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LAA CSI Focus Abstracts

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THE VALUE OF 3D PRINTING FOR LAAO DEVICE SIZING

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Background: Percutaneous left atrial appendage occlusion (LAAo) is an alternative approach to medical therapy to prevent atrial fibrillation (AF) mediated stroke, in patients with a high stroke risk and contraindication for long-term oral anticoagulation. Despite an increasing rate of successful implantations, correct sizing and optimal device positioning remain a challenge. 3D printing has capability to create a highly accurate model of any structure and may be a useful approach for entire LAA anatomy, optimizing device size testing before LAAo..

Aim: To explore the usefulness of 3D printed LAA models to predict adequate sizing and risk of peri-device leaks or malposition post LAAo in a large patient cohort.

Methods: 70 consecutive patients (CHA_2DS_2-Vasc score=4.5±1.5) with a LAAo procedure with Amulet™(St. Jude Medical, St Paul, MN, USA) and a pre- and post-procedure cardiac CT, were included in three institutions between Feb 2014 and Mars 2017. A clinical follow-up was effective for 17±10 months. Cavity segmentation was performed automatically based on CT Dicom data and manually adjusted to include the entire left atrium, then converted to a STL file and 3D printed with high resolution 50microns.

Results: Larges peri-device leaks >5mm occurred in 33% of patients. A mismatch between the model predicted size and the device used was a major predictor of peri-device leaks (AUC=0.85) with Predictive Positive Value (PPV)=82% and NPV=89% compared with CT sizing and TEE sizing (AUC=0.58 and 0.57, respectively p<0.001). Two cerebral ischemic events occurred and four silent devices-related thrombi located in patients with an off-axis prosthesis. An off-axis positioning was observed in 24% of patients. Predictive factors were a large pulmonary vein ridge and an inadequate transeptal site puncture. Complications rate was correlated with the mismatch between size used and printed model: odds ratio of 4.1 (1.5-12.7; p=0.01).

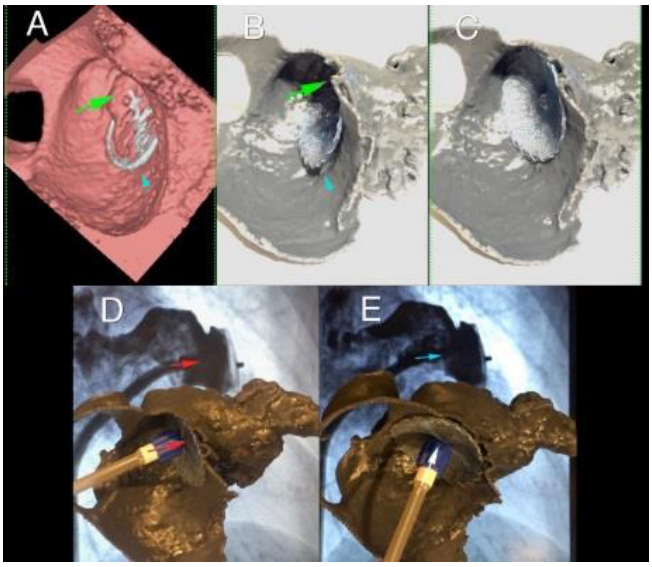

Figure 1. *Panel A.* Device-related thrombus (**green arrow**) in a patient with an off-axis prothesis leading to a cul-de-sac between the disc and the large pulmonary ridge. In addition, note a gap between the disc and LA ostium (**small arrow**). *Panels B, C, D, and E.* Device predicted positions with regard to the sheath orientation in a printed model. *Panel B.* Off-axis device predicted by the printed model. *Panel D.* In vitro printed model superimposed on a cineangiographic view: improper alignment between LAA ostium axis with the sheath (**red arrow**). *Panels C & E.* Optimal device sealing using a the printed model and a larger size with an adequate sheath orientation (**blue arrow**)

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Conclusion: 3D-printed patient-specific LA model allow more accurate sizing than TEE and CT measurements. It permits a pivotal training, device testing and evaluation of optimal trans-septal puncture site with potentially important implications in minimizing procedure-related complications.

LEFT ATRIAL APPENDAGE CLOSURE WITH A NOVEL DEVICE: INITIAL EXPERIENCE AND MID-TERM FOLLOW-UP FROM A SINGLE CENTER

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Background: Left atrial appendage (LAA) closure is considered an effective option in patients with non-valvular atrial fibrillation (NVAF) and contraindications to long-term oral anticoagulant (OAC) therapy. However, there are some concerns about safety of currently available devices.

Objective: Our aim is to provide an initial assessment on safety and efficacy of the novel LAA closure Ultraseal device in patients with NVAF and contraindications to long-term OAC therapy.

Methods: Thirteen consecutive patients with NVAF undergoing Ultraseal device implantation between July 2016 and April 2017 were included. All patients performed transesophageal echocardiography and computed tomography angiography prior to LAA closure.

Results: Procedural success was achieved in all patients except one who experienced incorrect device deployment but with complete LAA closure. Procedure duration halved from first to last procedure performed. No adverse events, including pericardial effusion, were observed during index hospitalization. At mean follow-up (166±80 days) all patients were alive and free from major bleedings and ischaemic strokes.

Conclusion: Our results suggest that the Ultraseal device is a safe and feasible option for LAA occlusion. Notably, the learning curve in this single-center experience was fast, paralleled by extremely low complication rates. These results should be considered hypothesis generating and larger studies are mandatory.

