

# CT Cavernosography and Penile Venous Leak



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## Abstract

**Introduction:** The aim of this work was to verify the value of CT-Cavernosography for penile venous leak diagnosis. Furthermore, we evaluated the effectiveness of pelvic vein embolisation with aethoxysclerol in air-block technique for the treatment of impotence due to venous leakage in men using sildenafil for intercourse. The aim of this procedure was to reduce or eliminate the use of sildenafil.

**Material and methods:** A total of 49 patients with veno-occlusive dysfunction, severe enough for the need of PDE5 inhibitors for vaginal penetration, underwent pelvic venoablation with aethoxysclerol. The mean patient age was 53.5 years. Venous leaks were identified by Color Doppler Ultrasound and CT Cavernosography after intra-cavernosal prostadil injection. Under local anesthesia a 5F-Angiopot was inserted antegrade into the penile deep dorsal penile vein. Aethoxysclerol 3% as sclerosing agent was injected in air-block under Valsalva manoeuvre. Success was defined as the ability to achieve vaginal insertion without the aid of any drugs, vasoactive injections, penile prosthesis, or vacuum device. Additionally, a pre- and post-therapeutical IIEF-5 score was performed.

**Results:** At a 12 month follow-up 40 out of 49 patients (81.63%) reported to have erections sufficient for vaginal insertion without the use of any drug or additional device. 4 (8.16%) patients did not report any betterment. Mean IIEF-Score and IIEF-Score-Differences after intervention see Figure 1 & 2. No serious complications occurred.

**Conclusion:** Our new pelvic venoablation technique using pre-operative Ct-cavernosography and aethoxysclerol in air-block technique was effective and minimally invasive. All patients were able to perform sexual intercourse without the previously used dosage of their PDE5 inhibitor. This new method may help in patients with contra-indications against PDE5 inhibitors, in patients who cannot afford the frequent usage of expansive oral medication or those who do not fully response to PDE5-inhibitors.

**Keywords:** Erectile dysfunction; Sclerotherapy; Venous leakage; Ct-cavernosography

## Introduction

As early as 1860, innovative research defined the neural and vascular phenomena which generate male sexual tumescence. Sophisticated animal experiments provided important data about enhanced arterial inflow and occlusion of venous outflow which cause and maintain erection of the penis. On the basis of these observations, various treatment strategies for impotence, like sclerotherapy or surgical ligation to improve penile venous occlusion, have been attempted since 1873 [1].

Although several types of venous surgeries that ligated the responsible penile veins were performed, the long-term outcome concerning to erectile function of simple ligation surgeries was disappointing. Virag [2] first reported papaverine

test as a clinical examination for erectile dysfunction in 1982. A movement to diagnose erectile function from the viewpoint of hemodynamic events began. Sohn et al. stated in a recent Meta-analysis that based on the available data it is not yet possible to define SOPs for surgical treatment of corporal veno-occlusive dysfunction, but it may be offered in special situations [3].

Diagnostic imaging has progressed remarkably. Color Doppler evaluation of erectile dysfunction has shown to be an effective method for differentiating psychogenic and vasculogenic causes of erectile dysfunction [4]. We can obtain high-resolution arterial images similar to digital subtraction angiography with a CT scanner [5], and images of the venous system with an MRI scanner [6]. Furthermore, recent technological developments

allow us to reconstruct three-dimensional (3D) images from cross-sectional image data. The aim of our study is to proof the reliability of Ct-cavernosography for diagnostics of venous leak conditions in erectile dysfunction, to demonstrate the connection of findings to newly developed mathematical principles, to evaluate the effectiveness of a simple and easy to perform interventional reduction of penile venous outflow based on the affore mentioned investigations.

