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Research & Science

A Case Report

The Rehabilitation of a Patient with Functional Instability Associated with Failed Back Surgery

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Abstract

Objective: A report of a case of a low-tech non-dynamometric functional exercise program in the rehabilitation of a functionally unstable lower back, associated with failed back surgery.

Clinical Features: A 41-year-old female presented to a chiropractic office with severe lower-back pain, with radiation down the left leg to the calf. Seven months prior, she had an L5-S1 discectomy. Two months after the surgery, her pain in the lower back and leg returned. An MRI 6 months after the surgery showed no evidence of a recurrent disc herniation, but revealed a small image enhancement along the, posterior annulus adjacent to the right S1 nerve root, consistent with post-operative change. Plain film radiography was unremarkable.

Intervention and Outcome: The home-based therapeutic techniques used in this case were based on the patient's weaknesses demonstrated on a functional evaluation. This evaluation consisted of 4 functional tests, including the repetitive squat, Sorenson static back endurance, repetitive sit-up, and the repetitive arch-up tests. The exercises were performed over a 6-week period, and resulted in a decrease in both pain and functional disability based on visual analog scale, pain diagrams, and the Oswestry low-back pain questionnaire.

Conclusion: A home-based exercise program proved very effective in decreasing this patient's functional disability level, but was ineffective in reducing pain levels. Further investigation of chiropractic management of such cases is warranted.

Key Words or Phrases: functional instability, rehabilitation, failed back surgery

Introduction

Failed back surgery syndrome (FBSS) is a complex clinical problem that results from persistent pain following lumbar spinal surgery. The complexity of FBSS derives in part from the multidimensional nature of pain itself. FBSS is addressed with numerous therapies, including epidural corticosteroids, opioids, pedicle screws, spinal cord stimulation, exercise, and acupuncture. Outcomes for these therapies are not conclusive, and no standard treatment has been established.[1]

Accurate diagnosis is necessary for optimal treatment. An accurate diagnosis of FBSS can be established in more than 90% of cases—through a proper history, selected imaging studies, psychological evaluation, and, possibly, diagnostic injections. Other common problems in patients with FBSS may include foraminal stenosis, discogenic and neurogenic pain, facet and sacroiliac joint pain, residual or recurrent disc herniation, and psychological disorders.[2] Medical imaging modalities, including magnetic resonance imaging, may be required to diagnose any clinically relevant abnormality and to determine if further surgical intervention is needed.[3]

An important factor in the genesis of FBSS can be clinical instability[4]—a significant decrease in the ability of the spine stabilization system to keep the intervertebral neutral zones within the physiological limits without neurological dysfunction, major deformity, or incapacitating pain. The neutral zone is a region of intervertebral range of motion around the neutral posture, where there is little resistance by the passive spinal column.[5]

Disc injury may alter overall spinal mechanics, including the behavior of the disc itself, as well as that of other spinal structures.[6]

According to McGill, "sufficient stability" is a complete concept and desirable objective that seeks the optimal balance between stability and mobility.[7] The best stabilizer of the spine is no single muscle, but the "most important muscle" is a transient definition that depends on the task. All muscles virtually work together to create sufficient stability in all degrees of freedom.[8]

Current research has not elucidated the most optimal exercises for each individual or situation; however, the combination of science and clinical experience can improve low-back health.[9] Developing therapeutic strategies based on academic and clinical evidence and utilizing them in the clinical framework are, however, in increased demand. Concurrent local and global retraining of muscles more efficiently helps functional integration than isolated training of one system, or successive training of one after the other.[10]

In healthy groups, researchers have tried to quantify lower-back muscles' endurance times and the ratios between extensors, flexor, and lateral flexor groups. These "normal" relative ratios are used to guide clinicians and identify any endurance deficits within specific patients.[11] One study, Alaranta, et al.,[12] established a normative database for low-tech functional tests, including sit-ups, arch-ups, squatting, and static back endurance. This study evaluated over 500 subjects of various ages and genders with good-to-excellent reliability for each of the functional tests.

