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Diagnosis and Treatment of Contraversive Pushing (Pusher Syndrome)

Jill Seale, PT, PhD, NCS
Physicaltherapy.com
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Objectives

Define contraversive pushing.
Describe at least three ways contraversive pushing impacts recovery time from a stroke.
Compare and contrast outcome measures for quantifying contraversive pushing.
Describe at least three examples of current evidence on interventions for contraversive pushing.
Outline at least three treatment interventions to overcome contraversive pushing.
Pusher Syndrome\textsuperscript{1,2}

- Tendency to push away from less affected side leading to loss of balance and falling toward more affected side
- Perception of body posture in relation to gravity is altered
- Experience body as oriented “upright”, when in reality body is tilted toward side of lesion
- Often a forceful resistance against interventions to correct posture
- Present in 10.3\% of patients with stroke
- Avoid using “pusher” or “pusher syndrome” incorrectly

\footnotesize{Karnath and Broetz\textsuperscript{1}}
Pusher Syndrome\textsuperscript{2,4-5}

- Observed in those with Right or Left hemisphere lesions
- No evidence of co-occurrence with spatial neglect, anosognosia, aphasia, or apraxia
- Neglect and Aphasia – NOT underlying cause of pusher syndrome
  - Neglect highly associated with pushing after Right hemisphere damage
  - Aphasia highly associated with pushing after Left hemisphere damage
- Pusher syndrome incidence is significantly higher in those with Right CVA

Posterolateral Thalamus

- Anatomy associated with pusher syndrome: Left or Right Posterolateral thalamus
- “Fundamentally involved in control of upright body posture”\textsuperscript{4}
- Lesions of thalamic nuclei found to be affected in those with CP
Posterolateral Thalamus

- Vision: provides info about movement and cues for judging upright posture
- Vestibular: informs person about head position relative to gravity and about head movement
- Somatosensation: provides information about weight bearing and relative position of body parts

Sorting out all the systems

- Visual and vestibular processing not necessarily disturbed
  - A lesion of vestibular cortex leads to tilt of perceived visual vertical but NOT to contraversive pushing
  - Normal perception of visual vertical
- Problems integrating visual and vestibular information
- Somatosensation is not associated
Graviception

- Perception of body position, equilibrium, and direction of gravitational forces
- Pusher Syndrome = DISTORTION of subjective postural vertical

Karnath HO et al
The Conflict³

- Mismatch between visual and postural vertical
  - Visual vertical based on vestibular AND visual inputs
  - Pushing behavior is effort to compensate

Prognosis\textsuperscript{1, 2, 6}

- Does not affect functional outcomes
- Rarely still evident at 6 months
- BUT.. It does slow process significantly
- Need 3.6 weeks longer to reach same functional outcome as those without pusher syndrome
  - Goal should be to shorten rehab time
- Brain can be fairly well compensated for by brain, as compared with aphasia or neglect

Prognosis\textsuperscript{7, 8}

- 83\% of patients resolved at 3 months
- Motor recovery and function significantly lower compared to non-pushers at 3 months
  - Longer LOS
  - FIM efficiency and d/c FIM scores worse in pusher group
- Similar LOS
- Those with R CVA and pusher syndrome significantly worse
  - Discharge to more dependent living locations
Newer Evidence on Prognosis

• Division into 3 sub-groups
  • Motor deficits only
  • Motor and visual-spatial OR motor and proprioception deficits
  • Motor, proprioception, and visual-spatial deficits
• Those with more deficits less often achieved resolution of pushing
• Slightly worse outcome in those with left hemiplegia

Recovery from Pusher Syndrome

• Indicators of delayed recovery:
  • L CVA: older age, worse admission motor status
  • R CVA: older age, greater admissions limb placement error, lower cognitive FIM scores
  • Visuospatial neglect did not influence recovery from PS
Table 1: A Comparison of the Characteristics of Different Related Disorders

