

Treatment of Lumbar Intervertebral Disc Protrusions by Manipulation

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From 1975 through 1983, a total of 517 patients with protruded lumbar discs were admitted for manipulative treatment. Of these, 76.8% had satisfactory results. There were 73 recurrences (14.1%) at intervals ranging from two months to 12 years. Forty-seven cases did not respond to manipulation. These results indicate that manipulation of the spine can be effective treatment for lumbar disc protrusions. In general, the manipulation consists of eight maneuvers in three positions. The selection of the appropriate maneuvers depends on the patient's symptoms and signs and on the judgment and expertise of the operator. Practice is necessary to become proficient in spinal manipulation techniques. Several mechanisms of regression lumbar disc protrusions are possible.

Low back pain is a common disability faced in daily orthopedic practice and occurs in a wide age range from the second to the sixth decade. According to statistics, this affliction accounts for about one-third of all orthopedic outpatients. Despite its frequency, however, low back pain still dismays the medical profession. The mode of treatment for this ailment has swung from nonoperative methods to surgical intervention and then back again.

In 1958, a search began in traditional Chinese medicine for a method of treating low back pain that was worthy of trial after integration with modern Western orthopedics. Manipulation of the spine was found to give remarkable relief in certain cases.⁴ Twenty-seven years of experience has demonstrated that manipulation is useful in treating low back pain, especially for the majority of lumbar disc protrusions.³

HISTORICAL BACKGROUND

As far back as the time of the "Three Kingdom Period" (220-265 A.D.), Hwa To (Fig. 1) was known as the "Father of Surgery" in Chinese medical history. He employed manipulation in the treatment of various ailments.¹² He created the "Five Animal" play (Fig. 2) from which the practice of manipulation evolved. "Five Animal" play was an exercise that mimicked the movements of the tiger, bear, deer, wolf, and bird, and formulated a series of modes of self exercise.¹³ Traditional doctors used these exercises as a series of manipulative procedures and thus developed the technique of manipulation. It was not until the Tang Dynasty (618-907 A.D.) that the technique of manipulation was fully established and became a routine for the treatment of low back pain. At that time there was no conception of the disease of lumbar disc protrusion. The effectiveness of manipulation was generally acknowledged, however. Since 1958, manipulation has been studied on a sci-

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FIG. 1. Portrait of Hwa To of the "Three Kingdom" Period (220-265 A.D.), regarded as the Father of Surgery in Chinese medical history (141-203 A.D.).

entific basis and widely used for joint and spinal ailments.

In the Western world, Hippocrates was considered to be the earliest pioneer to have documented manipulation. He applied a vertical manipulative thrust on a gibbous patient and prescribed exercise afterwards.⁵ Bonesetters in England in the nineteenth century practiced manipulation for cases of pain in joints; however, orthodox medical circles opined the rationale as untenable. Hugh Owen Thomas observed that Chinese seamen in

Liverpool manipulated each other's backs successfully.¹⁴ He, and later Robert Jones, employed manipulation in treating certain orthopedic ailments with success though no scientific explanation could be found. Until the present, manipulation has been used primarily in the fields of chiropractic and osteopathy. Through the efforts of Mennell,¹⁰ Cyriax,¹ Maigne,⁶ Maitland,⁷ and others, manipulation has reached its present state of popularity. In the United States, Palmar established the "theory of subluxation of the spine" as a significant factor in disease causation and advocated manipulation of the appropriate region of the spine to relieve symptoms.⁸ Still was considered as osteopathy's progenitor and formulated the osteopathic philosophy for disease causation.¹¹ His students employed scientific, medical, and surgical techniques of manipulation, and osteopathy has been accepted as a bona fide system of healing by many persons in orthodox medicine. The science and art of manipulation may gain better acceptance by the medical profession as further research reveals a scientific basis for these procedures.

TECHNIQUE OF MANIPULATION

The ways of performing manipulation include the supine, lateral recumbent, or prone position, and sometimes the sitting position. Before manipulation, traction should be instituted either manually or by an automatic traction apparatus. In manual traction (Fig.



