

Cases Of AV Complete Block: A Retrospective Review

AV Tam Blok Vakaları: Retrospektif Bir İnceleme

Ramazan KIYAK* 0000-0002-8866-8595

Özgen ŞAFAK** 0000-0001-8245-0117

* Balıkesir Üniversitesi Tıp Fakültesi Acil Tıp Anabilim Dalı

** Balıkesir Üniversitesi Tıp Fakültesi Kardiyoloji Anabilim Dalı

Yazışma Adresi: Ramazan KIYAK

Balıkesir Üniversitesi Tıp Fakültesi

Acil Tıp Anabilim Dalı Balıkesir, Türkiye

E-mail: kiyak1903@hotmail.com

Geliş Tarihi:16.06.2025

Kabul Tarihi: 25.07.2025

Abstract

Objective: This study aimed to examine the clinical and demographic characteristics of patients diagnosed with atrioventricular (AV) complete block in the Emergency Department of Balıkesir University and to evaluate the interventions applied.

Materials and Methods: The study population consisted of all bradycardia cases presenting to the emergency department between January 1, 2020, and January 1, 2025. The sample included patients aged ≥ 18 years with AV complete block on ECG, no missing data, and accessible medical records. A total of 147 bradycardia cases were evaluated, of which 34 were diagnosed as AV complete block.

Results: A total of 34 patients with complete AV block were evaluated. 52.9% of the patients were in the age group of 75 years and older, and the gender distribution was equal. The most common presenting complaints were syncope and dizziness (26.5%). Hypertension (82.4%) and previous myocardial infarction (41.2%) were the most common comorbid conditions. 55.9% of the patients were not taking regular medication; antihypertensives and antiarrhythmics were the most common drugs used. In clinical outcome, 91.2% of the patients were hospitalised in the intensive care unit and 5.9% of the patients died. The rate of interventional procedures was 52.9% and the most common procedures were permanent pacemaker implantation (23.5%) and temporary pacemaker implantation.

Conclusion: This study demonstrates that AV complete block predominantly affects elderly patients with a high cardiovascular risk profile. The results support the contribution of myocardial fibrosis and hypertension to its pathogenesis. A considerable proportion of patients required emergency interventions, Intensive Care Unit admission, and permanent pacemaker implantation. Prompt emergency diagnosis and timely management are critical for reducing mortality and improving outcomes; therefore, AV complete block should be considered in every elderly patient presenting with syncope or unexplained bradycardia.

Keywords: AV complete block, Bradycardia, Emergency department,

Öz

Amaç: Atriyoventriküler (AV) tam blok, atriyum ve ventrikül arasındaki elektriksel iletişimin tamamen kesildiği, ciddi bradikardi ve ani kardiyak ölüm riski taşıyan bir iletim bozukluğudur. AV tam blok genellikle ileri yaş, iskemik kalp hastalıkları ve elektrolit bozuklukları gibi altta yatan nedenlere bağlı olarak gelişir. Bu çalışmada, Balıkesir Üniversitesi Acil Servisi'ne başvuran AV tam blok tanılı hastaların klinik ve demografik özelliklerinin incelenmesi ve müdahale süreçlerinin değerlendirilmesi amaçlanmıştır.

Gereç ve Yöntemler: Çalışmanın evrenini, 01.01.2020 ile 01.01.2025 tarihleri arasında acil servise başvuran tüm bradikardi vakaları oluşturmuştur. Örneklem, EKG'lerinde AV tam blok saptanan, ≥18 yaşında olan, eksik verisi bulunmayan ve arşiv kayıtlarına ulaşılabilen hastalar dahil edilmiştir. Toplamda 147 bradikardi vakası değerlendirilmiş, bunlardan 34'ü AV tam blok olarak tanımlanmıştır.

