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

➔ 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
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 (Babyar 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


