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Radiology

TOTAL PERCUTANEOUS ENDOVASCULAR ANEURYSM REPAIR (PEVAR): SINGLE CENTRE EXPERIENCE

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ABSTRACT Endovascular Aneurysm Repair (EVAR) has become an accepted modality for therapy of aortic aneurysms offering lower morbidity and mortality as compared to open surgery. Totally percutaneous access for Endovascular Aortic Repair (PEVAR) has become possible with the use of suture mediated closure devices. We present a short series of PEVAR demonstrating the reliability and applicability of the technique with early ambulation (24 hours).

AIMS: To demonstrate practicality of total percutaneous access for Endovascular aneurysm repair with early ambulation.

SETTINGS AND DESIGN: Tertiary care centre in a metropolitan city. Retrospective analysis.

METHODS AND MATERIAL: All cases presenting with abdominal or thoracic aneurysms and/or aortic dissection where EVAR was judged possible based on anatomical factors and access vessel size were taken up for primary total PEVAR. All cases of PEVAR were selected and analysed.

RESULTS: 22 patients underwent PEVAR over a period of 2 years. All cases achieved haemostasis by percutaneous SMC placement. No complication on medium term follow up (1year to 1month) was noted in any patient undergoing PEVAR. One patient required surgical closure of the arteriotomy site while one patient had an access site pseudoaneurysm which required surgical management.

CONCLUSIONS: Total Percutaneous EVAR for aortic aneurysm repair appears to be feasible and safe.

KEYWORDS : Aortic Aneurysm, EVAR, Suture Mediated Closure, "Preclose"

INTRODUCTION:

Endovascular Aneurysm Repair (EVAR) for aortic aneurysms is a well- established technique. Due to the requirement of large size access ranging from 18F to 24F, this endovascular procedure is usually carried out with a surgical cut-down and closure of a femoral arterial access site. The use of Suture Mediated Closure (SMC) device Perclose Proglide (Abott) allows percutaneous suture placement for closure of arterial access sites of up to 24F. Here we present a short case series of our experience with the PEVAR technique.

SUBJECTS AND METHODS:

All cases presenting with abdominal or thoracic aneurysms and/or aortic dissection at our centre were taken up for primary total percutaneous endovascular repair (PEVAR). Vascular surgeon was available as a standby for all cases in event of failure of PEVAR.

Contraindications included uncorrected coagulopathy, severe calcification (as judged by the operator) at the femoral arterial puncture site, or any contraindication to endovascular procedure and / or use of iodinated contrast.

All procedures were carried out under local anaesthesia.

PEVAR was carried out unilaterally or bilaterally for all puncture sites of > 6F size in femoral arteries only. Bilateral closure was done for Abdominal aortic aneurysm therapy using a bifurcated endograft. Unilateral closure was done for Thoracic Aneurysm Repair where a unimodular device was used.

The technique used for PEVAR was pre-placement of the closure devices (Perclose Proglide, Abott Vascular) (Image1) after an initial 6F access was obtained. Devices were placed using a standard technique of placement of two devices for 20F or smaller access. Three devices were pre-placed for larger access (22F or larger).

EVAR was carried out in the standard fashion after upsizing to the required access size. Heparin was used in all cases at standard dosage. No reversal of heparinisation was done at the end of the procedure.

After completion of the procedure, the preplaced knots were tightened using the prescribed technique over a guidewire. (Image 3).

Guidewire was then removed and puncture site assessed for any haemorrhage or swelling. (Image 4).

Patients were followed up post EVAR as per usual protocol (Image 5).