ACUTE EMBOLISATION OF WATCHMAN PLUG ONTO AORTIC BIOPROSTHESIS FOLLOWED BY SUCCESSFUL PERCUTANEOUS REMOVAL

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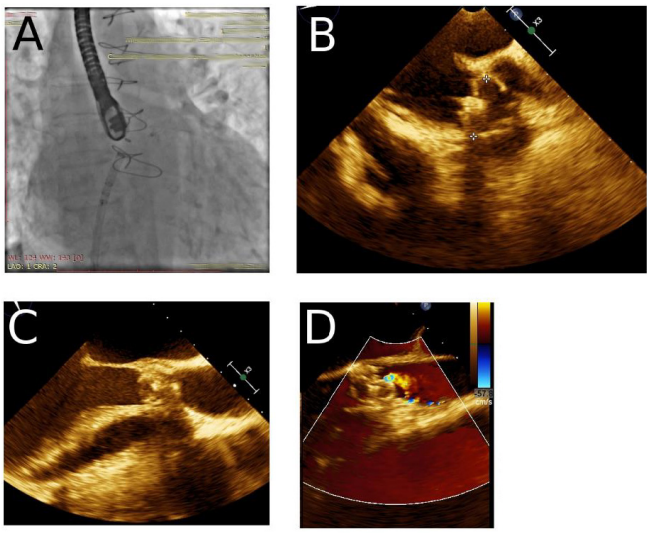

Figure 1. *Panel A*. Watchmann Device placed in LAA. *Panel B*. Confirmation of correct placement in TEE. *Panel C*. Device embolising aortic bioprosthesis. *Panel D*. Doppler showing residual flow through the device during reanimation.

History, Physical and Indication For Intervention: Our patient was an 80-year old woman who underwent implantation of aortic bioprosthesis (Shellhigh 27) 8 years earlier due to severe aortic stenosis. She suffered from chronic kidney disease (stage G3a), hypertension and paroxysmal atrial fibrillation, but no coronary artery disease. She had history of multiple severe bleedings from the lower digestive tract during oral anticoagulation with with rivaroxaban.

Intervention: The procedure initially went with no complications using sedative drugs only and no general anesthesia. Patients' LAA had "chicken wing" morphology and the maximum width of ostium was 14,1mm measured in TEE during the procedure. Initially a Watchman 27mm was used, but it had to be switched to a Watchman 21mm because of excessive protrusion. Correct localization of the Watchman device was confirmed in scopy and TEE, as shown on (Fig.1, panel A and B, respectively) as well as by tug test with 9% device compression (19/21mm). Color doppler showed no significant peri-device flow. A few minutes after the procedure was finished, while the patient was still in the cath lab, there was a cardiac arrest with pulseless electrical activity. Immediately we begun resuscitation and reintroduced the TEE probe. The echo image showed embolisation of the plug on the aortic bioprosthesis with almost complete obstruction of flow as shown on (Fig 1. panel C). During heart massage only a very small jet of flow across the plug was observed as shown on (Fig 1. panel D). Resuscitation was continued according to the ERC guidelines. Six minutes after arrest VF was observed and patient was defibrillated once with 200J successfully. Position of the device and lack of sufficient flow through aortic valve required immediate intervention.

Meanwhile, a EN Snare vascular loop 6x10 was introduced using a 11F Cordis vascular scaffold in left femoral artery. The loop was protruded through bioprosthesis valves and we succeeded in catching the device and moving it down to the abdominal aorta. Soon after

removing it from the prosthesis, ROSC was observed. Afterwards, using a 18x30 loop and 16F scaffold, device was removed completely. Time from embolisation and cardiac arrest to ROSC was about 30 minutes. The device was snared during heart massage, which was continued without any interruptions for the whole period of cardiac arrest. This might have contributed to survival. The patient was discharged week later with no neurological losses.

Learning Points of the Procedure: We suspect that the morphology of chicken wing might have caused the device to only have limited area of contact with LAA walls, as can be observed on Fig 1.B. Even though the compression was within the desired range, outer parts of the device didn't expand fully because the volume of LAA was not proportional to the ostium size. The difficult anatomy of LAA can increase the risk of device migration. Further studies are needed to evaluate the relation between various LAA morphologies and risk of device embolisation.

PREOPERATIVE WATCHMAN AND AMPLATZER AMULET OCCLUDER SIZING BY CARTO XP

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Background: Cardiac closure systems are used to manage anatomical anomalies and malformations of the heart and the associated pathological effects. In patients suffering from atrial fibrillation (AF) left atrial appendage (LAA) is the main source for thrombus formation and embolization. Currently, to select a particular LAA occluder size, several dimensions from fluoroscopy and TEE imaging have to be measured intraoperatively, depending on the chosen make and model.

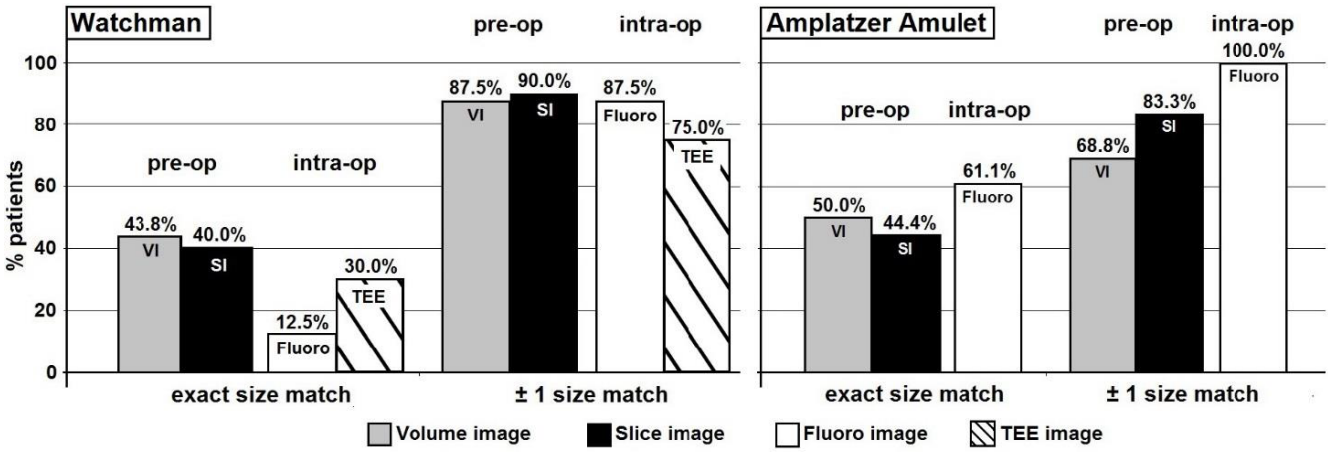
Objective: The aim is to enable a precise preoperative determination of individual LAA occluder size using the CARTOMERGE image integration tool which is a feature of the CARTO XP electro-anatomical mapping system.

