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“PUSHER SYNDROME”

Introduction
- Who gets it?
- What is it?
- What are its characteristics?
- How is it different from other balance disorders?

Who gets it?
- Stroke affects nearly 800,000 victims per year in the US
- While there is a higher than 15% mortality rate, there are more than 6.5 million stroke survivors in the US
- A good percentage of those who suffer a stroke (depending on which study you look at) present with a balance disorder unique enough to earn it’s own name

What is it?
- Aliases
  - Pusher syndrome
  - Contraversive pushing
  - Lateropulsion
  - Pushing behavior

Definitions
- “Pusher syndrome” was first defined by Patricia Davies in her 1985 book Steps to Follow.
  - She defines “pusher syndrome” as a condition seen after a CVA in which the patient “pushes strongly towards his hemiplegic side in all positions and resists any attempt at passive correction of posture...”

Definitions

- Davies describes this balancing difficulty as occurring in combination with other signs, including neglect, hemianesthesia, hemianopsia, flattened affect, and cognitive deficits.
- Davies also asserted that this condition was primarily seen in patients with right sided brain lesions.

Definitions Redefined

- In 1996 Pedersen et al investigated the incidence of "contraversive pushing" in a sample of 327 acute stroke patients.
- Pedersen found no relationship between the incidence of pushing behavior and:
  - Side of lesion.
  - Neglect, or
  - Any other neuropsychological conditions.

Incidence

- 5% of all patients post stroke.
- 10% of patients referred for neurologic rehabilitation.
  (Pedersen et al, 1996)
- Krewer et al found 17% of their cohort were pushers (2013b).
- 10% incidence in Abe’s group (2012).
- Clark et al (2012) found 26.9% of their group pushed.

What causes pushing?

- Karnath et al (2000) imaged 23 patients with pushing behavior and found an overlap of their lesions in the area of the posterolateral thalamus.
- This area of the thalamus is known to relay vestibular information to the cortex.
- Not a “vestibular” problem (Johannsen et al, 2006).
- Not a “somatosensory loss” problem (Lee et al, 2013).

- Ticini et al (2009) also found evidence of involvement in the following areas:
  - Inferior frontal gyrus—risk aversion, halting tasks
  - Middle temporal gyrus—distance judgment
  - Inferior parietal lobe—body image
  - Parietal white matter—spatial awareness.
- Baier et al (2012) found evidence of damage to lateral thalamus and temporal lobe.
- Santos-Pontelli et al (2011) implicated the parietal lobe and thalamus.
What causes pushing?

- Babyar et al (2007) found that muscle activation timing is similar in both pushers and non-pushers.
- However, the paraspinals on the hemiplegic side were not active as strongly or for as long.
- “Graviceptive neglect”?
- Barra et al (2010) found that pushing behavior seems to be caused by altered interpretation of somatosensory info from the trunk.

The skinny:
- Some type of circuit involving the thalamus and associated structures (probably parietal insula)
- The circuit is involved with perception of gravity and the body’s orientation to it (uses info from trunk proprioception)
- It is most likely bilaterally represented—may be similar to vestibular system (balance of input interpreted)

Karnath, 2000
Perennou et al, 2009
Perennou et al, 2013

Characteristics of pushing
Characteristics of pushing

- Patient spontaneously tilts posture towards the hemiplegic side
- Patient abducts and extends limbs on nonparetic side when changing positions or even at rest
- Patient resists correction of tilted posture by the therapist

Characteristics of pushing

- Pushing behavior is seen in all upright positions (sitting, standing, walking, etc.)
- When pushing behavior subsides in one position, it doesn’t necessarily subside in others (i.e. improved sitting balance doesn’t correlate with improved standing balance)
- Patients are able to identify visually objects that are vertically aligned (subjective visual vertical)? (Paci et al, 2011)

Assessment of pushing

The SCP is valid and reliable as long as scoring is considered abnormal for each item that is >0 (original criteria are >1) (Baccini et al, 2006 and Baccini et al, 2008)

Other valid and reliable tests are now available (Babyar et al, 2009), (Clark et al, 2012):
- Modified Scale for Controversive Pushing
- Burke Lateropulsion Scale—appears to be more sensitive to change than SCP (Krewer, 2013)
Assessment of pushing

Burke Lateropulsion Scale

SITTING: Score with the patient seated, feet off floor, with both hands in lap. The expected hemiplegic response is for patient to carry his weight towards the unaffected side. Some patients will passively fall towards their paretic side when placed in true vertical position by the examiner. This will not be scored as “pushing.” Position the patient with their trunk 30 degrees off true vertical towards their affected side, then score the patient’s response to your attempts to bring them back to vertical. The “pushing” phenomenon is an active attempt by the patient to keep their center of gravity towards their impaired side.

