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Role of Medical Therapy in Benign Prostatic Hyperplasia

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ABSTRACT

Background: Benign prostatic hyperplasia is a geriatric problem of the men. It causes mild, moderate or severe urinary symptoms. At times it causes urinary tract infection, hematuria, urinary bladder stones and acute retention of urine etc. The treatment modality remains open surgical removal of prostate adenoma or transurethral resection of prostate. The surgical treatment is associated with morbidity and rarely mortality. The quest for a safe alternative has lead to the medical therapy for BPH. The drugs used in its treatment include 5 Alpha-reductase Inhibitors: Finasteride or Dutasteride and Alpha–1 adrenergic receptor blockers like Terazosin, Alfuzosin, Tamsulosin etc. **Methods:** In this study we evaluated the effects of Finasteride, Terazosin, the combination of Finasteride and Terazosin and placebo in four groups of 20 patients each. The drugs were given for a period of 6 months. The reduction in International Prostate Symptom Score (IPSS), prostate size, post void residual urine and improvement in mean urinary flow rate were noted and evaluated. **Results:** It was found that the combination of Finasteride and Terazosin offered the best results. Finasteride was effective in reducing prostate size, where as Terazosin was more effective in improving IPSS symptom score, post void residual urine and mean urinary flow rate. **Conclusion:** Terazosin (Alpha Blocker) helps in improving the symptomatology of BPH and Finasteride (5 Alpha Reductase Inhibitor) reduces the volume of the prostate. Their combination gives better result than either of the drugs used alone.

Keywords: BPH (Benign Prostatic Hyperplasia), Finasteride, Terazosin, Alpha Blockers, 5 Alpha Reductase Inhibitors, Medical Therapy in BPH.

INTRODUCTION

Benign prostatic hyperplasia (BPH) is a geriatric problem and adds significantly to numerous other problems of that age as Benjamin Brodie rightly put it "When the hair become grey and scanty, when the specks of earthy matter begin to be deposited in the tunics of the artery, and when a white zone is formed at the margin of the cornea, at this same period the prostate gland usually – I might perhaps say invariably – becomes increased in size".[1]

The standard established treatment of this problem is surgical intervention. These days transurethral resection of prostate and laser enucleation / vaporisation is the surgical procedure of choice. However these interventions are not free from hazards of mortality and morbidity like haemorrhage, stricture, bladder neck contracture and dilutional hyponatremia etc. Hence the quest for a safe alternative continues.

Medical therapy for benign prostatic hyperplasia is the need of the hour to alleviate the sufferings of the elderly men. Various processes involved in increasing the size of prostate are overgrowth of both epithelial and stromal tissues. The symptoms of the prostate are due to increased size (static component) and increased tone of the prostatic smooth muscles (dynamic component). These smooth muscles have alpha 1a receptors. The medical therapy is thus targeted at decreasing the size of prostate (static component) using Finasteride or Dutasteride and decreasing the tone of prostatic smooth muscles (dynamic component) by using alpha 1a receptor blocking drugs.

The old concepts that have been put forward from time to time are:

1. Prepubertal castration prevents BPH.
2. Genetic diseases that impair androgen action or production inhibit prostatic growth.
3. Prostatic levels of dihydrotestosterone and androgen receptors remain high with ageing.

All these factors have opened the way for the research to establish the cause of prostatic hyperplasia, its symptomatology and medical therapy.

Aims and Objectives:

1. To find out the role of medical therapy in the treatment of benign prostatic hyperplasia.
2. To compare the efficacy and safety of various drugs alone or in combination in the treatment of BPH.

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Review of Literature:

Signs and symptoms resembling prostatic hyperplasia have been documented in Sushruta Samhita volume III (600 BC). Ancient Syrian and Egyptian communities made attempts to overcome this disease by using catheters.

