

The Role of Penile Venoligation with Tunical Plication in Surgical Correction of Erectile Dysfunction Due to Pure Corporovenous Leakage

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ABSTRACT

Purpose: To evaluate the possible role of surgical correction of corporovenous dysfunction as an alternative minimally invasive surgery to penile prosthesis in a selected group of patients with pure corporovenous dysfunction

Methods: We selected young patients not responding to intracorporal injection and had pure corporovenous dysfunction after exclusion of arterial element by penile duplex. Diagnosis of venogenic element was confirmed by cavernosometry and cavernosography. We performed degloving of the penis, opening of Buck's fascia, stripping of deep dorsal vein, resection of circumflex veins, then plication of tunica albuginea on both sides of corpora cavernosa aiming at making it tighter for more functioning occlusion mechanism. Patients were subjected to the validated Arabic version of the International Index of Erectile Function 5 (IIEF-5) preoperatively, one month postoperative after resuming sexual relation, then every 2 months for four times. Cavernosography was done 3 to 4 months post-operative. During follow up period oral sildenafil was offered to patients in case of unsatisfactory erection 7 months after the surgery as an adjuvant treatment to assess the possible synergism.

Results: The mean IIEF score increased from 6.6 ± 2.46 pre-operatives to 10.67 ± 5.046 seven months postoperative. The mean IIEF score increased again to 14.45 ± 3.913 at 9th month after addition of adjuvant therapy to some patients. There was significant increase in IIEF-5 score postoperative over the preoperative score in all postoperative visits (P value=0.000). Five of our twenty patients (25%) reported improvement of their erection after the operation and could perform unaided intercourse. Five other patients (25%) were capable of penetration after addition of oral sildenafil. The remaining 10 (50%) patients showed some increase in the IIEF-5 score especially with addition of oral sildenafil but they had no satisfactory sexual performance.

Conclusion: Penile venous surgery with tunical plication is still a viable option that can be offered to young men with pure corporovenous dysfunction and refusing penile prosthesis implantation. Proper counseling is essential as the success rate of the surgery is still limited.

Keywords: Venous leak; Venocclusive dysfunction; Corporovenous dysfunction; Erectile dysfunction; Cavernosometry; Cavernosography; Tunica albuginea; Deep dorsal vein

INTRODUCTION

Erectile Dysfunction is defined as the persistent inability to attain and maintain an erection sufficient to permit satisfactory sexual performance. It is reported that 40% of males during their fifth decade are impotent, a figure rising to 66% at their seventh decade [1].

Vascular events during erection require a normal arterial supply of inflow that is enhanced by the relaxation of the cavernous smooth muscles [2]. The existence and function of the venous occlusion mechanism is essential to maintain a normal erection [3]. Restoration of the vascular erectile mechanism in cases of dysfunction requires a distinction between insufficient inflow and excessive outflow. Venocclusive dysfunction

is ruled out by a positive erectile response to intra-corporeal injection of vasoactive agents [4].

Venous leakage, an impairment of the venocclusive mechanism, is a major cause of vascular erectile dysfunction [5]. It accounts for as much as 30-70 percent of all impotence. Some men have venogenic impotence since birth (primary). Such men have never had a rigid erection all their lives. Others develop venogenic impotence suddenly after years of normal sexuality (secondary) [6].

The cause of venocclusive dysfunction is not exactly known. It may result from several possible pathophysiologic processes which include the presence of large venous channels draining the corpora cavernosa, Peyronie's disease, diabetes and structural alterations in the fibroelastic

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components of the trabeculae, cavernous smooth muscle and endothelium [7].

The venules that drain the sinusoidal spaces and the smooth muscles of the penis coalesce as they approach the corpora cavernosa periphery and form the subtunical venular plexus. Small veins exit from the plexus through the tunica albuginea as the emissary veins, and drain into the

circumflex veins or directly into the deep dorsal vein. The position of the subtunical venular plexus between the sinusoids and tunica albuginea allows for their compression and occlusion as the smooth muscle and sinusoids relax and expand against the tunica albuginea during tumescence. This occlusion acts to trap the blood within the penis. The loss of this veno-occlusive function leads to leakage of blood from the penis with a resulting impotence [8].

It appears that the sublaxated tunica albuginea, during erection, fails to effect compression of both the subtunical venular plexus and the emissary veins passing through it. Failure of occlusion of the penile venous outflow presumably leads to venous leakage [9]. It is hypothesized that degeneration of smooth muscle cells of the cavernosa is in most patients the primary cause of the venous leakage [10].

