

## PREDICTIVE VALUE OF REAL-TIME RIGISCAN MONITORING FOR THE ETIOLOGY OF ORGANOGENIC IMPOTENCE

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### ABSTRACT

We performed routine diagnostic evaluations in 160 consecutive patients from our impotence clinic. After the diagnostic studies were completed, the results of RigiScan\* monitoring during visual sexual stimulation before and after intracavernous injection of vasoactive drugs were compared to the results of standardized pharmacological testing, single potential analysis of cavernous electrical activity and pharmacocavernosometry. The results suggest RigiScan monitoring to be a highly accurate method to evaluate and document objectively the erectile response after intracavernous injection of vasoactive drugs. Although pathological monitoring after intracavernous injection is significantly associated with pathological findings in the specific evaluation, the predictive value of RigiScan monitoring for specific organogenic etiologies is not satisfactory, since normal monitoring showed no convincing correlation to single potential analysis of cavernous electrical activity or cavernosometry.

**KEY WORDS:** impotence, penile erection, evoked potentials, pharmacology

The first objective diagnostic approach that was believed to differentiate psychogenic and organogenic impotence was the introduction of nocturnal penile tumescence measurements.<sup>1</sup> Popularized in the mid 1960s, this method was the standard evaluation in the etiological differentiation of organogenic and psychogenic factors. During the years this approach was refined by simultaneous registration of penile tumescence and rigidity.<sup>2</sup>

Recent neurophysiological studies are casting some doubts about the basic assumption that nightly erections are comparable with erections needed for intercourse and that, therefore, good nighttime erections should exclude organogenic factors for erectile dysfunction. In these neurophysiological studies there is strong evidence that nighttime erections may be different from erection during sexual arousal regarding the neurological input.<sup>3</sup> However, other recent studies suggest that real-time monitoring of penile tumescence and rigidity during visual sexual stimulation may be helpful in the differential diagnosis of psychogenic versus organogenic impotence.<sup>4</sup> We evaluate whether real-time monitoring of penile tumescence and rigidity during visual sexual stimulation before and after intracavernous injection of vasoactive drugs may be helpful in the differentiation of organogenic impotence.

### PATIENTS AND METHODS

A total of 160 consecutive patients from our impotence clinic entered this study. Since we routinely use intracavernous injections of vasoactive drugs in the diagnostic evaluation we excluded patients with arterial occlusive disease of stages 3 and 4, cardiac arrhythmias, recent myocardial infarction, sexual deviation, severe psychogenic disorders, addiction, severe liver insufficiency and age greater than 65 years. The diagnostic evaluation in every patient included history (with an emphasis on sexual function) with the aid of a standardized questionnaire, physical examination and blood chemistry studies (SMA-12, testosterone and prolactin levels).<sup>5</sup> History, sexual history and partner interview were then obtained by a psychiatrist, and psychological testing was done by a clinical psychologist. Single potential analysis of cavernous electric activity (SPACE) was registered with the frequency range set at 0.5 to 100 Hz.<sup>6</sup> A standardized diagnostic injection of a vasoactive drug mixture

(3 mg. papaverine hydrochloride and 0.1 mg. phentolamine mesylate) was given and the erectile response was evaluated by a urologist.<sup>5</sup> To enhance reproducibility the patient was advised to refrain from psychological or reflexogenic stimulation. Depending on the erectile response the dose was decreased, unchanged or augmented for the following injection (with at least a 24-hour interval) and at least 3 injections were administered.

Real-time monitoring of penile tumescence and rigidity was done with a RigiScan device.<sup>2</sup> After explanation of the diagnostic procedure and its possible relevance to the patient, and installation of the device the patient was exposed to a sexually explicit video for 30 minutes. Then, intracavernous injection of 3 mg. papaverine and 0.1 mg. phentolamine was done, and the recording (with video) was repeated for 30 minutes. Of 160 patients 53 underwent pharmacocavernosometry and pharmacocavernosography. This unusually high number is due to numerous patients in the extensive study for penile revascularization.

The results of the Doppler examination<sup>7</sup> were not included in this study, since the discussion about its significance is not finished. Results regarded as pathological included standardized, repeated intracavernous injections with an incomplete erectile response to doses greater than 7.5 mg. papaverine and 0.25 phentolamine;<sup>3</sup> SPACE showing repeated abnormal potentials, repeated desynchronization of both cavernous bodies and repeated positive or negative sharp waves;<sup>6</sup> RigiScan monitoring showing a penile rigidity of less than 70%<sup>2</sup> with at least 1 phase of 70% of at least 5 minutes to be classified as normal, and pharmacocavernosometry results showing a maintenance flow of 20 ml. per minute or more.<sup>8-10</sup> Statistical analysis was done with the chi-square test and Pearson's correlation test.

