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The prognostic value of admission vital signs, peripheral edema, ECG abnormalities, and orthostatic hypotension in ageing patients admitted to a medical department

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Abstract

Background: The global population is ageing, increasing the burden on medical services. Elderly patients often present with atypical symptoms and complex comorbidities. The combined prognostic value of initial clinical findings upon admission remains underexplored in local tertiary care settings.

Objective: To evaluate the association between initial clinical findings (vital sign instability, pedal edema, ECG abnormalities, and orthostatic hypotension) and in-hospital outcomes among ageing patients admitted to the medical department at King Hussein Medical Center.

Methods: A retrospective cohort study was conducted on 418 patients aged ≥60 years admitted between January 2022 and January 2025. Data collected included demographics, admission vital signs, peripheral edema, ECG findings, and orthostatic hypotension. The primary outcome was a composite of in-hospital mortality, length of stay >7 days, and discharge to increased care. Multivariate regression analysis identified independent predictors.

Results: Mean age was 72.4±8.6 years; 54.3% male. The composite adverse outcome occurred in 58.4% (n=244). Independent predictors were: orthostatic hypotension (aOR=3.24, 95% CI: 2.08–5.05, p<0.001), ECG abnormalities (aOR=2.18, 95% CI: 1.45–3.28, p<0.001), pedal edema (aOR=1.85, 95% CI: 1.22–2.80, p=0.004), tachycardia >100 bpm (aOR=1.72, 95% CI: 1.12–2.64, p=0.013), and hypotension (SBP <100 mmHg) (aOR=1.68, 95% CI: 1.08–2.61, p=0.021). Presence of ≥2 abnormalities increased risk substantially (aOR=4.56, 95% CI: 2.84–7.32, p<0.001). In-hospital mortality was 8.6%, highest in patients with orthostatic hypotension (14.2%) and ECG abnormalities (11.8%).

Conclusion: Simple admission clinical findings particularly orthostatic hypotension, ECG abnormalities, pedal edema, and vital sign instability are independently associated with adverse in-hospital outcomes in ageing patients. These readily available parameters should guide early risk stratification.

Keywords: Ageing; Geriatrics; Vital Signs; Electrocardiography; Orthostatic Hypotension; Hospital Admission; Risk Assessment

1. Introduction

The global demographic shift toward an ageing population represents one of the most significant public health challenges of the 21st century. By 2050, the number of people aged 60 years and older is projected to reach 2.1 billion (United Nations, 2020). In Jordan, the population aged ≥65 years is expected to rise from approximately 5% in 2020 to

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over 10% by 2040 (Jordan Department of Statistics, 2021). This transition places increasing demands on acute medical services, where older adults account for a disproportionate share of hospital admissions (Clegg et al., 2013).

Older patients frequently exhibit atypical presentations of common illnesses, have multiple coexisting chronic conditions, and experience age-related physiological changes (Dent et al., 2019). Frailty—a state of increased vulnerability to stressors—is highly prevalent among hospitalized older adults and is associated with prolonged hospitalization, institutionalization, and mortality (Fried et al., 2001).

Initial clinical assessment remains the cornerstone of risk stratification. Basic parameters such as vital signs, physical examination findings, and ECG abnormalities are routinely collected and require no specialized equipment (Rockwood et al., 2005). Despite their simplicity, the combined prognostic value of these admission findings in ageing patients has not been systematically evaluated in the Jordanian healthcare context.

Several individual clinical signs have been associated with adverse outcomes. Tachycardia, hypotension, and hypoxemia correlate with increased mortality (Keller et al., 2019). Peripheral edema may indicate heart failure or other serious conditions (Yancy et al., 2017). ECG abnormalities reflect underlying cardiovascular disease (Thygesen et al., 2018). Orthostatic hypotension is associated with falls, syncope, and increased mortality (Freeman et al., 2011).

This study aimed to evaluate the association between initial clinical findings and in-hospital outcomes among ageing patients at King Hussein Medical Center, hypothesizing that these simple admission findings would be independently associated with adverse outcomes.

