The use of magnesium sulfate to prevent seizures in the pre-eclamptic gravida: a cost-effectiveness analysis


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 use of magnesium sulphate (MgSO4) seizure prophylaxis for pre-eclamptic women. MgSO4 therapy was given as a 6.g bolus followed by a 2 g/hour continuous infusion.

Type of intervention
Treatment.

Economic study type
Cost-effectiveness analysis.

Study population
The hypothetical target population comprised women with pre-eclampsia. No further details were given.

Setting
The setting was secondary care. The economic study was carried out in the USA.

Dates to which data relate
The effectiveness data were collected from studies published between 1984 and 2000. The dates relating to the resource use data were not reported, and neither was the price year.

Source of effectiveness data
The effectiveness data were derived from a review or synthesis of completed studies, augmented with authors’ assumptions.

Modelling
A decision analysis model was used to compare the costs and outcomes. No further details of the model were provided.

Outcomes assessed in the review
The outcomes assessed were:

the incidence of pre-eclampsia;
the incidence of severe pre-eclampsia (in those patients with pre-eclampsia);
the mild pre-eclampsia seizure rate;
the severe pre-eclampsia seizure rate;
the non-preventable seizure rate; and
the efficacy of MgSO4 maternal mortality.

**Study designs and other criteria for inclusion in the review**
The authors searched the medical literature for variable and probability estimates. Priority was given to information derived from randomised clinical trials. Data from non-randomised studies and from observational studies were used when no other estimates were available.

**Sources searched to identify primary studies**
MEDLINE was searched and the bibliographies of retrieved articles were reviewed.

**Criteria used to ensure the validity of primary studies**
Not reported.

**Methods used to judge relevance and validity, and for extracting data**
Not reported.

**Number of primary studies included**
Sixteen articles were used in the review.

**Methods of combining primary studies**
Data from the primary studies were combined using narrative methods. When there was limited information or a wide range of estimates, the authors reported that more conservative estimates were chosen.

**Investigation of differences between primary studies**
Not reported.

**Results of the review**
The incidence of pre-eclampsia was 0.07 (range: 0.05 - 0.1);
the incidence of severe pre-eclampsia (of those patients with pre-eclampsia) was 33% (range: 25 - 50);
the mild pre-eclampsia seizure rate was 0.01 (range: 0.05 - 0.02);
the severe pre-eclampsia seizure rate was 0.03 (range: 0.02 - 0.50);
the non-preventable seizure rate was 0.50 (range: 0.25 - 1.0); and
the efficacy of MgSO4 maternal mortality was 0.02 (range: 0.01 - 0.05).

**Methods used to derive estimates of effectiveness**
The authors made assumptions to supplement the results of the review.
Estimates of effectiveness and key assumptions
The authors made assumptions to augment the estimates for the mild and severe pre-eclampsia seizure rates, the non-preventable seizure rate, and the efficacy of MgSO4 maternal mortality.

Measure of benefits used in the economic analysis
The summary measures of health benefit were the number of seizures averted and the number of deaths averted.

Direct costs
A perspective for the analysis was not stated, although the hospital perspective appears to have been used. The authors seem to have been concerned with the immediate costs of pre-eclampsia, as well as the costs over a 30-year period. A 3% discount rate was used for the 30-year period. The analysis was concerned primarily with medication and related costs. These were obtained from the hospital pharmacy and were, therefore, derived from actual data. The time costs of the pharmacy personnel were also estimated. The unit costs were reported separately. The quantities were determined by the treatment duration, which was assumed to be 48 hours. The dates relating resource use were not reported, and neither was a price year for the analysis.

Statistical analysis of costs
No statistical analysis of the costs was reported.

Indirect Costs
The indirect costs were not measured.

Currency
US dollars ($).

Sensitivity analysis
A series of one-way sensitivity analyses were carried out to assess the impact of using the maximum and minimum values of each of the parameters on the results.

Estimated benefits used in the economic analysis
The number of seizures averted was 0 when no MgSO4 was used, 970 (21%) when selective treatment was used, and 1,627 (35%) when universal treatment was used.