Methods: We compared conventional intraoperative fluoroscopy and/or TEE guided selection of LAA occluders with preoperative CARTOMERGE selection in 40 consecutive patients (24 m, 16 f, age: 69.6±8.5 years) receiving Watchman (n=22) or Amplatzer Amulet (n=18) devices. CHA_2DS_2-VASc Score was 3.6±1.9 and HAS-BLED-Score was 3.4±1.2. LAA-morphologies were Chicken Wing (50.0%), Cauliflower (25.0%), Windsock (17.5%) and Cactus (5.0%). During implantation 11 of the patients (27.5%) were in AF. Routine cardiac CT scans were imported into CARTOMERGE for segmentation of the left atrium. The resulting volume images (VI) and slice images (SI) were adjusted in their three dimensional orientation to fit the manufacturer's sizing recommendations. Subsequently, the match between pre- and intraoperative sizing was compared with the actually implanted device size.

Results: In the Watchman group, preoperative VI corresponded with 43.6% (7/16) and SI with 40.0% (8/20), while intraoperative fluoroscopy corresponded with 12.5% (2/16) and TEE with 30.0% (6/20) of all actually implanted devices. According to clinical routine an aberration of one size is commonly used. After including one additional size to the estimation, VI corresponded with 87.5% (14/16), SI with 90.0% (18/20), while fluoroscopy corresponded with 87.5% (14/16) and TEE with 75.0% (15/20) of all actually implanted occluders. The remaining were selected empirically.

In the Amplatzer Amulet group, preoperative VI corresponded with 50.0% (8/16) and SI with 44.4% (8/18), while intraoperative fluoroscopy corresponded with 61.1% (11/18) of all actually implanted devices. According to clinical routine an aberration of one size is commonly used. After including one additional size to the estimation, VI corresponded with 68.8% (11/16), SI with 83.3% (15/18), while fluoroscopy corresponded with 100.0% (18/18) of all actually implanted occluders. The remaining were selected empirically. Postoperatively in the Amplatzer group, one embolization and two dislocations occurred were observed and one patient died during follow-up.

Conclusion: In the 40 consecutive patients, preoperative utilisation of CARTOMERGE was found to be feasible and more accurate than conventional intraoperative fluoroscopy and/or TEE based sizing of Watchman occluders but less precise for the Amplatzer Amulet system. Larger studies have to be done.



LATE PERFORATION OF THE LAA 4 MONTHS AFTER OCCLUDER IMPLANTATION. REASON FOR OR CAUSED BY A RESUSCITATION?

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History and Physical: A 75-years old male with atrial fibrillation, a CHADS VASc Score of 4 and a HAS BLED Score of 4 was referred for an interventional closure of the left atrial appendage (LAA). The intervention was successful with an SJM® Amulet 18 mm device (panel 1). Nearly 4 months later the patient expressed acute dyspnoea and some minutes later had to be resuscitated. Pulseless electrical activity was documented by the rescue team. With ongoing thoracic compressions and application of catecholamines ROSC occurred after 10 minutes and the patient could be transported to a hospital. Ultrasound revealed a pericardial tamponade and a drainage tube was installed. Over the next hour two liters of blood were drained and conventional methods of stabilizing the coagulation did not stop the bleeding. In preparation of cardiac surgery a coronary angiogram was performed (panel 2). It revealed active leakage of contrast agent in the proximal circumflex artery and the patient was transferred to the cardiac surgery department. Intra-operatively a perforation of the tissue at the basis of the LAA close to the left main coronary artery was discovered. The occluder was excised through the opened left, and the LAA was closed by endocardial sutures. After that two sutures were used to seal another lesion at the LAA basis which stopped the bleeding.

Discussion: In review of the clinical information it remains unclear whether a primary perforation of the LAA led to the cardiac arrest. Since there were more than one laceration of the LAA it seems also possible that the thoracic compressions led to the perforation and consecutive pericardial tamponade. In the literature there are several reported cases of an early perforation of the pulmonary artery by an LAA occlusion device leading to cardiac tamponade. To our knowledge this is the first reported case of a potential late lazeration of the circumflex artery by an LAA occluder.

Imaging: Panel 1: TOE of the implantation, Panel 2: Coronary angiogram.

Indication for Intervention: Pericardial tamponade due to a perforation of the LAA by the occluder with suspected lazeration of the circumflex artery.

Intervention: Pericardiocentesis and introduction of a pig tail drainage catheter. Surgical removal of the occluder and closure of the LAA basis by suture.

Learning Points of the Procedure: Check early for cardiac tamponade after LAA occlusion even when the procedure has been performed more than 3 months earlier, i.e. after an unexplained resuscitation.

3D MULTIMODAL IMAGE FUSION FRAMEWORK FOR LAA CLOSURE PROCEDURE

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Background: The left atrial appendage (LAA) is the main site responsible of thrombus formation in patients with non-valvular atrial fibrillation (NVAF). Oral anticoagulant therapy is the gold standard treatment to prevent cardioembolic events. In patients with NVAF and contraindications to the anticoagulation therapy, percutaneous LAA closure is a strategy to reduce the cardioembolic risk. This procedure is particularly challenging because of LAA anatomical complexity.

Objective: The aim of this study was trifold: to develop a multimodal-image-fusion technique in order to support the procedure's planning and execution; to assess the feasibility of LAA anatomical and functional characterization by a multimodal approach based on LAA 3D surface models and to develop an automatic tool able to quantify morphological parameters.

