# Atrial Fibrillation, Atrioventricular Blocks and Bundle Branch Blocks in Hemodialysis Patients

**Ante Mandić[1], Monika Tomić[2], Božo Petrov[3] and Željko Romić[4]**

[1] Health Center Široki Brijeg, Široki Brijeg, Bosnia and Herzegovina
[2] Mostar University Hospital, Department of Internal Medicine, Mostar, Bosnia and Herzegovina
[3] Mostar University Hospital, Department of Psychiatry, Mostar, Bosnia and Herzegovina
[4] Dubrava University Hospital, Department of Laboratory Diagnostics, Zagreb, Croatia

## A B S T R A C T

*Atrial fibrillation is one of the most frequent arrhythmias diagnosed in clinical practice and it is also relatively common in dialysis patients. Atrioventricular and intraventricular conduction disturbances are less investigated in hemodialysis patients and data about their prevalence are insufficient. The objective of this study was to determine the prevalence of atrial fibrillation, atrioventricular blocks and bundle branch blocks in hemodialysis patients and to analyze different clinical risk factors. The study included 140 patients on long-term hemodialysis treatment. The presence of atrial fibrillation, atrioventricular blocks and bundle branch blocks was determined by electrocardiogram. Patients were divided into groups depending on the presence or absence of atrial fibrillation/bundle branch blocks and investigated variables were compared. Atrial fibrillation was present in 11 (7.9%) of the 140 patients. In multivariate analysis, age and higher concentration of uric acid were associated with atrial fibrillation. Prevalence of first-degree atrioventricular block was 2.9% (4 patients) and second- and third-degree atrioventricular blocks were not found. Prevalence of bundle branch blocks was 17.1% (24 patients): 5% of patients had a complete right bundle branch block, 6.4% had an incomplete right bundle branch block, 3.6% had a complete left bundle branch block and 2.1% of patients had an incomplete left bundle branch block. The prevalence of atrial fibrillation and bundle branch blocks in this study was relatively high in patients on hemodialysis and greater than that observed in general population. Presence of atrial fibrillation was associated with older age and higher concentration of uric acid.*

*Key words: atrial fibrillation, atrioventricular blocks, bundle branch blocks, chronic renal failure, hemodialysis*

## Introduction

Cardiovascular diseases are the major cause of death in hemodialysis patients[1,2]. Atrial fibrillation is one of the most frequent arrhythmias diagnosed in clinical practice and it is also relatively common in dialysis patients. Its prevalence in general population is 1–2%[3]. Different studies reported wide range of atrial fibrillation prevalence among hemodialysis patients, which is between 3% and 27%[4–10]. These results also certainly depend on average age of patients in the study and on considered types of atrial fibrillation (some studies did not include paroxysmal episodes of atrial fibrillation). It is known that the presence of atrial fibrillation is associated with higher mortality rate, both in general population[3] and in hemodialysis patients[11].

Atrioventricular and intraventricular conduction disturbances are less investigated in hemodialysis patients. To our knowledge, data about prevalence of atrioventricular (AV) and bundle branch blocks in these patients are insufficient. Vazquez et al. investigated the prevalence of bundle branch blocks in patients starting dialysis. This study showed that prevalence of complete bundle branch blocks in those patients was high (11.4%) and greater than in general population. They did not investigate incomplete bundle branch blocks. Also it was reported that the presence of bundle branch block (especially left) in patients starting dialysis might be indicative for poor prognosis[12].

Accordingly, the aim of this study was to determine the prevalence of atrial fibrillation, AV blocks and bundle branch blocks (complete and incomplete) in hemodialysis patients and to analyze different clinical risk factors.

## Methods

The research was conducted in 2011 in Dialysis center of the University hospital Mostar. A total of 140 patients (58 females, 82 males; the average age 61±15 years) on chronic hemodialysis program were included in the study. After obtaining a necessary approval, medical documentation of all patients was reviewed and electrocardiograms, laboratory tests and medical histories were analyzed.

Presence of atrial fibrillation, atrioventricular blocks, incomplete and complete bundle branch blocks was determined by electrocardiogram[13]. The patients who had brief paroxysms of atrial fibrillation usually associated with the dialysis sessions were not classified in atrial fibrillation group in this study.