Case Report

A 41-year-old female presented to a chiropractic office suffering with severe lower-back pain, radiating down the left leg to the calf. Seven months prior, she had had an L5-S1 discectomy. Two months after the surgery, her pain in the lower back and leg returned. An MRI 6 months post-surgery showed no evidence of a recurrent disc herniation, but revealed a slight amount of contrast enhancement along the posterior annulus adjacent to the right S1 nerve root, consistent with post-operative change. Plain film radiography of the lumbar spine did not demonstrate any radiological instability of the lumbar spine and was otherwise unremarkable. The radiographs did not include any stress positions, such as compression or flexion/extension views, which might have helped to demonstrate any radiological instability in this case.[13]

Clinical examination revealed a restricted forward flexion of 60 degrees, as well as extension to 20 degrees, with pain in the L4-5 paraspinal region. Lateral bending was restricted by pain to 15 degrees on the left and 25 degrees to the right. Manual testing for lumbar joint shear stability, however, was positive. During the test, the patient lies prone on the table with legs over the table and feet on the floor. A downward force is applied to each vertebral segment (L5, L4, L3, etc.). An unstable segment is identified by patient-reported pain or actual displacement felt by the clinician. In this case, reported pain at the L4 segment disappeared with the patient slightly raising her legs and activating the lumbar extensors. This test is positive if pain is present in the resting position, but disappears with active contraction of the lumbar extensors.[14]

There was motion palpation-elicited pain with end-range pressure at the L4-5 vertebral motion segment with point tenderness of the lumbar erector spinae muscles bilaterally.

Sacroiliac joint testing including passive motion palpation, Gaenslen's, Yeoman's, and Mennell's sacroiliac spring tests were negative. Straight-leg raising was limited to 50 degrees on the left with increased pain in the left buttock and posterolateral thigh (in a non-dermatomal distribution). The right straight-leg raise was 80 degrees with no pain referral into the leg. Neurological examination of the lower limbs elicited a +1 left Achilles tendon reflex, 3/5 motor strength on eversion and plantarflexion of the left foot, and a decrease in pinprick sensation over the lateral aspect of the left foot. The remaining examination of the left leg was normal. The right leg deep-tendon reflexes were 2+, and muscle strength was 5/5. Pinprick sensation for the L4, L5, and S1 dermatomes was normal.

A clinical diagnosis of an L5-S1 disc herniation with associated L4-5 facet joint dysfunction and functional instability of the lumbar spine was made. Two weeks of spinal manipulation provided only temporary benefit, with the pain returning within 24 hours post-treatment. There was no change in the neurological findings in the left leg. At this point, it was decided that a low-technique functional capacity evaluation should be done to assess the patient's strength and endurance. This evaluation consisted of 4 functional tests:

1. The repetitive squat test. The patient, standing with feet approximately a shoulder width apart (15 cm), is directed to perform a squat until thighs are horizontal to the floor surface, while maintaining a

Table 1. Results of initial functional capacity evaluation for patient A compared to normative data established by Alaranta H et al., 1994.[12]

Test	Initial Functional Evaluation, Patient A	Average Normative Data*
Repetitive squatting test (reps.)	15	18
Sorenson static back endurance test (secs.)	23	67
Repetitive sit-up test (reps.)	8	19
Repetitive arch-up test (reps.)	6	24

*Average normative data based on female, blue-collar worker, ages 40 to 44 (Alaranta H, et al., 1994)

flat back with heels firmly on the ground. The test rate is set at 1 repetition every 2 to 3 seconds, increased to a maximum amount.[12]

2. The Sorenson static back endurance test. The patient lies prone on the table with hands along the sides. The inguinal region is brought to the edge of the table with the ankles fixed by the examiner. The upper torso is freely suspended. The patient is requested to stay in the horizontal position as long as possible. The examiner records the time the patient is able to do so.[12]

3. The repetitive sit-up test. The patient is lying supine, with the knees flexed at 90 degrees and the ankles fixed to the table. The patient is requested to sit up until the thenar pad of the hand touches the patella, and then curl back to the supine position. The repetition rate starts at 1 repetition every 2 to 3 seconds, with a maximum number of repetitions set at 50.[12]

4. The repetitive arch-up test. The patient is lying prone with the arms alongside the inguinal region, suspended at the edge of the table. The ankles are held fixed by the examiner. The upper trunk is flexed downward to 45 degrees, and the

Table 2. Functional evaluation of exercise progression of patient A at 2-week intervals.

