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Prolonged conservative care versus early surgery in patients with sciatica from lumbar disc herniation: cost utility analysis alongside a randomised controlled trial

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ABSTRACT

Objective To determine whether the faster recovery after early surgery for sciatica compared with prolonged conservative care is attained at reasonable costs.

Design Cost utility analysis alongside a randomised controlled trial.

Setting Nine Dutch hospitals.

Participants 283 patients with sciatica for 6-12 weeks, caused by lumbar disc herniation.

Interventions Six months of prolonged conservative care compared with early surgery.

Main outcome measures Quality adjusted life years (QALYs) at one year and societal costs, estimated from patient reported utilities (UK and US EuroQol, SF-6D, and visual analogue scale) and diaries on costs (healthcare, patient's costs, and productivity).

Results Compared with prolonged conservative care, early surgery provided faster recovery, with a gain in QALYs according to the UK EuroQol of 0.044 (95% confidence interval 0.005 to 0.083), the US EuroQol of 0.032 (0.005 to 0.059), the SF-6D of 0.024 (0.003 to 0.046), and the visual analogue scale of 0.032 (-0.003 to 0.066). From the healthcare perspective, early surgery resulted in higher

costs (difference €1819 (£1449; \$2832), 95% confidence interval €842 to €2790), with a cost utility ratio per QALY of €41 000 (€14 000 to €430 000). From the societal perspective, savings on productivity costs led to a negligible total difference in cost (€-12, €-4029 to €4006).

Conclusions Faster recovery from sciatica makes early surgery likely to be cost effective compared with prolonged conservative care. The estimated difference in healthcare costs was acceptable and was compensated for by the difference in absenteeism from work. For a willingness to pay of €40 000 or more per QALY, early surgery need not be withheld for economic reasons.

Trial registration Current Controlled Trials ISRCTN 26872154.

INTRODUCTION

In a randomised controlled trial we compared the effectiveness of early surgery for sciatica with six months of prolonged conservative care.¹⁻³ We found faster recovery after early surgery, but no difference after a year.

Early surgery is associated with higher short term healthcare costs than prolonged conservative care. We carried out a cost utility analysis of our randomised

controlled trial, comparing observed quality adjusted life years (QALYs) at one year with observed societal costs at one year.

METHODS

Overall, 283 patients participated in a randomised controlled trial comparing prolonged conservative care for sciatica with early surgery.¹ Both groups were similar at baseline (see bmj.com).^{2,3}

Participants were aged 18-65 years, with a radiologically confirmed disc herniation and lumbosacral radicular syndrome of six to 12 weeks's duration (see bmj.com for exclusions). Surgery was scheduled within two weeks after randomisation. Prolonged conservative care was provided by the general practitioner. If sciatica persisted six months after randomisation, microdiscectomy was offered.

Utilities and QALYs

Utilities represent the valuation of the quality of life of the patients. Patients described their quality of life using the EuroQol classification system (EQ-5D),⁴ from which we calculated utilities for the United Kingdom and United States.^{5,6} Similarly, patients reported their quality of life using the SF-36, from which we calculated the SF-6D utilities.⁷ Both EQ-5D and SF-6D provide societal valuations. We also obtained valuations by the patients, using a visual analogue scale. We transformed the values to a utility scale.⁸

We obtained measurements for EQ-5D and the visual analogue scale at -2, 0, 2, 4, 8, 12, 26, 38, and 52 weeks after randomisation, and for SF-36 at -2, 8, 26, and 52 weeks after randomisation. We imputed missing values using the rounded average within the same group at the same time. From the area under the utility curves we calculated the average utility during each separate quarter of the year after randomisation and during the year (QALYs).

Costs

Costs from the societal perspective were converted to price levels in March 2008 using the general Dutch consumer price index.⁹ Patients used cost diaries to report variables such as admissions to hospital, informal care, and absenteeism from work. For periods that were not covered by questionnaire we imputed with the closest available diary from the same patient. We corrected for selective non-response by multiply imputing of cost data from patients who did return any diaries (from same group and of same surgical status).¹⁰ From the diagnosis-treatment prices available for 75 Dutch centres, we excluded the two highest and two lowest prices. The remaining prices ranged from €3421 (£2726; \$5327) to €4935 (average €4002). To introduce a cost structure dependent on hospital stay, we converted the average price to €2357 per hospital admission plus €390 per bed day.^{11,12}

For other health care we used Dutch standard prices,¹¹⁻¹⁴ including patients' time¹⁴ and travel costs.¹¹ We valued the reported hours of absenteeism

from work during the one year period according to the human capital method.¹¹

Analysis

According to protocol the base case cost utility analysis compared societal costs at one year to QALYs at one year based on the UK EQ-5D. We carried out sensitivity analyses on the use of different utility measures (UK EQ-5D, US EQ-5D, SF-6D, or visual analogue scale) and on the included cost categories (societal or healthcare).

