

## **RESEARCH REPORT**

### **Associated risks of spinal manipulative therapy**

**Harvey E, Burton AK, Moffett JK, Breen A, UK BEAM trial team. Spinal manipulation for low back pain: a treatment package agreed to by the UK chiropractic, osteopathy and physiotherapy professional associations. *Manual Therapy* 2003 feb 8 (1) 46-51 PMID 12635637**

This article describes the treatment package agreed to by the 3 professional associations for use in the uk beam trial. Cervical manipulation with a rotatory component taking the neck beyond its normal physiological range was excluded due to small chance of serious adverse side effects. This would suggest that all 3 professional associations involved in the use of manipulation are in agreement that a certain level of risk is associated with such procedures.

**Oliphant D. Safety of spinal manipulation in the treatment of lumbar disk herniation: a systematic review and risk assessment. *Journal of manipulative and physiological therapeutics*. 2004 Mar-apr 27 (3) 197-210 PMID 15129202**

A systematic review of the risk of spinal manipulation in the treatment of lumbar disk herniations (LDH). Based on the literature reviewed the article gives an estimate of the risk of spinal manipulation causing a severe adverse reaction in a patient presenting with LDH.

Relevant case reports, review articles, surveys, and investigations regarding treatment of lumbar disk herniations with spinal manipulation, adverse effects and associated risks were reviewed.

Papers were graded according to quality. Estimates of the risk of causing LDH or cauda equine syndrome (CES) with lumbar spinal manipulation range from one in 1 million to one in over 100 million. An estimate of the risk of spinal manipulation causing a clinically worsened disk herniation or CES in patients presenting with LDH was calculated to be less than 1 in 3.7 million. It was calculated to be at least 37,000 to 148,000 times safer than NSAIDs and 55,500 to 444,000 times safer than surgery for the treatment of LDH.

Over half the cases of CES reported in the literature involved manipulation under sedation or anaesthesia (MUA). These procedures take place without the natural guarding forces of muscular spasm or the feedback of patient complaints. They cannot therefore be considered analogous to manual therapy techniques. Excluding MUA, the risk falls to about one episode of CES in 286 million patient visits.

There is evidence that spinal manipulation has a beneficial effect on pain, straight-leg raising, range of motion, size of disk herniation and neurologic symptoms.

Detractors suggest spinal manipulation is responsible for causing disk herniations (the leading cause of claims against chiropractors) and CES. However some of these outcomes may have manifested as part of the progression of the patient's disorder.

Increased symptoms have been reported in the first week or so of manipulation and this has generally been thought to be a part of the treatment or healing process. However the incidence of increased symptoms following spinal manipulation (11%) has been found to be similar to that following placebo treatment of detuned short wave diathermy (12%) and may therefore represent normal fluctuations in pain intensity or be inappropriately attributed to the treatment given.

A clinician administering treatment is at risk of being identified as the cause, if leg pain and neurological deficit ensue. Gentle technique and limitation of lumbar flexion during rotational manipulation may further reduce the risk to patients presenting with LDH.

**Santilli V, Beghi, E, Finucci S (2006). Chiropractic manipulation in the treatment of acute back pain and sciatica with disc protrusion: a randomized double-blind clinical trial of active and simulated spinal manipulations. The spine journal 6 (2) p 131-7 PMID 16517383**

In this randomized double-blind clinical trial to assess the short- and long-term impact of spinal manipulations on acute back pain and sciatica in a cohort of patients with lumbar disc protrusion demonstrated on MRI no adverse events were reported.

However patients demonstrating rupture of the annulus and/ or posterior longitudinal ligament with sequestration of a disc fragment in the spinal canal or a history of chronic LBP were excluded. These findings therefore may not be generalisable to all patients with symptomatic disc protrusion.

**Murphy R, Hurwitz E, Gregory A, Clary R (2006). A non-surgical approach to the management of lumbar spinal stenosis: A prospective observational cohort study Biomed central Musculoskeletal Disorders 7 (16). Published online 2006 February 23 PMID16504078**

Prospective consecutive case series with long term follow up of fifty-seven patients diagnosed with lumbar spinal stenosis treated with distraction manipulation and neural mobilization.

No major complications were seen in any patient. Transient, mild increase in symptoms was seen in 12 patients (21.8%). This is less than the 34–55% rate of transient pain related to manipulative treatment in general that has been reported in some literature. Rare complications may not be detected in a sample size such as this one. The authors recommend further study with larger

samples to further investigate the safety of this approach to patients with lumbar spinal stenosis.