Functional Test	Initial Baseline	2 weeks	4 weeks	6 weeks
Repetitive squatting test (reps.)	15	30	30	30
Sorenson static back endurance test (secs.)	23	55	55	55
Repetitive sit-up test (reps.)	8	25	25	25
Repetitive arch-up test (reps.)	6	15	15	15

Table 3: Oswestry low-back questionnaire functional disability values pre-exercise program, compared with 6-week post exercise.

Functional Activity	Pre-Exercise	Post Exercises - 6 weeks
Pain Intensity	4/5	1/5
Personal Care (daily care)	1/5	1/5
Lifting	4/5	3/5
Walking	3/5	0/5
Sitting	4/5	3/5
Standing	3/5	1/5
Sleeping	4/5	0/5
Sex Life	3/5	1/5
Social Life	4/5	3/5
Traveling	4/5	3/5

patient is asked to move the trunk up to the horizontal position (avoiding the hyperextended position) and back down. One repetition every 2 to 3 seconds is required, with a maximum number of repetitions set at 50. The examiner records the maximum number of repetitions the patient is able to perform.[12]

The results of these tests were compared to the normative data for the patient's age and gender.[12] (Table 1) The patient was then instructed to perform the same 4 functional exercises utilizing a Swiss gym ball at home. The patient was evaluated in the office every 2 weeks to monitor the performance and progress of her exercises. (Table 2)

An Oswestry low-back pain questionnaire was completed prior to her functional evaluation (Fig. 1) and after her 6-week home exercise program (Fig. 2), to assess any changes in functional disability. A pain diagram along with a visual analog scale was also completed prior to the functional evaluation (Fig. 3) and after the exercise program (Fig. 4) to evaluate any relevant changes in pain level or location.

All outcome measures improved. The patient's initial measurement values, when compared to the Alaranta normative database, were very low, except for the repetitive squat test, which was very close to average. After 6 weeks, the patient more than doubled her results for each functional test. The greatest improvement occurred within the first 2 weeks. Nevertheless, even after 6 weeks, the results were still very low relative to the normative data. The most significant improvements occurred in the Oswestry low-back pain questionnaire, which was initially graded at a 68% disability and changed to a 28% disability after 6 weeks. Each question in the questionnaire had 6 answers, each receiving a value from 0 to 5. (Table 3) The number of points for the questionnaire was totaled and expressed as a percent disability.

The visual analog scale showed a small decrease from 9.2/10 to 7/10. Pain drawings also changed. After 6 weeks, no pain was shown in the left thigh and calf, with only residual pain in the lower back and left buttock. There were no changes to the neurological deficits in the left leg.

Discussion

Failed back surgery (FBSS) is a non-specific term implying that the expected outcome, established by the patient and surgeon prior to surgery, did not meet the final outcome. Treatment of FBSS should be individualized according to the cause of pain, and its frequency could be minimized if the surgeon is aware of the common causes. Outcome expectations will vary according to the type of structural problem, the number and types of prior surgeries, and the psychological well-being of the patient. The surgeon must explain the positive and negative outcomes of the surgery so that the patient can set realistic goals.[2]

Patients with FBSS face increasing disability as well as chronic pain. Currently, rehabilitative medicine is poorly developed, focusing mainly on pain relief and not necessarily on a patient's disability. The clinician should be aware of both diagnostic considerations and appropriate management of the FBSS patients. In this study, standard diagnostic evaluations were inconclusive for this patient's continuing pain, and chiropractic manipulation gave only temporary relief. This patient was then evaluated for functional strength and endurance with the low-tech functional tests of sit-ups, arch-ups, squatting, and static back endurance. The dramatic improvement in functional disability with only small changes in the visual analog scale for pain is consistent with the management goals in rehabilitation. These goals are based on objective functional progression, which can be measured, quantified, and compared against an ideal or normal benchmark versus subjective pain symptoms.[7]

