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A REVIEW ON THE MANAGEMENT OF NEPHROLITHIASIS BY ALPHA-1 RECEPTOR ANTAGONIST

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ABSTRACT

Nephrolithiasis is a prevalent and long-standing illness that impacts roughly 1 in 11 individuals in the United States. Renal stones are reported to have occurred in 9.4% of women and 19.1% of men by the age of 70. According to the National Health and Nutrition Examination Survey, the self-reported prevalence of kidney stones increased from 3.2% in 1976–1980 to 8.8% in 2014. This suggests that the illness burden is rising. Nephrolithiasis is treated using shockwave lithotripsy, percutaneous lithotripsy, and medical expulsive therapy utilizing corticosteroid medicines, NSAIDs, anti-inflammatory pharmaceuticals, and alpha-1 receptor antagonists. This review describes the management of nephrolithiasis by alpha-1 receptor antagonists.

KEYWORDS: Renal calculi, management, treatment, alpha 1 receptor antagonist.

INTRODUCTION

The major function of kidney is to removing waste from the body through urine. It performs number of tasks, like regulation of blood pressure, blood calcium level, water balance, electrolyte balance, and acid-base balance.[1]

Kidney stones are often referred as urinary stones, renal calculi, nephrolithiasis or urolithiasis, kidney stones are the depositions of either calcium oxalate crystals or calcium phosphate or uric acid in the renal epithelium due to urinary supersaturation.[2]

The urinary supersaturation is due to reduced intake of water, obesity, alcohol, surgery, diet or even family history.[3]

Nephrolithiasis – a oldest disease known to medicine, during past few years one in ten people in world are suffering, i.e., around 12% in the world population and 15% in Indian population.[4]

Types of Nephrolithiasis

There are five main types of nephrolithiasis;

1. Calcium oxalate stones[5]

It is preventable type of nephrolith caused by the deposition of calcium and oxalate, due to dehydration, high fat intake, high sodium and calcium intake etc., It occurs about 60-80% of total reported cases (Fig :1).

2. Uric acid stones[5]

It is caused by some myeloproliferative disorders, intake of high animal fats, low urinary output, diarrhea, prolonged increase in uric acid levels. It occurs about 10% of total reported cases (Fig :2).

3. Cystine stones[5]

It is a rare type caused due to deposition of cystine, chronic kidney disorder etc., It occurs about 1 -3 % of total reported cases (Fig :3).

4. Struvite (infectious stones)[5]

It is caused by urease producing bacteria which is responsible for urinary tract infections, the occurrence in female is comparatively high as compared to males because females are more susceptible to UTI. It occurs about 5 – 7% of total reported cases (Fig: 4).

5. Silicate stones or drug induced stones.[5]

Causes of Nephrolithiasis

Kidney and uretic stones occur when there is a disturbance in equilibrium between water, mineral and salt in the urine. The kidney stones are caused due to various etiological factors, like.[6]

- Urinary supersaturation.
- Increase in concentration like calcium, oxalate, phosphate and uric acid in urine (urinary super saturation promoters).

- High urinary excretion of citrate, potassium and magnesium (urinary super saturation inhibitors).
- Dehydration.
- Medications like Loop diuretics, Fluroquinolones like Ciprofloxacin, Sulfa medications, Guaifenesin, Indinavir.
- Urinary tract infections.
- Family history.
- Alcohol.
- Medical disorders like Chronic renal failure, Diabetes mellitus, Hyperlipidemia, Obesity, Endocrine and others.
- Vitamins C & D that facilitates more calcium absorption and increases the chance of development of calcium oxalate stones.

Treatment

The exact mechanism behind the formation of nephrolith was exactly not clear, but studies reveled that urinary super saturation causes the nucleation of calcium and oxalate, which further grow and aggregate to form kidney stones.[7]

The treatment for nephrolithiasis depends on various criteria i.e., size, type and its location, several studies revealed that about 71 – 98% of renal stones are less than 5 mm, and about 5 – 20% are between 5 mm to 10 mm.[8]

Treatment available for surgical management of renal calculi are percutaneous lithotripsy, shockwave lithotripsy and medical expulsive therapy with drugs like Alpha 1 receptor antagonist, Anti – inflammatory, NSAIDs and other Corticosteroid medications.[9]

Percutaneous lithotripsy

Percutaneous – skin, Nephro – kidney, Litho – stone, Tripsy – crushed.

Technique for removal of kidney stones with large irregularly shaped i.e., more than 2 cm, entering the kidney through smaller incisions on back, nephroscope with a camera are inserted, high frequency sound waves are allowed to pass into the hole, the stones were crushed into smaller one and then removed by using Vaccum lasting for a period of 20 to 45 minutes.[10]

Shock wave lithotripsy

When non-surgical treatment fails, the two most often used surgical management techniques are extracorporeal lithotripsy and ureteral lithotripsy, which are carried out with the use of rigid, flexible, and semi-flexible lithotripters.[11]

Extracorporeal Shock Wave Lithotripsy (ESWL) is a safe, non-invasive therapy that breaks down stones through the urine fast. No incisions are made during this process.[11]

Ureteral Shock Wave Lithotripsy (USWL) is a highly effective and minimal invasive procedure, a small telescope is used to remove the stones through the ureter and from bladder, it may cause some postoperative complications like bleeding, infections etc.[11]

Medical expulsion therapy

Medical expulsion therapy (MET) refers to removal of renal calculi with the help of drugs like Alpha 1 receptor antagonist- NSAIDs, Corticosteroids (Fig 5).[12]

The most commonly employed drug is Tamsulosin combination with Deflazacort as first line drug in MET.