Methods: Three different imaging modalities were involved in this study: pre-operative ECG-gated cardiac CT, pre- and intra-operative 3D echocardiography (transesophageal echocardiography TEE or intracardiac echocardiography ICE) and intra-operative angiography (XA). LAA 3D models were generated using the volumetric CT and US acquisitions; for both CT and US datasets, multiple models were created, one for each of the ten phases in which the cardiac cycle was divided. A custom software was developed to register these models with US and angiographic images, through an algorithm based on the use of RAO/LAO and CRA/CAU C-arm rotation angles and on the identification of anatomical reperi. This algorithm was applied for all cardiac phases, allowing a dynamic spatial fusion. LAA anatomical and functional parameters was measured directly from 3D US and CT models: LAA volume (V-LAA) and ostium area (AO-LAA) were calculated for each cardiac phase and LAA ejection fraction (LAA-EF) in a full cardiac cycle was measured for the LAA motility evaluation. The 3D models-based-method for LAA parameters extraction was validated on 10 CT datasets from patients scheduled for percutaneous LAA closure procedure, availing the Simpson's method at present the gold standard technique. The agreement between methods was assessed by paired t-test.

Results: This study has demonstrated the feasibility to fuse 3D LAA US and CT models with XA and 3D US images, without the use of dedicated commercial platform. The measurements extracted with our 3D-models-based-method has presented a high correlation with respect to the gold-standard technique (LA diastolic phase: V-LAA=10.61±5.17 cm^3 vs 10.55±4.88 cm^3, p=0.8319; AO-LAA=4.80±1.66 cm^2 vs 4.77±1.53 cm2, p=0.5045; LA systolic phase: V-LAA= 7.51 ± 4.85 cm3 vs 7.46 ± 4.71 cm^3 , p=0.7693; AO-LAA= 3.78 ± 1.72 cm^2 vs 3.79 ± 1.69 cm^2, p=0.8227; LAA-EF=33±16% vs 33±16%, p=0.9993).

Conclusion: The image-fusion techniques allow combining complementary information for improving the visualization of the patterns of interest and the procedure's planning and execution. By image-fusion is possible to take advantage of both the higher temporal resolution of the echocardiographic images and the greater anatomical accuracy of the CT models. Moreover, the use of 3D models in the registration procedure allows exploiting them for the LAA anatomical and functional characterization, for biomechanical simulation and for 3D printing in support of pre-operative planning. The multimodal-image-fusion overcomes the limitations of the standard image-techniques routinely used in cathlab.

SIMULTANEOUS PERCUTANEOUS CLOSURE OF LEFT ATRIAL APPENDAGE AND PATENT FORAMEN OVALE

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History: L.J.R, male, 69 yo, admitted with history of dyslipidemia, inferior limb venous insufficiency & several atrial fibrilation episodes. Echocardiography showed no thrombus in left atrium, left atrial appendage (LAA) with favorable anatomy to closure, and the presence of patent foramen ovale (PFO) with right to left shunt detected by saline microbubbles.

Images:

Indication With CHADS and CHA2DS2-VASC scores 1, oral anticoagulaion become among the indications. Because of clinical reasons and patient preference, percutaneous closure of the LAA and the PFO was performed.

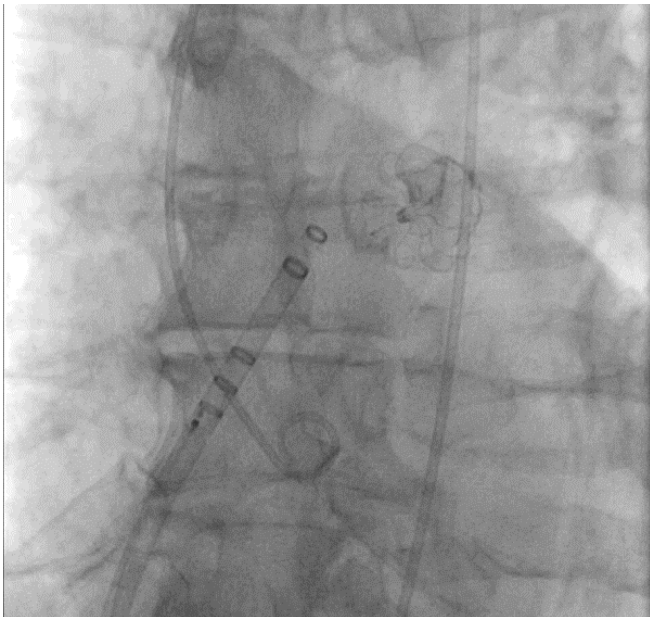

Figure 1. Delivering Watchman 27 device.

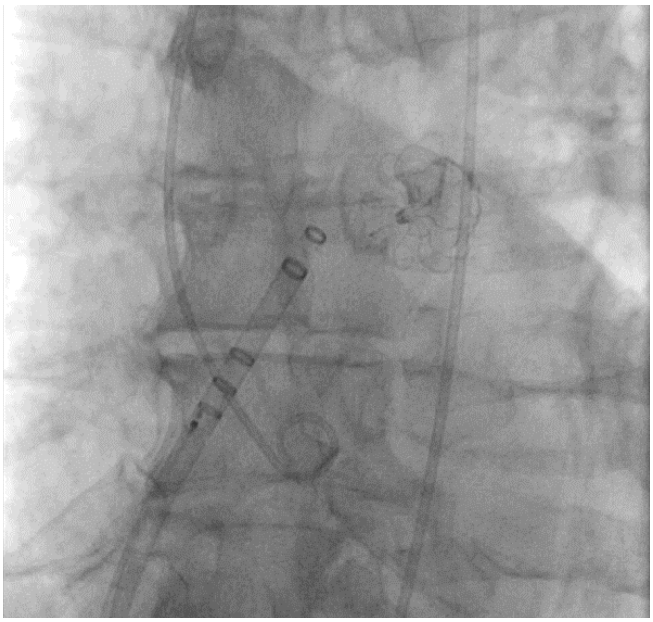

Figure 2. Delivering Amplatzer 25 PFO occluder.

Intervention: LAA closure was carried out under fluoroscopy and Transesophageal echocardiography (TEE). A multipurpose (MP) catheter was placed in the left atrium through the PFO. Using a 0,35 stiff wire, the MP was changed for a dedicated 14 Fr delivery catheter. LAA Angiography was performed using a pigtail through de delivery system. After measurements by fluoroscopy & TEE, a 27 Watchman device was released closing the LAA. Using the same delivery system, a 25 amplatzer PFO device was implanted confirming its size, position and stability. Doppler and saline microbubbles showed no shunt. The patient was discharged the following day. Oral anticoagulation was used and changed to ASA and Clopidogrel after 6 months.

