High Blood Pressure & Cardiovascular Prevention
https://doi.org/10.1007/s40292-026-00808-2

Online ISSN 1179-1985

ORIGINAL ARTICLE

Orthostatic Hypotension in Hypertensive Patients Hospitalized in Italian Internal Medicine Departments: FADOI-HYP-OP Study

Claudio Ferri[1] · Alberto Mazza[2,3] · Dario Manfellotto[4] · Francesco Dentali[5] · Alberto Moggi Pignone[6] · Maria D'Avino[7] · Roberta Buso[8] · Antonella Valerio[9] · Maria Lorenza Muiesan[10] · Giovanbattista Desideri[11] · Martino Pengo[12,13] · Grzegorz Bilo[12,13] · Gianfranco Parati[12,13] · Andrea Fontanella[14] · on behalf of FADOI HYP-OP Study Group

Received: 26 March 2026 / Accepted: 9 May 2026

Abstract

Introduction Orthostatic hypotension (OH) is defined as a decline in systolic blood pressure of at least 20 mmHg or a reduction in diastolic blood pressure of at least 10 mmHg, within the first 3 min of standing.

Aim To evaluate the prevalence of OH and to identify the characteristics of patients with OH in hypertensive patients hospitalized in medical inpatient departments.

Methods A multicenter, observational, prospective study (FADOI-HYP-OP) included 1000 hypertensive inpatients from 29 Departments throughout Italy. Demographic, clinical data, blood pressure and the presence of comorbidities were recorded at baseline. Factors associated with OH were assessed in multiple logistic regression analysis.

Results The prevalence of OH was 25.1%. Factors independently associated with OH included disturbances of consciousness (RR 1.56, 95%CI 1.10–2.20; $p=0.01$), Parkinson's disease (RR 2.30, 95%CI 1.47–3.59; $p=0.0002$), type-1 diabetes

Claudio Ferri and Alberto Mazza have contributed equally to this work.

✉ Antonella Valerio
antonella.valerio@fadoi.org

1 University of L'Aquila-MeSVA Department and Internal Medicine and Nephrology, Hypertension and Cardiovascular Prevention Unit, San Salvatore Hospital, L'Aquila, Italy

2 Internal Medicine Department, Rovigo General Hospital, Rovigo, Italy

3 Internal Medicine Department, San Bortolo General Hospital and Hypertension Center Certified by the Italian Society of Hypertension (SIIA), Vicenza, Italy

4 Department of Emergency and Internal Medicine,, Isola Tiberina Hospital, Gemelli-Isola, Rome, Italy, Rome, Italy

5 Department of Medicine, ASST-Settelaghi, Varese, Italy

6 Internal Medicine 4 Department, Careggi University Hospital, Florence, Italy

7 Internal Medicine Department, Cardarelli Hospital, Naples, Italy

8 Internal Medicine Department, "Cà Foncello" Hospital, Treviso, Italy

9 Research Department, FADOI Foundation, MIND—Viale del Decumano, 32, 20157 Milan, Italy

10 Internal Medicine Department, University of Brescia and ASST Spedali Civili, Brescia, Italy

11 Internal Medicine Department, "SS. Filippo e Nicola" Hospital, Avezzano, L'Aquila, Italy

12 Department of Cardiology, IRCCS, Istituto Auxologico Italiano, Milan, Italy

13 Department of Medicine and Surgery, University of Milano-Bicocca, Milan, Italy

14 Internal Medicine Department, Fatebenefratelli Hospital, Naples, Italy

Published online: 15 July 2026

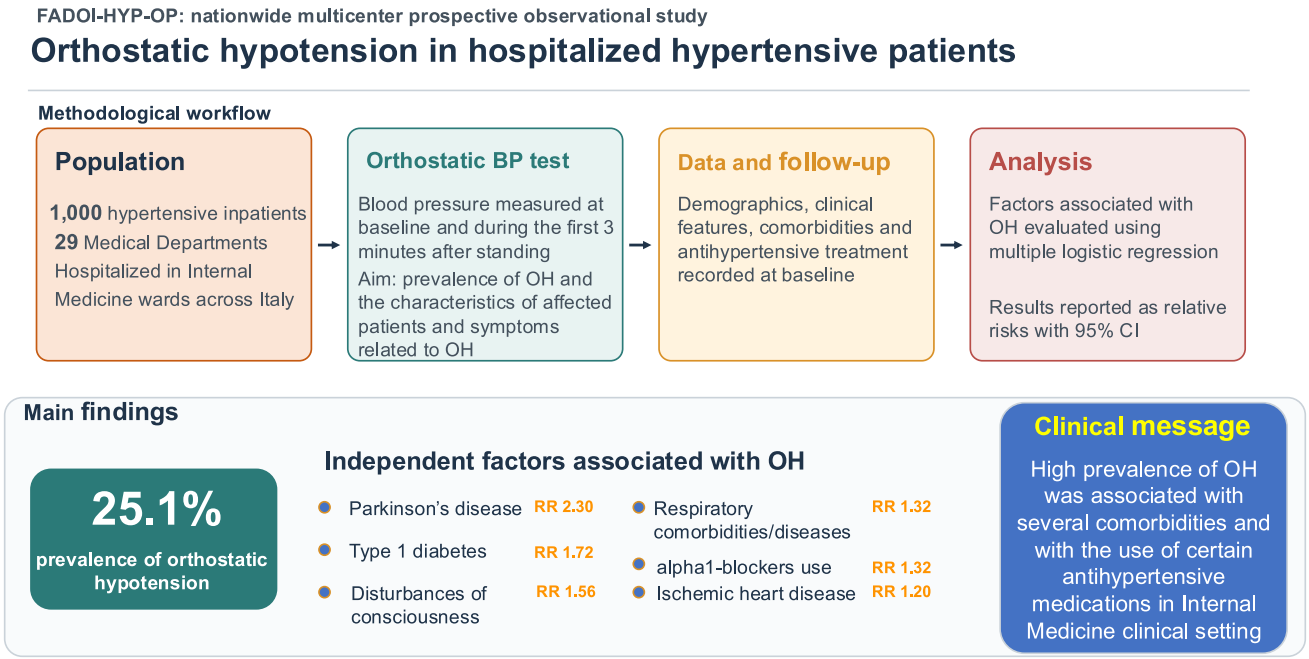
Adis

(RR 1.72, 95%CI 1.05–2.80; $p=0.03$), respiratory comorbidities/diseases (RR 1.32, 95%CI 1.02–1.70; $p=0.04$), ischemic heart disease (IHD) (RR 1.20, 95%CI 1.01–1.43; $p=0.04$) and α1-adrenergic receptor blockers use (RR 1.32, 95%CI 1.03–1.69; $p=0.03$).

Conclusions These real-world data indicate considerable prevalence of OH in hypertensive inpatients and confirm the association between OH and several common comorbidities as well as with use of α1-adrenergic receptor blockers.

Clinical Trial registration: NCT05247060.