**Lisi A (2006) Chiropractic spinal manipulation for low back pain of pregnancy: A retrospective case series. Journal of midwifery and womens health 51 (10) p 7-10 PMID 16399602**

This study described the results of chiropractic treatment including spinal manipulation for 17 women with low back pain of pregnancy. Sixteen of the 17 cases (95%) demonstrated clinically important improvement in pain intensity throughout the course of treatment. No adverse effects occurred in any of the 17 cases.

There is reasonable evidence supporting the safety and effectiveness of spinal manipulation for low back pain, neck pain, and chronic/recurrent headaches.

However, at present, there is only minimal evidence on the safety and effectiveness of spinal manipulation along with other alternative therapies for pregnant women.

It has often been written that low back spinal manipulation should be avoided in low back pain of pregnancy cases, but no data have been presented to support this finding.

**Oppenheim j, Spitzer D, Segal D (2005) Nonvascular complications following spinal manipulation. The spine journal 5 (6) p 660-666**

A review of the records and imaging of patients presenting to a neurosurgical practice over a 6-year period who suffered worsening of symptoms immediately after spinal manipulative treatment. Neurological conditions were compared pre-manipulation, post-manipulation, and post-surgery. The aim was to clarify the spectrum of nonvascular complications following spinal manipulation, and define risks of manipulative treatment.

Manipulation was defined as a sudden applied thrust to the spine that generally cannot be resisted by the patient.

Eighteen patients were identified whose neurological condition had worsened following treatment with SMT. Cervical, thoracic and lumbar spine problems were identified. Complications included myelopathy, paraparesis, cauda equina syndrome, radiculopathy, atlantoaxial dislocation, pathologic fracture, palsy of the long thoracic nerve, paralysis of the diaphragm and exacerbations of lumbar disc disease. Eighty-nine percent required surgery.

In this study no asymptomatic patients receiving "maintenance adjustments," were identified as suffering complications suggesting asymptomatic individuals have a lower risk of nonvascular complications after spinal manipulation. However the authors mention that manipulation causing a

symptomatic herniation in a previously asymptomatic patient has been reported in other studies

Patients with significant disc herniations appear to be at greater risk of complications after spinal manipulation. The authors recommend MRI or CT imaging to rule out the presence of significant disc herniations before spinal manipulation.

The authors conclude that the 18 cases identified in a relatively short time period from a single neurosurgical group practice suggest complications may be under reported. They advise the risks of manipulative complications should be a standard component of informed consent. In addition prompt evaluation and intervention is necessary when symptoms worsen or neurological deficits develop and is associated with a better outcome.

**Cox JM Chiropractic treatment of lumbar spine synovial cysts: a report of two cases. J Manipulative Physiol Ther. 2005 Feb;28(2):143-7. PMID: 15800515**

This article consists of 2 case studies where chiropractic distraction manipulation and physiological therapeutic care gave symptomatic relief from low back and radicular pain attributed to MRI-confirmed synovial cysts of the lumbar spine. The suggestion is made that such conservative treatment measures may be a safe and effective option for synovial cysts before surgical intervention. Careful patient monitoring for progressive neurologic deficit which would necessitate surgery is advised.

The article describes intraspinal extradural synovial cysts as a rare cause of low back and lower extremity pain due to compressive neuropathy. They are associated with facet degeneration, degenerative spondylolisthesis and facet joint instability, supporting the theory that increased segmental motion plays a role in the pathogenesis of synovial cysts.

Cysts are also referred to as hypertrophic synovitis, cysts of the ligamentum flavum, synovial cyst, or ganglion cysts. Controversy exists as to whether there is a difference between these types of cysts. Histopathologic studies demonstrate a variety of components, including reactive fibrous connective tissue, dense fibrous connective tissue, hyperplastic synovial membrane, and fine calcifications. Regardless of the tissue components, the standard surgical treatment of these cysts is decompression and excision of the mass. This is commonly done with hemilaminectomy or laminotomy.

**Lisi AJ, Bhardwaj MK Chiropractic high-velocity low-amplitude spinal manipulation in the treatment of a case of postsurgical chronic cauda equina syndrome. J Manipulative Physiol Ther. 2004 Nov-Dec;27(9):574-8. PMID: 15614245**

This is a case study describing the treatment of a patient with chronic cauda equina syndrome. The patient had undergone surgery for acute cauda equina syndrome but had been left with residual symptoms.