Prostate gland as such was unknown to Hippocrates and the word "Prostate" was used for the first time in 4th century BC by Herophelus of Alexandria, a Greek physician in Egypt (Pro=before, istani=to stand) indicating that the gland guards or stands before the bladder.[2]Oribasius described an abnormal induration of bladder neck, probably an enlarged prostate.[3]

The detailed anatomical description of prostate gland was given by Nicolo Massa. Lassar of Venice was first to discover that the swelling of prostate could block the exit of urine from the bladder. Riolan made definitive statement on the relationship of prostatic hyperplasia with bladder neck obstruction. The observations of Riolan were confirmed by Santorini and prostatic disease as a separate clinical entity. The relationship between the pathophysiological findings and clinical features of the disease evaluated by Morgagni and he mentioned that the various degrees of prostatic enlargement caused decreased flow to complete stoppage.[3]

The fact that the obstruction was caused by the hyperplasia of the lateral lobes, the middle lobes, it affected the bladder musculature (hypertrophy) and resulted in dilatation of upper urinary tract was observed by John Hunter.[4]

Various palliative and non-specific non-surgical measures were in use prior to establishment of surgery. These included various drug therapies, dietary control, catheterization etc. Gum elastic catheter which was easier to use and convenient to carry was introduced by Mercier.[5] If a catheter could not be passed per urethra during episode of acute retention, the suprapubic puncture of urinary bladder with a trocar and cannula was the only alternative known. The first attempted surgical intervention in the form of partial prostatectomy was done by McGill.[6] Sir Henry Thompson was of the view that in patients with chronic retention of urine, the bladder became atonic and lost its power to contract and it would not regain its contractility even when the obstruction was relieved.[7] Keeping this in mind, he advocated permanent suprapubic cystostomy.

The nineteenth century saw sporadic attempts at removal of a part or whole of the prostate. Suprapubic prostatectomy was an offshoot of suprapubic cystolithotomy as Amussat of France after doing cystolithotomy in an old man, observed a firm rounded tumour and removed it with scissors with subsequent relief of patient's obstructive symptoms.[8] Vasectomy and castration were also tried as a modality of treatment of prostatic obstruction.

Frayer's paper 'Total extirpation of the prostate' created a surgical sensation.[9] He gave up Fuller's practice of perineal drainage after suprapubic prostatectomy, instead instituted suprapubic drainage and established himself as originator of suprapubic prostatectomy.[10] The prostate these days is removed by any of these four basic approaches: McCarthy's transurethral resection of prostate, Freyer's suprapubic prostatectomy, Millin's retropubic prostatectomy and very few surgeons do Young's perineal prostatectomy.

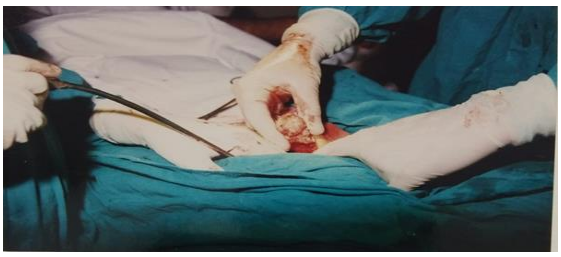

Image 1: Freyer's Prostatectomy in Progress.

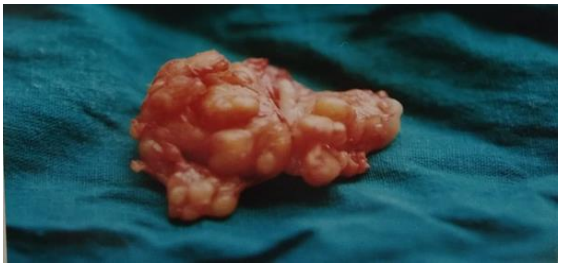

Image 2: Benign Prostatic Hyperplasia Showing Nodules of Varying Sizes.

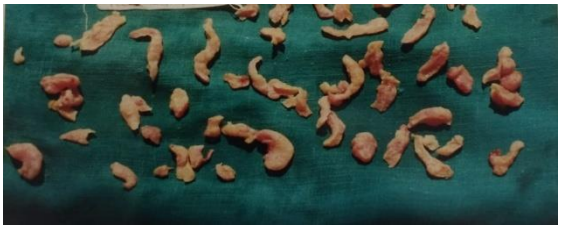

Image 3: Specimen: Transurethral Resection of Prostate.

Anatomical and Pathophysiological aspects:

Prostate, an accessory gland of the male reproductive system, lies below the neck of urinary bladder and surrounds the first three centimetres of male urethra at its commencement [Figure 1,2].[11]

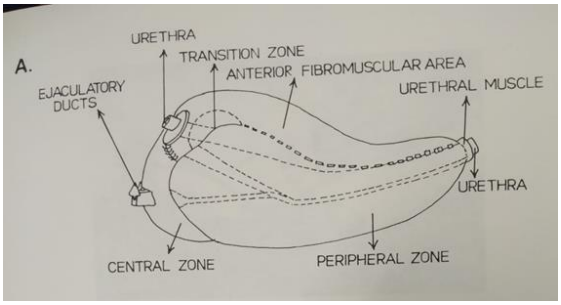

Figure 1A: Lateral view of the Prostate.