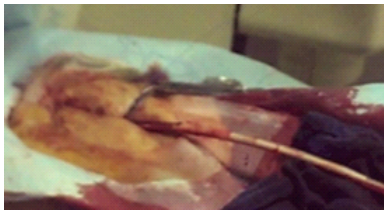

Fig 1 : Device deployment

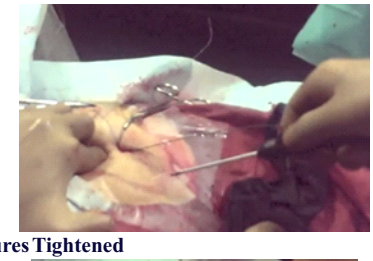

Fig 2: Sutures Tightened

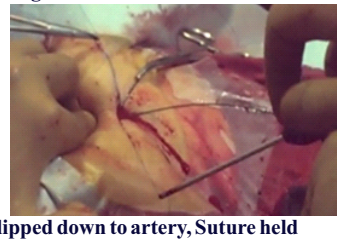

Fig 3: Knot slipped down to artery, Suture held

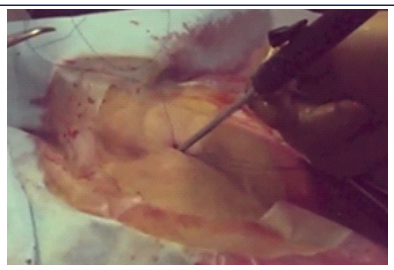

Fig 4: Knot tightened & sutures cut

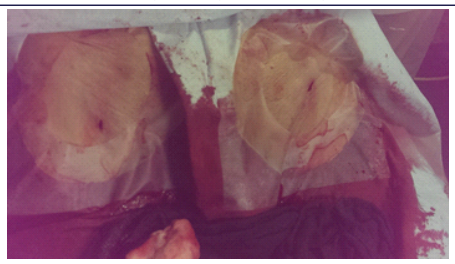

Fig 5: Final Outcome with hemostasis secured.

Results:

22 patients underwent PEVAR over a period of 2 years. All cases achieved haemostasis by percutaneous SMC placement. Demographic details of patients and salient features of the procedure along with the complications are detailed in the table (Table -1).

Table 1 : Details of cases.

	Age/ Sex	Indication for EVAR	Co morbidities	Anaesthesia	Access Size	Device Used	Complication
1	75M	Stanford B Dissection	CKD , Coeliac Artery Aneurysm	LA	24F	Zenith (Cook)	Nil
2	53M	Stanford B	Renal Dysfunction	LA with sedation	24F	Zenith (Cook)	Nil
3	77M	AAA	PAD	LA with sedation	18F	Endurant II (Medtronic)	Nil
4	56F	TAA	Hypertension	LA with sedation	22F	Valiant Captiva (Medtronic)	Nil
5	61M	AAA	Nil	LA with sedation	18F	Endurant II (Medtronic)	Nil
6	77M	TAA	Hypertension IHD	LA with Sedation	22F	Valiant Captiva (Medtronic)	Nil
7	73M	Juxtarenal AAA	IHD, CCF, CKD	LA with sedation	20F	Endurant II (Medtronic)	Nil
8	51M	AAA	TAA post TEVAR	LA with sedation	18F	Endurant II (Medtronic)	Pseudoaneurysm . Treated Surgically
9	61M	AAA	Hypertension	GA	18F	Endurant II (Medtronic)	Nil
10	45M	TAA	Nil	LA	22F	Zenith (Cook)	Nil
11	55M	Stanford B Dissection	ADPKD with Hypertension and Renal Dysfunction	LA	24F	Zenith (Cook)	Nil
12	59M	AAA	Post CABG, hypertension	LA	22F	Zenith (Cook)	Nil
13	62M	Thoraco-Abdominal Aneurysm	IHD	LA with Sedation	22F	Valiant (Medtronic)	Nil
14	74M	Thoraco-Abdominal Aneurysm	IHD, CKD	GA	24F	Valiant (Medtronic)	Nil
15	76M	AAA	IHD,CKD,PAD	LA with Sedation	22F	Endurant (Medtronic)	Sudden death (Cardiac arrest post procedure)
16	66M	Thoraco-abdominal aneurysm	IHD, PAD	GA	24F	Valiant(Medtronic)	Failure of Closure. Died of complications despite surgical closure.
17	55F	Stanford B Dissection	Hypertension	LA	22F	Valiant (Medtronic)	Nil
18	69M	TAA	Hypertension, post Debranching with extra-anatomic bypass	LA	24F	Valiant (Medtronic)	Died of sudden haemoptysis after 5 d
19	59M	Stanford B Dissection with thoraco-abdominal aneurysm	Renal Dysfunction, Post Interposition graft Thoracic aorta	LA with Sedation	24F	Valiant (Medtronic)	Died of Renal Failure
20	55F	Stanford B Dissection with Thoracic Aneurysm	Misplaced Thoracic Stent graft	LA with Sedation	24F	Valiant(Medtronic)	Nil
21	32M	Thoracic Aneurysm	-	LA	24F	Zenith (Cook)	Nil
22	62M	Thoracoabdominal Aneurysm	Hypertension, DMII	LA with Sedation	24F	Valiant (Medtronic)	Nil

Abbreviations:

AAA : Abdominal Aortic Aneurysm; TAA : Thoracic Aortic Aneurysm; TEVAR : Thoracic Endovascular Aneurysm Repair; EVAR : Endovascular Aneurysm repair ; CKD : Chronic Kidney disease
PAD : Peripheral Arterial Disease; IHD : Ischaemic Heart Disease; CCF : Congestive Cardiac Failure

