

Neurological complications of cervical spine manipulation

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SUMMARY

To obtain preliminary data on neurological complications of spinal manipulation in the UK all members of the Association of British Neurologists were asked to report cases referred to them of neurological complications occurring within 24 hours of cervical spine manipulation over a 12-month period.

The response rate was 74%. 24 respondents reported at least one case each, contributing to a total of about 35 cases. These included 7 cases of stroke in brainstem territory (4 with confirmation of vertebral artery dissection), 2 cases of stroke in carotid territory and 1 case of acute subdural haematoma. There were 3 cases of myelopathy and 3 of cervical radiculopathy.

Concern about neurological complications following cervical spine manipulation appears to be justified. A large long-term prospective study is required to determine the scale of the hazard.

INTRODUCTION

Manipulation of the cervical spine is performed by various practitioners (e.g. physiotherapists, osteopaths, chiropractors) with the intention of relieving neck and back pain and increasing range of motion. Although such treatment is generally perceived as safe, the complications range from transient discomfort^{1,2} to cerebrovascular accidents³ and death⁴. Summarizing reported cases of injury following cervical spine manipulation published between 1925 and 1997, di Fabio⁵ found 177 cases of severe injury, mainly arterial dissection or brainstem lesions, of which 18% were fatal.

Several groups have used published case reports to estimate the frequency with which spinal manipulative therapy (SMT) results in neurological damage, and have produced figures in the range of 1 case per 1–2 million treatments^{6–8}. Various assumptions had to be made regarding the total number of treatments being performed and the degree of under-reporting, so these estimates are largely speculative. In their comprehensive review of the published work, Assendelft *et al.*⁹ were unable to derive exact figures regarding the risk to patients.

Few prospective investigations have been done on the adverse consequences of SMT. A systematic review reported the results of five studies¹⁰. In four of them, mild transient adverse events were common but no serious complications were recorded^{1,11–13}. The fifth study, from

the Canadian Stroke Consortium, reported 21 cases of arterial dissection¹⁴, but no information is presented on the proportion of patients this represents.

In the absence of accurate information from prospective studies, the best estimates on the frequency of neurological complications following SMT are from retrospective surveys. However, poor recall or inability to trace case details means that results are unlikely to represent an accurate picture. A survey of delegates at a congress of the German Society of Manual Medicine (55 responses) yielded an estimate of 1–3 serious incidents per million cervical manipulations¹⁵. A postal survey of 368 members of the Swiss Society for Manual Medicine (response rate 55%) reported a ratio of 1 serious neurological complication per 383 750 cervical manipulations¹⁶. In both these surveys respondents were asked to report cases seen over their entire professional careers. This presents difficulties not only with recall but also the probability of under-reporting in earlier years before the link between SMT and neurological complications was well known¹⁷. In addition, lack of detail about the target populations raises questions about the representativeness of the samples.

On the basis of data from a computerized registration system in the Netherlands, Patijn¹⁸ reported a complication rate of 1 per 518 886 manipulations; and, when 250 physiotherapists in South Africa were surveyed (response rate 61%), the estimate was 1 per 228 050 spinal manipulations¹⁹. A survey of 9 neurologists (of whom 7 responded) and 17 chiropractors conducted in Perth, Western Australia, gave a figure of 5 strokes per 100 000 neck patients treated over 5 years²⁰. Calculations based on insurance claim data suggested that among US

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chiropractors there is 1 stroke per 2 million manipulations²¹. A survey of all 226 members of the Danish Chiropractors' Association (54% response rate) revealed 1 cerebrovascular accident per 1.3 million cervical treatment sessions and 1 per 0.9 million upper cervical treatment sessions¹⁷.

A survey of 486 members of the American Academy of Neurology in California (response rate 36%) revealed 91 patients with persistent neurological deficits three months after cervical manipulation²². A similar survey was conducted in all 13 consultant neurologists listed in the *Irish Medical Directory*²³. The 11 who responded had between them seen 16 patients in the previous 5 years with neurological complications following cervical manipulation, of whom 13 had persistent deficits.

All these surveys, despite their differences in conditions targeted and type of respondents, conclude that the incidence of neurological complications following SMT is small but worrying. So far, however, no data have emerged from the UK. A survey of consultant neurologists in the UK was therefore conducted to provide some preliminary information.

METHOD

A letter was sent to all 323 members of the Association of British Neurologists, outlining the study. Members were asked to complete a reply slip indicating the number of cases of serious neurological complications developing within 24 hours of cervical spine manipulation referred to them within a 12-month period (1 August 1998 to 31 July 1999) and return it in a freepost envelope. Those who reported seeing at least one such case were sent forms for recording details of the case(s), to be returned in another freepost envelope. The letter and questionnaire are available on request. Those who had not responded within one month of the first mailing were sent a second letter in an attempt to increase the response rate. Similarly, if the data forms had not been returned within one month of being posted, a second form was sent to try to obtain as much information as possible.

The South and West Multicentre Research Ethics Committee informed us that this study did not require ethical approval.

