

Impact of Orthostatic Hypotension in Inpatient Rehabilitation

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BACKGROUND

- Inpatient rehabilitation facilities (IRFs) provide intensive rehabilitation therapy to patients after an injury, surgery or to those with conditions such as stroke, Parkinson disease, polyneuropathy, severe deconditioning or cardiac disease.
- Orthostatic hypotension (OH) is commonly associated with these conditions, and therefore, it can be a significant problem in patients undergoing rehabilitation (i.e. less participation in therapy).
- Previous studies in post-stroke patients found that OH was present in 52.1% (n=37/71) of patients admitted to a rehabilitation unit within 1 month of the event, of whom 32% (n=12) were symptomatic and 18% (n=13) had severe hypotension (standing SBP, ≤ 100 mmHg).¹ OH resolved in 33% (n=23) of these patients at discharge, and OH did not influenced functional outcomes or length of stay (LOS).
- However, a study in post-stroke patients undergoing rehabilitation in a VA inpatient rehabilitation ward found² that 9% (7/75) had OH. Hypotension increased LOS by ~7 days and decreased functional outcomes at discharge (Functional Independence Measure efficiency) compared to those without hypotension. Moreover, a preliminary study in a VA medical center found³ that 30% of patients admitted for rehabilitation had OH, and that usual care did not improve this rate. Subjects with OH had higher preadmission fall rates, less participation in therapy, less FIM (Functional Independence Measure) gain, and higher mortality after discharge.
- Currently, there are no publications on the prevalence and impact of OH in different patient populations in IRFs. Thus, the purpose of this study is to investigate the prevalence of OH in different rehabilitation patient groups, and its impact on rehabilitation outcomes.

OBJECTIVES

- To determine the prevalence of OH in different patient populations who underwent rehabilitation at the Vanderbilt Stallworth Rehabilitation Hospital.
- To evaluate the impact of OH on rehabilitation as measured by the LOS and FIM score.
- We hypothesized that OH would be common in these patients and would have a negative impact on rehabilitation outcomes (i.e. longer LOS and lower FIM) compared to patients without OH admitted during the same period.

METHODS

Study population:

- We studied a cohort of 8350 patients who underwent rehabilitation at Vanderbilt Stallworth Rehabilitation Hospital between 2014-2019.
- OH patients were identified based on the presence of ICD-9 and 10 codes corresponding to the diagnosis of OH (485.0 and I95.1 respectively).

Study Design:

- This is a retrospective, cross-sectional study to compare rehabilitation outcomes between patients with and without OH who underwent rehabilitation at the Vanderbilt Stallworth Rehabilitation Hospital.
- The prevalence of OH was determined in the overall cohort and in sub-groups of patients defined by primary diagnosis for admission (impairment group codes; Table 1).
- Rehabilitation outcomes were compared between patients with and without OH in the overall cohort and within each impairment group.
- Primary outcomes included LOS at discharge, LOS change (discharge - admission).
- Secondary outcomes included predicted LOS on admission, FIM on admission and discharge, FIM change (discharge - admission), FIM efficiency (FIM change/ LOS), discharge status (Table 1) and demographic data.
- Statistical analysis was performed using SPSS (Version 22, SPSS, Chicago, IL). Continuous were assessed using Mann Whitney U tests. Categorical variables were compared by Pearson's chi-square or Fisher's exact tests. P value of ≤ 0.05 will be considered significant.

RESULTS

OH was present in 3.8% (n = 315; 60 \pm 18 yrs; 28% women) of patients undergoing rehabilitation.