Interestingly, the greatest improvement in the strength and endurance tests occurred within the first 2 weeks, with a plateau reached over the next 4 weeks. This may indicate the initial activation of de-conditioned muscles, with perhaps further progress occurring over a longer period. Also, there may have been some hesitation to push through pain levels over time. The improvement in both the lower-back and left leg symptoms may be related to the activation of the lumbar extensors, which would stabilize the shear instability and reduce pain levels. The continuing neurological deficits in the left leg may be explained by the 2-month delay between the L5-S1 disc herniation and the actual discectomy. The neurological deficits may improve over a longer period. This patient has returned to her full duties at work and has been continuing her home exercises with periodic checkups to monitor the neurological deficits in the left leg, as well as the changes in her symptoms.

Conclusion

This single case study has many obvious limitations, including no controls or randomization. This patient was very compliant with her exercise program, which may not be found in all cases. The exercises decreased this patient's leg pain and improved her functional abilities; however, they are specific to the individual and may not help the recovery of all FBSS cases.

An effective exercise program must address all the functional deficits of the stabilization system. The simple functional exercises presented in this study do not address all the subsystems of stabilization. Future studies may, for example, include investigating the effects of proprioceptive exercises or focus on the ligamentous or disc structures causing clinical instability.

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Fig.1

Low Back Pain Questionnaire

Please read:
This questionnaire has been designed to give the doctor information as to how your back pain has affected your ability to manage in everyday life. Please answer every section and mark **in each section only one statement which applies to you.** We realize you may consider that two of the statements in any one section relate to you, but please just **mark the statement which most closely describes your problem.**

Section 1 - Pain Intensity

____ I can tolerate the pain I have without having to use pain killers
____ The pain is bad but I manage without taking pain killers.
____ Pain killers give complete relief from pain.
____ Pain killers give moderate relief from pain.
__✓__ Pain killers five very little relief from pain.
____ Pain killers have no effect on the pain and I do not use them.

Section 2 - Personal Care (Washing, Dressing, etc.)

____ I can look after myself normally without causing extra pain.
__✓__ I can look after myself normally but it may cause extra pain.
____ It is painful to look after myself and I am slow and careful.
____ I need some help but manage most of my personal care.
____ I need help every day in most aspects of self care.
____ I do not get dressed, wash with difficulty and stay in bed.

Section 3 - Lifting

____ I can lift heavy weights without extra pain.
____ I can lift heavy weights but it gives extra pain.
____ Pain prevents me from lifting heavy weights off the floor, but I can manage if they are conveniently positioned, for example, on a table.
____ Pain prevents me from lifting heavy weights but I can manage light to medium weights if they are conveniently positioned.
__✓__ I can lift only very light weights.
____ I cannot lift or carry anything at all.

Section 4 - Walking

____ Pain does not prevent me from walking any distance.
____ Pain prevents me from walking more than 1 mile.
____ Pain prevents me from walking more than ½ mile.
__✓__ Pain prevents me from walking more th n 1/4 mile.
____ I can only walk using a cane or crutches.
____ I am in bed most of the time and have to crawl to the toilet.

Section 5 - Sitting

____ I can sit in any chair as long as I like.
____ I can only sit in my favorite chair as long as I like.
____ Pain prevents me sitting more than 1 hour.
____ Pain prevents me sitting more than 30 minutes.
__✓__ Pain prevents me sitting more than 10 minutes.
____ Pain prevents me from sitting at all.

Section 6 - Standing

____ I can stand as long as I want without pain.
____ I can stand as long as I want but it gives me extra pain.
____ Pain prevents em from standing for more than 1 hour.
__✓__ Pain prevents em from standing for more than 30 minutes.
____ Pain prevents me from standing for more than 10 minutes.
____ Pain prevents me from standing at all.

