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CORONARY INTERVENTIONS

Shockwave intravascular lithotripsy for calcified coronary lesions: first real-world experience

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Aims: Calcified coronary lesions often cause suboptimal stent expansion, which is one of the greatest predictors of adverse outcomes such as stent thrombosis and restenosis. Shockwave intravascular lithotripsy (S-IVL) is a recently approved technique used in the treatment of heavily calcified coronary lesions. We present our early real-world experience with the S-IVL device.

Methods and results: All patients treated with S-IVL between October 2018 and January 2019 during their PCI at our centre were included. During this period, a total of 26 patients undergoing PCI were treated with S-IVL prior to stent deployment (69% male; age, 72±8 years). Indications for PCI were acute coronary syndromes (ACS) in 14 patients (54%), stable angina in 11 patients (42%), and PCI before TAVI in 1 patient (4%). 71% of the ACS cases undergoing PCI with S-IVL were to the perceived ACS culprit lesion during the index procedure, while 29% were staged PCIs to severe non-culprit lesions. Upfront S-IVL usage occurred in 58% of cases; the rest were bail-out procedures due to suboptimal initial balloon predilatation. S-IVL was used most commonly in the left anterior descending coronary artery (50%), with 1.3±0.5 stents implanted/target vessel. Angiographic success (<20% residual stenosis) occurred in all cases, with no procedural complications.

Conclusions: S-IVL appears to be a useful modality in coronary calcium modification to optimise stent expansion. This device obviates the need for more complex lesion preparation strategies such as rotational atherectomy, except in severe undilatable cases where S-IVL is impossible. Further study is warranted to compare different calcium modification devices with conventional balloon angioplasty.

CORONARY INTERVENTIONS

Mechanical circulatory supported PCI in high-risk patients using veno-arterial ECMO compared to Impella: a single-centre experience

Pender P., Gibbs O., Faour A., Dang V., French J.K., Mussap C.J., Taylor D., Leung D., Juergens C., Lo S.

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Aims: Both Impella and veno-arterial extracorporeal membranous oxygenation (VA-ECMO) provide consistent cardiac output augmentation which can alleviate haemodynamic fluctuations during high-risk PCI (HR-PCI). Paucity of Australian data exists. We sought to investigate the outcomes of patients undergoing HR-PCI with mechanical circulatory support (MCS) in our single-centre registry.

Methods and results: Retrospective analysis of consecutive non-shock patients undergoing Impella or VA-ECMO supported elective/semi-urgent HR-PCI from the Liverpool Cardiac Catheterisation and ICU databases (January 2010-January 2019) was performed. Total of 15 surgical-turndown patients (heart team referred) underwent HR-PCI with MCS (6 patients received VA-ECMO [3 with adjunctive intra-aortic balloon] and 9 with Impella support). Baseline characteristics were similar with mean age 70.8±14.6 years (44-82) in the VA–ECMO group vs Impella 66.5±14 years (51-92). Left ventricular ejection prior to PCI was 24.5±5.3% for VA-ECMO vs 36.7±12.3% in the Impella group. Mean Society of Thoracic Surgeons (STS) predicted mortality risk was 7.4% vs 8.2% (VA-ECMO vs Impella). Duration of haemodynamic support was 18±8.7 hours (3-24) with VA-ECMO vs 3.6±1.2 hours (2-4.9) with Impella. General anaesthesia was required in 6 VA-ECMO cases vs 4 in Impella (p=0.001). Surgical vascular closure was required in 100% VA-ECMO cases vs 11±33.3% Impella group (p=0.00002).

Conclusions: VA-ECMO and Impella support for HR-PCI achieves excellent results. VA-ECMO appears significantly more resource intensive with higher access-site complication rates and extended hospital LOS in our experience. Impella use in this early experience was associated with significantly reduced ICU, CCU and total hospital length-of-stay and blood transfusion requirements.

CORONARY INTERVENTIONS

Endothelial shear stress and vascular remodelling in BRS and metallic stent in the ABSORB II trial

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Aims: The impact of endothelial shear stress (ESS) on vessel remodelling in vessels treated using BRS as compared to metallic DES remains elusive. To determine whether the relationship between ESS and remodelling patterns differs in BRS from those seen in metallic DES at 3-year follow-up.

Methods and results: In the ABSORB II randomised trial [BRS vs DES], lesions were investigated by serial coronary angiogram and IVUS. Three-dimensional reconstruction of coronary arteries post-procedure and at 3 years was performed. ESS was quantified using non-Newtonian steady flow simulation. IVUS cross-sections in device segments were matched using identical landmarks. Paired ESS calculation post-procedure and at 3 years was feasible in 57 lesions in 56 patients. Post-procedure, median ESS at frame was higher in BRS than in DES with marginal statistical significance (0.97±0.48 vs 0.75±0.39 Pa, p=0.063). In the BRS arm, vessel area showed a larger increase in the highest tercile of median ESS post-procedure as compared to the lowest tercile. In contrast, in DES, no significant relationship between median ESS post-procedure and remodelling was observed. In multivariate analysis, smaller vessel area, larger lumen area, higher plaque burden post-procedure, and higher median ESS post-procedure were independently associated with expansive remodelling in matched frame. Only in BRS, younger age was an additional significant predictor of expansive remodelling.

Conclusions: In a subset of lesions with large plaque burden, expansive remodelling and late lumen enlargement are associated with shear stress in BRS, while ESS has no impact in metallic DES.

CORONARY INTERVENTIONS

Cost analysis of mechanical circulatory supported PCI in high-risk patients using veno-arterial ECMO compared to Impella: a single-centre experience

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Aims: Both Impella and veno-arterial extracorporeal membranous oxygenation (VA-ECMO) provide cardiac output support during high-risk PCI (HR-PCI). These devices have increased consumable costings but total episode-of-care expenditure reflects patient comorbidities; resulting hospital length-of-stay (LOS); and also managing any device-related complications. This study compared the clinical and economic impact of mechanical circulatory support devices Impella and VA-ECMO for patients undergoing HR-PCI.

