



Rehabilitation Strategies for Pusher Syndrome

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Objectives

- Review typical characteristics of Pusher Syndrome
- Discuss short term and long term prognosis of this condition
- Identify the goals of rehab specifically for patients with Pusher Syndrome
- Examine the current research regarding treatment considerations



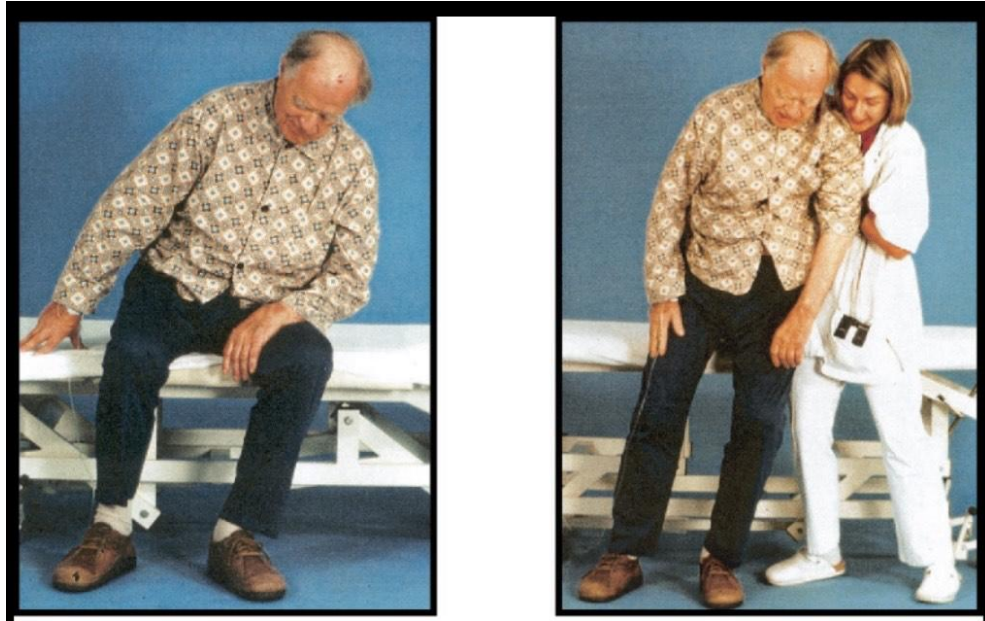
What is Pusher Syndrome

1. Spontaneous body posture is not upright, but tilted toward paretic side
 2. Pushing (abduction and extension of non-paretic limbs) toward paretic side
 3. Resistance to passive correction
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- Severe misperception of body orientation in relation to gravity
 - Occurs acutely in about 10% of strokes that present with hemiparesis (Pedersen et al, 1996)
 - Nurses and therapists are often the first to notice
 - Objective Measures
 - ◆ Scale for Contraversive Pushing (SCP)
 - ◆ Burke Lateropulsion Scale (BLS)



History of Pusher Syndrome

- First described by Patricia Davies in 1985
- Named “syndrome” because it appeared to consistently involve:
 - ◆ R sided brain lesion
 - ◆ Contralesional hemiplegia
 - ◆ Anosognosia
 - ◆ Neglect
- Later determined not to be a true syndrome
 - ◆ Occurs with right and left sided lesions
 - higher incidence with R sided lesions
 - ◆ Associated with, but not caused by, neglect (R sided lesions) and aphasia (L sided lesions)
 - ◆ Typically involves damage of the right or left posterolateral thalamus (Karnath and Broetz, 2003)
- Other names
 - ◆ Contraversive Pushing, Lateropulsion, Pusher Behavior, Ipsilateral Pushing



Karnath and Broetz 2003



Prognosis

→ Long term 😊

- ◆ Pushing behavior rarely evident after 6 months (Karnath et al, 2002)

→ Short term 😞

- ◆ Increased difficulty with transfers
 - Transfers toward non-paretic side difficult due to pushing
 - Transfers toward paretic side difficult due to decreased strength, coordination, etc.
- ◆ Increased risk of pressure ulcers due to challenges of repositioning (Chitambira and Evans, 2018)
- ◆ Increased LOS in acute rehab
 - 3.6 additional weeks to achieve same functional outcome (Pedersen et al 1996)
- ◆ If similar LOS, decreased FIM scores and increased likelihood of discharge to subacute settings for pushers (Babiar et al, 2008)
 - Specifically worse outcomes for R sided lesions