FIG. 2. "Five Animal" play mimicking the movements of the tiger, bear, deer, wolf, and bird (from left to right) from an old Chinese manuscript.

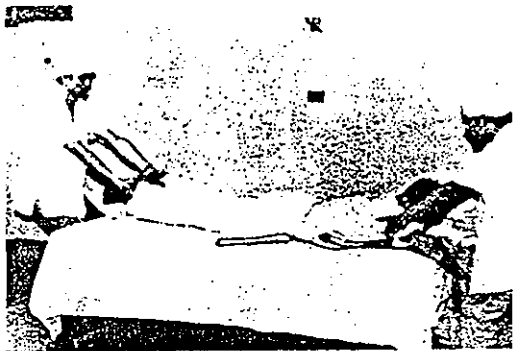


FIG. 3. Manual traction of the spine.

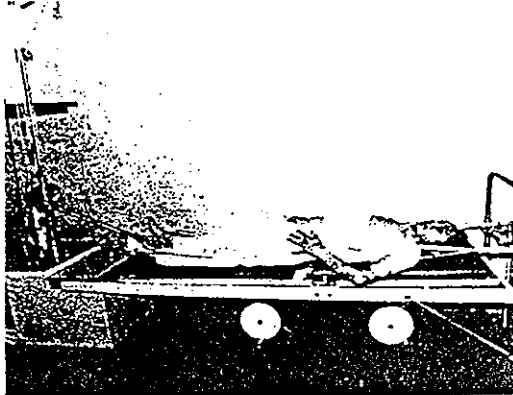


FIG. 4. Traction with an automatic controlled device.

3), two assistants are required. One pulls the pelvic straps caudally and the other pulls the thoracic harness cephalically. After maintaining the traction and counter-traction for about five minutes, three synchronous jerks are done. Using the automatic traction device (Fig. 4), the thoracic harness is attached to a fixed point, while the pelvic straps are attached to the electronic motor which pulls according to the operator's desire. The traction force is about equal to the patient's body weight and the traction is maintained for 20-30 minutes if the patient is able to tolerate it. Prior to manipulation, general anesthesia with intravenous thiopental sodium may be given to suppress pain and muscle spasm.

In the supine position, four maneuvers may be done alone or in combination as required.

(1) *Rotatory thrust.* With both the hip and knee on the left side acutely flexed, press firmly when first in the position of internal rotation and adduction, then gradually turn to the position of external rotation and abduction clockwise. Repeat the procedure on the right side and rotate counter-clockwise gradually (Fig. 5).

(2) *Straight leg raising with forced flexion of hip and extension of knee.* The operator rests one hand upon the anterior aspect of the patella and holds the heel with the other hand. The hip and the knee are first acutely flexed and then the knee is gradually extended. The leg should be lowered several times during this

manipulation. Force should not be used in order to prevent injury to the sciatic nerve (Fig. 6).

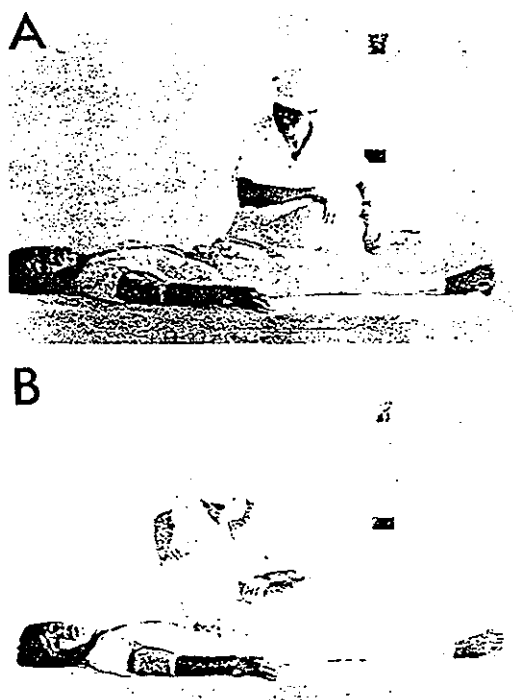


FIG. 5. Rotatory thrust with flexed hips and knees from internal rotation and adduction gradually to external rotation and abduction. (A) The internal rotation and adduction position. (B) The external rotation and abduction position.



