Measurement of Detrusor Contractility in the Reflex Micturition of the Decerebrate Dog

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Department of Urology, Akita University School of Medicine, Akita 010 and* Department of Urology, Erasmus University Rotterdam, 3000 DR Rotterdam, The Netherlands

Nishizawa, O., Moriya, I., Fukuda, T., Matsuzaki, A., Harada, T., Tsuchida, S. and Van Mastrigt, R. Measurement of Detrusor Contractility in the Reflex Micturition of the Decerebrate Dog. Tohoku J. exp. Med., 1985, 147 (1), 109-110 — Detrusor contractility was measured in the reflex micturition of the decerebrate dog, using a computer directly connected to a urodynamic setup. Detrusor contractility parameters seem to be useful for evaluation of bladder function. —— detrusor contractility; reflex micturition; decerebrate dog; on-line computer

The detrusor contractility has been recently measured to evaluate detrusor function (Van Mastrigt and Van Duyl 1981; Van Mastrigt 1984). The present article describes the detrusor contractility in the reflex micturition of the decerebrate dog, analyzed using a computer connected directly to a urodynamic setup.

Five dogs were decerebrated in order to create reflex micturition. An electromagnetic flowmeter probe (Nihon Kohden, internal diameter 4 mm) was attached to the external urethral meatus. A double lumen catheter was inserted through the dome into the bladder. One channel was used to record the bladder pressure and the other to fill at a rate of 10 ml/min with physiological saline and to measure residual urine after the voiding cycle. Urine flow rate was measured by an electromagnetic flowmeter (Nihon Kohden, MF 26) connected to the probe. The channel for measuring bladder pressure was connected to a Statham pressure transducer and bladder pressure was recorded on a multichannel polygraph (Nihon Kohden, RM 6000) together with urine flow rate. The bladder pressure and urine flow rate were sent from the urodynamic setup to a computer (DEC, PW 350) via A/D converter which samples at 10 samples per second. If the urine flow rate exceeded a trigger level, samples were stored into two separate files, one for urine flow rate and one for bladder pressure, during the previous 25 sec of isometric contraction immediately preceding the micturition and 90 sec of the micturition.

As shown in Fig. 1, from the isometric contraction a phase plot was made, a plot of the rate of rise of force as a function of the force, and fitted with a straight line to obtain extrapolated maximum derivatives of the detrusor contraction force (U). By dividing U by circumference of the bladder (L), the parameter U/L was measured. The dimension of U/
L is force/time (for U)/length (for L), thus kg/sec³. From the pressure flow studies during voiding, a plot of contraction velocity (V) as a function of bladder pressure (P) was made, and fitted to the theoretical, hyperbolic pressure-velocity relationship to obtain the parameter V max (the intercept on the velocity axis) and P max (the intercept on the pressure axis). In order to try to characterize the fitted curve with one parameter the parameter W which is an approximation of the power generated per surface area of bladder was obtained by the formula: W=(P+P max/4) X (V+V max/4). The dimension of W is watt/m², thus kg/sec³.

Table 1 demonstrates the values of U/L and W max parameters in five dogs. This method has the great advantage that detrusor contractility parameters can be directly determined on line.

**Table 1. U/L and W max parameters representing detrusor contractility**

<table>
<thead>
<tr>
<th>Dog No.</th>
<th>U/L (kg/sec³)</th>
<th>W max (kg/sec³)</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>3.9±1.0 (n=2)</td>
<td>43.5±1.8 (n=2)</td>
</tr>
<tr>
<td>2</td>
<td>8.5±5.1 (n=5)</td>
<td>127.0±7.8 (n=5)</td>
</tr>
<tr>
<td>3</td>
<td>15.9±2.2 (n=4)</td>
<td>71.1±10.1 (n=4)</td>
</tr>
<tr>
<td>4</td>
<td>9.3±0.4 (n=4)</td>
<td>86.9±8.0 (n=4)</td>
</tr>
<tr>
<td>5</td>
<td>33.8±1.5 (n=4)</td>
<td>71.9±5.0 (n=4)</td>
</tr>
</tbody>
</table>

Values are expressed in terms of mean±S.D.
n, number of voiding cycles studied by measurement of detrusor contractility.

L is force/time (for U)/length (for L), thus kg/sec³. From the pressure flow studies during voiding, a plot of contraction velocity (V) as a function of bladder pressure (P) was made, and fitted to the theoretical, hyperbolic pressure-velocity relationship to obtain the parameter V max (the intercept on the velocity axis) and P max (the intercept on the pressure axis). In order to try to characterize the fitted curve with one parameter the parameter W which is an approximation of the power generated per surface area of bladder was obtained by the formula: W=(P+P max/4) X (V+V max/4). The dimension of W is watt/m², thus kg/sec³.

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**References**