Methods and results: Consecutive non-shock patients treated with either Impella or VA-ECMO during semi-urgent HR-PCI from the Liverpool Cardiac Catheterisation and ICU databases (Jan 2010-Jan 2019) were analysed retrospectively. Estimated total–admission cost was based upon published local diagnosis-related group guidelines to compare cost differences between these 2 treatment modalities, expressed in Australian dollars (AUD). 15 patients underwent HR-PCI with cardiac support; 6 received VA-ECMO and 9 Impella. Impella compared to VA-ECMO was associated with reduced total hospital LOS [11.9±9.2 vs 25.8±9.4 days]; reduced coronary care unit (CCU) LOS [5.8±3.8 vs 10.5±3.9 days (delta-4.7)]; reduced ICU-LOS [0.6±1.3 vs 9.5±9.0 days (delta-8.9) (p=0.007)]; reduced ward bed LOS [3.5+4.8 vs 5+7.3 (delta-1.4)] and reduced rehab bed LOS (delta-1.33). Application of cost per unit/per bed day in ICU and CCU [$5,830*delta =$52,146 (ICU)+$27,531{CCU)]; ward–bed day ($1,344*delta =$1,941) and rehab LOS ($316*delta =$421)]. Overall net benefit of reduced hospital LOS equated to savings of $81,197 favouring Impella.

Conclusions: VA-ECMO and Impella support for HR-PCI achieves excellent results. VA-ECMO appears significantly more resource intensive with higher access-site complication rates and extended hospital LOS. Impella in this early experience was associated with significantly reduced ICU, CCU and total hospital length-of-stay and blood transfusion requirement. As such, Impella use amounts to substantial reduction in costs of care.

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CORONARY INTERVENTIONS

Advantages of optical frequency domain imaging compared with IVUS in PCI using rotational atherectomy

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Aims: This study aimed to compare the outcomes of PCI using rotational atherectomy with OFDI guidance versus IVUS guidance.

Methods and results: We evaluated the same vessels (7 cases, 74 areas) using both IVUS and OFDI to determine whether there was a difference between areas measured by IVUS and those by OFDI. The area measured by OFDI was 16.2% smaller than that done by IVUS ($p<0.001$). Secondly, we retrospectively assessed not only the lesion and procedural characteristics between OFDI (n=34) and IVUS (n=51) guided RA groups but also the vessel areas before and after PCI. Lumen areas estimated by IVUS were corrected to multiply by 0.838 in accordance with the results of the pilot study. Compared with the IVUS group, the mean final burr size (1.75±0.26 versus 1.63±0.23 mm, $p<0.05$) and final balloon diameter (3.29±0.60 versus 3.09±0.44 mm, $p<0.05$) were significantly larger in the OFDI group. The minimal lumen area (MLA) before PCI was significantly larger in OFDI group versus corrected IVUS group (1.76±0.76 versus 2.30±0.84 mm^2, $p<0.05$), but the MLA after PCI was not significant (5.26±1.72 versus 4.85±1.46 mm^2, n.s.). Acquired area, defined by difference in MLA before and after PCI, was significantly greater in PCI using RA in OFDI group than that in corrected IVUS group (3.49±1.58 versus 2.56±1.12 mm^2, $p<0.001$).

Conclusions: Greater acquired area using OFDI rather than IVUS might be associated with larger final burr and balloon size. OFDI has advantages of superior comprehension regarding thickness and circumferential extent of calcification, which can provide essential information for the decision process of the most suitable burr and balloon size following safer and maximal ablation effect compared with IVUS. Therefore, OFDI guided RA might reduce in-stent restenosis and stent thrombosis to minimise stent malapposition and underexpansion.

CORONARY INTERVENTIONS

Impact of plaque burden and composition on coronary slow flow in STEMI patients undergoing PCI: an intravascular ultrasound and virtual histology analysis

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Aims: Coronary slow flow is an important complication of PCI which is associated with poor prognosis. The aim was to assess greyscale IVUS and virtual histology (VH-IVUS) features of culprit lesions in STEMI.

Methods and results: 252 consecutive patients with STEMI underwent coronary angiogram and IVUS analysis. Following PCI, patients were divided into 2 groups; slow flow (TIMI flow ≤2, n = 61) and normal flow (TIMI flow >2, n = 191). Coronary plaque burden and its composition in relation to slow flow were evaluated. On greyscale IVUS analysis, plaque area (14.30±9.80 mm^2 vs 12.92±9.11 mm^2, p=0.047), plaque volume (121.38±41.28 mm^3 vs 102.94±30.70 mm^3, p=0.001), lesion external elastic membrane cross-sectional area (15.77±4.70 mm^2 vs 14.28±3.25 mm^2, p=0.038) and remodelling index (1.38±0.36 vs 1.27±0.32 mm^2, p=0.035) were significantly higher in slow flow group. On VH-IVUS analysis, absolute fibrous volume (52.48±21.55 mm^3 vs 43.48±15.74 mm^3, p=0.002), absolute necrotic core volume (12.42±6.50 mm^3 vs 6.75±4.79 mm^3, $p<0.001$), absolute dense calcium volume (1.94±2.46 mm^3 vs 1.26±1.71 mm^3, p=0.016) and thin-cap fibroatheroma either single (31.10% vs 16.80%, p=0.015) or multiple (4.90% vs 0.5%, p=0.045) were higher in slow flow arm. On multivariable analysis the absolute necrotic core volume (odds ratio = 1.184; 95% CI: 1.087-1.288, $p<0.001$) was the only independent predictor of slow flow. Receiver operating characteristic curve analysis identified the absolute NC volume (AUC = 0.765, $p<0.001$) and the plaque volume (AUC = 0.641, $p<0.001$) as the best discriminators for slow flow.

Conclusions: Virtual histology (VH-IVUS) derived absolute NC volume is closely associated with the coronary slow flow phenomenon in patients with STEMI after PCI.

CORONARY INTERVENTIONS

Impact of a stentless PCI strategy using directional coronary atherectomy and a DEB for left main and ostial lesions

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Aims: This study aimed to examine the safety and effectiveness of stentless PCI using directional coronary atherectomy (DCA) and drug-coated balloons (DCBs).

