Prophylactic cesarean delivery for fetal macrosomia diagnosed by means of ultrasonography: a Faustian bargain?

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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
Prophylactic caesarean delivery for foetal macrosomia diagnosed by means of ultrasonography, for estimated foetal weight 4000g or more (4000g policy), or for estimated foetal weight 4500g or more (4500g policy), was compared to management without ultrasound.

Type of intervention
Diagnosis and primary prevention.

Economic study type
Cost-effectiveness analysis.

Study population
The study population comprised 1,000,000 hypothetical pregnancies not complicated by diabetes and 1,000,000 hypothetical pregnancies complicated by diabetes.

Setting
The setting was secondary care. The economic study was carried out in Birmingham, Alabama, USA.

Dates to which data relate
Effectiveness evidence was obtained from sources published between 1973 and 1995. Costing data were obtained from a source published in 1994. The price year was 1995.

Source of effectiveness data
The source of the effectiveness data was a review/synthesis of the literature.

Modelling
A decision analytic model was constructed to assess the costs and effectiveness of the different strategies.

Outcomes assessed in the review
The outcomes assessed in the review were:

the probability of shoulder dystocia with non-diabetic mothers when foetal weight was less than 4000g, between 4000g and 4499g and greater than 4500g;

the probability of shoulder dystocia with diabetic mothers when foetal weight was less than 4000g, between 4000g and
4499g and greater than 4500g;

the probability of brachial plexus injury with shoulder dystocia when foetal weight was less than 4000g, between 4000g and 4499g and greater than 4500g;

the probability of permanent injury;

the sensitivity and specificity of ultrasonography;

birth weight prevalence with non-diabetic mothers when foetal weight was less than 4000g, between 4000g and 4499g and greater than 4500g;

birth weight prevalence with diabetic mothers when foetal weight was less than 4000g, between 4000g and 4499g and greater than 4500g; and

probability of caesarean delivery when foetal weight was less than 4000g, between 4000g and 4499g and greater than 4500g.

Study designs and other criteria for inclusion in the review
Not reported.

Sources searched to identify primary studies
Sources were retrieved from MEDLINE and from the bibliographies of the retrieved reports. If data could not be abstracted from the available literature, local sources were used. Virtually all estimates were derived from English language articles published from 1974.

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
At least 31 studies were included in the review.

Methods of combining primary studies
The narrative method was used to combine the results of the individual primary studies.

Investigation of differences between primary studies
Not reported.

Results of the review
The results of the review were as follows:

The probability of shoulder dystocia, with non-diabetic mothers, was 0.0065 (range: 0.00245 - 0.0105) when foetal weight was less than 4000g. 0.067 (range: 0.0343 - 0.0996) when between 4000g and 4499g, and 0.145 (range: 0.0980 - 0.22) when greater than 4500g.
The probability of shoulder dystocia, with diabetic mothers, was 0.022 (range: 0.00638 - 0.0370) when foetal weight was less than 4000g, 0.139 (range: 0.0478 - 0.231) when between 4000g and 4499g, and 0.525 (range: 0.375 - 0.833) when greater than 4500g.

The probability of brachial plexus injury with shoulder dystocia was 0.09 (range: 0.06 - 0.12) when foetal weight was less than 4000g, 0.18 (range: 0.12 - 0.24) when between 4000g and 4499g, and 0.26 (range: 0.173 - 0.347) when greater than 4500g.

The probability of permanent injury was 0.067 (range: 0.01 - 0.194).

The sensitivity and specificity of ultrasonography was 0.6 (range: 0.5 - 1) and 0.9 (range: 0.5 - 1) respectively.

The birth weight prevalence with non-diabetic mothers was 0.903 (range: 0.806 - 0.903) when foetal weight was less than 4000g, 0.082 (range: 0.082 - 0.157) when between 4000g and 4499g, and 0.015 (range: 0.0015 - 0.037) when greater than 4500g.

The birth weight prevalence with diabetic mothers was 0.768 (range: 0.661 - 0.768) when foetal weight was less than 4000g, 0.171 (range: 0.171 - 0.220) when between 4000g and 4499g, and 0.061 (range: 0.061 - 0.119) when greater than 4500g.

The probability of caesarean delivery was 0.18 (range: 0.094 - 0.282) when foetal weight was less than 4000g, 0.27 (range: 0.141 - 0.423) when between 4000g and 4499g, and 0.45 (range: 0.235 - 0.705) when greater than 4500g.

Measure of benefits used in the economic analysis
The measure of health benefit used in the analysis was the number of permanent brachial plexus injuries avoided.