Learning Point-Conclusion: LAA Percutaneous closure is at present a treatment option in stroke prevention settings. Also PFO closure is recommended when risk of paradoxical embolism exist. The case shows that it is possible to perform both percutaneous procedures simultaneously.

VIRTUAL HAEMODYNAMIC STUDY ON DIFFERENT LEFT ATRIAL APPENDAGE MORPHOLOGIES

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Background: Around 90% of thrombi leading to stroke in patients with non-valvular atrial fibrillation are originated in the left atrial

appendage (LAA). The evaluation of LAA morphologies in haemodynamic terms may shed some light on the role of this structure in the cardiovascular system and the effect of its occlusion.

Objective: The main objective of this virtual study was to evaluate some haemodynamics parameters in different patient-specific LA/LAA morphologies to identify characteristics potentially related to a high risk of thrombus formation.

Methods: Eleven patient-specific morphologies provided by the Cardiovascular Center in Aalst, Belgium were studied. From 3D rotational angiography images, left atria (LA) and LAA geometries were extracted and processed to create volumetric meshes. The Computational Fluid Dynamic (CFD) method was used to simulate blood flow in the atrium. Simulations were run using a laminar, Newtonian and incompressible flow hypothesis. All walls were simulated rigid replicating the worst AF scenario (e.g. chronic AF), when atrial contraction is not possible anymore. At the inlets (pulmonary veins) a time-varying blood flow function was applied following literature data. At the mitral valve a constant pressure of 8 mmHg was imposed during the diastolic phase. In systole, the mitral valve was closed, behaving like a wall.

Results: LAA morphology parameters and indices characterizing blood flow were jointly analysed. For instance, we computed the endothelial cell activation (ECAP) parameter, which is the ratio of the oscillatory shear index (OSI) and the time average wall shear stress (TAWSS), since it estimates the thrombogenic susceptibility of the LA/LAA walls. In addition, includes the CHA_2DS_2_VASc score to relate the risk of stroke with the computed haemodynamics and morphological indices. The ECAP distribution in LA during one cardiac cycle in the studied cases shows The higher values of ECAP are located on the LAA.

Conclusion: Despite the limitations of virtual models of biological processes such as thrombogenesis, this study offers a potential tool to better understand the relation of LAA morphologies and haemodynamic parameters.

FATAL LATE ISCHEMIC STROKE ON A POORLY ENDOTHELIALIZED WATCHMAN LEFT ATRIAL APPENDAGE OCCLUSION DEVICE

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History: A 77-year-old female with a significant past medical history for immune thrombocytopenic purpura, hypothyroidism, and hypertension was being treated for persistent atrial fibrillation with a CHA2DS2-VASc score of 3 (points for hypertension, age, and sex). Initially the patient was anticoagulated with warfarin until 2013 when she experienced a left hemorrhagic bursitis with an INR of 2.8. The patient's anticoagulation was changed to the direct oral anticoagulant rivaroxaban until 2015 when this was changed to apixaban following a lower gastrointestinal bleed. The patient tolerated this well until April 2016 when a Watchman® left atrial appendage (LAA) occlusion device was implanted.

Indication for Intervention: Multiple major bleeding episodes while on anticoagulation.

Intervention: In April 2016 under transesophageal echocardiography (TEE) guidance a 24mm Watchman® device was implanted into the LAA with adequate positioning and no peri-device leakage. Following the procedure, dual antiplatelet therapy (DAPT) including aspirin and clopidogrel was initiated. However, in May 2016 she presented to hospital with hemorrhoidal bleeding so her DAPT was changed to warfarin with an INR target of 2.0-3.0. Unfortunately, the INR was subtherapeutic for the first 5 weeks resulting in a TEE confirmed thrombus overlying the device in June 2016. After extensive discussion, the INR target was increased to 2.5-3.0 and low dose aspirin was initiated. TEE in September 2016 showed thrombus resolution whereby warfarin was discontinued in December 2016. In April 2017, the patient was admitted to the intensive care unit with altered level of consciousness, decompensated septic shock, and hypoxemic respiratory failure with a TEE confirmed device thrombus. Brain MRI showed small acute infarcts involving multiple vascular territories. The patient passed away peacefully in the presence of her family after withdrawing physiologic support. Autopsy showed multiple cerebral and cerebellar infarcts and micro-infarcts associated with fibrin thrombi, and cardiac examination showed a poorly endothelialized Watchman® device with a dislodged thrombus in the left atrium. The final cause of death was determined to be septic shock and multiple thromboembolic events.

Learning Points of the Procedure: We report the late complication of ischemic stroke due to thrombus formation on an incompletely endothelialized Watchman® device 1 year after implantation. This case suggests that the endothelialization process of this device is not fully understood and may be inhibited by early subtherapeutic anticoagulation and thrombus formation. In summary, complete endothelialization is crucial in preventing long-term ischemic stroke, and patients with early anticoagulation or device complications may require additional follow-up to prevent this fatal late complication.

PANNUS FORMATION AFTER LAA OCCLUDER DISLOGEMENT AS A RARE COMPLICATION

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Pannus formation after laa occluder dislogement as a rare complication

History and Physical: 75 years old female patient was admitted to the hospital in October 2016. Clinical diagnosis: Permanent normosystolic atrial fibrillation. CTI ablation (2011), VVIR pacemaker implantation (2011), DDDR pacemaker re-implantation (2013), arterial hypertension 2-nd degree, risk 4. Diabetes Mellitus, type 2. Pulmonary hypertension. Obesity 2 degree. CHA2DS2-VASc score 5. Patient was taking warfarin and having labile INR.