Acute cauda equina syndrome (CES) is a surgical emergency and an absolute contraindication to spinal manipulation. Postoperative chronic CES, characterized by back pain and neurologic deficit can persist. The natural history of chronic CES after surgery, residual symptoms and long-term prognosis is unclear.

Rates of adverse effects of lumbar spinal manipulation in general have been described. Acute cauda equina syndrome, the most serious potential negative effect of lumbar spinal manipulation is estimated to be approximately 1 per 100,000,000. Benign adverse effects such as transient local discomfort can occur in 44% to 55% of patients.

Post surgical joints are considered a relative to absolute contraindication to HVLA manipulation. Administering spinal manipulation to a patient after spinal surgery therefore requires a substantial knowledge of surgical procedures and a greater degree of diagnostic acumen and manipulative skill than is required for the management of uncomplicated LBP.

Outcomes data are limited for the use of spinal manipulation in the treatment of postoperative spinal surgery patients therefore clinicians must approach such cases with heightened diligence. There may be greater risk of worsening pain and/or neurologic symptoms in such cases than with uncomplicated LBP patients.

The authors go on to describe the process of manipulative decision-making to increase the safety of procedures. They refer to palpation and provocation testing of the spinal region to be treated. Articulations exhibiting tenderness and restricted end-feel are candidates for manipulation. Patient tolerance to the tested manoeuvre signifies its appropriateness and aids in predicting whether symptoms would be lessened or increased by the manoeuvre. A severe increase in pain or patient apprehension, as well as any increase in neurologic symptoms or signs, signifies a manoeuvre to be contraindicated.

A rapid relief of pain occurred in the case described, atypical of the natural history of chronic CES increasing the likelihood that HVLA manipulation contributed to pain reduction in this patient. However the authors acknowledge the potential role of natural history and a placebo response.

No effects adverse or beneficial were reported on the neurogenic bladder and bowel incontinence. The article concludes that whilst being prudent regarding identification and urgent referral of acute cauda equine syndrome, HVLA manipulation can be appropriate safe treatment for a patient with chronic CES.

**Murphy D, Hurwitz E, Gregory A. Case report. Manipulation in the presence of cervical cord compression: a case series. Journal of manipulative and physiological therapeutics. 2006 Mar-apr 29 (3) p 236-244**

This is a case series consisting of 27 patients with neck and/or arm pain with findings of cervical spinal cord encroachment on magnetic resonance imaging. No patients had severe or acute myelopathy or advanced signal

changes in the spinal cord. Patients were treated with a variety of approaches that included some form of cervical manipulation.

Nineteen patients were treated with high-velocity, low-amplitude "thrust" manipulation, 9 patients were treated with low-velocity muscle energy technique, and 1 patient was treated with both methods.

Patients were examined using a standard protocol paying special attention to the neurologic examination looking for signs of myelopathy in particular. A screening examination was done, which included heel, toe, and tandem walking, standing in Romberg's position with the eyes closed, cranial nerve examination, sensory examination to pin prick, muscle stretch reflexes and motor strength in the extremities, rapid alternating movements, heel-to-shin movements, and assessment for pronator drift.

If signs suggestive of an upper motor neuron lesion were seen further examination was done and this article gives a good description of useful neurological assessment techniques which aid decision making regarding imaging of the brain, cervical, thoracic, or lumbar spine.

- Superficial abdominal reflexes, if absent suggest that the lesion is above T10 through T11 (lower abdominal reflex) or T8 through T9 (upper abdominal reflex).
- Hoffman's signs, flicking of the relaxed middle finger and observing for sudden flexion of all the fingers and adduction of the thumb if present, suggests that the lesion is at the mid cervical spine or above.
- Scapulohumeral reflex localises the lesion to the upper cervical cord or above.
- Jaw jerk if hyperreflexic, suggests involvement at brainstem or higher.
- Sensory level testing by moving a pin up the spine to identify a point at which sensation suddenly increases.

Patients were treated according to clinical findings. Main complaints were not always specific to spinal cord compression, and cord compression was not symptomatic in every case. Three patients had upper motor neurone signs. None had bowel or bladder dysfunction.

Outcome measures were self-rated percentage of improvement, pain intensity using a Numerical Pain Rating Scale (NRS) and neck pain-related disability however the Neck Disability Index was used in some patients and the Bournemouth Neck Disability Questionnaire (BDQ) in others, making it difficult to compare results between patients.

