The SHOCC Study: SHOCkwave lithotripsy for patients with peripheral arterial disease

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Background
Intravascular lithotripsy (IVL) is an adjunct for treating severely calcified plaques by endovascular means. This is the first multicentre prospective study assessing outcomes using IVL as a primary treatment in patients with severely calcified lesions and chronic limb-threatening ischaemia across the NHS.

Methods
A multicentre prospective cohort-study was performed in eight NHS hospitals (consecutive patients). The primary outcome measured was vessel patency 90-days and six-months post-procedure. Impact of IVL on plaque morphology/consistency using computed-tomographic angiography (CTA) 3D plaque analysis was also assessed. This report details 90-day results.

Results
A total of 78 patients (mean age 72) with 92 lesions were recruited. Thirty-two (41%) had rest pain, 35 (45%) tissue loss, and 11 (14%) with claudication. Most lesions were femoropopliteal (51, 74%); 15 patients had multiple lesions treated (19%). All lesions were severely calcified on baseline CTA (PACSS-grading). All procedures were completed successfully using IVL as the primary preparation strategy, followed by angioplasty (plain or drug-coated). Stenting was performed in nine lesions (11%) post-IVL. Two participants (2.9%) required endovascular re-intervention within 30 days and one (1.4%) had a major amputation. At 90 days, two (2.9%) more minor amputations took place; no access, thromboembolic or cardiovascular complications were reported. Based on CTA plaque-analysis pre-/post-IVL (24 lesions), the calcium proportion/burden of treated plaques was reduced by a median 55%.

Conclusion
IVL in highly calcified lesions and patients with CLTI is safe, with promising 90-day results; IVL seems to change the morphology of calcified plaques in the immediate post-operative period.
The oxygenation status of calf and foot musculature predicts inadequate revascularisation in patients with limb ischaemia

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Background
Diagnosis/treatment algorithms for limb ischaemia rely solely on clinical signs and non-functional assessments. We have previously shown that calf muscle oxygenation, measured by Blood Oxygenation Level Dependent MRI (BOLD MRI), correlates with the severity of limb ischaemia. We aimed to develop BOLD for the foot and to determine calf/foot oxygenation after limb revascularisation.

Methods
T2*-weighted single-shot multi-echo BOLD MRI of the foot and calf at 3.0T were carried out prior to and up to 14 days after revascularisation by angioplasty/stenting or bypass surgery. Gradient (Grad), measured on T2* curve, indicated muscle oxygenation. Changes in calf/foot oxygenation were correlated with limb outcomes.

Results
48 patients [30 male, median age 73(59-88)] underwent pre-intervention foot BOLD scanning, with good inter-scan (P<0.0001) and inter-user (P<0.0001) reproducibility for Grad. CLTI patients had lower foot Grad than claudicants (P<0.0001). 56 patients [36 male, median age of 71(61–84)] had angiograms captured for collateral vessel assessment. 61 patients [40 male, median age=68(60-85)] had pre and post intervention BOLD of the calf and foot. Patients with unsuccessful revascularisation had a lower fold change in calf Grad (P<0.0001) and foot Grad (P<0.03). BOLD assessment of the Calf [sensitivity=82.14%(64.14%-92.12%), specificity=75%(46.77%-91.11%), P<0.0001] was superior to the foot [(n=21, sensitivity 100%(79.61%-100%), Specificity 66.67% (30%-94.08%), P=0.0051] for predicting unsuccessful revascularisation on follow up.

Conclusion
BOLD MRI is a reliable tool for assessing oxygenation in the calf and foot muscles of patients with limb ischaemia. Its role for identifying poorly oxygenated limbs after revascularisation merits further investigation.
Utility of intravascular ultrasonography in guiding intra-procedural decision-making

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Background
Intravascular ultrasonography (IVUS) use is increasing in endovascular infra-inguinal arterial interventions to aid accurate sizing of devices and identify significant residual disease. We aimed to evaluate our current practice and utility of intra-procedural IVUS as a decision-making aid during such interventions.

Methods
A retrospective review was performed of all infra-inguinal interventions involving use of IVUS between 2018 and 2021 with follow up to March 2023. Data were gathered on patient demographics and intervention. Outcomes measured were: 1) whether IVUS identified or guided further intervention intra-procedurally, 2) primary patency and limb outcomes.

Results
A total of 79 cases were included with a median age of 72.7 years and 30% were female. 96% of cases had chronic limb-threatening ischaemia. Levels treated were femoropopliteal only (n=30, 38%), tibial only (n=12, 15.2%) and femoropopliteal and tibial (n=37, 46.8%). Vessel preparation was performed in 45 (57%) cases, and 50 (63%) cases had target lesion stenting. IVUS identified a flow-limiting dissection not identified by angiography in 10 (13%) cases, with all leading to further treatment. IVUS identified a flow-limiting stenosis in 26 (33%) cases not identified by angiography, and guided further treatment in 21 (80.8%) of these cases. Median follow-up was 19.9 months with 27% cumulative mortality. Median primary patencies were 17.4 months for femoropopliteal cases, 12.4 months for tibial and 5.4 months for femoropopliteal and tibial.