Section 7 - Sleeping

____ Pain does not prevent me from sleeping well.
____ I can sleep will only by using tablets.
____ Even when I take tablets I have less than six hours sleep.
____ Even when I take tablets I have less than four hours sleep.
__✓__ Even when I take tablets I have less than two hours sleep.
____ Pain prevents me from sleeping at all.

Section 8 - Sex Life

____ My sex life is normal and causes no extra pain.
____ My sex life is normal but causes some extra pain.
____ My sex life is nearly normal but is very painful.
__✓__ My sex life is severely restricted by pain.
____ My sex life is nearly absent because of pain.
____ Pain prevents any sex life at all.

Section 9 - Social Life

____ My social life is normal and gives me no extra pain.
____ My social life is normal but increases the degree of pain.
____ Pain has no significant effect on my social life apart from limiting my more energetic interests, e.g. dancing, etc.
____ Pain has restricted my social life and I do not to out as often.
__✓__ Pain has restricted my social life to my home.
____ I have no social life because of pain.

Section 10 - Traveling

____ I can travel anywhere without pain.
____ I can travel anywhere but it gives me extra pain.
____ Pain is bad but I manage journeys over two hours.
____ Pain restricts me to journeys of less than one hour.
__✓__ Pain restricts me to short necessary journeys under 30 minutes
____ Pain prevents me from traveling except to the doctor or the hospital

Name_____ Signature_____

Date Nov 28 2003 For Office Use Only 68%

Fig.12

Low Back Pain Questionnaire

Please read:
This questionnaire has been designed to give the doctor information as to how your back pain has affected your ability to manage in e life. Please answer every section and mark **in each section only one statement which applies to you.** We realize you may consider of the statements in any one section relate to you, but please just **mark the statement which most closely describes your problen**

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✓ I can look after myself normally but it may cause extra pain.
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___ I need some help but manage most of my personal care.
___ I need help every day in most aspects of self care.
___ I do not get dressed, wash with difficulty and stay in bed.

Section 3 - Lifting

___ I can lift heavy weights without extra pain.
___ I can lift heavy weights but it gives extra pain.
___ Pain prevents me from lifting heavy weights off the floor, but I can manage if they are conveniently positioned, for example, on a table.
✓ Pain prevents me from lifting heavy weights but I can manage light to medium weights if they are conveniently positioned.
___ I can lift only very light weights.
___ I cannot lift or carry anything at all.

Section 4 - Walking

✓ Pain does not prevent me from walking any distance.
___ Pain prevents me from walking more than 1 mile.
___ Pain prevents me from walking more than ½ mile.
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___ I am in bed most of the time and have to crawl to the toilet.

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___ I can only sit in my favorite chair as long as I like.
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✓ Pain prevents me sitting more than 30 minutes.
___ Pain prevents me sitting more than 10 minutes.
___ Pain prevents me from sitting at all.

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___ I can travel anywhere but it gives me extra pain.
___ Pain is bad but I manage journeys over two hours.
✓ Pain restricts me to journeys of less than one hour.
___ Pain restricts me to short necessary journeys under 3
___ Pain prevents me from traveling except to the doctor hospital

