

The impact of venous ligation on erectile dysfunction in young patients with an abnormal dorsal penile vein

Clinical outcomes of a novel surgical procedure

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ABSTRACT

INTRODUCTION: Erectile dysfunction (ED) is a significant issue that adversely affects the quality of life in young men. Venous leakage is a common etiologic factor of ED. This study aimed to evaluate the clinical efficacy and safety of venous ligation applied to incidentally detected dorsal penile vein anomalies during penoscrotal surgeries.

METHODS: The study included 32 young male patients who presented with ED and underwent surgery for penoscrotal pathology (e.g., varicocele, hydrocele, spermatocele), during which an isolated dorsal penile vein anomaly was concurrently ligated. Patients were assessed preoperatively and at three and six months postoperatively using the International Index of Erectile Function (IIEF-5). Postoperative erectile response, patient satisfaction, and the presence of complications were also evaluated.

RESULTS: The mean age was 33.1 ± 5.4 years. The median operative time was 20 minutes (18–25), and the median followup duration was six months (6–9). The median IIEF-5 score increased from 18 (17–19) preoperatively to 21 (20–22) at three months and 22 (22–24) at six months ($p_1 < 0.001$, $p_2 < 0.001$, and $p_3 < 0.001$, respectively). Patient satisfaction improved significantly, with median satisfaction scores of 8 (8–9) at three months and 9 (8–10) at six months ($p_3 < 0.001$). The need for phosphodiesterase-5 inhibitors (PDE5i) therapy decreased markedly, from 100% preoperatively to 56.2% at three months and 31.3% at six months ($p_1 < 0.001$, $p_2 < 0.001$, $p_3 < 0.001$). No perioperative or postoperative complications were recorded.

CONCLUSIONS: Venous ligation applied to incidentally detected dorsal penile vein anomalies during penoscrotal surgeries represents an effective and reliable therapeutic option for young patients with ED.

INTRODUCTION

Erectile dysfunction (ED) is defined as the persistent inability to attain or maintain a satisfactory sexual performance.¹

The physiology of erection requires the coordinated interplay of anatomical, vascular, neurological, and hormonal systems, all of which must be supported by a sound psychological state.² A normal erection necessitates adequate arterial inflow, proper sinusoidal relaxation, and intact corporo-veno-occlusive function.²

Common etiologies of ED include diabetes mellitus, obesity, hypertension, hyperlipidemia, and cardiovascular diseases.³ Additionally, arterial and venous disorders, cavernous smooth muscle damage, trauma, priapism, and psychogenic factors are among other contributing causes. Venous leakage, which leads to insufficient blood retention in the corpus cavernosum, is a significant factor and has been detected in approximately 85% of patients presenting with ED.^{4,7}

Penile venous drainage is divided into superficial and deep dorsal venous systems, separated by Buck's fascia.⁸ Superficial dorsal veins drain the skin of the penile shaft and play no significant role during erection.⁹ During erection, the deep dorsal vein (DDV), located between Buck's fascia and the tunica albuginea, along with cavernous veins and para-arterial veins (PAV), assumes functional responsibility.⁹ Cavernous drainage occurs via the DDV, cavernous veins, and PAV at respective rates of 60.5%, 11.9%, and 11.4%, respectively.¹⁰

Penile duplex ultrasonography (US) is used to evaluate vascular insufficiency in patients with ED. During the test, intracavernosal injections are administered to induce an erection, followed by imaging.¹¹ A peak systolic flow >30 cm/s, end-diastolic velocity <3 cm/s, and resistance index >0.8 are indicative of a normal penile Doppler US.¹¹

Before considering penile prosthesis implantation in the surgical treatment of ED, vascular recanalization or surgical options should be explored;⁸ however, the uncertainty surrounding long-term outcomes of vascular surgery remains a significant concern.¹²

In recent years, with the widespread use of phosphodiesterase-5 inhibitors (PDE5i) and the inconsistent and limited long-term outcomes of venous surgery, dorsal penile vein ligation (DPVL) is no longer routinely recommended.^{12,13} In our clinical practice, standard DPVL is not routinely performed; however, in this study, we focused solely on the ligation of anatomically abnormal dorsal penile veins that emerge from deep planes and become superficial. This procedure is surgically feasible and technically simple.

