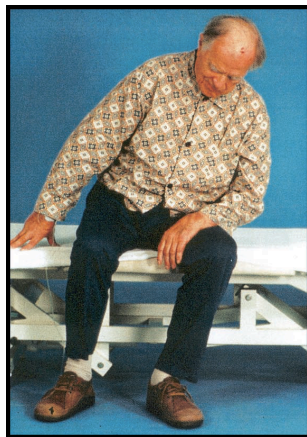


Pusher Syndrome Post-Stroke:

Background Information, Patient Presentation, and Evidence-Based Intervention Strategies **Reference Handout**

Pusher Syndrome (PS)

- Following a stroke, patients with PS push through the uninvolved upper and lower extremities towards the hemiparetic side.
- The pushing, which occurs in sitting and standing, results in postural instability and increased risk of falls.¹
- An estimated 10-16% of patients post-stroke have PS.²
- PS may occur following right- or left-sided lesions (see below).
 - Treatment and problems associated with PS following a right-sided stroke may be compounded by the presence of left neglect.¹
- These patients may present with a lean towards the hemiparetic side, and will resist passive attempts to correct posture with strong pushing.¹



1

Causes

- Patients with PS perceive incorrect body position with regard to sense of vertical.
 - They will sense that their posture is upright/vertical when they are tilted ~15-18° towards the side of the lesion.³
- This misperception of vertical causes the patient to push through the uninvolved extremity due to fear of falling towards that side.
- Given that patients are able to correct posture in the presence of visual cues that provide true earth-vertical, the vestibular and visual systems may aid in compensation.^{3,4}

Anatomy Considerations

- Damage to the posterolateral thalamus is a cause of PS (right- or left-hemisphere lesions).^{1,5}
- Damage to regions outside of the thalamus may also be associated with PS.⁶
 - Right-Side Lesion – Damage Associated with PS: Superior Temporal Gyrus, Operculum, Insula (posterior portion)⁶
 - Left-Side Lesion – Damage Associated with PS: Operculum, Anterior Insular Cortex, Internal Capsule to the lateral thalamus⁶

How Does PS Affect Progress?

- Patients will lack the ability to maintain quiet sitting or standing balance independently.
- Dynamic sitting and standing balance, and ambulation, is unrealistic and unsafe.⁷
- The pushing behavior can assist in functional activities (transfers and rolling).

- Long-term potential is not affected by PS, but patients are likely to demonstrate slower progress and longer hospitalization or inpatient rehabilitation (IPR) stays; e.g. patients with PS required a 63% longer stay compared to stroke patients without PS.⁸
- Pushing behavior may improve naturally (e.g. pushing behavior post-stroke resolved 6 weeks following the stroke for over 60% of participants.)⁹
- In general, there is a good prognosis for PS. Patients are likely to show resolution of symptoms in 6 months.^{1,10}

Outcome Measures for PS

- Primary Outcome Measures:
 - *Scale for Contraversive Pushing (SCP)* – The rater observes and grades the patients on three subcategories scored 0-2, with a maximum score of 6. A higher score on SCP indicates worse performance (i.e. more severe pushing behavior).^{7,11} A cutoff score of greater than 1 for each subcategory is supported in the literature for diagnosis of PS.¹² This outcome tool is widely used and has the most extensive literature examining psychometric properties.¹³ The SCP is available in the appendix of the article by Karnath and Broetz.¹
 - *Burke Lateropulsion Scale (BLS)* – Measures patients' ability to react and maintain position in sitting and standing.¹³ This scale is scored from 0-17, with a higher score indicating poorer performance. A score ≥ 2 is used as a cutoff for diagnosis of PS.¹³ *This scale may be more sensitive to small changes in pushing behavior compared to the SCP.*¹¹ The BLS is available in the appendix of the article by D'Aquila et al.¹⁴
- Secondary Outcome Measures
 - *Fugl-Meyer Assessment (FMA)* – Using only the “motor function” domain for the upper and lower extremities, evaluators can assess motor performance.^{7,15}
 - *Functional Independence Measure (FIM)* – This outcome measure identifies the amount of assist required for basic mobility. Largely used in IPR, a higher score on components of the FIM indicate increased independence.¹⁵
 - *Berg Balance Scale (BBS)* – This measure is more useful for higher functioning patients to identify balance deficits secondary to pushing behavior. The BBS is scored on a scale from 0-56, with a higher score indicating better performance.⁷

Treatment Options

- To “break” a patient’s pusher behavior, use external cues to correct orientation to vertical:
 - Use a full-length mirror with vertical tape as a continuous external visual cue during sitting and standing.^{7,16}
 - Use an external somatosensory cue of a wall or other vertical support placed next to the less involved side to encourage upright posture.¹⁶
 - Cue reaching to the unaffected side to encourage weight shifting and equalize base of support.¹⁰
- Use interactive balance system technologies (Nintendo Wii) to promote self-correction of upright posture.⁷
- Prolonged weight bearing through pushing extremity with or without additional tactile input. Begin with seated modified elbow prop position.
- Using “props”
 - Place a footstool under the patient’s pushing extremity to reduce ability to push through the lower extremity.
 - Place a wedge under the pelvis of the pushing side to equalize base of support.
 - Use a swiss ball under the pushing side to introduce reaching and equalize weight bearing.¹