**Materials and Methods**

Cavernocomputed tomography (CT) imaging was performed as described before [7]. In short:

- a. ICI of alprostadil (20mcg) (UCB Pharma, Colombes, France);
- b. Insertion of a 24G gauge in one of the cavernous bodies (CBs);
- c. Injection of 20-60 cc of diluted contrast media (1/2) using 20cc of Ioprimide (Bayer Schering Pharma, Berlin, Germany) at a concentration of 300 mg/mL with an infusion rate of 3ml/s;
- d. Spiral MDCT acquisition over the pelvis, including the penis, using 120kV and 100mAs with automatic dose modulation.

Radiation dose was 3mSv for one spiral acquisition. Patients were kept in the unit until detumescence was achieved. If not effective after 30 minutes, an ICI of epinephrine was administered. 3D VRT allowed us to identify various types of anomalous penile venous drainage.

A total of 49 patients with veno-occlusive dysfunction, severe enough for the need of PDE5 inhibitors for vaginal penetration, underwent pelvic venoablation with aethoxysklerol. The mean patient age was 53.5 years. Venous leaks were identified by Color Doppler Ultrasound/CT cavernosography in intra-cavernous alprostadil injection. Under local anesthesia a 5F-Angioport was inserted antegrade into the deep dorsal penile vein. The pelvic venogram obtained with deep dorsal venography was included. Aethoxysklerol 3% as sclerosing agent was injected after air-block technique under valsalva manoeuver in three consecutive steps. A 5F-angiography catheter was placed in the vein of major outflow from the penis. Success was defined as the ability to achieve vaginal insertion without the aid of any drugs, vasoactive injections, penile prosthesis, or vacuum device. Additionally, a pre- and post-therapeutical IIEF-5 score was performed.

**Results and Discussion**

CT-cavernosography could be performed in all patients without serious side effects. The diagnosis of venous leak could be revealed in all cases. Typical pictures of Ct-cavernosography before and after sclerotherapy are demonstrated in Figure 1A & 1B. At a 12 month follow-up 40 out of 49 patients (81.63%) reported to have erections sufficient for vaginal insertion without

the use of any drug or additional device. 4 (8.16%) patients did not report any betterment. Mean IIEF-Score and IIEF-Score-differences after intervention see Figure 2 & 3. Follow up Color Doppler Ultrasound revealed a newly developed venous leakage in 8 (16.33%) of the patients. The new leak was confirmed by repeated CT-cavernosography. In these cases, the blood flow was using alternative retrograde pathways over the glans and urethra. Interestingly, the crural vein system appeared without leakage.

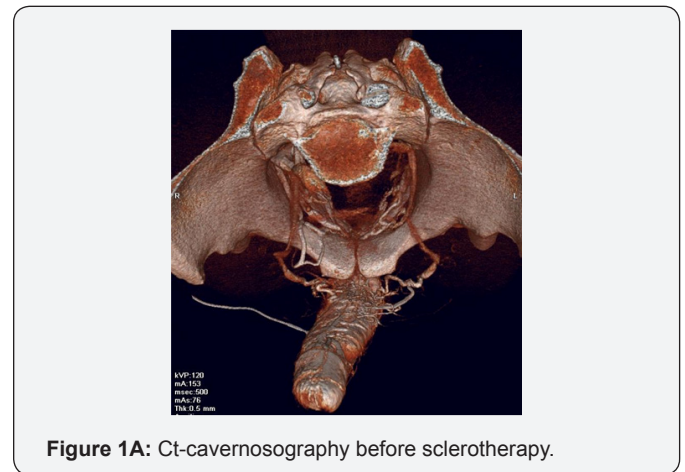


Figure 1A: Ct-cavernosography before sclerotherapy.



Figure 1B: Ct-cavernosography after sclerotherapy.