RESULTS

From the original 323 letters posted, 239 responses were received (response rate 74%). One letter was returned undelivered. Of the 239 responders, 5 indicated that they were retired and no longer receiving referrals. 210 respondents had no cases to report during the specified time-frame. 24 could recall at least one case each, contributing to a total of about 35 cases of serious

neurological complications within 24 hours of manipulation of the cervical spine within one year.

16 respondents were able to provide further details about the nature of the complication reported. These included 7 cases of stroke in brainstem territory, 4 with confirmation of vertebral artery dissection; 2 cases of stroke in carotid territory and 1 case of acute subdural haematoma. There were 3 cases of myelopathy and 3 cases of cervical radiculopathy. An example from each of these categories is described below, the remainder being summarized in Table 1.

Stroke

A woman (age not reported) had a computed tomographic (CT) scan and vertebral angiogram soon after entering accident and emergency and within four hours of upper spinal manipulation. The vertebral artery was occluded with clot, secondary to dissection. She was anticoagulated. Next morning her level of consciousness dropped and a CT scan revealed acute hydrocephalus with massive cerebellar swelling. She underwent surgery to remove part of the cerebellum and decompress the posterior fossa. She made a good recovery and was left with unilateral cerebellar features and a mild gait ataxia, causing moderate disability.

Subdural haematoma

A man aged 46 was diagnosed with acute subdural haematoma occurring immediately after chiropractic treatment. A burrhole was required. There was no neurological deficit at one-month or six-month follow-up.

Myelopathy

A woman aged 42 reported tingling in both hands, particularly the left, and was dragging her left leg. Magnetic resonance imaging showed prolapse of the cervical 5/6 disc with cord compression. Neurosurgery was performed. Six months after the manipulation, the residual neurological deficit was considered major.

Radiculopathy

A woman aged 32 described numbness in the C6–8 distribution and a 'heavy' arm. Symptoms began within 12 hours of receiving osteopathy. The neurological deficit was judged minor one month after manipulation and no further follow-up was reported.

DISCUSSION

Although the number of cases identified in this study may be small in absolute terms, the issue is serious in view of the grave nature and consequences of the complications. A Medline search indicated that none of these cases had been reported previously, confirming our impression that the

Table 1 Cases of neurological complications occurring within 24 hours of spinal manipulation

Diagnosis	Details
Brainstem stroke	Women in late 40s referred with lateral medullary syndrome. Stroke of posterior inferior cerebellar artery recorded. Neurological deficit major one month post-manipulation. No further follow-up reported
Brainstem stroke	29-year-old man presented with sensory symptoms and weakness in left side of face and right leg and arm. Stroke in vertebrobasilar territory recorded. Neurological deficit minor at one and six months post-manipulation
Brainstem stroke	Female in 40s with bilateral vertebral dissociation. Slow recovery made over six months
Brainstem stroke	Male in 70s presented with dizziness and feeling unsteady. Transient ischaemic attack in posterior circulation recorded
Brainstem stroke	28-year-old patient with Marfan's syndrome presented with nausea, vomiting and left paraesthesia. Bilateral vertebral artery dissection discovered. Treated with heparin and warfarin. Full recovery
Brainstem stroke	Patient with vertebral artery dissection. No further details available
Stroke	Male in 40s presented with right hemiparesis and dysphasia. Stroke of left middle cerebral artery recorded. Neurological deficit major at one month and minor at six months post-manipulation
Stroke	46-year-old woman presented with right hemiparesis and dysphasia. Stroke of left carotid artery recorded. Neurological deficit minor at one month post-manipulation. No further follow-up reported
Myelopathy	Woman in 60s presented with sensation of pins and needles in all four limbs. Neurological deficit moderate at one and six months post-manipulation
Myelopathy	Woman presented with transient paraparesis. No further details available
Radiculopathy	Patient presented with pain in C8 distribution, weakness and sensory loss. No further details available

number of published case reports is a poor indicator of incidence.

A weakness of our neurologist-based approach is that it tells us nothing about incidence. Nor do we know who did the manipulations or why, or whether some patients had experienced neurological symptoms beforehand. This survey was not intended to provide an estimate regarding incidence. Rather, to identify if there were cases of neurological complications associated with SMT in the UK and generate preliminary data. The information produced is inevitably limited by its retrospective nature. In many cases, the practitioner carrying out the manipulation and the reason for treatment is not known. Furthermore, no details regarding previous neurological symptoms are available. For various reasons the number of cases reported in this study is likely to be an underestimate. Although the time-frame for recall was only 12 months, respondents commented on the difficulty in accurately remembering particular cases. Only rarely was it possible to access and check the patient's case notes. For reasons of poor recall alone, several cases probably went unreported in this survey. Furthermore, underestimation of the scale of the problem is increased by including only neurologists. Some patients may have been referred to other specialists such as gerontologists. Cases of transient neurological disorders following SMT may have been unreported by the patient or dealt with by the practitioner responsible for manipulation or the patient's general practitioner. Another factor that would have limited the number of cases detected by our survey is the restricted time period for symptom onset. By including only cases that occurred within 24 hours of manipulation, causality can be considered probable. However, there may well be cases in

which neurological symptoms due to SMT develop later than 24 hours after treatment²⁴.