Graphical abstract



Keywords Orthostatic hypotension · Hypertensive patients · Internal medicine · Real-world data

1 Introduction

Orthostatic hypotension (OH) is defined as a drop in blood pressure (BP) on standing [1, 2]. Although a definite agreement has never been achieved, it is generally accepted that the diagnosis of OH is based on a decline in systolic BP of at least 20 mmHg or in diastolic BP of at least 10 mmHg within 3 min of standing, starting from at least 5 min in either the sitting or the supine position [1–3]. Measurement of standing BP levels, regardless of the presence of hypertension, is not routinely recommended in clinical practice. However, it is encouraged in older, treated hypertensive, diabetic patients and, in general, in people having specific factors potentially favoring a significant orthostatic BP decrement [3].

OH increases the risk of falls [4], cardiovascular disease [5], depression [6], cognitive decline [7], hospitalizations or emergency department visits [8] and death [9]. It is usually caused by failure of the autonomic reflex, volume depletion, and/or adverse reaction to antihypertensive and/or other medications [9, 10]. In specific conditions, particularly represented by the Parkinson's disease, the dangerous mixture of autonomic failure and medications can result in OH with supine hypertension [11, 12]. Symptoms on presentation of OH are commonly related to cerebral hypoperfusion. However, the drop in BP is commonly asymptomatic, thus leading to an even more marked increment in its negative consequences [13].

As expected, OH and hypertension often coexist, particularly in elderly hypertensives with multiple comorbidities and/or taking numerous medications [1, 2, 14]. The management of this coexistence is challenging, since antihypertensive treatment should be reduced in order to counteract hypotension while maintaining an adequate hypertension control [1, 2]. In this context, OH has been widely investigated in hospitalized Internal Medicine patients [15], with inconclusive results and a prevalence ranging from 22 [16] to 75% [17]. Limited information is available in this regard in Italian patients [18, 19].

Aim of the Orthostatic hypotension in hypertensive patients hospitalized in Italian Internal Medicine

Departments (HYP-OP) Study was: (1) to investigate the prevalence of OH in hypertensive patients who were hospitalized because of any reason and were not aware of this condition; (2) to describe the characteristics of affected patients and symptoms related to OH.

2 Methods

2.1 Study Design and Setting

HYP-OP was a prospective observational multicenter national study, promoted, sponsored and coordinated by the FADOI Foundation (the Italian Scientific Society of Hospital Internal Medicine) which provided the scientific and operational coordination, in collaboration with the Italian Society of Hypertension (SIIA). Details on the protocol are reported in the paper describing the rationale and design [20].

Investigators enrolled consecutive adult hypertensive patients hospitalized in the Internal Medicine Departments with hypertension either previously known or discovered on admission. Patients were enrolled in 29 Italian Internal Medicine Departments (from October 2018 to Novembre 2022), reasonably representative of this setting on a nationwide basis, by considering geographical distribution, characteristics of the hospital.

The study was divided in two phases:

(1) In the cross-sectional phase 1, the hospitalization, clinical data were collected from consecutive patients with arterial hypertension admitted to Internal Medicine and able to assume the upright position;
(2) in phase 2, the follow-up (FU), health status of participants was recorded, after 6–12–24–36 months from the index hospitalization, by telephone contact or clinical visit, if already scheduled, reporting falls, cardiovascular events (stroke, TIA, acute myocardial infarction, arrhythmias) or death. The results of phase 2 will be discussed in a separate publication.

2.2 Ethical Clearance

The study, following the approval of the protocol (FADOI-HYP-OP protocol code FADOI.02-2018) by local Ethics Committees, was carried out in full compliance with the Declaration of Helsinki and the principles of Good Clinical Practice; signed informed consent was collected from each patient. ClinicalTrial.gov registration number: NCT05247060.

2.3 Study Population

The cohort consisted of 1000 patients with hypertension either previously known or discovered on admission. The diagnosis of hypertension was made in accordance with the 2018 European Society of Hypertension (ESH) guidelines for a systolic BP (SBP) at least 140 mmHg or diastolic BP (DBP) at least 90 mmHg on repeated measurements, or independently of BP values for people taking anti-hypertensive medications.

2.4 Blood Pressure Measurement

Participants underwent three measurements of BP and heart rate, one after 3 min in a sitting position and two in a standing position (after 1 min and after 3 min), using locally available, validated semi-automatic BP devices equipped with cuffs of appropriate size based on arms circumference.

For the analysis the diagnosis of OH was based on a decline in SBP of at least 20 mmHg or in DBP of at least 10 mmHg within 3 min of standing, starting from at least 5 min in either the sitting or the supine position.

2.5 Data Collection

Demographic and clinical characteristics were recorded for each patient, as well as laboratory variables and drug therapies at the time of admission and during the hospital stay. Data were recorded in study-specific electronic case report form, based on contents of the hospital charts. All 1000 adult consecutive hypertensive patients with signed informed consent were enrolled, excluding only patients unable to stand up for a few minutes. Recorded variables included BP and heart rate in a sitting position, and subsequently, after 1 and 3 min from the assumption of the standing position. Other clinical and anamnestic parameters included: Charlson Index, lifestyle habits, cognitive status (Mini Mental Status Examination; MMSE), history of falls, pharmacological treatments, with particular focus on the antihypertensive therapy, Frailty Index (Short Physical Performance Battery; SPPB). Additionally, disturbances of consciousness (DOC) and difficulty in maintaining an upright position and the evaluation of visual disturbances were registered; they were considered if clinically manifesting with dizziness, blurred vision, unsteadiness, pre-syncope, and syncope, often associated with a failure of compensatory tachycardia.

Other parameters/events recorded were drug-related adverse reactions and in-hospital death.

Lastly, after 6–12–24–36 months from the hospitalization, falls and cardiovascular events (i.e. stroke, TIA, myocardial infarction, arrhythmias) or death were recorded.

Table 1 Demographic and clinical characteristics of the general population of patients with or without orthostatic hypotension at hospitalisation admission