Name _____ Signature _____

Date Jan 12 2004 For Office Use Only 28%

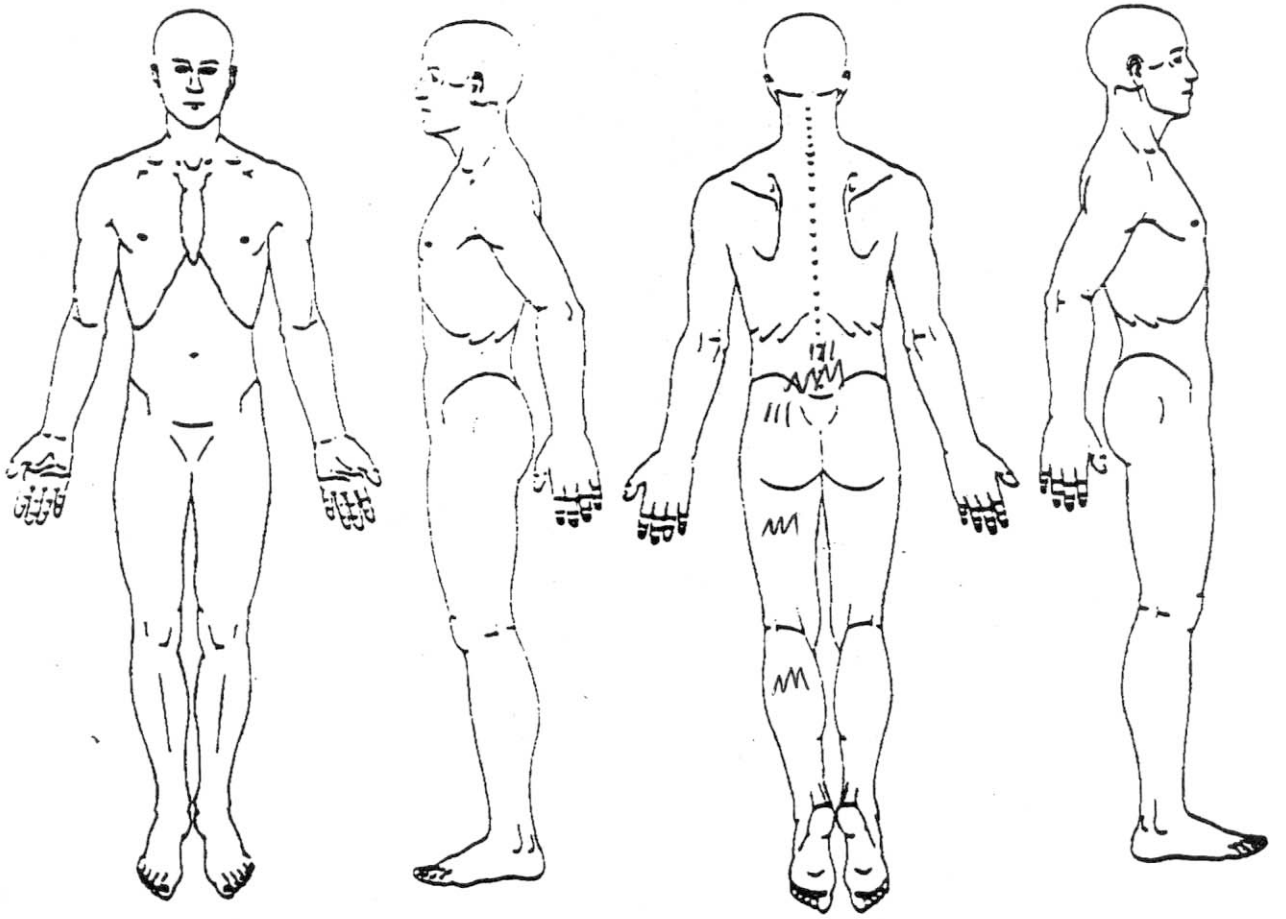
Fig.3

PAIN DRAWING

DATE Nov 28/03 NAME _____

Using the following descriptive symbols, draw the location of your pain on body outlines below. In addition, mark the level of your pain on the pain line at the bottom of the page.

Ache	Burning	Numbness	Pins & Needles	Stabbing	Other
^^^	====	0000	.....	//////////	XXXX
^^	===	00	.....	///////	XXX



No Pain ——————————— Worst Possible Pain

Please make a slash through this line as to the level of your pain.