There was a mean improvement of 31% in the BDQ score however 34% improvement is quoted by the authors to be the threshold for clinical significance.

The mean improvement in the single-level NRS score was 3.9 points.

The mean improvement in the 3-level NRS score from baseline was: right now 2.5, on average 2.1, at its worst 2.8.

The mean patient-rated subjective improvement at the last follow-up was 70.0%.

No indication is given in this article of the threshold for clinical significance for the NRS or patient rated subjective improvement measures.

Data on adverse reactions and complications that could be attributed to cervical manipulation was gathered retrospectively in some patients and prospectively in others again making comparison between patients difficult.

No major complications, such as worsening myelopathy or radiculopathy, long-term increase in pain, or vascular injury were reported. In those patients who reported increased pain after treatment the longest was 4 days. No new or increased neurologic symptoms or signs were seen in any patient.

Of the 3 patients in this study with upper motor neurone signs, 2 were treated with HVLA. One patient was treated with muscle energy techniques and had an adverse reaction consisting of increased pain after the second treatment. 1 patient improved and the 3<sup>rd</sup> had no change. These small numbers and equivocal results do not allow any conclusions to be drawn regarding treatment outcomes for patients with upper motor neurone signs.

Experimental evidence reviewed by these authors suggests cervical manipulation can be effective as part of the management of patients with neck pain and headache but less is known about its use in the management of patients with radiculopathy. It has also been suggested that the risks of cervical manipulation outweigh the benefits and in the presence of a disk protrusion it is dangerous or contraindicated.

The authors conclude that cervical spinal cord encroachment on magnetic resonance imaging should not necessarily be considered an absolute contraindication to manipulation. However, because radicular and myelopathic complications to cervical manipulation have been reported in the literature, great care should be taken and manipulation should be applied by an appropriately trained, experienced and skilled practitioner.

This article also has some very good MRI pictures of cervical disc protrusions.

**Mitchell J, Keene D, Dyson C, Harvey L, Pruey C, Phillips R. Is cervical spine rotation, as used in the standard vertebrobasilar insufficiency test, associated with a measurable change in intracranial vertebral artery blood flow? Man Ther. 2004 Nov;9(4):220-7 PMID: 15522647**

End range cervical rotation is a component of the physical tests recommended in the pre-manipulation guidelines for the cervical spine. The aim of this study was to provide normative, base-line data for vertebral artery blood flow, and to detect if end-of-range cervical spine rotation produces measurable and significant changes in vertebral artery blood flow in young, healthy adults.

A number of theories have been suggested for the use of cervical spine rotation as part of the VBI test. Stretching/compression of the arteries with contralateral/ipsilateral cervical spine rotation which is thought to occur at the atlanto-axial vertebral level (where approximately half of cervical spine rotation occurs). Similar forces can occur where the artery traverses the transverse foramina and posterior arch of the atlas where it is relatively fixed in position. These deformations of the vertebral artery may reduce the luminal cross-sectional area compromising blood flow in the vessel and provoking symptoms of VBI in those patients who may not possess a fully developed collateral circulation.

Much existing research does not refute the possibility that cervical rotation may significantly reduce vertebral artery blood flow. However the validity, specificity and sensitivity of the VBI test is questioned as the results of blood flow studies are not in agreement. This may be due to sample differences in terms of sex, age, normal subjects, patients, symptoms or pathology. As a result, the external validity of many of these studies may be questioned.

In this study sustained, end-of-range, contralateral rotation of the cervical spine was shown to be associated with a significant decrease in mean intracranial vertebral artery blood flow velocity, irrespective of side. The sample consisted of healthy young females. The findings support other reports of significantly decreased blood flow in both the extracranial and the intracranial vertebral artery.

It is assumed that healthy subjects are not at risk of suffering from any signs and symptoms of VBI during both pre-manipulative screening and rotation mobilisation and manipulation of the cervical spine. This is because the healthy individual has the capacity to compensate for minor and transient reductions in blood flow through primary collateral circulatory channels.

This study found a significant difference between the two sets of neutral measurements of vertebral artery blood flow, taken before and after cervical spine rotation. This has important clinical implications regarding both the use of cervical spine rotation as a screening test and as a movement for manual therapy techniques. The significantly lower final neutral blood flow measurement, relative to the initial neutral blood flow velocity, suggests mobilisation/manipulation should not be carried out immediately after using this movement as a pre-manipulative screening test, to ensure there is sufficient time to evaluate the latent effect of this test on vertebral artery blood flow.

