

# International Cardiovascular Research Meeting 2018, Abstracts

Medical Research Journal 2018;  
Volume 3, Number 2, 108–119  
10.5603/MRJ.2018.0018  
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ISSN 2451–2591

## The two faces of tumor necrosis factor alpha: from angiogenesis to early cellular mechanism of atherosclerosis

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**Background:** The angiogenesis process is usually strictly related to inflammation, both in the case of physiological and pathological conditions, such as wound healing or cardiovascular diseases, respectively. Typically, the generation of new vessels in almost all states is accompanied by increased vascular permeability, in both physiological and pathological conditions. Moreover, this increased leakiness of endothelium is promoted by a variety of mechanisms including endothelial cell proliferation and migration. The aim of the study was to elucidate the mechanism of inflammation-related disruption of cell-cell junctions.

**Methods:** We used primary human coronary artery endothelial cells derived from healthy 23-years old white male treated with tumour necrosis factor alpha. Activation of endothelial cells was confirmed by detection of functional E-selectin and VCAM-1 expression using antibody-coated magnetic beads as well as by co-culture with Jurkat T-cells. Changes in cell migration were investigated using in vitro tube formation, transwell migration, wound healing and open field migration assays. Changes in cell-cell and cell-ECM junctions were confirmed by fluorescence labelling of junctional proteins and actin cytoskeleton. Oligomerization of Claudin-5 was confirmed by immunoblot. The results obtained on fixed cells were compared with live-cell imaging experiments.

**Results:** Induction of the surface and intracellular expression of E-selectin and VCAM-1 and co-culture with Jurkat T-cells confirmed that TNF $\alpha$  activates pHCAECs and induces flattening, firm adhesion and further migration of T-cells on the endothelial monolayer. Furthermore, endothelial activation leads to a change in the organization of F-actin from star-like pattern to linear stress fibers, which affects both cell migration and tube formation on Matrigel. Moreover, creation of stress fibers was associated with the formation of 'discontinuous', or spot-like, cell-cell junctions. All those changes together led to the mechanical breakdown of cell-cell connections in ROCK-dependent manner. We also observed the breakage of retraction resulted in release of migrasome-like structures, which stayed in the place of previous cell-cell junction or were taken up by surrounding cells.

**Conclusion:** Our study confirmed that rebuilding of cell-cell junctions during endothelial cell migration involves mechanical breakdown of AJs through elevated F-actin polymerization accompanied by increased cell-ECM adhesion. In addition, we indicated the possible role of cell-cell junction-mediated signalization throughout the migration of TNF $\alpha$ -activated endothelial cells. Furthermore, we suggest that inflammation-induced angiogenesis is mechanically similar to early cellular mechanism of atherosclerosis.

## Novel potentials of Dipeptidyl peptidase-4 inhibitor Sitagliptin against ischemia reperfusion injury in normolipidemic and hyperlipidemic animals

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**Background:** Hyperlipidemia has been recognized as a prominent risk factor associated with increased risk of myocardial infarction (MI). Dipeptidyl peptidase-4 (DPP-4) inhibitors such as sitagliptin (Sitg), are a class of oral anti-diabetic drugs implicated in pleiotropic secondary

cardioprotective effects. However, the mechanisms of protection remain ambiguous in normal as well as in hyperlipidemic conditions. Thus, the aim of our study was to unveil the cardioprotective efficacy of Sitg towards myocardial ischemia- reperfusion (IR) injury in normal and hyperlipidemic conditions.

**Methods:** Male wistar rats were fed with normal (N) rat chow or mixed with fats (High fat= HF) for 12 weeks to induce hyperlipidemia. At the last two weeks of feeding, animals were orally treated with different doses of Sitg (25 mg, 50 mg, 100 mg, and 150 mg/kg/day), or its saline as a vehicle (control). Heart tissues were isolated and subjected to two different I/R-injury protocols: 10 min perfusion, 45 min regional ischemia, and 120 min reperfusion for infarct size (IS) measurement, or: 10 min perfusion, 45 min regional ischemia and 10 min reperfusion for biochemical analysis, including: NOS and DPP-4 activity, GLP-1, Calcium, TRPV-1 and CGRP levels, TRPC-1 and eNOS protein expression. To confirm the implication of NOS in DPP4 inhibition-induced cardioprotection, NOS inhibitor (L-NAME, 25mg/kg/day) was injected intraperitoneally, three hours post-oral administration of Sitg for IS evaluation.

**Results:** Following results are expressed as (Sitg (50mg) vs. Control (Saline)), in both N and HF diet animals. Infarct size significantly decreased in hearts isolated from both N ( $23 \pm 3.34$  vs.  $37.45 \pm 2.73$  %) and HF ( $22.39 \pm 3.25$  vs.  $39 \pm 3.29$  %) animals. DPP-4 activity displayed a significant decrease only in N ( $552.32 \pm 100.02$  vs.  $1005.92 \pm 190.96$   $\mu$ U/ml) animals, while NOS activity significantly increased in both N ( $210.6 \pm 58.57$  vs.  $77.48 \pm 15.67$  pmol/min/mg protein) and HF ( $96.51 \pm 13.75$  vs.  $52.38 \pm 11.56$  pmol/min/mg protein) animals. Only N animals showed a significant increase in TRPV-1 level ( $458.49 \pm 27.62$  vs.  $351.04 \pm 17.40$  ng/mg protein) and TRPC-1 expression ( $408.12 \pm 83.93$  vs.  $129.38 \pm 38.58$  mm<sup>2</sup>). In the presence of NOS- inhibitor (L-NAME), cardioprotective effect of Sitg (50mg) was abolished and IS increased in N ( $36.99 \pm 3.82$  vs.  $23 \pm 3.34$  %) and HF ( $59.17 \pm 6.67$  vs.  $23.42 \pm 3.26$  %) animals, comparing Sitg (50mg)+L-NAME group to Sitg (50mg) group.

**Conclusion:** The cardioprotective effect of Sitg in this study is not limited to lowering in infarct size (IS), but also in upregulation of NOS system and TRP channels in normal animals, while this protection is nearly abolished in hyperlipidemic condition.

## Targeted temperature management after out-of-hospital cardiac arrest — does time really matter?

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**Background:** Out-of-hospital cardiac arrest (OHCA) is a condition of high mortality. It is also associated with brain damage that leads to impaired neurological function in survivors. Targeted Temperature Management (TTM) is an important tool to reduce mortality and to improve neurological outcomes after OHCA. This study evaluates the relation of time from initiation of cooling to target temperature and neurologic outcome after OHCA in patients treated with TTM.

