DISSOLUTION OF STONES

THESIS

SUBMITTED IN PARTIAL FULFILMENT FOR
REQUIRING OF THE MASTER DEGREE IN
UROLOGY

BY

HANY ABD EL AZIM GUINEEDY
M.B.B.Ch.

SUPERVISED BY

PROF. DR. MOHAMED HATEM EL BIALY
PROFESSOR OF UROLOGY
AIN SHAMS UNIVERSITY

FACULTY OF MEDICINE
AIN SHAMS UNIVERSITY

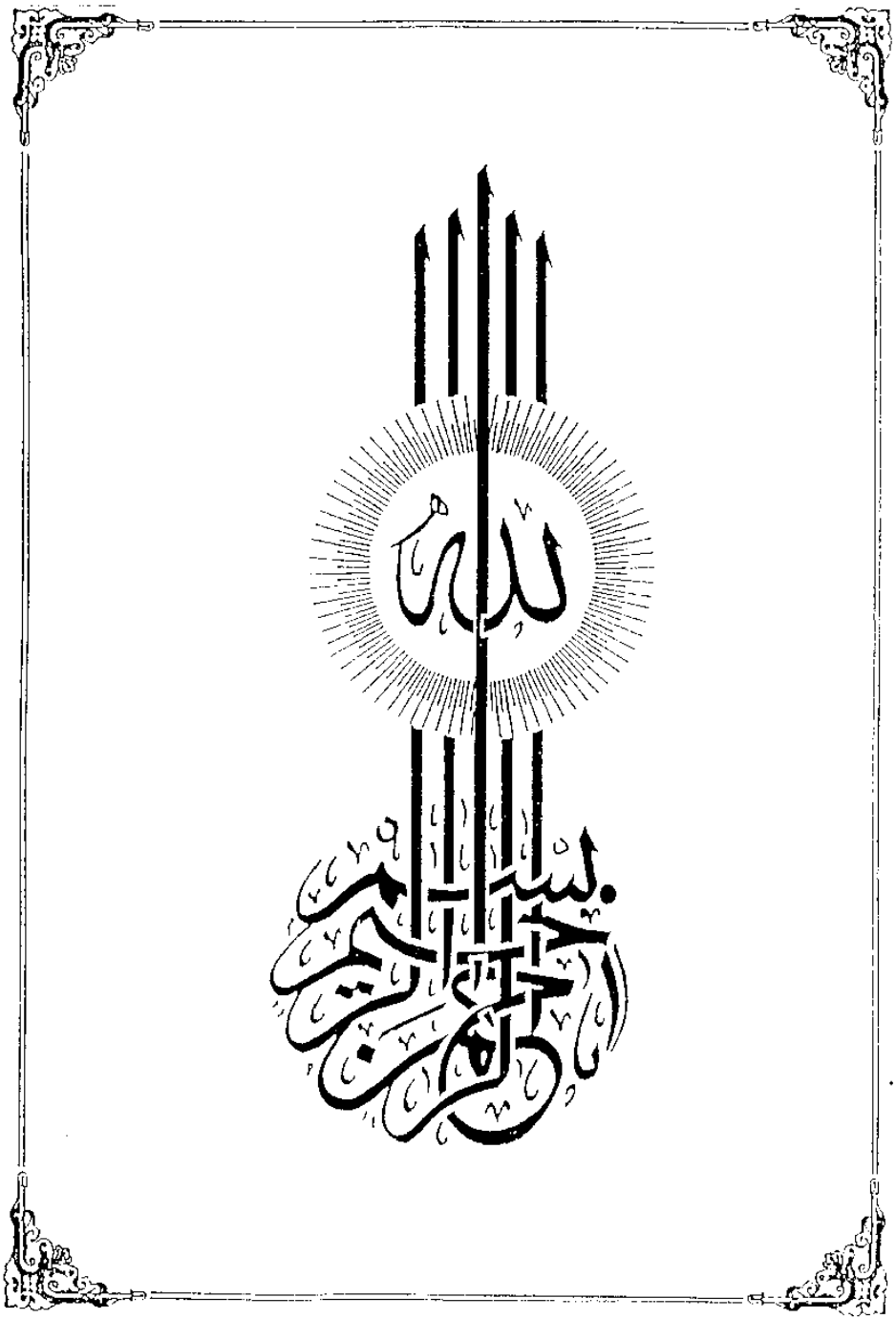
1987

بسم الله الرحمن الرحيم

ان الحمد لله نحمده ونستعينه ونستغفره ، ونعوذ بالله من شرور أنفسنا وسيئات أعمالنا ، من يهده الله فلامضل له ، ومن يضلل فلا هادى له ، وأشهد أن لا اله الا الله وحده لاشريك له الحقيق بالحمد والثناء على عظيم نعمه وأشهد أن سيدنا ومولانا وقائدنا وزعيمنا محمد رسول الله صلى الله عليه وعلى آله وصحبه وسلم ، بلغ الرسالة وأدى الأمانة اللهم فاجزه عن الأمة الاسلامية أفضل ماجزيت نبيا عن أمته .

