



Universitat de Girona

PERCUTANEOUS ACCESS VERSUS STANDARD FEMORAL EXPOSURE FOR ENDOVASCULAR ABDOMINAL AORTIC ANEURYSM REPAIR: A RANDOMIZED, CONTROLLED TRIAL

Final degree project

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*Gràcies a l'equip de Cirurgia Vascular de l'Hospital Dr. Josep Trueta de Girona,
per la implicació i dedicació que han mostrat durant les meves pràctiques al servei.*

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1. ABSTRACT

Background: The treatment of abdominal aortic aneurysm (AAA) has shifted from the exposure of the aorta artery in an open repair technique to a small groin cut in an endovascular repair. Recently, a percutaneous access for endovascular repair has appeared. This new technique aims to minimize the complications of the common femoral artery exposure, the patient discomfort and the length of hospitalization.

Objectives: To compare the proportion of discharged patients within the first 48 postoperative hours of two common femoral artery accesses for endovascular repair of AAA: the open exposure technique and the percutaneous technique. Secondary objectives include to evaluate the total procedure time, the femoral access complications, the need for extra analgesia and the patient satisfaction and groin discomfort of the two techniques.

Design: Randomized controlled trial conducted between 2014 and 2017

Participants: Patients diagnosed with abdominal aortic aneurysm with elective endovascular repair indication.

Keywords: PEVAR (percutaneous endovascular aneurysm repair); EVAR (endovascular aneurysm repair); preclose technique, proglide, femoral exposure

2. INTRODUCTION

An aneurysm is a focal vessel dilation that has a 50% increase of its normal diameter. In abdominal aorta, it is considered an aneurysm when its diameter exceeds 3 cm. When we talk about infrarenal abdominal aortic aneurysms, a 90% have degenerative etiology (1,2).

Abdominal aortic aneurysms can be classified in many ways (2):

- symptomatic or asymptomatic
- diameter (small < 5 cm, medium 5-7 cm, large >7 cm)
- fusiform (diffusely aneurysm) or saccular (protrusion of the vessel wall)

There are some risk factors for abdominal aortic aneurysms (from now, AAA). AAA is consistently related with male gender and increasing age. Other risk factors are smoking (OR>3), positive family history of AAA, ethnicity (AAA are more common in white men), hypercholesterolemia, hypertension, coronary heart disease, atherosclerosis, cerebrovascular disease and more recently genetics (variants of chromosome 9p21 and 4q31). Surprisingly, diabetes mellitus has a negative association with AAA development (3,4).

The following table shows risks factors associated with aortic aneurysm in population screening studies (3)

Study	AAA detected/ screened (%)		Age	Smoking	FH	Age	CHD	Cholesterol	Hypertension	Female	Black Race	Diabetes
ADAM ¹	1031/73 451	(1.4)	50–79	5.57	1.95	1.65	1.62	1.54	1.16	0.22	0.49	0.54
Rotterdam ^{11,12}	112/5283	(2.1)	≥55	3.10	NA	2.70	1.70	1.80	1.80	0.15	NA	0.71
Tromsø ¹³	337/6386	(5.3)	≥25	7.37	NA	3.31	NA	1.19	1.61	0.22	NA	NA
Genoa ¹⁴	70/1601	(4.4)	65–75	3.70	NA	NA	3.48	1.12	1.50	0.06	NA	1.02
Pittsburgh ²	451/4741	(9.5)	≥65	1.68	NA	1.31	1.85	NA	1.22	0.40	0.81	1.06
WA ¹⁵	875/11650	(7.5)	65–83	2.80	2.40	2.40	2.20	1.50	1.63	NA	NA	NA
Birmingham ¹⁶	219/2597	(8.4)	65–75	2.07	NA	NA	2.13	NA	1.24	NA	NA	0.83
Chichester ¹⁷	218/5392	(4.0)	65–80	1.56	NA	1.05	1.66	NA	NA	0.16	NA	0.80
Weighted mean	3313/111101	(4.0)	≥50	2.77	1.99	1.13	1.84	1.37	1.35	0.27	0.67	0.67
[CI]*		[3.9–4.2]		[2.48–3.10]	[1.61–2.46]	[1.10–1.16]	[1.68–2.02]	[1.26–1.49]	[1.24–1.46]	[0.23–0.31]	[0.54–0.82]	[0.58–0.77]

Some factors have an influence in AAA prevalence rates: age, gender and geographical location (4). In United States, the incidence of AAA is about 200,000 person-years and the reported prevalence is approximately 1% - 5,4% (2). AAA is estimated as the tenth leading cause of death worldwide (3).

The underlying problem of the abdominal aortic aneurysm is the progressive dilation and the risk of rupture. Other complications such as distal embolization, aortoenteric or aortocaval fistulae, iliac vein compression and deep vein thrombosis (DVT) are less common (3).

The rupture of an abdominal aortic aneurysm (rAAA) is the most feared complication. Its incidence is about 5,6 - 17,5 per 100,000 person-years in Western countries and the mortality is around 80-90% (4,5). Most patients with rAAA die before arriving to hospital. Its surgical treatment involves high risk and requires a lot of public health resources (6).

The goal of elective AAA repair is to prevent the rupture and to prolong patient's life.

There are some factors that need to be taken into account in order to select the most appropriate treatment: the risk of aneurysm rupture, the operative risk, the patient's life expectancy and the patient preferences. It is accepted that the most important

variable is AAA diameter because it is the best predictor of rupture (7). Several studies correlate the AAA size to the rupture risk as we can see in the following table (1):

Table 130-4 Range of Potential Rupture Rates for a Given Size of Abdominal Aortic Aneurysm	
AAA Diameter (cm)	12-Month Rupture Risk (%)
3.0-3.9	0.3
4.0-4.9	0.5-1.5
5.0-5.9	1-11
6.0-6.9	11-22
>7	>30

Guidelines recommend referring the following situations to vascular surgeon to start a surgical treatment: the abdominal aortic aneurysms greater than 5.5 cm, the developing of symptoms or the fast aneurysm growth (>1 cm/year). There is not any survival advantage of surgery in aneurysms up to 5.5 cm, and the surveillance with ultrasonography is safe. This is a general consideration because we also have to take into account other factors as previously said. Women, for example, have greater risk to aneurysm rupture than men, and the threshold of 5.5 cm diameter has to be reduced (4,7).

Once the indication of surgical treatment has been established, there are some options. All repairs involve putting in an artificial graft, a fabric-composed tube, in order to reinforce the artery wall (8).

Since the fifties, open repair technique has been the chosen treatment for abdominal aortic aneurysm (9). Open repair requires a laparotomy, the exposure of the aorta, and the clamping of proximal and distal sites of the aorta and iliac arteries. Then the aneurysm is opened and a graft anastomosis is made. To finish, the aneurysm sac is closed over the graft to protect it (9).

This technique involves a large incision, incurs a lengthy convalescence of 2-3 months (10), and the early mortality rate in combined studies is around 3,5% (9). Open repair complications are decreasing in frequency nowadays; however, they involve high morbidity (11)

Nowadays, open repair approach is only reserved for patients who cannot undergo endovascular repair, mostly, for anatomic reasons (e.g. hostile aortic neck or narrowed aortic bifurcation). Because of that, a detailed preprocedural anatomic evaluation by CT scanning with 3D reconstruction is needed (9).

In 1991, Parodi et al reported their initial experiences with another option to treat an AAA: endovascular repair (8). This technique appears as a less invasive alternative to the open surgical repair (7) and radically transformed the vascular surgery field.

Endovascular abdominal aortic aneurysm repair (EVAR) consists of placing a stent-graft in the aorta to exclude the aneurysm from the arterial circulation (12). With this, the pressure on the walls is reduced and the risk of aneurysmal rupture decreases.