Two similar surveys of neurologists, in California²² and the Republic of Ireland²³, produced higher figures than this survey, even after allowance for longer periods of data collection. This may represent national differences but is more likely to represent methodological discrepancies. The Californian data were based on only 35% of the target sample. The non-responders might have been those with no cases to report, thereby inflating the ratio of reported cases to respondent. By contrast, the data collected in this study were generated by a sample representing a high proportion of all consultant neurologists in the country. With the Irish survey, the time period between manipulation and onset of symptoms was not limited to 24 hours as in the present study.

This study indicates that there is indeed cause for concern about neurological complications following manipulation of the cervical spine. Although a precise estimate of the incidence is not possible from current data, there is sufficient information to suggest that the subject requires direct investigation. A large and long-term prospective study is planned, in an attempt to detect all serious cases and determine the scale of the hazard.

REFERENCES

- 1 Senstad O, Leboeuf-Yde C, Borchgrevink CF. Side effects of chiropractic spinal manipulation: types, frequency, discomfort and course. *Scand J Prim Health Care* 1996;14:50-3
- 2 Barrett AJ, Breen AC. Adverse effects of spinal manipulation. *J R Soc Med* 2000;93:258-9

- 3 Frisoni GB, Anzola GP. Vertebrobasilar ischemia after neck motion. *Stroke* 1991;**22**:1452–60
- 4 Peters M, Bohl J, Thömke F, *et al.* Dissection of the internal carotid artery after chiropractic manipulation of the neck. *Neurology* 1995;**45**:2284–6
- 5 Di Fabio RP. Manipulation of the cervical spine: risks and benefits. *Phys Ther* 1999;**79**:50–65
- 6 Wolff HD. Komplikationen bei manueller Therapie der Halswirbelsäule. *Manuelle Medizin* 1978;**16**:77–81
- 7 Hosek RS, Schram SB, Silverman H, Myers J, Williams SE. Cervical manipulation [Letter]. *JAMA* 1981;**245**:922
- 8 Powell FC, Hanigan WC, Olivero WC. A risk/benefit analysis of spinal manipulation therapy for relief of lumbar or cervical pain. *Neurosurgery* 1993;**33**:73–8
- 9 Assendelft WJJ, Bouter LM, Knipschild PG. Complications of spinal manipulations: a comprehensive review of the literature. *J Fam Pract* 1996;**42**:475–80
- 10 Ernst E. Prospective investigations into the safety of spinal manipulation. *J Pain Symp Man* (in press)
- 11 Senstad O, Leboeuf-Yde, Borchgrevink C. Frequency and characteristics of side effects of spinal manipulative therapy. *Spine* 1997;**22**:435–41
- 12 Rivett DA, Milburn P. A prospective study of complications of cervical spine manipulation: types, frequency, discomfort and course. *Scand J Prim Health Care* 1996;**14**:50–3
- 13 Leboeuf-Yde C, Hennius B, Rudberg E, Leufvenmark P, Thunman M. Side effects of chiropractic treatment: a prospective study. *J Manipulative Physiol Ther* 1997;**20**:511–15
- 14 Nadareishvili Z, Norris JW. Stroke from traumatic arterial dissection. *Lancet* 1999;**354**:158–9
- 15 Gutmann G. Verletzungen der Arteria vertebralis durch manuelle Therapie. *Manuelle Medizin* 1983;**21**:2–14
- 16 Dvorak J, Orelli F. How dangerous is manipulation to the cervical spine? Case report and results of a survey. *Manual Med* 1985;**2**:1–4
- 17 Klougart N, Leboeuf-Yde C, Rasmussen LR. Safety in chiropractic practice. Part 1: the occurrence of cerebrovascular accidents after manipulation to the neck in Denmark from 1978–1988. *J Manip Physiol Therapeutics* 1996;**19**:371–7
- 18 Patijn J. Complications in manual medicine: a review of the literature. *J Manual Med* 1991;**6**:89–92
- 19 Michaeli A. Reported occurrence and nature of complications following manipulative physiotherapy in South Africa. *Aust Physiother* 1993; **39**:309–15
- 20 Haynes MJ. Stroke following cervical manipulation in Perth. *Chiropractic J Aust* 1994;**24**:42–6
- 21 Dabbs V, Lauretto WJ. A risk assessment of cervical manipulation vs. NSAIDs for the treatment of neck pain. *J Manip Physiol Therapeutics* 1995;**18**:530–6
- 22 Lee KP, Carlini WG, McCormick GF, Albers GW. Neurologic complications following chiropractic manipulation: a survey of California neurologists. *Neurology* 1995;**45**:1213–15
- 23 Lynch P. Incidence of neurological injury following neck manipulation. *Ir Med J* 1998;**91**:130
- 24 Hufnagel A, Hammers A, Schönle PW, Böhm KD, Leonhardt G. Stroke following chiropractic manipulation of the cervical spine. *J Neurol* 1999;**246**:683–8