

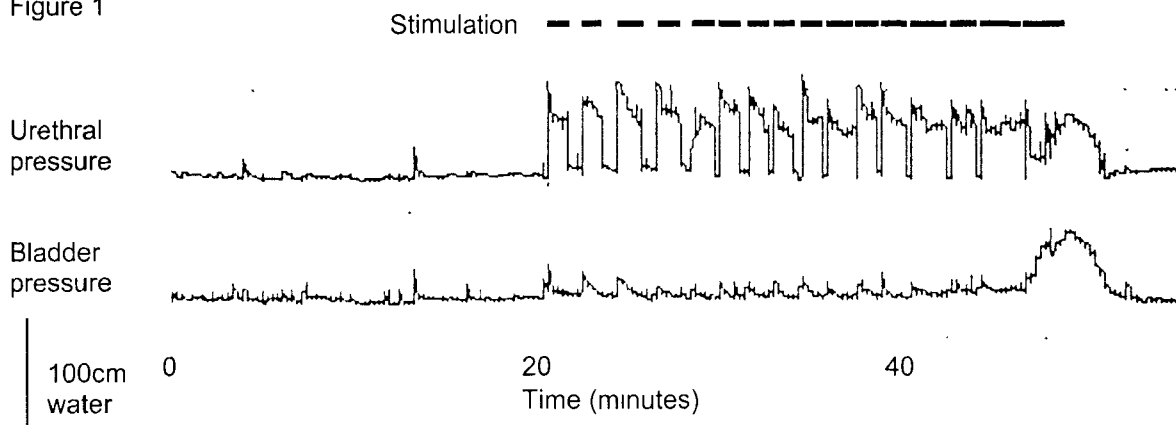
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Title (type in CAPITAL LETTERS, leave one blank line before the text) CONDITIONAL NEUROMODULATION OF END-FILL HYPERREFLEXIA TO INCREASE BLADDER CAPACITY IN SPINALLY INJURED PATIENTS
<p><u>Aims of study:</u> Stimulation of the Dorsal Penile (or Clitoral) nerve is known to suppress hyperreflexic bladder contractions in spinally injured patients(1). Such neuromodulation can be applied in several ways. Applied continuously, it increases bladder capacity in almost all cases(2). If applied at the start of a hyperreflexic contraction (conditionally), the strength of the contraction is markedly reduced. We are evaluating the use of neuromodulation via the posterior sacral roots to replace the need for posterior rhizotomy after the implantation of a Finetech-Brindley stimulator - in this case a Sacral Posterior and Anterior Root Stimulator (SPARS) (3). The stimulation will initially be continuous, but we aim to develop an implanted device that detects the start of hyperreflexic contractions and applies neuromodulation conditionally. The aim of this study was to determine the effects of conditional and continuous neuromodulation during slow bladder filling.</p> <p><u>Methods:</u> Seven spinally injured patients were studied. They all had lesions above L1, and in three patients the lesion was incomplete. Anticholinergics were stopped at least four days before the test. The bladder was filled at 10ml/min and in all cases two standard cystometrograms were performed to establish the baseline capacity, using a 4 channel solid state pressure transducer (Gaeltech, UK) to measure bladder and urethral pressure. Two different protocols were used to compare the effects of continuous and conditional neuromodulation. In the first (protocol A), four or six cystometrograms were performed, with continuous and conditional neuromodulation during alternate fills. In the second (protocol B), a series</p>

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of three cystometrograms was performed with conditional neuromodulation only, and on a different day the study was repeated using continuous neuromodulation only. In each protocol, a further control cystometrogram was performed at the end of the study. The neuromodulation in all cases was applied via skin electrodes to the dorsal penile nerve at a frequency of 15 pps and pulse width 200 μ s. The current was set at a level equal to twice the threshold for the pudendo-anal reflex (15 to 80 mA). In two patients we also examined the effects of conditional neuromodulation by stimulating the mixed sacral nerves using a Finetech-Brindley Sacral Nerve Root Stimulator Implant (figure 1). Conditional neuromodulation was triggered by a rise of 10cm in the bladder pressure trace, and lasted for one minute. Filling was stopped when there was urine flow per urethra or a rise in intravesical pressure of 35 cm H₂O.

Results: In each of the seven patients, the mean bladder capacity with conditional neuromodulation was greater than the initial controls. The increase ranged from 80 to 305ml (mean 170ml, standard deviation 95ml). It was significant (paired Student t test, $p < 0.01$). The bladder capacity in the final control cystometrogram was larger (mean increase 97ml, SD 103ml) than in the initial two control fills. In the four patients in protocol A, the means of both the conditional and continuous neuromodulation fills were increased over control, by a mean of 145ml (SD 107ml) and 98ml (SD 46ml) respectively.

Figure 1



Conclusions: This study has shown that both continuous and conditional neuromodulation through surface or implanted electrodes can significantly increase bladder capacity in spinally injured patients.

- (1) Experimental Physiology (1999), 84; 149-160
- (2) Neurourology and Urodynamics (1998), 17; 411-413
- (3) British Journal of Urology (2000), *in press*