To place the stent-graft in the aorta it is necessary to introduce large sheaths for delivery bulky devices; because of that, the common femoral artery (CFA) has to be surgical exposed for vessel control (13) (Annex 1). The components of the endovascular graft are advanced over the guidewires and deployed under radiographic control (8).

The safety and the efficacy of EVAR has been demonstrated, also, perioperative morbidity is reduced with EVAR if compared with the open repair technique, with fewer major adverse events (7,14). Due to this less-invasive approach, EVAR has demonstrate short-term advantages (e.g. less blood loss, decreased length of hospital

stay, more rapid recovery) (11). Despite this, EVAR results do not appear to be as enduring as open repair ones, narrow postoperative surveillance is needed and sometimes it is necessary to correct graft-complications in a reintervention (10).

The early mortality rate is lower in EVAR, but the re-intervention rate is higher. In available studies which compare EVAR vs open repair, the long-term outcomes are not different in the two techniques after 2 years (11,14,15).

Overall complications rates after EVAR are 30% and the rate of late complication requiring intervention is 2-3%. EVAR requires close monitoring with CT scan to detect any complication: persistent aneurysm growth, new aneurysms, device migration and kinking, graft thrombosis, stentgraft infection or endoleak (12).

Today, EVAR is a very good option to repair AAA with low mortality and morbidity; however, the exposure of the common femoral arteries involves significant local groin wound complication such as hematoma, thrombosis, dissection, seroma, femoral nerve injury, wound infection, prolonged pain and others (13,16,17).

To avoid these groin wound complications, even less invasive techniques have appeared. In 1999, it was reported the percutaneous approach to endovascular surgery (8,18).

Percutaneous endovascular aneurysm repair (PEVAR) avoids the open exposure of the common femoral artery. This technique consists in making a small hole in the skin with a needle to reach the common femoral artery and, when the vascular access is achieved, the exclusion of the aneurysm with the endograft is performed as usual (8) (Annex 1). To achieve the vessel control and arteriotomy closure different suture-

mediated arterial closure devices (SMCDs) such as Prostar XL® (Abbott) or the off-label use of Perclose ProGlide® (Abbott) exist.

There are not absolute contraindications to PEVAR but there are some unfavorable anatomical features that hinder the technique: high femoral bifurcation, need for frequent introducer sheath changes, severely scarred groin, significant proximal iliac occlusive disease, small iliofemoral arteries (<6 or 7 mm diameter), inguinal vascular graft or anterior calcifications of the common femoral artery (CFA) (13,17,19). There is a significant association between CFA calcification and access failure. The failure rates range from a 83.3% if a <50% anterior calcification exists to 0.9% for no femoral calcification (20).

Some multicenter trials (21,22) and a systematic review (16) concluded that PEVAR (performed by any suture-mediated closure device) is a safe and feasible technique to abdominal aortic aneurysm repair in selected patients. It is reported a technical success rate of 94% (13,20,23).

A recent multicenter randomized controlled trial concluded the noninferiority of PEVAR versus EVAR with regard to treatment success in the first 6 postoperative months (22). Supporting this, a 2014 review found equivalence and not necessarily superiority of PEVAR with regard to the early mortality and aneurysm exclusion (8).

Moreover, it is reported the low incidence of major access-related complications, the reduction of the time to hemostasis and procedure completion significantly (16). These results are obtained with ProGlide® device but not with Prostar XL® (22). Nonsignificant trends favoring PEVAR were observed with respect to blood loss and time to discharge (22).

This conclusion is supported by a recent systematic review of percutaneous access for EVAR that cites the potential for a shorter procedure time, less postoperative pain and a lowered risk of wound complications (16,17). In numbers, a systematic review and meta-analysis (13) found that the groin complication rate was 3.6% in the PEVAR group and 14.1% in EVAR group. It also concludes that the ultrasound-guided femoral artery access increases the technical success and it decreases with increasing sheath size (13,16,17).

Also, the systematic review shows that most studies used the ProstarXL device but the fact is that, taking into account the few studies with ProGlide device, the percutaneous closure success rate and the complication rate was better with ProGlide (16,22). The Perclose ProGlide® device is an effective, simple and easy-to-learn technique (18).

Keys to success with percutaneous technique are intensive operator experience and careful patient selection (22,24).

With these results, it is clear that PEVAR is safe and feasible nowadays but more evidence is needed to conclude its benefits regarding standard femoral exposure in EVAR.

3. JUSTIFICATION

Because of the high prevalence and mortal complications of abdominal aortic aneurysms and the consequent impact in the risk population, it's essential to treat them at an early time.

There are some surgical options and PEVAR has expectations to become the chosen technique for nonemergency AAA repairs in selected patients; however, it is not widely adopted in all vascular surgery services.

This less invasive technique (compared to EVAR) carries less vascular access complications such as infections or dehiscence, provides less hospitalization time, saves suture removal and decreases patient postoperative discomfort. By contrast, surgeons have less experience with PEVAR and they have more restlessness about the arterial suture failure. Besides, an initial investment in closure devices is needed; therefore it is a more expensive technique.

Many studies concluded the non-inferiority of PEVAR regarding to open femoral exposure (22). It is a safe and effective technique but not better than EVAR. Then, more evidence is required.

In the comparison of EVAR technique and PEVAR technique, some studies included the length of hospital stay as a variable without obtaining statistically significant results (16,22,24).

Our primary objective with this study is to show that a significant difference in length of hospital stay exists. The literature notes that the hospitalization length with PEVAR technique can be less than 2 days (1.4 ± 0.6) (21).

Other non-priority objectives are included in this trial. Some studies found a significant decrease of access related complications (16,22) but the results in other studies are not significant (8). Further information is needed; for that reason, femoral related complications are included as a variable. Procedure time is not included in all reviewed studies but significant differences between groups are found (16,22).

In our trial, the need for analgesia has been included because a lower analgesia requirement is found in PEVAR group without significant results (22).

In summary, in this study we aim to add evidence to extend the use of PEVAR technique. We want to verify the obtained results and implement the PEVAR technique as the standard AAA repair method in selected patients in the vascular surgery service of Hospital Josep Trueta of Girona.