This study aimed to evaluate the therapeutic efficacy and safety of DPVL, performed as a secondary procedure during penoscrotal surgeries in young patients with incidentally detected dorsal penile vein anomalies, by analyzing their preoperative and postoperative clinical data.

METHODS

The study was conducted in accordance with the Declaration of Helsinki and ethical standards. Male patients who underwent anomalous DPVL between January 2020 and November 2024 were included in the study, following the approval of the Scientific Research Ethics Committee of the Health Sciences University, Erzurum Faculty of Medicine, Republic of Turkey (Decision No: 2024/07-134). All patients signed informed consent forms detailing potential risks, including surgical failure, recurrence, infection, pain, and scarring. Patient data were kept confidential and anonymized. All surgical procedures were performed by a single surgeon with over 20 years of experience in penile surgery.

Data collection

Data were retrospectively collected from surgical notes, anesthesia records, and hospital information systems. Recorded variables included medical history, physical examination findings, penile Doppler US, preoperative International Index of Erectile Function (IIEF-5) score,

postoperative IIEF-5 scores at the third and sixth months, symptom duration, operative time, presence of complications, preoperative and postoperative use of PDE5i, and postoperative satisfaction scores at the third and sixth months (rated on a scale of 0–10, with 0=not satisfied at all and 10=fully satisfied). The presence of simultaneous scrotal or penile surgeries was also documented.

Patient selection

Young male patients presenting to the urology outpatient clinic with conditions such as varicocele, hydrocele, or spermatocele, who were found to have penile dorsal vein anomalies during physical examination (Figure 1), were evaluated for ED. These patients underwent preoperative and postoperative assessments using the IIEF-5 at baseline, three months, and six months. The IIEF-5 results were used to classify ED severity as severe (1–7), moderate (8–15), and mild (16–21). Patients diagnosed with ED commonly reported initial erection capability but difficulty in maintaining it. Penile Doppler US was performed following intracavernosal alprostadil injection (dose between 5–20 µg depending on erection response).

Inclusion and exclusion criteria

Patients aged 18–40 years, with at least six months of followup, diagnosed with venogenic ED via penile Doppler US, and who underwent anomalous DPVL, were included in the study.

Patients with a history of neurological or cardiovascular diseases and comorbidities such as diabetes and hypertension were excluded. Additional exclusion criteria included previous penile surgery, active psychiatric illness, lack of accessible data, or loss to followup.

Surgical technique

Under regional or general anesthesia, the surgical area was sterilized. The accompanying penoscrotal pathology was addressed first. Then, a transverse or longitudinal incision approximately 2 cm in length was made at the penile dorsum. The superficialized dorsal vein was isolated (Figure 2). The proximal and distal ends of the vein were ligated using 3/0 absorbable sutures (Figure 2). During vein dissection, no manipulation or damage was inflicted on the neurovascular bundle. Small deep dorsal veins were left untouched. Only the large, superficialized dorsal penile vein was ligated. Tissue layers were closed anatomically with absorbable sutures. Patients were discharged in good condition within 12–24 hours postoperatively.

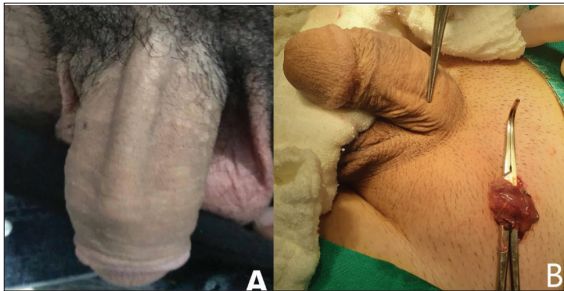


Figure 1. (A) Preoperative view demonstrating the dorsal penile vein coursing from a deep to a more superficial plane. (B) Intraoperative appearance of the dorsal penile vein, along with the incision site from a prior microscopic subinguinal varicocelectomy.

