Chemonucleolysis versus laminectomy: a cohort comparison of effectiveness and charges

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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
Treatment for herniated lumbar disc. In particular comparing chymopapain chemonucleolysis (CNL) with laminectomy.

Type of intervention
Treatment.

Economic study type
Cost-effectiveness analysis.

Study population
Patients with herniated lumbar disc, of both genders. The average age was 36 for men and 39 for women in the CNL cohort and for the laminectomy group 38.7 (men) and 44.5 (women). All patients had undergone conservative therapy, had clinical evidence of nerve root compression and had a positive test on a myelogram-CT.

Setting
Hospital. The economic study was performed at the University of Wisconsin Hospital, USA.

Dates to which data relate
The effectiveness analysis and resource data were taken from the cohort beginning January 1988, with a continual follow up until 1 year after the procedure. No price date was given.

Source of effectiveness data
Single study.

Link between effectiveness and cost data
The costing was undertaken on the same patient population used in the effectiveness study. It is unclear whether this is a set charge or was calculated retrospectively or prospectively.

Study sample
The sample comprised 200 consecutive patients:100 undergoing CNL and 100 laminectomy. None of the patients had undergone previous laminectomy, CNL or had spinal stenosis. No patients were dropped from the study. All patients had severe sciatica, had undergone adequate conservative therapy, had clinical evidence of nerve root compression and tested positive on a myelogram-CT. Using radiographic findings, those patients with an extruded disc in contiguity with the interspace were offered CNL. Patients who had sequestrated, migrated disc were excluded from the CNL study but offered laminectomy. No power calculations were reported.
Study design
Cohort study within a single centre. A follow-up examination was performed by the neurological resident and the author after 6 weeks and 6 months. At 6 months, 88% of CNL and 89% of laminectomy reported for follow-up examination. A questionnaire was sent 1 year after each procedure with 100% return.

Analysis of effectiveness
Analysis was based on treatment completers. A variety of outcomes were measured. At discharge: stiffness or spasm and sciatica. The improvement in back pain, sciatica, paraesthesia and a clinical examination (including forward bending, straight leg raising, etc) was undertaken after 6 weeks and 6 months. For patient evaluation the self-reported overall result was either good or excellent (improvement) or alternatively slight or no improvement (unsuccessful). Groups were comparable for age, sex and height. The possibility of differing results according to whether compensation was being received was also investigated.

Effectiveness results
For patient evaluation self-reported improvement was 87% for CNL compared with 82% for laminectomy. The results for non-compensation patients (93.3% CNL versus 86.8% laminectomy) were better than those for patients receiving compensation (68% versus 66.6%). In clinical examination CNL was superior to laminectomy at 6 weeks (p=0.002) regarding improvement in numbness, motor and sensory parameters. However, after a year the difference had narrowed to:

(i) Improvement in back pain for 87 CNL patients (no back pain - 60; good/marked improvement in back pain - 27). For 81 laminectomy patients (no back pain - 46; good/marked improvement in back pain - 35).

(ii) Improvement in sciatica for 86 CNL patients (no sciatica - 66; good/marked improvement in sciatica - 20). For 82 laminectomy patients (no sciatica - 64; good/marked improvement in sciatica - 18).

(iii) Improvement in paraesthesia in 90 CNL patients (no paraesthesia - 74; good/marked improvement in paraesthesia - 16). In 75 laminectomy patients (no paraesthesia - 57; good/marked improvement in paraesthesia - 18).

At six months, sensory improvement was better in the CNL group. (P<0.001).

Additional treatment was required for 7 CNL patients and 10 laminectomy patients who all received non-surgical treatment. Four complications occurred in CNL patients (one vasovagal reaction, urticaria, phlebitis and a rash caused by allergic reaction to Betadine). Six occurred in laminectomy (two superficial wound infections, two small dural tears which were sutured, one had urinary retention for several days and one persistent ulnar palsy resulting from positioning on the operating table). In terms of employment more CNL patients, both compensated and non-compensated, had returned to work 1 year after the procedure, with fewer needing to change jobs in order to be employed. The rates of employment were 89% for CNL and 84% for laminectomy in those workers without compensation. Of those with compensation 72% of CNL and 67% of laminectomy patients had returned to work.