References

1. Karnath H-O, Broetz D. Understanding and treating "Pusher Syndrome." *Phys Ther.* 2003;83(12):1119-1125. doi:10.1016/s0003-9993(96)90215-4.
2. Gandolfi M, Geroïn C, Ferrari F, et al. Rehabilitation procedures in the management of postural orientation deficits in patients with poststroke pusher behavior: a pilot study. *Minerva Med.* 2016;107(6):353-362. <http://www.ncbi.nlm.nih.gov/pubmed/27635603>. Accessed February 16, 2017.
3. Karnath HO, Ferber S, Dichgans J. The origin of contraversive pushing: evidence for a second graviceptive system in humans. *Neurology.* 2000;55(9):1298-1304. <http://www.ncbi.nlm.nih.gov/pubmed/11087771>. Accessed October 10, 2016.
4. Pérennou DA, Amblard B, Laassel EM, Benaim C, Hérisson C, Pélissier J. Understanding the pusher behavior of some stroke patients with spatial deficits: a pilot study. *Arch Phys Med Rehabil.* 2002;83(4):570-575. <http://www.ncbi.nlm.nih.gov/pubmed/11932865>. Accessed October 10, 2016.
5. Karnath H-O, Johannsen L, Broetz D, Küker W. Posterior thalamic hemorrhage induces "pusher syndrome". *Neurology.* 2005;64(6):1014-1019. doi:10.1212/WNL.65.10.1682.
6. Baier B, Janzen J, Müller-Forell W, Fechir M, Müller N, Dieterich M. Pusher syndrome: Its cortical correlate. *J Neurol.* 2012;259(2):277-283. doi:10.1007/s00415-011-6173-z.
7. Yang Y-R, Chen Y-H, Chang H-C, Chan R-C, Wei S-H, Wang R-Y. Effects of interactive visual feedback training on post-stroke pusher syndrome: a pilot randomized controlled study. *Clin Rehabil.* 2015;29(10):987-993. doi:10.1177/0269215514564898.
8. Pedersen PM, Wandel A, Jørgensen HS, Nakayama H, Raaschou HO, Olsen TS. Ipsilateral Pushing in Stroke: Incidence, Relation to Neuropsychological Symptoms, and Impact on Rehabilitation. The Copenhagen Stroke Study. *Arch Phys Med Rehabil.* 1996;77:25-28. http://ac.els-cdn.com/S0003999396902154/1-s2.0-S0003999396902154-main.pdf?_tid=24f75258-1a31-11e7-b442-00000aacb35d&acdnat=1491418583_2333a39f2c881003bd25db45b6c464a3. Accessed February 17, 2017.
9. Danells CJ, Black SE, Gladstone DJ, McIlroy WE. Poststroke "Pushing." *Stroke.* 2004;35(12). <http://stroke.ahajournals.org/content/35/12/2873.long>. Accessed March 25, 2017.
10. Broetz D, Johannsen L, Karnath H-O. Time course of "pusher syndrome" under visual feedback treatment. *Physiother Res Int.* 2004;9(3):138-143. <http://www.ncbi.nlm.nih.gov/pubmed/15560671>. Accessed October 10, 2016.
11. Krewer C, Rieß K, Bergmann J, Müller F, Jahn K, Koenig E. Immediate effectiveness of single-session therapeutic interventions in pusher behaviour. *Gait Posture.* 2013;37(2):246-250. doi:10.1016/j.gaitpost.2012.07.014.
12. Baccini M, Paci M, Rinaldi LA. The scale for contraversive pushing: A reliability and validity study. *Neurorehabil Neural Repair.* 2006;20(4):468-472. doi:10.1177/1545968306291849.
13. Babyar SR, Peterson MGE, Bohannon R, Pérennou D, Reding M. Clinical examination tools for lateropulsion or pusher syndrome following stroke: a systematic review of the literature. *Clin Rehabil.* 2009;23(7):639-650. doi:10.1177/0269215509104172.
14. D'Aquila MA, Smith T, Organ D, Lichtman S, Reding M. Validation of a lateropulsion scale for patients recovering from stroke. *Clin Rehabil.* 2004;18(1):102-109. doi:10.1191/0269215504cr709oa.
15. Babyar SR, Peterson MGE, Reding M. Case-Control Study of Impairments Associated with Recovery from Pusher Syndrome after Stroke: Logistic Regression Analyses. *Journal of Stroke and Cerebrovascular Diseases.* 2016.
16. Paci M, Nannetti L. Physiotherapy for pusher behaviour in a patient with post-stroke hemiplegia. *J Rehabil Med.* 2004;36(4):183-185. doi:10.1080/16501970410029762.