Direct costs
Some quantities were reported separately from costs. The direct costs used in the analysis were those of the third party payer. Direct costs included in the analysis were the costs of the ultrasonography, the cost of plexus injury rehabilitation, the cost of vaginal delivery and the cost of caesarean delivery before and in labour. Direct costs for the three management strategies were obtained from the decision analytic model. Unit costs were obtained from actual data: the cost of the ultrasound was the reimbursement fee from the largest third party payer in Alabama, the cost of treating a neonatal brachial plexus injury was obtained from consultation with the Occupational Therapy Department of the Children's hospital of Alabama, the costs of vaginal and caesarean delivery were estimated from the Metropolitan Life Insurance Company. Charges were converted to costs using a cost-to-charge ratio of 0.5. Discounting was not conducted as the length of follow-up was less than one year. The study reported incremental costs. Costs were adjusted for inflation by using a multiplicative factor of 1.05. The price year was 1995.

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

Indirect Costs
Indirect costs were not included.

Currency
US dollars ($).

Sensitivity analysis
A one-way sensitivity analysis was performed on all input parameters.
Estimated benefits used in the economic analysis
In non-diabetic women, the number of permanent brachial plexus injuries was 157 with standard management, 134 for ultrasound and elective caesarean delivery if foetal weight was greater than 4500g and 108 for ultrasound and elective caesarean delivery if foetal weight was greater than 4000g.

In diabetic women, the number of permanent brachial plexus injuries was 662 with standard management, 446 for ultrasound and elective caesarean delivery if foetal weight was greater than 4500g and 339 for ultrasound and elective caesarean delivery if foetal weight was greater than 4000g.

Cost results
In non-diabetic women, the cost in millions of dollars was $3,976 with standard management, $4,177 for ultrasound and elective caesarean delivery if foetal weight was greater than 4500g and $4,217 for ultrasound and elective caesarean delivery if foetal weight was greater than 4000g.

In diabetic women, the cost in millions of dollars was $4,047 with standard management, $4,248 for ultrasound and elective caesarean delivery if foetal weight was greater than 4500g and $4,330 for ultrasound and elective caesarean delivery if foetal weight was greater than 4000g.

Synthesis of costs and benefits
In non-diabetic women, the cost ($ Millions) per permanent injury avoided was 8.7 for ultrasound and elective caesarean delivery if foetal weight was greater than 4500g and 4.9 for ultrasound and elective caesarean delivery if foetal weight was greater than 4000g, relative to the standard management therapy.

In diabetic women, the cost ($ Millions) per permanent injury avoided was 0.93 for ultrasound and elective caesarean delivery if foetal weight was greater than 4500g and 0.88 for ultrasound and elective caesarean delivery if foetal weight was greater than 4000g, relative to the standard management therapy.

In the sensitivity analysis, for non-diabetic women, using parameters that favoured the ultrasound policies in general did not improve their functioning to a clinically reasonable level. For diabetic women, under alternate estimates, the expected performance of the ultrasonography policies was improved especially at the 4500g thresholds. The estimate for ultrasonography specificity critically influenced the outcome of the analysis. The authors also reviewed recently published data and concluded that the results of their model remained valid in light of the newly available studies.

Authors' conclusions
For the 97% of pregnant women who are not diabetic, a policy of elective caesarean delivery for ultrasonographically diagnosed foetal macrosomia is medically and economically unsound. In pregnancies complicated by diabetes, such a policy appears to be tenable, although the merits of such an approach are debatable. In light of recent data, optimising the management of shoulder dystocia seems to the most immediate and tenable approach to the prevention of birth related brachial plexus injury.

CRD COMMENTARY - Selection of comparators
A justification was given for the comparator used, namely standard management during delivery to avoid shoulder dystocia. You, as a user of this database, should decide if this is a widely used health technology in your own setting.

Validity of estimate of measure of effectiveness
The authors did not state that a systematic review of the literature had been undertaken, however, the methodology for conducting the review was thorough and well reported. The effectiveness estimates were combined using the narrative method and the source of the estimates and confidence intervals was clearly reported. The estimates of effectiveness were credibly derived from the primary studies.
Validity of estimate of benefit
The estimation of benefits was modelled using a decision analytic model, which was appropriate for the study question.

Validity of estimate of costs
In general the costing was well conducted and reported. All categories of cost relevant to the perspective adopted appear to have been included in the analysis. For each category of cost, all relevant costs were included in the analysis. A number of quantities were reported separately from the costs. A sensitivity analysis was conducted on prices. The price year was reported and prices were adjusted for inflation. Discounting was, appropriately, not conducted, as the time horizon of the study was less than two years.

Other issues
The authors did not make comparisons of their findings with those from other studies. The issue of generalisability to other settings was addressed through extensive sensitivity analyses. The authors did not appear to present their results selectively. The authors did not report any further limitations to the study.

Implications of the study
The authors' findings suggest that optimizing the management of shoulder dystocia appears to be the most immediate and tenable approach to the prevention of birth-related brachial plexus injury.

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