### RESULTS

In 12 patients (7.5%) RigiScan monitoring during audiovisual sexual stimulation showed a penile rigidity of 70% or more, while 148 (92.5%) had a rigidity of less than 70%. After intracavernous injection of the vasoactive drug mixture the former 12 patients and 96 of the latter 148 patients (60%) showed a rigidity of 70% or more during visual sexual stimulation, while the remaining 52 (32.5%) still had a penile rigidity of less than 70%. Of the 12 patients with normal monitoring before and after intracavernous injection 6 showed no abnormal findings in the other diagnostic procedures and 6 showed 1 abnormal result. Of the 96 patients with abnormal monitoring before

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and normal monitoring after intracavernous injection 42 (44%) showed no abnormal findings during examination. All patients with abnormal monitoring before and after intracavernous injection had at least 1 abnormal result during the diagnostic evaluation.

The 12 patients with normal RigiScan monitoring before and after intracavernous injection had a full erectile response to pharmacological testing, compared to 74 of the 96 (77%) with abnormal monitoring before and normal monitoring after intracavernous injection. The remaining 22 of the 96 patients (23%) had an incomplete erection on pharmacological testing. These 22 patients underwent cavernosometry: 18 showed an abnormal and 4 a normal maintenance flow. All 52 patients with abnormal monitoring results before and after intracavernous injection had abnormal pharmacological testing responses. Of the 160 patients overall 138 (86%) showed comparable results for erectile response when evaluated by RigiScan monitoring or by a urologist (see table).

Of the 12 patients with normal RigiScan monitoring during visual sexual stimulation, 6 had normal and 6 had abnormal SPACE findings, compared to 62 (65%) and 34 (35%), respectively, of the 96 patients with abnormal monitoring before and normal monitoring after intracavernous injection, and 9 (17%) and 43 (83%), respectively, of the 52 patients with abnormal monitoring before and after intracavernous injection (see table). Of the 53 patients undergoing pharmacocavernosometry 16 had a normal and 37 had an abnormal maintenance flow. The 2 patients in this group with normal RigiScan monitoring on visual sexual stimulation showed no venous leakage. No venous leakage was noted in 9 of the 27 patients (33%) with abnormal monitoring before and normal monitoring after intracavernous injection, and in 5 of the 24 (21%) with abnormal monitoring before and after intracavernous injection, while venous leakage occurred in 18 (67%) and 19 (79%), respectively.

#### DISCUSSION

Only 12 of 160 patients (7.5%) showed a RigiScan monitoring of 70% or more in response to visual sexual stimulation. This figure of a normal erectile response to audiovisual sexual stimulation seems to be low, especially because 48 of 160 patients had no abnormal findings on pharmacological testing, SPACE or cavernosometry. Since all of these patients with no abnormal findings in the evaluation had normal RigiScan monitoring to audiovisual sexual stimulation after an intracavernous injection of a minimal dose of vasoactive drugs (and only 6 of them before the injection), this reduced erectile response to audiovisual sexual stimulation before intracavernous injection may be explained by psychogenic inhibition.<sup>11,12</sup> The psychogenic inhibition may be evoked by the examination itself, the rigidity recording device, the video or many other factors that stress the patient. As shown in dogs, only small

amounts of norepinephrine, without systemic effects, may significantly influence the erectile response.<sup>12</sup> This elevated sympathetic tone induces cavernous smooth muscle contraction, thereby decreasing the erectile response to audiovisual sexual stimulation. These results suggest that even patients with a normal erectile capacity may not respond to audiovisual sexual stimulation with a full erection. To avoid these false-negative results, a minimal dose of vasoactive drugs should be given before real-time RigiScan monitoring.

Furthermore, we have requested a minimum of 5 minutes of 70% rigidity (according to the RigiScan scale) to classify the erectile response as normal. This 5-minute period was requested because a brief increase in penile rigidity may be due to either palpation of the penis by the patient or squeezing of the pelvic floor by the device during measurement of rigidity. This prerequisite of at least 5 minutes of 70% rigidity may also have contributed to the low figure of 7.5% normal erections to audiovisual sexual stimulation. In our series the unspecific predictive value of real-time RigiScan monitoring regarding the outcome of any specific investigations was low when monitoring showed a normal response before and/or after intracavernous injection. However, when monitoring showed abnormal results before and after intracavernous injection specific investigations revealed at least 1 abnormal finding in all patients.

