

## Original Research Article

# Comparison between holmium laser and cold knife direct vision internal urethrotomy for treatment of urethral stricture

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## ABSTRACT

**Background:** Urethral stricture (US) is one of the most difficult urological problems to cure adequately and is known to mankind since ages as it had been documented in ancient literature of the Hindus, Egyptians and Greeks and Islamic cultures. The aim of this study is to compare between Ho: YAG (holmium laser) and cold knife direct vision internal urethrotomy for the treatment of short segment urethral stricture regarding efficacy of treatment, operative time and complications.

**Methods:** A prospective study was conducted on a total of 38 male patients with definitive diagnosis of urethral stricture attending the urological outpatient clinic of Al Karama teaching hospital from September 2013 to May 2015. All patients involved agreed to participate in this study.

**Results:** In this study, total number of patients 31 mean age ( $43.94 \pm 11.70$ ). In the holmium group, 16 patients with mean age ( $42.06 \pm 10.43$ ), in cold knife group, 15 patients with mean age ( $45.93 \pm 12.99$ ). Regarding causes of urethral stricture, from total 31 patients 8 patients had infection, 11 traumatic, 10 iatrogenic and 2 unknown (idiopathic), in the holmium 4 patients had infection, 6 traumatic, 4 iatrogenic and one unknown. In cold knife group 4 patients had infection, 5 traumatic, 6 iatrogenic and one was unknown. In holmium group, 12 patients had strictures in anterior segment, 4 patients had it in posterior segment urethra, in cold knife group, there were 10 patients with strictures in anterior segment and 5 patients in posterior segment urethra. The peak flow rates were compared between the two groups pre- and post-operatively at 15 days, 3 months, and 6 months. At day 15 and 3 months, the difference between the means of peak flow rates (PFR) was not statistically significant and was comparable. At 6 months interval, the difference between mean of PFR for holmium and cold knife group was statistically highly significant.

**Conclusions:** Urethral stricture is a disease affecting middle-aged men. Both cold knife and laser urethrotomy are effective method for treatment of short segment urethral stricture. The change in  $Q_{\max}$  was observed to be greater with cold knife than with laser with statistical significance at 6 months. Operative time was shorter in cold knife group.

**Keywords:** Cold knife, Holmium laser, Urethral stricture

## INTRODUCTION

Urethral stricture (US) is one of the most difficult urological problems to cure adequately and is known to mankind since ages as it had been documented in ancient literature of the Hindus, Egyptians and Greeks and

Islamic cultures.<sup>1</sup> In which many scientists had an important role in the development of treatment of US like Abu Baker Al-Razi, who gave full account for treatment of urethral discharge and its treatment by irrigation, he appear to be familiar with urethral stricture and emphasized the importance of catheterization. If there was retention of urine, also Ibn Sena (980-1037AD)

describe treatment of acute urethritis by irrigating urethra using silver syringe and had key role in the historical treatment of US.<sup>2</sup>

Different techniques have been employed for the treatment of urethral strictures, depending on the stricture length, location, and depth of scar which include simple dilatation, urethrotomy, urolume stent placement, urethroplasty and perineal urethrostomy.<sup>1</sup> Male urethral stricture disease is prevalent and has a substantial impact on quality of life and health-care costs.<sup>3</sup> As urethral stricture causes progressive narrowing of the urethral lumen, symptoms and signs of urinary obstruction arise. Patients experience weak stream, straining to urinate, incomplete emptying, post-void dribbling, urinary retention, and recurrent urinary tract infections. The symptoms resemble those of other causes of bladder outlet obstruction such as benign prostatic hyperplasia. The presence of obstructed ejaculation also points to urethral stricture and is a cause of infertility.<sup>4</sup>

The most common causes of urethral stricture today are traumatic or iatrogenic. Less-common causes include inflammatory or infectious, malignant, and congenital. Infectious urethral strictures are secondary typically to gonococcal urethritis, which remains common in certain high-risk populations.<sup>5</sup> Management of urethral strictures is complex and depends on the characteristics of the stricture.<sup>3</sup>

Urethral strictures have been a reconstructive dilemma for many years due to the high incidence of recurrence and less than satisfactory outcomes. A thorough preoperative evaluation, appropriate surgical planning, and adherence to basic surgical principles, even in the hands of the most experienced surgeon, have failed to achieve the desired results. Since 1974, Sachse's optical internal urethrotomy (OIU) has been considered the treatment of choice US; however, the occurrence of refractory strictures has made results unsatisfactory; Since then, several alternatives have been evaluated and include the holmium laser, which was introduced into urological practice in the early '90 s.<sup>6</sup>