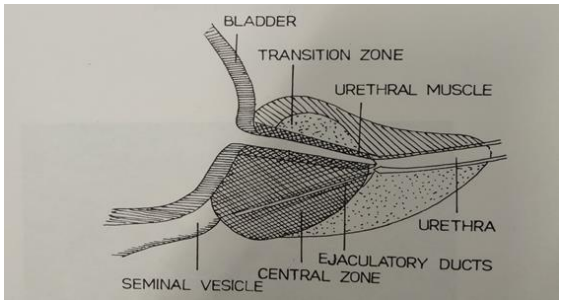

Figure 1B: Cut Section of the Lateral view of Prostate.

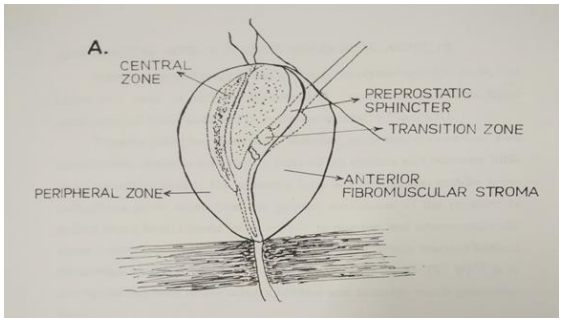

Figure 2A: Anatomy of the Prostate Gland.

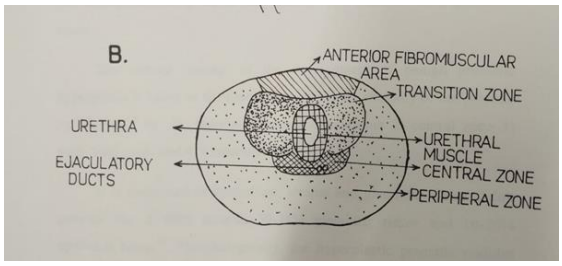

Figure 2B: Transverse Section of the Prostate Gland.

Prostate gland has five lobes- anterior, posterior, middle and two lateral lobes. Anterior lobe lies in the front of urethra and contains little or no glandular tissue. The posterior lobe lies behind the middle lobe. Adenomata never occur here but primary carcinoma of the prostate is said to begin here. Lateral lobes are two in number and adenomata may occur in lateral lobes. Middle lobe is the wedge of tissue situated behind the urethra and in front of the ejaculatory ducts [Figure 3-5].[12] It is just below the neck of the urinary bladder and contains much glandular tissue.

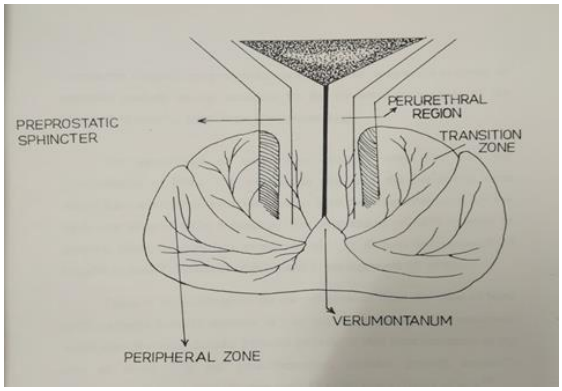

Figure 3: Oblique Coronal Plane of the Prostate.

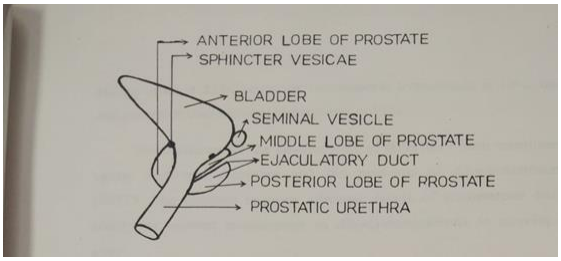

Figure 4: Sagittal Section of Bladder and Prostate Showing Normal Projection of Middle Lobe of Prostate into Prostatic Urethra.

