

Dual antiplatelet therapy is safe and efficient after left atrial appendage closure

Jakub Maksym¹, Tomasz Mazurek¹, Janusz Kochman¹, Marek Grygier², Agnieszka Kapłon-Cieślicka¹, Michał Marchel¹, Piotr Łodziński¹, Radosław Piątkowski¹, Radosław Wilimski³, Paweł Czub³, Anna Fojt¹, Natalia Karolczak¹, Piotr Hendzel³, Grzegorz Opolski¹

¹1st Chair and Department of Cardiology, Medical University of Warsaw, Warsaw, Poland

²Chair and 1st Department of Cardiology, Poznan University of Medical Sciences, Poznan, Poland

³Department of Cardiac Surgery, Medical University of Warsaw, Warsaw, Poland

Abstract

Background: Despite results of the PROTECT AF trial, many patients undergoing left atrial appendage closure (LAAC) have unconditional contraindications to warfarin.

Aim: We sought to investigate whether double antiplatelet therapy (DAPT) is safe in patients after LAAC.

Methods: Forty-four consecutive patients (22 males, mean age 74 ± 7.8 years) with non-valvular atrial fibrillation (NVAf) underwent LAAC procedure using a Watchman device followed by DAPT (75 mg/d aspirin and 75 mg/d clopidogrel). After the procedure and during 98 days' follow-up including transoesophageal echocardiography, peri-procedural complications and clinical outcomes were investigated.

Results: Mean CHA₂DS₂-VASc score was 4.9 ± 1.5 and mean HAS-BLED score was 3.6 ± 0.8 . The main LAAC indication was contraindication to anticoagulation reflected by HAS-BLED score ≥ 3 observed in 95.5% cases (among them history of bleeding in 38 patients, 90.5%). 36.4% of patients have history of stroke or transient ischaemic attack. The procedure was successful in 97.7%. Peri-procedural complications were tamponade (2.3%) and one death (2.3%) unrelated to the procedure with no bleeding or vascular complications. During follow-up neither stroke nor bleeding were observed, whereas two device related thrombi and two unrelated deaths occurred.

Conclusions: LAAC followed by DAPT seems to be a safe and efficient alternative for stroke prevention in patients with NVAf who have contraindications to anticoagulation therapy. This strategy may provide a significant reduction of events such as stroke and bleeding versus the score-predicted rate.

Key words: atrial fibrillation, left atrial appendage closure, stroke, bleeding, dual antiplatelet therapy

Kardiol Pol 2018; 76, 2: 459–463

INTRODUCTION

Atrial fibrillation (AF) is the most common cardiac arrhythmia affecting 1% of the population, and its prevalence is expected to increase in parallel with the increasing age of the population [1–3]. AF is associated with a fourfold to fivefold increase in the risk of stroke, and an estimated 15% of all strokes are caused by AF [3, 4]. Because risk of stroke increases with age, stroke prevention in the elderly community with AF is a key aspect of management for this group [5, 6].

Oral anticoagulation (OAC) using vitamin K antagonists (VKA) such as warfarin is the established therapy for stroke

prevention, and it dramatically reduces the risk of thromboembolism in patients with AF [7, 8]. Compared with placebo, anticoagulation with VKAs diminishes AF-related stroke risk by two-thirds, whereas aspirin decreases stroke risk only by 22% [9]. The ACTIVE W trial revealed that VKAs also reduce the risk of stroke by one-third in comparison to the combination of aspirin and clopidogrel [2]. However, the use of these drugs can be challenging because of increased risk of bleeding, the need for frequent monitoring to maintain a therapeutic international normalised ratio (INR), diet-dependent activity, and its wide interpatient variability in metabolism [8, 10]. There has been

Address for correspondence:

Tomasz Mazurek, MD, PhD, 1st Chair and Department of Cardiology, Medical University of Warsaw, ul. Banacha 1a, 02–097 Warszawa, Poland, tel: +48 22 5991951, fax: +48 22 5991950, e-mail: tmazurek@kardia.pl