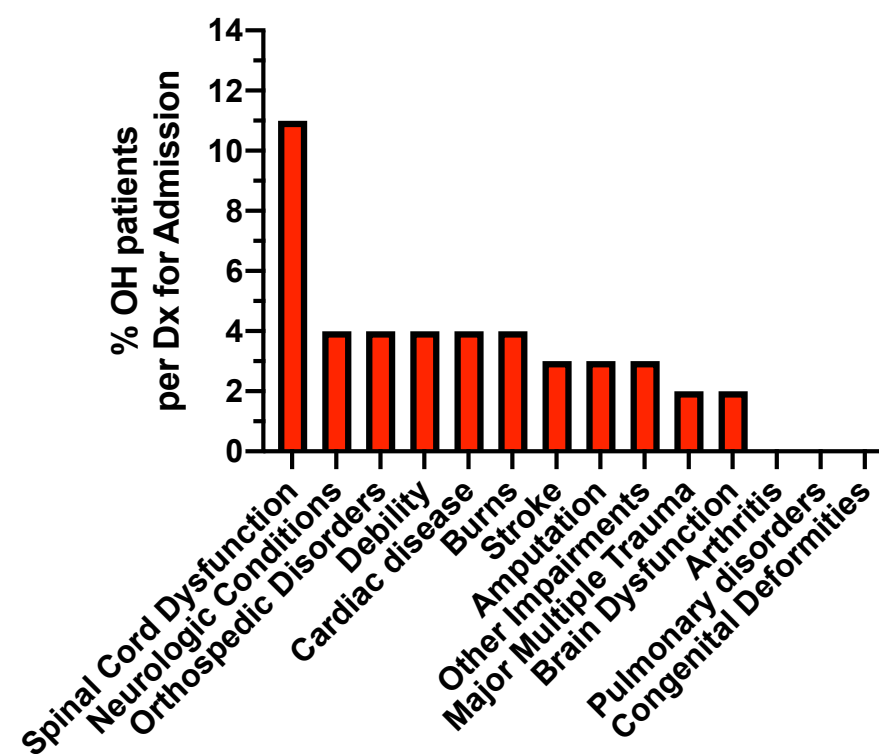


Figure. Prevalence of OH in patient groups based on diagnosis for admission (impairment group code)

Table 1. Characteristics of Patients with and without Orthostatic Hypotension (OH) in the Overall Study Population

Parameters, unit	OH+ 4% (n=315)	OH- 96% (n=8035)	P values	Total n=8350
Gender, female/male, %	28/72	43/ 57	<0.001	42/58
Age, years	60 \pm 17	60 \pm 18	0.423	60 \pm 18
Diagnosis for Admission, % (n)*				
Neurologic Conditions,	29 (91)	26 (2116)		26 (2207)
Spinal Cord Dysfunction	23 (71)	7 (579)		8 (650)
Orthopedic Disorders	13 (41)	14 (1119)		14 (1160)
Stroke	11 (34)	17 (1346)		17 (1380)
Major Multiple Trauma	6 (20)	13 (1005)		12 (1025)
Brain Dysfunction	6 (18)	10 (795)		10 (813)
Debility (non-cardiac or pulmonary)	5 (17)	5 (428)		5 (445)
Cardiac disease	4 (12)	4 (279)		4 (291)
Amputation	2 (6)	2 (189)		2 (195)
Burns	1 (3)	1 (79)		1 (82)
Other Disabling Impairments	<1 (2)	<1(61)		<1 (63)
Arthritis	-	<1 (16)		<1 (16)
Pulmonary disorders	-	<1 (20)		<1 (20)
Congenital Deformities	-	<1 (3)		<1 (3)
Discharge Status, % (n)*				
Discharged to home/ home care facility	69 (217)	71 (5717)		71 (5934)
Discharged to intermediate care or skilled nursing facility	14 (43)	9 (731)		9 (774)
Discharged/Transferred to other facility for acute care	17 (55)	19 (1529)		19 (1584)
Discharged to hospice	-	<1 (17)		<1 (17)
Other	-	<1 (41)		<1 (41)
FIM, a.u				
Admission	49 \pm 19	55 \pm 19	<0.001	55 \pm 19
Discharge	90 \pm 22	91 \pm 24	0.133	91 \pm 24
Δ FIM	37 \pm 19	35 \pm 17	0.052	35 \pm 17
FIM Efficiency	2.5 \pm 1.6	3.1 \pm 1.9	<0.001	3.1 \pm 1.9
Length of Stay (LOS), days				
Predicted on admission	18 \pm 6	16 \pm 5	<0.001	16 \pm 5
Discharge	19 \pm 13	14 \pm 9	<0.001	14 \pm 9
Δ LOS	1 \pm 11	-2 \pm 8	<0.001	-2 \pm 8

Data are presented as mean \pm SD. * Percentages were estimated within each group of patients with orthostatic hypotension (OH+) and without OH (OH-). Diagnosis for admission were obtained from impairment group codes. Other discharge status included 1 death and 40 patients who left the facility against medical advice. a.u., arbitrary units; LOS, length of stay. P values were obtained by Mann Whitney U-tests.

In the overall cohort:

- Neurological conditions, spinal cord dysfunction, orthopedic disorders and stroke were the most common conditions associated with OH.
- On admission, OH+ patients had a longer predicted LOS and lower FIM compared to OH- patients, reflecting greater medical complexity.
- At discharge, OH+ patients had longer than predicted LOS (actual LOS and Δ LOS) compared to OH- patients. FIM and Δ FIM were similar between groups, but FIM efficiency was lower in OH+ patients.
- Compared to OH- patients, a lower proportion of OH+ patients were discharged to home and a higher proportion were discharged to an intermediate care or skilled nursing facility.

Table 2. Characteristics of OH+ and OH- Patients in the Four Most Common Conditions Associated with OH on Admission.

