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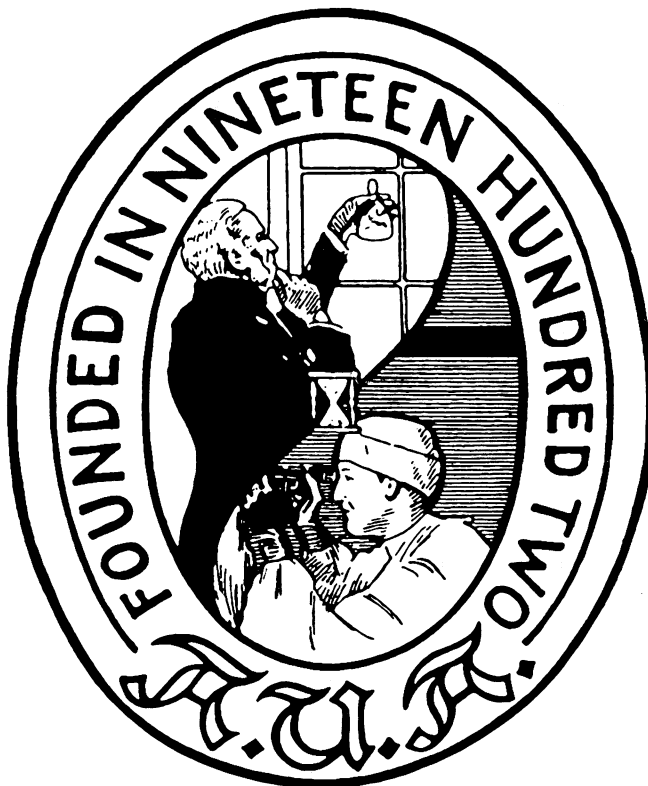
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# The Journal of UROLOGY®

Volume 151

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# PROGNOSTIC FACTORS FOR THE POSTOPERATIVE OUTCOME OF PENILE VENOUS SURGERY FOR VENOGENIC ERECTILE DYSFUNCTION

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## ABSTRACT

Since penile venous surgery is usually associated with a poor postoperative outcome, a study was done to evaluate possible prognostic factors for this procedure. A total of 77 patients with erectile dysfunction underwent ligation of all dorsal penile veins and resection of the deep dorsal penile vein for venous incompetence. In all patients a comprehensive evaluation was done preoperatively. All patients did not respond to pharmacotherapy and had a venous leak. After a followup of 6 months, patients were classified as having full spontaneous erections, failure and response to pharmacotherapy. Of the 77 patients 31 (40.3%) had full spontaneous erections, 8 (10.3%) were currently responding to pharmacotherapy and 38 (49.4%) failed. The maintenance flow was  $75 \pm 45$  ml. per minute in the group with spontaneous erections and  $103 \pm 60$  ml. per minute in the failure group ( $p = 0.20$ ). Mean patient age was  $49.8 \pm 11.7$  and  $49.1 \pm 10.2$  years, respectively ( $p = 0.23$ ). Of the 41 patients with normal single potential analysis of cavernous electrical activity 28 had full erections postoperatively, 5 responded to pharmacotherapy and 8 failed, compared to 3, 3 and 30, respectively, of the 36 patients with abnormal single potential analysis of cavernous electrical activity. After a mean followup of 21 months (range 6 to 47 months), 4 patients with full erections at 6 months postoperatively currently require intracavernous pharmacotherapy. Our results indicate that single potential analysis of cavernous electrical activity seems to be an important prognostic factor for the postoperative outcome of penile venous surgery for venogenic impotence.

KEY WORDS: impotence, penile erection, veins

Although intracavernous injection therapy<sup>1-4</sup> and penile prostheses<sup>5</sup> offer reliable therapeutic options for most patients with erectile dysfunction, these alternatives are often rejected for various reasons. This rejection is reflected by dropout rates of 50% or more in some longitudinal studies following patients on auto-injection therapy or by low overall acceptance rates of penile prosthesis implantation. Many of these patients indicate that they would like a therapy that restores spontaneous erectile function. For these patients penile reconstruction seems to be an attractive option.