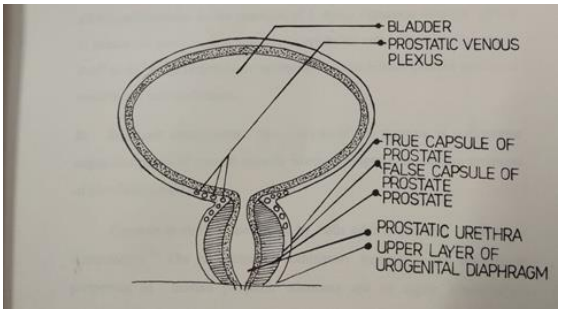

Figure 5: The Capsules of the Prostate.

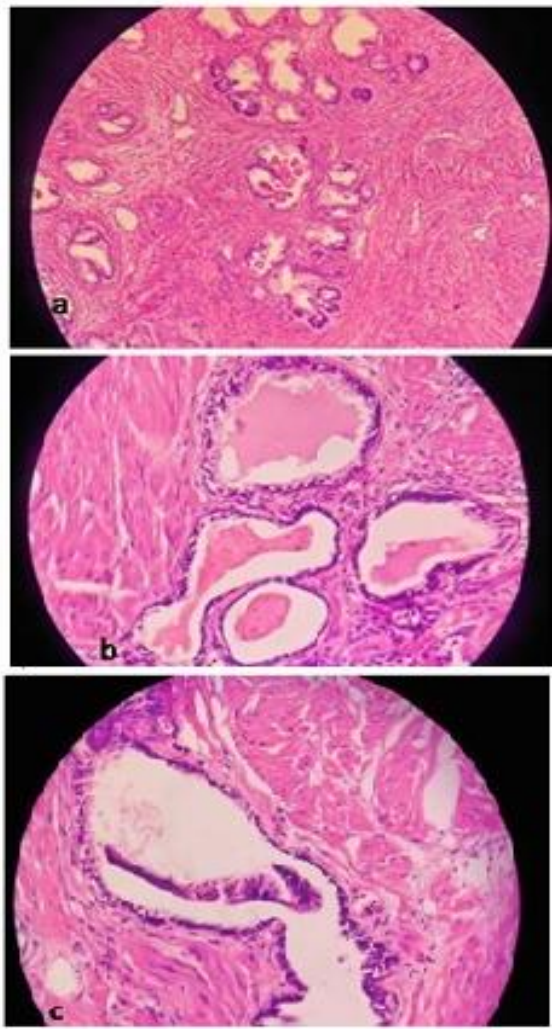

Image 4: a. Adenoleimyomatous type of Bengin Prostatic Hyperplasia. Lumen Contains Corpora Amylacea 10x, b & c in High Power 40x

The current concept of the development of benign prostatic hyperplasia is based on description of zonal anatomy of prostate by McNeal as 1) anterior fibromuscularstroma 2) central zone 3) peripheral zone and 4) transitional zone.[13]

The prostate is composed of epithelium, stroma and glandular tissue. Adult prostate has 45-60% stroma, 30-35% glandular tissue and 10-20% epithelial tissue.[14] Morphologically, the hyperplastic prostatic nodules could be stromal, fibromuscular, muscular, fibroadenomatous and fibroadenomyomatous (most common).[14-16]Bartsch et al.[17] demonstrated that the ratio of stroma to epithelium in normal prostate is about 2:1 . BPH has been described primarily as a stromal process as the ratio of stroma to epithelium increases to 5:1. Smooth muscle constitutes a significant proportion of stroma (Image 4) and contractile property of prostatic smooth muscles accounts for the dynamic component of obstruction causing significant symptomatology.

The three different components involved in the manifestation of BPH are mechanical (static), dynamic and detrusor as follows:

A. Mechanical (Static) component- Spherical masses of epithelial and stromal elements cause BPH. As these masses enlarge, they form lobes of varying configuration. Prerequisites for development of BPH are aging, androgen receptors and presence of dihydrotestosterone (DHT). The prostate requires adequate levels of testosterone and the ability to convert testosterone to dihydrotestosterone (DHT) to develop and grow. Leutinising hormone action on Leydig cells lead to the production of 95% androgens and remaining 5% androgens are secreted by adrenals. 98% androgen is protein bound and inactive. Only 2% of testosterone is converted to more active form i.e. dihydrotestosterone in the presence of 5 alpha-reductase enzyme which is present in the stromal cells and not in the epithelial cells. DHT binds itself to androgen receptors on epithelial cells to initiate protein synthesis resulting in cell replication.