2. Materials and methods

2.1. Study Design and Setting

A retrospective cohort study was conducted at the medical department of King Hussein Medical Center (KHMC), a tertiary military hospital in Amman, Jordan. The study was approved by the Institutional Review Board (No. 1_4/2026, 10 March 2026) and the Educational and Technical Directorate (22 April 2026). Informed consent was waived per retrospective, anonymized design.

2.2. Participants

- Included: patients aged ≥60 years admitted to the medical department between January 2022 and January 2025, with complete admission data (vital signs, physical examination, ECG) and documented outcomes.
- Excluded: direct ICU admission from ED, transfer from another hospital, incomplete records, elective admissions for planned procedures, terminal illness with palliative care only.
- Final analysis: 418 patients.

2.3. Data Collection

2.3.1. Standardized case report form extracted

Demographics, admission diagnosis, comorbidities, number of medications, admission vital signs (heart rate, blood pressure, respiratory rate, SpO_2, temperature), peripheral edema (none/mild/moderate/severe), ECG findings (normal, ischemic changes, arrhythmias, conduction abnormalities, other), orthostatic hypotension (SBP drop ≥20 mmHg or DBP drop ≥10 mmHg within 3 minutes of standing, or symptoms with BP drop).

2.4. Outcome Measures

2.4.1. Primary outcome

Composite adverse outcome defined as any of: (1) in-hospital mortality, (2) prolonged length of stay (>7 days), (3) discharge to increased care (nursing home, long-term care, or new home health services).

2.4.2. Secondary outcomes

Individual components of composite, length of stay, 30-day readmission, discharge to home.

2.5. Statistical Analysis

SPSS v27. Descriptive statistics: means±SD, medians [IQR], frequencies (%). Group comparisons: t-test/Mann-Whitney U or chi-square/ Fishers exact. Multivariate logistic regression identified independent predictors (variables with $p<0.10$ in univariate analysis, plus age and sex as a priori confounders). Model calibration: Hosmer-Lemeshow; discrimination: AUC. Subgroup analyses by age group (60–74 vs. ≥75 years) and sex. Significance: $p<0.05$ (two-tailed).

3. Results

3.1. Participant Characteristics

Of 587 patients screened, 418 were included. Mean age 72.4±8.6 years (range 60–96), 54.3% male. Most common admission diagnoses: cardiovascular disease (32.5%), respiratory disease (22.7%), infectious disease (18.9%). Comorbidities: hypertension (68.2%), diabetes (52.6%), coronary artery disease (38.8%), chronic kidney disease (22.5%). Polypharmacy (≥5 medications) in 74.4%.

Table 1 Baseline Characteristics of Study Population (N=418)

Characteristic	**Value**
Age (years), Mean ± SD	72.4 ± 8.6
Age ≥75 years, n (%)	170 (40.7)
Male, n (%)	227 (54.3)
Admission Diagnosis, n (%)	
Cardiovascular disease	136 (32.5)
Respiratory disease	95 (22.7)
Infectious disease	79 (18.9)
Gastrointestinal disease	42 (10.0)
Renal disease	28 (6.7)
Neurologic disease	24 (5.7)
Comorbidities, n (%)	
Hypertension	285 (68.2)
Diabetes mellitus	220 (52.6)
Coronary artery disease	162 (38.8)
Chronic kidney disease	94 (22.5)
Heart failure	78 (18.7)
Polypharmacy (≥5 medications), n (%)	311 (74.4)

3.2. Admission Clinical Findings

Prevalence: tachycardia (>100 bpm) 18.9%, hypotension (SBP<100 mmHg) 14.1%, hypertension (SBP>160 mmHg) 22.0%, tachypnea (>24/min) 16.3%, hypoxemia (SpO_2<90%) 12.4%, fever (>38°C) 8.9%. Peripheral edema in 31.8% (mild 18.2%, moderate 10.3%, severe 3.3%). ECG abnormalities in 58.4% (ischemic changes 28.7%, arrhythmias 16.3%, conduction abnormalities 8.9%, other 4.5%). Orthostatic hypotension in 28.2%.

