Surgery or assisted reproduction: a decision analysis of treatment costs in male infertility
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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 authors studied assisted reproductive technologies (ART), specifically intrauterine insemination (IUI) and sperm retrieval/intracytoplasmic sperm injection (ICSI). They compared these with surgery, in particular, the surgical reversal of vasectomy and surgical varicocelectomy.

Type of intervention
Treatment for infertility.

Economic study type
Cost-effectiveness analysis.

Study population
The hypothetical study population comprised male patients with infertility due to vasectomy or varicocele.

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

Dates to which data relate
The effectiveness data were obtained from studies published between 1997 and 2004. The dates when the cost data were collected and the price year were not reported.

Source of effectiveness data
The effectiveness data were derived from a review and synthesis of published studies, supplemented with authors' assumptions.

Modelling
The authors used a decision analytic model to depict the treatment choices and subsequent events associated with treatment. The model aimed to demonstrate the costs and outcomes, in terms of pregnancies achieved, for each strategy. The model was analysed using Data 2.5 software (TreeAge, Williamstown, MA).

Outcomes assessed in the review
The outcomes estimated during the review were probability values for inclusion in the model. The authors sought evidence applicable to their model. There was no evidence that the review was systematic.

Study designs and other criteria for inclusion in the review
The authors reported that data were gathered from the literature regarding vasectomy reversal patency and pregnancy rates after IUI and sperm retrieval/ICSI. Probabilities for the varicocele model were taken from published institutional data. No specific inclusion or exclusion criteria were reported.

**Sources searched to identify primary studies**
Not reported.

**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**
Seven studies were included in the review.

**Methods of combining primary studies**
The authors used the decision model to combine estimates from the primary studies. It was unclear whether multiple sources were combined to estimate single probabilities within the model.

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

**Results of the review**
The probability of patency following bilateral vasovasostomy was 87%.

The probability of patency following vasovasostomy/vasoepididymostomy was 70%.

The probability of patency following bilateral vasoepididymostomy was 65%.

The probability of pregnancy following vasectomy reversal was 30%.

The probability of pregnancy following one ICSI cycle was 30%.

The probability of pregnancy following four IUI cycles was 32%.

Pregnancy rates following varicocelectomy were:

16.5% for a preoperative total sperm mobility count (TMC) of 0 to 1.5,

30.6% for a TMC of 1.5 to 5,

36.2% for a TMC of 5 to 10,

39.7% for a TMC of 10 to 20,

58.3% for a TMC of 20 to 40, and

61.5% for a TMC of 40+. 
**Methods used to derive estimates of effectiveness**
The authors supplemented their estimates with some assumptions.

**Estimates of effectiveness and key assumptions**
The probability of seeking secondary treatment after primary treatment failure was assumed to be 50%.

The authors stated that the pregnancy rates following ICSI and IUI were assumptions, but then supported this with a reference from the literature (the values are reported above).

**Measure of benefits used in the economic analysis**
The summary measure of health benefits was the number of pregnancies achieved.

**Direct costs**
The authors estimated the cost of pregnancy. Although a perspective for the analysis was not reported, the costs seem to have been estimated from the perspective of the health care provider. The costs for the interventions were estimated from total charges at the authors’ institution. It seems as though discounting was not required as the immediate costs of the surgery or intervention was the focus for the analysis. The unit costs for each treatment alternative were inputs into the model, and the quantities were defined as one treatment. A price year was not reported.

**Statistical analysis of costs**
The costs were treated deterministically.

**Indirect Costs**
The indirect costs were not estimated. They would not have been relevant if the perspective of the study was that of the health care provider.

**Currency**
US dollars ($).

**Sensitivity analysis**
One- and two-way sensitivity analyses were carried out to estimate the impact of reversal patency rates and pregnancy rates on the cost per pregnancy achieved.

**Estimated benefits used in the economic analysis**
The pregnancy rates were used as an input to sensitivity analyses to determine the cost per pregnancy achieved. Pregnancy rates of between 10 and 50% were considered.