	General population N = 1000 (100%)	Orthostatic hypotension		*p*-value
		Yes 251 (25.1%)	No 749 (74.9%)	
Demographic characteristics				
Age ≥ 75 years	523 (52.3%)	145 (57.8%)	378 (50.5%)	0.05
Male sex	597 (59.7%)	159 (63.4%)	438 (58.5%)	0.18
In-hospital sitting blood pressure and heart rate				
Systolic Blood Pressure (mm/Hg) mean (± SD)	130.5 (±19.4)	135 (± 22.3)	137 (± 22.0)	0.26
Diastolic Blood Pressure (mm/Hg) mean (± SD)	74.6 (±11.3)	77 (±12.0)	76.2 (±11.7)	0.75
Heart rate (bpm) mean (± SD)	77.7 (±14.4)	79.4 (±15.8)	79.5(±15.5)	0.95
Systolic Blood Pressure < 120 mm/Hg	163 (16.3%)	50 (19.9%)	113 (15.1%)	0.06
Systolic/diastolic Blood Pressure < 120/70 mm/Hg	77 (7.7%)	24 (9.6%)	53 (7.1%)	0.18
Symptoms				
Visual disturbances	149 (14.9%)	40 (16.0%)	109 (14.6%)	0.59
Disturbances of consciousness	35 (3.5%)	15 (6.0%)	20 (2.7%)	0.006
Difficulty in maintaining an upright position	86 (8.6%)	30 (12.0%)	56 (7.5%)	0.02
Dizziness	151 (15.1%)	48 (19.1%)	103 (13.8%)	0.03
Other	37 (3.7%)	11 (4.4%)	26 (3.5%)	0.50
Cardiovascular comorbidities				
Peripheral arterial disease	94 (9.4%)	32 (17.7%)	62 (8.3%)	0.03
Ischemic heart disease	296 (29.6%)	93 (37%)	203 (27.1%)	0.002
Stroke	55 (5.5%)	16 (6.4%)	39 (5.2%)	0.47
TIA	49 (4.9%)	11 (4.4%)	38 (5.1%)	0.67
Heart failure	213 (21.3%)	48 (9.1%)	165 (22%)	0.34
Others cardiovascular comorbidity	430 (43%)	119 (47.4%)	311 (41.5%)	0.10
Neuropsychiatric comorbidities				
Major depression	26 (2.6%)	6 (2.4%)	20 (2.7%)	0.81
Alzheimer's disease	3 (0.3%)	0 (0%)	3 (0.4%)	ns
Parkinson's disease	10 (1%)	7 (2.8%)	3 (0.4%)	< 0.0001
Others neuropsychiatric comorbidity	92 (9.2%)	28 (11.2%)	64 (8.5%)	0.20
Metabolic comorbidities				
Type 1 diabetes	15 (1.5%)	7 (2.8%)	8 (1.1%)	0.02
Type 2 diabetes	306 (30.6%)	69 (27.5%)	237 (21.6%)	0.22
Diabetes (type 1 or type 2)	318 (31.8%)	76 (30.3%)	242 (32.3%)	0.55
Hypothyroidism	112 (11.2%)	24 (9.6%)	88 (11.7%)	0.35
Hyperthyroidism	16 (1.6%)	5 (2.0%)	11 (1.5%)	0.55
Others metabolic comorbidity	153 (15.3%)	37 (50%)	116 (43%)	0.28
Respiratory comorbidities/diseases				
Asthma	22 (2.2%)	7 (2.8%)	15(2.0%)	0.44
COPD	230 (23.0%)	64 (25.5%)	166 (22.2%)	0.27
Others respiratory comorbidities/diseases	87 (8.7%)	29 (11.5%)	58 (7.7%)	0.05
Gastro-pancreatic comorbidities				
Cirrhosis of the liver	20 (2%)	4 (1.6%)	16 (2.1%)	0.61
Chronic inflammatory disease	14 (1.4%)	5 (2.0%)	9 (1.2%)	0.32
Peptic ulcer	34 (3.4%)	11 (4.4%)	23 (3.1%)	0.30
Other gastro-pancreatic comorbidity	213 (21.3%)	48 (19.1%)	165 (22.0%)	0.34
Osteoarticular comorbidities				
Rheumatoid arthritis	9 (0.9%)	3(1.2%)	6 (0.8%)	0.54
Osteoporosis	78 (7.8%)	14 (5.6%)	64 (8.5%)	0.15
Others osteoarticular comorbidity	138 (13.8%)	31 (12.3%)	107 (14.3%)	0.45
Oncological comorbidities				
Local	151 (15.1%)	34 (13.5%)	117 (15.6%)	0.43
Metastatic	28 (2.8%)	8 (3.2%)	20 (2.7%)	0.66

Table 1 (continued)

	General population N = 1000 (100%)	Orthostatic hypotension		*p*-value
		Yes 251 (25.1%)	No 749 (74.9%)	
Other comorbidities	438 (43.8%)	110 (43.8%)	328 (43.8%)	0.99
Chronic kidney disease				
Mild	295 (29.5%)	65 (27.5%)	230 (32.8%)	
Moderate IIIa	186 (18.6%)	43 (18.2%)	143 (20.4%)	0.11
Moderata IIIb	178 (17.8%)	57 (24.1%)	121 (17.2%)	
Serious	91 (9.1%)	25 (10.6%)	66 (9.4%)	
Anemia	526 (52.6%)	144 (60.3%)	382 (53.9%)	0.09
Drugs for hypertension				
No drugs	39 (3.9%)	14 (5.6%)	25 (3.3%)	
Diuretics	497 (49.7%)	126 (50.2%)	371 (49.5%)	0.85
Beta-blockers	475 (47.5%)	115 (45.8%)	360 (48.1%)	0.54
Calcium channel blockers	381 (38.1%)	99 (39.4%)	282 (37.6%)	0.61
ACE-inibitors	401 (40.1%)	97 (38.6%)	304 (40.6%)	0.59
AT1 antagonists	284 (28.4%)	59 (23.5%)	225 (30.0%)	0.05
Alpha1 antagonists	83 (8.3%)	31 (12.3%)	52 (6.9%)	0.004
At central level	13 (1.3%)	4 (1.6%)	9 (1.2%)	0.62
Charlson index				
Charlson index mean (± SD)	2.5 (±2.1)	2.6 (±2.0)	2.4 (±2.1)	
Min-Max	0–11	0–10	0–11	
Charlson Index=0	170 (17.0 %)	33 (13.2%)	137 (18.3%)	
Charlson Index=1	209 (20.9%)	57 (22.7%)	152(20.3%)	0.08
Charlson Index=2	208 (20.8%)	51 (20.3%)	157 (21.0%)	0.24
Charlson Index=3	147 (14.7%)	42 (16.7%)	105 (14.0%)	0.06
Charlson Index=4	102 (10.2%)	22 (8.8%)	80 (10.7%)	0.67
Charlson Index=5	72 (7.2%)	16 (6.4%)	56 (7.5%)	0.62
Charlson Index ≤ 5	908 (90.8%)	221(88.1%)	687 (91.7%)	0.07
Charlson Index > 5	92 (9.2%)	30	62	0.02

SD, standard deviation; COPD, chronic obstructive pulmonary disease; TIA, transient ischemic attack; ACE, angiotensin converting enzyme; AT1: Angiotensin II Type 1 receptor

2.6 Sample Size Definition and Statistical Analysis

A sample size of 1000 patients was considered adequate to document a reliable estimate of a hypothetical prevalence of OH in the studied cohort of 12 ± 3% (statistical power of 80%, alpha error: 5%). Descriptive statistics were performed by calculating mean and standard deviation (SD) or median for continuous variables and absolute and relative frequencies for categorical variables. Prevalence of OH was reported with the corresponding 95% confidence interval (CI) corrected for continuity. Multivariate analysis model was carried out to evaluate the possible association between the presence of OH (primary end-point) and covariates selected on the basis of their clinical plausibility. Variables were selected if the relative *p*-value in univariate analysis was ≤ 0.1. Multivariate adjusted relative risk (RR) for OH was calculated adjusting for confounders in logistic regression models. *P*-value < 0.05 was considered as statistically significant. All analyses were performed using SAS version 9.4).

