NEW TRENDS IN MANAGEMENT OF RENAL CALCULI

ESSAY

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DEDICATION

TO

MY FAMILY

بسم الله الرحمن الرحيم

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INTRODUCTION

Nowadays, renal stone disease is increasingly prevalent problem, allready affecting more than 10% of adult population (**Ljunghall et al., 1979**). It represents a danger to the affected kidney due to its complications basically, obstruction and infection. In Germany about 6% of all dialysis cases are attributed to stone disease (**Eisinberger et al., 1985**).

In Egypt, the renal stone is quite prevalent problem, it is always thought that there is a strong relationship between patho-genesis of stone formation and bilharziasis which is an endemic disease in Egypt. However, in a study done on 1978, it is reported that bilharziasis was not found to be the prime or the sole factor in the process of stone formation, but arrest of downward movement of ureteric caculi proximal to bilharzial stricture ureter was found in some cases (Thesis for M.D. Urology by **Hegazy, 1978**).

Urinary tract stone disease is an ancient problem. It has been the cause of centuries of misery and suffering. The earliest evidence dates to before 4800 B.C. and was a stone bladder found among the pelvic bones of predynastic Egyptian. The ancient records reveals that the stone disease was also present in the Greek and Roman civilizations.

Hippocrates (460-373 B.C.) was the first to theorize about the etiological factors in urinary lithiasis. Galen, the great Roman physician also wrote about stone formation and recognized risk factors. Anton Von Heyden in (1684) was the first to demonstrate the structural complexity of urinary calculi. In the nineteenth century, scientists in different locations co-operated to a greater extent than previously which led to the furthering of concepts regarding stone formation and growth. The development of cystoscope by Nitze and diagnostic X-ray in the late 1800's was employed to increase knowledge of aetiological factors in stone formation. With the use of new analytical and microscopic techniques made available by the advances of the twentieth century, much knowledge has been gained in understanding the structural characteristics of calculi, chemical composition and the various components found in urine. In all likelihood, an individual's stone diathesis will be found to result from the interaction of numerous factors, many of which have already been studied but surely others remain as yet unknown (**Resnick and Boyce, 1979**).

Complete removal of the stone does nothing to affect the underlying cause of stone formation and subsequent recurrences occur. In the absence of adequate medical treatment, surgical intervention has been the only significant treatment for many cases. Operative management of renal calculi has changed radically in the past decade, new emaging techniques for intra-operative stone localization, the use of cooling techniques and drugs to protect renal function, and new operative techniques have even made possible the removal of complete Staghorn calculi in short and kidney-preserving procedure. Considerable morbidity, however, still result from conventional renal stone surgery, such morbidity may be accepted by the surgeon as merely incidental, this is quite definitely not so for the recipient of such operation. Many patients suffer pain months or even years following the operation at the site of the incision due to the cutting of large muscle masses and damage to nerves running within them. Sustained fistulae although much rarer, still occur. Massive wound infections, resulting dehiscence, herniation, many days or weeks in hospital and prolonged disability are still seen. Such morbidity is paramount when repeated operations are necessary for recurrent stone disease -in industrial countries the recurrence rate is between 50% and 70%- which represents increasing technical difficulties and ensuing impairment of renal function (**Eisinberger et al., 1985; and Wickham and Miller, 1983 h**).

In modern medicine there has been a steady steam of developments which complement or even supplant surgical techniques, enjoying the position of support from new technology which is constantly being developed and improved. In "Urology", this trend has taken on special significance over the past few years, aiming at evolution of new methods for destruction and/or extraction of "renal stones" with less morbidity and less invasiveness (**Chaussy, 1982a**).

The last few years have witnessed a revolution in the surgical approach to the treatment of urinary calculous disease. The majority of open surgical procedures for urinary stones could be replaced by endoscopic methods due to advances in endourology.

Untill about 10 years ago, only the urethera and bladder could be evaluated under direct vision rigid uretheral cystoscopes. The development of more efficient optical lens systems and instruments designed for anatomy of the upper urinary tract, now render visual inspection of the ureter and the collecting system of the kidney feasible. This was a pre-requisite for the diagnosis and treatment of stones in the upper urinary tract without the need for major surgery.

Percutaneous nephrolithotomy "PCNL" and ureterorenoscopy "URS", using these methods the adverse side effects and sequelae of open surgical interventions can be avoided.

Open surgery for urinary stones is being increasingly superseded by "PCNL" and by extracorporeal shock-wave lithotripsy "ESWL". In the treatment of complicated stones,a combination of these methods may be advantageous (**Wickham and Miller, 1983h**).

As a matter of fact, policies for stone management have changed completely. In a review of 1340 consecutive patients presented with stones between October 1983 and October 1984, **Eisinberger and associates (1985)** found that only 7% of all urinary stones, 1% of all renal stones and 15% of all ureteral stones still required an open operation. Successful use of these new techniques necessitates a more understanding of the advantages, disadvantages and limitations of the new technology.