Bulgular: Toplam 34 AV tam blok hastası değerlendirildi. Olguların %52.9'u 75 yaş ve üzeri grupta yer almakta olup, cinsiyet dağılımı eşitti. Başvuru şikayetleri arasında en sık senkop ve baş dönmesi (%26.5) görüldü. Komorbid hastalıklar arasında hipertansiyon (%82.4) ve geçirilmiş miyokard enfarktüsü (%41.2) ön plandaydı. Hastaların %55.9'u düzenli ilaç kullanmıyordu; kullanılan ilaçlar arasında en sık antihipertansifler ve antiaritmikler saptandı. Klinik sonlanımda hastaların %91.2'si yoğun bakım ünitesine yatırıldı, %5.9'u exitus oldu. Girişimsel işlem oranı %52.9 olup, en sık uygulamalar kalıcı kalp pili implantasyonu (%23.5) ve geçici kalp pili yerleştirilmesi olarak belirlendi.

Tartışma ve Sonuç: Bu çalışma, AV tam blok olgularının ileri yaş ve yüksek kardiyovasküler risk profiliyle ilişkili olduğunu ortaya koymuştur. Bulgularımız, miyokardiyal fibrozis ve hipertansiyonun AV blok gelişimindeki rolünü desteklemektedir. Hastaların önemli bir kısmında acil müdahale, yoğun bakım yatışı ve kalıcı pacemaker gereksinimi doğmuştur. Erken ve doğru acil tanı, mortaliteyi azaltmanın ve prognozu iyileştirmenin anahtarıdır; bu nedenle senkop veya açıklanamayan bradikardi ile başvuran her yaşlı hastada AV tam blok olasılığı mutlaka akılda tutulmalıdır.

Anahtar Kelimeler: AV tam blok, Acil servis, Bradikardi

Introduction

Complete atrioventricular (AV) block is a serious, potentially life-threatening cardiac conduction disorder that occurs when impulses from the sinoatrial node cannot be transmitted to the ventricles. In this condition, the electrical connection between the atria and ventricles is completely interrupted and the ventricles work slowly with their own intrinsic rhythm. Clinically, it may progress with serious complications such as syncope, hypotension due to bradycardia, congestive heart failure and sudden cardiac death (1).

The most common causes of AV complete block include acute or chronic ischaemic heart diseases, congenital conduction system disorders, myocarditis, cardiac surgeries, systemic diseases, some drugs (especially antiarrhythmics and beta-blockers) and electrolyte imbalances (2). Although AV blocks are more common in elderly patients, they may also occur in young individuals with congenital causes or toxic effects (3). Emergency departments are a critical step in the diagnosis and management of rhythm disorders such as complete AV block. A detailed anamnesis should be taken and a good physical examination should be performed.

In line with the patient's presenting complaints, further investigations other than ECHO and coronary angiography should be performed to investigate the etiology of AV complete block. Early diagnosis, rapidly initiated supportive treatment (e.g. transcutaneous pacemaker applications) and appropriate follow-up directly affect the prognosis of these patients. Early differentiation of high-grade AV block from benign bradycardias is of vital importance. Indeed, since patients may rapidly decompensate haemodynamically in the presence of underlying high-grade AV block, early diagnosis and emergency interventions such as temporary/permanent pacemaker application decrease mortality (4). However, data on the demographic and clinical characteristics of patients presenting with complete AV block are limited in our country.

The aim of this study was to retrospectively examine the patients admitted to the Emergency Department of Balıkesir University Faculty of Medicine Hospital between 01.01.2020 and 01.01.2025 and diagnosed with AV complete block, to analyse the clinical, laboratory and outcome data, and to provide recommendations for the diagnosis and treatment process based on these data.

Material And Method

This study is a descriptive, observational study in which the files of patients admitted to the Emergency Department of Balıkesir University Faculty of Medicine Hospital and diagnosed with complete AV block were retrospectively analysed. Ethics committee approval was obtained from Balıkesir University Health Sciences Non-Interventional Research Ethics Committee. (decision no:2025/94, date:18.2.2025)

The study population consisted of all bradycardia cases admitted to the emergency department between 01.01.2020 and 01.01.2025. Patients who had complete AV block on ECG, were ≥18 years old, had no missing data, and whose archive records could be accessed were included in the sample. A total of 147 bradycardia cases were evaluated and 34 of them were defined as AV complete block.

The data were obtained through the hospital information management system (MIA-MED) by scanning the digital archive records of the patients.

