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*Özgün araştırma / Original research*

# Endoscopic Surgery of Urethral Strictures: Laser Versus Knife

## Üretra Darlığında Endoskopik Cerrahi: Bıçağa Karşı Lazer

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**Özet**

**Amaç:** Üretra darlığının endoskopik cerrahisinde cold knife üretrotomi ile laser üretrotominin etkinliğini karşılaştırmayı amaçladık.

**Gereç ve Yöntemler:** Toplam 171 hasta retrospektif olarak değerlerlendirildi. Çalışma kapsamında verileri tam olan 118 hasta 2 gruba ayrıldı (grup 1; n=53 cold knife üretrotomi, grup 2; n= 65 lazer üretrotomi). Darlığın uzunluğu, operasyon süresi, preoperatif ve postoperatif 3., 6. ve12. aylardaki Qmax değerleri, nüks olup olmadığı ve komplikasyon varlığı (kanama, extravazasyon, ateş gb) açısından iki grup karşılaştırıldı.

**Bulgular:** Operasyon zamanının cold knife üretrotomi yapılan hastalarda daha kısa olduğu görüldü (14.01 ± 3.86 dk vs 25.03 ± 4.43 dk, p=0.001). Postoperatif 3., 6., ve 12. aylardaki Q max değerlerinin lazer üretrotomi yapılan hastalarda daha yüksek olduğu görüldü (p=0.03, p=0.001, p=0.001). Bir yıllık takip sonucunda grup-1' de 28 (52.83%) hastada nüks saptanırken, grup-2' de 12 (18.46%) hastada nüks geliştiği gözlendi (p=0.01). Postoperatif komplikasyonlar açısından her iki grup arasında istatiksel olarak anlamlı fark izlenmedi. (p=0.209).

**Sonuç:** Yaptığımız bu çalışmada üretra darlığını endoskopik cerrahisinde, lazer üretrotomi tekniğinin, cold knife üretrotomiye göre yüksek Qmax değerlerine ve daha düşük nüks oranına sahip olması nedeniyle daha başarılı bir cerrahi yöntem olduğu saptanmıştır. Sonuçların prospektif, randomize çalışmalarla desteklenmesi gerekmektedir.

**Anahtar Kelimeler:** üretral darlıklar; lazer üretrotomi; soğuk bıçak; nüks.

**Abstract**

**Objective:** We aimed to compare the efficiency of cold knife urethrotomy and laser urethrotomy in endoscopic surgery of urethral strictures.

**Material and Methods:** A total of 171 patients were evaluated retrospectively. A 118 patients with complete data were divided into two groups (group 1; n = 53 cold knife urethrotomy, group 2; n = 65 laser urethrotomy) in the study. Length of the stricture, operation time, preoperative and postoperative 3rd, 6th and 12th-month Qmax values, recurrence and the presence of complications (such as bleeding, extravasation, fever etc.) were compared in terms of the two groups.

**Results:** The operation time was found to be shorter in patients who underwent cold knife urethrotomy (14.01 ± 3.86 min vs 25.03 ± 4.43 min, p=0.001). The Q max values at the postoperative 3rd, 6th and 12th months were observed to be higher in patients who underwent laser urethrotomy (p=0.03, p=0.001, p=0.001). At the end of a one-year follow-up, recurrence was determined in 28 (52.83%) patients in group 1 and 12 (18.46%) patients had a recurrence in group 2 (p=0.01). No statistically significant difference was observed between the two groups in terms of postoperative complications. (p=0.209).

**Conclusion:** In this study, it was determined that laser urethrotomy technique was a more successful surgical method than cold knife urethrotomy in the endoscopic surgery of urethral strictures as it has higher Qmax values and lower recurrence rate. The results should be supported by prospective, randomized studies.

**Keywords:** urethral strictures; laser urethrotomy; cold knife; nux.

## INTRODUCTION

The oldest urethrotomy practice goes back to Ancient Rome, however, modern urethrotomy practice was developed by Otis and Mauermayer in the 19th century. The first urethrotomy under direct vision was performed by Sachse in Germany in 1972 (1). This procedure significantly contributed to the endoscopic treatment of urethral strictures. A 70% of urologists perform urethrotomy especially in bulbar urethral strictures up to 2 cm. The reported success rates of urethrotomy differ greatly in studies (8-75%).

After internal urethrotomy (IU), the scarred epithelial tissue is left to secondary wound healing, and the new urethral lumen is produced with epithelization. If epithelization occurs before contraction, the procedure is successful, otherwise, recurrence is inevitable if the wound contraction occurs more rapidly. Recently, we have hopes of increased success and lower recurrence compared to classical method thanks to the laser practice (Holmium, Argon, carbon dioxide, excimer, diode, KTP (Potasyum Titanil Fosfat) and Nd:YAG laser). No significant difference was found between the two groups in the first publications (2). However, as a result of the advances in laser technology, increased experience and more studies conducted, significant differences are observed between the two groups in recent publications (3,4).