Methods and results: From November 2017 to January 2019, stentless PCI for left main trunk and ostial lesions was performed in 23 consecutive cases. Stentless PCI was performed using "SeQuent Please" DCBs after "ATHEROCUT" DCA, and procedural success was obtained in all cases (4 cases with LMT, 15 with left anterior descending ostial, 3 with left circumflex (LCX) ostial, and 1 with RCA ostial lesion). The %PA decreased from 70.7±7.6% at baseline to 44.8±9.1% after the DCA. In 13 patients who completed a follow-up coronary angiography after 6 months, no restenosis was observed. No major adverse cardiac events occurred in any cases including TLR. In 9 cases in which the lumen was confirmed with IVUS at 6 months of follow-up, the PA had expanded significantly from 7.6±1.9 mm^2 at baseline to 8.8±2.4 mm^2 at 6 months (p=0.0215). Local paclitaxel may induce late lumen enlargement (LLE) after DCA/DCB.

Conclusions: Stentless PCI using DCA and DCB for bifurcation lesions including LMT and RCA ostial lesions was effective, safe, and useful. Furthermore, a chronic LLE effect by DCB is expected.

CORONARY INTERVENTIONS

QT dispersion as a valuable marker to predict the ischaemic burden on single-photon emission CT myocardial perfusion imaging of multivessel disease patients

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Aims: We aimed to investigate the value of QT dispersion to predict the ischaemic burden as detected by SPECT myocardial perfusion imaging (MPI).

Methods and results: This was a cross-sectional study of patients with multivessel coronary artery disease who underwent SPECT MPI. The QT dispersion was defined as the difference between the maximal and minimal QT interval duration. QT interval was measured as corrected QT interval (QTc) using Bazett Formula. Ischaemic burden was measured by SPECT MPI using semiquantitative scores on 17-segment assessment according to standard nomenclature and interpreted as small and moderate-large ischaemic burden. Total of 62 patients (49 males, mean age 55.5±8.9 years). There was negative correlation with good strength between QT dispersion and ischaemic burden ($r = -0.658$, $p<0.001$). Using ROC analysis, the optimal cut-off value of QT dispersion was 80 ms that yielded the highest sensitivity and specificity to discriminate between two groups. Sensitivity, specificity, positive and negative predictive value of QT dispersion ≤80 ms to predict moderate-large ischaemic burden were 89%, 87%, 86%, and 90%, respectively.

Conclusions: QT dispersion is a simple and reliable parameter with good diagnostic value to predict moderate-large ischaemic burden as detected by SPECT MPI. This parameter could also be applied to determine the management strategy of multivessel coronary artery disease patients in daily practice.

CORONARY INTERVENTIONS

The predictive accuracy of PRECISE-DAPT and CRUSADE bleeding risk scores in PCI treated STEMI patients: a single-centre, observational study

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Aims: The primary aim was to investigate the predictive accuracy of PRECISE-DAPT and CRUSADE bleeding risk scores in a single-centre cohort of PCI treated STEMI patients.

Methods and results:

We retrospectively analysed 310 consecutive STEMI patients having primary PCI at Liverpool Hospital, Sydney (Jan 2015-April 2016). Patients administered thrombolysis, prasugrel, and having coronary artery bypass grafting were excluded. The primary endpoint was in-hospital major bleeding, defined as any actionable bleeding event fulfilling BARC2-5 criteria. The study cohort comprised 288 patients, with median age 61 [21-94] years, 83% male, mean BMI 29±6.4, and 29.8% had diabetes (DM). PCI was performed via the femoral artery in 67.4%, and third-generation drug-eluting stents (DES) were used in 44.8%. Overall, T-DAPT (67%) was preferred over C-DAPT (33%), with no subgroup differences in baseline characteristics. All-cause mortality was low (7.3%), at median follow-up 222 days [IQR = 389-60 days], with no difference between C-DAPT vs T-DAPT (10.5 vs 5.7%; p=0.14). In-hospital BARC2-5 major bleeding occurred in 10.4%. There was no difference in major bleeding for C-DAPT vs T-DAPT (11.6 vs 9.9%; p=0.6). Tirofiban was administered in 27% of cases, and 22% of these patients had major bleeding. Receiver operating characteristic (ROC) analysis showed that PRECISE-DAPT (AUC 0.75 [95% CI: 0.65-0.83]) had better predictive accuracy for in-hospital major bleeding compared to CRUSADE (AUC 0.60 [95% CI: 0.50-0.90]; comparative p=0.01). Multivariate analysis showed that tirofiban (OR 3.7 [95% CI: 1.65-8.28]; p=0.001) and older age (OR 1.1 [95% CI: 1.2-1.1]; p=0.004) were independently associated with in-hospital BARC2-5 bleeding events.

Conclusions: In our cohort of PCI treated STEMI patients, the more potent T-DAPT was preferred over C-DAPT, without a significant increase in rates of in-hospital BARC2-5 bleeding or death. Major bleeding was more likely in older patients and those administered tirofiban. The PRECISE-DAPT bleeding risk score appears to be superior to CRUSADE in predicting in-hospital, major bleeding.

CORONARY INTERVENTIONS

Prognosis of patients with chronic coronary artery disease undergoing PCI (five-year follow-up)

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Aims: To evaluate the prognosis of patients with chronic ischaemic heart disease, who underwent PCI and were only on optimal medical therapy (OMT).