The hemodynamics of venous leakage could be studied by cavernosometry. The test involves measuring the flow rates required to obtain and maintain erection and gauging of intracavernous pressures during the test while the corpora are perfused, and its decay following cessation of fluid perfusion [5]. Cavernosography in patients with venogenic ED usually reveal dorsal leak in almost all cases (98%) who diagnosed as venogenic erectile dysfunction [10]. It has been commonly believed that erectile dysfunction will recur about 2 years after penile venous surgery is performed, and this type of surgery was deemed unjustified after 1996 [11-14].

We believe that penile venous stripping surgery deserves another look, and that it may be justified if those veins were stripped thoroughly and carefully, without the expense of tissue damage in properly selected patients. This study aimed to evaluate the possible role of surgical correction of corporovenous leakage as an alternative minimally invasive procedure to penile prosthesis in a selected group of patient with pure corporovenous dysfunction.

MATERIALS AND METHODS

During the period from January 2012 till January 2013 forty four male patients complaining of erectile dysfunction were selected from those attending Andrology outpatient clinic of Al-Aini hospital, Cairo University. Selection criteria were patients complaining of primary or secondary erectile dysfunction for more than one year not responding to oral therapy, age from 20 to 45 years old, nonsmokers, no dyslipidemia, no diabetes, no hypertension, response to ICI was unsatisfactory (E1-E3), penile duplex showing normal arterial supply (PSV>30 cm/sec. and percentage of arterial dilatation more than 70%), and suggesting venous leakage (EDV >5 cm/sec.) and cavernosometry revealed venous leakage.

After full explanation only twenty patients agreed to participate in the study and signed a written consent approved by the local ethical committee. Those men were subjected to serum measurement of testosterone and cavernosography. Cavernosography was done for anatomical localization of the leaking veins before the surgery.

Surgical technique

Under spinal anesthesia, a transverse hockey-stick public incision twice as long as the diameter of the proximal penile shaft was made. Blunt dissection is performed to enter Colle's fascia. The entire penis is then released with an inside-out maneuver. Buck's fascia is opened longitudinally

over the deep dorsal vein as it is dissected along the shaft. Identification of neurovascular bundle structures was done. The deep dorsal vein was stripped thoroughly and legated with a 4/0 nylon, as close to the tunica albuginea as possible, distally from the level of the retrocoronal sulcus. Stripping is made step-by-step with the ligature of the deep dorsal vein serving as a guide. All through the course of stripping the emissary veins encountered were legated with nylon 4/0 sutures near the tunica albuginea and transected from deep dorsal vein. Stripping continued proximally till the suspensory ligament where the deep dorsal vein was ligated and separated. Circumflex veins were double ligated and transected on both sides of penile shaft. Emissary veins if encountered were also ligated as described before. Plication of tunica albuginea was done on either side of corpora cavernosa using nonabsorbable sutures material (ethibond 2/0). Sutures included only the outer most layer of tunica albuginea for less invasiveness. This plication was done on one or two levels near the base of the penis. This was done lateral to the neurovascular bundle near the base of the penile shaft. We avoided dealing with the cavernosal vein in order to reduce operative complications and time. Finally regloving of the penis was done. Closure of wound in layers was done using absorbable suture material. After closure of the wound, dressing was immediately applied in order to prevent hematoma formation.

Follow up

Patients were clinically examined two weeks postoperative to ensure complete wound healing and to manage any postoperative complication if present. They were subjected to the validated Arabic version of the IIEF-5 one month postoperative after resuming sexual relation, then every 2 months for four times. Cavernosography was done again 3 to 4 months post-operative.

Addition of oral sildenafil

During follow up period oral sildenafil was offered to patients in case of unsatisfactory erection 7 months after the surgery as an adjuvant treatment to assess the possible synergism. IIEF-5 score was measured before and after using the medication. Thirteen patients (55%) used oral sildenafil.

Statistical methods

Data were statistically described in terms of mean \pm standard deviation (\pm SD), median and range, or frequencies (number of cases) and percentages when appropriate. Comparison of IIEF over the study period was done using repeated measure analysis of variance through a general linear model with posthoc paired t tests of matched samples. Comparison of IIEF and total testosterone versus cavernosometry results was done using one way Analysis of Variance (ANOVA) test with posthoc multiple 2-group comparisons. For comparing categorical data, Chi square test was performed. Exact test was used instead when the expected frequency is less than 5. Correlation between various variables was done using Spearman rank correlation equation. p values less than 0.05 was considered statistically significant. All statistical calculations were done using computer programs SPSS (Statistical Package for the Social Science; SPSS Inc., Chicago, IL, USA) version 15 for Microsoft Windows.

RESULTS

This study included twenty patients who were diagnosed as venoocclusive dysfunction proven by pharmacocavernosometry and cavernosography, and in whom arteriogenic impotence has been excluded by penile duplex.