4. BIBLIOGRAPHY

1. Holt PJE, Thompson MM. Abdominal Aortic Aneurysms : Evaluation and Decision Making. In: Rutherford's Vascular Surgery. 8 ed. Philadelphia: Elsevier; 2014.
2. Cooper A. Endovascular repair of abdominal aortic aneurysm. Crit Care Nurse. 2014 Aug;34(4):87–92.
3. Golledge J, Muller J, Daugherty A, Norman P. Abdominal aortic aneurysm: pathogenesis and implications for management. Arterioscler Thromb Vasc Biol [Internet]. 2006 Dec [cited 2014 Sep 30];26(12):2605–13. Available from: <http://atvb.ahajournals.org/content/26/12/2605.full.pdf+html>
4. Moll FL, Powell JT, Fraedrich G, Verzini F, Haulon S, Waltham M, et al. Management of abdominal aortic aneurysms clinical practice guidelines of the European society for vascular surgery. Eur J Vasc Endovasc Surg [Internet]. 2011 Jan [cited 2014 Jul 10];41 Suppl 1:S1–S58. Available from: [http://www.ejves.com/article/S1078-5884\(10\)00560-5/pdf](http://www.ejves.com/article/S1078-5884(10)00560-5/pdf)
5. Hoornweg LL, Storm-Versloot MN, Ubbink DT, Koelemay MJW, Legemate D, Balm R. Meta analysis on mortality of ruptured abdominal aortic aneurysms. Eur J Vasc Endovasc Surg [Internet]. 2008 May [cited 2014 Oct 4];35(5):558–70. Available from: [http://www.ejves.com/article/S1078-5884\(07\)00745-9/pdf](http://www.ejves.com/article/S1078-5884(07)00745-9/pdf)
6. Mehta M, Byrne J. Abdominal Aortic Aneurysms : Ruptured. In: Rutherford's Vascular Surgery. 8 ed. Philadelphia: Elsevier; 2014.
7. Brewster DC, Cronenwett JL, Hallett JW, Johnston KW, Krupski WC, Matsumura JS. Guidelines for the treatment of abdominal aortic aneurysms. Report of a subcommittee of the Joint Council of the American Association for Vascular Surgery and Society for Vascular Surgery. J Vasc Surg. 2003 May;37(5):1106–17.
8. Jackson A, Se Y, Clarke M. Totally percutaneous versus standard femoral artery access for elective bifurcated abdominal endovascular aneurysm repair. Cochrane Database Syst Rev. 2014;(2).
9. Woo EY, Damrauer SM. Abdominal Aortic Aneurysms : Open Surgical Treatment. In: Rutherford's Vascular Surgery. 8 ed. Philadelphia: Elsevier; 2014.
10. Epstein D, Sculpher MJ, Powell JT, Thompson SG, Brown LC, Greenhalgh RM. Long-term cost-effectiveness analysis of endovascular versus open repair for abdominal aortic aneurysm based on four randomized clinical trials. Br J Surg. 2014 May;101(6):623–31.

11. Chahwan S, Comerota AJ, Pigott JP, Scheuermann BW, Burrow J, Wojnarowski D. Elective treatment of abdominal aortic aneurysm with endovascular or open repair: the first decade. *J Vasc Surg* [Internet]. 2007 Feb [cited 2014 Oct 4];45(2):258–62; discussion 262. Available from: [http://www.jvascsurg.org/article/S0741-5214\(06\)01825-8/pdf](http://www.jvascsurg.org/article/S0741-5214(06)01825-8/pdf)
12. Picel AC, Kansal N. Essentials of endovascular abdominal aortic aneurysm repair imaging: postprocedure surveillance and complications. *AJR Am J Roentgenol* [Internet]. 2014 Oct [cited 2014 Oct 4];203(4):W358–72. Available from: <http://www.ajronline.org/doi/pdf/10.2214/AJR.13.11736>
13. Jaffan AA, Prince E, Hampson CO, Murphy TP. The preclose technique in percutaneous endovascular aortic repair: a systematic literature review and meta-analysis. *Cardiovasc Intervent Radiol*. 2013 Jun;36(3):567–77.
14. Piffaretti G, Mariscalco G, Riva F, Fontana F, Carrafiello G, Castelli P. Abdominal aortic aneurysm repair: long-term follow-up of endovascular versus open repair. *Arch Med Sci* [Internet]. 2014 May 12 [cited 2014 Oct 4];10(2):273–82. Available from: <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4042047/pdf/AMS-10-22708.pdf>
15. Fairman RM, Wang GJ. Abdominal Aortic Aneurysms : Endovascular Treatment. In: Rutherford's Vascular Surgery. 8 ed. Philadelphia: Elsevier; 2014.
16. Malkawi H, Hinchliffe RJ, Holt PJ, Loftus IM, Thompson MM. Percutaneous access for endovascular aneurysm repair: a systematic review. *Eur J Vasc Endovasc Surg* [Internet]. 2010 Jun [cited 2014 Oct 4];39(6):676–82. Available from: [http://www.ejves.com/article/S1078-5884\(10\)00065-1/pdf](http://www.ejves.com/article/S1078-5884(10)00065-1/pdf)
17. Georgiadis GS, Antoniou G, Papaioakim M, Georgakarakos E, Trellopoulos G, Papanas N, et al. A meta-analysis of outcome after percutaneous endovascular aortic aneurysm repair using different size sheaths or endograft delivery systems. *J Endovasc Ther* [Internet]. 2011 Aug [cited 2014 Oct 4];18(4):445–59. Available from: <http://jevtonline.org/doi/pdf/10.1583/11-342.1>
18. Dosluoglu HH, Cherr GS, Harris LM, Dryjski ML. Total percutaneous endovascular repair of abdominal aortic aneurysms using Perclose ProGlide closure devices. *J Endovasc Ther* [Internet]. 2007 Apr [cited 2014 Oct 4];14(2):184–8. Available from: <http://jevtonline.org/doi/pdf/10.1583/1545-1550%282007%2914%5B184%3ATPEROA%5D2.0.CO%3B2>
19. Sternbergh WC. Technique : Endovascular Aneurysm Repair. In: Rutherford's Vascular Surgery. 8 ed. Philadelphia: Elsevier; 2014.
20. Manunga JM, Gloviczki P, Oderich GS, Kalra M, Duncan A, Fleming MD, et al. Femoral artery calcification as a determinant of success for percutaneous access for endovascular abdominal aortic aneurysm repair. *J Vasc Surg*. 2013 Nov;58(5):1208–12.

21. Krajcer Z, Nelson PR, Bianchi C, Rao V, Morasch MD BJ. Percutaneous endovascular abdominal aortic aneurism repair. *J Cardiovasc surg.* 2011;52:651–9.
22. Nelson PR, Krajcer Z, Kansal N, Rao V, Bianchi C, Hashemi H, et al. A multicenter, randomized, controlled trial of totally percutaneous access versus open femoral exposure for endovascular aortic aneurysm repair (the PEVAR trial). *J Vasc Surg.* 2014 May;59(5):1181–93.
23. Lee WA, Brown MP, Nelson PR, Huber TS. Total percutaneous access for endovascular aortic aneurysm repair (“Preclose” technique). *J Vasc Surg [Internet].* 2007 Jun [cited 2014 Oct 1];45(6):1095–101. Available from: [http://www.jvascsurg.org/article/S0741-5214\(07\)00145-0/pdf](http://www.jvascsurg.org/article/S0741-5214(07)00145-0/pdf)
24. Mousa AY, Campbell JE, Broce M, Abu-Halimah S, Stone P, Hass SM, et al. Predictors of percutaneous access failure requiring open femoral surgical conversion during endovascular aortic aneurysm repair. *J Vasc Surg.* 2013 Nov;58(5):1213–9.

5. HYPOTHESES

5.1. PRIMARY HYPOTHESIS

The proportion of discharged patients from hospital on the second post-operative day will be higher in PEVAR group than in EVAR group.

5.2. SECONDARY HYPOTHESES

PEVAR group will have lower proportion of femoral access complications and less total operating time, need for extra-analgesia and groin discomfort. Global patient satisfaction will be higher in PEVAR group than in EVAR group.

6. OBJECTIVES

6.1. PRIMARY OBJECTIVE

This study aims to compare the discharged patient proportion on the second postoperative day in the following two endovascular abdominal aortic aneurysm repair techniques: PEVAR (percutaneous endovascular aneurysm repair) and EVAR (endovascular aneurysm repair) in Hospital Universitari Dr. Josep Trueta patients.

6.2. SECONDARY OBJECTIVES

- To evaluate the total procedure time.
- To compare the extra analgesia need during the admission.
- To evaluate femoral access complications such as infection, hematoma, hemorrhage, arteriovenous fistula, thrombosis, seroma and dehiscence.
- To evaluate the global patient satisfaction and groin discomfort asked in the first month postoperative control.

7. METHODS

7.1. DESIGN

A simple-blind clinical trial with randomized sample distribution: the percutaneous approach or the femoral exposure for AAA endovascular repair.

7.1.1. RANDOMIZATION METHODS

We will use a computer generated randomization with the SPSS software. The investigator will not have access to the randomization sequence and will not be aware of which femoral approach will be the following in order to avoid selection bias.