3.3. Composite Adverse Outcome

Composite outcome occurred in 244 patients (58.4%): in-hospital mortality 8.6% (n=36), prolonged LOS >7 days 42.6% (n=178), discharge to increased care 20.6% (n=86). Patients with composite outcome were older (75.2±8.4 vs. 68.6±7.2 years, $p<0.001$) and had higher rates of all admission findings.

Table 2 Comparison by Composite Adverse Outcome

Characteristic	Outcome Present (n=244)	Outcome Absent (n=174)	p-value
Age (years), Mean ± SD	75.2 ± 8.4	68.6 ± 7.2	<0.001
Age ≥75 years, n (%)	122 (50.0)	48 (27.6)	<0.001
Orthostatic hypotension, n (%)	96 (39.3)	22 (12.6)	<0.001
ECG abnormalities, n (%)	173 (70.9)	71 (40.8)	<0.001
Peripheral edema, n (%)	98 (40.2)	35 (20.1)	<0.001
Tachycardia (>100 bpm), n (%)	62 (25.4)	17 (9.8)	<0.001

3.4. Univariate Predictors

Significant predictors: age (OR=1.08 per year), tachycardia (OR=2.85), hypotension (OR=2.94), tachypnea (OR=2.48), hypoxemia (OR=2.84), peripheral edema (OR=2.68), ECG abnormalities (OR=3.42), orthostatic hypotension (OR=4.52), coronary artery disease, chronic kidney disease, heart failure (all p<0.01).

Table 3 Univariate Predictors of Composite Adverse Outcome

Variable	OR (95% CI)	p-value
Age (per year)	1.08 (1.05–1.11)	<0.001
Orthostatic hypotension	4.52 (2.85–7.17)	<0.001
ECG abnormalities	3.42 (2.28–5.13)	<0.001
Hypotension (SBP<100)	2.94 (1.68–5.15)	<0.001
Tachycardia (>100 bpm)	2.85 (1.74–4.67)	<0.001
Peripheral edema	2.68 (1.75–4.10)	<0.001
Chronic kidney disease	2.21 (1.34–3.64)	0.002

3.5. Multivariate Predictors

Independent predictors of composite adverse outcome:

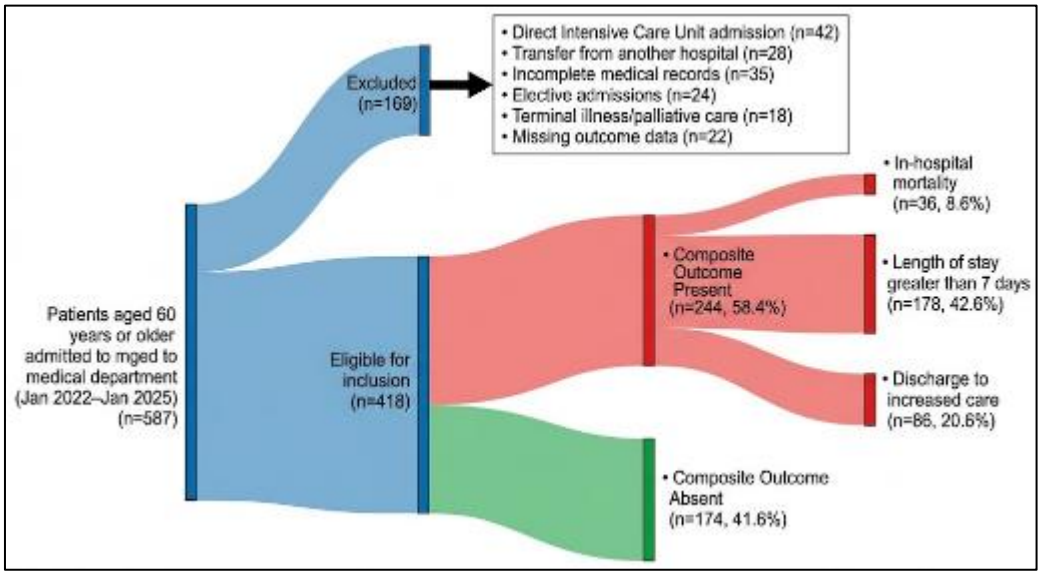
- Orthostatic hypotension: aOR=3.24 (95% CI: 2.08–5.05), p<0.001
- ECG abnormalities: aOR=2.18 (95% CI: 1.45–3.28), p<0.001
- Peripheral edema: aOR=1.85 (95% CI: 1.22–2.80), p=0.004
- Tachycardia (>100 bpm): aOR=1.72 (95% CI: 1.12–2.64), p=0.013
- Hypotension (SBP<100 mmHg): aOR=1.68 (95% CI: 1.08–2.61), p=0.021
- Age (per year): aOR=1.06 (95% CI: 1.03–1.09), p<0.001
- Chronic kidney disease: aOR=1.58 (95% CI: 1.02–2.45), p=0.042
- Model: AUC=0.81 (95% CI: 0.77–0.85), Hosmer-Lemeshow p=0.38.