**Methods:** This single-centre, retrospective cohort study was conducted at the University Hospital No. 1 in Bydgoszcz, Poland. Our study group included adults ( $\geq 18$  years) with OHCA of preassumed cardiac origin who remained comatose after restoration of spontaneous circulation and underwent TTM between January 2010 and March 2018. Good neurologic outcomes were defined as cerebral performance category (CPC) score of  $\leq 2$  at discharge. Association between neurologic outcomes and time from initiation of cooling to target temperature ( $33 \pm 0.2^\circ\text{C}$ ) was examined. Time variables were presented as median with interquartile range (IQR).

**Results:** Studied group consisted of 76 patients, 60 males (78.9%), treated with TTM during the study period. The mean age of the group was  $64.7 \pm 12.9$  years. Among studied population 31 (40.8%) patients were discharged in good neurologic condition. The median of cooling time in the group of good neurologic outcome was 350 min (IQR 240-550) and was significantly longer than the time of 270 min (IQR 180-360) in the group with CPC score  $>2$  ( $p=0.025$ ). Patients reaching the target temperature within 3 hours were more likely to have worse neurologic outcome (3.9% vs 19.7%,  $p=0.027$ ).

**Conclusion:** In this single-centre study of OHCA patients treated with TTM, shorter time from initiation of cooling to target temperature was associated with poor neurologic outcome. To the best of our knowledge this is the first Polish study to evaluate this relation.

## Kardia Mobile applicability in clinical practice: a comparison of Kardia Mobile and standard 12-lead ECG records in 100 consecutive patients of a tertiary cardiovascular care center

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**Background:** Mobile devices such as smartphones are gaining a rising number of users in all countries around the globe. Novel solutions to diagnose patients with out-of-hospital onset of arrhythmic symptoms can be easily used to record such events, but the exact effectiveness of such a utensil is still unknown. The aim of our study was to define sensitivity, specificity, and reliability of Kardia Mobile.

**Methods:** In a group of 100 consecutive patients of an academic cardiology care center (mean age  $68 \pm 14.2$  years, males: 66%) a standard 12-lead ECG and a Kardia Mobile record were registered. Both versions were subsequently assessed by three independent physician groups via a standardized online formulary.

**Results:** The analysis of comparison of standard ECG and Kardia Mobile records showed that the latter is of lower quality ( $P < .001$ ), it was non-inferior for detection of atrial fibrillation and atrial flutter, showed weaker rhythm detection in pacemaker stimulation ( $P = .008$ ), was superior in sinus rhythm detection ( $P = .02$ ), though. The sensitivity of Kardia Mobile to detect pathological Q wave was low compared to specificity (20.6% vs 93.7%, respectively,  $P < .001$ ). Basic intervals measured by Kardia device, namely PQ, RR, and QT were significantly different (shorter) than those observed in the usual method (160 ms vs 180 ms ( $P < .001$ ), 853 ms vs 880 ms ( $P = .03$ ) and 393 ms vs 400 ms ( $P < .001$ ), respectively).

**Conclusions:** Initial and indicative value of Kardia Mobile is comparable to results achieved in standard ECG. Kardia Mobile was superior in detection of sinus rhythm than eye-ball evaluation of 12-lead ECG. Though, the PQ and QT intervals were shorter in Kardia Mobile as compared to standard 12-lead ECG. Clinical value needs to be verified in large studies, though.

## Heart failure parameters one month after MitraClip implantation

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**Background:** The percutaneous mitral valve repair (PMVR) with the MitraClip (MC) system is a treatment modality for severe mitral regurgitation (MR) in patients whose condition is inoperable or who are at high conventional operative risk. MitraClip therapy consists of percutaneous edge-to-edge coaptation of the mitral leaflets. This method is safe and leads to relevant clinical improvement even in critically ill. The aim of this study was the objective assessment of effectiveness of the MitraClip therapy.

**Materials and methods:** Our retrospective single-center study was conducted at the Cardiology Department of the University Hospital No 1 in Bydgoszcz between 11/2014 and 12/2017. Data of 21 patients (female (F)=1, male (M)=20) aged between 55 and 81 years (mean 67) who underwent MitraClip implantation. All data were collected from patients' medical files and echocardiographic examinations. Impaired left ventricular ejection fraction (LVEF), advanced age, high comorbidity and multivessel disease defined patients as high-risk candidates for conventional surgery. We analyzed the extent of heart failure with the aid of The New York Heart Association (NYHA) Functional Classification, B-type natriuretic peptide (BNP), LVEF and range of mitral regurgitation before the MitraClip implantation and one month after the procedure.

**Results:** Thirteen patients (62%) had the history of prior myocardial infarction, fifteen (71%) suffered from arterial hypertension and four (19%) from chronic renal failure. Echocardiography revealed severely impaired LV function in all patients (LVEF  $28\% \pm 6.5\%$ ). The change in LVEF one month after MC implantation is not statistically significant. Procedure-related reduction in MR severity was one grade in 14 patients (67%), two grades in 3 patients (14%), and no change in 4 patients (19%). The study showed clinical improvement in NYHA functional class  $\geq$ III in 21 patients (100%) before and 4 patients (19%) after the procedure ( $p < 0.001$ ). A statistically significant decrease in BNP at follow-up was observed ( $p < 0.05$ ).

**Conclusions:** MitraClip therapy for functional mitral regurgitation is a valuable alternative to surgery for high-risk patients. The study showed relevant improvement in echocardiographic parameters as well as in the quality of life of the patients.

## Influence of burr to artery ratio on long-term outcomes in patients undergoing rotational atherectomy

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**Background:** Rotational atherectomy (RA) is an effective tool for treatment of calcified and diffuse coronary artery lesions. It has been previously reported that smaller burr sizing (burr to artery ratio (BtAR)  $< 0.7$ ), in comparison to greater BtAR, allows to achieve similar procedural and angiographic success along with reductions periprocedural complications. However the long-term outcomes of RA still requires further investigation.

**Aim of the study:** Aim of our study was to examine the association between BtAR during RA and long-term outcomes.

**Methods:** The retrospective analysis of RA procedures performed at the the Department of Cardiology and Internal Medicine in Bydgoszcz between January 2005 and February 2017 was made. During the study period 128 patients underwent RA, of which 83 were enrolled for further analysis. Two independent observers calculated BtAR for artery treated with RA. The exclusion criteria were more than one RA in a single patient or inability to calculate BtAR due to technical issues. The long-term outcome was defined as the all-cause mortality.