## METHODS

A prospective study was conducted on a total of 38 male patients with definitive diagnosis of urethral stricture attending the urological outpatient clinic of Al Karama Teaching hospital from September 2013 to May 2015. All patients involved agreed to participate in this study. Statistical analysis was performed using SPSS version 22 with paired T-Test, independent T-Test. All parametric data were expressed as mean  $\pm$  standard deviation. Independent sample t-test and Mann-Whitney U-tests were used for the comparison of parametric data when appropriate, while the Pearson's chi-squared ( $\chi^2$ ) test was used to compare the non-parametric data. A P-value < 0.05 was considered significant.

## Inclusion criteria

Patient aged from 20-65 years, patient with short segment US less than 2 cm, recurrent US (for first and second recurrent) were included in this study.

## Exclusion criteria

Patient with long US, more than 2 cm, multiple strictures, patient with obstructive BPH, patient with neurogenic and over active bladder, balanitis xerotica obliterans and seven patients who did not return for follow up after surgical intervention were excluded from this study.

## Data collection

Complete history and physical examination, urine analysis, serum creatinine measurement, voiding cystourethrogram, retrograde urethrogram, urine culture/sensitivity as well as ultrasonography for kidney, bladder and prostate were done.

Patients were randomized into two groups: group A (holmium group), internal urethrotomy was done with holmium laser and group B (cold knife group) cold knife was used.

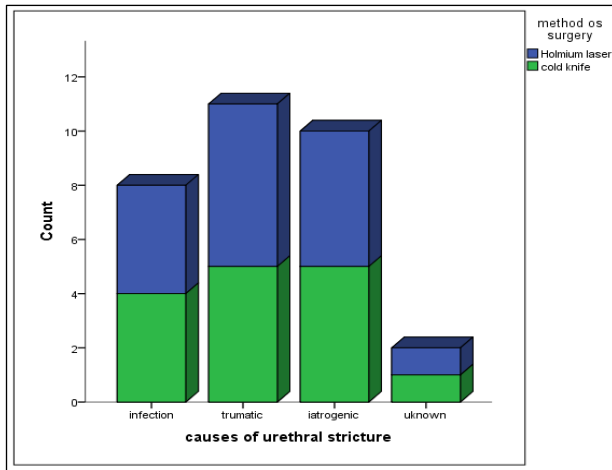
The success was completed by post-procedure negotiation of the cystoscope into the urinary bladder. Operative time was recorded as the time interval beginning with insertion of direct vision urethrotome from external urethral meatus, continuing with procedure either by laser or cold knife, and ending with the removal of urethrotome from external urethral meatus. A 16-Fr silicone Foley catheter was inserted per urethra at the end of the procedure which was removed after 5-7 days. Patients were followed up for 6 months after surgery in outpatient department on 15 days, 3 and 6 months. At each follow up visit we did physical examination, uroflowmetry and Ask patient for any complaint. Patient kept on intermittent catheterization program about once weekly for the 1<sup>st</sup> month post-operatively.

## RESULTS

**Table 1: Distribution of studied sample according to age and method of surgery.**

Method of surgery	Mean (years)	Number of patients	Standard deviation
Holmium laser	42.06	16	10.434
Cold knife	45.93	15	12.992
Total	43.94	31	11.707

In this study, total number of patients 31 mean age (43.94 $\pm$ 11.70). In the holmium group, 16 patients with mean age (42.06 $\pm$ 10.43), in cold knife group, 15 patients with mean age (45.93 $\pm$ 12.99) (Table 1).