The variables collected are as follows:

Demographic information (age, gender)

Presenting complaints (syncope, dizziness, weakness, etc.)

Vital signs (blood pressure, pulse)

ECG findings

Laboratory parameters (creatinine, potassium, calcium levels)

Comorbid diseases

Medicines used

Clinical outcome (intensive care admission, discharge, exitus)

Data analysis was performed using SPSS version 26.0. Since the study involved a limited number of cases and no intergroup comparisons were conducted, only descriptive statistics were used. These included mean, standard deviation, median, minimum-maximum values, and frequency distributions.

Results

When the demographic characteristics of the 34 patients who presented with complete AV block were analysed, the ratio of males and females was the same (50%, n=17). When the age distribution of the 34 individuals included in this study was examined, it was seen that 26.5% of the participants were 65 years of age or younger, 20.6% were 66-74 years of age and 52.9% were 75 years of age or older. The age range was between 45-93 years (Table I.).

Table I. Demographic data of patients with AV complete block

Variable	Category	n	%
Gender	Male	17	50
	Female	17	50
Age Group (years)	≤ 65 years	9	26.5
	66-74 years	7	20.6
	≥ 75 years	18	52.9
Mean Age (years)	-	72.76 ± 13.73	-
Age Range (years)	-	45-93	-

When the symptoms reported by the 34 patients at the time of presentation to the emergency department were analysed, the most frequently reported complaints were dizziness (n=9; 26.5%) and syncope (n=9; 26.5%). In addition, more non-specific symptoms, such as general disturbance (n=5; 14.7%) and malaise (n=5; 14.7%) were also observed at a considerable level. To a lesser extent, symptoms such as confusion, nausea and vomiting, shortness of breath, fatigue, hypertension and cardiac arrest were observed in one patient (2.9%) each (Figure I.).

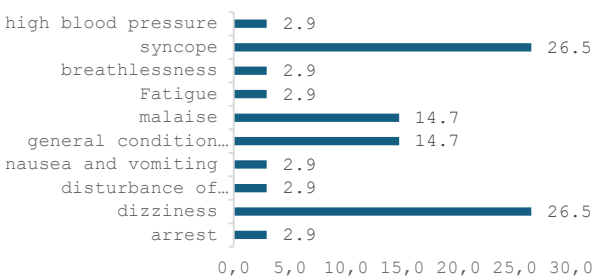


Figure I. Presenting complaints of patients with AV complete block

When the comorbidities and risk factors of the 34 patients included in the study were evaluated, the most common comorbidity was hypertension, which was found to be present in 82.4% (n=28) of the patients. The rate of patients with a history of previous myocardial infarction was 41.2% (n=14), and diabetes mellitus and hyperlipidaemia were found in 20.6% (n=7) of the patients. When regular medication use was questioned, 47.1% (n=16) of the patients were found to be taking medication (Table II.).

Table II. Distribution of patients with comorbidities and drug use

Variable	No	Yes	Total	%
Diabetes	27	7	34	20.6
Hypertension	6	28	34	82.4
Hyperlipidaemia	27	7	34	20.6
Previous heart attack	20	14	34	41.2
Rhythm disturbance	29	5	34	14.7
Drug use	18	16	34	47.1

When the blood pressures of the patients at admission were analysed, systolic blood pressure was 130 mmHg or less in 50% (n=17), 131-139 mmHg in 17.6% (n=6) and 140 mmHg or more in 32.4% (n=11) of 34 patients. When diastolic blood pressure values were analysed, it was found that 76.5% (n=26) of the patients had a diastolic blood pressure of 85 mmHg and below, and 23.5% (n=8) had a diastolic blood pressure of 86-89 mmHg (Table III.).

Table III. Blood pressure values

Category	n	%
Systolic 130 mmHg and below	17	50
Systolic 131-139 mmHg	6	17.6
Systolic 140 mmHg and above	11	32.4
Diastolic 85 mmHg and below	26	76.5
Diastolic 86-89 mmHg	8	23.5

When potassium levels, one of the biochemical parameters measured at the time of admission, were evaluated, potassium levels were within normal limits (3.5-5.1 mmol/L) in 88.2% (n=30) of the patients, while hypokalemia was found in 11.8% (n=4). When calcium levels were analysed, 76.5% (n=26) of the patients had levels within normal limits (8.8-10.6 mg/dL) and 23.5% (n=8) had hypocalcaemia. When creatinine levels were analysed, half of the patients (50%; n=17) had creatinine levels within the reference range (0.67-1.17 mg/dL), while the other half (50%; n=17) had low creatinine levels (Table IV.).