Beside electrocardiographic findings, observed clinical characteristics and laboratory tests were: age, sex, time on hemodialysis, arterial hypertension, diabetes mellitus, values of hemoglobin, urea, creatinine, uric acid, iron, ferritin, calcium, phosphate, parathyroid hormone, albumin, C-reactive protein (CRP), total cholesterol, triglycerides, HDL-cholesterol and LDL-cholesterol. The patients were considered to have hypertension or diabetes mellitus when they were receiving antihypertensive or antidiabetic drugs.

Since this is a cross-sectional study, the prevalence of investigated disturbances was calculated after collecting the data and groups of patients containing an adequate number of subjects for statistical analysis were compared by the observed variables.

### Statistical analysis

Continuous variables were expressed as median (interquartile range). The Mann-Whitney U test was used to compare continuous variables, and the chi-square test with Yates' correction was used to compare categorical variables. The variables for which comparison univariate analysis showed the statistically significant difference were included in multivariate logistic regression analysis, in which the beta coefficients and 95% confidence intervals (95% CI) were calculated. A $P$ value less than 0.05 was considered statistically significant. Analyses were made with the SPSS 17.0 statistical package.

## Results

Among 140 patients included in the study, 11 (7.9%) had an atrial fibrillation. Some of the bundle branch

**TABLE 1**
DIFFERENCES BETWEEN PATIENTS WITH ATRIAL FIBRILLATION AND THOSE IN SINUS RHYTHM

|  | Atrial fibrillation (n=11) | Sinus rhythm (n=129) | p* |
|---|---|---|---|
| Men, n (%) | 4 (36.4) | 78 (60.5) | 0.215 |
| Arterial hypertension, n (%) | 7 (63.6) | 105 (81.4) | 0.307 |
| Diabetes mellitus, n (%) | 0 (0) | 16 (12.4) | 0.455 |
| Age (years) | 75 (3) | 60 (26) | 0.002 |
| Hemoglobin (g/L) | 91 (26) | 98 (23) | 0.075 |
| Urea (mmol/L) | 22.9 (7.7) | 21.6 (6.8) | 0.846 |
| Creatinine ($\mu$mol/L) | 699 (251) | 771 (292) | 0.548 |
| Uric acid ($\mu$mol/L) | 372 (118) | 311 (65) | 0.026 |
| Iron ($\mu$mol/L) | 8.1 (6.0) | 9.6 (6.7) | 0.273 |
| Calcium (mmol/L) | 2.21 (0.17) | 2.23 (0.28) | 0.493 |
| Phosphate (mmol/L) | 1.3 (0.7) | 1.3 (0.6) | 0.923 |
| Albumin (g/L) | 35.0 (9.0) | 37.2 (4.7) | 0.023 |
| C-reactive protein (mg/L) | 15.4 (28.8) | 5.8 (11.9) | 0.008 |
| Cholesterol (mmol/L) | 3.3 (4.7) | 4.1 (1.4) | 0.012 |
| Triglycerides (mmol/L) | 1.1 (0.9) | 1.6 (1.1) | 0.044 |
| HDL (mmol/L) | 0.82 (0.22) | 0.93 (0.37) | 0.084 |
| LDL (mmol/L) | 2.13 (1.17) | 2.69 (1.05) | 0.018 |
| Ferritin ($\mu$g/L) | 162.0 (264.8) | 97.4 (219.7) | 0.446 |
| Parathyroid hormone (pg/mL) | 281.2 (390.4) | 212.9 (419.9) | 0.327 |
| Dialysis duration (months) | 40 (51) | 32 (53) | 0.786 |

Quantitative variables are expressed as median (interquartile range);
* Univariate analysis: $\chi^2$-test with Yates' correction for qualitative variables, Mann-Whitney U test for quantitative variables

|  | Beta coefficient | 95% CI* | p |
|---|---|---|---|
| Age | 1.094 | 1.006–1.190 | 0.036 |
| Uric acid | 1.018 | 1.003–1.034 | 0.016 |
| Albumin | 0.903 | 0.715–1.140 | 0.392 |
| Cholesterol | 0.586 | 0.020–17.487 | 0.758 |
| Triglycerides | 0.473 | 0.127–1.761 | 0.265 |
| LDL | 0.783 | 0.011–56.437 | 0.911 |

* 95% confidence interval

blocks were detected in 24 (17.1%) patients: 7 (5%) patients had a complete right bundle branch block, 9 (6.4%) had an incomplete right bundle branch block, 5 (3.6%) had a complete left bundle branch block and 3 (2.1%) of them had an incomplete left bundle branch block. First-degree AV block was found in 4 (2.9%) patients. Second- and third-degree AV blocks were not found in these patients.