Methods and results: Measurement of FFR was performed for 432 patients. All patients were randomised in 2 groups (1:2): Group I (n=168) – included patients, who had a FFR <0.8 and were followed by PCI; Group II (n=264) – included patients with FFR >0.8 – received OMT and were under monitoring for up to 5 years. Inclusion criteria: stable angina II-III FK, post-MI, silent myocardial ischaemia. Concomitant diseases: diabetes mellitus (19.2%), multifocal atherosclerosis (21%), hypertension (27%), post-MI (24%), PCI in previously (15%). According to angiography, 44% had a one-vessel disease, 35% had two-vessel diseases, and 21% had a three-vessel disease. Primary endpoints: MACE (death, MI, repeated interventions). Observation periods: 6, 12, 24, 36, 48, 60 months. Long-term results were evaluated by repeated coronary angiography and measurement of FFR. During 6 and 12 months there was not a single case of MACE in either group. By the 18th month, conversion of 7% of cases from the OMT to the PCI group on the basis of FFR measurements was recorded. By the 24th and 36th months in the OMT group, PCI was performed in 12 and 21% of patients, respectively. By the 48th and 60th months, the number of such patients was 24 and 31%, respectively. Among the total number of performed PCI in Group II, 20% of them were due to unstable angina. Thus, over the entire observation period, 149 patients from Group II (56%) had PCI performed. The frequency of MACE in Group I to 36 months was 2.4%, and in Group II 18% (p<0.001). By the end of the observation period, the frequency of MACE in groups I and II was 4.2 and 31%, respectively (p<0.001). Multifactor analysis showed that with SYNTAX score>28, multifocal atherosclerosis, diabetes mellitus, MACE was significantly more frequent and there was a need to perform PCI in the long-term period.

Conclusions: The prognosis of patients with chronic coronary artery disease undergoing PCI, performed using measurement of FFR, is significantly better than in patients who were only on OMT.

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CORONARY INTERVENTIONS

Outcome of magnesium BRS implantation in ACS: a single-centre experience

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Aims: BRS, the newest coronary stent technology, seems to be an especially interesting treatment option in the setting of ACS.

Methods and results: The first 100 consecutive patients who underwent PCI with the Magmaris BRS in the settings of ACS were enrolled for analysis as a part of the Magmaris-ACS Registry. Clinical 30-day and 12-month FU was obtained by telephone contact. Mean age of the analysed group: 63.2±8.2 years, 86% male with typical risk factors of ACS; clinical presentation: 17% unstable angina and 83% non-ST-segment myocardial infarction; 90% TIMI 3 flow; 93% single lesion disease, 77% type A + B1 lesion according to AHA/ACC classification. Predilatation was performed in 100% of lesions with a non-compliant balloon. In total, 107 scaffolds at mean diameter 3.2±0.3 mm and length 21.1±3.3 mm were implanted for *de novo* lesions located in LAD (39%), LCx (22%), and RCA (39%), respectively. Post-dilatation was performed in 99% of lesions, with the non-compliant balloon 0.25–0.50 mm larger than the scaffold size. Preprocedural MLD was 0.96 mm, with mean 67.3 %DS. Post-procedural MLD was 2.44 mm, resulting in an acute gain of 1.48 mm. Angiographic success in the target lesion was 100%. OCT-guided PCI confirmed the significant proximal (3%) or distal (1%) edge dissection, and a regular metallic DES overlapping BRS or additional BRS were implanted in four cases (4%). Three cases (3%) of interim small side branch (SB) occlusion after implantation of BRS occurred. On discharge, all patients remained on dual antiplatelet therapy. Twelve-month follow-up available for 60% of patients revealed one case of scaffold restenosis treated by DES implantation (9 months after index PCI). All patients remained on prescribed DAPT for the whole period of observation.

Conclusions: BRS seems to be an especially interesting treatment option in the setting of ACS.

CORONARY INTERVENTIONS

The effect of adding excimer laser coronary angioplasty to DEB therapy for restenosis of DES

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Aims: To evaluate the efficacy of excimer laser coronary angioplasty (ELCA) for the treatment of in-stent restenosis (ISR) of drug-eluting stent (DES) with drug-coated balloon (DCB).

Methods and results: We investigated our coronary intervention cases of coronary drug-eluting stent restenosis. From May 2014 to January 2019, in 49 lesions (44 cases) revascularisation was performed for DES-ISR with DCB and follow-up angiogram. We defined the ELCA group as those who underwent ELCA before using DCB for ISR of DES and the non-ELCA group was defined as those who did not undergo ELCA. We compared ELCA group (n=17) and non-ELCA group (n=32) and retrospectively analysed the LLL and the TLR rate. The mean duration of follow-up CAG was 7.7±2.9 vs 8.7±6.2 months. There was no significant deference between the ELCA group and the non-ELCA group at follow-up in the LLL (0.17±0.79 mm vs 0.42±0.64 mm) and the TLR rate (17.6% vs 28.1%).

Conclusions: These data suggest that there was no adjunctive effect of adding ELCA before using DCB for ISR of DES.

CORONARY INTERVENTIONS

Two-year follow-up of provisional T-stenting of left main coronary artery in patients with true bifurcation stenosis

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Aims: To evaluate the long-term results of the use of drug-eluting balloon catheters in patients with left main (LM) bifurcation stenosis.

Methods and results: 142 patients with true bifurcations of the LM. Randomisation in 2 main groups: Group I (n=52) included patients who received kissing-dilatation with traditional NC balloon catheters and Group II (n=52), who had a kissing-dilatation of the main bifurcation artery with traditional NC balloon catheters, and a side branch – with drug-eluting balloon catheters. Retrospectively, the third (III) control group (n=38) was formed, where the two-stent technique was performed. Inclusion criteria: true LM bifurcation stenosis according to QCA and OCT; SYNTAX score <32. Primary endpoints: incidence of MACE – death, MI, reinterventions. Secondary endpoints: the incidence of restenosis and late stent thrombosis.

Results: after 24 months the total incidence of MACE was 11.5 vs 3.8% in groups I and II, respectively ($p<0.05$). When comparing the results in groups II and III, the frequency of MACE was 3.8 vs 13.2%, respectively ($p<0.05$). Restenosis of the side branch of more than 50% according to QCA was detected in 4 patients (7.7%) from Group I and in 1 patient (1.9%) from Group II ($p<0.05$). In patients from Group I, the average MLA in the side branch after 24 months was 5.58±1.34 and 4.12±1.21 mm^2, respectively ($p<0.05$), compared with data after PCI; in the main branch – 6.34±1.56 and 5.88±1.14 mm^2, respectively ($p>0.05$). In patients from Group II, the average MLA was, respectively, 5.38±1.24 and 5.12±1.44 mm^2 in side branch ($p>0.05$) and 6.68±1.75 and 6.36±1.22 mm^2 in main branch ($p>0.05$). When comparing the data of MLA in the side branch in groups I and II, there was a significant difference (4.12±1.21 vs 5.12±1.44 mm^2; $p<0.05$). There were no cases of late thrombosis of the stents.