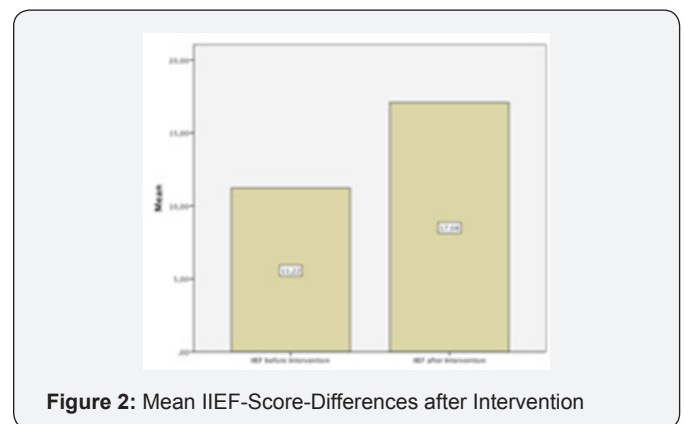


Figure 2: Mean IIEF-Score-Differences after Intervention

In a second intervention in local anaesthesia the retrograde blood flow was blocked by ligation of the residual veins of the deep dorsal vein system. Further 5 out of 8 patients regained

natural erections, 2 with help of PDE5 inhibitor (tadalafil 5mg every second day). No serious complications occurred.

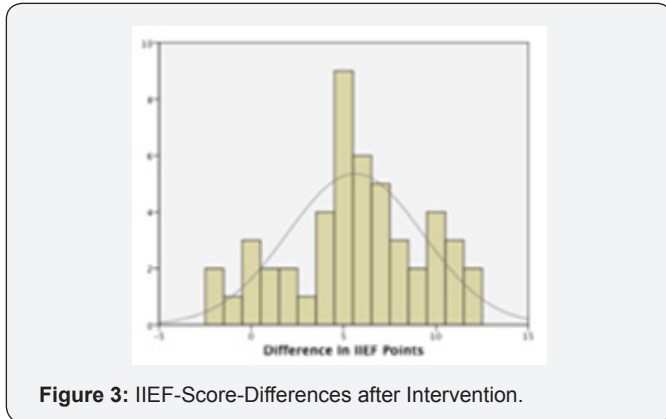


Figure 3: IIEF-Score-Differences after Intervention.

Interventional or surgical treatment for penile venous leak is still discussed controversially. Some urological societies are still deprecating the recent data acquired with modern methods like 3D Ct cavernosography or MRI and interventional methods like angiographical interventions.

Unfortunately, the previously provided data may not be qualified to substantiate such a statement. In an often cited study of We spes et al. [9] of 130 patients with vascular rectile dysfunction who under went different surgical procedures, only 11 patients were treated with venous resection. For further evaluation, only 7 patients were eligible for follow-up after 48 months in this group of which only one patient reported sexual satisfaction. No IIEF-Score or QOL evaluation was assessed (evaluated) before and/or after surgery. A statement about successful intervention cannot be seriously made from this number of patients with this evaluation method. Nevertheless, 100% success was stated for penilere vascularization in two out of two patients. The authors assert, that this finding is evidence enough to recommend penile revascularization for young patients with traumatic arterial lesions.

In a recent study of Chen et al., the authors compared two different methods of treatment, simple venous ligation versus venous stripping of the penile veins, in patients with confirmed venous leak. The IIEF-5 scoring in the ligation group changed from a preoperative mean IIEF-5 score of  $10.0 \pm 4.5$  to  $9.8 \pm 3.6$  post-operatively. In the stripping group, however, the mean preoperative IIEF-5 score of  $9.8 \pm 4.1$  increased to a mean post-operative IIEF-5 score of  $18.9 \pm 2.1$ . Although there was no significant difference between the 2 groups' preoperative IIEF-5 score, there was a statistically significant difference between treatments ( $P < .001$ ) [8].