FIG. 6. Straight-leg raising with extended knee.

(3) *Flexion of the low back to the knee-chest position.* Press the upper part of the leg with your right forearm and support the lumbosacral region with the left hand. Rotate the buttocks upwards until the knees press against the chest wall and tilt the pelvis cephalically ten times (Fig. 7).

(4) *Correction of spinal listing (if present).* Stabilize the upper lumbar region, pull on the ankles caudally and simultaneously swing the lower limbs toward the contralateral side of the list ten times (Fig. 8).

In lateral recumbency, two maneuvers may be performed alone or in combination and either unilaterally or bilaterally as required.



FIG. 7. Vertical thrust in knee-chest position and hyperflexion of back by rotation upwards of the pelvis.



FIG. 8. Lateral swinging.

(1) *Rotation of the waist.* The patient is placed on the sound side first with the hip and knee of the painful side flexed and the sound side straight. The operator rests one hand in front of the shoulder and the other hand on the buttock. By simultaneously pulling the shoulder backwards and pushing the buttock forwards, a snap or click can usually be heard or felt (Fig. 9). Then manipulate in the opposite direction and a similar snap or click may be heard or felt. This manipulation may then be repeated on the other side as required.

(2) *Hyperextension of the waist and hip by pulling the lower limb backwards.* With traction on the under leg by an assistant, steady the trunk at the lumbosacral region with one hand and hold the upper ankle with the other hand, pull backwards ten times, simulating a "pump-handle" action. Usually a snap or click is also heard or felt. Turn the patient over and repeat the same maneuver on the other side as required (Fig. 10).

In the prone position, only the vertical lumbar thrust is practiced. Place two pillows under the chest and two under the pelvis to permit free chest and abdominal breathing. Assistants hold both axillae and ankles and pull the upper and lower parts of the body in opposite directions. The operator places his right hand on top of his left, which rests on the patient's lumbosacral region, with the ulnar border of the left hand at the chosen spinous process so that the pisiform bone lies at the exact location of the disease level while the

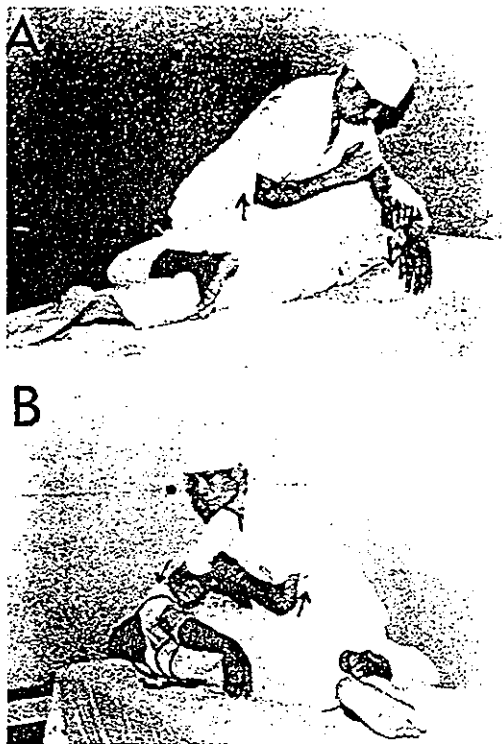


FIG. 9. Rotation of the waist by short leverage. (A) Lying on right side, (B) Lying on left side.

right hand steadies the left; both hands are palms downward. The operator performs the vertical thrust motion repetitiously with a speed of about four thrusts per second for two to three minutes. Strong force should be guarded against in this maneuver (Fig. 11). Afterwards, the patient should rest in bed for 24 hours to recover from the fatigue following manipulation.