Conclusions: The use of drug-eluting balloon catheters for provisional T-stenting in patients with true LM bifurcation stenosis was associated with significantly lower frequency of MACE and side branch restenosis, according to OCT data, compared with patients who used traditional NC balloon catheters for "kissing-dilatation" and two-stent technique strategy.

CORONARY INTERVENTIONS

Role of remote ischaemic conditioning in primary angioplasty: a randomised controlled trial

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Aims: We have tried to find out the role of remote ischaemic preconditioning in acute coronary syndrome patients who undergo primary angioplasty.

Methods and results: 284 patients satisfying the inclusion criteria were randomly included into interventional arm and control arm using block randomisation with 142 patients recruited in each arm. Remote ischaemic conditioning was done for patients in the interventional arm. The outcomes assessed were LVEF 24 hours post PCI and on discharge, troponin-T levels 24 hours after PCI, the percentage reduction in ST elevation, corrected TIMI frame count and myocardial blush grade after PCI as well as the rise in creatinine 48-72 hours after primary PCI. There was a significant difference for the endpoints of LVEF 24 hours after primary PCI and on discharge, the percentage reduction in ST elevation, troponin levels 24 hours after primary PCI, corrected TIMI frame count and myocardial blush grade with the intervention arm doing better ($p<0.05$). The difference remained significant irrespective of the type of MI. The intervention arm was also found to cause less contrast-induced nephropathy.

Conclusions: Remote ischaemic conditioning can preserve the LV systolic function, reduce enzymatic infarct size post-MI and improve microvascular function and reperfusion after primary PCI. It may also offer renal protection by reducing the contrast-induced nephropathy.

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CORONARY INTERVENTIONS

Use of a super high-pressure non-compliant percutaneous transluminal coronary angioplasty balloon in complex PCI procedures – three-year single-centre experience

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Aims: The aim of the study is to analyse the indications, performance and outcomes of a super high-pressure non-compliant PTCA balloon (OPN NC®; SIS Medical AG, Winterthur, Switzerland) in our centre.

Methods and results: The OPN NC®balloon was used in 33 patients from January 2016 to December 2018. Twenty-four were male and the mean age was 66. The clinical indication was stable IHD in 17 patients and acute coronary syndrome in 16 (including 2 STEMI). 21 patients had *de novo* lesions and the other 12 had a pre-existing stent. The OPN NC® was used for pre-dilatation alone in 15 patients, post-dilatation alone in 15 patients and for both in 3 cases. Prior dilatation with a regular NC balloon had been performed in 29 patients. IVUS was used in 23 procedures and OCT in 2. The balloon sizes used were 2.0 mm (4), 2.5 mm (7), 3.0 mm (12) and 3.5 mm (10). The median inflation pressure was 35 atm. The maximum pressure of 40 atm was used in 3 cases. In addition to the OPN NC® balloon, cutting balloon was also used in 3 patients and scoring balloon in 6 patients. The OPN NC® balloon was passed successfully in all 33 patients, although one patient required rotational atherectomy to enable balloon delivery. Following treatment with the OPN NC® balloon, a drug-eluting-stent was inserted in 21 patients and drug-eluting balloon in 9 patients, with 2 patients having only balloon angioplasty within pre-existing stents. One calcified proximal LAD with an old underexpanded stent was treated with a 3.5x10 mm OPN NC® balloon at 35 atm, followed by a drug-eluting-balloon. This resulted in a small perforation, requiring treatment with a covered stent.

Conclusions: The OPN NC® PTCA balloon is a safe and effective tool in the treatment of heavily calcified lesions and underexpanded stents. It should however be used with caution, especially at very high pressures and the operator should be vigilant for possible complications.

CORONARY INTERVENTIONS

Transradial coronary angiography in severe aortic stenosis: left vs right approach and 5 Fr vs 6 Fr diagnostic catheters

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Aims: The aim of the study was to evaluate the safety and feasibility of using the left radial compared to the right radial approach and 5 French (Fr) compared to 6 Fr diagnostic catheters.

Methods and results: 200 patients with severe AoS and without previous history of CABG (112 males, aged 73 years) underwent transradial coronary angiography. 136 were performed using the right (R) radial artery and 64 the left (L) radial artery, while 100 were performed using 5 Fr diagnostic catheters and 100 6 Fr diagnostic catheters. Thus, four groups of patients were formed (R5, R6, L5, and L6). The primary endpoints of the study were procedural success, fluoroscopy time (FT), dose-area product (DAP), number of catheters, and amount of contrast agent. One-way between groups analysis of variance showed statistically significant difference in mean scores of FT and DAP among the four groups [$F(3, 193) = 10.8$, $p<0.0001$ and $F(3, 192) = 4.8$, $p<0.05$, respectively]. *Post hoc* comparisons using the Tukey HSD test indicated that the mean FT and DAP for group R5 were significantly different from the other 3 groups (6.67±3.10 versus 3.06±1.89 minutes, $p<0.001$ and 38,627±16,423 versus 29,437±15,761 $Gycm^2$, $p<0.05$, respectively). Among the other three groups, the FT and DAP were not significantly different. There were no significant differences in procedural success, number of catheters, and amount of contrast agent among the 4 groups. Multiple linear regression revealed that radial approach, Fr diagnostic catheters and body mass index were the independent predictors of FT after controlling for other variables ($R2 = 0.378$, $p<0.001$).

Conclusions: Right radial approach in conjunction with 5 Fr diagnostic catheters is accompanied by augmented FT and DAP in patients with severe AoS undergoing coronary angiography. Furthermore, left radial approach and right radial approach with 6 Fr catheters may reduce FT and DAP. These findings imply that catheter size and radial approach should be taken into account in these patients.