Table 4 Multivariate Predictors of Composite Adverse Outcome

Variable	Adjusted OR (95% CI)	p-value
Orthostatic hypotension	3.24 (2.08–5.05)	<0.001
ECG abnormalities	2.18 (1.45–3.28)	<0.001
Peripheral edema	1.85 (1.22–2.80)	0.004
Tachycardia (>100 bpm)	1.72 (1.12–2.64)	0.013
Hypotension (SBP<100 mmHg)	1.68 (1.08–2.61)	0.021

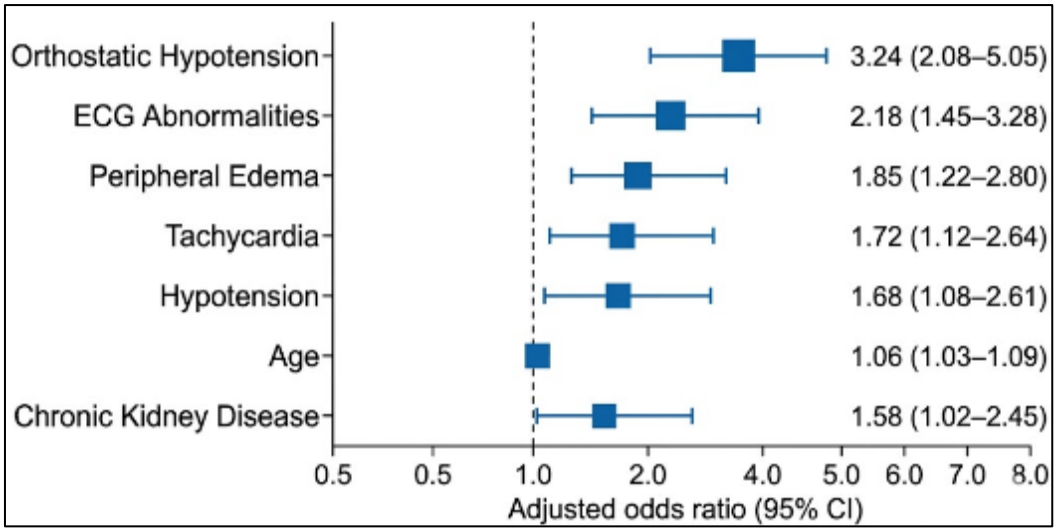
Age (per year)	1.06 (1.03–1.09)	<0.001
Chronic kidney disease	1.58 (1.02–2.45)	0.042

Model: AUC=0.81 (95% CI: 0.77–0.85), Hosmer-Lemeshow p=0.38



Legend: Sankey diagram illustrating patient selection, inclusion, and outcomes among 418 ageing patients. Flow widths represent patient numbers. The composite adverse outcome occurred in 58.4% of patients.

Figure 1 Participant Flow Diagram



Legend: Forest plot displaying adjusted odds ratios from multivariate logistic regression for predictors of composite adverse outcome. Orthostatic hypotension (OR=3.24) and ECG abnormalities (OR=2.18) were the strongest independent predictors. Values to the right of 1.0 indicate increased risk.