_____ Patient Signature

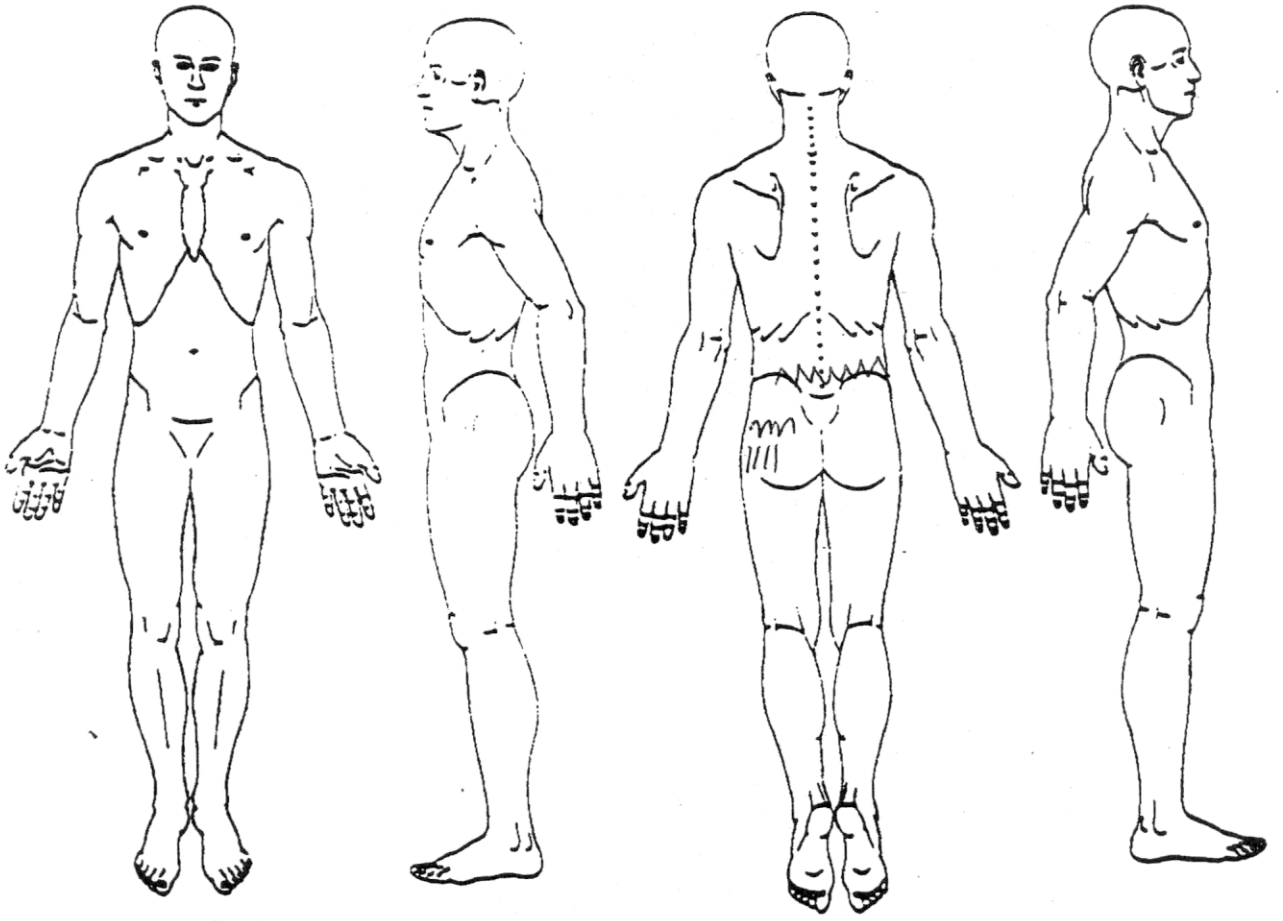
Fig.4

PAIN DRAWING

DATE Jan. 12 2004 NAME _____

Using the following descriptive symbols, draw the location of your pain on body outlines below. In addition, mark the level of your pain on the pain line at the bottom of the page.

Ache	Burning	Numbness	Pins & Needles	Stabbing	Other
^^^	====	0000	.....	//////////	XXXX
^^	===	00	.....	//////	XXX



No Pain ——————————— Worst Possible Pain

Please make a slash through this line as to the level of your pain.

_____

Patient Signature