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Short Report

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Age- and Sex-Related Electrocardiographic Abnormalities in Homebound Adults Aged ≥ 80 Years

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Abstract

We examined age- and sex-related electrocardiographic abnormalities in 556 adults aged ≥ 80 years evaluated by tele-electrocardiography. Arrhythmias were more frequent at ≥ 90 than at 80–89 years (19.6% vs 13.2%; OR 1.60, 95% CI 1.01–2.53). Among adults aged 80–89 years, conduction block was more frequent in men than women (23.7% vs 13.0%; OR 2.09, 95% CI 1.16–3.75), whereas prevalence was similar between sexes at ≥ 90 years (20.6% vs 20.4%). These findings suggest age-related changes in arrhythmia burden and exploratory sex-related patterns in conduction abnormalities at very advanced age.

Keywords: electrocardiography; arrhythmias; conduction block; aging; sex differences; tele-electrocardiography

Introduction

Age-related changes in cardiac structure and electrophysiology are reflected on the surface electrocardiogram (ECG). Progressive myocardial fibrosis, degeneration of the specialized conduction system, atrial remodeling, and changes in autonomic regulation contribute to a higher frequency of rhythm and conduction abnormalities with advancing age [1,2]. These changes are clinically relevant because the ECG remains a widely available method for identifying electrical abnormalities, including in patients who have limited access to more advanced cardiac testing.

Arrhythmias and conduction disturbances are among the most frequently reported ECG abnormalities in older adults. Atrial fibrillation increases markedly with age, while bundle branch block and other conduction disturbances also become more prevalent in later life [2–4]. Population studies have further demonstrated sex-related differences in ECG findings, with several conduction abnormalities occurring more frequently in men [5,6]. However, adults aged ≥ 90 years are often represented by relatively small numbers, leaving uncertainty about whether patterns described at younger ages persist into very advanced age.

Remote ECG interpretation offers an opportunity to characterize electrical findings in patients who are otherwise difficult to include in conventional ECG cohorts. We therefore examined the distribution of ECG abnormalities in adults aged ≥ 80 years evaluated through a tele-electrocardiography service, focusing on differences between adults aged 80–89 and ≥ 90 years and on sex-specific patterns of conduction block.

Methods

We conducted a retrospective cross-sectional analysis of TeleECG records from PADOMI home-care patients evaluated by the Centro Nacional de Telemedicina (CENATE), EsSalud, Peru, between 10 February and 31 March 2026. Of 621 TeleECGs available during the study period, 556 patients aged ≥ 80 years with complete age, sex, and ECG information were included. Patients were categorized as aged 80–89 years or ≥ 90 years.

ECG findings were based on the diagnostic categories recorded in the clinical database and included arrhythmia, atrioventricular or bundle branch block, ventricular hypertrophy, bradycardia or tachycardia, active myocardial ischemia, pathological T-wave inversion, prolonged QT interval, and pacemaker rhythm. Categories were not mutually exclusive; therefore, each abnormality was analyzed as a separate binary outcome. Conduction block comprised atrioventricular block and bundle branch block.

Categorical variables were compared between age groups using two-sided Fisher exact tests, with associations expressed as odds ratios (ORs) and 95% confidence intervals (CIs). Because prior population studies have described sex differences in conduction abnormalities [5,6], conduction block was additionally compared between women and men within each age group. An age-by-sex interaction was evaluated to assess whether the association between sex and conduction block differed by age group. Statistical significance was defined as $p < 0.05$. No adjustment for multiple comparisons was applied; secondary and stratified comparisons were therefore interpreted cautiously.

Results

Among the 556 included patients, 326 (58.6%) were aged 80–89 years and 230 (41.4%) were aged ≥ 90 years; 370 (66.5%) were women and 186 (33.5%) were men. Arrhythmia prevalence was significantly higher among adults aged ≥ 90 years than among those aged 80–89 years (19.6% vs 13.2%; OR 1.60, 95% CI 1.01–2.53; $p = 0.046$). Conduction block was numerically more frequent at ≥ 90 years (20.4% vs 16.9%; OR 1.27, 95% CI 0.82–1.95; $p = 0.317$), but the overall age-group difference was not statistically significant.

Other ECG abnormalities showed no statistically significant age-group differences (Table 1). Ventricular hypertrophy was present in 12.6% of adults aged 80–89 years and 15.7% of those aged ≥ 90 years. Bradycardia or tachycardia occurred in 13.2% and 11.7%, respectively, while active myocardial ischemia was recorded in 8.6% and 6.5%. Pathological T-wave inversion was less frequent at ≥ 90 years (2.6% vs 5.8%), although the difference did not reach statistical significance ($p = 0.095$).