Figure 2 Independent Predictors of Composite Adverse Outcome – Forest Plot

3.6. Risk Stratification by Number of Abnormalities

3.6.1. Dose-response relationship

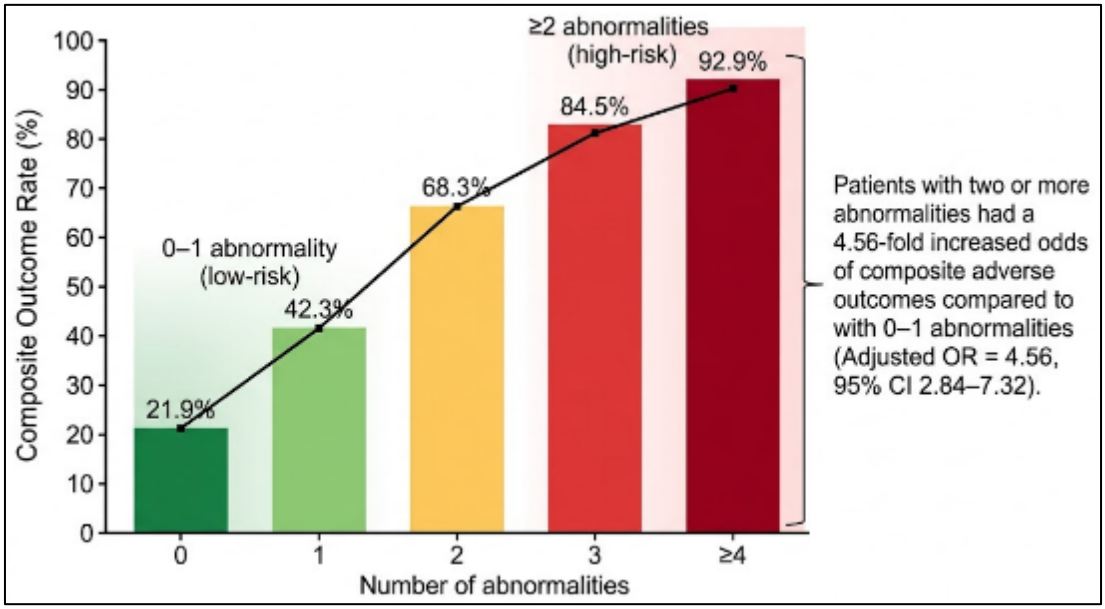
- 0 abnormalities (n=64): 21.9% composite outcome
- 1 abnormality (n=142): 42.3% (OR=2.62 vs. 0)
- 2 abnormalities (n=126): 68.3% (OR=7.48)

- 3 abnormalities (n=58): 84.5% (OR=18.92)
- ≥4 abnormalities (n=28): 92.9% (OR=45.29)
- Patients with ≥2 abnormalities had aOR=4.56 (95% CI: 2.84–7.32, p<0.001) vs. 0–1 abnormality.

Table 5 Risk Stratification by Number of Admission Abnormalities

Number of Abnormalities	n	Composite Outcome n (%)	Adjusted OR* (95% CI)
0	64	14 (21.9)	1.00 (ref)
1	142	60 (42.3)	2.18 (1.08–4.40)
2	126	86 (68.3)	4.86 (2.34–10.09)
3	58	49 (84.5)	9.52 (3.76–24.12)
≥4	28	26 (92.9)	18.24 (4.56–72.94)

Comparison: ≥2 abnormalities vs. 0–1 abnormality: aOR=4.56 (95% CI: 2.84–7.32), p<0.001
Adjusted for age, sex, and comorbidities

