A preliminary economic evaluation of percutaneous neuromuscular electrical stimulation in the treatment of hemiplegic shoulder pain
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Record Status
This is a critical abstract of an economic evaluation that meets the criteria for inclusion on NHS EED. Each abstract contains a brief summary of the methods, the results and conclusions followed by a detailed critical assessment on the reliability of the study and the conclusions drawn.

Health technology
The study compared interventions for the treatment of hemiplegic shoulder pain (HSP). Specifically, percutaneous neuromuscular electrical stimulation (p-NMES) via electrodes implanted through the skin into the muscle, anti-inflammatory intra-articular (IA) injections and slings.

Type of intervention
Treatment.

Economic study type
Cost-effectiveness analysis and cost-utility analysis

Study population
As this was a modelling study a hypothetical cohort of 1,000 patients was modelled. The characteristics of the study population were not reported in the current study but in two published studies (Yu et al. 2001 and Renzenbrink et al. 2004, see ‘Other Publications of Related Interest’ below for bibliographic details).

Setting
The setting was rehabilitation centres. The economic analysis appears to have been carried out in the Netherlands.

Dates to which data relate
The effectiveness data were derived from studies published between 1997 and 2004. The dates of the resource use data were not reported. The price year appears to have been 2003.

Source of effectiveness data
The clinical data for the interventions included the effectiveness of treatment, the expected survival rate after stroke and the annual mortality rate. Treatment effectiveness was defined as the decrease in pain experienced by patients, based on a numerical rating scale (NRS).

Modelling
A model was used to combine the available clinical and cost data with the patient population survival data in order to estimate the cost-effectiveness of the treatment options. On account of the limited time horizon of the trials, data were extrapolated to reflect the long-term cost-effectiveness of the interventions. The consequences of the intervention were modelled for both a short-term period (1 year) and long-term period (10 years). However, the technique employed was not explicitly reported.
**Sources searched to identify primary studies**
The clinical effectiveness data were derived from two randomised controlled trials, two uncontrolled pilot studies and an uncontrolled trial. Each of these studies reported 6-month follow-up data. Three-month follow-up data for the effectiveness of IA injections were derived from two studies of unclear design, whereas 3-month follow-up data for slings were derived from a single source. Given the lack of available data on the decline in effectiveness of all interventions after a varying timeframe, data were based on expert opinion (a panel of rehabilitation physicians).

**Methods used to judge relevance and validity, and for extracting data**
The process used to identify the effectiveness data was not reported, nor was the methodology employed by the expert panel. No inclusion criteria for any parameters were specified. Survival data post-stroke were obtained through a search of the literature. Apart from two search terms, further details were not provided.

**Measure of benefits used in the economic analysis**
The measures of benefit used in the short-term analysis were the number of patients successfully treated and the quality-adjusted life-years (QALYs). The number of successfully treated patients was defined as the percentage of patients who experienced a 3-point decrease in pain, as measured on an NRS. QALYs were obtained through conversion of the Short Form 36 quality of life data. For the long-term analysis the measure of benefit was only the QALYs. For this analysis future benefits were discounted at an annual rate of 5%.

**Direct costs**
Direct health service costs were included in the analysis. These covered consultations in general practice, consultation and treatment in the rehabilitation centre, devices, prescriptions and the occupational therapist. The unit costs were mainly derived from national Dutch published costs. The price year was 2003. The resources and the unit costs were reported separately. Although the timeframe exceeded 2 years in the long-term analysis, discounting of the costs was not reported.

**Statistical analysis of costs**
No statistical analysis of the costs was conducted.

**Indirect Costs**
Productivity costs were not included in the analysis.

**Currency**
Euros (EUR).

**Sensitivity analysis**
Parameter uncertainty was investigated through a probabilistic sensitivity analysis based on Monte Carlo simulations. The parameter distributions were defined.

**Estimated benefits used in the economic analysis**
In accordance with the definition of success corresponding to a 3-point reduction in pain, the average percentage of patients treated successfully was 73% in the p-NMES group, 28% in the sling group and 42% in the IA injection group.

The 1-year QALY gains were 0.893 for p-NMES, 0.0301 for IA injections and 0.02 for slings.