We calculated confidence intervals for cost utility ratios as those willingness to pay values for which the difference in net benefit was not significantly different.¹⁵ To facilitate multiple imputation techniques we analysed group differences using standard *t* tests for unequal variance. All analyses followed the intention to treat principle.

RESULT

Utilities and QALYs

According to the EQ-5D, the valuation of quality of life two weeks after randomisation for early surgery for sciatica was worse than for prolonged conservative care (see bmj.com). Other than that the utility measures were almost consistently better after early surgery. The largest difference in utilities was 0.123 (95% confidence interval 0.061 to 0.185), according to the UK EQ-5D, eight weeks after randomisation.

QALYs during all four quarters and according to all four utility measures were consistently more favourable after early surgery (see bmj.com). The first two quarters showed significant differences on all four measures. Over the first year early surgery provided significantly better QALYs (UK and US EQ-5D and SF-6D) or marginally significantly better QALYs (visual analogue scale). The difference in QALYs according to the UK EQ-5D was 0.044 (95% confidence interval 0.005 to 0.083), the US EQ-5D was 0.032 (0.005 to 0.059), the SF-6D was 0.024 (0.003 to 0.046), and the visual analogue scale was 0.032 (-0.003 to 0.066).

Healthcare costs

Of the patients randomised to early surgery, 89% had surgery during the first year compared with 40% of those randomised to prolonged care (see bmj.com); 4% and 1% had recurrent sciatica leading to surgery during the first year. The difference in surgery resulted in a cost difference of €2127 (95% confidence interval €1345 to €2908).

The higher costs of early surgery were partly compensated for by significant savings on visits to general practitioners, physical therapy in the third quarter, and analgesics. Regardless, over the first year, total healthcare costs after early surgery remained significantly higher than after prolonged care (difference in costs per patient €1819, €842 to €2790).

Societal costs

Productivity costs were higher in the first quarter but lower in later quarters. The total difference in

absenteeism from work per patient was 39 (–67 to 144) hours in favour of surgery, with an associated difference in productivity costs of €2445 (–€1132 to €6019). After one year 6% of the patients who had early surgery reported disability compared with 4% after prolonged care (difference 2%, –4% to 7%). The total non-healthcare costs after early surgery were lower than after prolonged care, with a total non-significant difference of €1831 (–€1823 to €5480). This difference was similar in size to the opposite difference in healthcare costs, resulting in a negligible difference in total societal costs of –€12 (–€4029 to €4006), slightly in favour of early surgery.

Cost utility analysis

From the societal perspective, both costs and QALYs based on the UK EQ-5D were in favour of early surgery. According to this base case analysis, early surgery is cost effective compared with prolonged care, regardless of the willingness to pay per QALY. As a result of the statistical uncertainty about costs and QALYs the probability that early surgery is cost effective compared with prolonged care varies with the willingness to pay (figure). From the societal perspective, this probability was 76% at €40 000 per QALY and 87% at €80 000 per QALY.

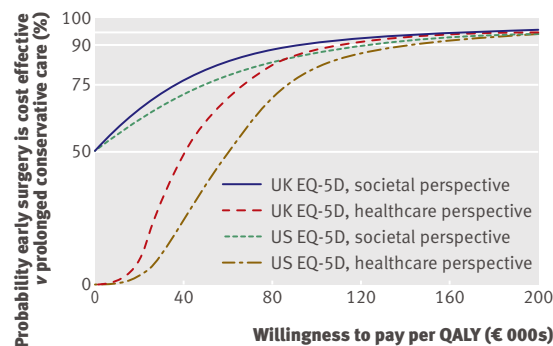
Using the US EQ-5D, SF-6D, and visual analogue scale, both societal costs and QALYs remain in favour of early surgery, but with smaller differences in QALYs (see *bmj.com*). For the US EQ-5D, the probability that early surgery is preferred reduces to 71% at €40 000 per QALY and to 83% at €80 000 per QALY (figure).

From the healthcare perspective, the higher healthcare costs would no longer be compensated for by productivity costs. As a result, the probability that early surgery is preferred is less favourable than from the societal perspective (figure). According to the UK and US EQ-5Ds, the cost utility ratio was estimated at €41 000 per QALY (95% confidence interval €14 000 to €430 000) and €57 000 per QALY (€19 000 to €436 000). In the Netherlands, costs per QALY are commonly classified as acceptable up to €40 000 and as possibly acceptable up to €80 000.^{16 17}

DISCUSSION

Our randomised controlled trial compared early surgery for sciatica that had lasted for 6–12 weeks with prolonged conservative care for six months.¹ The trial showed faster pain relief and perceived recovery after early surgery but no difference after a year.²³ In both groups about 95% of patients reported complete or near complete resolution of symptoms. Similarly, the utility measures reported here showed a faster recovery after early surgery, with the largest difference in utilities of 0.123 at eight weeks. The total difference in QALYs was estimated at 0.044, which is the equivalent of a life prolongation of 16 days in perfect health.