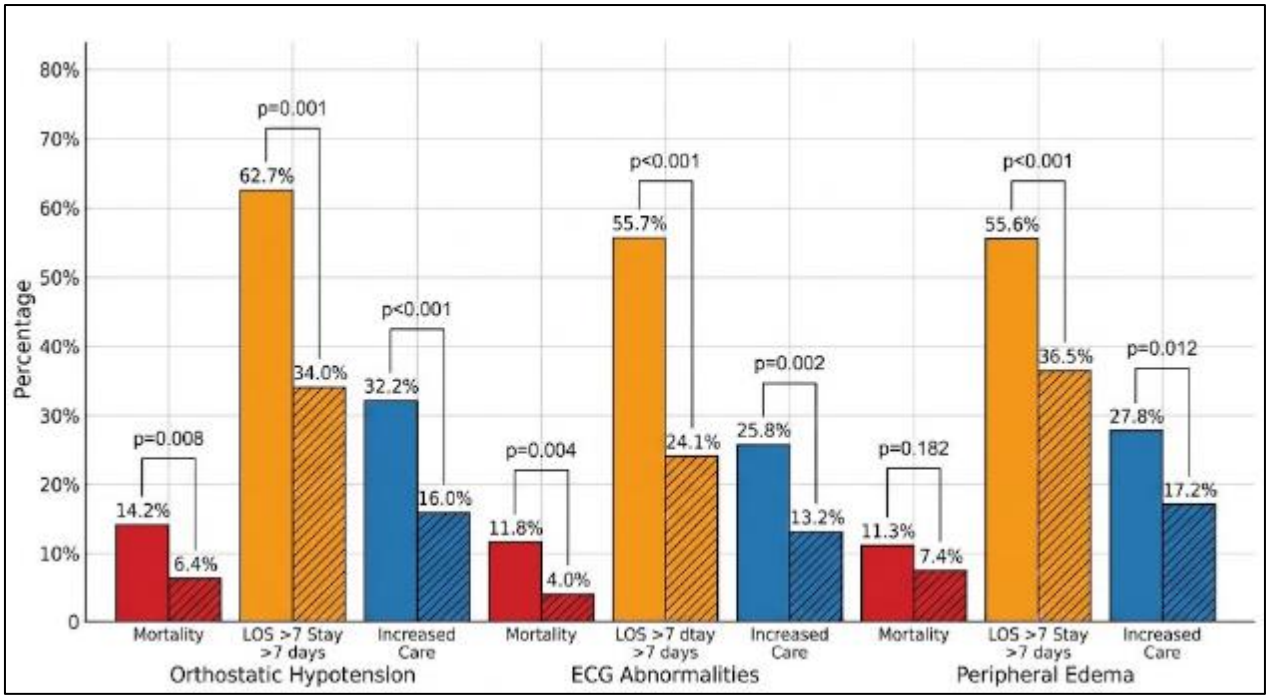


Legend: Risk stratification showing a clear dose-response relationship between the number of admission abnormalities and adverse outcomes. Patients with two or more abnormalities had 4.56-fold increased odds of composite adverse outcomes compared to those with 0–1 abnormality. Error bars represent 95% confidence intervals.

Figure 3 Risk Stratification by Number of Admission Abnormalities

3.7. Secondary Outcomes

Length of stay: orthostatic hypotension (8.4±4.2 vs. 5.6±3.8 days, p<0.001); ECG abnormalities (7.8±4.1 vs. 5.8±3.6 days, p<0.001). In-hospital mortality: orthostatic hypotension (14.2% vs. 6.4%, p=0.008); ECG abnormalities (11.8% vs. 4.0%, p=0.004). 30-day readmission: orthostatic hypotension (24.6% vs. 15.8%, p=0.048); ECG abnormalities (22.4% vs. 14.2%, p=0.032).



Legend: Secondary outcomes stratified by presence of key admission findings. Orthostatic hypotension was associated with significantly higher mortality, prolonged length of stay, and discharge to increased care. ECG abnormalities and peripheral edema were also associated with worse outcomes across most measures. Error bars represent 95% confidence intervals.

Figure 4 Secondary Outcomes by Presence of Key Admission Findings

3.8. Subgroup Analyses

Predictive value of orthostatic hypotension and ECG abnormalities was consistent across age subgroups (60–74 vs. ≥75 years) and by sex (all p for interaction >0.10). Effect of peripheral edema was slightly stronger in patients with documented heart failure (aOR=2.34 vs. 1.62, p for interaction=0.048).