CORONARY INTERVENTIONS

The impact of multiple stent implantation with novel abluminally coated sirolimus-eluting stent on one-year clinical outcomes of patients with AMI undergoing PCI: data from en-ABL e-registry

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Aims: We evaluate the impact of multiple stent implantation with Abluminus, a novel abluminally coated sirolimus-eluting stent with unique fusion technology (Envision Scientific) on one-year clinical outcomes of unselected patients with acute myocardial infarction (AMI).

Methods and results: 2,500 patients enrolled in a multicentre, prospective, real-world en-ABL e-registry. Among them 999 patients had acute MI. For current analysis patients were stratified based on number of implanted stents (≥2 stents) in the native coronary vessels. 228 patients with AMI had multiple stent implantation with Abluminus sirolimus-eluting stent while 771 patients were implanted with single stent. The primary endpoint of this analysis was MACE at one year. MACE comprised cardiac death, TV-MI and TLR/TVR. Secondary endpoints included definite or probable ST as defined by the Academic Research Consortium. We assessed 228 (22.8%) patients implanted with ≥2 stents for AMI while the remaining 771 patients were treated with single stent (77.2%). Patients treated with ≥2 had high prevalence of multivessel disease (58%). One-year follow-up data were available for 100% in patients with ≥2 stents implanted while it was achieved in 99.8% of patients treated with single stent. The incidence of MACE was reported as [3.1% vs 1.8%, p=0.290] respectively for both the groups. MACE components were reported as cardiac death [0.9% vs 0.6%, p=0.662], TV-MI [1.3% vs 0.6%, p=0.393] and TLR/TVR [0.9% vs 0.5%, p=0.624] respectively for both cohorts. The rate of ST was numerically higher in case of patients treated with multiple stents [2.2% vs 0.6%, p=0.054]. Definite ST occurred more frequently in both cohorts [1.8% vs 0.6%, p=0.085]. There was no statistical difference reported between both the cohorts in terms of MACE and ST.

Conclusions: The results of the present study revealed numerically higher rate of ST in patients treated with multiple stents for AMI compared to the patients treated with single stent. Yet, there was no statistically significant difference found between the studied cohorts suggesting that multiple Abluminus stent implantation had no impact on the one-year clinical outcomes in patients with AMI.

CORONARY INTERVENTIONS

The long-term outcome of NSTEMI patients treated with the Absorb BRS

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Aims: To investigate the long-term outcome of patients presenting with NSTEMI treated with the everolimus-eluting Absorb BVS in a high-volume interventional cardiology centre.

Methods and results: Between July 2012 and March 2016, 147 NSTEMI patients underwent PCI with a total of 200 Absorb BVS implanted for 150 lesions located in LAD (46%), LCX (27%), and RCA (27%), respectively. Median patient age was 60 (40 to 94) years, 77% male, 35% diabetes, 37% presented previous MI. Predilatation was performed in 88% of lesions with a non-compliant balloon. 25% of lesions required implantation of two or more overlapping scaffolds. In 3 patients multivessel stenting with the BVS during the index procedure was performed. In 82% of cases, the 3.0-3.5 diameter of BVS was used. Angiographic success in the TL was 100%. All patients remained on prescribed DAPT for 12-36 months after the index procedure. At a median FU of 48 months (mean 52±14 months), MACE occurred in 41 (27.9%) patients, all-cause death in 19 (12.9%) patients, MI in 21 (14.3%) patients, and TV revascularisation in 15 (10.2%) patients. Definite or probable scaffold thrombosis occurred in 3 (2%) patients.

Conclusions: Optimal Absorb BVS implantation in the NSTEMI population is associated with comparable rates of adverse events at long-term FU to metal DES implantation in this group of patients.

CORONARY INTERVENTIONS

Two-year clinical outcomes of sirolimus-eluting coronary stent in diabetic patients and its influencing factors: insights from en-ABL e-registry

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Aims: To assess the performance of Abluminus sirolimus-eluting stent (Envision Scientific) which has unique technology of coating on stent and parts of pre-crimped balloon in patients with DM and coronary artery disease.

Methods and results: 859 diabetic patients with coronary artery disease. Among them, 752 patients completed 2-year follow-up. The clinical outcome in terms of MACE is assessed for this cohort. Among 748 patients 76.3% were male and 60% patients had hypertension. More than half of the patients (60%) had ACS. Left anterior descending was most frequently treated artery (37.9%). 62.1% patients had lesions located in small coronary vessels (≤2.75 mm). The event-free survival was 97.2% at 2 years. MACE occurred in 21 (2.8%) patients including 13 (1.7%) TLR and 3 (0.4%) TVMI with 5 (0.7%) cardiac deaths reported. Logistic regression revealed that multiple stent implantation (Hazard ratio 3.832; 95% CI: 1.408 to 10.429; p=0.009) is associated strongly with increased MACE rate at 2 years. Hypertension (Hazard ratio 0.716; 95% CI: 0.294 to 1.740; p=0.460), acute coronary syndrome (Hazard ratio 0.907; 95% CI: 0.359 to 2.294; p=0.837), stable angina (Hazard ratio 0.512; 95% CI: 0.061 to 4.314; p=0.538), small vessel (Hazard ratio 4.040; 95% CI: 0.909 to 17.962; p=0.067) and long lesions (Hazard ratio 1.298; 95% CI: 0.435 to 3.877; p=0.640) are not strongly associated with increased incidence of MACE.

Conclusions: The implantation of Abluminus DES in real-world diabetic patients is associated with promising clinical outcomes with acceptable survival rate at 2 years.

CORONARY INTERVENTIONS

Outcomes of PCI and comparison of scoring systems in predicting procedural success for elderly patients with CTO

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Aims: The purpose of the study is to represent the clinical characteristics and in-hospital outcomes of PCI for elderly patients (≥75 years) with CTO diseases in contemporary era. Another aim is to assess different scoring systems in predicting procedural success in the real world.