ESSENTIALS OF MANIPULATION

Most protruded discs may be manipulated. When the diagnosis is in doubt, gentle force should be used at first as a trial in order to gain the confidence of the patient. Definite manipulative treatment should not be used more than three times if the first trial fails. Manipulation may also be used as one component of the combined treatment for the

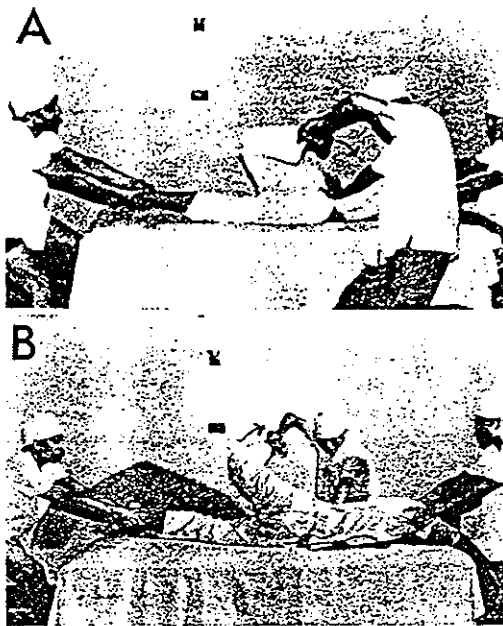


FIG. 10. Rotation of waist by long leverage. (A) Back view, (B) Front view.

“facet syndrome” and for associated lesions of extradural origin, such as ligamentous or muscular lesions.

The contraindications are clear. All vertebral fractures, pain related to inflammation, and both extraspinal and intraspinal tumors are absolutely contraindicated. Associated lesions of a protruded lumbar disc, such as a thickened ligamentum flavum, thickened laminae, and extensive spinal stenosis may be aggravated by manipulation; in such cases the



FIG. 11. Vertical lumbar thrust rhythmically in prone position.

TABLE 1. Sex and Age of 517 Patients with Protrusions of the Lumbar Disc

	Male	Female	Total
≤30 years	115	49	164
31-39	117	53	170
40-49	94	52	146
≥50 years	34	3	37
Total	360	157	517

stiffness might be improved by a delicate and prudent technique. Never attempt forced manipulations. Other conditions not related to disc protrusions may contraindicate manipulation, such as a stiff arthrotic spine or senile osteoporosis. They may derive benefit from mild repeated manipulations, but a single brisk manipulation should not be attempted. Patients suffering from systemic diseases and pregnant women should not be subjected to manipulation. For a central protrusion or a huge disc with incontinence or paraplegia, manipulation is of course strongly contraindicated.

Selection of the procedure should be based upon the symptoms and signs, with special attention given to the side of the list. If the nerve root is compressed by a disc that is located medial to it, the patient will have an ipsilateral list to decrease the nerve compression. The manipulation should begin with maximal bending to the painful side and then rotation of the spine toward the opposite side. If the nerve root is compressed from the lateral side, the patient will have a contralateral list. The

TABLE 2. The Location in 517 Patients of Protrusions of the Lumbar Disc

	Male	Female	Total
L3-L4	5	1	6
L4-L5	294	125	419
L5-S1	56	26	82
Multiple lesions	5	5	10
Total	360	157	517

TABLE 3. Results of Manipulation

	Male	Female	Total
Positive results	272	125	397
Recurrences	52	21	73
Failures	36	11	47
Total	360	157	517

manipulation should first bend the lumbar spine away from the painful side, and then rotate it contralaterally. Gaping of the disc on bending and rotation may create a condition favorable for the possible reentry of the protruded disc into the intervertebral cavity, or the rotatory manipulation may cause the protruded disc to shift away from pressing on the nerve root.

CLINICAL INVESTIGATION

From 1975-1983, a total of 517 patients with lumbar disc protrusions were admitted for manipulative treatment. The ratio of men to women was 2.3:1. The age range was from 23 to 62 years with the peak in the fourth decade (Table 1).