Concerning "PCNL" and "ESWL", these aspects would be intensively discussed throughout this work.

PATHOGENESIS OF STONE FORMATION

Urinary stone disease has perplexed patients and physicians for many centuries. The disorder occurs in two main forms: endemic bladder stones which occur in boys in the developing agricultural countries of the world and upper urinary tract stone disease which is becoming increasingly more prevalent, particularly in men, among the more affluent countries. In countries which are in the process of industrialization, a transition is taking place in which the incidence of bladder stones in children is decreasing and that of kidney stones in adult increasing. In the industrialized countries of Europe, North America and Australasia upper urinary tract stone disease is a relatively common disorder. Within these areas the prevalence in the population ranges from 3% in Great Britain, 3.1% in Italy, 6.8% in West Germany, 9.5% in Sweden to about 12% in the U.S.A. The vast majority of patients in most series form stones consisting of pure calcium oxalate or of a mixture of calcium oxalate and calcium phosphates (**Robertson, 1985**).

Theories for stone formation:

Resnick and Boyce (1979) stated that modern theories of stone formation and growth have concentrated on two separate but interrelated concepts:

1. The site of stone formation within the kidney.
2. The biochemical factors controlling stone formation and growth.

1. **The anatomical site of stone formation**: The stone must form somewhere, but whether it be in the renal tubules, collecting

ducts or pelvis remains controversial and several theories explaining the "where" of stone formation have been proposed:

A) Randall's Plaques: In the late 1930's, Randall described the presence of papillary calcification that he theorized were the precursor of primary renal calculus formation. Two types of lesions were recognized; the more common of which designated Randall's type (I) measured 1-2 mm, were subepithelial and located not in the collecting ducts but in the interstitial tissue. Several plaques frequently involved one papilla and often more than one papilla in one kidney was involved in the process. These papillary lesions had 3, stages of development. In the first stage the plaques appeared microscopically as small cream coloured areas situated peripherally in the wall of the renal papilla which represented calcium deposition on the basement membrane of the collecting tubules. In the second stage, the lesion presents itself as a small, irrigular depression on the surface of the papilla and was termed the initial lesion. At this stage calcium deposition has spread intertubularly, causing shrinkage and stricture of the tubules which lose their epithelial covering and finally completely disappear. In the third stage, a small dark deposit is seen on the calcium plaque which has lost its epithelial covering. This represents the beginning of a renal calculus. Careful and repeated microchemical analysis of these plaques reveals different ones to be composed of calcium phosphate, calcium oxalate and uric acid. Randall believed that type I plaques gave rise to primary calculus formation i.e. calculi whose formation is unassociated with significant metabolic abnormalities.

The less common type II lesions consist of calcium salt deposition in the terminal portions of the collecting tubules and papillary ducts. This type is characterized by an inspissation of the terminal tubules of the papilla and each papillary tip is self-encrusted. These are usually more frequently associated with urinary supersaturation and approximately half of these cases studied are associated with urinary infection. Type II lessions are characteristic of a hyperexcretory state and are seen in association with hyperparathyroidism, hypovitaminosis, forms of renal infection and with nephrocalcinosis. Studies and investigations done by Randall and others had proved the presence of these plaques.

One of the major problems is that stone formation has its largest incidence in the third and fourth decade of life but Randall's plaques are found most frequently in subjects greater than 50 years of page. He correctly pointed out that, without questions factors other than papillary calcification are of importance in initiating stone formation.

B) Carr's theory: **Rignald Carr (1953)** proposed on alternative hypothesis to explain the presence of renal stone formation in papillary region. He suggested that the plaques that Randall observed were actually aggregations of microscopic calculi and not degenerative lesions of the papilla itself. After intensive studies, Carr noted that practically all kidney's from patients greater than nine year of age contained microscopic opacities. He differentiated "concretions" from "microliths", microscopic calculi and true renal calculi. The microscopic concretions were found to lie just outside the fornices of the calyces in the corticomedullary zone or immediately beneth the capsule. Carr observed that the earliest detectable opacity is not of the papilla itself, but is in, or just outside the extreme angle of the fornix. When these concretions were removed from the renal parenchyma, they left a small endothelial lined cavity which did or did not communicate with the collecting system and in most instances the concretions were not adherent to the walls of the cavity. Carr theorized that since intrarenal concretions formed normally, there must exist a normal drainage mechanism for removing them. He believed this to be one of the purposes of renal lymphatic system and suggested that renal calculi formed when normal drainage becomes impaired which could occur because of overloading with an excessive number of microliths or by an impairment of drainage secondary to inflammation and fibrosis. This obstruction could be segmental or labor and explains the process of stone formation within only one portion of the kidney. As expected, more microliths have been observed in the affected lobule than in other portions of the kidney. After concretions accumulate and grow, there occurs necrosis and subsequent breakdown of the membrane separating them from the renal tubules and urine. The presence of urinary salts in contact with the concretions permit growth and eventual true stone formation. With