Clinical conclusions
The rates of return to work and patient-reported improvement are greater for CNL. There is no discernable difference in the results of clinical examination. The rates of complication are comparable and as such the overall results are similar for both procedures on this particular set of patients.

Measure of benefits used in the economic analysis
Improvement in back pain, sciatica and paraesthesia. Benefits were measured by patient evaluation, clinical examination, rate of return to work and change in job. Follow-up examinations were undertaken by a neurological resident and one of the authors.
Direct costs
Direct hospital charges were used, with the total cost being calculated for the patients in each treatment. The dates of the costs are not stated. No discounting was undertaken. Costs were given in terms of the total for all patients and consisted of hospital and professional charges.

Currency
US dollars ($).

Sensitivity analysis
No sensitivity analysis was undertaken.

Estimated benefits used in the economic analysis
For patient evaluation self-reported improvement was 87% for CNL compared with 82% for laminectomy. The results for non-compensation patients (93.3% CNL versus 86.8% laminectomy) were better than those for patients receiving compensation (68% versus 66.6%). In clinical examination, improvement in numbness, motor and sensory parameters, CNL was superior to laminectomy at 6 weeks ($p=0.002$). However, after a year the difference had narrowed to:

(i) Improvement in back pain for 87 CNL patients (no back pain - 60; good/marked improvement in back pain - 27). For 81 laminectomy patients (no back pain - 46; good/marked improvement in back pain - 35).

(ii) Improvement in sciatica for 86 CNL patients (no sciatica - 66; good/marked improvement in sciatica - 20). For 82 laminectomy patients (no sciatica - 64; good/marked improvement in sciatica - 18).

(iii) Improvement in paraesthesia in 90 CNL patients (no paraesthesia - 74; good/marked improvement in paraesthesia -16). In 75 laminectomy patients (no paraesthesia - 57; good/marked improvement in paraesthesia - 18). (No p-values were reported).

At six months, sensory improvement was better in the CNL group. ($P<0.001$).

Additional treatment was required for 7 CNL patients and 10 laminectomy who all received non-surgical treatment. Four complications occurred in CNL patients (one vasovagal reaction, urticaria, phlebitis and a rash caused by allergic reaction to Betadine). Six occurred in laminectomy patients (two superficial wound infections, two small dural tears which were sutured, one had urinary retention for several days and one persistent ulnar palsy resulting from positioning on the operating table). In terms of employment more CNL patients, both those compensated and non-compensated, had returned to work 1 year after the procedure, with fewer needing to change jobs in order to be employed. The rates of employment were 89% for CNL and 84% for laminectomy in those workers without compensation. Of those with compensation 72% of CNL and 67% of laminectomy patients had returned to work.

Cost results
The charges for 100 CNL patients totalled $422,906 which consisted of hospital charges of $198,537 and professional (neurosurgeon, anaesthesiologist and neuroradiologist) charges of $224,319. Charges for the 100 laminectomy patients totalled $962,536 which consisted of hospital charges of $596,257 and professional charges of $366,279. When reoperation costs were included, the total charges for CNL patients was $481,632 versus $1,018,157 for laminectomy.

Synthesis of costs and benefits
CNL was the dominant strategy.

Authors’ conclusions
Based on the results the authors assumed the outcomes of both treatments are the same. The average charge savings for
CNL patients was calculated to be $5365 when CNL was performed instead of laminectomy.

**CRD Commentary**
The study demonstrated that CNL is just as effective as laminectomy on those patients selected. To use CNL rather than laminectomy would reduce short and long run health costs if, as in the US, the NHS costs of laminectomy consistently outweigh those of CNL. The results of the study are based on non-random sample groups of patients and the clinical examination was partially carried out by the author. The results are applicable only to this particular study sample, and are dependant on the procedure being performed properly. There is crucially a lack of detail about what information was given to patients to determine the patient's choice of procedure. The results would have had greater validity if p-values and confidence intervals for the difference in improvement of outcomes were reported more extensively.

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