Methods and results: 246 consecutive patients were stratified into elderly group (age ≥75 years, n=68) and non-elderly group (age <75 years, n=178). Compared to the non-elderly, the elderly patients with CTOs had heavier burden of comorbid conditions, manifesting higher rates of renal dysfunction, chronic lung disease, and also previous cerebral stroke. The target CTO lesions were most frequently located at the left anterior descending artery (LAD) in both the elderly group (52.94%) and the non-elderly group (44.94%). However, the percentage of cases with triple-vessel diseases and SYNTAX scores in the elderly group were significantly higher than those in the non-elderly group (73.53% vs 53.93%, p=0.005; 31.39±7.68 vs 27.85±7.16, p=0.001, respectively), indicating that the elderly CTO patients had seriously diseased coronary arterial lesions. Procedure time and contrast volume in the elderly group were less than those in the non-elderly group. The in-hospital MACE rates, vascular access complication rates and major bleeding rates were similar between elderly and non-elderly groups (1.47% vs 1.69%, p=1.000; 1.47% vs 0.56%, p=0.477; 2.94% vs 1.12%, p=0.306, respectively). The total procedural success rate was 81.71% in 246 CTO patients, which was statistically lower in elderly group than that in the non-elderly group (73.53% vs 84.83%, p=0.040). With increasing strata, procedural success rates significantly declined for all scoring systems in the entire patient population (p for trend<0.001). All four score systems showed moderate predictive capacity (AUC for J-CTO score: 0.806, p<0.0001; AUC for PROGRESS CTO score: 0.727, p<0.0001; AUC for CL score: 0.800, p<0.0001; AUC for ORA score: 0.672, p<0.0001, respectively). Compared to ORA score, J-CTO score and CL score showed significant advantage in the overall patient population.

Conclusions: Elderly patients with CTOs tend to have more severe complex lesions and heavier burden of comorbid conditions. All of J-CTO, PROGRESS, ORA and CL scoring systems possess moderate discriminatory capacity in predicting procedure success. Integration of multiple scoring systems would be helpful to evaluate procedural risk–benefit ratio accurately.

INTERVENTIONS FOR HYPERTENSION

Renal sympathetic denervation in patients with refractory arterial hypertension: two-year follow-up

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Aims: To evaluate the efficacy of the sympathetic renal denervation procedure in patients with refractory arterial hypertension and heart failure.

Methods and results: 72 patients with refractory arterial hypertension. Randomisation in 2 main groups: the Group I (n=36) included patients who underwent denervation procedure of the main trunk of the renal artery and the Group II (n=36) included patients who underwent denervation procedure in main trunk and also in second-order renal arteries. Additionally, patients were divided into 2 subgroups: the subgroup A (n=30) included patients who underwent denervation procedure with a Symplicity catheter, and the subgroup B (n=42) which included patients who underwent denervation procedure with a Vessix catheter. Also, the renal denervation procedure efficacy in patients with chronic heart failure (CHF) was analysed. In all groups, 24-hour blood pressure monitoring, echocardiography and a 6-minute walk test were monitored. Inclusion criteria: refractory hypertension, age of patients 18-85 years, systolic blood pressure (SBP) ≥140/90 mmHg and ≥130/90 mmHg in patients with diabetes mellitus, functioning kidneys, renal arteries ≥40 mm in diameter and the length of the site up to the first bifurcation of at least 20 mm, absence of stenoses in the renal arteries, GFR ≥40 ml/min/1.73 m², suitable anatomy of the renal arteries for endovascular procedure. 24-month result after the denervation procedure demonstrated significantly decreased SBP in patients of both groups. In Group I, it was, compared with pre-operative data (174.9±1.6 vs 151.7±2.3 mmHg, respectively; $p<0.05$), and in group II 181.9±2.1 vs 140.4±3.8 mmHg, respectively; $p<0.05$. However, when comparing SBP values between groups, SBP in Group I was significantly higher than in Group II (151.7±2.3 vs 140.4±3.8 mmHg, respectively; $p<0.05$). In addition, the average number of drugs in Group I decreased to 2.1±0.8 after 24th month, and in Group II to 1.4±0.6 ($p<0.05$). When comparing SBP value in subgroup A and subgroup B, the average daily SBP was also significantly different and amounted to 147.8±1.8 vs 138.4±3.2 mmHg, respectively; $p<0.05$. Among all the patients included in the study, 38 patients were with CHF. The 6-minute walk test results, compared with pre-operative data, showed a significant improvement and amounted to 321.24±83.22 vs 212.42±54.72 m, respectively; $p<0.05$.

Conclusions: Sympathetic renal denervation may be regarded as an effective method of treatment of patients with resistant hypertension, as well as patients with concomitant chronic heart failure. Performing denervation in the arteries of the second order significantly improves the prognosis of patients, and in patients with concomitant heart failure significantly increases the quality of life and exercise tolerance.

INTERVENTIONS FOR HYPERTENSION

The results of balloon angioplasty of the pulmonary artery in patients with chronic thromboembolic pulmonary hypertension

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Aims: To evaluate transcatheter balloon angioplasty of the pulmonary artery procedure for patients with chronic thrombembolic hypertension (CTEPH).

Methods and results: The study included 10 patients with CTEPH (6 men, 4 women, average age 55±11), with lesions of the distal type, who were denied pulmonary artery thrombectomy and a staged balloon angioplasty was performed. All patients take sildenafil therapy. According to the pressure data of the right heart chambers, the patients showed precapillary mild hypertension of the pPA 95±12.7 mmHg. All patients underwent 4-6 stages of balloon angioplasty of the branches of the pulmonary artery with a decrease in the New York Heart Association class from 3.2±0.5 to 1.9±0.2 ($p<0.001$). In the postoperative period the mean pulmonary artery pressures decreased from 54±14.2 mmHg to 30±10.2 mmHg ($p=0.007$) and there was a decrease in PVR from 15±3.3 Wood units to 2.5±0.7 Wood units ($p=0.007$). The incidence of complications (reperfusion pulmonary oedema) did not exceed 23%.

