

PHARMACOCAVERNOMETRY: A MULTIPURPOSE TEST IN THE EVALUATION OF VASCULOGENIC IMPOTENCE

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SUMMARY

Pharmacocavernometry and pharmacocavernography were performed on 29 patients with erectile dysfunction. The papaverine test was negative and arterial insufficiency was ruled out by means of duplex penile ultrasonography for all of the patients. We divided the patients into two groups according to their pharmacocavernometric findings. The first group included 17 patients with intracavernous pressures below 50 mmHg, ten minutes after the papaverine injection (P_{10}) and five minutes after the end of saline infusion (P_{end}). The second group included 12 patients with P_{10} pressures below and P_{end} pressures above 50 mmHg. Significant differences were noted between the P_{end} values and average infusion rates for induction and maintenance of the two groups ($P < 0.05$). Moreover, we compared the pharmacocavernometric findings with pharmacocavernograms of each patient and found out that despite a negative papaverine test, none of the 12 patients in the second group had venous leakage.

We concluded that pharmacocavernometry is a useful and reliable test to increase the sensitivity of the papaverine test and diagnose excessive venous leakage from penile veins.

Key Words: Pharmacocavernometry, Papaverine test, Vasculogenic impotence.

INTRODUCTION

The introduction of pharmacologically induced erection generated an explosive development in the diagnostic evaluation of erectile dysfunction. Papaverine has been the drug of choice in diagnosis and treatment since 1983 (1). Induction of erection after papaverine injection eliminates vascular pathology. Ho-

wever, several studies indicated false negativity of the papaverine test up to 30 percent, reducing its sensitivity as a diagnostic tool (2,3).

In order to overcome this problem, different proposals such as increasing papaverine dose, combining papaverine with phentolamine and using prostaglandin E1 instead of papaverine have been brought up (4,5).

Another proposal is to combine the papaverine test with cavernometry (6).

In this study, the use and reliability of pharmacocavernometry in defining impotence of venogenic origin and the combination of papaverine with cavernometry to increase the sensitivity of the papaverine tests were evaluated.

MATERIAL AND METHODS

29 patients with venogenic impotence aged 17 to 36 years (mean 28) were included between July 1989 and September 1990 at the Hacettepe University Hospitals, Department of Urology.

A detailed history was obtained and a physical examination was done with special focus on the genital area. Serum testosterone was studied. The papaverine test was done and duplex ultrasonographic investigation of the penile arteries were performed to rule out arterial pathology in all patients (2).

The papaverine test was negative for all patients and their arterial evaluation defined no pathology by means of duplex penile ultrasonography (3), suggesting a problem in the penile veins (1-4).

Pharmacocavernometry was performed with infusion of saline through a 19 gauge needle, connected to a

rotary pump in one corpus cavernosum, and continuous measurement of the cavernous pressure through another 19 gauge needle in the other corpus cavernosum, connected to a disposable transducer (DPT-3003). Intracavernous pressures were recorded before papaverine injection (basic pressure - P_0) and five minutes (P_5) and ten minutes (P_{10}) after papaverine injection. Then artificial erection was started with a flow rate of 10 ml per minute.

The flow rates were increased continuously until full erection phase which indicated the induction flow rate. The flow rates were reduced to the maintenance flow indicating the flow rate necessary for maintaining the erection with intracavernous pressure values ranging between 90 and 120 mmHg. A final pressure was recorded 5 minutes after the end of the saline infusion (P_{end}). The infusion rates for full erection and maintenance of erection were recorded as well for each patient.

We limited the infusion rate with a maximum of 200 ml per minute if we could not get full erection.

Technique of pharmacocavernography: During complete erection a nonionic contrast material (Iohexol) was added in the saline for visualization of venous leakages and graphics were taken from different projection planes including 45 degree posterior oblique projection to demonstrate the deep penile veins, the deep dorsal vein of the penis and the superficial dorsal vein. The results were compared to those of dynamic cavernometry.

RESULTS

Patients were classified into 2 groups according to pressure differentials after papaverine injection (Table I). In the first group (17 patients), there were patients with both P_{10} and P_{end} pressures below 50 mmHg after papaverine injection; and in the second group (12 patients) there were patients with P_{10} pressures below and P_{end} pressures above 50 mmHg.

The values for P_0 , P_5 , P_{10} and P_{end} were taken into consideration and significant differences were recognized between P_{end} values of each group ($P < 0.05$) (Table I).

In Table II, average infusion rates of both groups for induction and maintenance of erections are shown. We noted significant difference between the values for each group ($P < 0.05$).

Distribution of patients with venous leakage according to the cavernosographic findings is shown in Table III for group 1 and 2. In the first group, 16 of 17 patients (94 %) had venous leakage, whereas in the second group all of the 12 patients (100%) were leakage free on cavernosography. We obtained significant difference between the groups here as well ($P < 0.05$).