3 Results

3.1 Characteristics of the Study Population

A total of 1000 patients were enrolled; the study population characteristics are presented in Table 1. Patients were elderly, the mean age was 72.5 ± 11.9 years, and 52.3% were ≥ 75 years old. The prevalence of comorbidities was very high with 16.4% of patients with Charlson Index ≥ 5 and about 60% of the population having 3 or more comorbidities mainly represented by cardiovascular (CV) diseases, anemia, chronic kidney disease, chronic obstructive pulmonary disease (COPD), diabetes. Nearly 63% of patients had the SPPB less than 9 indicating a moderate impairment of physical performance. Approximately one out of 4 patients had below-normal cognitive functions with a MMSE Score ≤ 24 (Table 2).

Table 2 Frailty assessed with short physical performance battery (SPPB) and level of cognitive decline assessed with Mini Mental State Examination (MMSE) both at baseline and association with orthostatic hypotension

	General population N = 1000 (100%)	Orthostatic hypotension		
		Yes 251 (25.1%)	No 749 (74.9%)	Chi-Square *P* value
Short physical performance battery (SPPB) score				
SPPB Score ≤ 2	62 (6.2%)	19 (7.6%)	43 (5.7%)	0.55
SPPB Score 3–9	565 (56.5%)	142 (56.6%)	423 (56.5%)	
SPPB Score ≥ 10	373 (37.3%)	90 (35.9%)	283 (37.8%)	
Mini-mental state examination (MMSE) score				
MMSE Score ≤ 18	37 (3.7%)	13 (5.2%)	24 (3.2%)	0.14
MMSE Score 19–24	230 (23.0%)	49 (21.3%)	181 (24.2%)	
MMSE Score ≥ 25	733 (73.3%)	189 (75.3%)	544 (72.6%)	

3.2 Patients with Orthostatic Hypotension

Of the 1000 patients enrolled, 251 (25.1%, 95% CI 22.5–27.9) were OH patients; of these 82 patients (8.2%) have a decline at least 20 mmHg in SBP, 98 (9.8%) patients have a decline at least 10 mmHg in DBP and 71 patients (7.1%) have both by decline SBP and DBP.

3.3 Factors Associated with Orthostatic Hypotension

Univariate e multivariable analyses (Table 3) demonstrated that several factors were associated with OH; in the univariate analyses, factors were age ≥ 75 years, disturbances of consciousness, other respiratory comorbidities/diseases, Parkinson's disease, peripheral arterial disease, ischemic heart disease, type-1 diabetes, and alpha-1 antagonist use, whereas AT1 antagonist therapy showed a borderline inverse association. In the multivariable logistic regression model, the strongest predictor of OH was Parkinson's disease (RR 2.30, 95% CI 1.47–3.59; $p = 0.0002$), followed by disturbances of consciousness (RR 1.56, 95% CI 1.10–2.20; $p = 0.01$), type-1 diabetes (RR 1.72, 95% CI 1.05–2.80; $p = 0.03$), alpha-1 antagonist use (RR 1.32, 95% CI 1.03–1.69; $p = 0.03$), other respiratory comorbidities/diseases (RR 1.32, 95% CI 1.02–1.70; $p = 0.04$), ischemic heart disease (RR 1.20, 95% CI 1.01–1.43; $p = 0.04$), and AT1 antagonist therapy ($p = 0.13$). Age ≥ 75 years ($p = 0.18$), peripheral arterial disease ($p = 0.21$), did not show significant association after adjustment.

4 Discussion

Prevalence of OH varies widely across studies and ranges from < 5% to more than 50%, depending on methodological and demographic factors, population characteristics, BP measurement technique and clinical context [21, 22]. Higher OH rates are observed in institutional/hospital settings than in community samples and commonly the prevalence is about 30% or more in geriatric inpatient cohorts [23, 24].

In our study, we aimed to define the prevalence and the clinical phenotype of patients with OH in patients admitted in Internal Medicine Department and to determine whether OH is associated with higher total and cardiovascular events or higher cardiovascular risk in a large, representative group of elderly inpatients of both sexes.

In our cohort, having an average age of 72.5 years, prevalence of OH was 25%. This finding can be compared with two other Italian studies. The study by Alli et al. reported a considerably lower prevalence (13.8%) [18], most likely because it included outpatients randomly recruited in general practices while our study included inpatients of internal medicine departments. On the other hand, a similar prevalence of persistent OH (27.1%) as in our cohort was reported by Pasina et al. [19], in a much smaller (N = 85) cohort of Internal Medicine inpatients. This latter study reported additionally a considerable proportion of patients

Table 3 Factors associated with orthostatic hypotension in univariate and multivariable logistic regression analysis

	Univariate logistic regression analysis			Multivariable logistic regression analysis		
	RR	(95% CI)	*p*	RR	(95% CI)	*p*
Age ≥ 75 years	1.25	1.00–1.55	0.05	1.12	0.95–1.32	0.18
Disturbances of consciousness	1.75	1.18–2.61	0.006	1.56	1.10–2.20	0.01
Others respiratory comorbidities/diseases	1.37	1.00–1.88	0.05	1.32	1.02–1.70	0.04
Parkinson's disease	2.84	1.86–4.32	< 0.0001	2.30	1.47–3.59	0.0002
Peripheral arterial disease	1.41	1.04–1.91	0.03	1.17	0.91–1.51	0.21
Ischemic heart disease	1.40	1.13–1.74	0.002	1.20	1.01–1.43	0.04
Type 1 diabetes	1.88	1.08–3.27	0.02	1.72	1.05–2.80	0.03
AT1 antagonists	0.77	0.60–1.00	0.05	0.86	0.71–1.04	0.13
Alpha1 antagonists	1.56	1.15–2.10	0.004	1.32	1.03–1.69	0.03

with occasional OH (48.2%). It should be noted that the participants in the study of Pasina et al. were considerably older (mean age 79.6 years) than in our study.

Our study identified several factors independently associated with OH.

Parkinson's disease—OH is a common non-motor symptom of Parkinson's disease (PD) and results from autonomic nervous system dysfunction and sympathetic denervation [1]. In PD, degeneration of sympathetic nerves and accumulation of α-synuclein impair the release of norepinephrine leading to a failure of the autonomic nervous system to adequately regulate BP during postural change [25]. Moreover, dopaminergic medications used to treat PD - such as levodopa and dopamine agonist - can further worsen OH [1, 25, 26].

In our study PD was associated with more than doubled risk of developing OH; this finding confirms the need to actively assess PD patients for impaired BP regulation and OH in order to improve patient safety and quality of life.