Conclusions: Transcatheter balloon angioplasty of the pulmonary artery is an effective and safe procedure on condition of the patient selection algorithm and methodology of procedure performance.

INTERVENTIONS FOR STROKE

Device hooks protrusion zone relative to pulmonary artery after LAA occlusion with AMPLATZER vs WATCHMAN device

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Aims: This study aimed to assess device hooks zone position within the LAA and its distance to PA in two occluders with varying design types.

Methods and results: Consecutive patients (n=57) after LAAO with AMPLATZER (n=30) or WATCHMAN (n=27) who underwent post-procedural cardiac computed tomography (CCT) between July 2015 and June 2018 were included. Demographic and clinical data were collected within a prospective, institutional LAAO Registry. Based on CCT images, position of hooks zone within the proximal 15 mm from LAA ostium was classified as shallow vs deep for more distal hooks zone position. The closest distance from device hooks protrusion zone to PA (hooks-PA) was measured and close proximity was defined as ≤2 mm. All 57 patients were analysed with 22 (38.6%) females and mean age of 72.9±10.2 yrs. Hooks protrusion zone of AMPLATZER device was found in shallow position within the LAA in 15 patients (50%), whereas all patients with WATCHMAN had deep hooks zone position (p<0.001). Hooks-PA close proximity was present in 11 (19.3%) patients, similarly in AMPLATZER vs WATCHMAN groups (5 [16.7%] vs. 6 [22.2%], p=0.74). Close hooks-PA proximity in shallow hooks zone position was found exclusively in AMPLATZER group (n=3, 10%).

Conclusions: Hooks protrusion zone is positioned more shallow within the appendage in AMPLATZER vs WATCHMAN but with similar frequency of close proximity to PA. Impact of device-specific hooks design and its position within the appendage on PA perforation risk needs further research.

INTERVENTIONS FOR VALVULAR DISEASE

Health-related quality of life following TAVI using transfemoral and transaortic approaches – single-centre study

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Aims: The aim of the study was to evaluate short- and long-term changes in quality of life status in patients undergoing transaortic TAVI procedure, in comparison to transfemoral TAVI and aortic valve replacement (AVR) patients.

Methods and results: 97 patients' samples were included in the study. 32 patients underwent transaortic TAVI procedure, 31 transfemoral TAVI procedure and 34 patients underwent AVR procedure. The quality of life status was assessed with EQ-5D-3L questionnaire at baseline, after 1-month and 1-year follow-up. The overall mean patient age was 80 (61-92) years and logistic EuroSCORE mean was 12.45% (1.39-78.98%). The analysis of baseline values compared to follow-up data showed a significant improvement of declared quality of life in all three groups (p<0.001). At baseline, up to 23.7% patients reported extreme problems in EQ-5D-3L questionnaire, mainly in pain and discomfort dimension, and up to 76.3% patients declared some problems before the procedure. Declared health state at baseline was significantly lower in transfemoral patients (TAVI TF) (p<0.001) and after 1 month there were no differences between the 3 groups (p=0.987). After 1 year, the AVR patients' results of EQ-5D-3L index value were lower in comparison to TAVI patients (p<0.05). There were significant differences between results of EQ-5D-3L index value for the period of time (TAVI Tao p<0.001; TAVI TF p<0.05; AVR p<0.05). In all groups, the values were significantly increasing after 1-month and 1-year follow-up, in comparison to baseline value. Significant differences were also found between visual analogue scale values (VAS) for TAVI TAo and AVR group (p<0.001) and TAVI TF and AVR (p<0.001) after 1 month and 1 year. AVR patients reported lower values of VAS; the two TAVI groups presented no differences between them.

Conclusions: A great improvement of quality of life status was presented in the following study for all three groups. Regardless of the TAVI approach, EQ-5D-3L index value and visual analogue scale values were significantly rising after 1-month and 1-year follow-up; the AVR patients, however, reported lower health status in comparison.

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INTERVENTIONS FOR VALVULAR DISEASE

Procedural and haemodynamic outcomes of the Portico transcatheter aortic valve in patients with adverse anatomy

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Aims: To evaluate procedural and 30-day outcomes of the first 50 cases treated with the Portico self-expanding valve (St. Jude Medical, St. Paul, MN, USA) in patients selected mainly on the basis of adverse aortic root and/or peripheral vascular anatomy.

Methods and results: Single-centre, retrospective report of the first 50 cases receiving the Portico valve at a tertiary care hospital. The Portico valve was initially selected for the following indications: (1) unfavourable annular or LVOT calcium; (2) small calcified sino-tubular junction (STJ), especially if concentric; (3) borderline sizing for a balloon-expandable valve; (4) small calibre ilio-femoral arteries; (5) predominant aortic regurgitation (AR), to take advantage of ascending aorta anchoring with this valve. Mean age of the patients was 84.4 with a slight female preponderance (64%). The mean EuroSCORE II was 8.7. 14% of patients had severe LV impairment. Adverse aortic root calcification was present in 22 (44%) cases on pre-procedural CT scans. There was left atrial appendage thrombus in 2 cases. There were 10 cases with a minimum mean ilio-femoral diameter ≤6.5 mm – the smallest being 5.3 mm. 38% of patients had a horizontal aortic root (annular plane angle >50°) and 18% had a low coronary height (≤12 mm). At 30 days, there was one death. The pre-procedural mean AV gradient of 46.3±16 decreased to 8.31±4.35 after implantation and 8.68±5.47 mmHg at 30 days. There was moderate AR in 8 patients – out of these, 2 patients had reduction in the degree of AR to mild on later follow-up at 6 months. This resulted in a rate of >mild AR of 12% at 6 months. There were no cases of severe AR. There was one case of subacute leaflet thrombus. The AV gradient improved to baseline at six months with oral anticoagulation, and the patient had no adverse sequelae.

Conclusions: In this cohort, with a high incidence of adverse aortic root and peripheral vascular anatomy, the Portico valve demonstrated excellent procedural safety and 30-day haemodynamic performance. There were no major vascular complications.