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Pakele Syndrome</th>
<th>Thalamic Anesthesia</th>
<th>Wallenberg's Syndrome</th>
<th>Vestibular Cortex Stroke</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direction of pushing or loss of balance</td>
<td>Push sideways toward the parietic side</td>
<td>Fall backward or to the parietic side without pushing</td>
<td>Fall sideways toward the non-parietic side without pushing</td>
<td>Lean and lose balance toward the parietic side without pushing</td>
</tr>
<tr>
<td>Location of lesion</td>
<td>Posterior thalamus</td>
<td>Posterior thalamus</td>
<td>Medulla of brainstem</td>
<td>Posterior inula, AKA semilunar cortex</td>
</tr>
<tr>
<td>Severity of lesions</td>
<td>Severe</td>
<td>Mild to none</td>
<td>Mild</td>
<td>Mild</td>
</tr>
<tr>
<td>Subjective visual vertical</td>
<td>Intact</td>
<td>Intact</td>
<td>Impaired</td>
<td>Impaired</td>
</tr>
<tr>
<td>Subjective postural vertical</td>
<td>Impaired</td>
<td>Not stated</td>
<td>Not stated</td>
<td>Intact</td>
</tr>
</tbody>
</table>

Roller M, INPT, 2004

Outcome Measures
Clinical Scale for Contraversive Pushing (SCP)\textsuperscript{12, 13}

<table>
<thead>
<tr>
<th>Examination Form</th>
<th>Clinical Scale for Contraversive Pushing (SCP)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name:..............</td>
<td>Date of birth:.....................</td>
</tr>
<tr>
<td>Examination date:</td>
<td>Diagnosis:..........................</td>
</tr>
<tr>
<td>(A) Spontaneous body posture</td>
<td>Sitting</td>
</tr>
<tr>
<td>Value 1 = severe contraversive lift with falling</td>
<td></td>
</tr>
<tr>
<td>to that side</td>
<td></td>
</tr>
<tr>
<td>Value 0.75 = severe contraversive lift without falling</td>
<td></td>
</tr>
<tr>
<td>Value 0.25 = mild contraversive lift without falling</td>
<td></td>
</tr>
<tr>
<td>Value 0 = Incomprencious</td>
<td></td>
</tr>
<tr>
<td>Subtotal (max. = 3)</td>
<td></td>
</tr>
<tr>
<td>(B) Use of the non-parietic extremities (adduction &amp; extension)</td>
<td></td>
</tr>
<tr>
<td>Value 1 = performed spontaneously, already</td>
<td></td>
</tr>
<tr>
<td>when at end</td>
<td></td>
</tr>
<tr>
<td>Value 0.5 = performed only on changing the position</td>
<td></td>
</tr>
<tr>
<td>(e.g. on transferring from bed to a wheelchair)</td>
<td></td>
</tr>
<tr>
<td>Value 0 = Incomprencious</td>
<td></td>
</tr>
<tr>
<td>Subtotal (max. = 3)</td>
<td></td>
</tr>
<tr>
<td>(C) Resistance to passive correction of tilted posture*</td>
<td></td>
</tr>
<tr>
<td>Value 1 = resistance occurs</td>
<td></td>
</tr>
<tr>
<td>Value 0 = resistance does not occur</td>
<td></td>
</tr>
<tr>
<td>Subtotal (max. = 3)</td>
<td></td>
</tr>
</tbody>
</table>

* Touch the patient at the sternum and the back. Instruction: “I will move your body sideways. Please permit this movement”.

Modified SCP (M-SCP)

- Based on original scale
- Score 0-2, max 8
- 4 test conditions
  - Static sitting at bedside, feet on floor
  - Static standing with a full erect posture
  - Transferring from bed to chair or wheelchair with squat pivot
  - Transferring from bed to chair or wheelchair using stand pivot
Burke Lateropulsion Scale (BLS)\textsuperscript{14-15}

- Postural alignment and degree of resistance when moving patient passively:
  - Supine (0-3)
  - Sitting (0-3)
  - Standing (0-4)
  - Transfers (0-3)
  - Walking (0-3)
- Sum scores, max of 17