In the economic evaluation we studied whether the faster recovery after early surgery was attained at reasonable costs. The difference in healthcare costs was



Cost effectiveness acceptability curves for early surgery compared with prolonged conservative care

estimated at €1819 and mostly consisted of the difference in surgery costs. This difference is relatively small, because with prolonged care 40% of the patients still received surgery. Partly as a result of increased absenteeism from work after surgery, the observed total difference in absenteeism in favour of early surgery was only 37 hours. This limited difference in productivity costs was, however, sufficient to compensate for the difference in healthcare costs. As a result, from the societal perspective early surgery was preferred on both QALYs and costs. From the healthcare perspective, the cost-utility ratio was estimated at €41 000 per QALY. From both perspectives, albeit with considerable uncertainty, early surgery was likely to be cost effective compared with prolonged care, according to the current Dutch economic threshold of €40 000 or more per QALY.¹⁷ Nevertheless, if a well informed patient prefers conservative care, there is no health economic reason to opt for early surgery, since surgery does not reduce costs and the difference in QALYs was relatively small.

Although the earlier economic evaluations by Malter¹⁸ and Hansson¹⁹ reported favourable cost-utility for surgery, our results differ from theirs in several ways. Firstly, our observed difference in QALYs of 0.044 is smaller. On the basis of the trial by Weber,²⁰ Malter's trial modelled a 10-fold larger difference of 0.43 QALYs, of which 0.10 QALYs were in the first year. The control patients in Weber's trial took longer to improve than our control patients, possibly a result of the more common use of disc surgery in our trial. Hansson estimated a 0.327 difference in QALYs, but this estimate was based on only two measurements, after 28 days and two years, which makes it impossible to estimate the course over time. Secondly, the assumed average charge for disc surgery in Malter's trial was higher than our finding (\$11 930 v €4002). Yet, our price is similar to the cost estimate used by Hansson (\$4685) and to Malter's alternative health maintenance organisation costs (\$5170), which Malter considers a better estimate of the true costs of surgery. Thirdly, in our trial the initial absenteeism from work after surgery was compensated for by lower absenteeism during the rest of the year, whereas in Hansson's study it was compensated for by

WHAT IS ALREADY KNOWN ON THIS TOPIC

Early surgery for sciatica, caused by lumbar disc herniation and lasting 6 to 12 weeks, results in faster recovery than prolonged conservative care

After a year results of both treatment strategies are similar

WHAT THIS STUDY ADDS

Early surgery provides better quality adjusted life years than prolonged conservative care

The difference in healthcare costs is acceptable and compensated for by the difference in absenteeism from work

less frequent permanent disability. We did not find a difference in permanent disability, which might result from the higher frequency of surgery in our control group or Hansson's non-randomised case-control design.

Limitations of study

Our Dutch setting may differ from other settings, for both health care and employment conditions. Surgery rates in the Netherlands are relatively high. In settings with lower rates, patients receiving prolonged conservative care would be less likely to receive surgery, which might lead to larger differences in QALYs and costs. Settings also differ for timing of surgery.²¹ In our study, early surgery was on average performed three months after diagnosis. In settings with longer waits both treatment strategies would be more similar, which would reduce the differences in QALYs and costs. Our patients' average hospital stay of 3.7 days might be relatively high, but this would only affect the results if the total costs of €4002 per admission for surgery changed. Dutch legislation is protective towards employees, which is likely to increase absenteeism from work but does not necessarily affect productivity. Secondly, we limited the duration of the evaluation to one year, because a longer time horizon would have reduced the statistical power, and the clinical evaluation showed no differences beyond the first year.³ Thirdly, as patients were aware of their treatment group, their reported utilities and costs may have been influenced by their treatment preference. Finally, some may consider it a limitation that 40% of the patients randomised to prolonged care underwent surgery during the first year. Our number of crossovers was similar to Österman's trial²² and less than Weinstein's trial.^{23,24} That persistent or increasing symptoms cause patients to cross over is part of clinical reality and should therefore also be part of the economic evaluation.

In conclusion, faster recovery from sciatica of 6-12 weeks' duration makes early surgery likely to be cost effective compared with prolonged conservative care. The estimated difference in healthcare costs was acceptable and was compensated for by the difference in absenteeism from work. For a willingness to pay of €40 000 or more per QALY, early surgery need not be withheld for economic reasons.

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