In our study, we aimed to compare the efficiency and recurrence rates of cold knife urethrotomy and laser urethrotomy in endoscopic surgery of urethral strictures.

## MATERIAL AND METHODS

### Study participants

A total of 171 patients who underwent endoscopic surgery for urethral strictures between 2013 and 2018 were evaluated retrospectively. Approval was obtained for this research with the decision of the SANKO University Faculty of Medical Local Ethics Committee dated 31.01.2019 (2019/01-02) and the study was conducted in compliance with the Helsinki Declaration Rules. Since laser was not used in our clinic until 2015, the patients were treated with cold knife urethrotomy (group-1) up until then. Group-2 patients include all patients who applied after 2015 and underwent laser urethrotomy. The patients underwent urethral surgery or urethral dilatation, under 14 years of age and had a longer than 2 cm urethral stricture segment and who did not have one year regular follow-ups were excluded from the study.

A 53 patients out of the 118 patients with complete data underwent cold knife urethrotomy (group 1), and 65 patients (group 2) underwent laser urethrotomy. Both groups were compared in terms of length of the stricture, operation time, preoperative and postoperative 3rd, 6th and 12th-month Q max values, recurrence and the presence of complications (such as bleeding, extravasation, fever etc.). The Q max values below 10 mm/s were accepted as recurrence in the follow-ups (5).

### Surgical procedure

All surgical procedures were performed by a single surgeon. 0-degree optics 21 f urethrotome was inserted from the external meatus in lithotomy position for cold knife urethrotomy. After the stricture segment was observed, a 5 f ureter catheter was inserted. Cold knife urethrotomy was performed on the 4, 8, 12 alignments guided by the catheter. Holmium laser (Ho: Oil, laser vision, 0.6 J/10 Hz) was used for laser urethrotomy in group 2 patients (Figure 1,2,3). Similarly, urethrotomy was performed at the 4, 8 and 12 alignments. A total of 18 f urethral catheters were inserted after the procedure. Urethral catheters were removed on the postoperative 5th day. None of the patients who participated in this study underwent postoperative self-dilatation.

### Statistical analyses

"SPSS 11 for Windows" statistical package program was used for statistical calculations and the data were expressed as an arithmetic average, standard deviation. Chi-square distribution test was used for the calculation of categorical variables and Mann-Whitney U test was used to compare the averages. 95% confidence interval ($p < 0.05$) was accepted as statistically significant.

## RESULTS

The mean age was 57,47 ± 12,57 in Group 1 patients and 59,49 ± 11,37 in Group 2 patients (p=0,305). No sig-

**Tablo 1:** Patients' characteristic.: Demographic data.

| | cold knife uretrotomy (n=53) | laser urethrotomy (n=65) | p |
|---|---|---|---|
| **Age (year)** | 57.47 ± 12.57 | 59.49 ± 11.37 | 0.305 |
| **Etiology** | | | 696 |
| traumatic | 8 (15%) | 7 (10.8%) | |
| inflammatory | 4 (7.5%) | 6 (9.2%) | |
| iatrogenic | 34 (64.1%) | 41 (63%) | |
| idiopathic | 7 (13.2%) | 11 (17%) | |
| **Location** | | | |
| penile | 12 (22.6%) | 8 (12.3%) | 0.137 |
| bulbar | 41 (77.4%) | 57 (87.7%) | |
| **Stricture length (mm)** | 10.39 ± 3.12 | 10.8 ± 3.06 | 0.321 |

**Table 2:** Data for comparison of operations.

| | cold knife uretrotomy (n=53) | laser urethrotomy (n=65) | p |
|---|---|---|---|
| **preoperative Qmax** | 7.16 ± 1.67 | 7.15 ± 1.51 | 0.921 |
| **3th month Qmax** | 20.67 ± 2.34 | 21.91 ± 1.95 | 0.03* |
| **6th month Qmax** | 16.91 ± 4.25 | 19.96 ± 4.11 | 0.001* |
| **12th month Qmax** | 14.09 ± 6.21 | 18.75 ± 5.53 | 0.001* |
| **operation time (minute)** | 14.01 ± 3.86 | 25.03 ± 4.43 | 0.001* |
| **nux (n), (%)** | 28/53, 52.83% | 12/65, 18.46% | 0.001* |
| | 3th mo : 2 (3.7%) patient | 3th mo: 1 (1.5%) patient | |
| | 6th mo: 4 (7.5%) patient | 6th mo: 3 (4.5%) patient | |
| | 12th mo: 22 (41.5%) patient | 12th mo:8 (12.3%) patient | |
| **complications (n), (%)** | | | 0.209 |
| bleeding | 10 (18.86%) | 3 (4.61%) | |
| fever | 2(3.7%) | 7 (10.7%) | |
| extravasation | 2(3.7%) | 1 (1.5%) | |