Diabetes mellitus. OH is widely recognized as a frequent and clinically relevant complication of DM, especially in patients with long-standing disease and poor glycemic control [27].The primary link between DM and OH is diabetic autonomic neuropathy but other diabetes-related factors may also contribute to OH, including osmotic diuresis, volume depletion, endothelial dysfunction, arterial stiffness, and impaired activation of the renin–angiotensin–aldosterone system. [28, 29].

In our cohort type 1 DM was a potent independent predictor of OH, associated with over 70% higher OH risk than in non-diabetic patients. Interestingly, this relationship was not evident for the more common type 2 DM. This in apparent contrast with population data showing that symptoms of autonomic neuropathy are more common in type 2 DM and the prevalence of orthostatic intolerance is similar [30]. However, the impact of DM on autonomic function largely depends on its duration and on long-term metabolic control, which were not necessarily comparable between our sample and general population data.

Disorders of consciousness (DOC) typically result from central nervous system abnormalities, such as disruption of signaling in the ascending reticular activating system, thalamo-cortical circuits or widespread cortical networks responsible for wakefulness and awareness. They may involve global neurological symptoms which reflect diffuse cortical or subcortical dysfunction and focal neurological symptoms which often depend on abnormal cranial nerve function [31, 32]. The presence of these abnormalities configures a particular form of OH, namely neurogenic orthostatic hypotension, often associated with a failure of compensatory tachycardia, a hallmark of the neurogenic form [1, 3, 21, 33].

In our study patients with DOC had a OH risk increased by 56%; an early identification of DOC-OH association is thus essential to reduce falls, syncope, and impaired functional independence.

Alpha-adrenergic receptor antagonists (α-blockers) widely used in the management of hypertension and lower urinary tract symptoms and disease (i.e. prostatic hyperplasia) highly prevalent conditions in older patients. Their mechanism of action inherently (arterial and venous vasodilation caused by α1-receptor blockade) predisposes patients to disturbances in orthostatic BP regulation. [21, 33, 34]. In particular, non-selective agents, such as phenoxybenzamine and phentolamine, and non-uroselective α1-blockers, including prazosin, doxazosin, and terazosin, exert more pronounced systemic vasodilatory effects and are therefore more frequently associated with symptomatic OH. In contrast, uro-selective α-blockers (eg. tamsulosin) exert minimal influence on systemic vascular tone, resulting in a comparatively lower incidence of OH [3, 35, 36].

In our cohort, patients taking α1-blockers had a risk of having OH increased by more than 32% and for these patients the implementation of mitigation strategies, such as gradual dose titration, nighttime initiation of therapy and patient selection, can significantly reduce the risk and severity of orthostatic events.

Respiratory disease Chronic obstructive pulmonary disease (COPD) was among most frequent comorbidities in our sample but it was not associated with incidence of OH.

Other respiratory diseases such as interstitial lung disease, pulmonary fibrosis and sleep disordered breathing may contribute to OH due to severe hypoxemia, autonomic dysfunction and chronic right heart strain especially in case of advanced, long-standing disease [37, 38]. Neurodegenerative respiratory syndromes diseases like multiple system atrophy (MSA) or Parkinson's disease may also favour OH via autonomic dysfunction and respiratory involvement [39]. In our study, the presence of others comorbidities/respiratory diseases (with asthma and COPD excluded), increased the risk of OH by 32%, however, our data do not allow to identify any specific respiratory condition underlying this difference.

Coronary artery disease—OH is frequently observed in older adults and in patients with CV comorbidities and as in our patients coronary artery disease (CAD) was associated with the risk of OH increased by 20%.

From a pathophysiological perspective, CAD may be linked with OH through several common mechanisms, including increased arterial stiffness, endothelial dysfunction and impaired baroreceptor-mediated autonomic regulation of BP [21, 34]. Also, pharmacologic treatments commonly used in patients with CAD, including nitrates, beta-blockers, diuretics, and ACE inhibitors, may exacerbate OH by

inducing vasodilation, volume depletion, or blunting of reflex tachycardia [35, 40]. This association may have clinical consequences as acute hypotensive episodes may reduce coronary perfusion, precipitating ischemic events [21, 41]. Our data reinforce the need for an integrated approach to patients with OH and CAD, balancing the reduction of long-term ischemic risk with the prevention of hypotensive complications. In this respect, strategies include careful titration of antihypertensive and antianginal medications and non-pharmacologic measures such as gradual positional changes and close monitoring of orthostatic BP responses.

Overall, our data emphasize that OH should not be simply considered as a BP drop but rather as a distinct clinical phenotype highly prevalent in Internal Medicine inpatient population, both in normotensives and hypertensives. It reflects impaired autonomic regulation, vascular stiffness, hypovolemia and/or medication effects. This phenotype includes symptoms, signs, autonomic features, hemodynamic patterns and is commonly associated with comorbidities such as DM, PD and respiratory diseases [33, 34].

5 Conclusions

This prospective, nationwide study aimed to assess the phenotype of patients with orthostatic hypotension (OH) among hypertensive individuals hospitalized in Internal Medicine Departments. It provides real-world data from a large patient sample representative of the Italian setting. The prevalence of OH was relatively high and was associated with several comorbidities and with the use of certain antihypertensive medications.

Our results suggest several possible areas where current clinical practice may improve. First, the screening for OH should be mandatory among internal medicine inpatients. A well-standardized orthostatic BP measurement represents a simple way to identify this common condition thus allowing to mitigate the associated risks and to trigger an active search for underlying conditions, in particular for autonomic dysfunction. A careful review of chronic treatments is mandatory in OH patients with a particular attention to alpha1-agonists, which, while representing in current guidelines a medication class basically reserved for resistant hypertensive patients, are still commonly used in older and frail patients at high risk of OH.

Further research is warranted to confirm these findings in different clinical settings and populations and to explore optimal management strategies.

Acknowledgements The authors acknowledge all patients that participated in the study. We are grateful to all physicians and nurses involved in the daily activity at the Internal Medicine Departments that collaborated for patients recruiting. A special acknowledgment goes to Davide Ghilardi for the start-up procedures and Annachiara Crespi for the initial phase of the study.