The possible cause of reduced blood flow, after rotation of the cervical spine, is unclear. It is suggested that cervical spine rotation may cause vasospasm of the vertebral artery that persists for a period after the mechanical stress to the artery ceases. Added rotational movements of the cervical spine may cause an increase in this vasospasm, leading to signs and symptoms of VBI. This demonstrates the VBI test itself is not without risk and the authors go on to suggest the use of transcranial Doppler sonography to assess vertebral artery blood flow may be an alternative pre-manipulative screening tool worth considering.

The results of this study provide further evidence that sustained end-of-range cervical spine rotation significantly reduces blood flow in the intracranial vertebral arteries. This study also reports that there may be a latent reduction in blood flow after cervical spine rotation.

**Murphy DR Herniated disc with radiculopathy following cervical manipulation: nonsurgical management. Spine J. 2006 Jul-Aug; 6 (4):459-63. PMID: 16825056**

This article consists of a case report where a patient treated with chiropractic SMT involving HVLA techniques developed radiculopathy secondary to cervical herniated disc after the sixth visit. These symptoms were then successfully treated with less forceful techniques including mobilisation, muscle energy and exercises.

This article cites literature indicating events or side effects of spinal manipulative therapy (SMT) are relatively common but usually benign. Between 30% and 60% of manipulative visits being associated with some type of mild to moderate side effect, lasting 1–2 days. Serious complications can occur but are less common. Complications from cervical SMT are more common than from thoracic or lumbar.

In cases of cervical herniated disc after SMT it is impossible to tell whether worsening symptoms actually resulted from treatment, or whether symptom progression occurred due to natural history of the condition.

**Conclusions/comments**

General complications of SMT described in the literature include disc herniation and aggravation of symptoms. Acute cauda equina syndrome is described as a risk specific to lumbar manipulation. The presence of cauda equina syndrome represents a surgical emergency and manipulation of any sort is contraindicated (Oliphant 2004). Specific to cervical spine manipulation vascular complications associated with risk of stroke and death are reported.

Literature suggests minor adverse events are common but permanent complications of spinal manipulations are rare and these risks may be lower than the risk of a nonsteroidal anti-inflammatory drug causing a gastrointestinal haemorrhage or morbidity and mortality rates associated with cervical spine surgery. The apparent safety of spinal manipulation when compared with other "medically accepted" treatments should stimulate its use (Oliphant 2004).

Unfortunately calculation of complication rates for different treatments such as NSAIDS, surgery, SMT are not based on similar groups of patients making meaningful comparison of complication rates between different treatment procedures difficult (Oppenheim et al 2005).

Chiropractic, osteopathic and physiotherapy professional associations appear to be in agreement that cervical manipulation procedures involving

rotation beyond physiological range carry risk of serious side effects (Burton et al 2003). This may be due to a latent reduction in blood flow after cervical spine rotation. The use of transcranial Doppler sonography to assess vertebral artery blood flow could be a valuable pre-manipulative screening tool (Mitchell et.al 2004). However access to such facilities in the clinical setting is limited.

Much recent literature regarding safety of and risks associated with spinal manipulative therapy consists of single or small scale chiropractic case studies. Many of these studies report efficacy of SMT in small numbers of patients that traditionally would be considered as contraindicated to treatment with spinal manipulation. Examples include cervical radicular symptoms (Murphy et al 2006), lumbar disc protrusion (Santilli et al 2006), lumbar spinal stenosis (Murphy et al 2006), lumbar radicular symptoms secondary to synovial cysts (Cox 2005), chronic cauda equina syndrome post surgery (Lisi and Bhardwaj 2004) and pregnancy related back pain (Lisi 2006). This indicates more evidence is required regarding inclusion/exclusion criteria and contraindications for treatment with spinal manipulation.

The incidence of treatment soreness in SMT appears to be very similar to a number of other modalities including some non mechanical therapies and placebo. This raises the question whether treatment soreness actually occurs or whether normal variations in pain intensity are attributed to treatment. It can also be difficult to assess whether worsening symptoms actually resulted from treatment, or whether symptom progression occurred due to natural history of the condition (Murphy 2006). The risks of manipulative complications should be a standard component of informed consent (Oppenheim et al 2005) which may help to reduce the risk of SMT and the treating practitioner being 'blamed' unnecessarily if symptoms worsen.

## **References**

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