**Results:** The mean age of the studied group was  $72.3 \pm 8.6$  years with the majority of men (62.7%). The mean BtAR for a first observer was  $0.5769 \pm 0.1458$  and for a second observer  $0.5635 \pm 0.1179$ . A total of 23 patients died (27.7%) with the mean of  $844.0 \pm 874.0$  days from the procedure to death. Receiver operating characteristic (ROC) curve analysis of BtAR determined threshold of 0.6106 for all-cause mortality de-

tection. The sensitivity and specificity were 60.9% and 78.7%, respectively ( $p=0.025$ ). Kaplan-Meier survival analysis showed that the all-cause mortality rate in the group with the  $\text{BtAR} > 0.6106$  is significantly higher compared to the patients with lower  $\text{BtAR}$  ( $p=0.018$ ).

**Conclusions:** To the best of our knowledge, this is the first study to demonstrate the relationship between  $\text{BtAR}$  and long-term outcomes in patients undergoing RA.

$\text{BtAR} > 0.6106$  is associated with worse prognosis of patients treated with RA.

## Contribution of mild renal impairment and arterial stiffening to left ventricular concentric hypertrophy in moderate degenerative aortic stenosis

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**Background:** Degenerative aortic stenosis (AS) is a progressive disease and left ventricular (LV) hypertrophy develops gradually already in moderate AS, an antecedent of severe AS. LV remodeling and symptomatic status in moderate AS may be affected by non-valvular factors, e.g. hypertension, CAD and renal function. AIM: To assess effects of renal function on characteristics of real-world patients with moderate AS.

**Methods:** We reviewed hospital records of 150 subjects with moderate AS, out of whom 70 with pure AS in sinus rhythm, with  $\text{EF} > 40\%$  and stable in-hospital creatinine entered the final analysis. The patients (age:  $76 \pm 9$  years) were compared according to  $\text{GFR}$  [ $\text{ml}/\text{min}$  per  $1.73 \text{ m}^2$ ]: group A ( $\text{GFR} > 85$ ), B ( $\text{GFR} = 60 - 85$ ) and C ( $\text{GFR} = 15 - 59$ ). We also calculated systemic arterial compliance (SAC) and valvulo-arterial impedance ( $Z_{\text{va}}$ ), an index of total LV afterload, from echocardiographic records and blood pressure.

**Results:** The 3 groups did not differ in aortic valve area, EF, LV mass, prevalence of symptoms or CAD. Compared to group A, group B subjects were older ( $p=0.002$ ), had lower SAC ( $p=0.004$ ) and higher pulse pressure ( $p=0.004$ ), relative LV wall thickness (RWT) ( $p=0.04$ ) and LV mass/volume ratio ( $p=0.03$ ).  $\text{GFR}$  correlated to SAC ( $r=0.48$ ,  $p=0.002$ ), pulse pressure ( $r = -0.38$ ,  $p=0.02$ ), RWT ( $r = -0.46$ ,  $p=0.001$ ) and  $Z_{\text{va}}$  ( $r = -0.34$ ,  $p=0.04$ ) only in groups A and B.

**Conclusion:** Mild renal impairment appears associated with LV concentricity in moderate AS irrespective of valve area. This relation can be mediated by concomitant arterial stiffening that increases LV afterload. Thus, prevention of early  $\text{GFR}$  decline may possibly delay development of LV diastolic dysfunction and symptoms in AS.

## Does the ablation procedure improve the quality of life in patients with cardiac arrhythmias? Analysis of short- and long-term efficiency of arrhythmia treatment by ablation

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**Background:** The percutaneous catheter ablation is the invasive technique for treating arrhythmias. This procedure is characterised by high efficiency and reduce symptoms which significantly decrease quality of life and limit the patients' occupational activity. The aim of this study was to assess the direct effectiveness and the subjective effectiveness of ablation.

**Methods:** Retrospective single-centre study was conducted at Cardiology Department at University Hospital No 1 in Bydgoszcz. We analyzed the data of 416 patients ( $F=207$ ,  $M=209$ ) who underwent catheter ablation between 01/2015 and 12/2016. Analyzed arrhythmia were: atrio-ventricular nodal re-entrant tachycardia (AVNRT)-131, pre-excitation syndrome-71, atrial tachycardia (AT)-8, atrial flutter (AFI)-63, atrial fibrillation (AF)-45, ventricular tachycardia (VT)-27, ventricular extrasystole (PVC)-46, supraventricular extrasystole (SVES)-1, atrioventricular re-entrant tachycardia (AVRT)-24. We analyzed direct efficacy and recurrence of palpitations within one year after procedure. Three questions were asked to patients during the phone conversation: (1) Did the palpitations return within one year after ablation?; (2) How do you assess quality of your life before ablation procedure? (in a scale of 1-10, where 10 is the best quality, 1 is the worst); (3) How do you assess quality of your life one year after ablation procedure? (using the same scale).

**Results:** The ablation procedure was directly successful in 92.5% of patients. According to the type of arrhythmia the rate of success was 97.7% for atrio-ventricular nodal re-entrant tachycardia, 93.0% for pre-excitation syndrome, 100% for atrial tachycardia, 90.5% for atrial flutter, 84.4% for atrial fibrillation, 85.2% for ventricular tachycardia, 91.3% for ventricular extrasystole, 100% for supraventricular extrasystole, 91.7% for atrioventricular re-entrant tachycardia. 284 (68.3%) of the patients who were called to answered the phone. In general, 74.9% of them do not complain about recover of palpitations. Results according to the type of arrhythmia: SVES 100%, AVNRT 77.0%, PVC 60.0%, preexcitation syndrome 58.7%, AVRT 58.3%, AF 58.3%, VT 55.6%, AT 50.0%, AFI 37.2%. Average improve in life quality was SVES 8.00, AVNRT 5.17, VT 4.93, AF 4.69, PVC 3.94, AVRT 3.45, AFI 2.90, preexcitation syndrome 2.80, AT 1.50.

**Conclusion:** Ablation is highly effective method of treating different types of arrhythmia. However, part of patients have experienced return of symptoms within one year after ablation, which they had had before intervention. Most of called patients ensure that their quality of life has improved since ablation. Nevertheless, group with still present symptoms claims, that their life quality also increased since the procedure.

## Chronic heart failure in hemodialysis patients

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**Background:** Heart failure (HF) is one of the most serious challenges in the contemporary cardiology. The prevalence of HF in adults is 1-2%, and still growing. In 40% of HF patients chronic kidney disease coexists. Presence of HF at the beginning of dialysis therapy significantly worsens prognosis. Diagnosis of HF is based on typical clinical symptoms and features of systolic (left ventricular ejection fraction LVEF <40%) or diastolic heart dysfunction. In HD patients symptoms of HF can be mimicked by anemia or hypervolemia. It can lead to false diagnosis of HF. **The aim:** The aim of this study was to assess the prevalence of HF and to analyse heart damage in HD patients with (HF+ group) and without HF (HF- group).