Access to computerized information of the following surgery will be opened to the investigator 24 hours before the day of the surgery, when all the preoperative is finished.

7.1.2. DEGREE OF BLINDING

This will be a simple blind trial; only patients will not be aware of the type of intervention they receive. Vascular surgeons must know which technique they will apply, so it is not possible to preserve the surgeon's blinding.

To minimize the bias of simple blind, the statistical consultant will not have access to this information.

7.2. STUDY POPULATION

In our study we will include patients diagnosed with abdominal aortic aneurysm and elective endovascular repair indication in Hospital Universitari Dr. Josep Trueta Hospital of Girona.

7.2.1. INCLUSION CRITERIA

- Men or women at least 18 years old
- Patients diagnosed with abdominal aortic aneurysm (AAA) by CT scan with a diameter above 5 cm or rapidly expanding ($>1\text{cm/year}$)
- Infrarenal location of the aneurysm
- Degenerative (atherosclerotic) etiology of the aneurysms
- Only patients undergoing elective surgery will be included in our study. We will not consider emergency surgeries for a ruptured abdominal aortic aneurysm.
- The trial will include patients in the province of Girona which are referred to the Hospital Universitari Dr. Josep Trueta to be diagnosed and treated by the vascular surgeons.
- Patients have to understand and sign informed consent form; otherwise they will not be included.

7.2.2. EXCLUSION CRITERIA

- Require the use of devices of 22F or more will be excluded because the percutaneous technique is not possible.

- Patients with calcification of the anterior wall of the common femoral artery target area or it occupies >50% of the posterior wall have an unsuitable anatomy to percutaneous technique and will be excluded.
- Patients undergoing the implantation of an aorto-mono-iliac graft
- Morbid obesity (body mass index greater than 40)
- Life expectancy < 1 year (judged by the investigator)
- Known allergy to any device component
- Coagulopathy or bleeding disorder
- Connective tissue disease
- Active systemic or localized groin infection
- Femoral artery aneurysm or arteriovenous fistula
- Prior common femoral artery surgery with groin incision

7.3. SAMPLING

7.3.1. PATIENT SELECTION

The sample recruitment will take place at Hospital Universitari Dr. Josep Trueta of Girona for 3 years. A consecutive non-probability sampling will be taken.

Patients with a non-ruptured infrarenal AAA and an endovascular repair indication will be potential candidates for our study.

Patients who meet all the inclusion criteria and none of the exclusion criteria will receive an information sheet describing the study (Annex 2). If the patient is interested

to participate in our study, we will provide them the informed consent form (Annex 3). Patients must be informed that it is entirely voluntary to participate in the study and their decision will not condition the treatment they receive.

Patient information sheet and informed consent form will be available in Catalan and Spanish.

7.3.2. SAMPLE SIZE

Accepting an alpha risk of 0.05 and a beta risk of less than 0.2 in a two-sided test, 28 subjects in the first group and 28 in the second group (56 in total) are needed to detect a minimum relative risk of 2.0. It is expected that the proportion of discharged patients from hospital at the second postoperative day will be an 80% in group 1 and a 40% in group 2.

Because we will measure the variable in the first week postoperative, it is not expected a high proportion of tracking loss rate. We accept that it is possible to have some perioperative death of a patient, so it is estimated a tracking loss rate of 1%.

Sample size has been calculated with GRANMO.

7.4. VARIABLES

7.4.1. INDEPENDENT VARIABLE

The independent variable of this study is to be allocated in the PEVAR group or in the EVAR group for abdominal aortic aneurysm repair. This is a dichotomous qualitative variable.

7.4.2. DEPENDENT VARIABLE

The proportion of discharged patients on the second postoperative day in the Hospital Universitari Josep Trueta of Girona.

This is a dichotomous qualitative variable; patients will be categorized in two groups: patients discharged in the first 48 postoperative hours and patients discharged after the 48 postoperative hours.

7.4.3. SECONDARY VARIABLES

- Total procedure time (min):

This is a continuous quantitative variable and it will be measured as the time between the skin incision or puncture until the skin closure.

- Need for extra-analgesia during the admission (yes/no):

The usual analgesia medication consists in a 2 g intravenous metamizol each 8 hours alternated to 1 g intravenous paracetamol each 8 hours. Tramadol is used as rescue treatment (50-100 mg iv).

The extra-analgesia need is defined as the requirement for analgesic medication added to the usual in order to control the patients' pain. It will be measured as a dichotomous qualitative variable.

- Femoral access complication (yes/no):

It is defined as the occurrence of any of the following complications: infection, hematoma, hemorrhage, arteriovenous fistula, thrombosis, seroma and dehiscence. It will be measured as a dichotomous qualitative variable.

- Global patient satisfaction and groin discomfort asked in the first month postoperative control.

It is a discrete quantitative variable. Patients will indicate their global satisfaction with the surgery and the degree of groin discomfort with punctuation of 0 to 5. (Annex 5).

7.4.4. COVARIATES

- Gender (male or female)
- Age (years)
- Body mass index (kg/m^2)
- Abdominal perimeter (cm)
- Maximum aneurysm diameter (mm)
- Proximal neck length (mm):

The measurement should be taken from the level of the lowest renal artery to the aneurysm beginning.

- ASA classification:

It is classification system used by the American Society of Anesthesiologists (ASA) to estimate the risk induced by the anesthesia for various patient conditions.

In our trial, patients will be categorized in two groups: ASA class 1 or 2 and ASA class 3, 4 or 5.

- Sheath size (Frenches):

It is defined as a dichotomous qualitative variable. Patients will be categorized in two groups: sheaths < 18 F and sheaths \geq 18F.

7.5. DATA COLLECTION

FIRST VISIT

Patients will come to vascular consults to be assessed for a suspected abdominal aortic aneurysm. Vascular surgeon will establish if there is surgical indication.

In the same visit, in order to collect all patients' data, an anamnesis and a physical exploration will be done. The physician will ask about demographics, personal and familiar history, tobacco consumption and regular drugs.

A nurse will register physical exploration data. Height and weight will be measured with a mechanical scale with a stadiometer. Abdominal perimeter will be measured with a measuring tape. Blood pressure and heart rate will be evaluated with an electronic tensiometer (Omron®).

Contrast enhanced CT scanning will be scheduled to all patients, although patients have been subjected a previous one. CT machine is a Philips Ingenuity™, multislice with 64 detector rows. To evaluate aorta artery we will need slices thickness of 1 mm with 0.5 mm intervals.

SECOND VISIT

CT scan images will be reviewed and the vascular surgeon will decide if the patients are suitable for endovascular repair and if they meet all the inclusion criteria and none of the exclusion criteria.

Once it is decided that the patients can participate in our study, we will provide them an information sheet and an informed consent form and they will decide if they want

to take part. Patients will sign the surgery informed consent form, where risks and complications have to be written.

PREOPERATIVE

Preoperative evaluation will be done by an anesthesiologist; it will be obtained a score from the ASA classification and we will use it as a covariate.

It is essential to make a preoperative sizing and planning. CT images will be reconstructed with postprocessing software (3mensio Vascular™) that allows more precise length and diameter measurements. When the endograft sizing is done, the sizing sheet and order form of the chosen endoprosthesis will be completed (Annex 4). Maximum aneurysm diameter and proximal neck length will be collected as covariates.

HOSPITAL ADMISSION

Patients will be hospitalized 12 hours before the intervention. Nurses will measure their blood pressure, heart rates and temperature. Patients will not eat nor drink anything 6 hours before surgery. The genital and abdominal area and legs must be shaved off in order to perform an open surgery if necessary.