nificant difference was observed between the two groups in terms of the factors involved in aetiology (traumatic, inflammatory, iatrogenic, idiopathic; p=0.696). The stricture was located in the bulbar in 41 (77.4%) patients and penile in 12 (22.6%) patients in group 1, and bulbar in 57 (87.7%) patients and penile urethra in 8 (12.3%) patients in group 2 (p=0.137 ). While there was no difference between the two groups in terms of mean stricture length (10.39 ± 3.12 mm vs 10.8 ± 3.06 mm, p=0.321), the operation time was found to be shorter in patients who underwent cold knife urethrotomy (14.01 ± 3.86 min vs 25.03 ± 4.43 min, p=0.001) (Table 1).

In addition, while no difference was observed between the two groups in terms of preoperative average Qmax values (p=0.921), the Q max values in the postoperative 3rd, 6th and 12th months were observed to be higher in the group that underwent laser urethrotomy (p=0.03, p=0.001, p=0.001, respectively). At the end of a one-year follow-up, recurrence was determined in 28 (52.83%) patients in group 1, and 12 (18.46%) patients had recurrence in group 2 (p = 0,001). It was determined that 2 of the patients had recurrence in the 3rd months, 4 patients in the 6th month, 22 patients in the 1st year in group 1, and 1 patient had recurrence in the 3rd months, 3 patients in the 6th month, and 8 patients in the 1st year in group 2 (Table 1).

In the postoperative period, the following complications were observed as, bleeding in 10 (18.8%) patients, fever in 2 (3.7%) patients, fluid extravasation in 2 (3.7%) patients in group 1, and bleeding in 3 (4.61%) patients, fever in 7 (10.7%) patients and fluid extravasation in 1 (1.5%) patient (p=0.209).

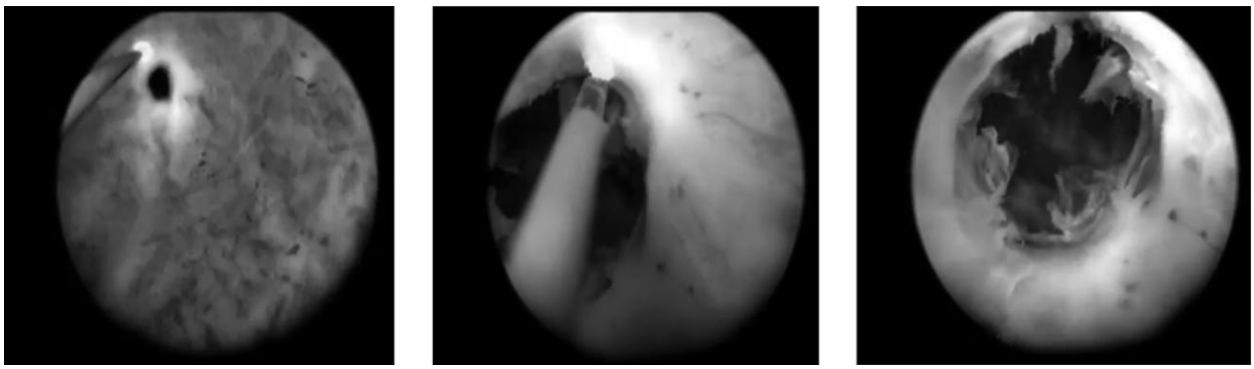

**Figure 1-2-3:** Intraoperative images

## DISCUSSION

Different laser technologies are widely used in urology practice for the treatment of benign prostatic hyperplasia, ureter and kidney stones, the treatment of urethral strictures, and the treatment of diseases such as endoscopic tumours. Holmium laser is a solid-state laser with a wavelength of 2140 mm and an impact-like emission. The tissue absorption of the Holmium laser has a penetration depth of only 0.4 mm. The emission time is as short as 0.25 ml/sec. Laser energy evaporates stone or scar tissue in a very short time with minimal thermal damage (6). In this study, we observed that endoscopic urethral surgery with laser urethrotomy had a lower recurrence rate and higher treatment efficiency.

