Xenon and future anesthesia

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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
Xenon, and nitrous oxide (sevoflurane and isoflurane) anesthesia.

Type of intervention
Treatment; Anaesthesia.

Economic study type
Cost-effectiveness analysis.

Setting
Hospital. The economic study was carried out in Japan.

Dates to which data relate
The effectiveness data related to 1997. Resource dates were not presented and the price year was not stated.

Source of effectiveness data
The effectiveness data were derived from a review of previously completed studies.

Modelling
Not used.

Outcomes assessed in the review
The outcomes assessed were the time taken for inhalation induction and for emergence from anaesthesia and the correlation between time to extubation and duration of anaesthesia.

Sources searched to identify primary studies
Not stated.

Criteria used to ensure the validity of primary studies
Not stated.

Methods used to judge relevance and validity, and for extracting data
Not stated.
Number of primary studies included
Four studies were included in the review.

Methods of combining primary studies
Narrative method.

Results of the review
In the study of inhalation induction, as end-tidal MAC fraction increased faster with xenon than with sevoflurane, xenon resulted in shorter inhalation induction than sevoflurane (71 seconds versus 147 seconds, p<0.05). In the study of emergence from anaesthesia, xenon took a shorter time (average 3.6 minutes, p<0.01) than nitrous oxide-sevoflurane or nitrous oxide-isoflurane, which took about two to three times the time of xenon. Emergence time was shown not to be affected by the duration of xenon anaesthesia while it was shown to become longer with a longer duration of nitrous oxide-isoflurane anaesthesia (r²=0.54, p<0.001). In the study of mutual effects with another chemical, xenon was shown to have less effect in extending vecuronium-induced neuromuscular blockage than sevoflurane.

Measure of benefits used in the economic analysis
The authors did not develop a summary benefit measure. As such the benefits are assumed to be equal to the effectiveness results reported above.

Direct costs
The only reported costs are the bulk cost of xenon per litre and that of nitrous oxide at the time of publication of the paper in 1997.

Statistical analysis of costs
Not undertaken.

Indirect Costs
Not included.

Currency
Japanese Yen.

Sensitivity analysis
Not undertaken.

Estimated benefits used in the economic analysis
The estimated benefits are shown in the effectiveness results recorded above.

Cost results
Xenon costs about 60 times more than nitrous oxide (1,800 yen versus 30 yen) per litre.

Synthesis of costs and benefits
Costs and benefits were not combined. Xenon was shown to be a more effective anaesthetic than nitrous oxide with faster inhalation induction and emergence from anesthesia and less effects in extension of vecuronium-induced...
neuromuscular blockage. Environmentally, nitrous oxide is said to be related to the destruction of the ozone layer and also leads to greenhouse effects while xenon is not associated with either. However, the costs of xenon are much higher than those of nitrous oxide. The higher costs of xenon can be reduced in two ways: firstly by using a closed-circuit method which minimises the flow of fresh gas and secondly by recycling xenon.

**Authors' conclusions**

Xenon has been proven to be a very effective anaesthetic and has great potential for the future. However, before being used widely as a clinical anaesthetic, further studies have to be conducted concerning its characteristics and to find solutions to some of the problems encountered so far.

**CRD COMMENTARY - Selection of comparators**

The rationale for the choice of comparator is clear. Traditional anaesthesia using nitrous oxide (sevoflurane and isoflurane) was less effective than xenon and was also associated with harmful effects, both to those administering the anaesthesia and to the environment. However, the cost of xenon is prohibitive and limits its wider application.

**Validity of estimate of measure of benefit**

The estimates of benefit were shown to be strongly in favour of xenon. However, each outcome analysed was derived from a separate trial and there is no explanation regarding the quality of the literature review in identifying other potentially suitable studies for inclusion. However, at least one author was involved with all trials reviewed which suggests the study might also be considered as being a single trial with four sub-trials.

**Validity of estimate of costs**

The authors only considered the direct costs of each anaesthetic per litre. As such one might expect that other costs might need to be considered such as those associated with any adverse effects to both patients and those administering each anaesthetic. The costs associated with damage to the ozone layer are clearly not feasible although the authors present this as a valid reason for preferring xenon.

**Other issues**

The results might be considered as a preliminary indicator of the superior effectiveness of xenon, but more analysis of the costs and long term effectiveness of its use needs to be undertaken. If the analysis is able to capture external costs, such as those associated with damage to the environment, its cost-effectiveness may become more favourable.

**Implications of the study**

More research is required to demonstrate that xenon is the most cost-effective choice of anaesthesia.

**Source of funding**

None stated.

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