B. Dynamic component- The capsule of prostate is a dynamic organ composed of smooth muscle fibres, collagen and varying amounts of glandular tissue. Capsule is richly innervated by both adrenergic and cholinergic components.[12] The receptors predominantly mediating the contractile properties of human prostatic adenoma are of alpha 1-adrenergic subtype. The capsule covers the enlarging adenoma anatomically and according to variation in the degree of autonomic stimulation, produces variable tension. This dynamic component is responsible for the variability in symptoms experienced by patients and explained the efficacy of drugs that relax the smooth muscles. The prostatic intraurethral pressure reduced to as much as 40% after intravenous administration of alpha- adrenergic antagonists.[18]

C. Detrusor component- Urinary bladder tries to compensate for prostatic obstruction in initial stages resulting in detrusor muscle hypertrophy, hyperplasia and deposition of collagen.[19] These changes lead to the development of detrusor instability or loss of normal control over reflex detrusor response. Together these changes are responsible for irritative symptoms that often trouble the patients most like frequency, urgency, nocturia and urge incontinence.

Stearns et al.[19] assessed the testicular exocrine function and androgen dependent secondary sexual characteristics in 283 men, 18 to 96 years of age. Mean serum testosterone levels remained unchanged up to the age of 70 years and declined thereafter.

While looking at the clinical aspects of BPH, the symptoms produced by the enlarging adenoma are often termed as “prostatism”. The symptoms are arbitrarily divided into two groups : Obstructive and irritative. Obstructive symptoms are produced by enlarging adenoma and by dynamic component related to the tone of smooth muscle in the prostatic capsule. These symptoms include weak stream, hesitancy, straining, dribbling, sensation of incomplete bladder emptying and acute retention. As the disease progressed, there was decreased vesical compliance and development of bladder instability leading to the development of irrelative symptoms like nocturia, frequency, urgency and dysuria.

To study the symptomatology of BPH and efficacy of its medical therapy, International Prostate Symptom Score (IPSS) has been developed, which consists of seven questions, each of which is given a score of 0 to 5, with a total score varying from 0 to 35 points. A patient scoring 0 to 7 points is considered mildly symptomatic, 8 to 19 points moderately symptomatic and 20 to 35 points severely symptomatic. This scoring system has an advantage that the index is operationalized for patient self-administration.

Suprapubic ultrasonography has been much advocated for monitoring the prostatic size and residual urine volume during follow up of patients on medical therapy for BPH.

MATERIALS AND METHODS

The study comprised of 80 symptomatic patients of BPH who were given medical therapy for a period of 6 months. These patients were divided into four groups:

Group 1-Finasteride (F)
Group 2- Terazosin (T)
Group 3-Finasteride and Terazosin (FT)
Group 4- Placebo (Vitamin E)

The patients were included in this study irrespective of the cardio-respiratory status. Those patients who were having malignancy of the prostate or other

urinary tract diseases including stricture urethra, urinary calculi, prostatitis, genitourinary tumours, diabetics and patients having definitive neurological lesions in brain or spinal cord were excluded from the study. Other exclusion criteria were previous history of treatment with drugs used in this study and of open or endourological surgery on prostate gland.

The pre and post treatment evaluation during two follow-ups of all patients was done as follows:

1. **Mode of presentation:** prostatic symptoms, urinary tract infection, haematuria or urinary retention.
2. **IPSS Symtom Score Index:** The IPSS symptom score index was noted at the start of medical therapy and was reviewed during subsequent follow-ups of the patients.
3. **Mean Urinary Flow Rates:** It was calculated by dividing voided urinary volume (in millilitres) with voiding time (in seconds). It was expressed in millilitres /second.
4. **Digital Rectal Examination:** The patients having tender prostate (prostatitis) or nodular prostate (suspicion of malignancy) were excluded from the study.
5. **Haematological and Biochemical Assessment:** Complete Haemogram, Bleeding Time & Clotting Time, Fasting Sugar, Urea, Creatinine, Electrolytes, Acid Phosphatase, Liver Function Tests and Prostate Specific Antigen.
6. **Microbiological Investigations:** Urine Routine, Microscopy, Culture & Sensitivity.
7. **Radiological:** Chest X-Ray PA View and Plain X-Ray Abdomen (KUB region)
8. **Ultrasonography:** Prostate size, Post Void Residual Urine, Kideys, Ureters and Urinary Bladder were evaluated.

