

Unexplained falls in chronic back pain: A proposed neuromuscular physiologic explanation

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Patients with chronic pain (CP) report unexplained falls. Few articles discuss chronic pain associated with increased risk of falling. In a private office based practice consisting of 600 patients age 25 to 70 with chronic low back and other types of pain, falls and consequential injuries have been documented. Over a 3-year span, pictures of superficial injuries were collected. Fifty-five patients had a total of 88 visible injuries, mostly contusions and abrasions. The injury location was 15 head, 15 trunk and 14.5 injuries per limb. In contrast to this random distribution, Census Bureau data in women ages 49 to 60 in 2000 through 2003 showed fractures predominantly in the radius and ulna, indicating the presence of protective reflex after loss of balance. The random distribution of injuries in patients with chronic pain cannot be explained by traditional concepts of environmental influence or osteoporosis.

Previously published studies about the physiology of the back and chronic pain can be used to support a new concept about the etiology of falls in CP. The supporting concepts include patient descriptions of events, physiology of motion and function of normal and abnormal discs, the abnormally brisk reflexes in chronic pain due to loss of supraspinal inhibitory signals that provide a blanketing effect on myotatic reflex signals.

In this proposed model, a noxious and/or mechanical stimulus in the trunk or periphery, in the presence of heightened reflexes and absence of normal inhibitory supraspinal reflexes, triggers a flexor withdrawal reflex causing loss of limb control.

1. Case reports:

- ❖ 54 y.o. woman walking. Left leg in air, pain associated with sudden elevation of right leg. Injured right 2nd toe phalanx, 5th metatarsal and lateral ankle.
- ❖ 40 y.o. man falling backward, suddenly airborne landing on buttocks with burst fracture of T11.
- ❖ 34 y.o. woman fell walking in her driveway. First contact with ground was underside of chin causing large stellate laceration.
- ❖ 42 y.o. woman beginning to sit on commode, turned to get bearings and was thrown forward, landing with hands on ground causing injury in interscapular area. (Insurance issues have precluded early diagnosis.) Subsequent CT Myelogram showed failure of fusion at C7 that had been done 2 months prior to the fall.

2. Normal physiology of back:

- Tightly controlled motion between segments of back.
- Instantaneous center of rotation inside nucleus, predictable change in location.
- Disc functions very much like a car tire, controlling motion via a pressurized vesicle.
- Neuromuscular CNS interplay orchestrates safe and purposeful movements.
- Normal disc can buckle under rare load.

3. Abnormal physiology:

- Frequent buckling, instantaneous center of rotation often outside disc itself.
- Irregular and unpredictable change in position of ICOM.
- Chronic pain disrupts the normal inhibitory pathways from the brain to periphery.
- Reflexes are enhanced and crossed adductor reflex can be present.

4. Clinical observations:

- Falls are frequent in patients with chronic pain, although patients rarely bring up the issue because they are embarrassed.
- Approximately 98% of patients say, "It was like the leg just wasn't there." Rarely, "It was like I was thrown backwards."
- Same mechanism reported in patients who are not taking pain medication.
- Patients are NOT "drunk" or "uncoordinated" or "drowsy."
- Patients do not trip or have environmental hazards to trigger falls.
- Duration of pain and type of insurance correlate with risk of falling.
- Patients do not have normal protective reflexes.
- Consequential injuries are randomly distributed: (15 head, 15 trunk, 14.5 per limb in series of superficial photographed injuries in series of 65 patients in my office.)

5. Literature Review:

- 75% of fall related fractures in general population occur in the wrist, due to protective reflex.
- Community dwelling women with diffuse pain fall TWICE as frequently as women with no pain.
- Women with pain taking at least one daily analgesic fall 50% more frequently.
- Community intervention program in people at risk for falls showed no benefit.
- Case report of split second absence of motor activity in postural muscles with simultaneous activation of antagonist muscles (Asterixis or negative myoclonus) in a patient with chronic neuropathic pain and frequent buckling of legs, sometimes with falls.
- Crossed adductor reflex, requiring supraspinal modulation of knee reflex, reported in fibromyalgia.

6. Comments:

- Sufficient rapid hip flexor (Primarily iliopsoas) impulse will tend to lift the leg.
- Lower intensity hip flexor impulse will give the appearance that the leg is weak and “giving out.”
- In absence of electrical activity of postural agonists, ANY iliopsoas activity will tend to lift leg, disrupting control of stance and balance.
- Use of simple single wire diagrams lead us to conceptualize the role of the nervous system to be like the old “tin can telephone.”

- Actual neuro-muscular control has the complexity of the Internet.

7. Proposed mechanism of falls trying to put all of these factors together:

- Disc suddenly buckles.
- Bony segments restrained by surrounding ligaments and myotendinous structures.
- Sudden unanticipated stretch of soft tissues triggers reflex activity.
- Reflex can be “flexor withdrawal” or “extensor thrust” in nature. This phenomenon may very well be the postural asterixis described by Babiy and Stubblefield.
- If present, asterixis will enhance the physical power of these reflexes.
- Sudden, brief loss of postural agonist activity and/or onset of postural antagonist activity cause instantaneous loss of control of support limb resulting in fall.

8. Conclusions: Falls are frequent in patients with chronic pain. They result in injuries that are drastically different from individuals who fall as a result of environmental obstacles. These injuries are significant and can be life-threatening. It may be that interventions such as avoiding sudden twisting movements of the trunk or avoiding activities that involve forceful twisting of the trunk, may help to limit the frequency and intensity of the leg buckling. Nonetheless I believe this clinical phenomenon is gaining widespread support of evidence in the medical literature. It is a topic that is generally ignored by clinicians, researchers and health care agencies. I believe it does lead drastic interventions. The events that happen at the instant of the fall, as described by most patients, fit precisely the negative myoclonus described by Babiy and Stubblefield.

9. Reference:

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7. Asterixis related to gabapentin as a cause of falls.

[Am J Phys Med Rehabil. 2005; 84\(2\):136-40](#) (ISSN: 0894-9115)

Babiy M; Stubblefield MD; Herklotz M; Hand M; New York-Presbyterian Hospital, Weill Medical College of Cornell University, New York, NY 10021, USA

(Note: Simultaneously stopping gabapentin, adding elastic knee braces and providing physical therapy reduced but did not eliminate the asterixis.)

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 - a) "Center of Mass of the Body and Load I: A Model for Assessment using a Desktop PC"
 - b) "Center of Mass of the Body and Load II: Effect of Trunk angle for a 50 lb Load"
 - c) "Center of Mass of the Body and Load III: Effect of Load at Three Trunk Angles"
 - d) "Simulation of a Clinically Observed Pattern of Bent Knee Lifting I: Joint Velocities"
 - e) "Simulation of a Clinically Observed Pattern of Bent Knee Lifting II: Motion of Center of Mass"

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