FADOI-Hyp-Op Study Group authors: who actively contributed to the enrolment of patients and data collection (listed by center and, in descending order, by numbers of patients enrolled): Anita Di Renzo MD 1, Romina Di Salvatore MD 1, Davide Grassi MD 1, Laura Schiavon MD 2, Irene Caridi MD 4, Alessia Montano MD 4, Eleonora Moriconi MD 4, Luca Di Lazzaro MD 4, Cristina De Dionigi MD 5, Vera Gessi MD 5, Giulia Bandini MD 6, Fabrizio Capasso MD 7, Marcello Rattazzi MD 8, Davide Bassetti MD 10, Giuseppe Bulgari MD 10, Simona Vittoria Maulè MD 15, Gabriele Sobrero MD 15, Fabrizio Vallelonga MD 15, Pietro Minuz MD 16, Lorella Branz MD 16, Andrea Dalbeni MD 16, Andrea Maria Maresca MD 17, Rossana Corso MD 17, Michele Ciccarelli MD 18, Franco Cipollini MD 19, Enrica Arcangeli MD 19, Monica Nardi MD 19, Nicola Nesti MD 19, Aniello De Leo MD 20, Francesco Fantin MD 21, Maurizio Renis MD 22, Vittorio Salvatore MD 22, Giovanni Rossi MD 23, Carlo Lorenzo Muzzulini MD 24, Daniela Avolio MD 24, Giovanni Ferraro MD 25, Antonio Maria Agrati MD 25, Arianna Pani MD 25, Alessandra Romandini MD 25, Michele Senatore MD 25, Santo Agatino Neri MD 26, Giovanni Di Santo MD 27, Vincenzo Cioffi, MD 27, Giovanni Malgieri MD 27, Salvatore Lenti MD 28, Giada Tosoni MD 28, Michele Meschi MD 29, Maria Teresa Lavazza MD 30, Sara Speroni MD 30, Enzo Apolloni MD 31, Nadia Xamin 31, Giancarlo Parisi MD 32, Carmen Tirrito MD 32, Plinio Fabiani MD 33, Valentina Annoni MD 33, Davide Carrara MD 33, Giulia Galli MD 33.

FADOI-Hyp-Op Study Group authors' affiliations are as follows: 1 University of L'Aquila-MeSVA Department and Internal Medicine and Nephrology, Hypertension and Cardiovascular Prevention Unit, San Salvatore Hospital, L'Aquila, Italy; [2] Internal Medicine Department, Rovigo General Hospital, Rovigo, Italy; [4] Internal Medicine, Fatebenefratelli Isola Tiberina Hospital, Gemelli Isola, Rome, Italy; [5] Department of Medicine, ASST-Settelaghi, Varese, Italy; [6] Internal Medicine 4 Department, Careggi University Hospital, Florence, Italy; [7] Internal Medicine Department, Cardarelli Hospital, Naples, Italy; [8]Internal Medicine Department, "Cà Foncello" Hospital, Treviso, Italy; [10] Internal Medicine Department, ASST Spedali Civili, Brescia, Italy; [15] Internal Medicine Department, "Città della salute" Hospital, Torin, Italy; [16] Internal Medicine Department, "Borgo Roma" Hospital, Verona, Italy; [17] Internal Medicine Department, "Circolo Macchi" Hospital, Varese, Italy; [18] Internal Medicine Department, "San Giovanni di Dio e Ruggi d'Aragona" Hospital, Salerno, Italy; [19] Internal Medicine Department, "San Jacopo" Hospital, Pistoia, Italy; [20] Internal Medicine Department, "Buon Consiglio Fatebenefratelli" Hospital, Naples, Italy; [21] Internal Medicine Department, "Borgo Trento" Hospital, Verona, Italy; [22] Internal Medicine Department, "S. Maria Incoronata dell' Olmo" Hospital, Cava de' Tirreni, Salerno, Italy; [23] Internal Medicine Department, "S. Anna" Hospital, Como, Italy; [24] Internal Medicine Department, Ceva Hospital, Ceva, Cuneo, Italy; [25] Internal Medicine Department, "Niguarda" Hospital, Milan, Italy; [26] Internal Medicine Department, ARNAS Garibaldi Hospital, Catania, Italy; [27] Internal Medicine Department, "Sant' Agata dei Goti" Hospital, Benevento, Italy; [28] Internal Medicine Department, Abbadia San Salvatore Hospital, Siena, Italy; [29] Internal Medicine Department, "S. Maria" Hospital, Borgo Val di Taro, Parma, Italy; [30] Internal Medicine Department, Civile Hospital, Legnano, Milan, Italy; [31] Internal Medicine Department, Bassano del Grappa Hospital, Bassano del Grappa, Vicenza, Italy; [32] Internal Medicine Department, Piove di Sacco Hospital, Padova, Italy; [33] Internal Medicine Department, Versilia Hospital, Viareggio, Lucca, Italy.

Author Contributions CF, AM, DM, FD, GB, GP: Conceptualization, Methodology, Statistical methodology, Formal analysis, Writing - original draft preparation, Supervision, Writing - review & editing. AV: Project administration, Data curation, responsible for collection and analysis of adverse events, writing - review & editing. CF, AM,

DM, FD, AMP, AD, RB, MLM, GD, MP, GB, GP: Substantial contribution to data collection with guaranteed of accuracy and integrity data; organization patients' data collection for the compilation of CRFs. AF: Conceptualization, Methodology, Funding acquisition, Supervision, Writing - review & editing. All authors agreed to be accountable for all aspects of the work. All authors read and approved the final manuscript.

Funding This research received no external funding. The study was funded by FADOI Foundation, a not-for-profit organization (Italian Scientific Society of Hospital Internal Medicine).

Data Availability The datasets used and/or analyzed during the current study are available from the corresponding Author on reasonable request.

Declarations

Conflict of interest On behalf of all authors, the corresponding author states that there is no conflict of interest.

Ethical Approval and Consent to Partecipate The study, conducted according to the guidelines of the Declaration of Helsinki, was approved by the Ethics Committee of the study's coordinating center (Comitato Etico per le Province di L'Aquila e Teramo), and then by the local Ethics Committee of each and every participating center (Protocol code FADOI.02-2018 FADOI-Hyp-Op Study; date of approval 07/06/2018). All investigations were conducted according to the principles set out in the Declaration of Helsinki. Once the study had been authorized by the Ethics Committees of all participating centers, written informed consent was requested from all enrolled patients.

