Justus 1556). This operation could certainly be classified as an elective percutaneous nephrolithotomy.(Wickham and Miller, 1983).

Occasionally drainage operations were performed in the ensuing centuries until the late 19 th century when the techniques of pyelolithotomy and nephrolithotomy were increasingly practised, to become well established in the 20 th century.

HISTORICAL DEVELOPMENT IN PERCUTANEOUS NEPHROLITHOTOMY

1941 : Rupel and Brown: Removed a residual stone from a patient with a solitary kidney who had recently undergone a formal open nephrostomy for calculus anuria. A general anaesthetic, utility forceps and panendoscope were used.

1955. Goodwin: First demonstrated the technique of percutaneous needle puncture and nephrostomy.

1974. Bentley and Shirley: Extracted residual stones by using a panendoscope, stone basket and a U loop nephrostomy tube.

1974. Bissada: Used a panendoscope and grasping forceps to remove a residual stone under general anaeste-ic.

1975. Harris: Was the first to use a fibreoptic bronch-oscope for stone extraction following open surgery.

1976. Fernstrom and Fohanseen: First combined a percut-aneous nephrostomy track and percutaneous extract-ion of renal stones under fluoroscopic control using a basket and stone grabbing forceps.

1976. Weiss: Employed a percutaneous track to apply a hydraulic jet on the the renal stones with the prospect of flushing them down the ureter. Catheters were used to manipulate impacted stones.

1976. Rather: Reported the experimental use of ultrasound in a patient with a functionless kidney to disrupt a renal stone.

1977. Karamacheti et al : Used a combined retrograde and antegrade approach to extract ureteric stones from a patient with an ileal conduit.

1980. Thuroff et al: Described ultrasonically guided percutaneous puncture and subsequent endoscopy with stone extraction using a Zeiss loop and cystoscope.

1980. Hellsten and Palestrant: Both reported further cases of radiological percutaneous stone extraction.

1981. Wickham et al: Reported 31 cases of elective nephrolithotomy and advocated its use in the fit patient who had not previously undergone renal surgery. All the tracks had been placed via the percutaneous route and subsequently dilated.

1981. Alken et al: Reported their extensive experience of 34 patients, 15 of whom had operatively established percutaneous tracks, 13 patients had their stones disintegrated by ultrasound.

1982: Marberger et al: Reported 19 cases undergoing ultrasonic lithotresis via the percutaneous route.

1984: Howard and Marc. : Described percutaneous urolithotomy with the use of balloon catheters as an adjunct.

Percutaneous nephrolithotomy is being now practised in most urologic centres in the world, gradually replacing open renal surgery.

APPLIED ANATOMY

C H A P T E R   II

APPLIED ANATOMY

APPLIED ANATOMY

INTRODUCTION

A sound knowledge of renal anatomy is an essential prelude to all percutaneous manoeuvres. Knowledge gleaned from the stantdard anatomical texts is often inadequate, in that only static or morbid anatomical descriptions are given.

It is the interrelationships of calyces, infundibula, renal pelvis and blood vessels that is most important to percutaneous renal surgery(Kaye, 1982).

Plain abdominal X Ray often indicates the position and size of the kidney, intravenous urography the structure and function of the kidney, angiography the disposition of vessels, CO_2 insufflation the surface of kidney and X Ray screening the movements of kidney in response to respiration and position. The advent of computerised axial tomography enabled the relationships of the kidney to be studied in different dimension. Ultrasound also provides images of increasing clarity. Nuclear magnetic resonance will undoubtedly play a major role in the future. All these methods have been exploited in order to demonstrate the relevent features of percutaneous anatomy.

THE POSITION OF THE KIDNEYS:

The kidneys lie one on each side of the spinal column, usually beside the bodies of the twelfth thoracic through the third lumber vertebra. Classically the pelvis lies opposite the lower border of the 1 st lumber vertebra on the right side and slightly higher on the left. Radiological inspection however shows the pelvis to lie opposite L.2. on the right, being 1- 2 cm higher on the left.However there is enough variation in position (and shape) to make it difficult to determine exactly what is the "normal". In a slender person with a long, narrow abdominal cavity, the kidneys tend to lie lower than in a stocky person with a broad abdominal cavity.(kaye, 1982).

SIZE :

At autopsy, the average adult kidney is approximately 11 cm long, 6 cm wide, and 3 cm thick. On excretory urogrephy however the kidneys appear to be much larger, having a normal mean length, in the adult man of 12.9 cm on the right and 13.2 cm on the left, In part, this is a consequence of magnification of approximately 10% (more in obese persons) by the radio- graphic process. Also, the diuresis usually accompanying urography can lengthen the kidneys 1 cm or more. (Moell. H., 1961).

Representative Mean Measurements of Renal Size

Type of Measurement	Men		Women	
	Right	Left	Right	Left
Length(cm)Autopsy	11.4	12	10.8	11.6
Radiograph	12.9± .8	13.2±.8	12.3±.8	12.6±.8
Width(cm)Autopsy	6.5	6.7	5.9	6.0
Radiograph	6.2±.4	6.3±.5	5.7±.5	5.9±.4
Weight	320g.		260 g.	

ATTITUDE OF THE KIDNEYS : ROTATION :

The kidneys are not situated parallel and vertical, rather, their upper poles are tilted slightly toward one another, so that the logtudinal axis when projected superiorly will intersect the thoracic spine(Fig. 1) (Lich et al., 1978). Also, the anterior surface of the kidney faces forwards and laterally and the posterior surface backwards and medially, so the transverse axis of the kidney makes an angle with the coronal plane of the body about 30° (Kaye,1983).

POSITION OF KIDNEY RELATIVE TO RESPIRATION,POSITION AND ABDOMINAL FORCES:

Movement of the diaphragm in respiration causes the kidney to move downwards in inspiration and upwards in expiration.

The amplitude of movements is very variable but it is in order of 3 cm. The right kidney is more mobile than the left. Such movement is more pronounced in woman than in men. A kidney transfixed by a percutaneous needle will convey this movement (in vertical plane) to the needle which will oscillate. Shifts of 8 - 9 cm have been reported when the recumbent patient becomes erect, 3-5 cm is the norm. (Wickham and Miller, 1983).

For the initial puncture the prone oblique position is optimal, and here the convex lateral border of the kidney is displaced posteriorly and thus presents itself for trans-parenchymal puncture. (Fig. 2).

SURFACE ANATOMY

With the patient lying prone, two parallel vertical lines are drawn 2.5 cm and 9 cm on either side of the middle line, and two horizontal lines are drawn at the level of the spinous processes of T - 11 and L - 3. Within the resultant rectangles, the outline of the left kidney is drawn with the upper pole more medial (about 4 cm from the midline) than the lower pole(6-7 cm) and the right kidney is drawn 1 - 2 cm lower than the left. The kidneys lie at an angle of approximately 30° posterior to the coronal plane.(Kaye. 1982).