When we compared the patients who had atrial fibrillation with those in sinus rhythm, the univariate analysis showed that patients with atrial fibrillation were older, had lower albumin, cholesterol, triglycerides and LDL concentrations and higher concentrations of uric acid and C-reactive protein (Table 1).

In the multivariate analysis, older age and higher concentration of uric acid were associated with atrial fibrillation (Table 2).

When we compared patients with sinus rhythm who had some form of bundle branch blocks and those without bundle branch block in the electrocardiogram, any of the investigated variables showed no statistically significant difference among groups.

## Discussion

Prevalence of atrial fibrillation in hemodialysis patients in this study was 7.9%, which is higher than that observed in the general population. Namely, the prevalence of atrial fibrillation in the general population was 1–2%[3], or as it is known that the prevalence increases with age, in persons older than 65 from the general population prevalence was about 4.7%[14]. The results of similar studies have shown a different prevalence of atrial fibrillation in patients on hemodialysis ranging from 3 to 27%[4–10], which corresponds to the results of this research. The prevalence probably depends partly on what types of atrial fibrillation were included in the study, or whether paroxysmal atrial fibrillation was observed.

The results indicated no division between patients with atrial fibrillation at some of its forms (first diagnosed, paroxysmal, persistent, long-standing persistent, permanent – according to the latest guidelines of the European society of cardiology[3]), because we could not classify all patients to some groups with certainty and fur-

ther monitoring and analysis would be required, which was the limitation of the study to an extent. However, short paroxysms of atrial fibrillation which were spontaneously converted to sinus rhythm were not considered. Patients with atrial fibrillation were significantly older than those in sinus rhythm, which corresponds to the previously known fact. Significantly higher concentrations (but still within the reference range) of uric acid were found in patients with atrial fibrillation, which some similar studies did not explore[5,9]. Those patients also had a significantly lower serum albumin concentration, as demonstrated by similar studies[5,9]. Patients with atrial fibrillation had significantly higher concentrations of CRP. This finding was demonstrated by Vazquez et al. in patients starting dialysis[15]. We attach small importance in this study to it. Therefore, CRP was not included in the multivariate analysis, because it is known that CRP is a parameter whose level relatively rapidly changes in inflammatory states. Hence, more credible result and conclusion could be found after monitoring of CRP over a longer time. Some similar studies have not shown that cholesterol, triglycerides and LDL were significantly lower in patients with atrial fibrillation[9,15]. Multivariate logistic regression analysis showed that older age and higher concentrations of uric acid were associated with atrial fibrillation. In other studies in the multivariate analyses, older age was found to be associated with atrial fibrillation as well[5,9,15].

First-degree AV block was found in four patients (2.9% of all study patients), which is comparable to the general population[16,17]. Second- and third-degree AV blocks were not recorded. We found no research on AV blocks in patients on hemodialysis, so that comparison was not possible, although the prevalence was expected to be higher in this study.

In 24 patients (17.1%) some form of bundle branch blocks was found: the right bundle branch block was found in 7 patients (5%), an incomplete right bundle branch block was found in 9 (6.4%), a left bundle branch block was found in 5 (3.6%) and an incomplete left bundle branch block was found in 3 patients (2.1%). Compared to the general population[18–20], the prevalence of bundle branch blocks was higher in this study. The Framingham study results showed that the prevalence of bundle branch blocks (left and right) in older people in the general population was about 8%[18]. The Reykjavik study showed that the case of the right bundle branch block in patients aged 30 to 39 was not documented, while the prevalence was 1.6% in females and 4.1% in males aged from 75 to 79[19]. According to Hardarson et al., the prevalence of the left bundle branch block in general population is 0.36% in average[20]. We have not found this kind of research on the bundle branch blocks in hemodialysis patients in the literature.

Vazquez et al. researched the prevalence of complete bundle branch blocks in patients starting hemodialysis. The prevalence of the bundle branch blocks in this study was approximately 11.4% (24 of 211 study patients had a bundle branch block), including 8.5% of the right bundle

branch block and 2.8% of the left bundle branch block[12]. These data are comparable to this research, although the mentioned study refers to the patients starting hemodialysis, which is not the case in this study. Also, in that study authors did not research the prevalence of incomplete bundle branch blocks.

