Drug eluting balloon angioplasty for arteriovenous haemodialysis access stenosis - systematic review and meta-analysis

Queen Elizabeth Hospital Birmingham
Part of University Hospitals Birmingham NHS Foundation Trust

Khawaja AZ, Cassidy DB, Al Shakarchi J, McGrogan DG, Inston NG, Jones RG

Introduction

Native or prosthetic arteriovenous (AV) fistulas are preferred for permanent haemodialysis (HD) access. These are marked with circuit steno-occlusive disease leading to dysfunction or even failure. Late failure rates have been reported as high as 50%. Standard angioplasty balloons are an established percutaneous intervention for HD access stenosis. Reported restenosis rates remain high and practice guidelines recommend a wide 6 month primary patency (PP) of at least 50% for any intervention. Neointimal hyperplasia is one of the main causes for access circuit stenosis. Drug eluting angioplasty balloons (DeB) have been proposed as an alternative intervention to reduce restenosis by local drug delivery and possible inhibition of this process.

PURPOSE

To systematically assess the reported efficacy and safety of DeB angioplasty in percutaneous management of prosthetic and autologous HD access stenosis.

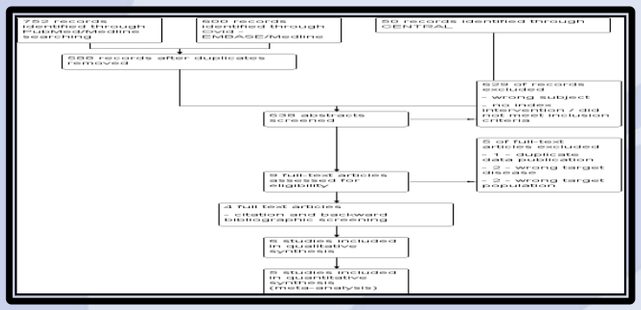

Figure 1.PRISMA Flowchart of study - electronic database of Medline, EMBASE and the Cochrane Central register of controlled trials

Material and Methods

Protocol was developed following the PRISMA-P 2015 statement. An electronic database (Medline, EMBASE, Clinical Trials.gov & Cochrane CENTRAL) search was conducted to identify articles reporting on the use of DeB intervention in HD AV access. Backward & forward citation search as well as grey literature search was performed. The MOOSE & PRISMA 2009 statement were followed for the reporting of results. Data from the included studies comparing DeBs with non-DeBs were reported separately on randomized and non-randomized studies. The odds ratio (OR) for each outcome was calculated from individual studies and pooled with the Mantel-Haenszal random-effects method. As selection bias can be a feature of cohort studies, this statistical model was decided to be an appropriate measure of outcome. Statistical heterogeneity was assessed with the Chi^2 test, with *P*-values <.10 suggesting significant heterogeneity. Inconsistency across the trials was assessed using I^2, where I^2<25% suggests mild, I^2 between 25% and 50% suggests moderate, and I^2>50% suggests extensive statistical inconsistency. Risk of bias assessment was carried out in duplicate using questionnaire assessment. Publication bias was visually inspection in Deeks' funnel plot.

Figure 2. Analysis of target lesion revascularization at 6 months using random effect model. TLR-target lesion revascularization, DeB – Drug eluting balloon, M-H - Mantel-Haenszal model, CI

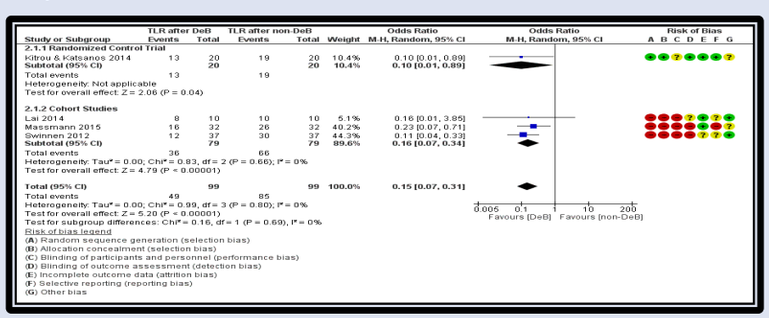

Figure 3. Analysis of target lesion revascularization at 12 months using random effect model and Risk of Bias assessment results.

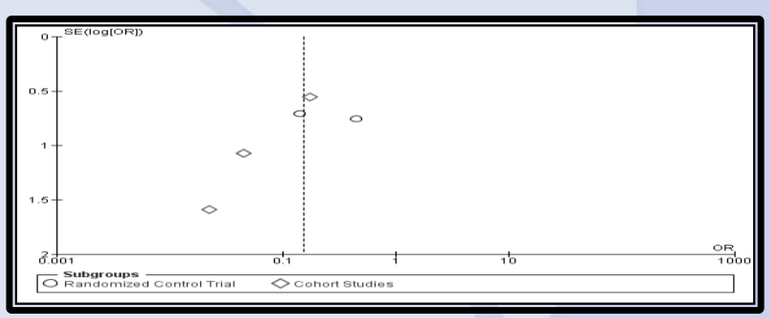

Figure 4. Deek's Funnel Plot of all included studies

Results

Six studies reported on 254 interventions in 162 participants (mean 27±10 SD). The pooled mean and median duration of follow up was 12 and 13 months (range 6-24 months). These comprised 2 randomized control trials (RCT) and 4 cohort studies. Participant mean age was 64±5 years and 61% were male. Target lesions (TL)s ranged from under 2mm to 5.9mm and 51 were reported as denovo stenosis. Device failure described as waisting of the DeB was reported in two studies (55% and 92.8%). At 6 months TL PP was reported between 70% to 97% for DeBs in the RCTs and cohort studies, and 0% to 26% for non-DeBs. TL treated with DeBs were associated with a higher primary patency at 6 months as compared to non-DeB balloons (RCTs: odds ratio [OR] 0.25, 95% CI 0.08 to 0.77 and I^2=19%, cohort studies: OR 0.10, 95% CI 0.03 to 0.31 and an I^2=20%). No procedure related major or minor complications were reported. Risk of bias assessment of the RCTs was low 57% (n=8/14 questionnaire assessment) or unclear 43% (n=6/14). The cohort studies were assessed to have a high selection, performance and detection bias (57%, 12/21) (figure 2,3). Visual assessment of publication bias with Deek's funnel plot is provided in figure 4 showing the variable results across the studies.

Conclusion

Current literature reports DeBs as being safe and may convey some benefit in terms of improved rate of restenosis when used to treat AV access disease. However, this body of evidence is small and clinically heterogeneous. A large multicentre RCT may help to clarify the role of DeBs in the percutaneous treatment of arteriovenous haemodialysis access stenosis.

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