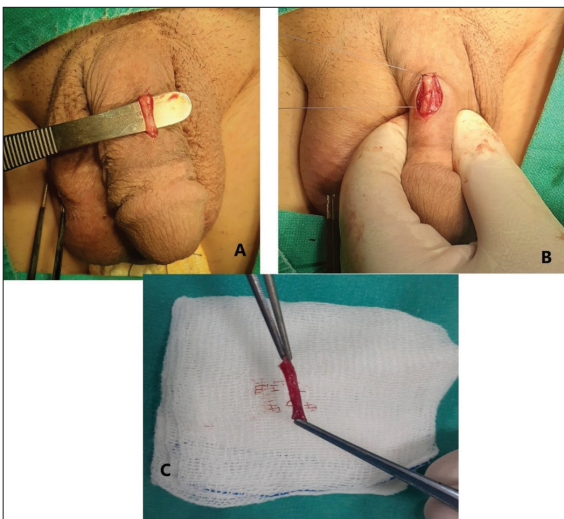


Figure 2. (A) Intraoperative view of the isolated abnormal dorsal penile vein through an approximately 1 cm incision. (B) Ligation of the proximal and distal ends of the dorsal penile vein, which was mobilized without any intervention to the neurovascular bundle. (C) Extraction of the excised segment of the dorsal penile vein.

Followup protocol

Patients were seen during the first postoperative week for early evaluation. Routine followups were conducted at the third and sixth postoperative months for surgical outcome assessments. Patients were advised to abstain from smoking and alcohol during the postoperative period.

Statistical analysis

All statistical analyses were conducted using IBM SPSS Statistics for Windows, version 26.0 (IBM Corp., Armonk, NY, U.S.). The Shapiro-Wilk test was used to assess the normality of continuous variables. Descriptive statistics were expressed as mean \pm standard deviation (SD) for normally distributed data and as median with interquartile range (IQR) for non-normally distributed data. Categorical variables were presented as frequencies and percentages. The Wilcoxon signed-rank test was used for comparisons of non-parametric continu-

ous variables across time points, and the McNemar test was used for paired categorical variables. A p-value of <0.05 was considered statistically significant.

RESULTS

A total of 32 patients were included in the study, with a mean age of 33.1 ± 5.4 years and a mean body mass index (BMI) of 24.2 ± 2.0 kg/m². Most patients had attained a university-level education (56.3%), while 46.9% were active smokers and 15.6% reported alcohol consumption. Comorbidities included diabetes mellitus (6.3%) and hypertension (3.1%), and 15.6% of patients were receiving psychiatric support for ED-related issues. Although patients diagnosed with diabetes mellitus and hypertension were excluded from the final analysis, it was observed that these individuals experienced an increase in IIEF-5 scores postoperatively, albeit with continued need for PDE5i therapy. No psychiatric disorders were identified in patients under psychiatric care.

The mean duration of ED symptoms was 20.1 ± 9.2 months. All patients (100%) were using PDE5i therapy prior to surgery. The median preoperative IIEF-5 score was 18 (17–19). Penile Doppler US showed peak systolic flow rates exceeding 30 mL/s in all patients, with end-diastolic flow rates ≥ 5 mL/s. The preoperative resistive index was >0.9 in 83.6% of cases. Preoperative demographic and clinical characteristics are presented in Table 1.

Among the concomitant surgical procedures performed with DPVL, varicocelectomy was the most common (65.6%), followed by hydrocelectomy (21.9%) and spermatocelectomy (12.5%). The median operative time was 20 minutes (18–25), with no perioperative or postoperative complications reported. The median followup duration was six months (6–9). No complications were observed during the perioperative or followup periods. Perioperative findings are summarized in Table 2.

Postoperative assessment indicated a significant improvement in erectile function. The median IIEF-5 score rose from 18 (17–19) preoperatively to 21 (20–22) at three months, and to 22 (22–24) at six months ($p_1 < 0.001$, $p_2 < 0.001$, $p_3 < 0.001$). Patient satisfaction also increased significantly, with median scores of 8 (8–9) at the third month and 9 (8–10) at the sixth month ($p_3 < 0.001$). The necessity for PDE5i therapy decreased substantially, from 100% preoperatively to 56.2% at three months and 31.3% at six months ($p_1 < 0.001$, $p_2 < 0.001$, $p_3 < 0.001$). A comparison of preoperative and postoperative outcomes is provided in Table 3.