أما بعد : قال رب العزة تبارك وتعالى : ـ

" وفى أنفسكم أفلا تبصرون "



A C K N O W L E D G M E N T

I would like to express my deepest gratitude to Prof. Dr. MOHAMMAD HATEM EL BIALY Professor of Urology, Ain Shams University for his kind guidance, sincer help, continuous close supervision and valuable advice throughout the course of this work.

I wish to extend my thanks to all the staff members of Urology, Ain Shams University for their encouragement, and help in achieving this work. A lot of thanks to all of them.

C O N T E N T S

I N T R O D U C T I O N

Ancient man was undoubtedly afflicted with stone just as man is now. Riches (1968) referred to a stone that was found in the pelvis (presumably bladder)of an Egyptian skeleton estimated to be over 7000 years old.

Sir Henry Thompson (1873) was interested in medical therapy of bladder stone and suggested the possibility of treatment of bladder stone by dissolution. Galen,treated stone disease with wine and honey, parsiey and caraway seed, and Howship recommended administration of alkalies or acids to arrest calculi.

Dissolution of renal calculi was first attempted using irrigation via retrograde ureteral catheters by Suby and Albright, (1943). With the advent of percutaneous nephrostomy, large bore nephrostomy tubes that could effectively perfuse and drain the pyelocaliceal system became available (Newhouse and Pfister, 1982).

This thesis will attempt to discuss the most recent methods and trials of the dissolution of renal stones.First, the epidemiologic factors in the incidence of urolithiasis will be discussed, such as, heredity, age, sex, geography, environment and occupation or economic level. Next,modern theories of etiology of urinary lithiasis will be discussed.

Special aspects of etiology will be discussed prior to the dissolution of each type.

Dissolution of uric acid calculi will be discussed first as it is the best type responding to dissolution therapy, followed by dissolution of cystine calculi, stones of urinary infection and calcium stones respectively. Routes of administration of the solvents will be mentioned on discussing the dissolution process of each type , either orally, parentrally (by intravenous fluids) or by direct irrigation methods. After discussing the dissolution of each type of stones we will give a note about the prevention of recurrence of this particular type which is of great importance as the danger of recurrence in many cases may be so serious that it could end with loss of the kidney and hence called "Stone Cancer".

A note about the rare types of stones will be discussed briefly at the end of the thesis.

EPIDEMIOLOGIC ASPECTS OF UROLITHIASIS

Andersen (1973) presents an interesting multifaceted theory of urinary calculi. He feels that there are at least two separate epidemiologic factors involved in the genesis of urianry calculi . The first factor may be considered intrinsic. Intrinsic factors are related to the inherited biochemical or anatomic make up of the individual as well as age and sex. The second factor may be considered extrinsic. Extrinsic factors are also termed "environmental factors". These factors include: climate, water, dietary patterns of populations and different occupations (Drash, 1986).

A- INTRINSIC FACTORS

I- Heredity:

Underlying all epidemiologic concepts of causation of urinary calculi is the role of heredity.Numerous authors have noted that urinary calculi are relatively rare in the North American, Indian, the Negros of Africa and America, and the native born Israeli. It would appear that resistance to urianry stone disease has been part of the natural selection of individuals for persistence of their race in areas that have relatively hot climate. Conversely , the incidence of stone disease is known to be highest in some of the colder temperate areas of the world. These areas

are populated primarily by Eurasians and caucasians.Though the incidence of bladder stones seem to be related primarily to dietary habits and malnutrition in underdeveloped countries, dietary improvement over the years has probably resulted in a change of the site of occurrence of urinary calculi from bladder to kidney (Sutor, 1972). In other words, the hereditary capability of forming stones persists while the anatomic site has changed.

Genetic studies have been performed by Resnic et al. (1968) and Mc Geown (1960). These authors conclude that urolithiasis requires a polygenic defect. In addition genetic predisposition to urinary lithiasis has partial penetrance, so that the severity of stone disease may differ from generation to generation even though the individual has the gene defects necessary for urinary lithiasis.

White et al. (1969) caution against accepting familial or hereditary theories of stone formation too readily, however. They studied stone formers and their spouses and similar pairs of non stone formers. They noted that urinary calcium excretion was significantly higher in spouses of stone formers than in control persons of the same sex in non stone forming households. Hence, household diet as well as familial tendencies must be considered in theories of etiology of urinary lithiasis.