Pop Quiz



Treatment Goals

Karnath and Broetz, 2003

Patient will:

1. Realize their perception of upright is not correct
2. Recognize vertically oriented objects in their environment, use that information to correct posture
 - a. Ability to determine visual vertical IS NOT impaired
 - b. Examples of helpful objects to identify: door frames, windows, pillars
3. Learn the necessary movements to achieve true vertical body position
4. Maintain this position while performing other tasks



Treatment Tips

- DO NOT push/pull patient to midline
 - ◆ Provide physical assist at the sternum and back to avoid resistance
- Stand/sit with non-paretic side against a wall to provide feedback on true upright position
- Eliminate objects to push from (UE and/or LE)
- Allow patient to push past their idea of vertical and assist to controlled fall in sidelying
- Have patient point out/observe vertical objects and align their body with them
- Mixed reviews on if mirror therapy is helpful
 - ◆ Negatives:
 - no visual vertical to align self with
 - Emotional/psychological reaction to seeing reflection
 - ◆ Try tape down center of mirror, tape down center of patient and have them align the tape



Treatment Tips cont.

- Attempt wedging pelvis on either side
- Focus on sit to stand prior to transfers
 - ◆ Progressively load paretic leg
- If pushing is severe, transfer toward the paretic side. If mild, transfer toward the non-paretic side.
- Provide tactile cues to the ischial tuberosity to increase weight shift to non-paretic side
- Practice side lying on non-paretic elbow/forearm
- Place non-paretic arm in supinated/externally rotated position
- Distract non-paretic arm to avoid pushing
 - ◆ Hold a cup
 - ◆ Reach for an object



Pop Quiz



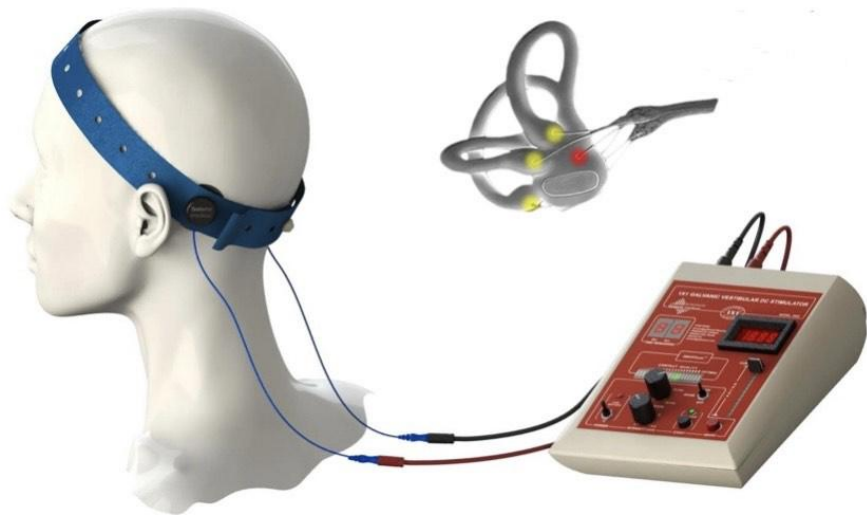
What does the newest research say?



Vestibular Stimulation & Machine Supported Gait Training

Krewer et al, 2012

- N=24(14 pushers, 10 non-pushers)
- Randomized cross-over study with blinded assessor
- Purpose: Determine the immediate after effects of
 - ◆ Galvanic vestibular stimulation (GVS)
 - ◆ Gait training with Lokomat
 - ◆ PT with visual feedback (PT with vf)
- Objective measurement: SCP and BLS



GVS



Lokomat



Vestibular Stimulation & Machine Supported Gait Training

- GVS:
 - ◆ transmastoidal e-stim 1-2 mA x 20 minutes
- Lokomat training (body weight supported treadmill):
 - ◆ exoskeleton guided LE movement (all passive)
 - ◆ 50-100% body weight support
 - ◆ 1.2 mph x 20 minutes
- PT with vf
 - ◆ 1:1
 - ◆ Focus on position changes (sit to stand, weight shifts)
 - ◆ Use of external references (wall, furniture) against non-paretic side
 - ◆ Cues to align with visual vertical references (doorframe, window)
 - ◆ 20 minutes



Vestibular Stimulation & Machine Supported Gait Training cont.