INTERVENTION

Surgical team will be formed by vascular surgeons, instrumentalist nurses, and anesthesiologist. Interventions will be performed in the operating room and radiology imaging will be obtained with high quality portable C-arm fluoroscopic unit (GE Healthcare OEC 9900 Elite MD™).

During surgery, total procedure time (since skin incision to closure) will be timed with a stopwatch by nursing staff to include it in the secondary variables. Also, the size of the used sheath will be registered.

POSTOPERATIVE

After surgery, patients will join the post-surgical unit, to recover from anesthesia and in a 4-hour period they will return to the vascular unit. All patients will remain on bed rest for a minimum 24 hours.

Patients will be evaluated every day by the vascular surgeon prior to decide the discharging. During this period, it will be registered the need for extra-analgesia and the vascular surgeon will assess if any access related complications have appeared. The main variable will be collected by checking if the patients are discharged before 48 hours or not.

SURVEILLANCE

Postoperative follow-up will allow us to detect the short-term and late complications. Clinical evaluation will be done in our consult in the week 1, the week 4, the week 12 and a year after the intervention. Subsequently, the visits will be done annually. Imaging follow-up will be performed with contrast enhanced CT scanning at the month 1, the month 12 and annually thereafter.

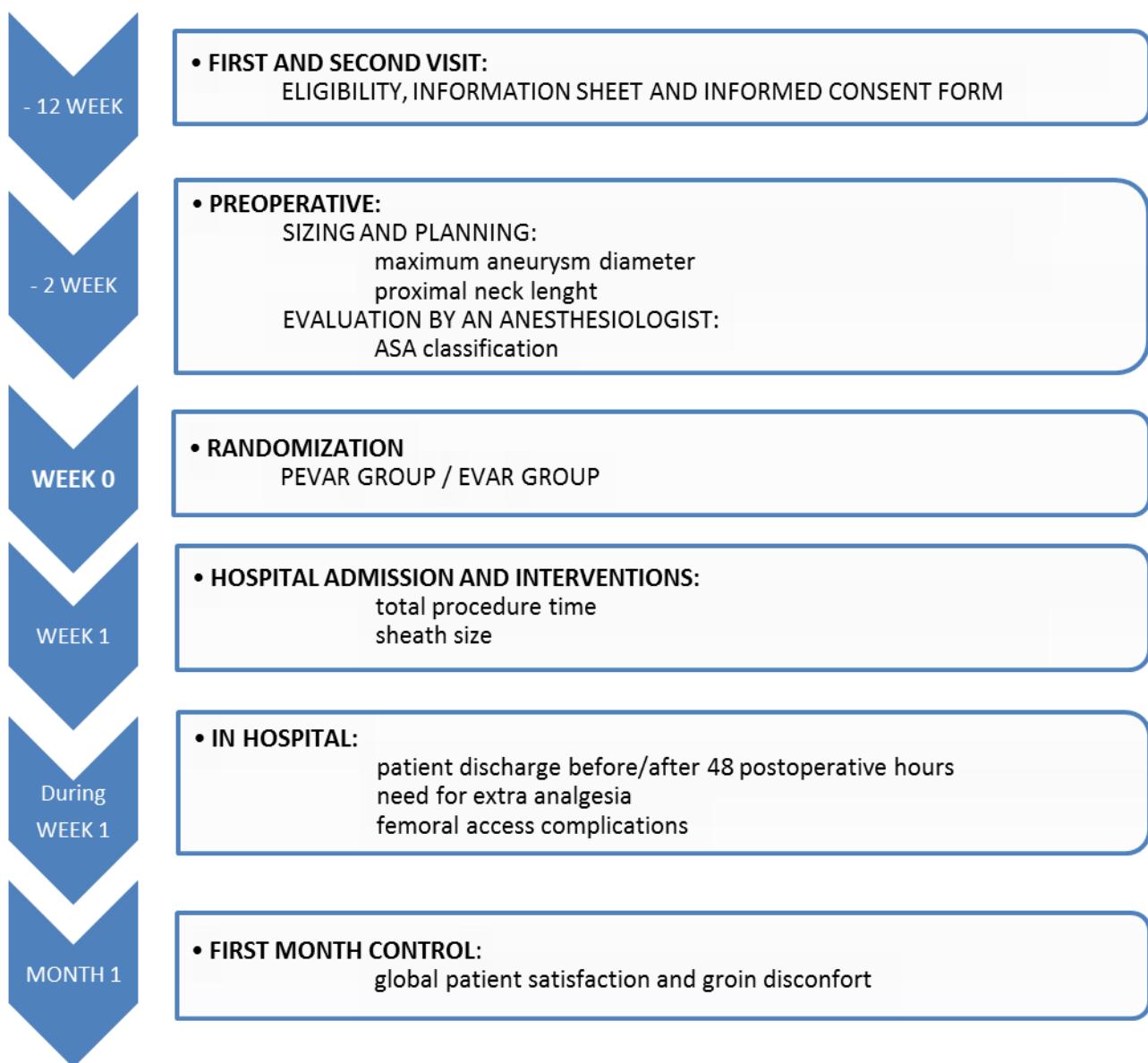
Femoral access complications will be evaluated in the first week control and the first postoperative month control.

Patient's satisfaction will be assessed in the first postoperative month with a Likert-type scale. Patients will indicate their global satisfaction with the surgery (0 points for

“extremely dissatisfied” and 5 points for “completely satisfied”) and the degree of discomfort and pain related to groin wound (0 points for “no discomfort” and 5 points for “intolerable pain”).

The participant data sheet will be filled by the physician as these data are collected.

This participant data sheet is provided in the annex 5.



7.6. INTERVENTIONS

Patients will be preoperatively examined by an anesthesiologist. The percutaneous approach is feasible under local anesthesia but in our hospital, epidural anesthesia will be indicated in order to be prepared if surgical cutdown is required.

All procedures will be performed in the operating room with high-quality fluoroscopy and angiographic equipment and a special surgical table adapted to radiography needs. The interventions will always be performed by the same vascular surgeon.

Bifurcated prosthesis will be placed in all patients; because of this, the procedure must be bilateral.

7.6.1. PERCUTANEOUS ENDOVASCULAR ANEURYSM REPAIR (PEVAR)

The anterior wall of CFA is percutaneously accessed 1 to 2 cm proximal to its bifurcation but below the inguinal ligament by a micropuncture (with an 18 gauge-abbocath), approximately in a 45° angle with ultrasound guide. Careful evaluation of CFA, presence of calcifications or atherosclerotic plaques is also achieved with ultrasounds.

A Terumo® 0.035-inch hydrophilic standard guidewire is introduced and advanced into the aorta. To verify the guidewire position, fluoroscopy is used.

The abbocath is removed and a mosquito is used to widen the skin hole to facilitate the device introduction.

In our study, this percutaneous technique will be performed only with the Perclose ProGlide® 6F Suture-Mediated Closure (SMC) System (Abbott Vascular).

To place an endovascular stent-graft a sheath greater than 8F is needed, because of that, at least two pre-close devices are required.

This is the moment to sheathe ProGlide® until the mark. The first device is deployed with a 30° medial rotation (10 o'clock). Maintaining wire access, the second device is deployed with a 30° lateral rotation (2 o'clock). As said before, this procedure has to be performed in each artery bilaterally.

These devices place a single monofilament suture, proximal and distal to the puncture site. When the delivery device is removed, the sutures are exteriorized to complete the closure at the end of the procedure. To avoid the bleeding through the artery puncture, we introduce the 8F sheath. Patients receive a bolus of 5000 UI of heparin after sheath insertion.

In this point, the components of the endovascular graft are advanced over the guidewires and deployed under radiographic control. To confirm the correct deployment of the prosthesis and the aneurysm exclusion an angiography is used.

