Section: General Surgery

Original Research Article

IMPACT OF LOW SERUM TESTOSTERONE ON URETHRAL STRICTURE AND SURGICAL OUTCOMES IN MEN : A PROSPECTIVE STUDY

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Abstract

Background: Urethral stricture is a urological condition characterized by the narrowing of the urethra, leading to symptoms like reduced urine flow and recurrent urinary tract infections. While common in the bulbar urethra, the exact etiology remains unclear for many patients. Recent studies suggest that low serum testosterone levels may play a significant role in the development and recurrence of this condition. **Materials and Methods:** This prospective study included 100 male patients over 18 years with urinary stream thinning, divided into cases (stricture) and controls (other causes). Serum testosterone levels were measured, and diagnoses were confirmed via Micturating Cystourethrogram and Retrograde Cystourethrogram. Statistical analysis was performed to determine the significance of findings. **Result:** Patients with urethral stricture had a mean testosterone level of 3.70 ng/ml, significantly lower than the control group's 4.57 ng/ml ($p < 0.05$). Recurrence rates post-Visual Internal Urethrotomy were 10% at 3 months, increasing to 30% at final follow-up. Patients with recurrence exhibited even lower testosterone levels (1.71 ng/ml) compared to non-recurrence patients (3.89 ng/ml) ($p < 0.05$). **Conclusion:** Lower serum testosterone levels are significantly associated with both the presence and recurrence of urethral strictures. These findings highlight the need for further investigation into the role of testosterone in urethral stricture disease and potential therapeutic interventions.

INTRODUCTION

Urethral stricture is a urological disorder defined by the narrowing of urethral lumen. This condition can cause a number of urinary symptoms, including reduced urine flow, retention of the urine, and recurrent urinary tract infections.[1] Urethral strictures can develop in any segment of the urethra, although they most commonly occur in the bulbar urethra.

The male urethra is made up of the following segments (from the neck of the bladder to the meatus urethra): the anterior or spongious urethra (embedded in the corpus spongiosum) which contains the bulbar urethra (between the penoscrotal angle and the membrane urethra) and the penile urethra (between the penoscrotal angle and the meatus urethra) and posterior urethra constitute membranous urethra and prostatic urethra.[2]

In ancient India, urethral stricture was first reported in the sixth century, and dilatation using a reed catheter was the method of treatment at that time1. For a large proportion of patients, the aetiology of this oldest-described pathology in urology and medicine is still unknown. Lichen sclerosis (LS) illness (formerly known as balanitis xerotica obliterans) and iatrogenic, viral, and traumatic injuries are the most common causes of anteroventral urethral strictures. 34%–41% of anterior urethral strictures occur in affluent nations and have an idiopathic or unexplained aetiology.[3]

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The principal hormone associated with male sex, testosterone, is essential for the development of secondary sexual traits as well as for the control of other physiological functions, including as wound healing, immunological response, and tissue repair. Changes in testosterone levels may impact tissue integrity and repair mechanisms, which could have an impact on the pathophysiology of urethral stricture, according to newly emerging research. The relationship between low blood testosterone levels and the development of urethral strictures in men has gained a lot of interest recently, despite the identification of other etiological variables.

MATERIALS AND METHODS

All male patients presenting to Northern Railway Central Hospital's surgery department and are aged over 18 years having complaints of thinning of the urinary stream were included in the study group. Thinning was subjectively observed based on patient complaints and objectively evaluated using uroflowmetry (qmax< 10ml/sec). Diagnosis of stricture urethra was confirmed using Micturating Cystourethrogram (MCU) and Retrograde Cystourethrogram (RGU). Two groups were established: cases and controls. Cases comprised patients with stricture urethra, while controls consisted of patients with thinning of the urinary stream other than stricture urethra like benign prostatic hyperplasia, carcinoma prostate, high bladder neck, etc. Serum testosterone levels were measured in both groups. About 4–5 ml of venous blood without anticoagulant was collected from all patients, taking aseptic measures and after obtaining consent from the patients. Serum was separated as per standard protocol. The testosterone levels in blood were measured by automated analyser based on chemiluminescence technology. The reference range for testosterone levels in the blood typically falls between 1.75 -7.81ng/ml. All patients with stricture urethra underwent Visual Internal Urethrotomy – VIU. Correlation of serum testosterone level was done with recurrence after surgery (visual internal urethrotomy).