Another, valuable study was performed earlier in the 1999 by Popken et al. [10]. In this evaluation ligation and resection of the superficial and deep veins of the penis (DPVL) were performed in 122 patients. All patients were non-responders to SKAT,

which is a very difficult initial situation. Twenty-six per cent had ectopic veins, 38% a leakage through the rural veins and 24% a glandular or spongiosal shunt. After the 70-month follow-up, 14% of the 122 patients were able to achieve an adequate spontaneous erection and 19% also responded to SKAT. Taking in to account that those patients are strong candidates for a penile implant, the success rate of 33% seems to be acceptable for this setting [10]. In about a third of the patients natural erections could be regained and maintained for a long time. This is an important aspect, because in many countries penile implants are not covered by insurance companies and therefore most of the patients cannot afford this therapy option.

Even though Lewis et al. [11] tried to promote cavernosography through the use of cinetaped cavernosography, the diagnosis of the leak site continued to use conventional X-ray. However, because the veins were often overlapped by other veins, or by bone or cavernous body, we were not always able to obtain clear images of the origin of the veins, even when we used radioscopy or tried changing the angle of the X-ray beam or tilting the position of the patient. Diagnostic imaging has progressed remarkably so we can obtain high-resolution arterial images similar to digital subtraction angiography with a CT scanner [5], and images of the venous system with an MRI scanner [6]. Furthermore, recent technological developments allow us to reconstruct three-dimensional (3D) images from cross-sectional image data.

Recently, we described a new three dimensional mathematical model for the penis to calculate the risk of superficial penile tunical rupture due to mechanical load during intercourse [12]. Based on this model we developed a mathematical scheme to describe the tunical outflow during erection in case of venous leak (Figure 1). For this scheme the newest data about venous drainage of the Penis was included. Izumi et al. [13] described, that the cavernous vein, the most common drainage vein, originates from the coapted part where the right and left corpus cavernosum join together [13]. Specifically the cavernous veins flow out from proximal dorsal points at the furcation of the crus. This area is also the place where the artery comes in, and virtual cavernoscopy showed that the cavernous vein ran adjacent to the cavernous artery. Crural veins were observed in the dorsal part of the crus. Crural veins originated from the midpoint of the crus or at a more distal point [13].

3D-CT Cavernosography was performed on patients who had previously failed to respond to medical therapy. In four cases, no administration of alprostadil before CT-Cavernosography was given. In these cases, the venous system was presented in flaccide rest condition of the penis with Ct-Cavernosography for the first time. In these studies it could be demonstrated, that intra-cavernosal injection of contrast media results in a drainage into the crural, as well as into the deep dorsal vein. From here the veins are connected to the superficial venous system, which

drains into the femoral and iliac external venous system. This draining system for the penis has, to our knowledge, never been described before.

We recently described a technique of closing/reducing venous outflow in both, the cavernous and crural region, in a simple and easy to perform intervention in local anaesthesia [14]. In short: After penile block with lidocaine a 1 to 2cm penile dorsal midline incision was made at the penile base. The superficial dorsal vein was ligated. The deep dorsal vein was identified and isolated for about 2cm length under the Buck's fascia. The distal end was ligated with 4-0 Vicryl™ to prevent backflow into the glans penis and corpus cavernosum. Circumflexed veins, which branched off from the isolated portion of the deep dorsal vein at the penile base, were ligated with 4-0 Vicryl™, too. The proximal end was catheterized with a 5 F angiocath (Radiofocus Introducer II, Terumo Medical Corporation, Leuven, Belgium).

The venous tract was confirmed by venography. An air-block was set by antegrade injection of 1ml air followed by 4ml aethoxysclerol 3% for venoablation. The patient was asked to do a Valsalva maneuver for about 30-60 seconds before starting the injection. The occluded dorsal vein and its occluded collaterals were visualized. The penile incision was anatomically closed with absorbable suture material. Compared with 3D-CT cavernosography, observing cavernous veins and the proximal part of the deep dorsal veins using MIP imaging, as a correlation to classical x-ray cavernosography, was especially difficult because the origins of the penile veins are often behind the pelvic bone or cavernous body [15].