Mean age of selected patients was 33.7 ± 7.057 years with mean serum testosterone level 4.501 ± 1.4057 . Thirteen patients (65%) had primary ED while seven patients (35%) had secondary ED. Mean duration of erectile dysfunction was 5.71 ± 2.752 years. Response of the patients to ICI test preoperative showed 100% in range from E1 to E3. Mean PSV of

cavernosal arteries was 37.6 ± 9.499 right and 40.41 ± 10.384 left. Mean arterial dilatation was $122.99\% \pm 29.041\%$. Mean EDV was 6.275 ± 4.9210 right and 6.445 ± 5.9340 left.

Nine patients (45%) had moderate venous leak. Another nine patients (45%) had sever venous leak as indicated by failure of induction of erection during cavernosometry. Two patients (10 %) had mild venous leak (Table 1). Seventy percent of patients [14] underwent pharmacocavernosography, 6 (30%) had leakage through intermediate venous system (deep dorsal vein and internal pudendal veins), 5 (25%) had leakage via intermediate system plus external pudendal veins and 3 (15%) via intermediate and circumflex veins.

Table 1: Descriptive data of selected patients.

	No	Mean	SD
Age	20	33.7	7.057
Duration of erectile dysfunction	20	5.71	2.752
Testosterone level	20	4.501	1.4057
Rt cavernosal MSV	20	37.68	9.499
Lt cavernosal MSV	20	40.41	10.384
Rt cavernosal EDV	20	6.275	4.921
Lt cavernosal EDV	20	6.445	5.934
Type of ED	No.	%	
Primary	13	65	
Secondary	7	35	
Response to ICI	No.	%	
E1	7	35	
E2	6	30	
E3	7	35	
Cavernosometry	No.	%	
Mild venous leak	2	10	
Moderate leak	9	45	
Severe venous leak	9	45	

The mean IIEF score increased one month postoperatively from 6.6 ± 2.46 to 14.95 ± 4.42 which then started to decline in each visit till it reached 10.67 ± 5.046 seven months postoperatively. After adding adjuvant therapy to 65% of patients the mean IIEF score increased again to 14.45 ± 3.913 at 9th month. There was significant increase in IIEF-5 score postoperative over the preoperative score in all 5 times assessment (Table 2).

Table 2: Comparison between preoperative and postoperative IIEF-5.

Pair	Description	Mean	SD	t	p
Pair 1	IIEFPre	6.6	2.458	-8.549	0
	IIEFPost	14.95	4.419		
Pair 2	IIEFPre	6.6	2.458	-7.089	0
	IIEF- 3m	13.75	4.919		
Pair 3	IIEFPre	6.6	2.458	-6.882	0
	IIEF- 5m	12.45	4.418		
Pair 4	IIEFPre	6.6	2.458	-4.838	0.005
	IIEF- 7m	10.67	5.046		
Pair 5	IIEFPre	6.6	2.458	-9.554	0
		14.45	3.913		

Five patients (25%) reported improvement of their erection after the operation and could perform unaided intercourse. Five patients (25%) were capable of penetration after addition of oral sildenafil. The remaining

10 (50%) patients showed some increase in the IIEF-5 score especially with addition of oral sildenafil but they had no satisfactory sexual performance. There were no major postoperative complications as only 3 patients suffered from prolonged edema for 3 weeks and 3 had skin ecchymosis that disappeared within 2 weeks.

DISCUSSION

The etiology of venogenic erectile dysfunction whether due to cavernosal factor (loss of smooth-muscle relaxation and fibrous compliance) or venous factor (venous incompetence) is still a matter of controversy. Currently, the consensus among urologists is that the (venous factor) should not be considered as a significant contributing factor in erectile dysfunction, and attention is focused on the (cavernosal factor). Hsien-sheng wen et al. suggested that the (venous factor) should also be considered, and further research studies should be conducted to explore its importance [12]. A hemodynamic study conducted on 7 fresh human cadavers found that reaching a rigid erection was unequivocally attainable after the erection related veins were removed in all subjects in spite of the fact that their sinusoidal tissues were not alive [13]. This implies that a full rigid erection may depend upon the drainage veins as well, rather than just the intracavernosal smooth muscle [11].

Shafik et al. added a third factor that is the tunical factor. They hypothesized that collagenous degeneration and atrophy could be a primary pathologic condition affecting the tunica albuginea and leads to venous leakage during erection. [7].

This controversy motivated us to deal with two of the contributing factors to the pathophysiology of venogenic erectile dysfunction, the venous and the tunical factors.