The IU is conventionally is performed by incising the scar tissue at the 12 o'clock position. Turner-Warwick then stated that the incision at 4, 8 and 12 alignments reduced recurrence. Additionally, methods of incising at the 1, 3, 9, 11 levels were also defined (7). We performed incisions at 2, 6, and 10 levels in our patients. There are many studies conducted with long-term follow-up of patients who underwent IU. The short-term success rates were around 80% and the long-term success rates were 10-30% in these (8,9). Santucci et al. reported the long-term success rate as 8% in their review (10). Al-Tawell et al. reported recurrence rate as 92% in a 5-year follow-up (11). Recent studies have shown that the success rate in complex or recurrent strictures is very low, while the success rate in multiple IU's is reported to be almost 0% (12). In our follow-ups, our 1-year success rate was found to be 81.6% in the laser group and 47.2% in the cold knife group.

Recently, we have hopes of increased success and lower recurrence compared to classical method thanks to the laser practice (Holmium, Argon, carbon dioxide, excimer, diode, KTP and Nd: YAG lasers (Neodymium-Doped Ytrium Aluminium Garnet)). The widest meta-analysis conducted by Jin et al. in 2010 found that laser urethrotomy results were better, however, there was no statistically significant difference between laser urethrotomy and urethrotomy with a classical cold knife (2). Again, in this study, it was stated that laser urethrotomy caused more side effects than classical urethrotomy. With the increasing use of laser urethrotomy, the number of publications comparing the two methods has recently increased. In these publications, generally, laser urethrotomy is found to be more effective. Aboulela et al. compared the two methods in children. A significant increase in Qmax was detected better in laser urethrotomy. Additionally, the success rate in the second operation was determined to be higher in the laser urethrotomy group (3). Although the recurrence rates in the first 3 months were observed to be similar in both methods in a recent meta-analysis, the recurrence rates in the $6^{th}$ and $12^{th}$ months were determined to be lower in the laser group (4). In our study, a significant increase in Q max values in the $3^{rd}$, $6^{th}$ and $12^{th}$ months in favour of laser urethrotomy was determined (p=0.03, p=0.001, p=0.001, respectively).

In order to increase the success of IU, a number of combined drug administrations have been performed. In patients administered with simultaneous mitomycin-c, promising results were demonstrated in the early period, and 75 % of the patients did not require additional intervention for 2 years (7). In another randomized study, methylprednisolone was used and a 95% success rate was observed in the 18-month follow-up (13). In their study, Kumar et al. determined a success rate of 95.8% in a 12-month follow-up in laser urethrotomy in strictures less than 1 cm along with quadruplet injection (mitomycin-c, hyaluronidase, triamcinolone, n-acetylcysteine) (14). Despite the recent publications stating the decrease in recurrence of stricture of self-dilatation following IU, long-term results showed that the risk of hospitalization and the risk of IU intervention have not decreased (15). We did not use any extra drugs in our study, we did not perform self-dilatation, and we determined the recurrence rate to be 18.4% in the laser group and 52.2% in the IU group.

When both groups were compared in terms of operation time, different results were found according to the studies. Atak et al. determined a 16.4 ± 8.04 min operation time in the laser group and 23.8 ± 5.47 min operation time in the classical IU group (16). In their study, Jhanwar et al. determined a 16.3 ± 1.78 min operation time in the cold knife group and 20.96 ± 2.23 min operation time in the laser group (17). In our study, the operation time was determined to be shorter in the cold knife group (14.01 ± 3.86 min vs 25.03 ± 4.43 min, p=0.001). Urethral catheter duration varies between 3-7 days in different studies. In a study, keeping the urethral catheterization for a duration less than 3 days leads to a low recurrence rate (18). Again, the studies conducted stated that increased urethral catheter time increased the risk of infection and this caused a high recurrence rate (19). We tried to keep the catheter time short in our patients (5 days). In our study, no major complication was observed in any patient. All complications were treated conservatively.

The main limitation of our study was its retrospective nature. Current results should be supported by prospective, randomized studies.

## CONCLUSION

Our study showed that laser urethrotomy technique had lower recurrence rate and better Qmax values compared to cold knife urethrotomy at the 3rd, 6th and 12th months Neither of these techniques had serious complications and both were found to be reliable. The increase in the number of studies performed on laser urethrotomy in recent years constitutes the belief that this method can be performed more widely and it will be more preferred.

### List of Abbreviations

Internal Urethrotomy: IU

Potasyum Titanil Fosfat laser: KTP laser Neodymium-Doped Ytrium Aluminium Garnet laser: Nd :YAG laser

### Author Contributions

MS did physical examinations and acquired the data of patients. OB studided on design. OB performed the statistical analysis and interpretation of data drafting of the manuscript. MS worked on critical revision of the manuscript for important intellectual content. All authors read and approved the final manuscript.

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### Conflict of Interest

Nothing to disclose.

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