Received: 01.08.2017

Accepted: 12.10.2017

Available as AoP: 08.12.2017

Kardiologia Polska Copyright © Polskie Towarzystwo Kardiologiczne 2018

a great hope that novel agents, which act by inhibiting factor Xa or thrombin, would overcome the disadvantages associated with VKA use, for example, may provide more stable anticoagulation and eliminate the inconvenience of warfarin monitoring [8, 11, 12]. Randomised trials have demonstrated that non-vitamin K antagonist oral anticoagulants (NOACs) achieve comparable or even better stroke prevention than warfarin with lower intracranial bleeding risk [13–15]. However, in case of high-dose dabigatran and rivaroxaban, these drugs still encounter issues of gastrointestinal (GI) bleeding and non-compliance [13, 14]. Compared to warfarin, only apixaban achieved superiority in reduction of both major and intracranial bleeding, and there was a non-significant difference in the rate of GI bleeding [15].

Nonpharmacological approaches are under investigation to exclude the left atrial appendage (LAA) from the systemic circulation, based on evidence suggesting that this is the main site of thrombus formation and subsequent cardioembolic stroke in AF patients [16]. PROTECT AF was the first randomised, clinical trial that demonstrated that left atrial appendage closure (LAAC) with Watchman device was non-inferior to warfarin in the prevention of ischaemic stroke [17]. In addition, LAAC was superior to warfarin in the reduction of all-cause mortality (3.2% vs. 4.9%), cardiovascular mortality (1.0% vs. 2.4%), and haemorrhagic stroke (0.2% vs. 1.1%) [18]. The second randomised trial, PREVAIL, confirmed that Watchman LAAC was non-inferior to chronic warfarin therapy for the prevention of stroke and systemic embolism beginning one week after randomisation, and it also revealed that procedural complications were infrequent and significantly improved compared with the PROTECT AF trial [19]. Thus, LAAC is worth considering in the group of patients with high risk of bleeding and contraindications to anticoagulation therapy. The aim of the study was to evaluate whether dual antiplatelet therapy (DAPT) during the first three months after Watchman device implantation is as safe and efficient as warfarin therapy.

METHODS

Patient selection

In our observational study, all included patients who were recruited to the LAAC procedure were at high risk of thromboembolic complication, i.e. with at least two points in CHA₂DS₂-VASC scale, and had one of the following:

- HAS-BLED score ≥ 3 ;
- history of bleeding complication while using OAC;
- inability to maintain INR values within therapeutic range;
- history of stroke while using OAC;
- contraindication for OAC.

Exclusion criteria included the following:

- presence of thrombus in LAA;
- too small or too big LAA on transoesophageal echocardiography (TEE);

- contraindication to general anaesthesia;
- lack of patient consent.

Procedure

Between 31.03.2015 and 6.06.2017, 44 consecutive patients who fulfilled the inclusion criteria were treated with the Watchman device at our department. The loading dose of 300 mg of aspirin and 600 mg of clopidogrel was administered prior to the procedure. In patients treated with aspirin and clopidogrel before the procedure, the therapy was continued with 75 mg of each drug daily. All the procedures were performed under general anaesthesia with TEE and fluoroscopic guidance. After transeptal puncture, unfractionated heparin was administered intravenously at a dose of 1000 U/10 kg to continue the procedure with prolonged activated clotting time to at least 250 s. Following the sheath introduction to the LAA, angiographic projections were made to assess the shape of the LAA. Based on the acquired angiographic planes and TEE visualisation, the LAA anatomy and landing zone were assessed to choose the most suitable size of the device. After preparation of the Watchman introduction system, the occluder was deployed under TEE and angiographic guidance. The tug test was performed to confirm device stability before its final release. Colour-Doppler in TEE was used to eliminate leaks. All patients underwent transthoracic echocardiography within 24 h to exclude peri-procedural complications, such as pericardial effusion, as well as to confirm a position of the Watchman device.

Treatment and follow-up

After the procedure, all patients were treated with DAPT using 75 mg of aspirin and 75 mg of clopidogrel per day, and maintained until the control examination. At three-month follow-up, the implanted device was assessed using TEE. When proper position and absence of thrombi were observed, clopidogrel was abandoned, unless the patient required its administration. In the case of the presence of thrombus, the patient was treated with low-molecular-weight heparin (LMWH) for six weeks and the device was re-assessed in repeat TEE.