Table IV. Blood values

Parameter	Category	n	%
Potassium	Normal	30	88.2
Potassium	Low	4	11.8
Calcium	Normal	26	76.5
Calcium	Low	8	23.5
Creatinine	Normal	17	50
Creatinine	Low	17	50

Regarding the outcome of patients with complete AV block, 91.2% (n:31) were admitted to the ICU, and 5.2% (n:2) patients were exited (Table V.).

Table V. Finalisation of patients

		Frequency	%
	Exitus	2	5.9
	Hospitalisation	1	2.9
	ICU admission	31	91.2
	Total	34	100

When the drug use status of a total of 34 patients included in the study was evaluated, it was found that 55.9% (n=19) of the patients did not use any regular medication. The rate of single drug use was 23.5% (n=8), dual drug use was 14.7% (n=5) and triple drug use was 5.9% (n=2). When the drug types were analysed, it was observed that the most commonly used drugs were antihypertensives (20.6%; n=7) and antiarrhythmic agents (20.6%; n=7). This was followed by antiplatelet drugs (17.6%; n=6), anticoagulants (5.9%; n=2) and statins (5.9%; n=2), respectively (Figure II.).

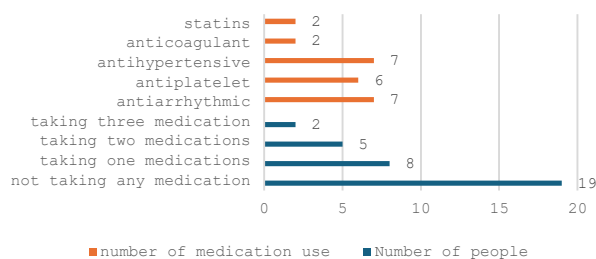


Figure II. Medication uses

The rates of use of drugs known to slow down atrioventricular conduction in our patients with AV complete block are presented in Table 6. According to our findings, the most common bradycardia-inducing drug groups were beta-blockers and digitalis glycoside. Approximately 14.7% of the patients were using beta-blockers (e.g. metoprolol or bisoprolol) and 11.8% were using digoxin. The use of non-dihydropyridine calcium channel blockers (verapamil) and class III antiarrhythmic drugs (amiodarone) was observed at lower rates (5.9% and 8.8%) (Table VI.).

Table VI. Distribution of drugs causing bradycardia.

Drug Class	Molecule	Number of Patients	%
Beta-blocker	Metoprolol	3	8,8
Beta-blocker	Bisoprolol	2	5,9
Calcium channel blocker (non-DHP)	Verapamil	2	5,9
Cardiac glycoside	Digoxin	4	11,8
Antiarrhythmic (Class III)	Amiodarone	3	8,8

Cardiac intervention processes of 34 patients diagnosed with AV complete block after the emergency department were evaluated. It was determined that 47.1% (n=16) of the patients did not undergo any interventional procedure, while 52.9% (n=18) underwent various interventions. 8.8% (n=3) patients underwent only temporary pacemaker application, 2.9% (n=1) patients underwent only coronary angiography (CAG), 5.9% (n=2) patients underwent temporary pacemaker implantation after CAG, 23.5% (n=8) patients underwent permanent pacemaker implantation after CAG, and 11.8% (n=4) patients underwent direct permanent pacemaker implantation (Figure III.).