Inclusion Criteria

All male patients aged over 18 years who presented consecutively with thinning of the urinary stream at Northern Railway Central Hospital.

Patient going surgical correction with VIU (Visual internal urethrotomy).

Exclusion Criteria

Patients with active urinary tract infection.

Patients with recurrent urethral stricture.

Patient of traumatic stricture urethra.

Statistical Analysis

The collected data was analysed using descriptive statistics, including frequency analysis and percentage analysis for categorical variables, while mean and standard deviation (S.D) were used for continuous variables. To determine the significance of associations in categorical data, the Chi-Square test or Fisher's exact test was used.

RESULTS

A prospective study was conducted in surgery department of Northern Railway Central Hospital, New Delhi which included 50 patients with stricture urethra (cases) and 50 patients with thinning of the urinary stream from other causes (controls). The control group had conditions such as benign prostatic hyperplasia, prostate carcinoma, and high bladder neck.

Age Distribution: Age distribution varied significantly between the groups. In the cases group, 20% were aged 20-40 years, 8% were 41-50 years, 4% were 51-60 years, 50% were 61-70 years, and 18% were 71-90 years. The control group showed a different distribution: 2% were 20-40 years, 4% were 41-50 years, 18% were 51-60 years, 54% were 61-70 years, and 22% were 71-90 years. The mean age was significantly lower in the cases (55.31 years, SD 15.01) compared to the controls (65.36 years, SD 14.75).

Complaints: The chief complaints reported included burning micturition, urinary retention, increased frequency of urination, and nocturia. Burning micturition was reported by 20% of cases and 6% of controls; urinary retention was noted by 8% of cases and 4% of controls; increased frequency was reported by 28% of cases and 22% of controls. However, these differences were not statistically significant ($p > 0.05$). Notably, nocturia was reported by 14% of cases versus 34% of controls, with a statistically significant difference ($p < 0.05$), suggesting nocturia is more prevalent among controls.

Diagnostic Characteristics: Diagnostic measures including uroflow maximum flow, voiding time, and symptom duration were assessed. The mean uroflow maximum flow was 8.90 ± 2.50 in cases and 9.78 ± 1.79 in controls ($p > 0.05$). Voiding time averaged 79.24 ± 5.37 minutes in cases and 84.88 ± 6.87 minutes in controls ($p > 0.05$). Duration of symptoms was 12.7 ± 4.3 years for cases and 11.9 ± 5.2 years for controls ($p > 0.05$). No significant differences were found across these diagnostic measures.

Serum Testosterone Levels: Serum testosterone levels were significantly lower in the cases group, with a mean of 3.70 ng/ml (SD 1.50) compared to 4.57 ng/ml (SD 1.23) in controls ($p < 0.05$).

Stricture Recurrence: Stricture recurrence rates were monitored at various follow-up intervals. At 3 months, 5 cases (10%) showed recurrence, increasing to 10 cases (20%) at 6 months, and reaching 15 cases (30%) at the final follow-up.

Characteristics of Patients with Recurrence: Among patients with recurrent stricture, the mean age was 64.31 years, compared to 57.36 years in those without recurrence. The mean duration of symptoms was similar between groups (11 years for recurrence vs. 11.2 years for non-recurrence). Uroflow

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maximum flow was slightly lower in patients with recurrence (8.28) compared to those without recurrence (8.98), though this difference was not statistically significant. The most significant finding was in serum testosterone levels: patients with recurrence had a mean testosterone level of 1.71 ng/ml, notably lower than the 3.89 ng/ml observed in non-recurrence patients ($p < 0.05$).