RESULTS

The baseline characteristics are presented in Table 1.

The mean age was 74 ± 7.8 years, and 52.3% of the treated patients were male. Mean CHA₂DS₂-VASC score and HAS-BLED score were 4.9 ± 1.5 and 3.6 ± 0.8 , respectively. The main indication to perform the LAAC procedure was contraindication to OAC with HAS-BLED score ≥ 3 in 95.5% of cases (among them history of bleeding in 38 [90.5%] patients).

In 97.7% of the cases the device was deployed successfully (Fig. 1).

In one (2.3%) case the deployment had to be abandoned because of unfavourable anatomy of LAA. Table 2 summarises

Table 1. Baseline characteristics

Study group	44
Age [years]	74 ± 7.8
Male	23 (52.3%)
Atrial fibrillation:	
Paroxysmal/Persistent	22 (50%)
Permanent	22 (50%)
Hypertension	35 (81.8%)
Congestive heart failure	21 (47.4%)
Diabetes mellitus	15 (34%)
History of stroke/TIA	16 (36.4%)
History of bleeding	38 (86%)
Vascular disease	19 (43%)
CHA ₂ DS ₂ -VASc score	4.9 ± 1.5
HAS-BLED score	3.6 ± 0.8

Data are presented as mean ± standard deviation or numbers and percentages; TIA — transient ischaemic attack

Table 2. Procedural data

Study group	43
Total procedural time [min]	83.2 ± 25.5
Fluoroscopy time [min]	14.4 ± 2.3
Contrast agent [mL]	133 ± 10.9
Diameter of implanted device [mm]	27 ± 3.31
Device compression [%]	17.8 ± 7.1

Data are presented as mean ± standard deviation or numbers.

Table 3. Procedure-/device-related complications

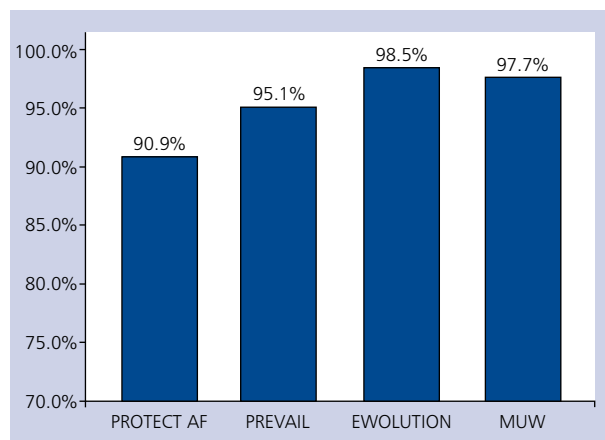
Study group	43
Tamponade	1 (2.3%)
Device embolisation	0 (0%)
Stroke	0 (0%)
Major bleeding	0 (0%)
Vascular complication	0 (0%)
Death	1 (2.3%)

Data are presented as numbers and percentages or numbers.

procedural details for the subjects with successful device deployment.

During four (9.3%) procedures the device had to be partially recaptured due to its unstable or improper position, and only in one (2.3%) case the device had to be replaced with a new one of different size. The mean device compression was 17.8 ± 7.1%. Directly after the procedure the peri-device flow > 2 mm was observed only in two patients, but it never exceeded 5 mm.

Procedure-related complications are presented in Table 3.

**Figure 1.** Implant success at the Medical University of Warsaw (MUW) when compared to previous Watchman device studies

There was only one peri-procedural tamponade, which had to be managed by interventional pericardiocentesis. One week after the device implantation, one death occurred at the cardiac intensive care unit due to septic shock.

The mean time of TEE follow-up was 98 days. At this time, TEE was performed in 36 (83.7%) cases. Four (9.3%) patients refused to have echocardiographic examination, thus the medical condition was assessed over the phone. Two (4.6%) unrelated deaths occurred. During the follow-up period, neither stroke nor major bleeding were observed. In the control TEE, no device embolisation was detected. In two (4.6%) patients, follow-up TEE revealed a small thrombus attached to the Watchman device during the two-month follow-up period. These patients were treated with LMWH for six weeks, and subsequent TEE was arranged. In both cases, the thrombus resolved completely and no clinically evident thromboembolic events were observed.