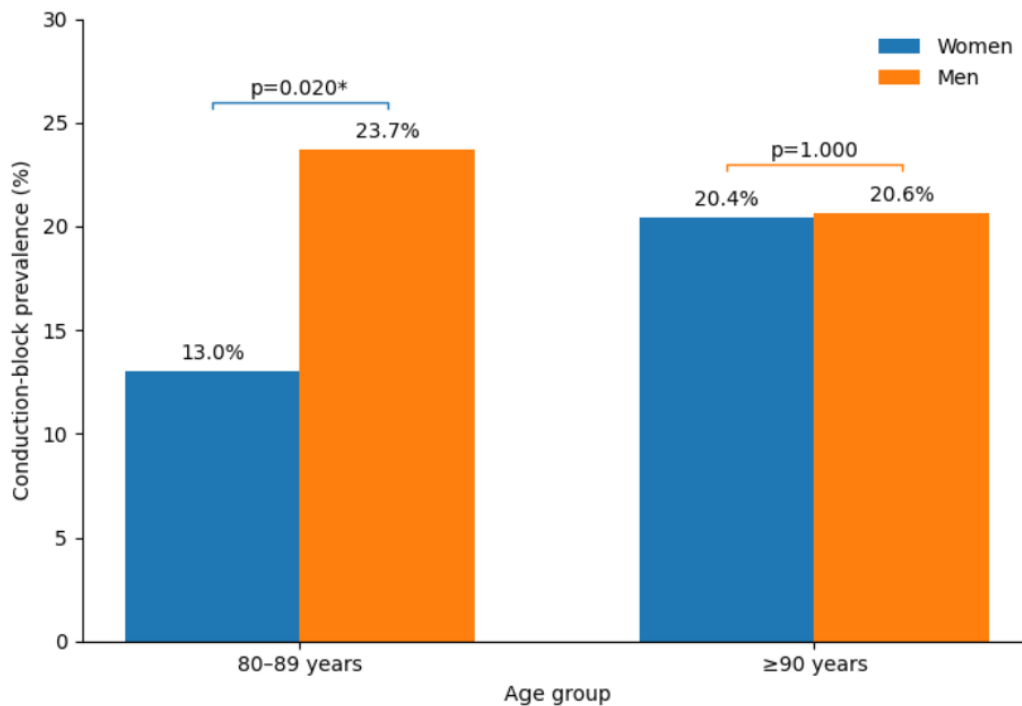
Sex-stratified analysis identified a distinct pattern for conduction block. Among adults aged 80–89 years, conduction block was significantly more frequent in men than women (23.7% vs 13.0%; OR 2.09, 95% CI 1.16–3.75; $p = 0.020$). At ≥ 90 years, prevalence was nearly identical between sexes (20.6% in men vs 20.4% in women; OR 1.01, 95% CI 0.50–2.04; $p = 1.000$) (Fig. 1). The formal age-by-sex interaction was not statistically significant ($p = 0.122$); therefore, the apparent convergence between sexes should be considered exploratory rather than evidence of a confirmed interaction.

Table 1. ECG abnormalities according to age group (n=556)

ECG finding	80–89 y (n=326), n (%)	≥ 90 y (n=230), n (%)	OR (95% CI)	p
Arrhythmia	43 (13.2)	45 (19.6)	1.60 (1.01–2.53)	0.046
Conduction block	55 (16.9)	47 (20.4)	1.27 (0.82–1.95)	0.317
Ventricular hypertrophy	41 (12.6)	36 (15.7)	1.29 (0.80–2.09)	0.320
Bradycardia/tachycardia	43 (13.2)	27 (11.7)	0.88 (0.52–1.46)	0.697
Active myocardial ischemia	28 (8.6)	15 (6.5)	0.74 (0.39–1.42)	0.422
Pathological T-wave inversion	19 (5.8)	6 (2.6)	0.43 (0.17–1.10)	0.095
Prolonged QT	8 (2.5)	5 (2.2)	0.88 (0.29–2.74)	1.000
Pacemaker rhythm	2 (0.6)	3 (1.3)	2.14 (0.35–12.92)	0.409

OR, odds ratio; CI, confidence interval. Individual patients could have more than one ECG abnormality.

Fig. 1. Conduction-block prevalence by age group and sex. Conduction block includes atrioventricular block and bundle branch block. P values are from Fisher exact tests comparing women and men within each age group. * $p < 0.05$.



Discussion

Two ECG findings stand out in this cohort of adults aged ≥ 80 years. First, arrhythmias were more frequent among adults aged ≥ 90 years than among those aged 80–89 years. This is consistent with the well-established increase in rhythm disorders with advancing age [2,3] and supports the expectation that arrhythmic burden continues to rise even within the oldest age strata. The finding is relevant because studies frequently group all adults above 75 or 80 years together, potentially obscuring differences that emerge at ≥ 90 years.