**Material and methods:** All patients undergoing chronic HD therapy in Dialysis Unit of University Hospital No 1 in Bydgoszcz were investigated in cross-sectional study. We analyzed 121 patients (47 female and 74 male), aged 22-90. Based on medical records HF was diagnosed in 67 (55%) HD patients. Echocardiography was performed in 66 (99%) HF+ patients and 42 (78%) of HF- patients.

**Results:** Patients with HF+ were older (70 vs 57;  $p < 0,001$ ), more often suffered from diabetes (52% vs 28%;  $p < 0,01$ ), coronary artery disease (58% vs 11%;  $p < 0,001$ ), and atrial fibrillation (31% vs 9%;  $p < 0,01$ ). Significant differences were found between HF+ and HF- groups in: left ventricular end-diastolic dimension (52 vs 47 mm;  $p < 0,01$ ), left atrial dimension (45 vs 41 mm;  $p < 0,01$ ), left ventricular mass index (153 vs 136 g/m<sup>2</sup>;  $p < 0,05$ ), and LVEF (51% vs 60%;  $p < 0,001$ ). LVEF < 40% was found in 18% of HF+ and 2% of HF- patients. No difference was observed in hemoglobin concentration (10,9 vs 10,9 g/dl).

**Conclusion:** Confirmed systolic heart failure is present in small percentage of HD patients with clinical diagnosis of HF. Clinical diagnosis of HF in HD patients should be verified by echocardiography.

## Evaluation of oxidative stress measured by means of MDA and ROS levels in AMI patients

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**Background:** Acute coronary syndromes (ACS), a common life threatening complications of coronary heart disease, are in most cases caused by the erosion or rupture of an atherosclerotic plaque. Crucial mediators of pathological mechanism underlying development of atherosclerotic plaque are the high LDL level and its subsequent modifications. One of the atherosclerosis progression consequence is the increase of oxidative stress level which leads to plaque destabilization and finally development of the myocardial infarction. High levels of reactive oxygen species (ROS) (with the coexistence of impairment of antioxidative mechanisms) arise during reperfusion therapy and leads to lipid peroxidation and extends myocardial infarct size. Focusing on lipid peroxidation, malondialdehyde (MDA) is the most commonly used marker of oxidative degradation of lipids. The aim of this study was to analyze level of ROS and MDA in patients with AMI, treated with primary percutaneous coronary intervention (pPCI).

**Methods:** The study included 26 patients with ACS (STEMI [n = 17], NSTEMI [n = 9]) admitted to the Department of Cardiology and Internal Medicine, Dr A. Jurasz University Hospital, Bydgoszcz, Poland. All trial participants underwent a coronary angiography and coronary revascularization with PCI. Whole blood samples for MDA and ROS assessment were collected directly before PCI, 24 hours after PCI and 4 days after PCI. MDA and ROS were evaluated using commercial ELISA Kits in accordance with manufacturer protocol.

**Results:** Our study showed that levels of ROS and MDA are higher in NSTEMI patients in comparison with STEMI group. This trend continued in every sample collection time point. Increase in ROS levels is associated with higher levels of MDA. No significant correlation between the plasma concentrations of MDA, ROS and lipid profile was demonstrated.

**Conclusion:** To our knowledge, this is the first study demonstrating the differences between STEMI and NSTEMI patients in ROS and MDA levels. The cause of increased levels of ROS and MDA in NSTEMI patients is unclear. We suspect that the reason of those changes could be prolonged time between onset of myocardial infarction symptoms and reperfusion therapy in NSTEMI group in comparison to STEMI patients.

## Safety and efficacy of transvenous lead extraction procedures – data from high volume centre

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**Background:** In recent years the number of transvenous lead extractions (TLE) has increased as a result of increasing number of implantations of cardiac electronic devices and patients' longer life expectancy.

The aim of this study was to analyse safety and efficacy of the TLE procedures performed in our Department.

**Methods:** The retrospective analysis of electronic medical records of 101 procedures of TLE carried out in the Department of Cardiology, University Hospital no 1 in Bydgoszcz in years 2015-2017 have been performed. In a few cases also paper medical records were analysed to complete the data. The number of procedures per year was 29 in 2015, 40 in 2016 and 32 in 2017. Collected data included: patients' demographics, lead characteristics, details of the procedure and reported complications. Clinical success was defined as achieving the clinical outcome for which TLE was scheduled, while radiological success was defined as a complete removal of the electrode according to a division proposed by The European Lead Extraction ConTRolled (ELECTRa) study.

**Results:** Complete clinical and radiological success rates were 98.0% (99 patients) and 96.0% (97 patients), respectively. Partial radiological success defined as abandonment of less than 4 cm of a lead was achieved in 2.0% (2 patients), while radiological failure defined as more than 4 cm of a lead abandoned in the body occurred in 2.0% (2 patients). Clinical failure described as either failure to achieve the clinical outcome for which the TLE was scheduled or a procedure related major complication, occurred in 2.0% (2 patients). Indication for TLE were infective in 26.7% (27 patients) and non-infective in 73.3% (74 patients). In total, 153 electrodes were extracted and there was only 1 patient with failure to extract the electrode transcutaneously, who finally undergone surgical removal. The mean dwell time of extracted leads was  $54.7 \pm 43.8$  (months) and the mean number of leads extracted per case was  $1.5 \pm 0.8$ . Lead fixation mechanisms were active in 63.8% and passive in 36.2%. There were 5 post-procedural deaths and 1 stroke but they were not connected to the procedure itself. The complications' relationship with the procedure was defined by the physician. Minor complications occurred in 20 patients (19.8%). Most common post-procedural complications were pocket hematoma [9 patients (8.9%)] and hematoma at the surgical site other than pocket hematoma [5 patients (5.0%)]. Only 1 patient had major complication – acute respiratory failure.

**Conclusions:** The analysis of data from our centre confirms that the TLE procedure is safe and effective with low incidence of major complications. The data on success rate and occurrence of the major complications is comparable with the international studies.

## Total Thrombus-Formation Analysis System (T-TAS)- as a potential new method of monitoring the effectiveness of antiplatelet therapy in STEMI patients treated with ticagrelor

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**Background:** Coronary artery disease, including myocardial infarction is the main cause of morbidity and mortality in the world. Therefore, it is important to develop modern methods to monitor the progress and effectiveness of treatment of patients after myocardial infarction. Total Thrombus-Formation Analysis System (T-TAS) is an automated microchip flow chamber system, developed for quantitative analysis of thrombus formation using microchips with thrombogenic surfaces. This system analyse thrombus formation process using dual-monitoring system by flow pressure waveform and real-time video imaging. The aim of this study was to use the T-TAS system as a potential new method of monitoring the effectiveness of antiplatelet therapy in STEMI patients treated with ticagrelor.