DISCUSSION

This study showed that DAPT with aspirin and clopidogrel may be a safe and efficient alternative therapy after LAAC performed with the Watchman device in consecutive patients encountered in daily clinical practice. Compared to previous clinical trials, in our study a greater proportion of patients were unsuitable for OAC, due to numerous comorbidities and due to high bleeding risk. The mean CHA₂DS₂-VASc score of our population was 4.9, which indicates a higher risk of thromboembolic complications than in the PROTECT AF (mean CHA₂DS₂-VASc of 3.4), PREVAIL (CHA₂DS₂-VASc of 4.0) or EWOLUTION registry with CHA₂DS₂-VASc score of 4.5. Furthermore, in comparison to other studies, most of our subjects were at high risk of bleeding complications during OAC. 95.5% of our patients had HAS-BLED score of ≥ 3, whereas in PROTECT AF it was 20%, in PREVAIL 30%, and in the EWOLUTION registry it was 40% of recruited patients.

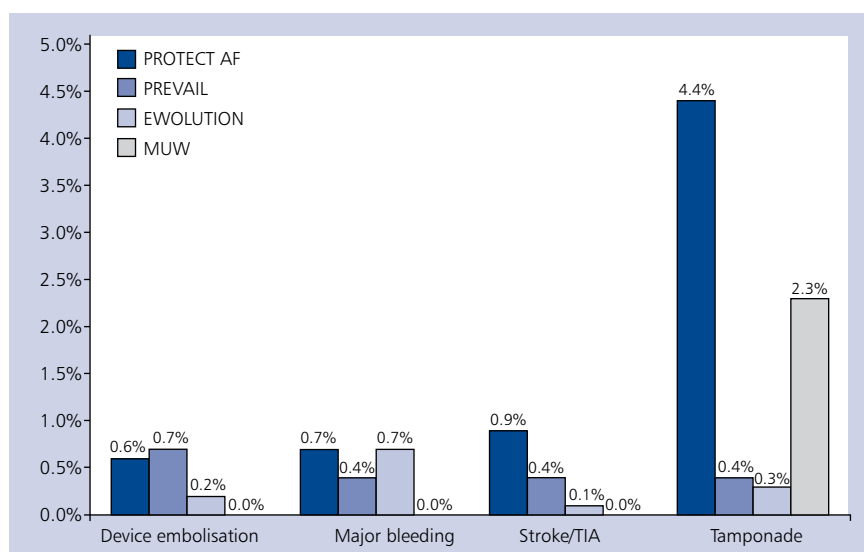


Figure 2. Serious procedure-/device-related complications within seven days after left atrial appendage closure procedure at the Medical University of Warsaw (MUW) compared to previous Watchman device studies; TIA — transient ischaemic attack

The peri-procedural safety profile of our study, which involves tamponade, stroke, major bleeding, and device embolisation, were observed at similar or lower levels than in previous studies. Procedure- or device-related strokes were not observed in our population, while in the PROTECT AF, PREVAIL, and the EWOLUTION registry this complication appeared in 0.9%, 0.3%, and 0.1% of cases, respectively. We also did not observe major bleeding or device embolisation during hospitalisation. In general, procedure- or device-related serious adverse events through seven days occurred at a rate of 8.7% in the PROTECT AF, 4.2% in PREVAIL, 2.8% in EWOLUTION registry [20], and in our study, it was 4.6% with one tamponade and one death due to septic shock.

In addition, three-month results of the multicentre, real-world EWOLUTION registry revealed that the Watchman LAA closure device provides high success and safety rates. It was the first European data collection from small, local registries from 47 countries. As in our study, the EWOLUTION registry comprised a high-risk population. Three-months follow-up data were obtained in 979 patients, and it is worth highlighting that there was no significant impact on serious adverse events, regardless of whether patients were on warfarin, single antiplatelet therapy, DAPT, NOACs, or nothing at all [21]. 607 patients were treated with DAPT after the LAAC procedure. Among these patients, bleeding severe adverse events (SAE) rate was similar to that in subjects on warfarin regimen: 3.6% and 4.8%, respectively. During a mean follow-up period of 98 days no bleeding SAE was observed in our study group. Among all treatment regimens in the EWOLUTION registry, the highest rate of thrombus on the device was observed in patients treated with DAPT, at 3.5%. Whereas in our study thrombus on the device reached 4.6%. Both cases were successfully treated