After years of great enthusiasm about cavernous arterialization,<sup>6,7</sup> mid-term and long-term success rates are disappointing. In addition, significant complications of these procedures have been reported.<sup>8-10</sup> Penile venous operations are also followed by poor long-term results,<sup>11-13</sup> even when a more aggressive surgical approach is chosen.<sup>14-16</sup> These observations led to the question of whether penile venous surgery for venogenic impotence is a basically useless procedure or if adequate patient selection has not yet been established. We evaluate the postoperative outcome of 77 consecutive patients with venous leakage who underwent penile venous surgery, thus possibly identifying prognostic factors for the outcome of this procedure.

## PATIENTS AND METHODS

All patients at our impotence clinic undergo a comprehensive approach<sup>17</sup> regarding the etiology of the erectile dysfunction, including a case history, physical examination, blood laboratory studies, sexual case history (performed by a psychiatrist), single potential analysis of cavernous electrical activity (SPACE),<sup>18</sup> pharmacological testing<sup>17</sup> and Doppler ultrasound.<sup>19</sup> When indicated,<sup>17</sup> patients undergo further examinations, such as cav-

ernometry and cavernosography,<sup>20</sup> penile angiography or somato-motor and/or autonomic neurological examinations.

If patients do not respond to maximal doses of intracavernous injections (30 mg. papaverine plus 1 mg. phentolamine) plus additional psychogenic or reflexogenic stimulation, they are informed about the high likelihood of venous leakage as a (co)factor for the erectile dysfunction. They also are informed about the implication of this finding with either the alternative of further diagnostics, for example cavernosometry and cavernosography, or other therapeutic strategies, such as vacuum devices, a penile prosthesis or a trial with intracavernous injection of a combination of calcitonin gene-related peptide plus prostaglandin E1.<sup>21</sup> In patients who choose further diagnostic procedures, cavernosometry and cavernosography are done as described previously.<sup>20</sup> The maintenance flow is measured after cavernous smooth muscle relaxation is induced by intracavernous injection of 30 mg. papaverine plus 1 mg. phentolamine, with a flow rate exceeding 14 ml. per minute being considered abnormal.<sup>22,23</sup> If a venous leakage is diagnosed the patients are offered, independently from possibly existing other etiological factors, dorsal penile vein resection or ligation. They are extensively informed about the poor outcome of this procedure and about possible therapeutic alternatives.

From June 1989 to November 1992, 77 patients with erectile dysfunction and documented venous leakage underwent penile venous surgery. Independently from the site of leakage visualized by cavernosography, a longitudinal incision approximately 4 cm. long is made at the base of the penis. Then, all superficial dorsal and lateral penile veins (within Colles' fascia) are doubly ligated and divided. The deep dorsal vein(s) within Buck's fascia is resected from the suspensory ligament to the distal third of the cavernous bodies. Special attention is paid to avoid damage to the dorsal nerves and arteries supplying the glans penis. Cavernous vein ligation is not done.

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All patients are seen at 6 months postoperatively. In patients who report full spontaneous erections no further tests are done. Patients who report results other than full erections are offered pharmacological testing as well as cavernosometry and cavernosography. To evaluate the long-term success of our approach to the management of venous leakage, in May 1993 we sent an extensive questionnaire to all patients with a history of penile venous surgery. Patients and their partners were asked in detail about preoperative and postoperative self-esteem and libido, sexual function, partner relationships (general and sexual), alternative or additional treatments of the (possibly) persistent erectile dysfunction, and possible side effects they relate specifically to the operation. In case of an incomplete response to the questionnaire or if no response was received within 3 weeks, another questionnaire with an individualized cover letter was sent. Again, if no reply was received, the patients were telephoned and either asked to complete the questionnaire or invited on an outpatient basis to reply to the questions personally.

RESULTS

A total of 77 patients with venogenic erectile dysfunction underwent penile venous surgery between June 1989 and November 1992. All 77 patients were available at 6 months postoperatively and 70 were available for review in May 1993. Followup was 6 to 47 months (mean 21.4 ± 15, median 18.5). Patient age was 24 to 72 years (mean 50.1 ± 13.0 years). Mean interval since the onset of erectile dysfunction was 4.9 years. Case histories are shown in the table.

There was 1 severe postoperative complication. One patient treated as an outpatient suffered an extensive penile hematoma with subsequent skin necrosis that required multiple plastic revisions and caused significant paresthesia of the glans penis. In 20 patients minor side effects were reported: 7 had mild paresthesia of the penile glans, 6 had minor paresthesia at the incision, 14 had persistent edema of the prepuce and 5 had a penile deviation.