The level of the lesion occurred with the greatest frequency in the space between L4 and L5. The next most frequent occurrences are at L5-S1 and L3-L4, respectively. There were ten cases with multiple disc involvement (Table 2).

All patients underwent manipulation as a preliminary measure, either for treatment or for preoperative evaluation. Acceptable results were obtained in 76.8% of the cases. The criteria for acceptable results were that the patients had relief of pain or lessening of the symptoms and were able to perform daily activities or light work. The recurrence rate was 73 of 517 cases (14.1%). Forty-seven cases showed no response or became worse after manipulation (Table 3).

Of the 73 patients that relapsed, the longest interval before a recurrence was 12 years after the first series of manipulations. The recurrence rate was highest within the first six

TABLE 4. Length of Time Prior to Recurrence

	Male	Female	Total
Within 6 months	24	15	39
7-12 months	11	1	12
1-2 years	4	3	7
Over 2 years	13	2	15
Total	52	21	73

months after treatment. There were 39 patients (53.4%) who had recurrences during this period. Later, recurrences tended to decrease and it became difficult to determine whether the problem should be classified as a recurrence or as a new protrusion at another level (Table 4).

Of the 73 cases that recurred, 13.4% (56 of 149) were at the level of L4-L5; 15.9% (13 of 82) were at the level of L5-S1, and 33.3% (2 of 6) were at the level of L3-L4. Two cases of multiple lesions recurred. There was no significant difference in the rate of recurrence according to the level of the lesion (Table 5).

Lateral spinal deviation is usually considered one of the important signs in a protruded lumbar disc. Seventy-three patients with recurrences were examined according to the relationship of the protruded disc to the nerve root. Fifty-three patients who had recurrences (72.6%) originally had an ipsilateral list, nine (12.3%) had a contralateral list, and ten had no obvious list. Only one patient had an al-

TABLE 5. Relationship between the Level of the Lesion and the Frequency of Recurrence*

	Male	Female	Total
L3-L4	1	1	2
L4-L5	41	15	56
L5-S1	8	5	13
Multiple lesions	2	—	2
Total	52	21	73

* $\chi^2 = 2.48, p > 0.05$

TABLE 6. Relationship between Spinal List and Recurrence*

Direction of Listing	Male	Female	Total
Ipsilateral	39	14	53
Contralateral	6	3	9
None	7	3	10
Alternating	—	1	1
Total	52	21	73

* $\chi^2 = 90.98, P < 0.01$

ternating scoliosis. This analysis indicated that there were more recurrences with an ipsilateral list, indicating that a medial protrusion was more likely to recur. This relationship was statistically significant ($p < 0.01$) (Table 6).

All patients unresponsive to manipulation were subjected to surgical exploration. The findings gave an indication of the causes of failure and provided the basis for a revision of the indications and the protocol of treatment.

The operative findings in the 47 unsuccessful cases were similar to those of the 36 patients with recurrences (Tables 7 and 8). Some patients had more than one lesion. In all, 434 of 517 (83.9%) cases responded well to manipulation. Therefore, our impression is that most lumbar disc protrusions could be effectively treated by manipulation. This technique should be considered as a supplemental measure to simple bed rest and pelvic traction.

TABLE 7. Operative Findings in 36 Cases of Recurrence not Responsive to Remanipulation

Gross Findings	Cases
Central protrusion	4
Multiple protrusion	1
Huge protruded disc	8
Sequestered disc	4
Thickened ligamentum flavum	9
Hypertrophied laminae	4
Nerve root adhesions	4
Not stated	2

TABLE 8. Operative Findings in 47 Cases
in which Manipulation Failed

Gross Findings	Number of Occurrences
Central protrusion	8
Multiple protrusions	5
Huge protruded disc	21
Sequestered disc	5
Thickened ligamentum flavum	10
Spinal stenosis	11
Dumb-bell shaped protrusions	2
Nerve root adhesions	25
Stenosis of nerve root canal	8
Calcification of nucleus pulposus	3