In Table IV, patients were divided into three groups, based on the locations of venous leakage on their cavernosograms as: patients leaking from deep veins only (cavernous and crural veins - 4 patients), from superficial and intermediate veins only (superficial and deep dorsal veins - 2 patients) and from all three venous systems (10 patients). The P_{end} values and infusion rates for erection maintenance were taken into consideration for each group. No significant differences were found between P_{end} and infusion rate values and the localizations of venous leakage for these 3 groups ($P > 0.05$).

In this study, we observed false negativity of the papaverine test in 12 of 29 patients. These 12 patients had no vascular pathology by means of penile arterial and venous evaluation.

DISCUSSION

Occlusion of the penile veins is one of the most important hemodynamic events for both initiating and maintaining erection. Previous electron microscopic studies have demonstrated that the sinusoidal system empties into the subtunical venular plexus. Compression of this venular plexus between the dilated sinusoids and the non-compliant tunica albuginea reduces venous outflow. Any abnormality in this veno-occlusive system (i.e, defects in sinusoidal smooth muscles and subtunical venular plexus) and/or an abnormal drainage through an ectopic or aberrant vein will cause erectile dysfunction (7).

The evaluation of penile venous system and the quantity of abnormal leakage has been done by means of cavernometry proposed by Virag. Later on, the test was improved with intracavernous injection of papaverine (pharmacocavernometry). Recently, pharmacocavernometry has been almost always combined with dynamic cavernography (8).

Even though there is no standardization of cavernometric findings; results of induction flow rate, ma-

intenance flow rate, intracavernous pressure changes after papaverine injection, may be considered as reliable criteria (7). The results of this study, exposed briefly in Tables I and II, support this assumption.

Correlation between cavernometric and cavernographic results suggests the reliability of cavernometry in the evaluation of venogenic impotence (Table III).

Since no relation between the quantity of venous leakage and its anatomic localization could be found (Table IV), cavernography should be reserved for candidates of venoocclusive surgery when cavernometry suggests pathologic venous outflow, avoiding the unnecessary use of X-rays in the diagnosis of sexual dysfunction.

The papaverine test provides the first step for defining vasculogenic impotence. It is accepted that intracavernous papaverine injection increases penile arterial inflow and venous outflow resistance. The decrease in venous outflow is assumed to be a passive phenomenon. A negative papaverine test is caused by arterial insufficiency and/or excessive venous outflow. However, false negativity of the test in ten to 30 percent of the patients, as stated in various articles, diminishes its sensitivity. The false negativity may be caused by increased adrenergic tonus secondary to anxiety (2-3).

After obtaining a negative result with the papaverine test, increasing the dose, combining papaverine with phentolamine and trying another intracavernous agent such as prostaglandin E1 were proposed. In this study, pharmacocavernometry identified normal venous system in 12 patients whose papaverine tests were negative. Thus, we believe that combination of papaverine with cavernometry is another method to increase the sensitivity of the papaverine test, moreover it can be easily done in office conditions.

Table I. Mean pressure values before and after papaverine injection in pharmacocavernometry.

	Number of Patients	P ₀	P ₅	P ₁₀	P _{end} *
Group 1*	17	6.64+2.49	11.47+5.49	12.82+5.80	20.47+8.27
Group 2**	12	8.58+2.74	15.50+7.24	19.66+10.71	56.58+6.40

* Patients with P₁₀ and P_{end} values below 50 mm Hg

** Patients with P₁₀ values below 50 mm Hg and P_{end} values above 50 mmHg

+ Significant difference in P_{end} values between group 1 and group 2 at P < 0.05 (Repeated measurements with two groups, paired T test)

All values are mean + standard deviation in mm Hg.

Table II. Mean infusion rates for induction and maintenance of erection.

	Mean inf. rate* for induction	Mean inf. rate** for maintenance
Group 1	102.35+80.39	81.47+71.95
Group 2	37.50+17.51	19.33+10.62

* Significant difference in infusion rate for induction between group 1 and group 2 at P < 0.05 (Independent samples T test)

** Significant difference in infusion rate for maintenance between group 1 and group 2 at P < 0.05 (independent samples T test)

All values are mean+standard deviation in ml per minute

Table III. Number of patients with and without venous leakage for Gr. 1 and Gr. 2

	Venous Leakage (+)	Venous Leakage (-)
Group 1	16	1
Group 2	-	12

Significant difference in the number of patients with and without venous leakage for Group 1 and Group 2 at P < 0.05 (2x2 chi square test).

Table IV. Mean P_{end} and maintenance infusion rate values according to the anatomic location of venous leakage.

	P _{end} (mm Hg)	Maintenance flow rate (ml per minute)
Superficial and intermediate venous system	27.50+3.53	158.20+68.21
Deep venous system	21.22+5.83	146.25+94.12
All venous system	22.20+17.67	171.38+89.58

No significant in P_{end} and maintenance flow rate values between the three groups at P > 0.05 (Two way analysis of variance).

All values are mean + standard deviation.

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