Second, conduction block showed a sex-specific pattern. Among adults aged 80–89 years, men had approximately twice the odds of conduction block compared with women. This direction is consistent with large population studies and surveys of older adults reporting a greater prevalence of bundle branch block and other conduction abnormalities in men [5,6]. In contrast, conduction-block prevalence was almost identical in women and men aged ≥ 90 years. The pattern suggests that sex differences evident earlier in late life may become less pronounced at very advanced age. The observed convergence should be interpreted as hypothesis-generating. Age-related fibrosis and degeneration of the conduction system become increasingly prominent with advancing age [1,7], and it is plausible that these processes could attenuate relative differences associated with sex; confirmation would require larger cohorts with sufficient numbers of nonagenarians and centenarians.

The broader distribution of ECG findings was relatively stable between age groups. Ventricular hypertrophy, bradycardia/tachycardia, ischemic changes, prolonged QT, and pacemaker rhythm did not differ significantly between adults aged 80–89 and ≥ 90 years. This may reflect heterogeneity in comorbidity and treatment among very old adults, but it also emphasizes that not all ECG abnormalities increase uniformly with chronological age. The strongest age-related signal in this dataset was observed for arrhythmia rather than for the full spectrum of ECG abnormalities.

This study also illustrates the value of remote ECG acquisition for studying populations that are rarely represented in conventional electrocardiographic cohorts. Tele-electrocardiography allowed ECGs obtained during home care to be interpreted remotely and created a dataset with a substantial proportion of adults aged ≥ 90 years. The clinical significance of individual abnormalities cannot be inferred from this cross-sectional analysis, but major ECG abnormalities in older adults have been associated with cardiovascular and all-cause mortality [8]. Characterizing how these findings are distributed at very advanced age may therefore help define questions for prospective studies of prognosis, referral, and treatment.

Several limitations should be considered. The retrospective design depended on diagnostic categories recorded in routine care and did not permit standardized adjudication of individual ECG tracings for this analysis. Clinical covariates such as cardiovascular diagnoses, medications, symptoms, and prior pacing were not incorporated, and longitudinal outcomes were unavailable. The study was also based on a single tele-electrocardiography pathway, which may limit generalizability. Finally, multiple ECG categories and stratified comparisons were examined without adjustment for multiplicity; findings other than the prespecified age-group comparisons should therefore be interpreted cautiously.

Conclusion

Arrhythmias were more frequent among adults aged ≥ 90 years than among those aged 80–89 years, while conduction block showed an exploratory age- and sex-related pattern. These findings extend ECG data into very advanced age and support further study of electrical abnormalities in populations aged ≥ 90 years.

Declarations

Funding: The authors received no funding for this work.

Competing interests: All authors are employees of CENATE, EsSalud, where the tele-electrocardiography service was implemented. The authors declare no financial competing interests.

Ethics approval: Approved by the Ethics Committee of Hospital Nacional Edgardo Rebagliati Martins, EsSalud, Lima, Peru (CEI 2287; Exp. 0012720260000011; 14 May 2026).

Consent: Not applicable; this retrospective study used existing clinical records and involved no prospective recruitment or study-specific intervention.

Data availability: Data are available from EsSalud subject to patient-privacy and institutional restrictions.

References

1. Bensaid J. Électrocardiogramme du sujet âgé. EMC Cardiol-Angéiol. 2004;1:11–22. doi:10.1016/j.emcaa.2003.12.001.
2. Goyal P, Rich MW. Electrophysiology and heart rhythm disorders in older adults. J Geriatr Cardiol. 2016;13:645–651. doi:10.11909/j.issn.1671-5411.2016.08.001.
3. Chugh SS, Havmoeller R, Narayanan K, et al. Worldwide epidemiology of atrial fibrillation: a Global Burden of Disease 2010 Study. Circulation. 2014;129:837–847. doi:10.1161/CIRCULATIONAHA.113.005119.
4. Devkota KC, Pudasaini B. ECG changes in octogenarians. Nepal Med Coll J. 2011;13:216–219.
5. De Bacquer D, De Backer G, Kornitzer M. Prevalences of ECG findings in large population based samples of men and women. Heart. 2000;84:625–633. doi:10.1136/heart.84.6.625.
6. Khane RS, Surdi AD. Gender differences in the prevalence of electrocardiogram abnormalities in the elderly: a population survey in India. Iran J Med Sci. 2012;37:92–99.
7. Molander U, Dey DK, Sundh V, Steen B. ECG abnormalities in the elderly: prevalence, time and generation trends and association with mortality. Aging Clin Exp Res. 2003;15:488–493. doi:10.1007/BF03327371.
8. Shafiee G, Sharifi F, Alizadeh M, et al. Electrocardiogram abnormalities and risk of cardiovascular mortality and all-cause mortality in old age: The Kahrizak Elderly Study. Arch Gerontol Geriatr. 2014;59:69–73. doi:10.1016/j.archger.2014.03.011.

Supplementary Files

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