### Conclusion

CT cavernosography is able to more accurately describe the anatomical and pathological conditions before and after interventions on the vascular system of the penis, than currently used plain x-ray methods. Based on this technique new functional and therapeutical models and principals can be developed to cure more effectively vasculogenic erectile dysfunction. Venous leakage interventions with sclerotherapy after CT-cavernosography in air block technique under Valsalvamaneuver are more effective than previously described simple ligation procedures. Our new pelvic venoablation technique using aethoxysclerol in air-block technique was effective, minimally invasive and cost-effective. All patients were able to perform sexual intercourse without the previously used dosage of their PDE5 inhibitor. This new method may help in patients with contra-indications against PDE5 inhibitors, in patients who

cannot afford the frequent usage of expansive oral medication or those who do not fully response to PDE5-inhibitors.

### References

1. Das S (1994) Early history of venogenic impotence. *Int J Impot Res* 6(4): 183-189.
2. Virag R (2002) Intracavernous injection of papaverine for erectile failure. 1982. *J Urol* 167(2): 1196.
3. Sohn M, Hatzinger M, Goldstein I, Krishnamurti S (2013) Standard operating procedures for vascular surgery in erectile dysfunction: revascularization and venous procedures. *J Sex Med* 10(1): 172-179.
4. Bari V, Ahmed MN, Rafique MZ, Ashraf K, Memon WA, et al. (2006) Evaluation of erectile dysfunction with color Doppler sonography. *J Pak Med Assoc* 56(6): 258-261.
5. Kawanishi Y, Lee KS, Kimura K, Kojima K, Yamamoto A, et al. (2001) Feasibility of multi-slice computed tomography in the diagnosis of arteriogenic erectile dysfunction. *BJU Int* 88(4): 390-395.
6. Kurbatov DG, Kuznetsky YY, Kitaev SV, Brusensky VA (2008) Magnetic resonance imaging as a potential tool for objective visualization of venous leakage in patients with veno-occlusive erectile dysfunction. *Int J Impot Res* 20(2): 192-198.
7. Virag R, Paul JF (2011) New classification of anomalous venous drainage using caverno-computed tomography in men with erectile dysfunction. *J Sex Med* 8(5): 1439-1444.
8. Chen SC, Hsieh CH, Hsu GL, Wang CJ, Wen HS, et al. (2005) The progression of the penile vein: could it be recurrent? *J Androl* 26(1): 53-60.
9. Wespes E, Wildschutz T, Roumeguere T, Schulman CC (2003) The place of surgery for vascular impotence in the third millennium. *J Urol* 170(4 Pt 1): 1284-1286.
10. Popken G, Katzenwadel A, Wetterauer U (1999) Long-term results of dorsal penile vein ligation for symptomatic treatment of erectile dysfunction. *Andrologia* 31 (Suppl 1): 77-82.
11. Lewis RW, Puyau FA, Bell DP (1986) Another surgical approach for vasculogenic impotence. *J Urol* 136(6): 1210-1212.
12. Herwig R, Bayerl M (2015) Superficial tunica albuginea rupture as initial starting point of Peyronie's disease: a topic for interdisciplinary consideration. *Biomed Res Int* 2015: 751372.
13. Izumi K, Kawanishi Y, Muguruma H, Kusuhara Y, Komori M, et al. (2011) Virtual cavernoscopy: a novel diagnostic tool for use in the corpus cavernosal lumen in patients with erectile dysfunction. *BJU Int* 108(8): 1316-1320.
14. Herwig R, Sansalone S (2015) Venous leakage treatment revisited: pelvic venoablation using aethoxysclerol under air block technique and Valsalva maneuver. *Arch Ital Urol Androl* 87(1): 1-4.
15. Kawanishi Y, Izumi K, Muguruma H, Mashima T, Komori M, et al. (2011) Three-dimensional CT cavernosography: reconsidering venous ligation surgery on the basis of the modern technology. *BJU Int* 107(9): 1442-1446.



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