After completion of the EVAR, the delivery sheath is removed while retaining guidewire access. Gentle manual compression is applied to maintain the hemostasis while the preformed knots advance to the artery.

When bleeding is controlled and hemostasis is confirmed, the guidewire is removed and manual compression is reapplied. Patients receive protamine to reverse heparin.

Open surgical conversion is indicated if three ProGlide devices are used and hemostasis is not achieved.

7.6.2. ENDOVASCULAR ANEURYSM REPAIR (EVAR)

First, a 4-6 cm transverse skin incision is made just below the inguinal ligament. Then, the procedure is continued down through the subcutaneous tissue until arriving to the artery plane. The common femoral artery (CFA) is exposed approximately 2-3 cm circumferentially.

Proximal and distal vessel control is obtained with vessel loops and vascular clamps.

Then, the artery is punctured with an 18 gauge abbocath.

Since this point, the endograft placement procedure is performed as usual.

After the completion of the endoluminal graft and the sheath is removed, the artery is closed with 5-0 monofilament polypropylene sutures. If the CFA wall is mechanically damaged after devices introduction, a patch is required.

Finally, the incision is closed in layers.

8. STATISTICAL ANALYSIS

All statistical analysis will be performed with Statistical Package for the Social Sciences (SPSS) for Windows®. Sample size calculation is provided in methods section (see 7.3.2: sample size).

Univariate

The results will be expressed as percentages for categorical variables. For continuous variables, we will use mean and standard deviation (if a normal distribution can be assumed) or median, first and third quartile (if a normal distribution cannot be assumed).

Bivariate

The Relative Risk (RR) will be calculated for each group to analyze our primary objective. Categorical variables will be compared with Chi Square test or Fisher exact tests. For continuous variables, a two-sided Student's t-test will be used.

Multivariate

In addition, multivariate logistic regression analysis will be performed in order to add the covariates that could skew the main association we want to analyze.

We will assume a confidence interval of 95% and P value <0.05 to consider that there is a significance difference.

Missing data

During the perioperative period patients could die. If this situation occurs, the variables will not be collected; therefore these data will not be imputed and will be lost.

9. ETHICS

It is imperative that patients read and understand the information sheet of this clinical trial and sign the informed consent form. Thereby, the principle of autonomy will be respected.

All basics ethics principles will be respected according the World Medical Association Declaration of Helsinki.

This trial will have to be approved by the Clinical Research Ethics Committee (CEIC) of the Hospital Universitari Josep Trueta of Girona and it will be registered in ClinicalTrials.gov and in EudraCT.

The patients data collected will follow the Spanish data protection law (Ley Orgánica 15/1999, de 13 de diciembre, de Protección de Datos de Carácter Personal), in order to protect the patients' confidentiality.

This trial will follow the Spanish drugs and health products law (Real Decreto 1591/2009 de 16 de octubre y 1616/2009 de 26 de octubre: Investigación con Productos Sanitarios).

Many studies have demonstrated the efficacy and the safety of PEVAR technique; for this reason, our study does not involve many ethical problems.

We have hypothesized that PEVAR technique is superior in some aspects to EVAR technique, so we may think why performing EVAR when we assume that PEVAR is better. Considering this ethical problem, we conclude that our assumptions are not proved, so patients in the EVAR group are not being subjected to a worse intervention and there is not an ethic violation.

10. STUDY LIMITATIONS

- The first limitation in our study is the impossibility of making a triple blinding, because of the vascular surgeon must know if he has to perform a PEVAR or an EVAR technique. It is only possible to maintain the patients' blind; they will be informed that he can receive one or other surgery.

To overcome this limitation, the statistician will be blind and will not be aware of which participant belongs to which group.

- Other limitation is the extrapolation to other populations. We can ensure that the results will be valid to our population treated by the vascular surgeons of Hospital Universitari Josep Trueta of Girona, but the results may or may not coincide with other centers, especially considering that operator experience is one of the keys to technical success.
- It's known that AAA is more prevalent in men than in women, and also women are anatomically less auspicious to receive endovascular surgery (so, many of them will be excluded). The limitation is that we cannot extend the study until we have the same number of men and women, so we accept that maybe women will be underrepresented.
- Patients' global satisfaction and groin discomfort will be measured at the first month postoperative control with non-validated questions. The ideal situation would be measure it with a validated scale but we could not find any validated scale to fit exactly our goal.

- We must take into account the loss of patients follow-up. In our main variable we will only consider as “loss of follow-up” the patients who die. Regarding the secondary variables collected in the first postoperative month, patients may not come to visit, so these results may be biased.
- Secondary variables that have been proposed in this study will not have a definitive result. The results will be exploratory and must be confirmed in an *ad hoc* study specifically designed to investigate these variables.
- In this study, we have only calculated the sample size to our primary objective. To have statistically significant results we need 56 patients in total, so the recruitment time lasts 2 years.

The limitation is that we don't ensure that this sample size will be enough to evaluate the secondary objectives.

11. WORK PLAN

Investigators: Omar Andrés, Cristina Tello

Collaborators: Vascular surgeons of Hospital Dr. Josep Trueta of Girona

1. Meeting and coordination phase (1 month):

Conducted by: All investigators, collaborators and nursing staff

At the beginning of the trial, the chronogram will be performed and all investigators and collaborators will meet to define their participation at every stage of the study. The protocol will be detailed to the collaborators and it will be explained how the patient recruitment and the data collection should be. This information will be shared with the nursing staff.

Investigators and collaborators will have monthly face-to-face meetings; until the end of the study in order to solve problems that can appear.

Furthermore, in this phase, collaborators and nursing staff will receive training by investigators to familiarize with the Perclose ProGlide® during the surgery.

2. Recruitment of patients and interventions (24 months):

Conducted by: All investigators and collaborators

The recruitment of patients will take place in the consulting room of Hospital Universitari Dr. Josep Trueta of Girona. Patients will come with a suspected diagnosis of abdominal aortic aneurysm. Investigators and collaborators will evaluate if the patients meet all inclusion and exclusion criteria.

Patients will be informed about our trial and will receive an information sheet, if acceptance, the informed consent form must be signed. The participant data sheet will be filled by investigators and collaborators.

The interventions will be undertaken. Once the patient is admitted in vascular surgery floor after the procedure, collaborators will assess the patient's state every day.

Clinical evaluation will be done by investigators and collaborators in 7 days and 30 days after the intervention.

3. Data collection and processing data base (26 months):

Conducted by: All investigators, collaborators and nursing staff

Data will be updated and reviewed regularly and will be entered in the database simultaneously with the trial development.

4. Data analysis (4 months):

Conducted by: Investigators and statistical consultant

A statistical expert will be hired to perform the analysis of the collected data.

5. Interpretation of results (6 months)

Conducted by: Investigators

While the statistical analysis is done, the investigators will draw conclusions from the obtained results.

6. Publications (5 months)

Conducted by: Investigators

Finally, the corresponding articles will be written according to the results and they will be sent to different journals for their publication.

The chronogram is provided in annex 6.

12. FEASIBILITY

12.1. RESEARCH TEAM

Interventions will always be performed by the same surgeon. Our main surgeon is the chief of vascular surgery at the Hospital Universitari Dr. Josep Trueta of Girona. He has more than 10 years of experience in endovascular surgery and is highly qualified to perform these procedures.

Collaborators and nurses are familiarized with endovascular procedures but not with the ProGlide® closure technique. To solve this, during the meeting and coordination phase of the study (see section 11: work plan) collaborators and operating room nurses will receive specific training.

The research team will be able to perform the study, except for statistical analysis and data monitoring; therefore qualified staff will be hired.