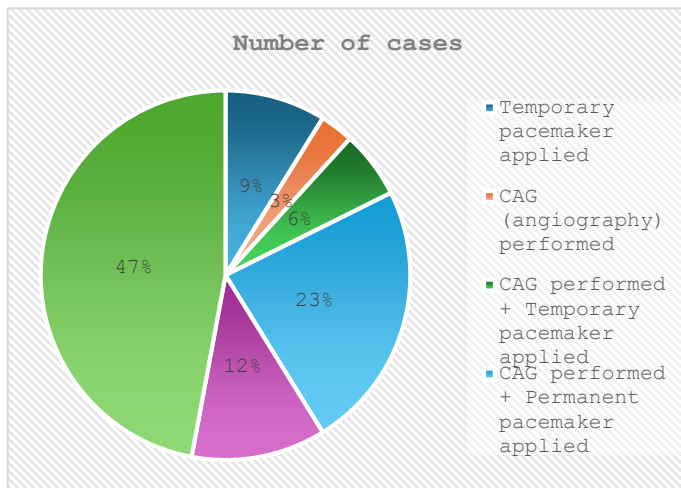


Figure III. Number of cases

Discussion

Complete Atrioventricular (AV) block is a life-threatening conduction disorder in which impulses originating in the atria fail to reach the ventricles, resulting in profound bradycardia and a risk of syncope, heart failure and sudden death (5). The resulting severe bradycardia may lead to complications including syncope, hypotension due to bradycardia, congestive heart failure or sudden cardiac death if left untreated.

The demographic characteristics of the 34 patients with AV complete block analysed in this study revealed the prominent role of advanced age, in accordance with the literature. The mean age of our patients was 72.7 ± 13.7 years, 52.9% were 75 years or older, and the gender distribution was equal. Similarly, in a larger-scale study (n=191), the mean age of patients with AV complete block was 62.7 ± 14 years (range 21-90) and a slight female predominance was reported (6). These data support that AV blocks are mostly seen in the elderly population. Degenerative fibrosis occurring in the conduction system with age is thought to play an important role in the pathogenesis of AV block. Indeed, the fact that no obvious acute triggering cause was found in most of our patients suggests that primary conduction system degeneration plays a role.

When the complaints of our patients admitted to the emergency department were analysed, the most common symptoms were syncope and dizziness. In addition, symptoms such as weakness, general condition disorder, confusion, nausea-vomiting and dyspnoea were also observed, but each of them remained at lower rates. These symptoms reflect cerebral hypoperfusion due to severe bradycardia and are quite typical in the presence of complete AV block. One study reported that syncope was the presenting symptom in approximately 40% of patients with atrioventricular complete block. This rate shows that syncope is a common symptom in patients with AV complete block (7). In a study by Alyan et al., more than half of 191 patients presented with a history of syncope (6). Therefore, high-grade AV conduction disorders should definitely be kept in mind and electrocardiographic evaluation should be performed urgently, especially in elderly patients presenting to the emergency department with unexplained syncope or marked dizziness.

Hypertension was the most prevalent comorbidity (82.4%), followed by previous myocardial infarction (41.2%). Both conditions promote myocardial fibrosis and damage to the conduction system, a link confirmed in multicentre studies (8). Diabetes and hyperlipidaemia each affected one-fifth of the cohort, emphasising the clustered cardiovascular risk typical of this population. Nearly half of the patients were receiving negative chronotropic drugs, most commonly β -blockers, non-dihydropyridine calcium-channel blockers or digoxin. Drug-induced AV block can be reversible, but recurrence is common after withdrawal (9-10,11). Therefore, drug history should definitely be evaluated in patients with complete AV block and patients should be kept under close follow-up even if agents that may be the culprit are discontinued. Even if a significant drug-related blocks are reversible, the block may reappear in approximately two thirds of patients over time.

Again, 41% of our patients had a history of previous MI, suggesting that ischaemic aetiology may be an important contributor. Ischaemic heart disease is considered to be one of the leading causes of complete AV block (6). The prognostic burden of ischaemia persists even in the era of primary PCI; complete block complicating anterior infarction remains an independent predictor of mortality (12,13).

Severe bradycardia in patients with complete AV block led to notable haemodynamic compromise. Half of the patients had a systolic blood pressure ≤ 130 mmHg at presentation, and 76.5% had diastolic pressures < 85 mmHg, reflecting reduced cardiac output. Even among those with systolic pressures > 140 mmHg (32.4%), perfusion may have remained inadequate due to slow ventricular rates. Critically low pulse rates (< 40 bpm) were documented in 14.3% of cases, reinforcing the urgency of pacing support.