DISCUSSION

Visual Internal Urethrotomy (VIU) is a widely used treatment for urethral stricture but has a notable recurrence rate. This study aimed to identify the impact of serum testosterone level in male patients with urethral stricture and the correlation of serum testosterone levels with the recurrence after visual internal urethrotomy. The study also aimed to identify the factors influencing the incidence and recurrence rates post-surgery, and their association with serum testosterone levels.

Our findings suggest that urethral stricture predominantly affects a younger population compared to controls. The mean age for cases was 55.31 years, whereas for controls, it was 65.36 years. Although the cases are younger on average, the age distribution similarity between both groups implies that age alone may not be a major risk factor. This is consistent with Sanz et al., who reported mean ages of 59.5 years for cases and 64.3 years for controls, but contrasts with Fu Q et al and Singh et al who noted younger mean ages for stricture cases.[4,5]

Thinning of urine was the most common complaint among both cases and controls, but nocturia was more common in controls. Burning micturition and urinary retention were reported more frequently in cases, and increased urination was slightly higher among cases. These findings differ from Hembram et al., who identified a thin urine stream, dribbling, and urinary retention as predominant complaints. Our study found bulbar urethral stricture to be the most prevalent (36%), followed by bulbo-membranous, prostatic, and penile strictures. This aligns with Jhanwar et al, who reported the bulbar urethra as the most common site of stricture.[6]

Diagnostic characteristics revealed that cases generally had lower mean maximum flow rates (8.90 mL/s), shorter voiding times, and slightly longer symptom durations compared to controls. These findings are consistent with Jhanwar et al., who noted a mean maximum flow rate of approximately 6.79 mL/s.

A significant finding of our study was the lower mean serum testosterone level in cases (3.23 ng/ml) compared to controls (4.57 ng/ml), with a p-value of <0.05 indicating statistical significance. This supports Sanz et al's results showing lower testosterone levels in stricture cases compared to controls.[7]

Recurrence rates for stricture increased over time, with 10% of cases experiencing recurrence at 3 months, rising to 20% at 6 months, and reaching 30% overall. Although age, symptom duration, and maximum flow rate did not differ significantly between patients with and without recurrence, lower testosterone levels were associated with a higher risk of recurrence. This suggests that testosterone deficiency may be linked to increased recurrence risk. Sanz et al. reported a positive correlation between hypoandrogenism and urethral stricture occurrence, while Jhanwar et al. noted a 40% recurrence rate after VIU. In contrast, Shukor et al8. found no significant association between lower urinary tract symptoms (LUTS) and testosterone levels.

Spencer et al,[9] reported that 56.5% of men undergoing urethroplasty had testosterone deficiency, with a higher body mass index and longer stricture lengths observed in these men. Bonilla et al,[10] found significantly lower mean testosterone levels in men with urethral strictures compared to controls, and a higher prevalence of testosterone levels <300 ng/dL. These findings suggest a growing body of evidence linking testosterone deficiency to urethral stricture disease, although the precise role of testosterone in stricture pathogenesis remains to be fully elucidated.

Limitations of the Study

This study has several limitations. The relatively small sample size may impact the statistical power and reliability of the findings. Additionally, being a single-center study limits the generalizability of the results, as it may not represent diverse patient populations or healthcare practices. Selection bias is another concern, as the study only includes patients from a specific institution, potentially skewing the results. The absence of long-term follow-up restricts the ability to assess outcomes or recurrence rates beyond the observed period, which affects the evaluation of treatment effectiveness. Furthermore, the study does not include interventional analyses, such as the effects of testosterone replacement therapy on stricture recurrence, which could have provided additional insights into the role of testosterone in the disease process.

CONCLUSION

Urethral stricture disease primarily affects older individuals, with the bulbar urethra being the most common site. While age alone is not a major risk factor, lower serum testosterone levels are significantly associated with both the presence and recurrence of stricture. Symptoms such as burning micturition and urinary retention are more common in cases compared to controls. Lower maximum flow rates and longer symptom durations were observed in cases. These findings suggest a potential link between testosterone deficiency and urethral stricture disease, highlighting the need for further research to explore underlying mechanisms and therapeutic options.

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