At 6 months postoperatively 31 patients (40.3%) reported full erections with normal intercourse possible, 8 (10.3%) responded to intracavernous papaverine plus phentolamine and 38 (49.4%) failed to achieve full spontaneous or pharmacologically-induced erections. During the extended followup until May 1993, 4 patients with full spontaneous erections at 6 months required intracavernous pharmacotherapy to achieve full erections. These 4 patients reported loss of spontaneous erections after 6 (2), 9 (1) and 24 (1) months postoperatively.

For comparability of the data, the results were analyzed with the outcome at 6 months postoperatively. Mean patient age was 49.8 ± 11.7 years (range 24 to 72 years) for those with full erections, 49.1 ± 10.2 years (range 27 to 66 years) in the failure group (p = 0.23) and 56.0 ± 3.9 years (range 33 to 67 years) in the pharmacotherapy group. Mean interval since the onset of erectile dysfunction was 4.6, 4.7 and 5.2 years, respectively. Regarding the medical histories, there was no correlation with the postoperative outcome in patients with transurethral resec-

tion of the prostate or diabetes mellitus. Patients after radical pelvic surgery or intervertebral disk prolapse, or those with primary erectile dysfunction had a high likelihood of postoperative failure (see table).

The maintenance flow was 75 ± 45 ml. per minute in the group with spontaneous erections, 103 ± 60 ml. per minute in the failure group (p = 0.20) and 61.9 ± 46 ml. per minute in the pharmacotherapy group (p = 0.08, compared to the success group). Of the 41 patients with normal preoperative SPACE results 28 (68.3%) had full erections postoperatively, 8 (19.5%) failed and 5 (12.2%) responded to pharmacotherapy, compared to 3 (8.3%), 3 (8.3%) and 30 (83.4%), respectively, of the 36 patients with abnormal preoperative SPACE. When the preoperative SPACE findings are compared in the groups with postoperative full erections or failure, the difference is highly statistically significant (chi-square test, p < 0.001). In May 1993, 42 patients had failed and 21 of these are currently using other treatment options: 13 are on an auto-injection program using a combination of calcitonin gene-related peptide plus prostaglandin E1, 5 received a penile prosthesis and 3 use vacuum devices.

In May 1993, 17 of 70 patients reported an increase in libido, 12 a decrease and 41 no change compared to the preoperative status. Nocturnal or morning erections were improved in 12 patients, worse in 12 and unchanged in 35. A total of 43 patients would undergo this procedure a second time, 25 would not and 2 were undecided. Of the men treated as outpatients 2 suggested that this procedure should be performed only on an inpatient basis due to postoperative pain that was not adequately managed by the referring physician. Of 5 patients who reported erections sufficient for intercourse but a lack of "100% rigidity," the female partners considered the postoperative erection to be "100%."

DISCUSSION

At our department venogenic erectile dysfunction is defined as abnormal cavernous drainage, quantified by a maintenance flow in cavernosometry exceeding 14 ml. per minute.<sup>22-24</sup> The decrease in intracavernous pressure during a defined interval may also be considered as a parameter of cavernous veno-occlusive dysfunction<sup>25</sup> but these 2 tests seem to examine the same mechanisms of cavernous occlusion with, as shown by others, consequently similar results in a comparative study.<sup>26</sup>

These quantitative tests of the cavernous occlusive function rely heavily on adequate cavernous smooth muscle relaxation by intracavernous pharmacological application of drugs.<sup>20,25</sup> An increased sympathetic tone, for example by stress or anxiety, will cause cavernous smooth muscle contraction with subsequent false-positive cavernosometric results. To minimize this effect, we performed cavernosometry and cavernosography at the end of our evaluation, with the patient having received at least 3 intracavernous injections on different days and, thus, being familiar with diagnostic procedures in this intimate region of the body. Furthermore, the patient is followed throughout the study by the same urologist to obtain his confidence, and cavernosometry and cavernosography are done in an atmosphere as relaxed as possible.

There have been attempts at objective followup after penile reconstruction<sup>9,10</sup> but in our series only a poor or even no correlation was found between objective data and subjective reports. Since no diagnostic test exists that can discriminate with a high degree of accuracy between normal and abnormal erectile function, it currently is generally accepted that postoperative results of penile reconstruction are best monitored by the patient estimate of the functional result.<sup>27</sup> To substantiate further the patient personal estimate in this study, we asked the partner for an evaluation of the preoperative and postoperative erectile function.