Renal tubular acidosis is one of the hereditary diseases that has certainly been associated with frequent episodes of urianry lithiasis. Nephrolithiasis and nephrocalcinosis have been reported to occur in almost 73 per cent of patients with this disease (Dretler et al., 1969;Marquardt, 1973). Incomplete renal tubular acidosis also appears to be transmitted as hereditary trait that results in urinary lithiasis.

Cystinuria is a prime example of familial transmittion of a type of urinary lithiasis that is definitely hereditary, it is homozygous recessive disease (Crawhall and Watts,1968). The genetic defect is that of excessive excretion of cystine, ornithine, lysine, and arginine (mnemonic COLA). Only cystine becomes insoluble in urine. Interestingly , some patients with cystinuria do not develop urinary calculi(King, 1967, 1971). It therefore appears that at least two gene defects (again polygenic) are required to predispose some cystinurics towards formation of cystine urinary calculi (Drash, 1986).

2- Age and Sex:

Drash, (1986) observed that the peak age incidence of urinary calculi occurs in the third to fifth decades. About 3 males are afflicted for every female. Several authors

have pointed out that the maximum incidence of urinary lithiasis appears to occur in the 30 to 50 year age group(Bailey et al., 1974; Burkland and Rosenberg, 1955; Fetter and Zimskind,1961; Frank et al., 1959; Prince and Scardino , 1960).

But when does urolithiasis begin?

Drash, (1986) also reported that the majority of patients report onset of disease in the second decase of life, with decreasing onset through the third, fourth, and fifth decades. Urinary calculus disease has a tendency to persist over an individuals life.

In females most upper urinary tract calculus disease is caused by chronic urinary tract infection or metabolic defects such as cystinuria or hyperparathyroidism. On the other hand, most upper urianry tract lithiasis throughout the world is accounted for by recurrent idiopathic calcific or uric acid calculi in males (Lonsdale, 1968).

Several authors have commented upon the apparently equal tendency toward urinary lithiasis in males and females during childhod (Malek and Kelalis, 1975; Prince and Scardino, 1960). This observation Coupled with reports that increased serum testosterone levels resulted in increased endogenous oxalate production by the Liver (Liao and Richardson, 1972), Led Finalyson (1974) to postulate that

lower serum testosterone levels may contribute to some of the protection of women (and children) against oxalate stone disease.

Welshman and Mc Geown (1975) have demonstrated increased urinary citrate concentrations in the urine of females, and they postulate that this may aid in protecting females from calcium urolithiasis (Drash, 1986).

B- EXTRINSIC FACTORS

I- Geography:

Numerous studies attempt to relate high or low incidence to the geographic distribution of this disease (urinary lithiasis).
There is a noticeable increase in urinary calculi in mountaneous areas.

Finalyson (1974) reviewed several worldwide geographic surveys and stated that the United States is relatively high in the incidence of urinary calculous disease for its population. Other high-incidence areas are the British Isles, Scandinavia, the the Mediterranian countries, northern India and Pakistan, northern Australia, central Europe, portions of the Malayan Peninsula, and China.

In certain other areas of the world there is a relatively low occurrence of idiopathic urianry lithiasis.Low incidence areas include Central and South America,most of Africa , and those areas of Australia populated by native aborigines. Many of the areas with a low incidence of stone disease have warm climates and large populations of native inhabitants.

Geography has some influence on the incidence of urinary calculi and on the types of calculi.
This influence could be summarised as follows:-

1- The capability of individuals to transport the intrinsic tendency toward urinary stone formation from area to area makes it likely that the major tendencies contributing to urinary lithiasis are inherent in the individual and the racial factors play an important role in the likelihood of the individual developing stone disease.

2- Improvement of the socioeconomic factors can eliminate endemic bladder calculi.

3- Anderson (1973) stated in his stone formation hypothesis that, given an intrinsic predisposition toward urinary lithiasis, "dietary structure provides the baseline of

stone incidence in all countries or regions". He points out that certain types of geography tend to establish dietary patterns e.g. the negro races.

4- Geography has an effect in terms of temperature and humidity, which also seem to influence the incidence of human urinary calculi.

5- Living in rural areas appears to be assocaited with a reduced incidence of symptomatic stone disease and those who are more active at work are less likely to be affected than those in sedentary occupation.

6- Some factors, e.g. the calcium content of water , which seem an obvious stone forming factor do not appear to be important in determining the incidence of stone disease.

2- Water Intake:

Two factors involved in the relationship between water intake and urolithiasis are the volume of water ingested and the mineral or trace element content of the water supply of the region.

One of the prevailing assumptions in the literature of urolithiasis is that increased water intake and increased urianry output decrease the incidence of urinary calculi