within six weeks of LMWH administration and neither of them experienced a thromboembolic event. Based on the EWOLUTION registry, it was postulated that DAPT regimen in highest risk patients is a safe and efficient option for patients with contraindication to OAC. Nevertheless, very promising results of completed trials and registries, European [21] as well as American [22] guidelines for AF management and stroke prevention classify LAAC as a IIb recommendation. However, following favourable trends, it is expected to be upgraded in the nearest future.

Limitations of the study

A larger population and additional randomisation with control or a differently treated group would provide more powerful data to confirm Watchman device safety in favourable stroke incidence reduction. Moreover, given the relatively short follow-up period of three months in our study, we cannot convincingly show that the LAAC with the Watchman device is effective protection for future thromboembolic events.

CONCLUSIONS

Left atrial appendage closure seems to be a feasible and safe procedure in the high-risk population. Compared to large multicentre, randomised trials, as well as real life registries, our results demonstrate comparable procedure-related complications, and that DAPT is an effective therapy with a similar rate of device-related thrombus formation compared to warfarin therapy (PROTECT AF). In addition, withdrawal of anticoagulation therapy after LAAC does not increase the rate of stroke, whereas the bleeding rate decreases, as compared to large clinical trials.

Conflict of interest: Marek Grygier — Boston Scientific: proctor, research grants and Advisory Board Member.