Imaging and Intervention: Due to high risk of stroke and labile INR on warfarin the patient underwent Left Atrial Appendage Occluder (LAAO) implantation. During the procedure LAA angiography was performed. Entrance of LAA was measured in different positions:

RAO 30, CRAN 15 – 23.4 mm; RAO 30, CAUD 15 – 24.2 mm. Amplatzer Cardiac Plug 26 mm was selected for implantation. LAAO implantation was successfully performed. Traction test was negative. LAAO position stable. The second day after LAAO implantation trans-esophageal Echo was performed and revealed no abnormalities. The patient was discharged on the 3-d day after the procedure. Rivaroxaban was prescribed for 3 months. At 3-month follow–up TEE was performed. The Patient had dislodgement of a disk-part of the occluder into distal direction of the appendage. The upper part of the disk slept under the ridge. Pannus formation is currently registered above the disk at previous disk position, so that it was covering the main part of the ridge. We could describe triangle formation which is formed by the disk surface, pannus and the ridge (Pic. 1). The patient was switched to warfarin aiming INR about 2,5-3,0. At 6-month follow–up TEE was performed. This diagnostic revealed thrombus formation on LAAO disk surface in size of 1,46*0,41cm (Pic. 2). The pannus was not visualized anymore. Warfarin dose was increased, aiming INR about 3,0. At 9-month follow-up no more thrombotic masses were verified. The patient was recommended to continue intake of Rivaroxaban.

Learning Points of the Procedure: Pannus formation is a rare additional complication phenomenon after LAA occluder disk dislodgement. Pannus is a substrate for further thrombus development. In order to prevent LAAO dislocation it is important to choose the right size of the device, to be sure not to put the device too deep into LAA. Achieve stable position of the occluder is always important. Adequate anticoagulation after LAAO implantation should not be underestimated.

THE INTRAOPERATIVE ROLE OF RT3DTEE FOR TRANSSEPTAL PUNCTURE: CHALLENGING CASES

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Background: Access to the left atrium (LA) for several interventional procedures is obtained by transseptal puncture that permits direct passage to the LA via the interatrial septum (IAS) and systemic venous system. Careful knowledge of anatomy of IAS and its anatomical variations (thickened, aneurysmal, previous procedures, presence of PFO) is important for the success of the procedure and the safety of the patient.

Methods: RT3DTEE permits good images of IAS and correct evaluation of the distance from aorta and left atrium walls; may be useful in patients with unusual anatomy of interatrial septum such as lipomatous hypertrophy (LH) and very small surface of fossa ovalis (FO) (Panel A) to reach exactly the right point to puncture and to see the tenting of the fossa by the catheter tip. In patients with congenital heart disease who have undergone surgical or percutaneous repair, access from the RA to the LA could be challenging and the use of RT3DTEE con be very helpful for the procedure. A case of previous ASD closure with Amplatzer device n.22 (PANEL B) in which is possible to see the close relationship between the device, the aortic root and the roof of LA. Clearly to access the LA without puncturing the transseptal device is possible only in the inferior part of IAS just below the device through the adjacent native septum. 3DTEE imaging facilitates the procedure by providing in one single view detailed pictures of the targets in relation to each other. Congenital corrected transposition (cGTA) in situs viscerum inversus is a rare cardiac malformation characterized by the combination of discordant atrio-ventricular and ventriculo-arterial connections (PANEL C). The great arteries are parallel to each other. By far the most important structure to avoid puncturing is in our case the pulmonary trunk due to its close position with IAS.

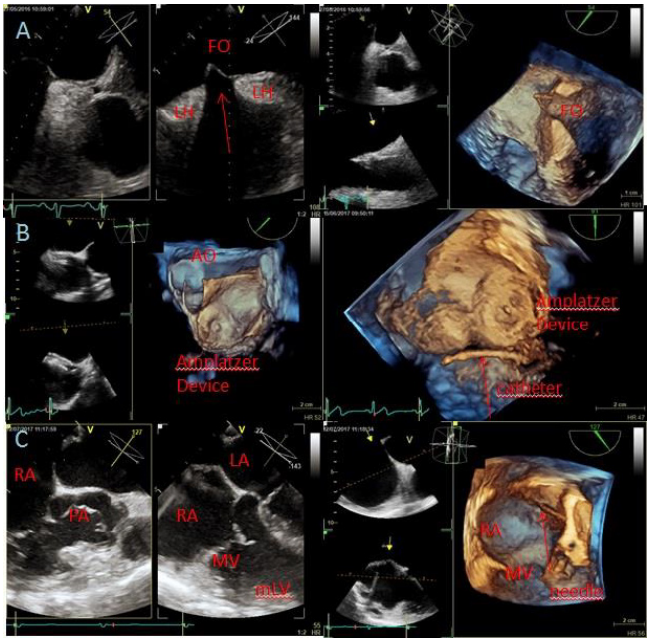

Figure 1.

Conclusions: Performing transseptal puncture the role of RT3DTEE is an added value showing anatomical images in multiple perspective, even more if complex congenital heart disease or previous percutaneous repair are present.

LEFT ATRIAL APPENDAGE OCCLUSION FOR STROKE PREVENTION IN PATIENTS WITH VALVULAR ATRIAL FIBRILLATION

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Background: Left atrial appendage occlusion (LAAO) is a valuable therapy for stroke prevention among patients with non valvular atrial fibrillation (NVAF).

Objective: The aim of the present study was to evaluate the feasibility and the safety of LAAO in patients with valvular atrial fibrillation (VAF).

Methods and Results: Among 85 consecutive patients undergoing LAAO in our center since 2009, 10 of them had prior valvular surgery (2 surgical bioprostheses, 2 TAVI and 6 valve repairs) at a median time of 1520 days. At baseline, the CHA2DS2-VASc score was significantly higher in patients with VAF (group 1 ; 5.6 ± 2.1) than in those with NVAF (group 2 ; 4.7 ± 1.4, p=0 .04), but the HASBLED was similar between groups 1 and 2 (3.8 ± 1.4 vs 3.4 ± 1.1 respectively, p=0.17). There were no difference in procedural success (100 vs 97%) nor in the rate of periprocedural major adverse events (1 migration successfully snared in group 1 vs 2 tamponades treated successfully by pericardiocentesis in group 2). At follow-up (median time 312 vs 330 days respectively, p=NS), overall survival was 80% in group 1 vs 89% in group 2 (p= 0.33) with no death procedure- nor device-related; the rate of additional adverse events was similarly low between groups 1 and 2 : major bleedings (2 vs 3, p=0.10) and ischemic strokes (0 vs 3, p=1).