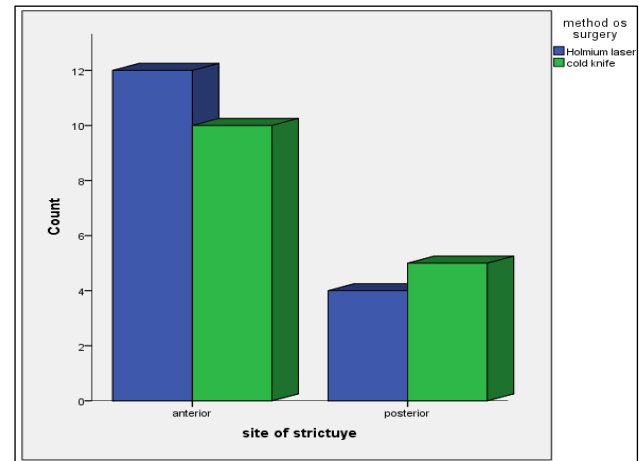


**Figure 1: Etiology of structures.**

Regarding causes of urethral stricture, from total 31 patients 8 patients had infection, 11 traumatic, 10 iatrogenic and 2 unknown (idiopathic), In the holmium 4 patients had infection, 6 traumatic, 4 iatrogenic and one unknown. In cold knife group 4 patients had infection, 5 traumatic, 6 iatrogenic and one was unknown (Figure 1, Table 2). In holmium group, 12 patients had strictures in anterior segment, 4 patients had it in posterior segment urethra, in cold knife group, there were 10 patients with strictures in anterior segment and 5 patients in posterior segment urethra (Figure 2). On applying Pearson-chi squared test, it was concluded that the two groups were comparable with respect to age distribution, etiology of stricture, and site of stricture.

**Table 2: Distribution of studied sample according to causes of urethral stricture.**

Cause	%	Number of patients
Trauma	35.48	11
Iatrogenic	32.2	10
Infection	25.8	8
Unknown	6.45	2



**Figure 2: Structure site.**

The peak flow rates were compared between the two groups pre- and post-operatively at 15 days, 3 months, and 6 months (Table 3).

**Table 3: Changes in peak flow rate.**

Holmium laser n=16				Cold knife n=15			P-value
	Mean (ml/sec)	Standard deviation	Range (ml/s)	Mean (ml/s)	Standard deviation	Range (ml/s)	
Pre-operative	7.32	1.09	3.6	7.08	1.21	4.1	
Day 15	24.62	2.67	10.2	25.35	2.24	8.1	0.28
3 months	21.67	1.92	6.5	22.60	1.87	6.2	0.19
6 months	19.23	1.80	6.4	20.88	2.08	6.7	0.03

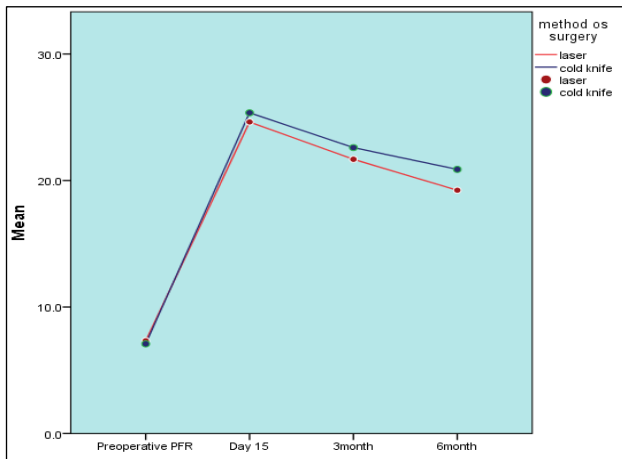
**Table 4: Changes in operative time.**

Cold knife n=15			Holmium laser n=16		P-value
	Mean	Standard deviation	Mean	Standard deviation	
Operative time	11.58	3.37	17.31	2.75	<0.005

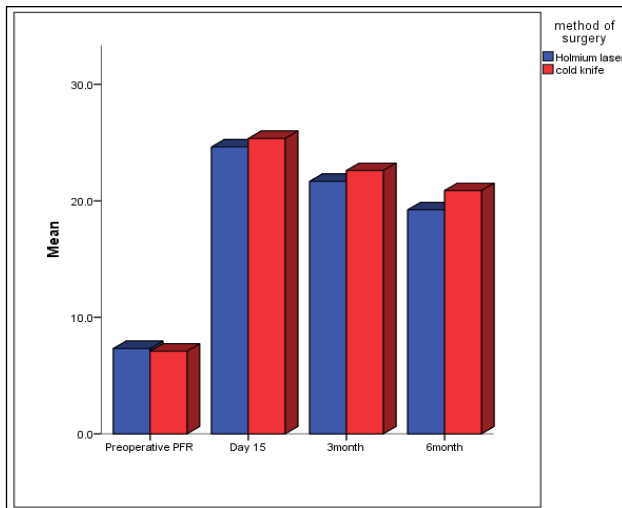
At day 15 and 3 months, the difference between the means of PFRs was not statistically significant and was comparable. At 6 months interval, the difference between mean of PFR for holmium and cold knife group was statistically highly significant (P value = 0.030) (Figure 3, 4). In Group A (holmium group), the mean operative time was 17.31 min (range 12-23 min), in Group B (cold knife

group), the mean operative time was 11.58 min (range 6-18 min.). (P value <0.005) (Table 4). Regarding complication in cold knife group we had 1 patient (6.6%) developed intraoperative bleeding that necessitate ending the procedure, 2 (13.3%) patient had urinary tract infection(UTI), in laser group no intra- or postoperative

complications, such as hemorrhage, UTI, epididymitis, were encountered.