References

- Miyasaka Y, Barnes ME, Gersh BJ, et al. Secular trends in incidence of atrial fibrillation in Olmsted County, Minnesota, 1980 to 2000, and implications on the projections for future prevalence. *Circulation*. 2006; 114(2): 119–125, doi: [10.1161/CIRCULATION-AHA.105.595140](https://doi.org/10.1161/CIRCULATION-AHA.105.595140), indexed in Pubmed: [16818816](https://pubmed.ncbi.nlm.nih.gov/16818816/).
- Connolly S, Pogue J, Hart R, et al. ACTIVE Writing Group of the ACTIVE Investigators. Clopidogrel plus aspirin versus oral anticoagulation for atrial fibrillation in the Atrial fibrillation Clopidogrel Trial with Irbesartan for prevention of Vascular Events (ACTIVE W): a randomised controlled trial. *Lancet*. 2006; 367(9526): 1903–1912, doi: [10.1016/S0140-6736\(06\)68845-4](https://doi.org/10.1016/S0140-6736(06)68845-4), indexed in Pubmed: [16765759](https://pubmed.ncbi.nlm.nih.gov/16765759/).
- Wolf PA, Abbott RD, Kannel WB. Atrial fibrillation as an independent risk factor for stroke: the Framingham Study. *Stroke*. 1991; 22(8): 983–988, doi: [10.1161/01.str.22.8.983](https://doi.org/10.1161/01.str.22.8.983), indexed in Pubmed: [1866765](https://pubmed.ncbi.nlm.nih.gov/1866765/).
- Lip G, Lim H. Atrial fibrillation and stroke prevention. *Lancet Neurol*. 2007; 6(11): 981–993, doi: [10.1016/s1474-4422\(07\)70264-8](https://doi.org/10.1016/s1474-4422(07)70264-8), indexed in Pubmed: [17945152](https://pubmed.ncbi.nlm.nih.gov/17945152/).
- Mant J, Hobbs FD, Fletcher K, et al. BAFTA investigators, Midland Research Practices Network (MidReC). Warfarin versus aspirin for stroke prevention in an elderly community population with atrial fibrillation (the Birmingham Atrial Fibrillation Treatment of the Aged Study, BAFTA): a randomised controlled trial. *Lancet*. 2007; 370(9586): 493–503, doi: [10.1016/S0140-6736\(07\)61233-1](https://doi.org/10.1016/S0140-6736(07)61233-1), indexed in Pubmed: [17693178](https://pubmed.ncbi.nlm.nih.gov/17693178/).
- Rothwell PM, Coull AJ, Giles MF, et al. Oxford Vascular Study. Change in stroke incidence, mortality, case-fatality, severity, and risk factors in Oxfordshire, UK from 1981 to 2004 (Oxford Vascular Study). *Lancet*. 2004; 363(9425): 1925–1933, doi: [10.1016/S0140-6736\(04\)16405-2](https://doi.org/10.1016/S0140-6736(04)16405-2), indexed in Pubmed: [15194251](https://pubmed.ncbi.nlm.nih.gov/15194251/).
- Steinberg BA, Piccini JP. Anticoagulation in atrial fibrillation. *BMJ*. 2014; 348: g2116, doi: [10.1136/bmj.g2116](https://doi.org/10.1136/bmj.g2116), indexed in Pubmed: [24733535](https://pubmed.ncbi.nlm.nih.gov/24733535/).
- Canestaro WJ, Patrick AR, Avorn J, et al. Cost-effectiveness of oral anticoagulants for treatment of atrial fibrillation. *Circ Cardiovasc Qual Outcomes*. 2013; 6(6): 724–731, doi: [10.1161/CIRCOUTCOMES.113.000661](https://doi.org/10.1161/CIRCOUTCOMES.113.000661), indexed in Pubmed: [24221832](https://pubmed.ncbi.nlm.nih.gov/24221832/).
- Hart RG, Pearce LA, Aguilar MI. Meta-analysis: antithrombotic therapy to prevent stroke in patients who have nonvalvular atrial fibrillation. *Ann Intern Med*. 2007; 146(12): 857–867, doi: [10.7326/0003-4819-146-12-200706190-00007](https://doi.org/10.7326/0003-4819-146-12-200706190-00007), indexed in Pubmed: [17577005](https://pubmed.ncbi.nlm.nih.gov/17577005/).
- Katritsis DG, Gersh BJ, Camm AJ. Anticoagulation in Atrial Fibrillation - Current Concepts. *Arrhythm Electrophysiol Rev*. 2015; 4(2): 100–107, doi: [10.1542/aer.2015.04.02.100](https://doi.org/10.1542/aer.2015.04.02.100), indexed in Pubmed: [26835109](https://pubmed.ncbi.nlm.nih.gov/26835109/).
- Schirmer SH, Baumhäkel M, Neuberger HR, et al. Novel anticoagulants for stroke prevention in atrial fibrillation: current clinical evidence and future developments. *J Am Coll Cardiol*. 2010; 56(25): 2067–2076, doi: [10.1016/j.jacc.2010.09.017](https://doi.org/10.1016/j.jacc.2010.09.017), indexed in Pubmed: [21144965](https://pubmed.ncbi.nlm.nih.gov/21144965/).
- Garcia D, Libby E, Crowther MA. The new oral anticoagulants. *Blood*. 2010; 115(1): 15–20, doi: [10.1182/blood-2009-09-241851](https://doi.org/10.1182/blood-2009-09-241851), indexed in Pubmed: [19880491](https://pubmed.ncbi.nlm.nih.gov/19880491/).