References

1. Wieling W, Kaufmann H, Claydon VE, van Wijnen VK, Harms MPM, Juraschek SP, et al. Diagnosis and treatment of orthostatic hypotension. Lancet Neurol. 2022;21(8):735–46. https://doi.org/10.1016/S1474-4422(22)00169-7.
2. Freeman R, Abuzinadah AR, Gibbons C, Jones P, Miglis MG, Sinn DI. Orthostatic hypotension: JACC state-of-the-art review. J Am Coll Cardiol. 2018;72(11):1294–309. https://doi.org/10.1016/j.jacc.2018.05.079.
3. Mancia G, Kreutz K, Brunstrom M, Burnier M, Grassi G, Januszewicz A, Muiesan ML, Tsioufis K, Agabiti-Rosei E, Algharably EAE, Azizi M, Benetos A, Borghi C, Hitij JB, Cifkova R, Coca A, Cornelissen V, Cruickshank JK, Cunha PG, Danser AHJ, Pinho RM, Delles C, Dominiczak AF, Dorobantu M, Doumas M, Fernández-Alfonso MS, Halimi JM, Járai Z, Jelaković B, Jordan J, Kuznetsova T, Laurent S, Lovic D, Lurbe E, Mahfoud F, Manolis A, Miglinas M, Narkiewicz K, Niiranen T, Palatini P, Parati G, Pathak A, Persu A, Polonia J, Redon J, Sarafidis P, Schmieder R, Spronck B, Stabouli S, Stergiou G, Taddei S, Thomopoulos C, Tomaszewski M, Van de Borne P, Wanner C, Weber T, Williams B, Zhang ZY, Kjeldsen SE. 2023 ESH Guidelines for the management of arterial hypertension. The task force for the management of arterial hypertension of the European Society of Hypertension. Endorsed by the European Renal Association (ERA) and the International Society of Hypertension (ISH). J Hypertens 2023;41(12):1874-2071. https://doi.org/10.1097/HJH.0000000000003480.
4. Mol A, Bui Hoang PTS, Sharmin S, Reijnierse EM, van Wezel RJA, Meskers CGM, et al. Orthostatic hypotension and falls in older adults: a systematic review and meta-analysis. J Am Med Dir Assoc. 2019;20(5):589-597.e5. https://doi.org/10.1016/j.jamda.2018.11.003.
5. Ricci F, Fedorowski A, Radico F, Romanello M, Tatasciore A, Di Nicola M, et al. Cardiovascular morbidity and mortality related to orthostatic hypotension: a meta-analysis of prospective observational studies. Eur Heart J. 2015;36(25):1609–17. https://doi.org/10.1093/eurheartj/ehv093.
6. Briggs R, Carey D, Kennelly SP, Kenny RA. Longitudinal association between orthostatic hypotension at 30 seconds post-standing and late-life depression. Hypertension. 2018;71:946–54. https://doi.org/10.1161/HYPERTENSIONAHA.117.10542.
7. Min M, Shi T, Sun C, Liang M, Zhang Y, Wu Y, et al. The association between orthostatic hypotension and dementia: a meta-analysis of prospective cohort studies. Int J Geriatr Psychiatry. 2018;33(12):1541–7. https://doi.org/10.1002/gps.4964.
8. Juraschek SP, Taylor AA, Wright JT Jr, Evans GW, Miller ER 3rd, Plante TB, Cushman WC, Gure TR, Haley WE, Moinuddin I, Nord J, Oparil S, Pedley C, Roumie CL, Whittle J, Wiggers A, Finucane C, Anne Kenny R, Appel LJ, Townsend RR; SPRINT Research Group. Orthostatic hypotension, cardiovascular outcomes, and adverse events: results from SPRINT. Hypertension. 2020;75(3):660–7. https://doi.org/10.1161/HYPERTENSIONAHA.119.14309.
9. Masaki KH, Schatz IJ, Burchfiel CM, Sharp DS, Chiu D, Foley D, et al. Orthostatic hypotension predicts mortality in elderly men: the Honolulu heart program. Circulation. 1998;98(21):2290–5. https://doi.org/10.1161/01.cir.98.21.2290.
10. Juraschek SP, Appel LJ, Miller ER 3rd, Mukamal KJ, Lipsitz LA. Hypertension treatment effects on orthostatic hypotension and its relationship with cardiovascular disease. Hypertension. 2018;72(4):986–93. https://doi.org/10.1161/HYPERTENSIONAHA.118.11337.
11. Fanciulli A, Leys F, Falup-Pecurariu C, Thijs R, Wenning GK. Management of orthostatic hypotension in Parkinson's disease. J Parkinsons Dis. 2020;10(s1):S57–64. https://doi.org/10.3233/JPD-202036.
12. Ahmed A, Ruzieh M, Kanjwal S, Kanjwal K. Syndrome of supine hypertension with orthostatic hypotension: pathophysiology and clinical approach. Curr Cardiol Rev. 2020;16(1):48–54. https://doi.org/10.2174/1573403X15666190617095032.
13. Claffey P, Pérez-Denia L, Lavan A, Kenny RA, Finucane C, Briggs R. Asymptomatic orthostatic hypotension and risk of falls in community-dwelling older people. Age Ageing. 2022;51(12):afac295. https://doi.org/10.1093/ageing/afac295.
14. Biaggioni I. Orthostatic hypotension in the hypertensive patient. Am J Hypertens. 2018;31(12):1255–9. https://doi.org/10.1093/ajh/hpy089.
15. Tzur I, Izhakian S, Gorelik O. Orthostatic hypotension in internal medicine wards. Curr Med Res Opin. 2019;35(6):947–55. https://doi.org/10.1080/03007995.2018.1546679.
16. Fortherby M, Iqbal P, Potter J. Orthostatic blood pressure changes on prolonged standing in elderly hospital inpatients. Blood Press. 1997;6(6):3438.
17. Potocka-Plazak K, Plazak W. Orthostatic hypotension in elderly women with congestive heart failure. Aging Clin Exp Res. 2001;13:378–84. https://doi.org/10.1007/BF03351506.
18. Alli C, Avanzini F, Bettelli G, Colombo F, Corso R, Di Tullio M, et al. Prevalence and variability of orthostatic hypotension in the elderly. Results of the "Italian study on blood pressure in the elderly (SPAA)." Eur Heart J. 1992;13(2):178–82. https://doi.org/10.1093/oxfordjournals.eurheartj.a060143.
19. Pasina L, Casati M, Cortesi L, Tettamanti M, Pellegrini R, Oppedisano I, et al. Orthostatic hypotension among elderly patients in Italian internal medicine wards: an observational study. Intern Emerg Med. 2020;15(2):281–7. https://doi.org/10.1007/s11739-019-02172-7.