Parameters, unit	Neurologic Conditions			Spinal Cord Dysfunction		Orthopedic Disorders			Stroke			
	OH+	OH-	P values	OH+	OH-	P values	OH+	OH-	P values	OH+	OH-	
Gender, female/male, %	22/78	42/ 58	<0.001	34/66	40/60	0.368	44/56	54/46	0.204	32/68	45/55	0.167
Age, years	64 \pm 12	63 \pm 15	0.802	49 \pm 19	55 \pm 17	0.033	65 \pm 15	63 \pm 17	0.404	67 \pm 15	64 \pm 15	0.142
Discharge Status, % (n)*												
Discharged to home/ home care facility	66 (60)	70 (1473)		69 (49)	69 (402)		73 (30)	77 (865)		68 (23)	64 (862)	
Discharged to intermediate care or skilled nursing facility	5 (5)	5 (121)		18 (13)	12 (72)		24 (10)	11 (122)		15 (5)	15 (200)	
Discharged/Transferred to other facility for acute care	29 (26)	24 (505)		13 (9)	18 (102)		3 (1)	11 (125)		17 (6)	21 (276)	
Discharged to hospice	-	<1 (6)		-	<1 (1)		-	<1 (1)		-	-	
Other	-	<1 (11)		-	<1 (2)		-	<1 (6)		-	<1 (8)	
FIM, a.u												
Admission	53 \pm 20	58 \pm 18	0.021	45 \pm 13	53 \pm 16	<0.001	52 \pm 17	58 \pm 16	0.022	52 \pm 21	48 \pm 21	0.226
Discharge	90 \pm 24	91 \pm 23	0.621	83 \pm 24	90 \pm 23	0.029	96 \pm 15	97 \pm 18	0.385	93 \pm 25	81 \pm 28	0.019
Δ FIM	33 \pm 20	33 \pm 17	0.564	37 \pm 21	36 \pm 18	0.795	41 \pm 12	38 \pm 15	0.281	38 \pm 17	33 \pm 19	0.086
FIM Efficiency	2.5 \pm 1.7	3 \pm 1.9	0.117	1.9 \pm 1.8	2.6 \pm 1.9	<0.001	3.2 \pm 1.6	3.6 \pm 1.9	0.097	2.6 \pm 1.4	2.6 \pm 1.7	0.748
Length of Stay (LOS), days												
Predicted on admission	15 \pm 4	15 \pm 4	0.132	25 \pm 7	20 \pm 6	<0.001	15 \pm 3	14 \pm 3	0.395	18 \pm 6	19 \pm 6	0.358
Discharge	15 \pm 9	13 \pm 8	0.014	27 \pm 15	18 \pm 12	<0.001	14 \pm 5	12 \pm 6	0.006	17 \pm 6	15 \pm 9	0.059
Δ LOS	0 \pm 9	-2 \pm 7	0.119	3 \pm 14	-1 \pm 11	0.017	0 \pm 5	-2 \pm 5	0.020	-1 \pm 6	-4 \pm 9	0.082

Data are presented as mean \pm SD. * Percentages were estimated within each group of patients with orthostatic hypotension (OH+) and without OH (OH-). Diagnosis for admission were obtained from impairment group codes. Other discharge status included 1 death and 40 patients who left the facility against medical advice. a.u., arbitrary units; LOS, length of stay. P values were obtained by Mann Whitney U-tests.

- Similar to the overall cohort, FIM on admission was lower in OH+ patients admitted due to neurologic conditions, spinal cord dysfunction and orthopedic disorders compared to those without OH. Only OH+ patients admitted due to spinal cord dysfunction had lower FIM and FIM efficiency at discharge.
- The actual LOS was longer in OH+ patients admitted due to neurologic conditions, orthopedic disorders and stroke compared to those without OH, despite similar predicted LOS on admission.
- A lower proportion of OH+ patients admitted due to neurologic conditions and orthopedic disorders were discharged to home compared to those without OH.
- A preliminary analysis using a general linear model with LOS as a dependent measure also identified a significant main effect of OH on this outcome.

CONCLUSIONS

- Orthostatic hypotension was present in a significant proportion of patients undergoing acute rehabilitation, particularly in those admitted due to neurological conditions, spinal cord dysfunction, orthopedic disorders and stroke.
- Orthostatic hypotension adversely impacts the recovery of these patients as measured by a prolonged rehabilitation period (i.e. longer length of stay) to achieve the same functional gain as patients without OH. Moreover, in the overall group, a lower proportion of OH+ patients were discharged to home and a higher proportion were discharged to an intermediate care or skilled nursing facility.

REFERENCES

- Kong et al. Arch Phys Med Rehabil, 2003
- Qureshi et al Arch Phys Med Rehabil., 2003
- Scott and David, 2014