When comparing patients with sinus rhythm who had some form of bundle branch block with those without bundle branch block in the electrocardiogram, there was no statistically significant difference in any investigated parameters among groups. Comparing the Vazquez et al. aforementioned study[12] by the parameters that are observed in this study, patients with the bundle branch block were significantly older and had a higher prevalence of diabetes mellitus. However, a comparison to that study is not the best one, because patients observed in this research are patients undergoing chronic hemodialysis program for some time.

In addition to the standard limitations of cross-sectional studies, it would be more complete if the research also included echocardiographic parameters, which technically was not feasible in this study.

The objectives set out in this paper have been achieved, and further research could go in terms of monitoring these patients and determining long-term prognosis. Specifically, it is considered that patients on hemodialysis who have an atrial fibrillation or a bundle branch block, especially the left, have a worse prognosis than those without these changes[11,12], which indicates the importance of timely detection and appropriate treatment of these disorders. There are not many similar studies in the literature, particularly on atrioventricular and intraventricular conduction disturbances, and a comparison with other studies in some parts of the study was impossible. Therefore, we expect future researches to clarify these issues.

# REFERENCES

1. RONCO C, BOWRY S, TETTA C, Blood Purif, 24 (2006) 39, DOI: 10.1159/000089435. — 2. SIDHU MS, DELLSPERGER KC, Adv Perit Dial, 26 (2010) 47. — 3. EUROPEAN HEART RHYTHM ASSOCIATION; EUROPEAN ASSOCIATION FOR CARDIO-THORACIC SURGERY, CAMM AJ, KIRCHHOF P, LIP GY, SCHOTTEN U, SAVELIEVA I, ERNST S, VAN GELDER IC, AL-ATTAR N, HINDRICKS G, PRENDERGAST B, HEIDBUCHEL H, ALFIERI O, ANGELINI A, ATAR D, COLONNA P, DE CATERINA R, DE SUTTER J, GOETTE A, GORENEK B, HELDAL M, HOHLOSER SH, KOLH P, LE HEUZEY JY, PONIKOWSKI P, RUTTEN FH, Eur Heart J, 31 (2010) 2369, DOI: 10.1093/eurheartj/ehq278. — 4. ABE S, YOSHIZAWA M, NAKANISHI N, YAZAWA T, YOKOTA K, HONDA M, SLOMAN G, Am Heart J, 131 (1996) 1137, DOI: 10.1016/S0002-8703(96)90088-5. — 5. VAZQUEZ E, SANCHEZ-PERALES C, BORREGO F, GARCIA-CORTES MJ, LOZANO C, GUZMAN M, GIL JM, BORREGO MJ, PEREZ V, Am Heart J, 140 (2000) 886, DOI: 10.1067/mhj.2000.111111. — 6. FABBIAN F, CATALANO C, LAMBERTINI D, TARRONI G, BORDIN V, SQUERZANTI R, GILLI P, DI LANDRO D, CAVAGNA R, Clin Nephrol, 54 (2000) 234. — 7. GENOVESI S, POGLIANI D, FAINI A, VALSECCHI MG, RIVA A, STEFANI F, ACQUISTAPACE I, STELLA A, BONFORTE G, DEVECCHI A, DECRISTOFARO V, BUCCIANTI G, VINCENTI A, Am J Kidney Dis, 46 (2005) 897, DOI: 10.1053/j.ajkd.2005.07.044. — 8. BOZBAS H, ATAR I, YILDIRIR A, OZGUL A, UYAR M, OZDEMIR N, MUDERRISOGLU H, OZIN B, Ren Fail, 29 (2007) 331, DOI: 10.1080/08860220701191237. — 9. ACAR G, AKCAY A, DOGAN E, ISIK IO, SÖKMEN A, SÖKMEN G, SAYARLIOGLU H, KÖROGLU S, NACAR AB, TUNCER C, Turk Kardiyol Dern Ars, 38 (2010) 8. — 10. WINKELMAYER WC, PATRICK AR, LIU J, BROOKHART MA, SETOGUCHI S, J Am Soc Nephrol, 22 (2011) 349, DOI: 10.1681/ASN.2010050459. — 11. VAZQUEZ E, SANCHEZ PERALES C, LOZANO C, GARCIA-CORTES MJ, BORREGO F, GUZMAN M, PEREZ P, PAGOLA C, BORREGO MJ, PEREZ V, Am J Cardiol, 92 (2003) 868, DOI: 10.1016/S0002-9149(03)00904-4. — 12. VAZQUEZ RUIZ DE CASTROVIEJO E, SANCHEZ PERALES C, LOPEZ LOPEZ J, GARCIA CORTES MJ, ARAGON EXTREMERA V, GUZMAN HERRERA M, FAJARDO PINEDA A, LOZANO CABEZAS C, Rev Esp Cardiol, 61 (2008) 719, DOI: 10.1157/13123993. — 13. Disorders of the cardiovascular system. In: KASPER DL, BRAUNWALD E, FAUCI AS, HAUSER SL, LONGO DL, JAMESON JL (Eds) Harrison's Principles of Internal Medicine (McGraw-Hill, 2005), DOI: 10.1036/0071402357. — 14. SUDLOW M, THOMSON R, THWAITES B, RODGERS H, KENNY RA, Lancet, 352 (1998) 1167, DOI: 10.1016/S0140-6736(98)01401-9. — 15. VAZQUEZ E, SANCHEZ PERALES C, GARCIA GARCIA F, CASTELLANO P, GARCIA CORTES MJ, LIEBANA A, LOZANO C, Kidney Int, 76 (2009) 324, DOI: 10.1038/ki.2009.185. — 16. BEXTON RS, CAMM AJ, Eur Heart J, 5 (1984) 107. — 17. CHENG S, KEYES MJ, LARSON MG, MCCABE EL, NEWTON-CHEH C, LEVY D, BENJAMIN EJ, VASAN RS, WANG TJ, JAMA, 301 (2009) 2571, DOI: 10.1001/jama.2009.888. — 18. KREGER BE, ANDERSON KM, KANNEL WB, Am Heart J, 117 (1989) 903, DOI: 10.1016/0002-8703(89)90630-3. — 19. THRAINSDOTTIR IS, HARDARSON T, THORGEIRSSON G, SIGVALDASON H, SIGFUSSON N, Eur Heart J, 14 (1993) 1590, DOI: 10.1093/eurheartj/14.12.1590. — 20. HARDARSON T, ARNASON A, ELIASSON GJ, PALSSON K, EYJOLFSSON K, SIGFUSSON N, Eur Heart J, 8 (1987) 1075.