**Methods:** The study included 23 consecutive patients with STEMI, admitted to the Department of Cardiology and Internal Medicine at the University Hospital in Bydgoszcz. All patients received a standard dual antiplatelet therapy (acetylsalicylic acid (ASA) and ticagrelor as P2Y<sub>12</sub> receptor inhibitor). The blood samples were collected from each patient (4mL per each time point) on two time points. First time point: 0h- immediately before the start of ticagrelor administration and second time point: 24h- 24 hours after administration of antiplatelet therapy. Platelet thrombus formation measured using T-TAS in a flow chamber system (PL-chip) at a high shear rate of 2000 s<sup>-1</sup>.

**Results:** Platelet thrombus-formation area under the curve (AUC<sub>10</sub>) at shear rate of 2000 s<sup>-1</sup>, which represents platelet thrombogenicity in the first time point was significantly higher compared to the next time point:  $315.9 \pm 134.9$  vs.  $38.9 \pm 31.7$  (AUC<sub>10</sub> 0h vs. AUC<sub>10</sub> 24h,  $p = 0,000132$ ).

**Conclusions:** It seems that T-TAS is a useful tool to evaluate the effectiveness of ticagrelor treatment in patients with STEMI. Moreover, analysis of the results provide useful information reflects onset time of platelet thrombus formation, as well as growth and stability of formed thrombi. However, it is crucial to continue further investigation comparing with the standard methods used to monitor antiplatelet treatment.

## Mitochondrial DNA degradation during ischemia/reperfusion injury as a consequence of oxidative stress

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**Background:** Reperfusion therapy is one of the methods use in patients after myocardial infarction (MI). The main goal of therapy in MI patients is the early restoration of coronary flow to limit myocardial necrosis. It is well known that reperfusion of occluded artery is associated with generation of reactive oxygen species (ROS) and enlargement myocardial infarct size. ROS arised as a consequence of ischemia/reperfusion injury (I/R) could led to oxidative damage molecules such as: genomic DNA(gDNA), mitochondrial DNA(mtDNA), lipids and proteins.

**Methods:** The aim of this study was to analyze gDNA and mtDNA damage induced by ROS in patients with MI treated with primary percutaneous coronary intervention (PCI). The study included 27 patients with MI (STEMI n = 18, NSTEMI n = 9) admitted to the Department of Cardiology and Internal Medicine, Dr A. Jurasz University Hospital, Bydgoszcz, Poland. All trial participants underwent a coronary angiography and coronary revascularization with PCI. Whole blood samples for gDNA damage and mtDNA assessment were collected directly before PCI, 24 hours after PCI and 4 days after PCI. gDNA was isolated using paramagnetic particles, electrophoretically separated on 1.5% agarose gel and stained with ethidium bromide before evaluation. mtDNA was elicted from gDNA using REPLI-g Mitochondrial DNA kit from QIAGEN®. Moreover, ROS and HsTnl were measured in each time point.

**Results:** Significant differences in gDNA damage between STEMI and NSTEMI groups were present in visual inspection. gDNA degradation in STEMI patients was demonstrated by steaks on agarose gels, while in patients with NSTEMI it was imprinted as bands. Observed differences were most severe in STEMI patients indicating a wide range of gDNA damage in this group. gDNA damage was most pronounced on the first and second day after myocardial infarction. Furthermore, brands observed on gDNA agarose gel fall in with mtDNA range. Range of mtDNA is grater that gDNA.

**Conclusion:** ROS generated during myocardial ischemia as a consequence of I/R injury after PCI cause gDNA and mtDNA damage. Electrophoretic separation enables the assessment of the genetic material damage in patients with MI.

## One-year Outcome after Percutaneous Coronary Intervention (PCI) of Saphenous Vein Graft (SVG) by Using New-Generation DES vs. BMS

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**Background:** Drug-eluting stents (DES) compared with BMS substantially reduced restenosis and reocclusion rates in patients undergoing percutaneous coronary intervention (PCI) of native coronary lesions. Although PCI of saphenous vein grafts (SVG) accounts for 5-10% of all PCI procedures, very little is known about the impact of the new-designed DES vs. BMS on outcomes in SVG setting. Herein, we sought to investigate one-year clinical outcomes of SVG PCI using new-generation DES vs. BMS in a real-world population.

**Methods:** This was a multicenter registry of all consecutive patients undergoing PCI of SVG (n=792) in high volume teaching centres between 2008-2014. The primary endpoint was a composite of major adverse cardiac and cerebrovascular events (MACCE) at 1 year. Additionally, since the patient assignment was not random, we performed the propensity scoring to minimize selection bias.

**Results:** This observation included all consecutive patients (n=792), age 69±8.9y, treated with either DES (n=379, 47.9%) or BMS (n=413, 52.1%). Patients with DES were more often characterized by diabetes, anemia and had more previous MI or PCI. Embolic protection devices were more often used in the DES group vs. BMS group. Patients treated with DES vs. BMS had lower MACCE (28.3% vs. 21.4%, HR=0.69, 95%CI 0.50-0.95, p= 0.025) as well as MI (12.1% vs. 6.3%; HR 0.49, 95%CI 0.30-0.82, p=0.005) at 1 year. A similar, significant reduction in overall MACCE and MI was noted with DES vs. BMS after a propensity score analysis (HR 0.66, 95%CI 0.46-0.96, p=0.030; and HR 0.53, 95%CI 0.31-0.92, p=0.020, respectively).

**Conclusion:** New-generation DES as compared with BMS is associated with reduced overall MACCE and MI at one year in a subset of patients after PCI for SVG.

## Effect of scar massage and mobilization in patient after cardiac surgery

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**Background:** Coronary artery bypass grafting and valvular heart surgery are the most common procedures performed at cardiac surgery clinics. Progress in surgical technique, instrumentation and post-operative care is significant. Guides for patients after surgical operations that contain practical tips are helpful, but there is no information on rehabilitation and scar improvement.

Wound reparative process after surgery, burns, injuries, and inflammatory processes results in a spectrum of scar formation ranging from nearly scarless healing to excessive fibrosis or atrophy. Scarring is considered a major medical problem that leads to aesthetic and functional

sequelae. Scar tissue is clinically distinguished from normal skin by an aberrant color, rough surface texture, increased thickness (hypertrophy), occurrence of contraction, and firmness.