   Suprapubic ultrasonography using a transducer of 3.5 M Hz. The patients were examined with full urinary bladder. The suprapubic transducer was placed on hypogastrium angled into caudal direction. The measurements of prostate were obtained to calculate the glandular volume. The cranio-caudal (CC) and the antero-posterior (AP) measurements were made in centimetres (cms.) from the largest dimensions at right angles to each other in the midline sagittal plane. The transverse measurement (W) was made in cms in transverse plane with widest diameter. The volume of prostate was calculated baseon mathematical formula for an ellipse which reduced to volume = (0.52xCCxAPxW) in cm^3. The volume of prostate gland thus measured was taken to be equivalent to estimated weight of the prostate. Since the specific gravity of the gland is 1.05 gram/cc. [20] After measuring the prostate volume the patient was asked to void and post void residual volume was calculated.

Medical Therapy Used in the Study:

Group 1-Finasteride 5 mg once daily at bed time (F)
Group 2- Terazosin 2 mg once daily at bed time (T)
Group 3- A combination of Finasteride 5 mg once daily & Terazosin 2 mg once daily at bed time (FT).
Group 4-Placebo (Vitamin E 600mg once daily) (E)

During 6 months trial of medical therapy, follow-ups were carried out twice at the end of 3 months and at the end of 6 months of drug trial. During first and second follow-ups clinical, ultrasonological, haematological, biochemical, microbiological, radiological studies were carried out as per proforma and observations recorded. Adverse drug reactions were also noted. The data obtained was analyzed statistically by difference between two means, two proportions and paired comparison tests.

RESULTS

A. Age Distribution- Overall age ranged between 47 to 87 years and average age was 64.4 years.

B. Modes of Presentation –

In study group, 80% presented with prostatism, 15% with prostatism and UTI and 5% with prostatism and haematuria.

In the control group, 75% patients presented with prostatism, 20% with prostatism and UTI, 5% with prostatism and haematuria.

C. IPSS Symptom Score-

1. **Sensation of incomplete bladder emptying:** In Finasteride group 70% patients showed IPSS improvement with respect to this sensation by a score of upto 2, compared to 85% patients showing improvement in Terazosin group by a score upto 3. In the patients receiving combination of Finasteride and Terazosin 90% patients showed improvement by a score upto 3. In patients receiving combination 20% showed improvement of symptom score by 3, compared to 5% in Terazosin group and none in Finasteride group. In control group only 25% showed improvement by a score of 1 only. These observations revealed that the combination of Finasteride and Terazosin has a better impact on improving the sensation of incomplete emptying as compared to drugs used singularly. Terazosin alone or in combination with Finasteride showed statistically significant difference ($p<0.01$) as compared to Finasteride alone which indicated that it is Terazosin which is effective in improving sensation of incomplete emptying of bladder rather than Finasteride. Since Terazosin affects the dynamic component of BPH by inhibiting the alpha adrenergic mediated smooth muscle tone, sensation of incomplete bladder emptying is smooth muscle tone dependent. The comparison between group T and FT also revealed insignificant difference which indicated that adding Finasteride with Terazosin did not change the effect on incomplete bladder emptying.
2. **Frequency of micturition:** Overall improvement was observed in 86 % in study group as compared

to 20% in control group. There was significant improvement of frequency of micturition with Terazosin, as compared to Finasteride. The combination of Finasteride with Terazosin had a better effect on improving frequency of micturition, as compared to drugs used singularly or with placebo.

3. **Hesitancy of Micturition:** Overall improvement was observed in 84% in the study group, as compared to 30% in the control group. There was significant improvement in relation to hesitancy of micturition with Terazosin, as compared to Finasteride. The combination of Finasteride with Terazosin had a better effect on improving hesitancy of micturition, as compared to drugs used singularly or with placebo.
4. **Urgency of Micturition:** Overall improvement was observed in 82% in the study group, as compared to 28% in the control group. There was significant improvement in relation to urgency of micturition with Terazosin, as compared to Finasteride. The combination of Finasteride with Terazosin had a better effect on improving urgency of micturition, as compared to drugs used singularly or with placebo.
5. **Weak Stream:** Overall improvement was observed in 90% in the study group, as compared to 20% in the control group. There was significant improvement in relation to weak stream of micturition with Terazosin, as compared to Finasteride. The combination of Finasteride with Terazosin had a better impact on improving weak stream, as compared to drugs used singularly or with placebo.
6. **Straining at Micturition:** Overall improvement was observed in 85% in the study group, as compared to 15% in the control group. There was significant improvement in relation to straining at micturition with Terazosin, as compared to Finasteride. The combination of Finasteride with Terazosin had a better impact on improving straining at micturition, as compared to drugs used singularly or with placebo.
7. **Nocturia**: Overall improvement in nocturia was observed in 94% in the study group, as compared to 15% in the control group. There was significant improvement in relation to nocturia with Terazosin, as compared to Finasteride. The combination of Finasteride with Terazosin had a better impact on improving nocturia, as compared to drugs used singularly or with placebo.