In line with international guidelines, temporary transcutaneous or transvenous pacing should be promptly initiated in third-degree AV block when bradycardia compromises perfusion (14). Permanent pacemaker implantation remains the cornerstone of therapy; without it, long-term survival is markedly reduced, whereas pacing significantly improves prognosis and quality of life patients (15).

Electrolyte disturbances were uncommon but clinically relevant: hypokalaemia (11.8 %) and hypocalcaemia (23.5 %) can aggravate conduction abnormalities, while hyperkalaemia absent in our patients – has been shown to necessitate pacemaker support when severe (16,17). Rapid correction of such derangements remains a key component of acute management.

Across the broader cohort of 147 bradycardia cases seen during the study period, only 23.1% were due to complete AV block, yet this subgroup accounted for the vast majority of ICU admissions (91.2 %) and all observed in-hospital deaths, highlighting the critical importance of early identification and intervention (4).

Although AV complete block is usually seen in individuals with a history of cardiovascular disease, a significant proportion of patients (55.9%) in our study were not on regular medication. This finding may indicate the presence of subclinical cardiac conduction disorders that have not yet been detected in the general population. The high rates of antiarrhythmic and antihypertensive drug use are compatible with the literature findings supporting that these agents may be related with the development of AV complete block (18).

Therefore, patients receiving antiarrhythmic or antihypertensive therapy should be closely monitored for conduction system complications. Moreover, the risk of AV complete block is not limited to those with known cardiovascular risk factors; even asymptomatic individuals may be affected.

In our study, nearly half of the patients with complete AV block were on regular medications, including agents known to cause bradycardia such as beta-blockers, calcium channel blockers, and digoxin. This highlights the importance of considering drug-induced AV block, which may be reversible and not always require permanent pacemaker implantation. However, recurrence can occur even after discontinuation. Therefore, a thorough review of medication history is essential, and any potentially causative agents should be stopped. In our study, beta-blockers and digoxin were the most frequently used drugs. Similarly, Damirbek et al. reported beta-blockers as the leading culprit, followed by digoxin (10), while Zeltser et al. found that 54% of patients had used beta-blockers and/or verapamil or diltiazem (19). Even when the AV block appears drug-related, recurrence is observed in up to two-thirds of cases (19), underscoring the need for careful medication evaluation, discontinuation of risky agents, and close follow-up to monitor for recurrence and facilitate potential recovery.

Permanent pacemaker implantation is the cornerstone of treatment in patients with complete AV block. Without it, long-term survival is significantly reduced, while pacing markedly improves outcomes (18). In our study, a considerable number of patients required urgent cardiac interventions. The high proportion of patients who underwent permanent pacemaker implantation following coronary angiography (CAG) suggests that underlying coronary artery disease often coexists with AV block. Conversely, the presence of patients managed with only temporary pacing indicates that, in some cases, the block may be transient and reversible. These findings align with previous studies, which highlight permanent pacing as especially important in elderly patients with AV block and concomitant coronary disease (18). Meanwhile, the notable proportion of patients who required no intervention further supports that AV block may occasionally result from reversible causes.

Therefore, individualised evaluation and appropriate risk stratification are essential in the management of complete AV block. Treatment decisions should consider the underlying cause and clinical stability of the patient. In a previous study, two-thirds of patients diagnosed with complete AV block eventually required pacemaker implantation, with many initially managed with temporary pacing before receiving a permanent device (7).

Conclusion

Complete AV block is a high-risk conduction disorder, most frequently affecting the elderly and commonly encountered in emergency settings. The majority of patients require intensive care and have underlying cardiac conditions such as hypertension or a prior myocardial infarction. In patients presenting with syncope, dizziness, or unexplained weakness, high-grade AV block should be considered, and immediate ECG evaluation is warranted. Syncope and bradycardia in older adults must not be overlooked, as the incidence of AV conduction disorders increases with age. This study contributes to the clinical understanding of AV complete block by analysing the demographic and clinical features of affected patients in the emergency department. Further large-scale, multicentre studies are needed to validate these findings and guide optimal management strategies.