*A. Mandić*

*Health Center Široki Brijeg, Dr. Jure Grubišića 11, 88220 Široki Brijeg, Bosnia and Herzegovina*
*e-mail: ante.mandic@live.com*

## FIBRILACIJA ATRIJA, ATRIOVENTRIKULSKI BLOKOVI I BLOKOVI GRANA U BOLESNIKA NA HEMODIJALIZI

### S A Ž E T A K

Fibrilacija atrija jedna je od najčešćih aritmija koje se dijagnosticiraju u kliničkoj praksi i također je relativno česta u bolesnika na hemodijalizi. Atrioventrikulske i intraventrikulske smetnje provođenja su manje istraživane u bolesnika na hemodijalizi te su podatci o pojavnosti istih nedostatni. Cilj ovog istraživanja bio je odrediti pojavnost fibrilacije atrija, atrioventrikulskih blokova i blokova grana u bolesnika na hemodijalizi te analizirati različite čimbenike rizika. Istraživanje je obuhvatilo 140 bolesnika koji su na kroničnom programu hemodijalize. Prisutnost fibrilacije atrija, atrioventrikulskih blokova i blokova grana određena je pomoću elektrokardiograma. Bolesnici su podijeljeni u skupine na osnovu prisutnosti ili odsutnosti fibrilacije atrija/blokova grana te uspoređeni po istraživanim varijablama. Fibrilacija atrija je dijagnosticirana u 11 (7,9%) od 140 bolesnika. Multivarijatna analiza pokazala je povezanost starije dobi i veće koncentracije mokraćne kiseline s fibrilacijom atrija. Pojavnost atrioventrikulskog bloka prvog stupnja bila je 2,9% (4 bolesnika), a atrioventrikulski blokovi drugog i trećeg stupnja nisu pronađeni. Pojavnost blokova grana bila je 17,1% (24 bolesnika): 5% bolesnika imalo je potpuni blok desne grane, 6,4% nepotpuni blok desne grane, 3,6% potpuni blok lijeve grane i 2,1% bolesnika imalo je nepotpuni blok lijeve grane. Pojavnost fibrilacije atrija i blokova grana u ovom istraživanju bila je relativno velika u bolesnika na hemodijalizi i veća nego u općoj populaciji. Pojavnost fibrilacije atrija bila je povezana sa starijom dobi i većom koncentracijom mokraćne kiseline.