**Cost results**
The cost of microsurgical vasovasostomy was $10,000.

The cost of microsurgical varicocelectomy was $4,500.

The cost of one in vitro fertilisation-ICSI cycle was $10,000.

The cost of one IUI cycle was $500.
Synthesis of costs and benefits
For post-vasectomy infertility, in the base-case with 80% patency and 30% pregnancy, the expected cost per pregnancy was $38,983 for initial vasectomy reversal and $39,506 for sperm retrieval/ICSI. Sperm retrieval/ICSI became more cost-effective if patency rates were lower (<80%). The pregnancy rate did not affect the relative cost-effectiveness of the interventions.

For varicocele-associated infertility, the overall initial surgical repair was more cost-effective than ART. However, when the TMC was very low, IUI was more cost-effective. These results were sensitive to the pregnancy rates.

Authors' conclusions
Vasectomy reversal is more cost-effective than sperm retrieval and in vitro fertilisation-intracytoplasmic sperm injection (ICSI). However, the authors highlighted their threshold analyses, which indicated the need for individual consultation with urologists and quality standards to be strictly adhered to in order for the correct treatment to be identified.

CRD COMMENTARY - Selection of comparators
The authors compared ART and classic surgery for male infertility. The specific ART or surgical treatment depended on the cause of infertility (i.e. vasectomy or varicocele). It was unclear from the study which of the treatments was most common in their authors' setting, or whether a mix of the treatments was used depending on patient characteristics.

Validity of estimate of measure of effectiveness
The authors did not state that a systematic review of the literature was carried out. As the analysis was model-based, it would appear that they selected studies that provided data relevant for inclusion in the model. The study would have benefited from a more thorough discussion of the methodology underlying the review of the literature. For instance, although the authors searched literature relating to vasectomy reversal patency and pregnancy rates after IUI and sperm retrieval/ICSI, it was unclear whether they identified all possible literature, or how they selected those data that were included. A report of the sources searched might help the reader to gain a deeper understanding of likely and unlikely sources, should they aim to carry out a similar analysis in their own setting. More specifically, the authors might have reported the exact source of each probability input, or reported whether the variable estimate was the product of combining primary source data.

Validity of estimate of measure of benefit
The authors used the number of pregnancies achieved as a summary measure of benefit, but used this as an input to their sensitivity analysis to estimate the cost per pregnancy achieved. This outcome enables a cost per pregnancy to be estimated and therefore facilitates comparisons with similar studies.

Validity of estimate of costs
The cost analysis provided a basic indication of the likely costs of treatment over a very short time horizon. The authors might have considered the longer run costs associated with treatment failures; a long run view might also have affected the pregnancy rate achieved. Reporting a perspective allows readers to gain a greater understanding of the results presented. For instance, a societal perspective would have encompassed broader economic costs to society such as the lost economic productivity relating to stress and attendance at clinics. Reporting a price year would have facilitated comparisons with similar studies; without a price year for costs it would be misleading to try to make such comparisons. The sensitivity analysis carried out was beneficial for providing a broader understanding of the key cost-drivers in the model.

Other issues
The authors were able to make some comparisons of their findings with those of other authors. For instance, the
observed patency threshold beyond which vasectomy remains cost-effective was substantiated by a review of the literature. The issue of generalisability was also well discussed. In particular, the authors emphasised how the model might be tailored to be accurate for alternative settings and populations and even individual surgeons, depending on their success rates. The authors presented a range of results and substantiated these with one- and two-way sensitivity analyses. The results and conclusions drawn were an accurate representation of the scope of the study. Several limitations were presented. These focused on factors not considered, such as the number of children desired, social and monetary costs in the female partner, and time lost from work.

**Implications of the study**
The authors highlighted how their decision model provides a framework for further work and emphasised that future studies might concentrate on the refinement of the variable estimates.

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