Cost-effectiveness of presentation versus delayed troponin testing for acute myocardial infarction

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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.

CRD summary
This study examined the cost-effectiveness of delayed troponin testing, compared with testing upon presentation, for patients attending hospital with suspected myocardial infarction, but a normal or non-diagnostic electrocardiogram and no major comorbidities that would require admission. The authors concluded that troponin testing at 10 hours was unlikely to be cost-effective, compared with high-sensitivity troponin testing at presentation, in most scenarios. The analysis used a valid cost-effectiveness framework and the authors’ conclusions appear to be robust.

Type of economic evaluation
Cost-utility analysis

Study objective
This study examined the cost-effectiveness of delayed troponin testing, compared with testing upon presentation, for patients attending hospital with suspected myocardial infarction, but a normal or non-diagnostic electrocardiogram and no major comorbidities that would require admission.

Interventions
The five strategies were: no testing, testing with a 10% coefficient of variation (CV) threshold, normal testing, high-sensitivity testing, and delayed testing. With no testing, all patients were discharged without treatment. For all testing strategies, measurement occurred on presentation. For normal, high-sensitivity, and delayed testing, the 99th percentile was used as the threshold. For delayed testing, a second test was given, to all those who tested positive on presentation, 10 hours after symptom onset.

Location/setting
UK/tertiary care.

Methods
Analytical approach:
The analysis was based on a decision model, with a lifetime horizon. The authors stated that the perspective was that of the NHS in England and Wales.

Effectiveness data:
The test accuracy for the troponin assay at presentation was from a published meta-analysis. Other published studies or official statistics were used for the other model parameters. It was assumed that troponin testing at 10 hours was the gold standard with perfect accuracy. The sensitivity and specificity of the diagnostic tests were key inputs for the model.

Monetary benefit and utility valuations:
The utility values were from the literature.

Measure of benefit:
Quality-adjusted life-years (QALYs) were used as the summary benefit measure. Survival was discounted.

Cost data:
The economic analysis included the costs of the tests, hospital stay, treatment for myocardial infarction, subsequent cardiac events, and lifetime care for patients with coronary artery disease. These costs were NHS reference costs or from published studies. They were in UK £.

Analysis of uncertainty:
Probabilistic sensitivity analyses were performed to estimate the mean costs and QALYs of the alternative strategies and cost-effectiveness acceptability curves were constructed. An analysis was performed using the high-sensitivity troponin I test instead of the high-sensitivity troponin T test, as the I test had lower sensitivity and higher specificity. Another analysis considered the measurement of high-sensitivity troponin I at presentation and three hours later. Three scenarios considered different delays between the results being available and a decision on admission being made.

Results
In the whole cohort, with no testing the expected costs were £965,994.41 and the QALYs were 26,226.68.

For the three scenarios of delay between result and decision, the expected costs ranged from £1,560,351 to £1,621,152 with testing with a CV threshold; from £1,609,760 to £1,705,989 with normal testing; from £1,806,910 to £2,030,901 with high-sensitivity testing; and from £2,016,540 to £2,705,696 with delayed testing. The QALYs were 26,344.84 with CV testing, 26,352.42 with normal testing, 26,378.75 with high-sensitivity testing, and 26,386.36 with delayed testing.

Compared with the next most effective alternative, the incremental costs per QALY gained with the CV, normal, and high-sensitivity testing strategies were well below the threshold of £20,000 per QALY gained. The incremental cost per QALY gained with the addition of delayed testing was only below a threshold of £30,000 per QALY gained when it was assumed that a treatment decision was made as soon as the result was available. Otherwise, the delayed strategy was not cost-effective.

Similar results were found in the probabilistic sensitivity analysis. In the alternative scenarios, high-sensitivity troponin I at presentation and three hours later was most cost-effective, compared with testing on presentation, and with testing on presentation and at 10 hours, regardless of the assumptions made.

Authors' conclusions
The authors concluded that delayed troponin testing at 10 hours was unlikely to be cost-effective, compared with high-sensitivity troponin testing at presentation, in most scenarios. Repeat high-sensitivity testing at three hours from presentation might be more cost-effective, but needed further investigation.

CRD commentary
Interventions:
The selection of the comparators was appropriate, as the available testing strategies were considered, and an alternative troponin test was considered.

Effectiveness/benefits:
The accuracy of the troponin test at presentation was a key input for the model and was from a meta-analysis, which should have ensured the inclusion of most of the relevant data, but the analysis was not described. It was assumed that the sensitivity and specificity of testing at 10 hours was 100%, making the results conservative against testing at presentation. The other sources were not described and it is difficult to fully judge the validity of the studies used. Extensive sensitivity analysis was conducted on all the model parameters. QALYs were an appropriate benefit measure for patients with suspected myocardial infarction, given its impact on survival and quality of life. The derivation of the utility values was not described.

Costs:
The types of costs and the data sources were consistent with the perspective stated. The unit costs for the troponin tests were reported, but other costs were presented as category totals. Official tariffs representative of the UK were used for most items. Probabilistic distributions were assigned to the costs in the sensitivity analyses. The price year was not reported, limiting the possibility of replicating or updating the analysis.
The results were clearly presented, with additional findings available in online tables. An incremental approach was appropriately used to synthesise the costs and benefits of the alternative strategies, and conventional cost-effectiveness thresholds were used. Appropriate sensitivity analyses were carried out to assess uncertainty, and the methods and results were clearly reported. The future costs and benefits appear to have been discounted, but the rates were not reported. The authors acknowledged some limitations to their analysis, mainly related to the need for some assumptions. The findings appear to be specific to the UK and it is unclear whether they might be relevant to other settings.

Concluding remarks:
The analysis used a valid cost-effectiveness framework and the authors’ conclusions appear to be robust.

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