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| Attributes | Scale for Conservative Pushing\textsuperscript{14-16} | Modified Scale for Conservative Pushing\textsuperscript{15} | Burke Lateropulsion Scale\textsuperscript{15}
|------------|------------------------------------------------------|----------------------------------------------------------|----------------------------------------------------------
| Ordinal scale characteristics | 3 components scored in sitting and standing: spontaneous body posture (1, 0.5, 0.25), 1 = severe lateropulsion, abduction or uncontrolled extension (0, 0.5, 1) = performed spontaneously at rest; resistance to passive correction (0, 1 = resistance occurs.\textsuperscript{16-18}) | 4 testing positions: sitting, standing, sitting transfer, standing transfer. Each score 0-3 is given: nonresistance continuously with force enough to fall if not supported, abducts uninvolved arm and/or leg spontaneously, even at rest. Total maximum = 6 | 5 testing positions: supine rolling, sitting, sitting transfer, standing, walking. Scoring based on degree and point of onset of resistance to passive correction in supine, sit, stand or degree of pushing evident (supine, transfer, walking). 0-3 scale except for standing (0-4). Total maximum = 17 |
| Indicator of lateropulsion syndrome | Score on each component \textsuperscript{14,16} | 3 points or more | 2 points or more |
| Face validity based on Davier's criteria\textsuperscript{16} | Includes 3 aspects | Includes 2 aspects | Includes 2 aspects |
| Content validity Sample | Limited by sampling: Patients with stroke with presence of postural asymmetry in sitting and standing: n = 26 (right brain lesion n = 17, left brain lesion n = 9)\textsuperscript{16} | Limited by sampling: Patients with stroke exhibiting probable pushing: n = 18 for interrater reliability study | Adequate Patients with stroke: n = 95 |
| Heterogenous sample | No | No | Yes |
| Number of raters | 1 physician and 3 physiotherapists including one expert \textsuperscript{17} | 5 physiotherapists | 1 study physical therapist and 6 physical therapists |
| Mean number of days post onset of CVA when initial testing occurred | 19.0 ± 7.8 (SD) days\textsuperscript{17} | 4-8 days, no mean specified | 19±2 (SD) days |
Recommended Measure

- BLS recommended for identifying contraversive lateropulsion
  - Across several functional tasks (rolling to walking)
  - Only scale originally written in English
  - Best reliability and responsiveness

Early Treatment Evidence

- Passive movements to restore lateral flexion of head
- Stimulating lateral trunk flexion on non-paretic side
- Learning equal weightbearing through both sides
- External support for paretic LE
- Getting upright as soon as possible
  - Davies P, “Steps to Take”, 1985
More Current Evidence\textsuperscript{3,18}

- Treat in earth vertical positions (sitting, standing, walking)
- Allow pushing to occur so pt experiences falling
- Make pts visually aware of tilted position
- Assist with active correction
- Reaching vertical position actively
- Trained to use visual orientation
  - Are you upright?
Visual Feedback Treatment\textsuperscript{18, 19}

- Realize the disturbed perception of erect body position
- Visually explore the surroundings and the body’s relation to the surroundings
- Learn the movements necessary to reach a vertical body position
- Maintain the vertical body position while performing other activities.

Most Current Evidence

- Locomomat somewhat effective in single session\textsuperscript{20, 21}
- Computer generated interactive visual feedback more effective than mirror visual feedback training (but both beneficial)\textsuperscript{22}
  - Nintendo Wii balance board and customized, interactive visual feedback training program
  - Addresses maintaining vertical body posture and rhythmic body shifting to limits of stability
Treatment for Pusher Syndrome - Summary

- Awareness of perceptual dysfunction
- Exercises in earth-vertical position
- Link visual input to reality
- Involve visual stimulus in motor learning
- Relearning movements to achieve and maintain vertical
- Integration into functional tasks

Activities for the Pusher

- Patient needs to see that they are or are not oriented upright
  - Use of vertical structures
- Active reaching (goal directed) to temporarily extinguish pushing
- Managing transfers
  - Forward weight shift is key
  - Which side do we go to?
- Blocking the unwanted movement
Specific challenges

- Transfers
  - First work on forward weight shift and fear of falling forward
  - Toward paretic side initially may be easiest
  - Progress to transferring in both directions

- Wheelchair Positioning

Activities for the Pusher
Questions?

• jseale27@sbcglobal.net