**Methods:** We present a case of a 70-year-old woman with a hypertrophic scar after aortic valve replacement surgery. The patient was referring to post-cardiac rehabilitation in ambulatory care 5 months after the surgical intervention. In the interview, the patient reported discomfort around the postoperative scar. Before and after the therapy the scar was evaluated using the POSAS (The POSAS consists of two parts: a Patient Scale and an Observer Scale). There were also made ultrasound examination and anthropometric measurements of the scar. After the tests, a therapy was planned with the use of techniques by Manheim and Chaitow - it is a collection of techniques that focuses on freeing restrictions of movement in the scar tissues. The procedure was performed three times a week for 2 months during 10-20 minutes, including 20 therapy sessions.

**Results:** After a series of cardiac rehabilitation, there was an improvement in mobility and less stiffness of the scar, reduced discomfort and improved color and shape of the wound. All changes were noted by the patient as well as the person conducting the research. The difference in ultrasound was also shown. There were no changes in anthropometric measurement.

**Conclusion:** Massage and mobilization of the scar is effective in improving the scar after an open heart surgery. Direct techniques are effective and safe forms of conservative work with scarring after cardiac surgery. Improving the scar positively affects the patient's comfort and quality of life. It is necessary to undertake further studies to examine a larger group of participants in order to confirm benefits of massage and mobilization of the scars to reduce time needed to allow for recovery.

## Relationship between atmospheric pressure, temperature, rainfall and the occurrence of acute coronary syndromes (ACS)

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**Introduction:** The influence of the weather conditions on the frequency of the occurrence of acute coronary syndromes (ACS) remains unclear. Our hypothesis is that weather conditions are significantly correlated with the frequency of ACS occurrences.

The aim of our study was to describe the influence of the atmospheric pressure, temperature and rainfall on the ACS.

**Methodology:** 1171 patients, average age of 60.5±10.8 (of which 327, 27.9%), were hospitalized over the period of two years due to ACS. Data were compared with information about atmospheric pressure, temperature and rainfall, as well as their daily changes obtained from the Institute of Meteorology and Water Management.

**Results:** The majority of the patients - 796 (68.3%), suffered from the ST segment elevation myocardial infarction (STEMI). Patients were categorized into four categories based on the number of ACS/day: I: 0-1, II: 2-3, III: 4-6, IV: 7-8 ACS/day. The results showed that the higher minimum ( $P=0.02$ ) and maximum ( $P=0.03$ ) atmospheric pressure, the higher maximum fluctuations of the atmospheric pressure ( $P=0.04$ ), the longer time between maximum fluctuations of the atmospheric pressure ( $P=0.02$ ) and higher level of precipitation ( $P=0.08$ ) the day before ACS occurred the higher was the number of ACS. Whereas, on the day of ACS, higher maximum ( $P=0.03$ ) atmospheric pressure correlated with the higher rate of ACS. There were no influence of the values of temperature on ACS either the day before or in the day of ACS.

**Conclusions:** The number of ACS on the particular day is significantly correlated with registered weather conditions that day as well as the day before.

## Mechanical thrombectomy with rotarex system in surgical treatment of severe lower limbs ischemia

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**Background:** The number of patients with severe ischemia of the lower limbs is progressively increasing: approximately 300 new cases per million population are recorded every year in the world.

The aim of the study was to assess efficiency of the rotarex thrombectomy in patients with severe forms of lower limbs ischemia.

**Methods:** The immediate and long-term (after 6 month) results of the Rotarex thrombectomy in 18 patients with severe lower limbs ischemia were analyzed. 6 patients had decompensated ischemia and 12 had critical ischemia. The results were evaluated in accordance with clinical and angiographic criteria as good, satisfactory, without changes and unsatisfactory.

**Results:** In total 22 interventions using Rotarex system were carried out. The results of 21 of them were good. Of these, there were 15 thrombectomies from native blood vessels (10 operations in patients with atherosclerosis and 5 once in patient with thromboangitis obliterans), 3 from intravascular stents, 2 from femoropopliteal bypasses, 1 from the aortal endograft. Unsatisfactory result was registered in 1 patient. Intraoperative complication was obtained in 1 case. Long-term results of 12 of the 22 interventions were analyzed. In 75% of these cases the effect of the operation fully preserved. The extensive rethromboses appeared in 3 patients, in view of this the aortobifemoral bypasses were formed.



**Conclusion:** The rotarex thrombectomy is an effective method of treating acute and chronic lower limb occlusions. Repeated discontinuations of the main blood flow proceed without recurrence of severe ischemia. Cases of recurrent decompensated ischemia retain the prospect of their elimination through traditional reconstructive surgery or repeated intraluminal disobliterations.

## New onset bundle branch block in acute coronary syndrome - clinical characteristic and the influence on long-term outcomes

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**Introduction:** New bundle branch block (BBB) is one of the symptoms which appears in ECG in acute coronary syndrome (ACS). So far, acclaimed symptom which needs immediate conducting was new left bundle branch block (LBBB). In recent years, there have been more reports about significant diagnostic role of new right bundle branch block (RBBB).

**Aim of the study:** To compare clinical characteristic, angiography lesions and in-hospital and long-term outcomes of patients with LBBB and RBBB in ACS.

**Material and Methods:** From patients who were admitted in 2007-2016 with ACS (4909 patients - 1938 unstable angina), on the basis of admission ECG, bundle branch block was observed in 408 (8,31%) patients. Next, available in hospital database previous ECGs of patients were analysed. 125 LBBB and 153 RBBB patients were identified. Data and clinical outcomes of LBBB, RBBB and 1015 patients with ACS without BBB were compared. Telephone follow-up of patients with BBB was performed with special regard for major adverse cardiac and cardiovascular events. Full data about long-term outcomes of 87 LBBB and 102 RBBB patients was collected.

**Results:** Patients with LBBB and RBBB were significantly older ( $p < 0,001$ ), more often were diagnosed with heart failure and ischemic stroke than patients with ACS without BBB. Furthermore, LBBB group was more often recognised with previous myocardial infarction ( $p = 0,057$ ) and renal failure ( $p = 0,001$ ). In-hospital mortality rate was 1,6% in LBBB, 2,61% in RBBB and 2,08% in without BBB. Median time of follow-up was 60,57 months. Differences in overall mortality ( $p = 0,42$ ), cardiovascular mortality ( $p = 0,288$ ), frequency of further myocardial infarctions ( $p = 0,767$ ), ischemic strokes ( $p = 0,377$ ), bleedings ( $p = 0,914$ ), cardiological re-hospitalizations ( $p = 0,178$ ) and further CABG ( $p = 0,316$ ) and PCI ( $p = 0,47$ ) between LBBB and RBBB were not detected. Methods of ACS treatment were also analyzed. Among patients with LBBB there were no any significant differences of overall ( $p = 0,694$ ) and cardiovascular mortality ( $p = 0,828$ ) between urgent PCI and no-PCI group. In case of RBBB treated with PCI surprisingly higher overall ( $p = 0,055$ ) and cardiovascular mortality ( $p = 0,052$ ) were observed.

