Anal acoustic reflectometry – a novel method for predicting outcome of sacral nerve stimulation for faecal incontinence

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Introduction

- Sacral nerve stimulation (SNS) has become an established treatment for faecal incontinence. Prior to the insertion of a permanent implant, patients undergo a test period of percutaneous nerve evaluation (PNE) to evaluate the efficacy of treatment.
- Anal acoustic reflectometry (AAR) is a new, clinically reliable and reproducible technique of assessing anal sphincter function, offering a dynamic assessment and providing greater physiological insight compared to conventional manometry.1,2
- The aim of this study was to assess whether the parameters measured with AAR could predict the outcome from PNE.

Methods

- Data were collected prospectively from patients undergoing PNE. AAR and conventional anal manometry were performed on the day of surgery prior to the PNE procedure.
  - In AAR, a very thin, collapsible polyurethane bag measuring 6cm in length and 5mm in diameter (when fully inflated), is inserted into the anal canal (figure 1).
  - Cross-sectional area measurements are calculated along the entire length of the bag by the reflection co-efficients of sound waves sent into the bag by a transmitter.
  - The bag is slowly inflated and deflated, during which simultaneous opening and closing pressures are measured along the entire length of the anal canal.
  - The cross sectional area of the High Pressure Zone at each pressure level is plotted on a graph of Area vs. Pressure, allowing the AAR parameters to be determined (figure 2).
  - The Opening and Closing Pressures represent the pressure at which the anal canal just begins to open/close.
  - The Opening and Closing Elastances represent the resistance of the anal canal to opening and the ability of the anal canal to close down against a reducing pressure.
  - The Hysteresis is an expression of the energy dissipated during opening and closing of the anal canal.

Results

Table 1
Comparison of successful and unsuccessful patients

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Successful PNE (n=17)</th>
<th>Unsuccessful PNE (n=14)</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>At rest</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Opening Pressure (cmH₂O)</td>
<td>28 (8 – 92.8)</td>
<td>17 (20.1 – 85.2)</td>
<td>0.016*</td>
</tr>
<tr>
<td>Opening Elastance (cmH₂O/mm²)</td>
<td>1.09 (0.76 – 2.45)</td>
<td>0.99 (0.47 – 2.96)</td>
<td>0.184</td>
</tr>
<tr>
<td>Closing Pressure (cmH₂O)</td>
<td>20 (11.9 – 76.5)</td>
<td>14 (18.0 – 82.3)</td>
<td>0.127</td>
</tr>
<tr>
<td>Closing Elastance (cmH₂O/mm²)</td>
<td>1.11 (0.61 – 2.72)</td>
<td>0.84 (0.45 – 2.65)</td>
<td>0.047*</td>
</tr>
<tr>
<td>Hysteresis (%)</td>
<td>21 (45 – 24)</td>
<td>21 (5 – 47)</td>
<td>0.766</td>
</tr>
<tr>
<td>MRP (cmH₂O)</td>
<td>53 (11 – 127)</td>
<td>48 (18 – 177)</td>
<td>0.244</td>
</tr>
<tr>
<td>Voluntary contraction</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Squeeze Opening Pressure (cmH₂O)</td>
<td>48 (31 – 127)</td>
<td>29 (8 – 200)</td>
<td>0.211</td>
</tr>
<tr>
<td>Squeeze Opening Elastance (cmH₂O/mm²)</td>
<td>1.33 (0.55 – 2.71)</td>
<td>1.39 (0.67 – 2.33)</td>
<td>0.564</td>
</tr>
<tr>
<td>MSP (cmH₂O)</td>
<td>75 (32 – 167)</td>
<td>88 (14 – 245)</td>
<td>0.771</td>
</tr>
</tbody>
</table>

Comparison using Mann-Whitney U test, *significant at 0.05 level

- The acoustic parameter of Opening Pressure was significantly greater in those patients who had a successful PNE outcome.
- No significant difference was found in the manometric equivalent of Resting Pressure.
- The Closing Elastance was also significantly greater in the successful group.

Conclusion

- Anal acoustic reflectometry is a novel, clinically reliable technique providing a dynamic assessment of anal sphincter function.
- The acoustic parameters have greater sensitivity than routine anal manometry in determining those patients who are more likely to have a successful result from sacral nerve stimulation. This may have time and cost implications.
- The use of AAR in the evaluation of patients with faecal incontinence and the evaluation of therapeutic strategies is being established.

References