Maximum percentage improvement in total IPSS score (58.9%) was observed in Finasteride with Terazosin group FT which was highly significant ($p<0.01$). In Finasteride group F this improvement in total IPSS score was (25.6%) which was also statically highly significant ($p<0.01$). In Terazosin group T this improvement was (48.03%). In control group E, the percentage improvement in total IPSS score was (6.3%) which was not significant ($p>0.01$).

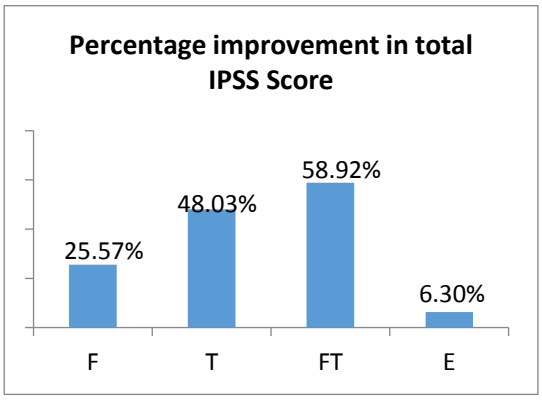

Figure 6: Bar diagram showing percentage improvement in total IPSS score in different study and control groups.

D. <u>Change in Prostate Volume after medical therapy:</u> Statistically significant reduction in prostate volume was observed in group F and in group FT ($p<0.01$), whereas it was insignificant in Terazosin group T ($p>0.01$). In Finasteride group F there was an overall reduction in prostate volume of 29.90%. In Terazosin group the prostate volume decreased by 5.45%. In Finasteride with Terazosin group FT the percentage reduction in prostate volume was 32.44%. In the control groups E, The prostate volume increased by 2.43%.

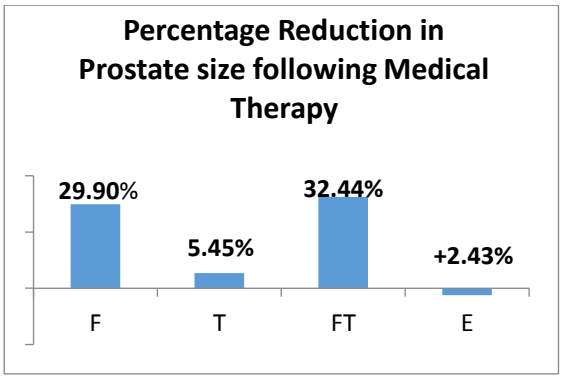

Figure 7: Bar diagram showing percentage reduction in prostate size in different study and control groups.

These observations indicated that Finasteride is effective in reducing the prostate volume as compared to Terazosin.

E. <u>Post Void Residual Urine:</u> The percentage reduction of post void residual urine was maximum in Finasteride with Terazosin group FT (61.4%), followed by Terazosin group T (50%) and Finasteride group F (26.6%).

F. <u>Mean Urinary Flow Rate:</u> Statistically highly significant improvement in mean urinary flow rate ($p<0.001$) was observed in all study groups as compared to the control group. Maximum improvement was observed in Finasteride with Terazosin group FT (64.7%), followed by Terazosin group T (55.7%) and Finasteride group F (15.5 %) and control group (1.96%) ($p=0.160$).

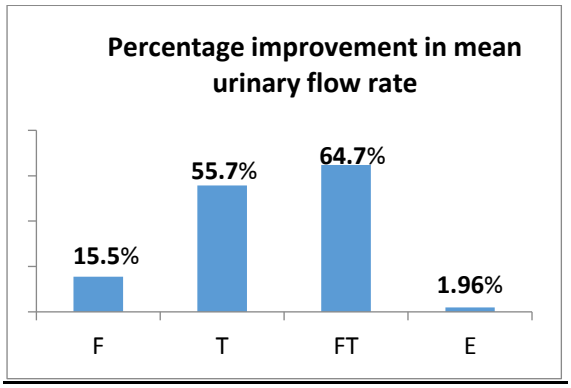

Figure 8: Bar diagram showing percentage improvement in mean urinary flow rate in different study and control groups.