**Conclusions:** New BBB in ACS is rare but significant problem in invasive cardiology. According to authors knowledge, long-term outcomes of BBB have not been analyzed up till now. Our study shows that patients with LBBB as well as with disregarded in current guidelines RBBB are in high risk group which is illustrated by in-hospital mortality and similar long-term outcomes. The issue of appropriate treatment method in ACS with RBBB should be determined.

## Retrograde tibiopedal artery access for challenging occlusions in patients with critical limb ischemia – a new approach in endovascular treatment

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**Background:** In some patients with critical lower limb ischemia antegrade endovascular recanalization (in accordance to the blood flow) occluded arteries below the inguinal ligament cannot be performed. In that case retrograde access (contrary to the blood flow) to foot and crus arteries may be used to endovascular therapy for chronic total occlusion. Aim of our study was to rate effectiveness of retrograde access method and frequency of complications during these procedures.

**Methods:** During the study, 119 patients treated in a relatively large angiology center, who undergone percutaneous transluminal angioplasty (PTA) and required retrograde access were observed. Using the data collected in Angiology Procedures' Register, procedures technique, effectiveness of revascularization and complications were reviewed. Furthermore, clinical condition and hemodynamical parameters before PTA, 1 day, 30 days, 3 month and 6 month after the procedure were assessed.

**Results:** In 100 out of 133 cases (75%) retrograde access enabled artery recanalization, which was impossible using the antegrade method. In 23 cases (17%) complications occurred (2 blood vessel contractions, 5 occlusions, 2 perforations, 2 arteriovenous fistulae) which were successfully managed intra-procedurally (in 1 case covered stent was inserted, in 10 cases additional PTA was performed and in 7 cases pressure dressing was used). In 6 month observation 11 (9,2%) patients required reintervention and in 5 patients (4,2%) lower limb was amputated, however retrograde access did not contribute to these complications. Clinical condition of lower limb after 6 month in 88 cases improved (74%), did not change 25 (21%) and worsened 6 (5%).

**Conclusion:** Tibiopedal retrograde access substantially increases effectiveness of artery recanalization in lower limb arteries located below the inguinal ligament. Complications of retrograde access are relatively rare and can be successfully managed intra-procedurally, using endovascular techniques. Retrograde access revascularizations should be introduced into daily clinical practice.

## Causes of hemolysis after in- on pump coronary bypass graft surgery

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**Introduction:** The cardiac operations promotes the hemolysis due to mechanical damage. As a result of destruction of erythrocytes there is an increase in the level of free hemoglobin, which initiates the development of oxidative stress and other pathogenetic mechanisms. The purpose was to study the factors that promote on pump cardiac operations hemolysis in patients after in on pump coronary bypass graft surgery.

**Methods:** Studies were performed in 123 patients after in on pump coronary bypass graft surgery (CABG). The free hemoglobin (Hb) was determined before off-pump completion with the Hemo-Cue Plasma / Low Hb level analyzer, Sweden. The association between the Hb level in the blood plasma and patient-dependent and operation-dependent factors were studied using the methods of correlation statistics (Spearman criterion).

**Results:** There were an association between the level of Hb in the blood plasma with: arterial hypertension ( $p = 0.53$ ), diseases of the urinary system ( $p = 0.26$ ), iron deficiency anemia ( $p = 0.31$ ), excess of body weight and obesity ( $p = 0.45$ ), diabetes mellitus ( $p = 0.25$ ), previous surgical interventions ( $p = 0.20$ ), as well as risk factors: atherogenic nutrition ( $p = 0.38$ ), smoking ( $p = 0.55$ ), drinking of alcohol (abuse) ( $p = 0.43$ ), cardiovascular disease ( $p = 0.37$ ), low physical activity ( $p = 0.20$ ), stress ( $p = 0.26$ ). There were an associations between the degree of hemolysis and a operation-dependent factors (duration of the on-pump period ( $p = 0.72$ ), and the duration of myocardial ischemia ( $p = 0.73$ )).

**Conclusion:** Prevention of high hemolysis as a risk factor for complications of cardiac surgery should be aimed at elimination the factors with which the highest associations were noted, as well as reducing the on-pump period and the period of ischemia.

## The outcome of counseling on lifestyle among patients with cardiovascular disease in Alshaab and Ahmad Gasim Teaching Hospitals, Sudan, 2016

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**Background:** Lifestyle changes in patients with cardiovascular disease are an integral part of the adequate management of these patients. Heart-healthy lifestyle changes include heart-healthy eating, maintaining a healthy weight, managing stress, physical activity, and quitting smoking. Patients should receive proper information, education and support to both change and maintain adequate lifestyle changes and comply with therapeutic interventions. This makes proper medical counseling essential.

The aim of this descriptive cross sectional hospital-based study was to determine and assess the methodology of medical counseling among patients with cardiovascular disease, and to assess the effectiveness of counseling patients on lifestyle changes. The study took place in the outpatient clinics of Alshaab and Ahmad Gasim Teaching Hospitals, Sudan in 2016.

**Methods:** 50 newly diagnosed CVD patients, visiting the outpatient clinics of Alshaab and Ahmad Gasim Teaching Hospitals in Khartoum, Sudan for the first time since diagnosis, were interviewed right after counseling. Their lifestyle habits were assessed, and the counseling methodology was determined. A follow up through telephone calls 2 weeks later was done in order to identify the lifestyle changes made by the patients.

**Results:** The identified patients tended to be older and overweight/obese. Findings showed generally poor practice of healthy lifestyle habits among patients and lack of adequate counseling regarding risk factors and lifestyle modifications. Also, there was a significant association between receiving counseling and making dietary changes and increasing physical activity (carbs:  $p = 0.000$ , fat:  $p = 0.000$ , salt:  $p = 0.000$ , fiber:  $p = 0.000$ , sugar sweetened drinks:  $p = 0.002$ , caffeine:  $p = 0.028$ , and exercise:  $p = 0.000$ .)

**Conclusion:** Counseling patients has a strongly positive effect on lifestyle, indicating that it is of high importance to counsel patients adequately. However, the methodology of medical counseling practiced lacks emphasis on lifestyle and its importance.