Discussion:

The performance of Endovascular Aneurysm Repair (EVAR) has become an accepted technique of therapy for a majority of abdominal and thoracic aortic aneurysms with reduced operative morbidity, mortality and shorter hospital stay. [1] The devices used are of a larger size (12 – 24 French) and thus the procedures were initially carried out by surgical cut-down with a formal arteriotomy and repair of the access site at the Common Femoral Artery (CFA), or sometimes of the External Iliac Artery (EIA). [2] This procedure carries a significant morbidity of 14 – 22% with complications like haematoma, infection, dissection, thrombosis, pain and restriction of movement, lymphocoele etc. [3]

Suture Mediated Closure Devices (SMCDs) were designed for achieving percutaneous closure of a common femoral arterial access site by placing a non-absorbable suture across the arterial wall using a device introduced through the puncture site. The Perclose Proglide device (Abbott Vascular, Redwood City, California, USA) is the

current generation device in common use and is approved for access size of 6 F to 8 F as per the manufacturer. This device places a 3-0 polypropylene suture through the arterial wall at the puncture site. The delivered suture has a pre-placed knot that is then pushed down to the arterial wall and tightened using a supplied knot-pusher device. The knot is tightened to close the arteriotomy and the suture is trimmed using the knot-pusher device. [4]

Haas et al first described a technique of preplacing the suture using a suture-mediated device to achieve a total percutaneous closure of punctures up to 22 F. They used a device called the Prostar XL (Abbott Vascular, Redwood City, California, USA)[5]. Subsequently multiple smaller Perclose devices placed at differing angles at the puncture site were used to achieve the same result. [6] The technique of placing the suture through a small access and then dilating the access to the required size over a guidewire is known as the "Preclose" technique.

Over the succeeding decade, many case series describing the Preclose technique for PEVAR were published. A pooled analysis of 36 articles with 3606 access sites closed by using SMC devices showed an overall technical success rate of 94%. [7].

Factors that are predictive of failure of percutaneous closure in PEVAR are not well established. A retrospective review of 391 access sites where PEVAR was carried out showed that patients with anterior femoral artery calcification had significantly higher risk of failure of Preclose technique as compared to individuals with no anterior calcification or with posterior calcification. 62 out of these 391 cases had access sites larger than 20 F and these cases showed a higher conversion to surgical closure as well as a higher complication rate. The difference, however, did not achieve statistical significance. [8]. In our small series, the patients with extensive wall calcification underwent US guided access to avoid access through a calcified area.

Another single centre retrospective review of 400 access sites in 200 patients had 266 sites that were closed by SMC devices. Of these 32 sites (12%) required conversion to surgical closure. This study looked at a period of three years over which the use of PEVAR as compared to open access increased from 45.5% in the first year to 88.5% in the third year. Conversion rates to surgical closure in this period decreased from 24.3% to 4.3%. The significant predictors of conversion were female gender, moderate or severe calcification of the femoral artery and age of patient. The year of the procedure was also a significant predictor with higher rates in the first year as compared to last, showing the importance of operator experience in this series. [9]

In a comparison of surgical access with percutaneous access, the percutaneous group had a lower overall complication rate, even in patients with obesity or arterial calcification. [10]

A multicentre randomized prospective trial demonstrated non–inferiority of the Perclose Proglide device based PEVAR as compared to surgical access. The trial showed that 50 cases with PEVAR using Perclose Proglide had a success rate of 94% as opposed to 98% for 50 cases of surgical access. [11]

Complications were reported in 3.6% over the pooled series. The commonest reported complication was haematoma formation followed by pseudoaneurysms. 1.6% of the total 3606 access sites required open surgical closure. Other complications included infection, thrombosis, lower limb ischaemia or arterial stenosis, vascular dissection, seroma formation, vessel rupture, femoral neuropathy, distal embolization, vascular dissection, and arterio-venous fistula formation. [7]

We had one case of access site complication (pseudoaneurysm) in our short series which required surgical treatment. In one additional case, surgical closure of the arteriotomy site was required due to failure of Preclose.

All cases in our series were carried out under local anaesthesia, whereas surgical access usually is carried out under general or spinal anaesthesia. Our study is limited by being retrospective and having a relatively small sample size.

Conclusions:

Overall, percutaneous access for EVAR appears to be safe and reliable with need for caution in patients with extensive anterior wall calcification of the access artery. The use of ultrasound guided access may improve the likelihood of successful access site closure in these patients.

Key Messages: Total Percutaneous EVAR for aortic aneurysm repair appears to be feasible and safe. The use of ultrasound guidance enables precise selection of arterial puncture site with increased safety.

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