12.2. MEANS AVAILABLE

Patients included in our study require endovascular surgery, so we just have to collect the data that is provided to us. The means that the institution makes available to us includes: CT machine, operating rooms with its equipment (fluoroscopy machine), surgical material, endografts, qualified staff such as vascular surgeons and operating room nurses.

We have access to all these means in our hospital.

12.3. PATIENTS

In a year, there are approximately 50 patients who receive endovascular surgery for AAA repair in Hospital Universitari Dr. Josep Trueta of Girona. We have to consider that some patients (20% approximately) will not meet our criteria, especially anatomical ones. Taking into account these 50 patients, we expect to include about 35 patients a year.

If 56 patients in total are needed to our study, the recruitment of patients will last 2 years. However, we can't predict exactly the AAA incidence, so if in 2 years we do not reach the 56 patients, the recruitment time will have to be enlarged.

13. BUDGET

The research team is employed by the institution and is not required to work overtime, so their services are not included in our budget.

The research team will carry out all the tasks related with recruitment of patients, interventions, data collection, interpretation of results and publications. However, the research team does not have enough knowledge to perform the statistical analysis. We will hire statistics support and the estimated budget is 1400 € (35€ per hour, assuming 40h). Also, a skilled staff is required to carry out the data monitoring, quality control data as well as regular submissions to Spanish Medicines Agency. The estimated budget for the clinical research associate (CRA) is 9360 € (30€ per hour, assuming 2 hours per week per 3 years).

Our intervention consists in introducing the percutaneous femoral access for endovascular repair. To do that, the closure devices are needed (Perclose ProGlide®). As said before (see 7.6: interventions) two devices to close each wound groin are needed, so we include in our budget 112 closure devices. The total price of closure devices is 33040 € (295€ per device assuming 2 devices in each groin and 28 patients in PEVAR group). The rest of the procedure is performed as usual and is not included in our budget.

Other services include printing information sheets for patients, informed consent forms and participant data sheets (50 €).

Finally, it has been taken into account the costs of the dissemination plan. This study is expected to be published in scientific journals with open access. The budget is estimated to be around 2500 €

The costs of attending to the International Symposium of Endovascular Surgery (Sociedad Española de Angiología y Cirugía Vascular) have been calculated. We budgeted 1700 €, which includes inscription, transport, accommodation and diets.

1. STAFF COSTS

Statistical expert for data analysis	1400 €
Clinical research associate (CRA)	9360 €

2. SERVICES AND MATERIAL

Perclose ProGlide® devices	33040 €
Printing and papers	50 €

3. PUBLICATION AND PRESENTATION COSTS

Publish in Journal of Vascular Surgery	2500 €
International Symposium of Endovascular Surgery registration (SEACV)	
- Inscription	1000 €
- Transport to Madrid, accommodation and diets	700 €

TOTAL	48050 €
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14. PROJECT IMPACT AND APPLICABILITY

With this project we wish to achieve more information about the indication of the PEVAR technique as an abdominal aortic aneurysm first election treatment in selected patients. Several trials have demonstrated the safety and the efficacy of this technique and have shown some benefits for patients. However, most studies conclude that more information is needed.

If we get the expected results, we will show that PEVAR has benefits for patients and the health system in comparison to EVAR. With this technique, aneurysm can be excluded with the same success but with less postoperative discomfort and fewer vascular access complications.

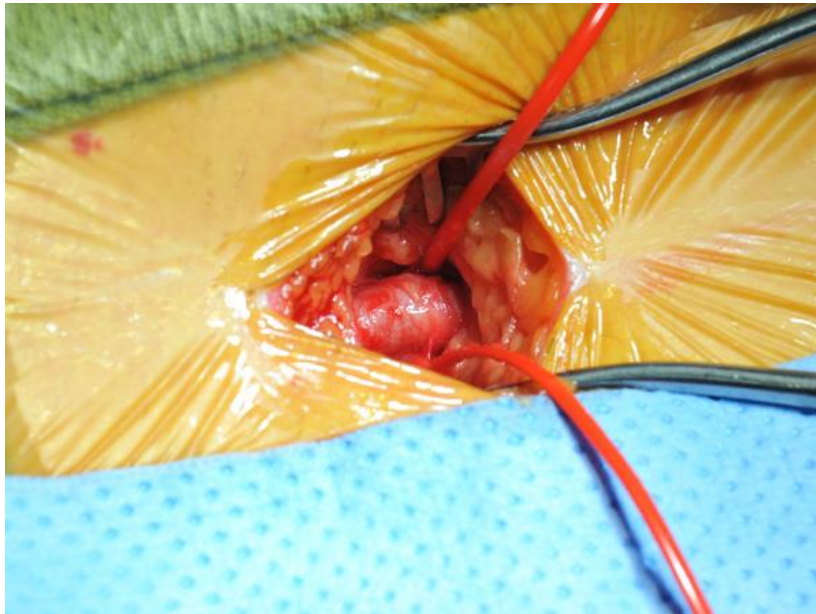
For the health system, the impact of the study lies in the reduction of the operating time, the decrease of hospital stay and the need for extra analgesia and consequently, a decrease of hospital costs.

In summary, we expect that this study provides more information for this technique to be widely used by vascular surgery services. This protocol can be reported by others future studies and can increase the pool of data available for analysis.