## Enhancing Cardiovascular Disease Predictions Using Bioinformatics

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**Background:** Annually, cardiovascular disease causes nearly 30% of mortalities in the world. Enhancing diagnostic accuracy and early prediction of cardiovascular disease is critical for patient outcomes and improving their chances for survival. In this research, a computational model built using bioinformatics and clinical patient data is used to help physicians in enhancing accuracy of predicting cardiovascular disease.

**Methods:** The computational model was built using bioinformatics and boosting algorithms to diagnose cardiovascular outcomes in patients. Clinical data, including 768 patients (53% male, 47% female) from medical institutions in Hungary, United States, and Switzerland, was used to build, train, and test the computational model. To train the model, 50% of the data was utilized while the remaining 50% of patient data was utilized for testing the cardiovascular prediction capabilities of the model.

**Results:** In diagnosing cardiovascular disease in patients, the prediction model equipped with boosting algorithms was able to achieve an overall accuracy of 92%, exceeding those of current models.

**Conclusion:** Thus, models based on bioinformatics and boosting algorithms may be used to aid medical professionals for enhancing the accuracy of cardiovascular disease predictions in patients.

## Frequency of contrast induced nephropathy at patients with chronic thromboembolic pulmonary hypertension treated with balloon pulmonary angioplasty

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**Background:** Balloon pulmonary angioplasty (BPA) is a new, rapidly developing method of treating inoperable patients suffering from chronic thromboembolic pulmonary hypertension (CTEPH). Effective BPA requires conducting few interventions, which may run the risk of increased periprocedural complications, like those associated with ionizing radiation as well as nephropathy associated with contrast media (CIN).

The aim of the study was to define the frequency of CIN at patients with CTEPH, who had BPA undergone.

**Methods:** Study group counted 18 patients suffering from CTEPH (mean age  $63.6 \pm 12.2$  years; 14 F / 4 M) treated from 14.05.2015 till 03.07.2017, who had a total of 81 procedures undergone (mean  $4.5 \pm 2.2$  BPA /patient). Creatinin concentration at admission was compared with creatinin concentration 48 hours after BPA or highest measured while hospitalization. The diagnosis of CIN was established if creatinin concentration increased by  $\geq 26.5 \mu\text{mol/l}$  in 48 hours after contrast media administration or increase by  $\geq 50\%$  in comparison to creatinin concentration at admission.

**Results:** Creatinin concentration equalled  $103.2 \pm 37.5 \mu\text{mol/l}$  before BPA and  $105.7 \pm 41.5 \mu\text{mol/l}$  after BPA. Mean use of contrast media while BPA was  $320.6 \pm 99.8 \text{ ml/procedure}$ , those medias were: iodaksol, iomeprol, iopromid, iowersol (68(83.9%), 8 (9.8%), 4(4.9%), 1(1.2%), respectively). CIN was diagnosed at 6 (12.2%) patients while whole hospitalization, including 4 (8.1%) patients with CIN diagnosed within 48 hours after BPA. Non of patients required renal replacement therapy. The only factor affecting CIN incidence was contrast media volume, which was  $435 \pm 59.2 \text{ ml/procedure}$  averagely.

**Conclusion:** BPA procedures are associated with moderate risk of renal failure induced by contrast media. There is a need to improve procedure technique to reduce volume of contrast media.

## Use of NOAC's in secondary prevention of ischemic stroke in patients with atrial fibrillation between 2015 and 2017 in Neurologic Unit of Nicolaus Copernicus University

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**Introduction:** The atrial fibrillation (AF) detection rate in patients with ischemic stroke is insufficient, despite its particular importance in patients over 65 years old who are at high risk of cardioembolic stroke. Recent introduction and increasing use of New Oral Anticoagulants (NOAC) significantly extended safety and accessibility of pharmacological prevention of ischemic stroke in AF patients and can, indirectly, contribute to better stroke prevention factor of frequently using in clinical practice.

**Aims:** To evaluate and compare the presence of atrial fibrillation and use of oral anticoagulants in patients with ischemic stroke between 2015 and 2017 with respect to proportion of NOAC's usage.

**Materials and methods:** We have retrospective assessed and compared medical records of patients with ischemic stroke treated in Stroke Unit of Neurological Department Collegium Medicum in Bydgoszcz, Nicolaus Copernicus University of Toruń, Antoni Jurasz University Hospital No. 1 in Bydgoszcz: 848 patients hospitalized in 2015 and 817 patients hospitalized in 2017.

**Results:** Atrial fibrillation was confirmed in 232 (27,3%) patients in 2015 and in 212 (25,9%) patients in 2017. Secondary prevention with oral anticoagulants was used in 2015 in 64 (37,6%) patients and in 2017 in 138 (65,1%)( $p < 0,001$ ). NOAC's was used in 25 (39%) patients in 2015 and 111 (80,4%) patients in 2017 ( $p < 0,001$ ).

**Conclusions:** The frequency rate of atrial fibrillation in patients with ischemic stroke treated in Stroke Unit of Neurological Department, Antoni Jurasz University Hospital No. 1 in Bydgoszcz was similar in 2015 and 2017. However important growth of use of oral anticoagulants in secondary stroke prevention and important growth of NOAC's use has been observed.

## Capsules from Fish

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**Background & objectives:** Can capsules (Pharmacy) from fish gelatin be a safe alternative to capsules from animal gelatin? So in this paper, we will discuss the effectiveness of an alternative capsule from fish gelatin for all the people around the world which will be cheaper and greatly useful for our body.

**Methods:** Independent variables: Boiled water. Dependent variables: Gum Tragacanth Titanium Oxide Fish scales, bones and fins Mortar and pestle Beaker Sorbitol.

At first, we have to take necessary quantities of fish scales and bones, boil them at a temperature of 130-140 degrees and triturate the disinfected fish bones and scales with a mortar and pestle. Then we will mix the resulting powder with Gum Tragacanth and sorbitol to make it gummy or sticky and mix Titanium Oxide(.0425gm/1kg) with the mixture. Now, if we dip a metal inside this mixture, we will get fish capsules.

**Results:** Fish scales, bones and fins are regarded as kitchen waste but we can reuse them through recycling to keep the environment clean and healthy. Capsules made of animal gelatin can not exist in more than 15 degrees but capsules from fish gelatin can exist upto 30 degrees. An interesting thing is that it can prevent acidity for upto 12 hours and it is proved theoretically.

**Conclusion:** The aim of this presentation is to create an eco-friendly environmental system that will help turn kitchen waste into something that can save millions of lives.