The underlying etiology of abnormal cavernous veno-occlusive function may be manifold, with factors such as incomplete

| Case History                                 | No. Pts. | Postop. Results |          |
|--|----------|-----------------|----------|
|  |          | Full Erections  | Failures |
| Diabetes mellitus                            | 8        | 3               | 5        |
| Primary erectile dysfunction                 | 6        | 1               | 5        |
| Peyronie's disease                           | 3        | -               | 3        |
| Post-transurethral resection of the prostate | 4        | 3               | 1        |
| Intervertebral nucleus prolapse              | 4        | -               | 4        |
| Kidney transplantation                       | 3        | 1               | 2        |
| Radical pelvic surgery                       | 3        | -               | 3        |
| Pelvic ring rupture                          | 1        | -               | 1        |
| Polyneuropathy                               | 1        | -               | 1        |
| Vasculitis                                   | 1        | -               | 1        |
| Open prostatectomy                           | 1        | 1               | -        |

cavernous smooth muscle relaxation due to endothelial or neurotransmitter defects, localized noncompression of sub-tunical or intra-tunical veins,<sup>28</sup> or cavernous smooth muscle degeneration.<sup>29</sup> Since cavernous smooth muscle relaxation was induced in our series, as at most other institutions, by pharmacological agents (papaverine) not dependent on endothelial or neurotransmitter function, patients with venous leakage at cavernosometry and cavernosography are most likely to have abnormal cavernous drainage due to either cavernous smooth muscle degeneration, or sub-tunical or intra-tunical venous malcompression.

From a theoretical standpoint, patients with venogenic erectile dysfunction due to cavernous smooth muscle degeneration will not benefit from penile venous surgery, since in that case this procedure does not address the causative mechanism. Penile prosthesis implantation or the use of a vacuum device seems to be the only treatment option left for these patients. However, for patients with a functioning cavernous smooth musculature but a localized defect in the sub-tunical or intra-tunical venous compression system (and no additional etiologies of the erectile dysfunction), penile venous surgery may be beneficial. In our opinion, these different underlying etiologies of venogenic erectile dysfunction with entirely different causative mechanisms explain the low overall success rate of penile venous surgery for venogenic erectile dysfunction.

Independently from the surgical approach, the mid-term and long-term success rates of penile venous surgery vary between 10% and 50%.<sup>11-14</sup> Our results, with approximately 40% full spontaneous erections after 6 months and 35% after 21 months, fit in the frame of the aforementioned experiences. In our opinion these postoperative results are in that low range of success, since the classical diagnostic evaluation of erectile dysfunction with pharmacological testing, Doppler or duplex ultrasonography, and cavernosometry did not allow for a differentiation between the aforementioned 2 main etiologies of venous erectile dysfunction. This is also reflected by the results of our preoperative evaluation, which did not show any correlation of the postoperative results with patient age, duration since onset of erectile dysfunction or maintenance flow. Also, no correlation was found in patients with diabetes mellitus or erectile dysfunction after transurethral resection of the prostate. The only strong correlation in our series was found comparing the preoperative SPACE results (or corpus cavernosum electromyography, as it should now be referred to since the first international meeting on cavernous smooth muscle electromyography in April 1993 at Mannheim, Germany) and the postoperative outcome. Of the 41 patients with normal SPACE results 28 (68.3%) had full erections postoperatively, whereas 30 of 36 (83.4%) with abnormal SPACE findings failed. These data suggest that SPACE has an important role as a prognostic factor for patients with venogenic erectile dysfunction. Impotent patients with normal preoperative SPACE findings combined with venogenic erectile dysfunction are now encouraged at our institution to undergo penile venous surgery, since the likelihood of an improvement in erectile function is 70% or better. In contrast, patients with venogenic erectile dysfunction and abnormal preoperative SPACE findings are informed about the low success rate of penile venous surgery and are encouraged to choose another treatment option.

Since the introduction of corpus cavernosum electromyography<sup>30,31</sup> much criticism was raised doubting that the signals recorded were actually electrical activity of cavernous smooth muscle cells or of different origin. In the meantime, experimental studies on isolated cavernous smooth muscle cells<sup>32</sup> as well as extrinsic recordings of electric activity of cavernous smooth muscle strips<sup>33</sup> showed a correlation of mechanical and electrical activity of these smooth muscle cells. Furthermore, corpus cavernosum electromyography in animal experiments showed marked differences before and after cavernous denervation.<sup>34</sup> Although these studies demonstrated the sound scientific bases

of corpus cavernosum electromyography, its interpretation and, subsequently, its clinical usefulness still are under debate.