Table 1. Demographic and clinical characteristics of patients

Number of patients	32
Mean age ± SD, years	33.1±5.4
Mean BMI ± SD, kg/m ²	24.2±2.0
Education level, n (%)	
Primary school	2 (6.3)
High school	11 (34.4)
University	18 (56.3)
Postgraduate	1 (3.1)
Smoker, n (%)	15 (46.9)
Alcohol usage, n (%)	5 (15.6)
Comorbidities, n (%)	
Diabetes mellitus	2 (6.3)
Hypertension	1 (3.1)
Patient receiving psychiatric support, n (%)	5 (15.6)
Mean duration of symptoms ± SD, months	20.1±9.2
Preoperative IIEF-5, (median [IQR])	18 [17–19]
Preoperative PDE5i usage, n (%)	32 (100.0)
Preoperative laboratory values, mean ± SD	
FSH (IU/L)	4.0 ± 1.4
LH (IU/L)	2.9 ± 0.9
Total testosterone (ng/ml)	492.0 ± 125.7
Preoperative peak systolic flow rate, n (%)	
<25 mL/s	0 (0.0)
25–30 mL/s	0 (0.0)
>30 mL/s	32 (100.0)
Preoperative end-diastolic flow rate, n (%)	
<5 mL/s	0 (0.0)
≥5 mL/s	32 (100.0)
Preoperative resistive index, n (%)	
>0.9	26 (83.6)
<0.75	6 (16.4)
BMI: body mass index; FSH: follicle-stimulating hormone; IIEF: International Index of Erectile Function; IQR: interquartile range; LH: luteinizing hormone; SD: standard deviation.	

No notable or serious complications were observed in any patients during the early or late postoperative periods.

DISCUSSION

ED affects approximately 34–52% of men over the age of 40, with 80–90% of cases being of organic origin, primarily due to arterial insufficiency and veno-occlusive dysfunction (VOD).^{2,3} Venous leakage can result from congenital anomalies or develop with advancing age.⁹ Although its prevalence increases with age, younger patients represent the subgroup that responds most

Table 2. Perioperative and postoperative findings of patients

Parameters	n (%)	Median (IQR)
Main surgical procedure		
Varycolectomy	21 (65.6)	
Hydrocelectomy	7 (21.9)	
Spermatoclectomy	4 (12.5)	
Followup time (months)		6 (6–9)
Complications	0 (0.0)	
Operation time (min.)		20 (18–25)
IQR: interquartile range.		

favorably to venous leakage surgery.¹⁴ All patients in our study were under the age of 40, belonging to this younger demographic.

The etiologies of VOD include congenital venous malformations, advanced age, Peyronie's disease, smoking, trauma causing tunica albuginea damage, hyperlipidemia, diabetes mellitus, connective tissue disorders, penile trauma, and prior penile surgeries.^{13–15} Our cohort specifically comprised patients with anatomically abnormal venous structures.

Patient selection is critical in vascular surgery. Ideal candidates are those without diabetes mellitus, hypertension, hyperlipidemia, or neurological diseases, and who present with a normal hormonal profile, no major psychiatric disorders, no penile deformities, such as Peyronie's disease, no significant arterial insufficiency, and who are responsive to intracavernosal agents and have no history of smoking.^{13,15,16} All patients in our study had normal preoperative luteinizing hormone (LH), follicle-stimulating hormone (FSH), and total testosterone levels.

The diagnosis of VOD is established via penile Doppler US.¹¹ All of our patients demonstrated findings consistent with venous leakage, and 83.6% had a preoperative resistive index >0.9, reported as normal.

Although recent studies have proposed low-intensity shockwave therapy for vasculogenic ED, evidence remains inconclusive and lacks robust, long-term data.^{17,18} For this reason, the European Association of Urology no longer recommends standard venous ligation due to insufficient long-term outcomes;^{12,13} however, our study does not report on a standard venous ligation procedure. Instead, it involves the ligation of a specific anatomically abnormal superficialized dorsal penile vein, sparing other DDV and the neurovascular bundle.