Tamsulosin

Being extremely selective for the α1A-adrenoceptors in the urinary system, Tamsulosin is an α1-adrenoceptor antagonist that was specifically created to treat Benign Prostatic Hyperplasia.[13]

To improve the effectiveness of treatment, patients with ureteral stones should be firmly advised to take tamsulosin. Tamsulosin has generally been shown to increase the rate of stone expulsion and reduce the need for analgesics in clinical trials. α-blockers are thought to work by inhibiting the contraction of smooth muscle in the ureter, which makes it easier for the stone to move into the bladder.[14]

Alpha-1A and Alpha-1B adrenoceptors are specifically blocked by Tamsulosin. In the majority of randomised trials, it markedly increased the ejection of distal ureteral stones measuring 3–10 mm. As far as we are aware, Tamsulosin has never been evaluated in the treatment of ureteral stones measuring between 10 and 15 mm.[15]

For individuals with larger stones, Tamsulosin greatly enhances stone passage; however, for those with smaller stones, who are expected to pass their stone regardless of treatment, Tamsulosin's benefit is lessened.[16]

To treat benign prostatic hyperplasia, a fast-dissolving sublingual wafer of Tamsulosin hydrochloride was created utilising a solvent casting film forming.[17]

Tamsulosin effect causes the prostatic urethra and prostate's smooth muscle tone to diminish, which increases urine flow.[18]

BPH, or Benign Prostatic Hyperplasia, is a frequent ailment in older men. Tamsulosin does not impact blood vessel receptors and has a higher specificity for the α1 receptor in the human prostate when compared to other α1 antagonists. When treating problems related to the lower urinary tract, it is the medicine that is most commonly recommended.[19]

Men over 45 are more likely to experience Lower Urinary Tract Symptoms (LUTS), which have a serious negative influence on their health. In order to treat LUTS, which are typically linked to Benign Prostatic Hyperplasia (BPH), alpha blockers are frequently recommended. According to available data, treating LUTS related to BPH with antimuscarinics in addition to α1-blockers may be more successful than treating LUTS with α-blockers alone.[20]

Alpha-1-adrenergic receptor antagonists have been researched for their potential to ease discomfort and aid in the evacuation of stones due to their selectivity for the detrusor and the distal ureter. It has been proposed that α-blockers likely aid stone transit by reducing ureteral spasm, raising pressure proximally to the stone, and relaxing the ureter distally to the stone.[21]

A stone that has moved from the kidney into the ureter is called a ureteric stone. Little solid material grains settle in the kidney, forming the stone. The lower portion of the ureter contains about 70% of all ureteric stones. Intermittent bouts of ureteric colic are frequently brought on by a stone travelling down the ureter. The anterior surface of the thigh, the groyne, and the external genitalia are usually affected by waves of excruciating loin pain.[22]

Fig 1: Calcium Oxalate Stones.

Fig 2: Uric Acid Stones.

Fig 3: Cystine Stones.

Fig 4: Struvite Stones or Infection Stones.

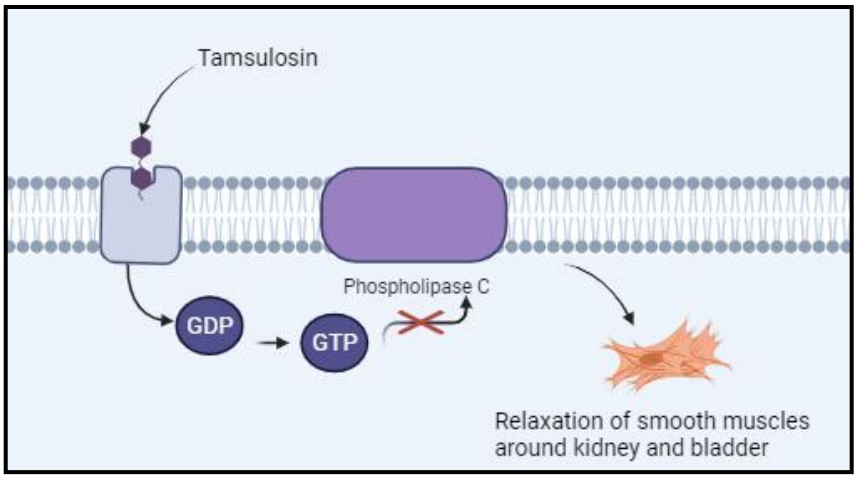

Fig 5: Mechanism of action of Tamsulosin.

CONCLUSION

Tamsulosin will effective as an adjuvant in nephrolithiasis management and as first line drug of choice for medical explusion therapy in combination with corticosteroid deflazacort.

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