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THE DIAGNOSIS OF VENOGENIC IMPOTENCE: DYNAMIC OR PHARMACOLOGIC Cavernosometry?

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ABSTRACT

In an attempt to refine the diagnosis of venogenic impotence, we evaluated different techniques of cavernosometry in 10 dogs. Saline was perfused intracavernously in five dogs to induce erection. Regardless of the amount required for induction, a mean flow rate of 23.4 ml./min. was necessary to maintain an intracavernous pressure level of 110 cm. H_2O. In seven dogs, a leak was created by intracavernous insertion of a 19-gauge needle. When erection was induced by either cavernous nerve stimulation or a combination of papaverine injection and saline perfusion, the mean flow through the needle was significantly less than when erection was induced by saline perfusion alone (1.73, 1.78, and 8.77 ml./min., respectively). Sympathetic trunk stimulation at the level of L5 could reduce the intracavernous pressure by 90% in erections induced by neural stimulation or papaverine plus perfusion but had no effect on erection induced by saline perfusion alone. Our findings show that cavernosometry after intracavernous injection of papaverine will provide more valuable information in patients in whom venogenic impotence is suspected. (J. Urol., 140: 1561-1563, 1988)
The mean rate of flow through the leak was 1.78 ml./min., much lower than with saline perfusion alone (table 1).

Electrical stimulation of the sympathetic trunk reduced the intracavernous pressure by 90% in erections induced by either cavernous nerve stimulation or by two mg. papaverine plus saline perfusion (fig. 3A, B). Sympathetic trunk stimulation did not influence the intracavernous pressure of an erection induced by saline perfusion alone. It could neither abolish nor significantly reduce the erection induced by saline perfusion when sympathetic stimulation was applied 30 seconds before perfusion (fig. 3C).

**RESULTS**

The intracavernous pressure levels induced by saline perfusion were identical at a given perfusion rate, regardless of whether we continuously increased the flow rate or waited for the pressure to return to baseline before so doing (fig. 2). The pressure rose off the scale (>200 cm. H$_2$O) only when the initial perfusion rate was 34.4 ml./min. or higher (fig. 2C). However, when the perfusion rate was increased gradually (fig. 2A and B), it was possible to perfuse at a rate higher than 34.4 ml./min. without provoking a pressure level >200 cm. H$_2$O. These findings were reproducible twice in the same animals.

Creation of the artificial leakage resulted in a mean pressure drop of 65 cm. H$_2$O, regardless of mode of induction. When erection was induced by cavernous nerve stimulation, the mean rate of flow through the leak was 1.73 ml./min.; with erection induced by saline perfusion alone, the mean rate was 8.77 ml./min. Within 60 seconds after intracavernous injection of two mg. papaverine, cavernous smooth muscle relaxation was obtained with a mean intracavernous pressure of 40 cm. H$_2$O. Only one dog (#8) did not respond to papaverine. In the six that did respond to papaverine, a mean saline perfusion rate of 4.3 ml./min. was necessary to maintain full erection, and the

### Table 1. Rate of drainage through the artificial cavernous leak in canine erection induced by various means

<table>
<thead>
<tr>
<th>Dog No.</th>
<th>Saline Perfusion</th>
<th>Cavernous Stimulation</th>
<th>Papaverine + Perfusion</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>22.0*</td>
<td>2.4</td>
<td>2.9</td>
</tr>
<tr>
<td>5</td>
<td>5.8</td>
<td>1.3</td>
<td>0.6</td>
</tr>
<tr>
<td>6</td>
<td>12.0</td>
<td>1.8</td>
<td>1.4</td>
</tr>
<tr>
<td>7</td>
<td>3.3</td>
<td>0.9</td>
<td>0.9</td>
</tr>
<tr>
<td>8</td>
<td>3.5</td>
<td>0.9</td>
<td>No reaction to papaverine</td>
</tr>
<tr>
<td>9</td>
<td>7.0</td>
<td>2.8</td>
<td>2.5</td>
</tr>
<tr>
<td>10</td>
<td>7.8</td>
<td>2.0</td>
<td>2.4</td>
</tr>
</tbody>
</table>

*A* All values are ml./min.

**Fig. 2.** Intracavernous pressures induced by A, perfusion rates increased by 3.82-ml./min. increments after pressure had plateaued; B, perfusion rates increased by same increment after pressure had returned to baseline; and C, initially high perfusion rate (26.74 ml./min.) followed by same incremental increases as in A and B.

**Fig. 3.** Effect of sympathetic trunk stimulation (L5) on intracavernous pressure increases induced by A, electrical stimulation of the cavernous nerve; B, two mg. papaverine plus saline perfusion; and C, saline perfusion alone.
DISCUSSION

The mode of saline perfusion, whether by continuous incremental increases or by interrupted increases with a return to baseline between increments, did not influence the level of intracavernous pressure provoked by a given perfusion rate. Only in response to an initially high perfusion rate did the pressure rise acutely, presumably by surpassing the compliance of the cavernous tissue and the venous system. By gradually increasing the flow rate, the venous channels may remain open and perfusion rates far in excess of 34.4 ml./min. can be accommodated.

Because the penile venous drainage capacity during erection is determined quantitatively by the maintenance flow, tumescence will result if a rate higher than the maintenance flow rate is used to induce an erection. Thus, the flow rate required to induce an erection depends on the size of the penis and the maintenance flow rate. The induction flow therefore has no diagnostic usefulness in the evaluation of venous leakage.

The amount of flow through the artificial leak was similar in erection induced by neurostimulation or by papaverine and saline (1.73 and 1.78 ml./min., respectively). However, in erection induced by saline perfusion alone, the flow was five times higher (8.77 ml./min.). This can be explained by the fact that the smooth muscles remain contracted in saline-induced erection and permit a free flow from the perfusion needle to the leak. In contrast, the relaxation of the cavernous smooth muscles with neurostimulation or papaverine injection results in outflow resistance and does not permit this high rate of transcavernous flow.

Similarly, the divergent responses to stimulation of the sympathetic trunk can likewise be explained: erection induced by cavernous nerve stimulation or papaverine injection more closely mimics the normal physiologic event, and the resultant smooth-muscle relaxation is susceptible to suppression by sympathetic stimulation; erection induced by saline perfusion cannot be influenced because the cavernous smooth muscles have remained contracted.

In human erectile dysfunction, venous leakage is diagnosed and quantified during cavernosometry by measuring the maintenance flow and the intracavernous pressure drop after cessation of the saline perfusion. The findings of Diederichs et al. and our results show that these parameters can be significantly influenced by sympathetic stimulation, which seems to increase the intracavernous adrenergic level that causes smooth muscle contraction. Carati and coworkers found that the cavernous smooth muscle contraction induced by sympathetic chain stimulation could be partially reduced by intracavernous injection of phentolamine. These findings suggest that the intracavernous injection of papaverine and phentolamine may reduce psychological inhibition during pharmacocavernosometry. Nevertheless, our clinical experience has shown that even when high doses of papaverine and phentolamine are injected intracavernously, full erectile response can be inhibited by nervousness or anxiety of the patient. Thus, pharmacocavernosometry should be performed only in a relaxed setting after the physician has gained the patient's confidence. Any remaining nervousness or anxiety must be taken into account in the interpretation of the cavernosometric results.

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