Conclusion: Our data suggest that LAAO for stroke prevention is feasible and safe among patients with valvular atrial fibrillation, at mid term follow-up.

TRANSCATHETER LEFT ATRIAL APPENDAGE OCCLUSION USING DIFFERENT DEVICES IN THE REAL LIFE: RESULTS OF THE BELGIAN REGISTRY

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Objectives: This study aimed at assessing the safety and efficacy at mid-term follow-up of left atrial appendage occlusion using different devices, in the real life in Belgium.

Methods and Results: Between June 2009 and November 2016, 457 consecutive patients (63% males, 75±12 yrs, CHA_2DS_2-VASc 4±0.6, HASBLED 3.5±0.7) undergoing left atrial appendage occlusion in 21 centers, were included in the study. Technical success was 97.1%. There were 19 periprocedural major adverse events (4.1%) including three death (0.6%), nine tamponnades (1.9%), four major bleedings (0.8%) and two device embolizations (0.4%). The procedural outcome was similar between patients implanted with the Watchman device (N = 139) and those treated with the ACP/Amulet prosthesis (N = 318).

Among patients successfully implanted with a complete follow-up (672 patient-years, median follow-up 1273 days), the actual annual stroke rate was 1.2%, lower than the expected stroke risk (4%, 70% reduction). The observed bleeding rate was 2%, while the calculated risk was 3.7% (46% reduction).

Kaplan-Meier analysis showed a similar overall survival (91±3% and 87±4% versus 93±2% and 87±3% ; p = 0.35) and event-free survival (88±3% and 80±5% versus 92±2% and 84±3% ; p = 0.17) at 1 and 2 years, for the Watchman versus the ACP/Amulet groups of patients, respectively.

At last follow-up, 90% of patients were left untreated by any anticoagulants: medication was limited to aspirin in 65% or to nothing in 5.7% of cases.

Conclusions: The data of the Belgian left atrial appendage occlusion registry suggest that the procedure is safe and effective in a real world setting, to prevent atrial fibrillation-related thromboembolism at mid-term follow-up, using either the Watchman or the ACP/Amulet device.

PERCUTANEOUS CLOSURE OF LAA IN A PATIENTE WITH COR TRIATRIATUM

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Background: Cor triatriatum(CTT)is a rare congenital heart disease (incidence 0,1-0,4%) in which the left atrium is divided into parts by a fibromuscular membrane. The postero-superior portion receives venous blood, whereas the anterior-inferior part is in contact with mitral valve, fossa ovalis and left atrial appendage (LAA). The membrane is attached laterally to the junction of the left upper pulmonary vein and LAA, medially to the interatrial septum above the fossa ovalis. CTT could be associated with other cardiac defects for example LSVC, ASD or anomalous venous return. This type of disease can be very severe in infancy mimic mitral stenosis or have a late presentations related to other cardiac conditions such as mitral regurgitation or atrial fibrillation (AF).

History: We report a case of a patients (woman, 47 years) with CTT with large unrestrictive communications between the two chambers and small ostium secundum atrial septal defect. She was referred to our echolab for evaluation for LAA percutaneous closure as a bearer of permanent AF and Cooley's disease (CHA2-DS2-VASC:2, HAS-BLED:4). The latter condition is an absolute contraindication for oral anticoagulation.

Imaging: RT2D/3D TEE clearly shows the absence of clots, the LAA anatomy: cauliflower like, the anatomical relationships between the membrane and surrounding structures and the interatrial septum in detail.

Indication for intervention: we decides to use the Watchman device (n.21, Boston Scientific) for the presence of the membrane just above

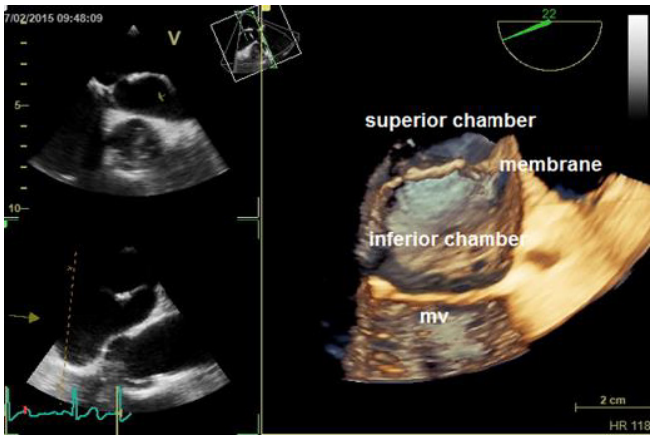

Figure 1.

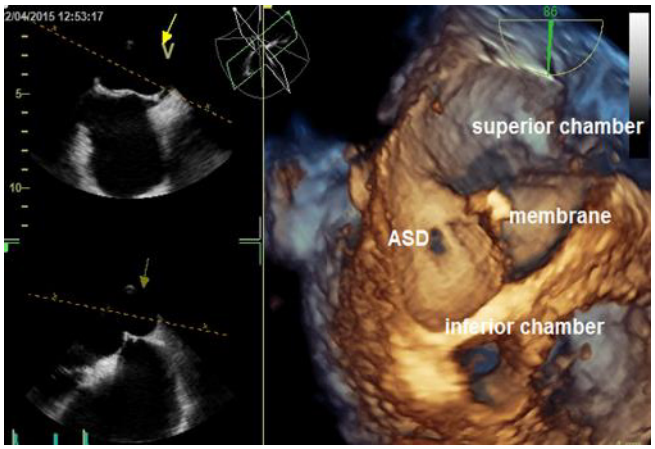

Figure 2. The membrane arising from the IAS just above the small ASD.