DISCUSSION

Manipulation produces passive motion, the extent of which is just beyond the extremes of the range of a joint plus an accelerated velocity at its termination so that the ligaments are put under tension. However, the force should be instantly released so that no damaging stretching of the tissues occurs. If the force is carried beyond the limits of extensibility, the tissues will enter into a plastic phase and deformation and failure will result. The manipulation will only be beneficial just prior to the critical point. The amplitude of force applied cannot be measured and can only be estimated by experience. Therefore, expertise plays an important role in the success of manipulation.

For safety and guaranteed success, the following points should be carefully evaluated based on symptoms and signs. (1) During manipulation the back muscles should be fully relaxed. Anxiety will increase muscle spasm that will cause failure or be harmful. If necessary, the patient may be manipulated under anesthesia. In such cases, it should be carried out with great gentleness. (2) No contraindicated cases should undergo trial manipulation for any reason. (3) Manipulation usually begins with preparatory movements of the vertebral joints to their extreme and then rotation is carried out. The thrust technique is used only when the gentle movements are effective

or the joint stiffness is mild. Forced movements should never be used when there is obvious muscle spasm. (4) Ample rest (*e.g.*, one week) is required after each manipulation.

During manipulation a snap may accompany rotation. Subjectively it has dramatic influence on both patient and operator and is thought to be a sign of relief. Many explanations have been postulated for this spectacular phenomenon. Mennell^{9,10} considered that this was a result of sudden stretching of joint capsules, creating a vacuum that sucked in the capsule, thus precipitating the snap. Fisk² thought a suction force was created during manipulation that separated the joint surfaces and that the fluid on the joint surface vaporized with the cracking of a film of nitrogen that produced the sound. Maigne⁶ theorized that the stretching apart of articular facets caused a reduction of pressure on the synovial fluid, causing gas bubbles to form and burst within the fluid, and making the noise. There is no evidence for any of these theories, and the snap may not be of any significance.

The mechanism of manipulation is not well understood. Although there are many hypotheses, none has been proven. The eight maneuvers may be divided into three categories.

(1) *Preparatory procedure.* Premanipulative traction, rotation of the hips in flexion, and stretching of the back tissues and sciatic nerve may relax the soft tissue. This is an important aspect, and the whole process may not be successful because of muscle tightness and pain reflex. A supplementary measure of applying hot fomentations to the back for a few days, preferably using herb medicine, may be instituted.

(2) *Rotation.* This is the key maneuver of the manipulation. The herniated nucleus pulposus might not be reduced, although it could be in some cases, especially in the bulging type with an intact annulus fibrosis. It is not impossible for the protruded disc to pass through the disrupted annulus fibrosis with reduction of the displaced sequester disc. The symptoms

and signs will be relieved after manipulation, even though the defect may still be seen in the myelogram, implying that the disc is still protruding or is still in the neural canal with its position unchanged. It is also possible that the position of the nerve root may change during manipulation. If derangement of the facets or subluxation of the posterior elements near the protruded disc occurs, the rotation may have caused reduction, giving remarkable relief. This maneuver has two forms called "short-" and "long-leverage rotation." Selection depends on the results of previous manipulation. If short-leverage manipulation is not so efficacious, long-leverage rotation should be used as a supplement or a substitution.

(3) *Vertical thrust*. This maneuver provides a high velocity movement of small amplitude. The action of manipulation is usually so rapid that the patient is not alert enough to respond to it. This procedure could cause damage and should be performed with great care.

During traction, the intervertebral space widens, increasing the space for the nerve root to emerge through the intervertebral foramen. Under these circumstances, the vertical thrust may have three effects: (1) it provides a soothing effect to the nerve endings; (2) the rhythmic

rubbing between fascia and muscle produces a physiotherapeutic action, and (3) the rhythmic thrust may cause reduction of a bulging disc or a shifting of its position, thus abolishing nerve impingement.

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