References

1. Jensen G, Sigurd B, Sandoe E. Adams-Stokes seizures due to ventricular tachydysrhythmias in patients with heart block: prevalence and problems of management. *Chest*. 1975;67(1):43-48.
2. Kerola T, Eranti A, Aro AL, Haukilahti MA, Holkeri A, Juntila MJ, et al. Risk factors associated with atrioventricular block. *JAMA Network Open*. 2019;2(5):e194176.
3. Glikson M, Hayes DL. Cardiac pacing: a review. *Medical Clinics*. 2001;85(2):369-421.
4. Knabben, V., Chhabra, L., & Slane, M. (2019). Third-degree atrioventricular block.
5. Mitchell LB. Atrioventricular block. In: Merck Manual Professional Version [Internet]. Merck & Co., Inc.; 2024
6. Alyan Ö, Ozcan Ozdemir DMS, Demir AD. Classification of patients with complete atrioventricular block according to etiological, demographic, clinical characteristics and pacemaker needs. *Anatolian Cardiol Derg*. 2003;3:203-210.
7. Aste M, Brignole M. Syncope and paroxysmal atrioventricular block. *J Arrhythm*. 2017;33(6):562-567.
8. Nguyen MN, Kiriazis H, Gao XM, Du XJ. Cardiac fibrosis and arrhythmogenesis. *Compr Physiol*. 2017;7(3):1009-1049
9. Jordán-Martínez L, Rivera-López R, Bermúdez-Jiménez F, Jiménez-Jaimez J, Alzueta J, Barrera-Cordero A, et al. Atrioventricular block in patients undergoing treatment with bradycardic drugs: predictors of pacemaker requirement. *Rev Esp Cardiol (Engl Ed)*. 2020;73(7):554-560.
10. Osmonov D, Erdinler I, Ozcan KS, Altay S, Turkkan C, Yildirim E, et al. Management of patients with drug-induced atrioventricular block. *Pacing Clin Electrophysiol*. 2012;35(7):804-810.
11. Zeltser D, Justo D, Halkin A, Rosso R, Ish-Shalom M, Hochenberg M, et al. Drug-induced atrioventricular block: prognosis after discontinuation of the culprit drug. *J Am Coll Cardiol*. 2004;44(1):105-108.
12. Kawamura Y, Yokoyama H, Kitayama K, Miura N, Hamadate M, Nagawa D, et al. Clinical impact of complete atrioventricular block in patients with ST-segment elevation myocardial infarction. *Clin Cardiol*. 2021;44(1):91-99.
13. Kostuk WJ, Beanlands DS. Complete heart block associated with acute myocardial infarction. *Am J Cardiol*. 1970;26(4):380-384.
14. Friedberg CK, Donoso E, Stein WG. Nonsurgical acquired heart block. *Ann N Y Acad Sci*. 1964;111(3):835-847.
15. Mittal S. Third-degree atrioventricular block (complete atrioventricular block), atrioventricular dissociation. In: *Insights into Electrocardiograms with MCQs*. Singapore: Springer Nature Singapore; 2023. p. 137-146.
16. Erden E, Cakmak M. An overlooked cause of complete atrioventricular block: hyperkalaemia. *Dirim Tip Gazetesi*. 2010;85(4):193-196.
17. Baratloo A, Haroutunian P, Rouhipour A, Safari S, Rahmati F. Hyperkalemia-induced complete heart block. *J Emerg Pract Trauma*. 2015;1(1):35-38.
18. Kusumoto FM, Schoenfeld MH, Barrett C, et al. 2018 ACC/AHA/HRS guideline on the evaluation and management of patients with bradycardia and cardiac conduction delay: a report of the American College of Cardiology/American Heart Association Task Force on Clinical Practice Guidelines and the Heart Rhythm Society. *J Am Coll Cardiol*. 2019;74(7):e51-e156.
19. Parsova KE, Hayiroglu MI, Pay L, Cinier G, Gurkan K. Long-term follow-up of patients with drug-related atrioventricular block without a need of permanent pacemaker during index hospitalisation. *Egypt Heart J*. 2022;74(1):56..