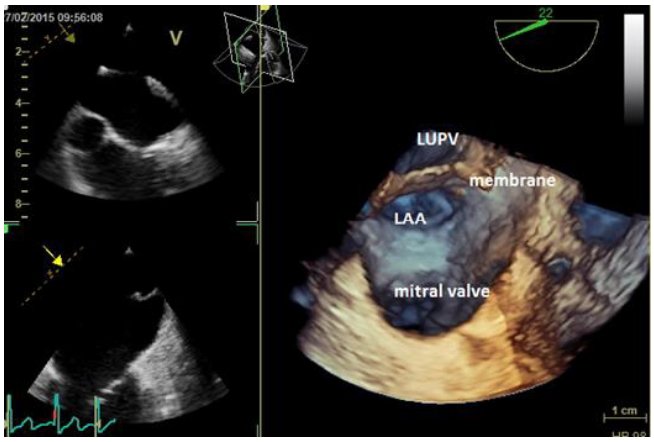

Figure 3. The anatomical relationship between LAA, membrane and LAA.

the LAA. We decided not to cross the interatrial septum through the ASD but to perform the transseptal puncture in a more postero-inferior position in the IAS below the membrane.

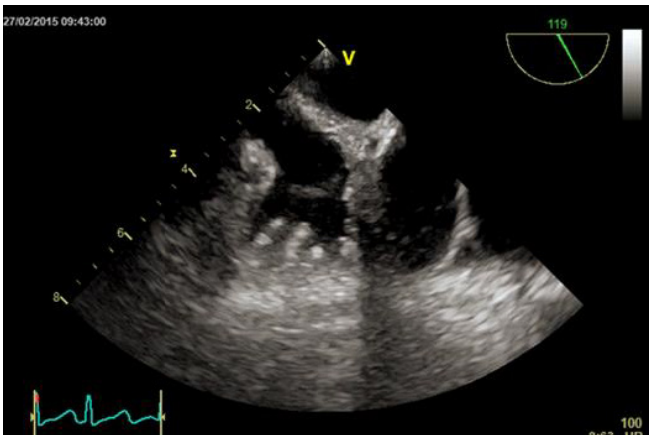

Figure 4. LAA with "cauliflower" morphology, no evidence of clots.

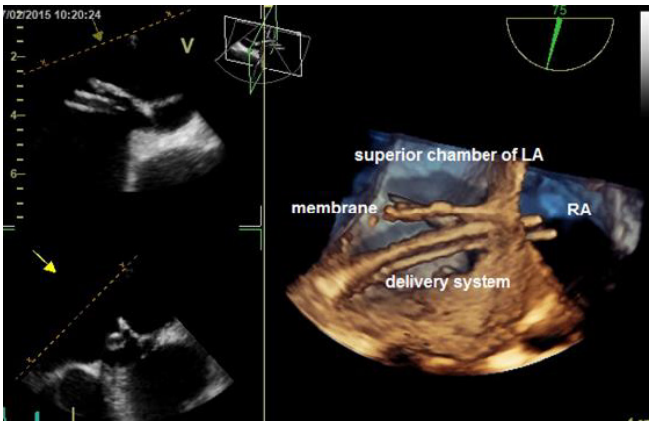

Figure 5. The passage of the delivery system below the membrane, towards the LAA.

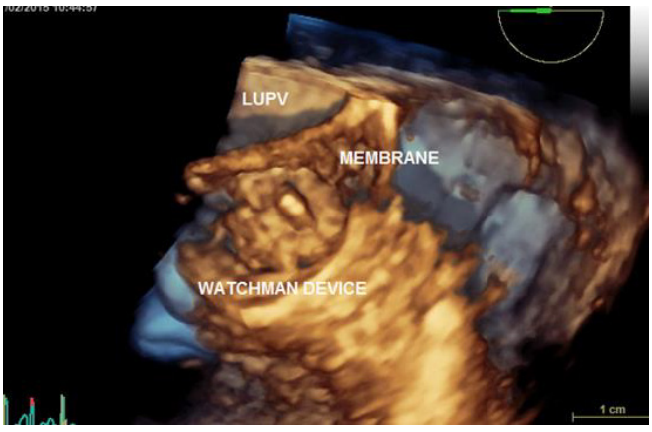

Figure 6. The Watchman device allocated in LAA just below the membrane.

Conclusions: In our case the decision to close the LAA was very helpful for the patient with Cooley's disease and absolute contraindication for anticoagulation. The 3D findings help us to guide the

percutaneous approach of LAA closure in each step: the passage of the delivery system through the interatrial sepum, the right positioning of the device in LAA and the relationship with the membrane.

NO ANTIPLATELET THERAPY FOLLOWING LEFT ATRIAL APPENDAGE CLOSURE IN PATIENTS WITH VERY HIGH BLEEDING RISK

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Background: LAA percutaneous closure (LAAC) has been proposed and validated as an effective and safe treatment in patients with atrial fibrillation (AF) and contra-indication to anticoagulant therapy. Optimal post procedural antithrombotic medication and its duration is still under debate, as the bleeding risk needs to be balanced against the risk of device thrombus formation and thromboembolic complications. Many different antiplatelet regimens after LAAC have been proposed :1) 6 months DAPT + lifelong ASA, 2) 3 months DAPT + lifelong ASA, 3) 6 weeks DAPT + lifelong ASA, 4) Single ASA lifelong. Nevertheless in very high risk bleeding patients the requirement of lifelong single antiplatelet therapy remains the main limitation, as recent data showed similar bleeding rates in patients treated with ASA to those treated with oral anticoagulant. In clinical practice about 6% of patients have no antithrombotic therapy post LACC, due to high bleeding annual rates.

Objective: To investigate the long-term outcome of patients undergoing LAAC followed by no antiplatelet therapy.

Methods: This is an ongoing, observational, retrospective, nonrandomized, multicenter registry. All patients treated with LAA percutaneous occlusion with ACP/AMULET, between 2012 and 2016, that have suspended any antiplatelet therapy due to clinical conditions, will be included. At least 1 year of follow-up will be required.

Patients with no antiplatelet therapy at follow up will be compared to patients with patients who maintain either single or dual antiplatelet therapy. Additionally, the efficacy of this new antithrombotic strategy will be evaluated by comparing the rate of embolic and bleeding events at follow-up in the study population with the event rate predicted by the patients' CHA2DS2-VASc and HAS-BLED scores, respectively.

Conclusion: Aim of this study is to prove the feasibility and safety of LAAC in a subsets of AF patients at very high bleeding risk unsuitable for lifelong sin.

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