- Connolly SJ, Ezekowitz MD, Yusuf S, et al. RE-LY Steering Committee and Investigators. Dabigatran versus warfarin in patients with atrial fibrillation. *N Engl J Med*. 2009; 361(12): 1139–1151, doi: [10.1056/NEJMoa0905561](https://doi.org/10.1056/NEJMoa0905561), indexed in Pubmed: [19717844](https://pubmed.ncbi.nlm.nih.gov/19717844/).
- Patel MR, Mahaffey KW, Garg J, et al. ROCKET AF Investigators. Rivaroxaban versus warfarin in nonvalvular atrial fibrillation. *N Engl J Med*. 2011; 365(10): 883–891, doi: [10.1056/NEJMoa1009638](https://doi.org/10.1056/NEJMoa1009638), indexed in Pubmed: [21830957](https://pubmed.ncbi.nlm.nih.gov/21830957/).
- Granger CB, Alexander JH, McMurray JJV, et al. ARISTOTLE Committees and Investigators. Apixaban versus warfarin in patients with atrial fibrillation. *N Engl J Med*. 2011; 365(11): 981–992, doi: [10.1056/NEJMoa1107039](https://doi.org/10.1056/NEJMoa1107039), indexed in Pubmed: [21870978](https://pubmed.ncbi.nlm.nih.gov/21870978/).
- Reddy VY, Doshi SK, Sievert H, et al. PROTECT AF Investigators. Percutaneous left atrial appendage closure for stroke prophylaxis in patients with atrial fibrillation: 2.3-Year Follow-up of the PROTECT AF (Watchman Left Atrial Appendage System for Embolic Protection in Patients with Atrial Fibrillation) Trial. *Circulation*. 2013; 127(6): 720–729, doi: [10.1161/CIRCULATIONAHA.112.114389](https://doi.org/10.1161/CIRCULATIONAHA.112.114389), indexed in Pubmed: [23325525](https://pubmed.ncbi.nlm.nih.gov/23325525/).
- Holmes DR, Reddy VY, Turi ZG, et al. PROTECT AF Investigators. Percutaneous closure of the left atrial appendage versus warfarin therapy for prevention of stroke in patients with atrial fibrillation: a randomised non-inferiority trial. *Lancet*. 2009; 374(9689): 534–542, doi: [10.1016/S0140-6736\(09\)61343-X](https://doi.org/10.1016/S0140-6736(09)61343-X), indexed in Pubmed: [19683639](https://pubmed.ncbi.nlm.nih.gov/19683639/).
- Lewalter T, Kanagaratnam P, Schmidt B, et al. Ischaemic stroke prevention in patients with atrial fibrillation and high bleeding risk: opportunities and challenges for percutaneous left atrial appendage occlusion. *Europace*. 2014; 16(5): 626–630, doi: [10.1093/europace/euu069](https://doi.org/10.1093/europace/euu069), indexed in Pubmed: [24798956](https://pubmed.ncbi.nlm.nih.gov/24798956/).
- Holmes DR, Kar S, Price MJ, et al. Prospective randomized evaluation of the Watchman Left Atrial Appendage Closure device in patients with atrial fibrillation versus long-term warfarin therapy: the PREVAIL trial. *J Am Coll Cardiol*. 2014; 64(1): 1–12, doi: [10.1016/j.jacc.2014.04.029](https://doi.org/10.1016/j.jacc.2014.04.029), indexed in Pubmed: [24998121](https://pubmed.ncbi.nlm.nih.gov/24998121/).
- Boersma LVA, Schmidt B, Betts TR, et al. EWOLUTION investigators. Implant success and safety of left atrial appendage closure with the WATCHMAN device: peri-procedural outcomes from the EWOLUTION registry. *Eur Heart J*. 2016; 37(31): 2465–2474, doi: [10.1093/eurheartj/ehv730](https://doi.org/10.1093/eurheartj/ehv730), indexed in Pubmed: [26822918](https://pubmed.ncbi.nlm.nih.gov/26822918/).
- Kirchhof P, Benussi S, Kotecha D, et al. 2016 ESC Guidelines for the management of atrial fibrillation developed in collaboration with EACTS. *Eur Heart J*. 2016; 37(38): 2893–2962, doi: [10.1093/eurheartj/ehw210](https://doi.org/10.1093/eurheartj/ehw210), indexed in Pubmed: [27567408](https://pubmed.ncbi.nlm.nih.gov/27567408/).
- Meschia JF, Bushnell C, Boden-Albala B, et al. American Heart Association Stroke Council, Council on Cardiovascular and Stroke Nursing, Council on Clinical Cardiology, Council on Functional Genomics and Translational Biology, Council on Hypertension. Guidelines for the primary prevention of stroke: a statement for healthcare professionals from the American Heart Association/American Stroke Association. *Stroke*. 2014; 45(12): 3754–3832, doi: [10.1161/STR.0000000000000046](https://doi.org/10.1161/STR.0000000000000046), indexed in Pubmed: [25355838](https://pubmed.ncbi.nlm.nih.gov/25355838/).

Cite this article as: Maksym J, Mazurek T, Kochman J, et al. Dual antiplatelet therapy is safe and efficient after left atrial appendage closure. *Kardiol Pol*. 2018; 76(2): 459–463, doi: [10.5603/KP.a2017.0245](https://doi.org/10.5603/KP.a2017.0245).