In our study corpus cavernosum electromyography/SPACE was the only predictive diagnostic parameter for penile venous surgery in patients with venogenic erectile dysfunction. For this clinical application of corpus cavernosum electromyography, a differentiation only between normal and abnormal potentials was attempted. Further differentiation, such as myogenic or neurogenic, was avoided since no consensus has yet been reached on this point. However, this discrimination is only of academic interest for the patients with venogenic erectile dysfunction, since the myogenic and neurogenic groups would not benefit from surgery. In contrast, patients with venogenic erectile dysfunction and normal corpus cavernosum electromyography/SPACE findings should have a normal cavernous innervation and a normal smooth musculature with a localized veno-occlusive dysfunction. Theoretically, these patients are likely to benefit from penile venous surgery. The results of our clinical study support these theoretical assumptions and showed that corpus cavernosum electromyography/SPACE has a predictive value for the postoperative outcome of penile venous surgery in patients with venogenic erectile dysfunction. However, further studies are needed to improve the interpretation of corpus cavernosum electromyography and to confirm our surgical findings.

#### REFERENCES

1. Virag, R.: Intracavernous injection of papaverine for erectile failure. Letter to the Editor. *Lancet*, **2**: 938, 1982.
2. Brindley, G. S.: Cavernosal alpha-blockade: a new technique for investigating and treating erectile dysfunction. *Brit. J. Psychiatr.*, **143**: 332, 1983.
3. Zorgniotti, A. W. and Lefleur, R. S.: Auto-injection of the corpus cavernosum with a vasoactive drug combination for vasculogenic impotence. *J. Urol.*, **133**: 39, 1985.
4. Stackl, W., Hasun, R. and Marberger, M.: Intracavernous injection of prostaglandin E1 in impotent men. *J. Urol.*, **140**: 66, 1988.
5. Montague, D. K.: Penile prostheses. An overview. *Urol. Clin. N. Amer.*, **16**: 7, 1989.
6. Levine, F. J., Gasior, B. L. and Goldstein, I.: Reconstructive arterial surgery for impotence. *Sem. Intervent. Rad.*, **6**: 220, 1990.
7. Goldstein, I.: Penile revascularisation. *Urol. Clin. N. Amer.*, **14**: 805, 1987.
8. Schraudenback, L., Klima, M., Kraft, G. and Altwein, J. E.: Problems of penile revascularisation using Hauri's technique. *Int. J. Impotence Res.*, suppl. 2, **4**: A134, 1992.
9. Sohn, M. H. H., Sikora, R., Wein, B., Zabelberg, U. and Jakse, G.: Objective follow-up parameters after penile revascularization. Correlations to subjective outcome. *J. Urol.*, part 2, **149**: 320A, abstract 431, 1993.
10. Riccardi, R., Jr. and Melman, A.: Objective, long-term results of penile revascularization. *J. Urol.*, part 2, **149**: 320A, abstract 429, 1993.
11. Gilbert, P., Sparwasser, C., Beckert, R., Treiber, U. and Pust, R.: Venous surgery in erectile dysfunction. The role of dorsal-penile-vein ligation and spongiosolysis for impotence. *Urol. Int.*, **49**: 40, 1992.
12. Wespes, E., Delcour, C., Preserowitz, L., Herbault, A. G., Struyven, J. and Schulman, C.: Impotence due to corporeal veno-occlusive dysfunction: long-term followup of venous surgery. *Eur. Urol.*, **21**: 115, 1992.
13. Freedman, A. L., Costa Neto, F., Mehringer, C. M. and Rajfer, J.: Long-term results of penile vein ligation for impotence from venous leakage. *J. Urol.*, **149**: 1301, 1993.
14. Lewis, R. W. and Puyau, F. A.: Procedures for decreasing venous drainage. *Sem. Urol.*, **4**: 263, 1986.
15. Lue, T. F.: Penile venous surgery. *Urol. Clin. N. Amer.*, **16**: 607, 1989.
16. Rossman, B., Mieza, M. and Melman, A.: Penile vein ligation for corporeal incompetence: an evaluation of short-term and long-term results. *J. Urol.*, **144**: 679, 1990.
17. Stief, C. G., Bähren, W., Gall, H. and Scherb, W.: Functional evaluation of penile hemodynamics. *J. Urol.*, **139**: 734, 1988.
18. Stief, C. G., Djamilian, M., Schaebdsau, F., Truss, M. C., Schlick, R. W., Abicht, J. H., Allhoff, E. P. and Jonas, U.: Single potential