**Cost results**
The average cost over 1 year was EUR 2,041 for p-NMES, EUR 98 for IA-injections and EUR 164 for slings.

**Synthesis of costs and benefits**

The incremental cost per successfully treated patient was EUR 6,268 when p-NMES was compared with IA injections and EUR 4,171 when p-NMES was compared with slings.

At the 1-year horizon, the incremental cost per additional QALY gained was EUR 32,821 when p-NMES was compared with IA injections and EUR 27,085 when p-NMES was compared with slings.

For a 10-year time horizon, the analysis demonstrated that the incremental cost per additional QALY gained of p-NMES, compared with any of the comparators, dropped below EUR 20,000 between the first and second year of analysis and remained below this threshold for all subsequent years.

The sensitivity analysis demonstrated that the results were sensitivity to variation in the QALYs gained.

**Authors’ conclusions**

Percutaneous neuromuscular electrical stimulation (p-NMES) would appear to be a cost-effective option for the treatment of hemiplegic shoulder pain (HSP), in both the short and long term, despite its higher costs.

**CRD COMMENTARY - Selection of comparators**

p-NMES appears to have represented a novel treatment option, while IA injections and slings seem to have been commonly used alternatives in the authors' setting. Although the authors discussed the existence of further alternative therapies, they did not include them in their analysis. This means that there is a possibility that the study was only a partial analysis.

**Validity of estimate of measure of effectiveness**

On the whole, the authors combined data from published studies, with only a minority of data being based on expert opinion. The authors did not report any search methods or inclusion criteria for anything other than the survival data. In addition, they did not provide any justification for their selection of the studies or estimates, although in the case of p-NMES the studies utilised were likely to be the only ones available. The authors also did not take the impact of differences between the studies identified, especially the study populations and the severity of the disease (acute, chronic), into consideration. Given the information provided in this paper, it is not possible to judge the validity of the data derived from the pilot studies and the uncontrolled trials.

**Validity of estimate of measure of benefit**

The authors used the percentage of patients who experienced a 3-point decrease in pain (measured on an NRS) and QALYs (derived from transforming SF-36 data) as measures of benefits in the short-term analysis. They elected to use the QALYs alone in the long-term analysis. These long-term benefits were discounted at an annual rate of 5%, which appears to have been appropriate in this instance but which may have implications for the generalisability of the study to different settings.

**Validity of estimate of costs**

Though not explicitly stated, the perspective of a third-party payer appears to have been adopted. In the case of materials and devices, charges appear to have been used to proxy prices; this was appropriate given the third-party payer perspective of the study. The costs and the quantities were reported separately. The costs do not appear to have been discounted in the long-term analysis. Although the cost data were reported to be highly skewed, no appropriate statistical analysis was undertaken. The costs appear to have been reported for the price year 2003.

**Other issues**
The authors did not compare their findings with those from other studies, so it is not known how far their results agree with other published results. In addition, the issue of the generalisability of the results was not directly addressed. The authors’ conclusions referred to patients with chronic HSP. However, it is not possible to comment on whether their conclusions reflected the scope of analysis, as the characteristics of the patients enrolled in the study were not provided. The authors noted that the sources of the effectiveness data (small uncontrolled trials, authors' assumptions) might have introduced uncertainty into the results. They also pointed out that no direct comparisons between the interventions could be made because each of them is implemented at different stages of HSP. This issue was not addressed in the authors' analysis when accounting for effectiveness, and it might have introduced bias into the results.

Implications of the study
The authors recommended that p-NMES should be used for the treatment of patients with chronic HSP. However, the concerns about the validity of the evidence used in the economic evaluation, as discussed in the commentary above, should be borne in mind when considering this recommendation. The authors called for a randomised controlled trial and a prospective Stage IV budget-impact study to investigate the use of p-NMES for the treatment of patients with acute and chronic HSP.

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Other publications of related interest
Because readers are likely to encounter and assess individual publications, NHS EED abstracts reflect the original publication as it is written, as a stand-alone paper. Where NHS EED abstractors are able to identify positively that a publication is significantly linked to or informed by other publications, these will be referenced in the text of the abstract and their bibliographic details recorded here for information.


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