4. Discussion

This retrospective cohort study of 418 ageing medical patients demonstrates that simple admission clinical findings—orthostatic hypotension, ECG abnormalities, peripheral edema, tachycardia, and hypotension—are independently associated with adverse in-hospital outcomes. The presence of multiple abnormalities identified a very high-risk subgroup with a nearly 5-fold increased odds of composite adverse outcomes (aOR=4.56).

The strong association between orthostatic hypotension and adverse outcomes (aOR=3.24) is a key finding. Orthostatic hypotension affects up to 30% of community-dwelling elders and up to 50% of hospitalized older patients (Freeman et al., 2011); our prevalence of 28.2% is consistent. Mechanisms include underlying autonomic dysfunction, which is associated with frailty, neurodegenerative diseases, and cardiovascular comorbidities (Fedorowski and Melander, 2013). Additionally, orthostatic hypotension predisposes to falls, syncope, and impaired mobility, contributing to functional decline and prolonged LOS (Rutan et al., 1992).

ECG abnormalities (58.4% prevalence, aOR=2.18) reflect the high burden of cardiovascular disease. Ischemic changes (28.7%) and arrhythmias (16.3%) were most common. ECG abnormalities identify patients at higher risk for decompensation, arrhythmias, or heart failure during hospitalization (Keller et al., 2019; Thygesen et al., 2018).

Peripheral edema (31.8% prevalence, aOR=1.85) likely reflects underlying heart failure, venous insufficiency, fluid overload, or renal dysfunction. The association with adverse outcomes is consistent with studies demonstrating that volume overload is a marker of disease severity (Gheorghiade et al., 2005).

Vital sign abnormalities—tachycardia (aOR=1.72) and hypotension (aOR=1.68)—align with the recognized importance of physiological stability as a clinical marker. The dose-response relationship between the number of abnormalities and adverse outcomes suggests cumulative physiological burden drives risk.

The independent predictive value of these findings after adjusting for age and comorbidities suggests they capture dimensions of vulnerability not fully captured by traditional risk factors. Importantly, these parameters are readily available at admission, require no specialized testing, and can be incorporated into clinical prediction tools.

4.1. Clinical Implications

(1) Orthostatic hypotension should be systematically assessed in all older medical admissions. (2) Admission ECG provides prognostic information beyond its diagnostic utility. (3) Presence of multiple abnormalities should prompt early risk stratification and targeted interventions. (4) These simple parameters can guide resource allocation and monitoring intensity.

Limitations

Retrospective design may introduce bias. Orthostatic vital sign measurement was not standardized across all patients. ECG interpretation based on clinical reports rather than centralized review. Single-center design may limit generalizability. Unmeasured factors (frailty, cognitive status, functional status) may influence outcomes.

5. Conclusion

Simple admission clinical findings including orthostatic hypotension, ECG abnormalities, peripheral edema, tachycardia, and hypotension are independently associated with adverse in-hospital outcomes in ageing patients. The presence of multiple abnormalities identifies a very high-risk subgroup with nearly 5-fold increased odds of composite adverse outcomes. These readily available parameters should be incorporated into early risk stratification to guide resource allocation, intensity of monitoring, and discharge planning. Systematic assessment of orthostatic hypotension and ECG in all older medical admissions is warranted.

Compliance with ethical standards

Acknowledgments

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Disclosure of conflict of interest

The authors declare no conflict of interest.

Statement of ethical approval

This study was conducted in accordance with the ethical principles of the Declaration of Helsinki and was approved by the Institutional Review Board (IRB) of the Royal Medical Services, Jordan, on 10 March 2026 under registration number 1_4/2026. Final approval from the Educational and Technical Directorate was obtained on 22 April 2026. Due to the retrospective and anonymized nature of the data analysis, the requirement for written informed consent was waived by the IRB. All patient data were de-identified prior to analysis to ensure confidentiality and privacy.

Statement of informed consent

Informed consent was obtained from all individual participants included in the study.

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