20. Ferri C, Manfellotto D, Mazza A, Dentali F, D'Avino M, Valerio A, Bilo G, Parati G, Fontanella A on behalf of FAHYP-OP Study Group. Orthostatic hypotension in hospitalized hypertensive patients admitted to internal medicine wards: rationale and design of the HYP-OP Study. Italian J Med. 2026. https://doi.org/10.4081/itjm.2026.2494.
21. Juraschek SP, Cortez MM, Flack JM, Ghazi L, Kenny RA, Rahman M, et al. Orthostatic hypotension in adults with hypertension: a scientific statement from the American Heart Association. Hypertension. 2024;81:e16–30. https://doi.org/10.1161/HYP.0000000000000236.
22. McDonagh STJ, Mejzner N, Clark CE. Prevalence of postural hypotension in primary, community and institutional care: a systematic review and meta-analysis. BMC Fam Pract. 2021;22:1. https://doi.org/10.1186/s12875-020-01313-8.
23. Torabi P, Ricci F, Hamrefors V, Sutton R, Fedorowski A. Classical and delayed orthostatic hypotension in patients with unexplained syncope and severe orthostatic intolerance. Front Cardiovasc Med. 2020;7:21. https://doi.org/10.3389/fcvm.2020.00021.
24. Saedon NI, Tan MP, Frith J. The prevalence of orthostatic hypotension: a systematic review and meta analysis. J Gerontol A Biol Sci Med Sci. 2020;75(1):117–22. https://doi.org/10.1093/gerona/gly188.
25. Espay AJ, LeWitt PA, Hauser RA, Merola A, Masellis M, Lang AE. Neurogenic orthostatic hypotension and supine hypertension in Parkinson's disease and related synucleinopathies: prioritisation of treatment targets. Lancet Neurol. 2016;15(9):954–66. https://doi.org/10.1016/S1474-4422(16)30079-5.
26. Kaufmann H, Norcliffe-Kaufmann L, Palma JA. Baroreflex dysfunction. N Engl J Med. 2020;382(2):163–78. https://doi.org/10.1056/NEJMra1509723.
27. American Diabetes Association Professional Practice Committee. Retinopathy, neuropathy, and foot care: standards of care in diabetes—2025. Diabetes Care. 2025;48(Suppl 1):S252–65. https://doi.org/10.2337/dc25-S012.
28. Eleftheriadou A, Spallone V, Tahrani AA, Alam U. Cardiovascular autonomic neuropathy in diabetes: an update with a focus on management. Diabetologia. 2024;67(12):2611–25. https://doi.org/10.1007/s00125-024-06242-0.
29. Ang L, Dillon B, Mizokami Stout K, Pop Busui R. Cardiovascular autonomic neuropathy: a silent killer with long reach. Auton Neurosci. 2020;225:102646. https://doi.org/10.1016/j.autneu.2020.102646.
30. Bitsch Poulsen M, Wegeberg AM, Røikjer J, Nikontovic A, Vestergaard P, Brock C. Prevalence of self-reported symptoms of diabetic autonomic dysfunction in the North Denmark Region: a population-based survey. Acta Diabetol. 2025;62(5):707–16. https://doi.org/10.1007/s00592-024-02390-2.
31. Kondziella D, Bender A, Diserens K, van Erp W, Estraneo A, Formisano R, Laureys S, Naccache L, Ozturk S, Rohaut B, Sitt JD, Stender J, Tiainen M, Rossetti AO, Gosseries O, Chatelle C; EAN Panel on Coma, Disorders of Consciousness. (EAN Panel). European Academy of Neurology guideline on the diagnosis of coma and other disorders of consciousness. Eur J Neurol. 2020;27(5):741–756. https://doi.org/10.1111/ene.14151.
32. Maas AIR, Menon DK, Manley GT, Abrams M, Åkerlund C, Andelic N, Aries M, Bashford T, Bell MJ, Bodien YG, Brett BL, Büki A, Chesnut RM, Citerio G, Clark D, Clasby B, Cooper DJ, Czeiter E, Czosnyka M, Dams-O'Connor K, De Keyser V, Diaz-Arrastia R, Ercole A, van Essen TA, Falvey É, Ferguson AR, Figaji A, Fitzgerald M, Foreman B, Gantner D, Gao G, Giacino J, Gravesteijn B, Guiza F, Gupta D, Gurnell M, Haagsma JA, Hammond FM, Hawryluk G, Hutchinson P, van der Jagt M, Jain S, Jain S, Jiang JY, Kent H, Kolias A, Kompanje EJO, Lecky F, Lingsma HF, Maegele M, Majdan M, Markowitz A, McCrea M, Meyfroidt G, Mikolić A, Mondello S, Mukherjee P, Nelson D, Nelson LD, Newcombe V, Okonkwo D, Orešič M, Peul W, Pisică D, Polinder S, Ponsford J, Puybasset L, Raj R, Robba C, Røe C, Rosand J, Schueler P, Sharp DJ, Smielewski P, Stein MB, von Steinbüchel N, Stewart W, Steyerberg EW, Stocchetti N, Temkin N, Tenovuo O, Theadom A, Thomas I, Espin AT, Turgeon AF, Unterberg A, Van Praag D, van Veen E, Verheyden J, Vyvere TV, Wang KKW, Wiegers EJA, Williams WH, Wilson L, Wisniewski SR, Younsi A, Yue JK, Yuh EL, Zeiler FA, Zeldovich M, Zemek R; InTBIR Participants and Investigators. Traumatic brain injury: progress and challenges in prevention, clinical care, and research. The Lancet Neurology. 2022;21(11):1004–60. https://doi.org/10.1016/S1474-4422(22)00309-X.
33. Fedorowski A, Ricci F, Hamrefors V, Sandau KE, Chung TH, Muldowney JASM, et al. Orthostatic hypotension: management of a complex, but common, medical problem. Circ Arrhythm Electrophysiol. 2022;15(3):e010573. https://doi.org/10.1161/CIRCEP.121.010573.
34. Wiersinga J, Jansen S, Peters MJL, Rhodius-Meester HFM, Trappenburg MC, Claassen JAHR, et al. Hypertension and orthostatic hypotension in the elderly: a challenging balance. Lancet Reg Health Eur. 2024;48:101154. https://doi.org/10.1016/j.lanepe.2024.101154.
35. Bhanu C, Nimmons D, Petersen I, Orlu M, Davis D, Hussain H, et al. Drug-induced orthostatic hypotension: a systematic review and meta-analysis of randomised controlled trials. PLoS Med. 2021;18(11):e1003821. https://doi.org/10.1371/journal.pmed.1003821.
36. Park JW, Okamoto LE, Shibao CA, Biaggioni I. Pharmacologic treatment of orthostatic hypotension. Auton Neurosci. 2020;229:102721. https://doi.org/10.1016/j.autneu.2020.102721.
37. Olsson KM, Corte TJ, Kamp JC, Montani D, Nathan SD, Neubert L, et al. Pulmonary hypertension associated with lung disease: new insights into pathomechanisms, diagnosis, and management. Lancet Respir Med. 2023;11(9):820–35. https://doi.org/10.1016/S2213-2600(23)00259-X.
38. Tobushi T, Floras JS. Sleep apnea, autonomic disturbances, and blood pressure variability. Hypertension. 2024;81(9):1837–44. https://doi.org/10.1161/hypertensionaha.124.20433.
39. Beach PA, Hyland S, Chen X, Huddleston DE. Locus coeruleus degeneration is associated with orthostatic hypotension in Parkinson's disease and multiple system atrophy. Clin Auton Res. 2025. https://doi.org/10.1007/s10286-025-01164-2.
40. Knuuti J, Wijns W, Saraste A, Capodanno D, Barbato E, Funck-Brentano C, Prescott E, Storey RF, Deaton C, Cuisset T, Agewall S, Dickstein K, Edvardsen T, Escaned J, Gersh BJ, Svitil P, Gilard M, Hasdai D, Hatala R, Mahfoud F, Masip J, Muneretto C, Valgimigli M, Achenbach S, Bax JJ; ESC Scientific Document Group. 2019 ESC Guidelines for the diagnosis and management of chronic coronary syndromes. Eur Heart J. 2020;41(3):407–77. https://doi.org/10.1093/eurheartj/ehz425.
41. Juraschek SP, Hu JR, Cluett JL, Ishak AM, Mita C, Lipsitz LA, et al. Orthostatic hypotension, hypertension treatment, and cardiovascular disease: an individual participant meta-analysis. JAMA. 2023;330(15):1459–71. https://doi.org/10.1001/jama.2023.18497.