Two main techniques were reported for venoligation, either simple ligation or stripping of the deep dorsal vein. Shyh-chyan chen et al. studied 31 men with venogenic impotence. Of these 23 men underwent venous stripping of the deep dorsal vein. The remaining 8 patients underwent a simple ligation of the deep dorsal vein. There was a statistically significant improvement in the stripping group compared to the ligation group using IIEF score ($P < 0.001$).

For this reason we selected the stripping method for our patients. We did the same steps of stripping of deep dorsal vein but with no ligation of the crural veins due to technical factors.

Genglong et al. reported that their results were better from those of previous reports because of their surgical approach. They believe that a slow deliberate approach, at times requiring 3-6 hours and demanding between 7 and 125 ligatures per case for the sake of completeness, is the most important factor leading to surgical success and minimal tissue trauma. In spite of encountering multiple small vessels, they never used cautery or suction, since they felt that these might cause sinusoidal injury [14]. We adopted this meticulous technique to ensure the best surgical results. In addition we did tightening of the tunica albuginea at the penile base to reduce its redundancy and to support the venous occlusion mechanism. We think that our procedure provides good management with fewer complications and less invasiveness.

Popken et al., and Cayan et al., demonstrated that younger patients with primary cavernous erectile dysfunction, with normal penile arterial system, and no risk factors such as diabetes have the best chance for improved erectile function following venoligation operation [10,15].

In this work the mean age of the studied subjects was 33.7 ± 7.0 years. Their IIEF5 increased one month postoperatively from 6.6 ± 2.46 to 14.95 ± 4.42 . The mean IIEF5 scores started to decline in the following visits till it reached 10.67 ± 5.046 after 7 months. There was statistically significant

increase in IIEF-5 score postoperatively compared to the preoperative score in all follow up assessments (P value=0.000). Five patients (25%) reported good improvement of their erection after the operation and could perform successful unaided intercourse.

Popken et al. performed ligation and resection of just the superficial and deep dorsal veins of the penis in 122 patients that were nonresponders to intracavernous pharmacological treatment. After the 70-month follow-up, only 14% of the 122 patients were able to achieve an adequate spontaneous erection and 19% responded to intracavernous pharmacotherapy [10].

Vale et al. studied twenty-seven patients who underwent venous leak surgery. In all cases the deep dorsal vein of the penis was excised and ligated along with any other large accessory veins. Three months after surgery, 19 of 27 patients (70%) had been able to resume sexual intercourse, 17 (63%) had spontaneous erections and two (7%) required papaverine/prostaglandin E1 intracavernous injection. One year after surgery, 14 (51.8%) patients were able to achieve erections sufficient for sexual intercourse, although four of these required self-injection with papaverine. There were no serious post-operative complications, and when asked whether or not they would undergo the operation again, 13 of 20 said they would. [16].

After adding adjuvant sildenafil therapy to 65% of patients the mean IIEF score increased again to 14.45 ± 3.913 at 9th month. A possible synergistic effect between penile venous surgery and oral sildenafil was consistently found in treating patients with erectile dysfunction [17,18].

Hsien-sheng et al. found that 61 men (93.8%) out of 65 reported a positive response to sildenafil after venous stripping surgery. In contrast, only eight patients (12.7%) felt a beneficial response in the control group that did the surgery alone ($p < 0.001$) [12].

In our work nine patients underwent post-operative cavernosography, three patients had minimal venous leak with no opacification of internal pudendal veins. Surprisingly those three patients had poor response to surgery and reported no improvement of sexual performance. All of them needed to receive oral sildenafil with mild rise in their IIEF-5 score which remained unsatisfactory to them. In contrast patients who reported satisfactory results with the operation had significant leakage in postoperative cavernosography through deep dorsal vein and internal pudendal veins. This observation was similar to that of Hsien-sheng et al. that there were few residual veins in each follow-up cavernosogram despite enhanced effect postoperatively specially after using sildenafil.

In our study edema and ecchymosis were the most common postoperative complications. Elevation of penile shaft for one week post-operative markedly diminished this complication. No complication in the form of penile deviation, shortening or urethral tear. We never encountered postoperative penile numbness and pain which were avoided by proper identification of dorsal nerve of the penis and avoiding its injury or inclusion in ligature.

CONCLUSION

In conclusion we found that venoligation procedure remains a viable option that can be offered to young men with pure venoocclusive dysfunction refractory to medical therapy and intracorporeal injection. In spite of its high failure rate, it should be offered to those young patients before the irreversible penile prosthesis surgery. We believe that penile venous stripping surgery deserves another look, and that it may be justified if and only if the operation is thoroughly and properly performed, with completeness of venous removal and without tissue damage.

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