**Figure 3: Changes in PFR.**



**Figure 4: Mean PFR fall.**

## DISCUSSION

The goal of urethral stricture treatment is to reconstruct the anatomical continuity and patency of the urethra without significantly impairing urogenital functions.<sup>8</sup>

Regarding etiology of US; in this study, the prevalence was trauma 35.48 %, Iatrogenic 32.2 %, infection 25.8 % and unknown (idiopathic) 6.45%; while in study done by AL-Mosawi HY, conducted on 40 patients at Babylon; the etiology was trauma 20%, iatrogenic 30%, infection 37.5% and unknown (idiopathic) 12.5%.<sup>9</sup> In a study done by AL-Farzai AS, at Mosul, the etiology was trauma 38%, iatrogenic 30%, infection 27% and unknown (idiopathic) 4.3%.<sup>10</sup>

Regarding operative time; in this study, the holmium group the mean was 17.31 minutes (range 12-23 minutes), which comparable to the result of study done by Atak M,

et al; which was 16.4 ± 8.04 minutes, while study done by Jain SK et al, the operative time was 19.8 minutes (range 15-30 minutes).<sup>1,11</sup> In this study; cold knife group the operative time was 11.58 minutes (range 6-18 minutes) while in a study by Atak M, et al 2011 the operative time was longer 23.83 ± 5.47 minutes.<sup>11</sup> In controversy to study of Jain SK, et al, operative time was shorter 7.44 minutes (range 5-10 minutes).<sup>1</sup> For follow up of patients after DVIU, peak flow rate ( $Q_{max}$ ) was used for this purpose in 15 days, 3 and 6 months.

In cold knife group, the mean change in  $Q_{max}$  was 25.35 ml/sec, 22.60 ml/sec, 20.88 ml/sec respectively in 15 days, 3 and 6 months; while in a study done by Slawomir A et al, patient followed for 3, 6, 12 months, the mean PFR ( $Q_{max}$ ) changes were: 11.92 ml/sec at 3 months and 10.60 ml/sec at 6 months.<sup>6</sup> In holmium laser group, the mean change in  $Q_{max}$  was 24.62 ml/sec, 21.67 ml/sec, 19.23 ml/sec at 15 days, 3 and 6 months respectively; while in a study done by Slawomir et al, patient followed for 3, 6, 12 months, the mean PFR ( $Q_{max}$ ) changes were: 11.44 ml/sec at 3 months, and 10.72 ml/sec at 6 months.<sup>6</sup>

In this study, in Holmium laser group, excellent results were seen in 15 out of 16 (93%) cases at 3 months. These were defined as catheter free status with PFR more than 15 ml/sec and no requirement for any other intervention; while in Hussain M et al, this percentage was 77% (60 patients out of 78).<sup>12</sup>

In cold knife group, the excellent results were seen in 13 out of 15 (87%). Regarding complication in cold knife group we had 1 patient (6.6%) develop intraoperative bleeding, 2 (13.3%) patient had UTI; while in Jain SK, et al. 2014 seven patients (15.56%) had intra-operative bleeding.<sup>1</sup> In laser group no intra- or postoperative complications, such as hemorrhage, bacteraemia, epididymitis, were encountered; the same result was found in a study of Atak M et al, and Slawomir A et al, while in Jain SK et al, 4/23 patients (8.89%) developed extravasations of irrigating fluid in the perineum in Hussain M et al, UTI was the most frequent complication seen in 10 (13%) patients.<sup>1,6,11,12</sup>

## CONCLUSION

US is a disease affecting middle-aged men. Almost all patients present with obstructive urinary tract symptoms, external trauma was the common cause; Both cold knife and laser urethrotomy are effective method for treatment of short segment urethral stricture.

Uroflowmetry showed significant improvements in both groups at 15 days, 3 and 6 months follow up visits. The change in  $Q_{max}$  was observed to be greater with cold knife than with laser with statistical significance at 6 months; operative time was shorter in cold knife group. Complication rate was more in cold knife group.

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