These observations indicated that the urinary flow rate is primarily dependent upon dynamic component of BPH which improved significantly with Terazosin. Static component has less effect on urinary flow rate.

G. Adverse Drug Reactions: Decreased libido was noticed in one patient taking Finasteride. Headache , dizziness, asthenia and postural hypotension were also noted in few patients which improved with time.

DISCUSSION

These observations clearly indicated that Finasteride was effective in reducing the prostate volume whereas Terazosin was found to improve the IPSS symptom score index by providing symptomatic relief. Terazosin primarily affects the dynamic and detrusor components by inhibiting alpha 1-adrenergic receptors, which means that the symptomatic improvement is primarily due to the smooth muscle component of prostate and adjacent organs whereas Finasteride actually reduces the prostate volume by reducing the static component of epithelial and stromal tissue elements. Terazosin was more effective than Finasteride in reducing postvoid residual urine and in improving mean urinary flow rate. However the combination of Finasteride and Terazosin was better than any of the drugs used alone in improving all the parameters evaluated in the study.

CONCLUSION

Terazosin helps in improving the symptomatology and Finasteride reduces the volume of prostate. Both the drugs used in combination give better results. Thus medical therapy shows promise in alleviating the suffering of old patients with benign prostatic hyperplasia.

REFERENCES

1. Brodie Benjamin. Prostate and seminal vesicles. In : Bailey and Love's short practice of surgery. Mann CV, Russel RCG, Williams NS (Eds). Twenty second edition 1995; 971.
2. Weinerth JL. The male genital system. Text bbook of surgery. Sabiston. Igaku-Shoin / Saunders International ed. 13th ed., London 1986; Vol2 : 1670-1695.
3. Quoted by Murphy LJT. In The History of Urology. Murphy LJT, Thomas CC (Eds). Springfield Illinois USA 1972; 378-380.
4. Hunter J. A treastise on the venereal diseases. London.
5. Mercier LA. Quoted by Wells C. In. Prostatectomy. Wells C (Ed). E&S Livingstone Ltd. Edinburgh, 1st Ed., 1952; 1.
6. McGill AF. Suprapubic prostatectomy. Br Med J 1887; 2:1104.
7. Thompson H. Suprapubic prostatectomy. Br Med J 1887; 2:1104.
8. Amussat J. Quoted by Wells C. In Prostatectomy. Wells C (Ed). E&S Livingstone Ltd. Edinburg, 1st Edition, 1952; 2.
9. Freyer PJ. A clinical lecture on total extirpation of the prostate for radical cure of enlargement of that organ. Br Med J 1901; 11:125.
10. Fuller E. Six successfull and successive cases of prostatectomy. J Cutan Gen Urin Dis 1895; 13:229.
11. Weinerth JL, Robertson CN. The male genital system. In : Text book of surgery. Sabiston DC, Lyerly HK (Eds). WB Saunders co & Prism books Pvt. Ltd., Bangalore, 1997; 1454-1455.
12. McGregor Lee. Prostate. In Lee McGregor's Synopsis of Surgical Anatomy. Decker GAG (Ed). Twelfth edition 1986;320-325.
13. McNeal J. Pathology of benign prostatic hyperplasia-Insight into etiology. UrolClinNor Am 1990; 17:477-486.
14. Berry SJ, Coffey DS, Walsh PC. The development of human benign prostatic hyperplasia with age. Urol 1984; 132:474-479.
15. Franks LM. Benign nodular hyperplasia of the prostate-A review. Ann R CollSurg 1954; 14:92.
16. Frank LM. Benign prostatic hypertrophy-Gross and microscopic anatomy. Department of Health Education and Welfare, NIH Publication No. 1976; 76-1113:63.
17. Bartsch F, Frick J, Roegg I et al. Electron microscopic stereological analysis of the normal prostate and of benign prostatic hyperplasia. J Urol 1979; 122:481.
18. Christensen MM, Bruskewitz RC. Clinical manifestations of benign prostatic hyperplasia and indications for therapeutic intervention. UrolClin North Am 1990; 17:509.
19. Stearns EL, McDonnel JA, Kaufman BJ, Padua R, Lucman TS, Winter JSD, Faiman C. Declining testicular function with age. The American J of Medicine 1974; 57:961-966.
20. Hennberry M, Carter MF, Nieman HI. Estimation of prostate size by suprapubic ultrasonography. J Urol 1979; 121:615-616.

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