Real-time RigiScan monitoring showed a high correlation with the erectile response to pharmacological testing. The chi-square test and Pearson's correlation indicate a high correlation of both variables. In 86% of the patients RigiScan monitoring to visual sexual stimulation after intracavernous injection revealed a comparable erectile response than that evaluated by a urologist after pharmacological testing. In the remaining 14% of the patients RigiScan monitoring indicated a better erectile response than the response evaluated by the urologist. This discrepancy may be easily explained by the additional psychogenic (and perhaps by the recording device itself, even reflexogenic) stimulation applied with intracavernous injection during RigiScan monitoring, compared to intracavernous injection alone for pharmacological testing. This additional stimulation is most likely responsible for most of the increased rate of patients with better results in RigiScan monitoring compared to pharmacological testing. Furthermore, 18 of these 22 patients showed venous leakage, obviously moderate to mild, since pharmacological relaxation plus psychogenic stimulation induced a sufficient erectile response. These figures suggest that RigiScan monitoring is a highly accurate and objective measuring device for erectile response to intracavernous injections of vasoactive drugs.

Of 12 patients with a normal response to visual sexual stimulation on RigiScan monitoring 6 had pathological findings on SPACE. This finding strongly suggests that, to a certain extent, disturbances of the autonomic cavernous supply may still be associated with a functionally sufficient penile hemodynamic response. This assumption correlates well with the findings of Walsh et al, who observed that even after unilateral iatrogenic disruption of the cavernous nerve the erection may still be sufficient for intercourse.<sup>13</sup> Further studies are needed to reveal the critical extent of abnormal SPACE findings that are still associated with a sufficient erection.

The specific predictive value of RigiScan monitoring for SPACE was low when monitoring showed a normal response before and/or after intracavernous injection (although after intracavernous injection more patients with normal monitoring show normal SPACE findings and vice versa). However, when the monitoring was abnormal before and after intracavernous injection abnormal SPACE findings were obtained in 83% of the patients. This correlation of RigiScan and SPACE findings is statistically significant but quantitatively limited. Therefore, this correlation seems to be of no or only limited clinical significance.

The specific predictive value of RigiScan monitoring for

Results of RigiScan monitoring versus pharmacological testing, SPACE and pharmacocavernosometry in 160 patients

	RigiScan Monitoring		
	Normal/ Normal	Abnormal/ Normal	Abnormal/ Abnormal
Pharmacological testing:*			
Normal	12	74	0
Abnormal	0	22	52
SPACE:†			
Normal	6	62	9
Abnormal	6	34	43
Pharmacocavernosometry:‡			
Normal	2	9	5
Abnormal	0	18	19

\* Chi-square 91.73, 2 degrees of freedom,  $p < 0.001$ . Pearson's  $R = 0.72$ ,  $p < 0.001$ .

† Chi-square 30.21, 2 degrees of freedom,  $p < 0.001$ . Pearson's  $R = 0.35$ ,  $p < 0.001$ .

‡ Chi-square 5.75, 2 degrees of freedom,  $p = 0.06$ . Pearson's  $R = 0.27$ ,  $p = 0.03$ .



venous leakage seems to be low, since only a third of the patients with normal monitoring after intracavernous injection had no venous leakage but two-thirds had venous leakage. This finding may be explained by the fact that venous leakage is a gradual phenomenon, from just above normal to excessive. Low or moderate venous leakage may well be compensated by additional arterial inflow, as shown in the animal. This compensation results in normal RigiScan monitoring in the presence of venous leakage. However, pathological monitoring after intracavernous injection is associated in 79% of the cases with a venous leak. Statistically, the correlation of RigiScan monitoring and cavernosometry is on the edge of significance. This limited correlation of both variables seems to be of no clinical significance as shown previously.

Our results strongly suggest RigiScan monitoring to be a highly accurate method of evaluating and objectively documenting the erectile response after intracavernous injection of vasoactive drugs. Although pathological monitoring after intracavernous injection is significantly associated with pathological findings in the specific evaluation, the predictive value of RigiScan monitoring for specific organogenic etiologies is not satisfactory, since normal monitoring showed no clinically significant correlation to SPACE or cavernosometry. Currently, RigiScan monitoring seems not to be able to replace specific diagnostic investigations. As soon as valid parameters for arterial diagnosis are well established their correlation to RigiScan monitoring should be examined.

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