- analysis of cavernous electric activity—a possible diagnosis of autonomic impotence? *World J. Urol.*, **8**: 75, 1990.
19. Jevtich, M. J.: Non-invasive vascular and neurologic tests in use for evaluation of angiogenic impotence. *Int. Angiol.*, **3**: 225, 1984.
  20. Lue, T. F., Hricak, H., Schmidt, R. A. and Tanagho, E. A.: Functional evaluation of penile veins by cavernosography in papaverine-induced erections. *J. Urol.*, **135**: 479, 1986.
  21. Djamilian, M., Stief, C. G., Kuczyk, M. and Jonas, U.: Followup results of a combination of calcitonin gene-related peptide and prostaglandin E1 in the treatment of erectile dysfunction. *J. Urol.*, **149**: 1296, 1993.
  22. Stief, C. G., Wetterauer, U. and Sommerkamp, H.: Intra-individual comparative study of dynamic and pharmacocavernosography. *Brit. J. Urol.*, **64**: 93, 1989.
  23. Kromann-Andersen, B., Nielsen, K. K. and Nordling, J.: Cavernosometry: methodology and reproducibility with and without pharmacological agents in the evaluation of venous impotence. *Brit. J. Urol.*, **67**: 517, 1991.
  24. Vickers, M. A., Jr., Benson, C., Dluhy, R. and Ball, R. A.: The current cavernosometric criteria for corporovenous dysfunction are too strict. *J. Urol.*, **147**: 614, 1992.
  25. Padma-Nathan, H., Goldstein, I. and Krane, R. J.: Evaluation of the impotent patient. *Sem. Urol.*, **4**: 225, 1986.
  26. Siegmund, M., Juenemann, K. P., Schmidt, P., Tschada, R. and Alken, P.: Kavernosometrie: Korrelation zwischen intrakavernösem Druckabfall und Maintenance Flow zur Differentialdiagnose der kavernösen Insuffizienz. *Akt. Urol.*, **22**: 366, 1991.
  27. Barada, J. H.: The changing role of impotence surgery. State-of-the-art lecture. *J. Urol.*, part 2, **149**: 99A, 1993.
  28. Juenemann, K.-P., Lue, T. F., Hellstom, W. G. J., Fournier, G. R., Jr. and Tanagho, E. A.: Hemodynamics of papaverine- and phentolamine-induced penile erections in monkeys and dogs. *J. Urol.*, part 2, **133**: 218A, abstract 418, 1985.
  29. Mersdorf, A., Goldsmith, P. C., Diederichs, W., Padula, C. A., Lue, T. F., Fishman, I. J. and Tanagho, E. A.: Ultrastructural changes in impotent penile tissue: a comparison of 65 patients. *J. Urol.*, **145**: 749, 1991.
  30. Gerstenberg, T. C., Nordling, J., Hald, H. and Wagner, G.: Standardized evaluation of erectile dysfunction in 95 consecutive patients. *J. Urol.*, **141**: 857, 1989.
  31. Wagner, G., Gerstenberg, T. and Levin, R. J.: Electrical activity of corpus cavernosum during flaccidity and erection of the human penis: a new diagnostic method? *J. Urol.*, **142**: 723, 1989.
  32. Derouet, H., Eckert, R., Ziegler, M. and Trautwein, W.: Cavernosale Einzelzellanalyse glatter cavernöser Muskelzellen von PGE1-Nonrespondern. 11. Symposium für Experimentelle Urologie, Wuppertal, 1992.
  33. Stief, C. G., Höppner, C., Jonas, U., Mandrek, K., Noak, T. and Golenhofen, K.: Electrical and mechanical activity of isolated strips from rabbit penile corpus cavernosum. *Int. J. Impotence Res.*, suppl. 2, **4**: A36, 1992.
  34. Bührle, C. P., Schmidt, P., Juenemann, K. P., Berle, B. and Alken, P.: Automatic acquisition and analysis of EMG data from corpus cavernosum recordings in the dog. *Int. J. Impotence Res.*, suppl. 2, **4**: A29, 1992.