Results

- Significant improvement in pusher behavior after Lokomat training versus PT with vf
- No significant difference between GVS and PT with vf
 - ◆ Previous studies showed that Pusher Syndrome is not caused by a vestibular issue
- Pushers have altered perception of body vertical AND fear of falling
 - ◆ Both are addressed by Lokomat training
 - ◆ Allow weight bearing through paretic leg while still maintaining vertical



Interactive Visual Feedback Training

Yang et al, 2014

- N=12
- Assessor blinded, randomized controlled study
- Experimental group
 - ◆ Physically assisted in sitting or standing on Nintendo Wii balance board
 - ◆ 20 minutes
 - Finding midline/vertical posture, maintaining x 10 seconds at a time
 - Performing body weight shifting tasks in all planes
- Control group
 - ◆ Visual feedback training using full body mirror
 - ◆ 20 minutes
 - Same tasks as experimental group
- Both groups
 - ◆ 20 minutes traditional therapy (mat exercises, upper and lower body exercises) in addition to the above 3x/week x 3 weeks
- Objective measurement: SCP and Berg Balance Test



Interactive Visual Feedback Training

Results

- Both groups had significant decrease in severity of pusher syndrome and improved balance
- Significantly better outcomes in experimental group
- Computer-generated interactive visual feedback training was superior to mirror training
- Discussion:
 - ◆ Computer-generated interactive visual feedback provided quantified posture information to allow patient to correct their posture and control their dynamic body movement.
 - ◆ Mirror training cannot provide this quantifiable feedback
 - ◆ Computer-generated training increased attention and provided a definitive goal



Prone Positioning

Fujino et al, 2016

- N=3
 - ◆ Severe pusher behavior and unilateral spatial neglect
- Conventional therapy plus relaxation therapy in prone 10 minutes/day x 2 days
- Theories
 - ◆ Pusher Syndrome may involve excessive motor output by non-paretic limbs in addition to the known vertical perception mismatch
 - ◆ Prone position might inhibit this excessive motor output through recruitment of TLR (tonic labyrinthine reflex)
 - TLR facilitates flexor muscle tone in the prone position
- Objective measurement: SCP



Prone Positioning cont.

- Patients instructed to relax entire body
- Therapists applied gentle shaking as needed
 - ◆ To reduce excessive muscle tone in extensors
 - ◆ To facilitate awareness of excessive motor output
- Results
 - ◆ SCP scores improved after intervention
 - ◆ All patients could sit independently
- Conclusions
 - ◆ Prone positioning reduced pusher behavior
 - ◆ Prone positioning influences motor output rather than vertical perception



Electrical stimulation

Fujino et al, 2019

- N=2
- Background:
 - ◆ Pusher Syndrome known to be a subjective bias in verticality perception, but muscle activity is unknown.
 - ◆ Electromyography of the non-paretic triceps brachii muscle revealed excessive activity
 - ◆ The authors hypothesize that Pusher Syndrome is partly a pathology of motor output of the non-paretic limbs
- Patients had estim to non-paretic biceps brachii x 5 minutes in addition to 1 hour/day of traditional therapy
 - ◆ Activation of the biceps brachii suppresses Triceps brachii (antagonist) through reciprocal inhibition (via spinal reflex)
- Objective measurement: SCP and BLS
- Results:
 - ◆ Both SCP and BLS scores reduced immediately by e-stim



Pop Quiz



Final thoughts

- Treating stroke patients with Pusher Syndrome adds added challenges
 - ◆ Increased risk for immobility complications
 - ◆ Increased difficulty with transfers
 - ◆ Increased length of stay and/or lower levels of independence at discharge
 - ◆ \$\$\$
- There is limited information about how to best treat these patients from the rehab perspective
 - ◆ More research is needed



Final thoughts cont.

- Take home messages regarding treatment
 - ◆ DO NOT push/pull patients to achieve vertical posture
 - ◆ Use physical/visual cues to help patient self correct
 - ◆ Remove pushing surfaces when possible/appropriate
 - ◆ Use technology when it's available
 - Body weight supported treadmill training
 - Computer-generated visual feedback training
 - ◆ Prone positioning and e-stim to non-paretic limbs may be useful

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