The number of deaths averted was 0 when no MgSO4 was used, 19 (20%) when selective treatment was used, and 33 (36%) when universal treatment was used.

Cost results
The medication costs of MgSO4 were $10 per patient.

The total costs of MgSO4 (including preparation time and personnel time) were $35 per patient.

No treatment cost $0, selective treatment cost $3,234,000, and universal treatment cost $9,800,000.

Synthesis of costs and benefits
The cost per seizure averted was $3,333 (range: 1,667 - 6,667) for selective therapy and $6,024 (range: 3,012 - 12,048) for universal therapy. The incremental cost per additional seizure averted was $9,994 (range: 5,000 - 20,000).
The cost per death averted was $166,667 (range: 83,333 - 333,333) for selective therapy and $301,205 (range: 150,602 - 602,410) for universal therapy. The incremental cost per additional death averted was $469,000 (range: 250,000 - 1,000,000).

With selective therapy, the results were insensitive to changes in the incidence of pre-eclampsia and the risk of maternal death due to eclampsia.

With universal therapy, the results were insensitive to changes in the incidence of pre-eclampsia, the rate of severe versus mild disease, the seizure rate without treatment and the risk of maternal death due to eclampsia.

The efficacy of MgSO4 was reported to have a significant effect on the outcomes of both strategies.

Authors’ conclusions
The authors concluded “universal seizure prophylaxis with MgSO4 (magnesium sulphate) for all patients with pre-eclampsia was cost-efficient in the prevention of maternal mortality related to eclampsia”.

CRD COMMENTARY - Selection of comparators
The authors compared three treatment strategies (no therapy, selective therapy and universal therapy) using MgSO4 for patients with pre-eclampsia. Universal therapy was reported to be standard practice in the authors’ setting. Selective therapy was compared as the authors reported that there was no prior evidence to suggest who benefits most from the treatment.

Validity of estimate of measure of effectiveness
The authors did not state that a systematic review of the literature was carried out. The effectiveness estimates from the primary studies were combined but, although the authors provided some discussion of this, the methods used to combine the studies were not apparent. For instance, it was unclear whether the relative sizes of the studies were systematically taken into account. The authors considered the impact of differences between the primary studies on the effectiveness estimates, through a series of one-way sensitivity analyses. This enabled the authors to highlight those parameters that were most influential on the model used. Very few details of the model were reported. This will reduce the reader’s ability to verify the results or replicate the analysis in their own setting.

Validity of estimate of measure of benefit
The summary measures of health benefit were the numbers of seizures averted and deaths averted. These were estimated via the model and were appropriate for the clinical question studied.

Validity of estimate of costs
A perspective for the cost analysis was not reported. Therefore, it is not possible to assess whether all the relevant costs were included in the analysis. However, the analysis appears to have focused on the cost borne by the hospital, and it included medication and personnel costs. A thorough analysis from this perspective might also have included an element of overhead costs and hospitality costs. The authors discussed some cost elements that were omitted from the analysis, such as the costs incurred if a seizure took place and resulted in a longer stay in hospital and additional diagnostic tests. The authors estimated that the inclusion of these costs would have improved the cost-effectiveness of MgSO4. The unit costs were reported separately, enabling the reader to gain a more thorough understanding of the cost results.

Other issues
The authors made appropriate comparisons of their findings with the results from other studies. Some differences that were noted arose from the inclusion of Caesarean delivery in one study, which was not included in the current study. The issue of generalisability to other settings was not addressed and, as already suggested, reproducing the results in
other settings would be difficult given the lack of detail of the model. The results were not presented selectively. The conclusions drawn are a good reflection of the scope of the analysis and the population to which the results referred. Some limitations were presented. For example, costs that were omitted from the analysis and the importance of two assumptions on which the analysis was built, the assumptions that MgSO4 was efficacious in preventing seizures and that the prevention of seizures would produce fewer maternal deaths.

**Implications of the study**
The authors made no recommendations for policy or practice following their study. Although the authors did not explicitly call for further work to be carried out, they referred to the possibility that future work on MgSO4 may alter the assumptions underlying the study, thus affecting the results.

**Source of funding**
None stated.

**Bibliographic details**

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