Treatment options for VOD include open or laparoscopic venous ligation and angiographic embolization. In

a recent study involving young men undergoing venous surgery, 9.2% had severe ED and 90.7% had moderate ED preoperatively. Postoperatively, 36.84% reported no ED, 36.84% had mild ED, and 26.31% had moderate ED, with none exhibiting severe ED at 18 months.¹⁹ Outcomes measured via IIEF-5 scores indicated successful results in 65%, moderate in 13%, and poor in 22% of patients.¹⁹ In our study, all patients had mild ED preoperatively, and by the sixth postoperative month, the majority had achieved normal IIEF-5 scores.

Age-related venous leakage often coexists with fibrosis, reducing surgical success in patients over 40 years old.^{12,19} Accordingly, our study focused exclusively on patients under 40.

Reported outcomes for venous surgery vary widely, with short-term success rates ranging from 10–95% and long-term rates from 13–74%.^{12,20} In one study, a significant improvement in IIEF-5 scores and a patient satisfaction rate of 57.7% were observed.²¹ Another study in young men reported an IIEF increase from 18 to 24, with most achieving sufficient erection without additional therapy.²² Embolization of the DDV yielded 68.7% restoration of sexual activity and no major complications.²³ Similarly, most of our patients achieved satisfactory erections without PDE5i by the third and sixth months, and nearly all expressed satisfaction with the procedure. Significant postoperative improvements in IIEF-5 scores were documented.

While standard venous surgery typically takes 2–5 hours with 1–2 days of hospitalization,²⁴ our technique demonstrated high feasibility and simplicity, with a median operative time of 20 minutes and discharge within 12–24 hours.

Preoperative use of PDE5i is common; however, a major goal is to reduce its postoperative necessity. Studies have shown that 57.6% of postoperative PDE5i users respond favorably to surgery.^{12,19} In our study, all patients used PDE5i preoperatively, but usage significantly declined postoperatively.

Potential complications following VOD surgery include wound infection, penile skin necrosis, hematoma, penile curvature, pain, painful erections, and transient paresthesia.¹² Although standard DPVL is considered a complex procedure, serious complications are rarely reported.^{21,24} In our study, no complications were observed.

In patients presenting with various scrotal pathologies, the incidental detection of abnormal dorsal penile veins on routine physical examination should prompt consideration of venous insufficiency-related ED. In such cases, ligation of the anomalous dorsal vein should

Table 3. Comparison of outcomes after surgical procedures

Parameters, median (IQR), n (%)	Preoperative	3-month	6-month	p
IIEF-5	18 (17–19)	21 (20–22)	22 (22–24)	p1:<0.001* p2:<0.001* p3:<0.001*
Satisfaction survey	–	8 (8–9)	9 (8–10)	p3: <0.001*
Postoperative PDE5i need, n (%)	32 (100.0)	18 (56.2)	10 (31.3)	p1:<0.001# p2:<0.001# p3:<0.001#

*Wilcoxon test. #McNemar test. p1: preoperative vs. 3-month; p2: preoperative vs 6-month; p3: 3-month vs. 6-month. IIEF: International Index of Erectile Function; IQR: interquartile range.

be discussed as a treatment option. This technique is simple to perform and has demonstrated effectiveness, significantly reducing PDE5i use and improving IIEF-5 scores. Furthermore, the absence of complications underscores its safety.

Limitations

This study has several limitations. First, the small sample size and retrospective design limit generalizability. Second, long-term followup data beyond 12 months are not yet available. Third, there was no randomized control group, and patient-reported outcomes may be subject to placebo or reporting bias. Additionally, we did not use advanced imaging, such as venography, to objectively characterize venous anatomy preoperatively.

CONCLUSIONS

Our findings suggest that ligation of incidentally identified, abnormal dorsal penile veins responsible for venous leakage significantly improves erectile quality, markedly reduces the need for PDE5i therapy, and substantially enhances patient satisfaction. Therefore, in patients with ED due to such anomalous veins, ligation represents an effective and safe treatment option; however, larger, prospective studies are warranted before widespread adoption.

COMPETING INTERESTS: The authors do not report any competing personal or financial interests related to this work.

This paper has been peer-reviewed.

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