Conclusion
Intra-operative IVUS can identify flow-limiting residual disease and guide further intervention in a substantial proportion of infra-inguinal endovascular procedures.
Endovascular revascularisation of "no-option" chronic limb-threatening ischaemia patients

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Background
Patients with chronic limb-threatening ischaemia (CLTI) often present with multi-level disease and might be deemed to have no revascularisation options. We report outcomes after endovascular revascularisation of limbs, previously deemed impossible to revascularise and subsequently referred to a tertiary complex peripheral arterial disease (PAD) service.

Methods
Overall, 57 consecutive patients [median age 71 years, 43 (75.4%) male, all with tissue-loss, diabetes, IHD, previous smoking history, multi-level TASC-D PAD; 14 (24.6%) on renal dialysis] underwent intervention, referred between 01/10/2019-31/12/2021 by other institutions once deemed impossible to revascularise. Of these, 91% had severely calcified PAD (PACSS ≥3). Procedures included femoro-popliteal stenting with retrograde access (22), SAFARI-technique (14), common-femoral lithotripsy with drug-coated ballooning (DCB) (8) and/or biomimetic stenting (1), femoral endarterectomy with aorto-iliac stenting and distal angioplasty (5), CERAB with distal angioplasty (2), femoro-popliteal atherectomy with DCB for in-stent occlusion (2), and CERAB with chimney endografting (1). Two patients underwent deep-venous arterialisation (DVA), following an inflow procedure.

Results
Overall, 55 procedures were completed successfully, with the exception of two DVAs. One peri-operative iliac rupture was treated with a covered stent. Fifteen patients (26.3%) developed acute kidney injury (stage 2). Thirty-day and one-year mortality was 3.5% and 10.5% (all cardiovascular causes). Thirty-day and one-year re-intervention rates were 1.8% and 24.6% (endovascular re-intervention), and 0% and 1.8% (hybrid re-intervention). At one-year there were 6 (10.5%) major amputations.

Conclusion
Using a wide repertoire of endovascular tools, an acceptable limb-salvage rate was maintained in this population of "no-option" CLTI patients, treated by a tertiary multidisciplinary-team.
Early experience of the Phoenix atherectomy device

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Background
Vessel preparation with rotational atherectomy is considered a safe and effective strategy for targeting complex infra-inguinal lesions. This study aims to report the early experience of using the Phoenix atherectomy device in a single centre.

Methods
A retrospective analysis of all cases incorporating Phoenix atherectomy between 2017 and 2021, with follow-up till end of 2022, was performed. Outcomes of interest were atherectomy-related complications, primary patency and 1 year freedom from major adverse limb events (f-MALE).

Results
A total of 66 cases with a median age of 69.5 years were included, of whom 24 (36%) were female. Target lesions were native femoropopliteal (23, 35%), femoropopliteal in-stent restenosis (12, 18%), native crural (30, 46%) and crural in-stent restenosis (1, 1%). Median lesion length was 193 [IQR 6 – 497] mm, mostly chronic total occlusions (52, 78.8%). The atherectomy device failed to cross the target lesion in 2 cases due to heavy calcification. Intra-procedural complications were perforation (5, 8%), dissection (12, 19%), distal embolization (6, 9%), and slow/no flow phenomenon (7, 11%). Bail-out stent rate was 31.8%, but 52.4% of these had <60% of the atherectomised segment stented. The median primary patencies were 12.8 months in femoropopliteal and 2.7 months in crural segments. Overall 1-year f-MALE was 81.1%.

Conclusion
Vessel preparation with the Phoenix atherectomy device demonstrated acceptable rates of intra-procedural complications, but primary patency rates were greatly superior in femoropopliteal compared to crural target lesions. fMALE was high in this cohort of mostly long occlusions.
Acute Deep Vein Thrombosis clearance: Is thrombolysis still being used?

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Background
Various treatment modalities for clot clearance are available to the clinician for the management of acute deep vein thrombosis (DVT). These include catheter directed thrombolysis (CDT), percutaneous pharma-mechanical thrombectomy and mechanical thrombectomy. The use of thrombolytic therapy carries a risk of major bleeding during the infusion period. It also requires greater hospital and human resources, requiring higher level of nursing care, length of stay for the duration of the infusion as well as repeat visits to the interventional radiography suite for assessment of thrombus clearance. The aim of the study was an epidemiological study assessing trends of treatment of acute DVT in a tertiary referral centre.

Methods
A retrospective analyses of a prospective collated database was performed to assess for trends in the treatment modality of the management of acute DVT. Patients treated for an acute DVT between 2014 and 2022 were included in the study.

Results
A total of 101 patients were treated for an acute DVT between 2014 and 2022 with varying modalities as presented below.

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<th>Year</th>
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Conclusions
In the past 18 months, this centre has weaned off the use of thrombolysis. This has decreased the resources needed to proceed with intervention and decreased patient exposure to potential life-threatening complications.