0 = No resistance to passive return to true vertical sitting position.
1 = Voluntary or reflex resistive movements in trunk, arms or legs noted only in the last 5 degrees approaching vertical.
2 = Resistive movements noted but beginning within 5 to 10 degrees of vertical.
3 = Resistive movements noted more than 10 degrees off vertical.

TOTAL SCORE = SUM OF THE ABOVE ___ (Max = 17)
Assessment of pushing

Differentiate from other postural disorders:
- Thalamic astasia
  - Unable to sit up and fall to hemiplegic side but do not resist correction
- Cerebellar and brain stem lesions (Wallenberg's syndrome)
  - Tilt of subjective visual vertical
  - Lateropulsion without resistance to correction
- Vestibular cortex lesions
  - Tilt of subjective visual vertical without pushing behavior

Functional Assessment
- Transfers, bed mobility, ambulation, and wheelchair positioning
- Transfers will tend to require less caregiver assistance when transferring to the hemiplegic side. This is due to the fact that the patient will not only resist postural correction to the stronger side, but also will tend to resist any movement at all towards that side.

Assessment of pushing

Balance Perception
- Self awareness of deficit
  - Avoid leading questions: “Do you feel yourself leaning to the left?” should be substituted with, “Do you have a difficult time balancing yourself? If so, is there a direction you tend to fall towards?”
  - Can they self correct?

Treatment

3 steps:
- Self Awareness
- Active Correction
- Translation

1st step: draw patient’s attention to the problem
- Use intact visual system: Mirrors can allow patients to see their tilted posture in relation to their environment

1st step: draw patient’s attention to the problem
- Use intact vestibular system: Allow patients to experience loss of balance using controlled falling
Treatment

- 2nd step: encourage patient to actively correct his posture
  - Have patient use vision to line himself up with vertical structures in the environment
  - Practice shifting weight within base of support using visual and sensory cues to guide patient
    - Aubert effect—recalibration of bias
  - Reach for objects on the nonparetic side

I no longer promote using visual guidance alone for treating pushing for two reasons:

1. Research originally suggested SVV was spared, but more recent studies suggest otherwise (Bonan et al, 2006 and Mansfield et al, 2015) — although pushing is worse without visual info (Perennou et al, 2002)
2. It does not appear to have any lasting effect on the behavior when used in isolation
3. Combine with other tasks (seated reaching, walking, etc.)
Treatment

- Use stable structures to convince patients to shift their weight to the nonparetic side (i.e., Standing with shoulder on wall, supported on “intact” elbow in sitting)—Aubert effect
- Perform functional tasks in these “stable” positions (walking, reaching, etc.)

Insert “Geoff Mosley Pusher video 3”

Treatment

- Forced upright posture and walking appears to be more effective than visual cueing (Krewer et al. 2013)

Treatment

- 3rd step: automate/internalize newly learned compensation
- Perform other tasks while maintaining correct posture: walking, talking, carrying objects, etc.
- Work on a wide variety of tasks: patient’s need to learn how to incorporate new posture during all functional skills, especially ones that are new or more challenging

Treatment

- Transfers—the modified stand pivot (blind transfer) to the hemiplegic side:
Treatment
- To the stronger side:

Prognosis
- Most patients’ pushing behavior resolves by 6 months s/p, even without treatment (Karnath et al, 2002)
- Patients who push average 3.6 weeks longer recovery (Pedersen, 1996) and are more dependent and have greater burden of care at discharge (Babyar et al, 2008), (Krewer et al, 2013b)
- In a study by Broetz et al, 8 patients with pushing dramatically improved their postural responses after 3.5 weeks of the previously outlined treatment regimen

Treatment
- Walking—choice of assistive device

Treatment
- Walking—use of BWSGT

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Treatment
- Walking—incorporate variety: turns, obstacles, varying surfaces/terrain

Insert “Geoff Mosley Pusher video 4”
References


References


References

- Johannsen, L, Broetz, D, Karnath, HO. Leg orientation as a clinical sign for pusher syndrome. BMC Neurology; 2006, 6:30.
References