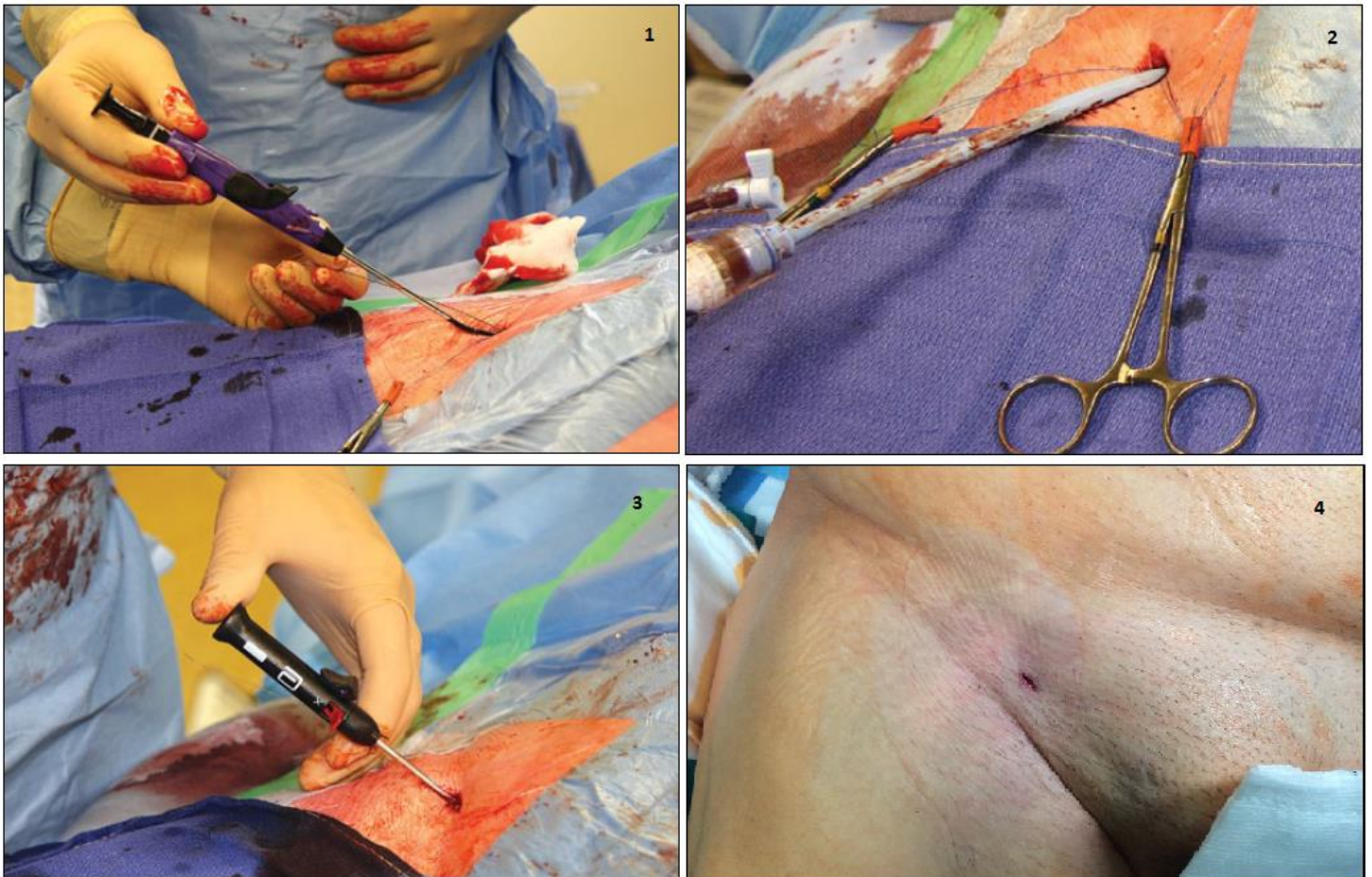
15. ANNEXES

15.1. IMAGES OF PROCEDURES

CFA EXPOSURE FOR ENDOVASCULAR AAA REPAIR



PROGLIDE® FOR PERCUTANEOUS ACCESS (PEVAR)



Source: http://evtoday.com/pdfs/et0314_F2_Vercauteren.pdf

15.2. INFORMATION SHEET FOR PARTICIPANTS

Title: PERCUTANEOUS ACCESS VERSUS STANDARD FEMORAL EXPOSURE FOR ENDOVASCULAR ABDOMINAL AORTIC ANEURYSM REPAIR: A RANDOMIZED, CONTROLLED TRIAL

Investigators: Cristina Tello, Omar Andrés

Location: Hospital Universitari Josep Trueta in Girona

We would like you to consider this research study and then decide whether or not you wish to take part. Before you decide whether to participate or not it is important for you to understand why the research is being done and what it will involve. Please take time to read the following information carefully and to decide whether or not you wish to take part.

1. What is the purpose of this study?

This study aims to compare clinical outcomes of PEVAR (percutaneous endovascular aneurysm repair) compared to EVAR (endovascular repair) in patients of Hospital Universitari Josep Trueta of Girona. Our main objective is to demonstrate that PEVAR requires less days of hospital stay than EVAR, so we will analyze the number of patients discharged at second day postoperative in both groups. When abdominal aortic aneurysm is diagnosed, it must be studied to indicate or not a surgical treatment. The surgical treatment reduces the risk of rupture, which causes high mortality. This new endovascular repair technique, PEVAR, is less invasive and can involve less femoral access complications as bleeding, infections and it can be more comfortable to the patients, who can get discharged earlier.

2. Why have I been invited?

You have been chosen because you've been diagnosed with an abdominal aortic aneurysm and you have surgical treatment criteria. Also, you meet all the inclusion criteria and none of the exclusion criteria.

3. Do I have to take part?

It is up to you to decide to take part of this study or not. You are free to withdraw at any time and without any reason. If you decide to take part we will ask you to sign a consent form. Your decision will not affect the healthcare you receive.

4. What will happen if I take part?

If you participate in this study, you will undergo to abdominal aortic aneurysm repair. Previously, your vascular surgeon will have explained you that the most appropriate technique in your case is to put an endovascular stent-graft, reducing the pressure that blood exerts on the aortic aneurysm walls.

In order to put this stent-graft, we can exposure the femoral artery (EVAR) o we can access percutaneously through the skin (PEVAR). To know which technique is the most convenient, we put participants in two groups, one will undergo PEVAR and the other group will undergo EVAR. The results will be compared and analyzed. The patient will not be knowledgeable of the technique he receives. The surgeon and the evaluator of the results will know in which group each patient will belong.

5. What do I have to do?

You only have to provide the information required by the clinician, in order to analyze your data and the results of the surgery.

6. What are the possible benefits of taking part?

Your condition of abdominal aortic aneurysm must be treated anyway. If you are in the femoral access exposure group you will receive the same surgical that if you are not in the study, but if you are in the percutaneous access group you can benefit from less days of hospital stay, less wound complications and less groin discomfort.

7. What are the possible risks of taking part?

The risks and complications are the same in both techniques, so to participate in our study does not involves an increased risk. Both techniques include vascular complications (arteriovenous fistula, femoral neuropathy, infection, bleeding, thrombosis/occlusion...), and seldom major adverse events as renal failure or respiratory complication.

8. Will my taking part be kept confidential?

Yes. All patient data is stored on password protected computer database. The information will be kept confidential according to current data protection law.

9. What if I change my mind about taking part?

As said before, the participation is entirely voluntary. If you decide to withdraw from the study, your standard health care will not be affected. In this case, all clinical information that we have obtained up to the point of your withdrawal from the study will continue to be used.

10. What if there is a problem?

If you wish to contact us to make a complaint about any aspects or to ask any questions, you can be informed in the Hospital Universitari Josep Trueta of Girona. Contact with investigators on our mails: crstina.tello11@gmail.com / cirvasc@gmail.com

Thank you for reading this.

Please keep this information sheet for your records.

If you agree to enter the study, please sign the attached consent form.

15.3. INFORMED CONSENT FORM

CONSENT FORM

Informed consent to participate in the clinical trial named: PERCUTANEOUS ACCESS VERSUS STANDARD FEMORAL EXPOSURE FOR ENDOVASCULAR ABDOMINAL AORTIC ANEURYSM REPAIR: A RANDOMIZED, CONTROLLED TRIAL.

- I have been informed by the investigator about the purpose of the study
- I read and understand the information sheet
- I have time to think and consider this information
- I have the opportunity to ask any questions and be answered
- I understand that my participation is entirely voluntary and I can withdraw the study in any moment, for any reason and without consequences for the healthcare I receive.
- I give permission to collect my data and analyze it. I have been informed that my data will be kept confidentially
- Finally, I agree to participate in this study:

Name of participant

ID

Signature


Name of Doctor taking consent

ID

Signature

Girona, _____ of _____ of 20____

15.4. SIZING SHEET AND 3D CT RECONSTRUCTION



Zenith Flex[®]

AAA ENDOVASCULAR GRAFT

DEVICE PLANNING AND SIZING WORKSHEET

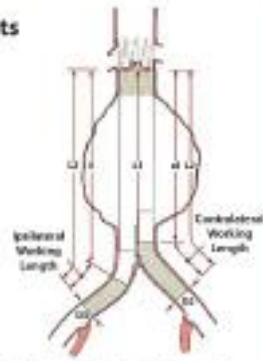
Select Side of Main Body Introduction and Fixation Sites

☐ Right Iliac ☐ Left Iliac
 External Iliac (EI) measurement _____ mm
(Maximum diameter, inner wall to inner wall, from introduction site to aorta.)

Anatomical Measurements

CT table position at:
 _____ lowest renal artery
15 mm below lowest renal artery, check for tortuosity

_____ aortic bifurcation
 _____ origin of internal iliac
 _____ origin of internal iliac



• When using CT for length, approximate lateral deviation/tortuosity and add to difference in table position.

Diameters: D1 D2 D3
Lengths: L1 L2 L3

D1: Largest aortic neck diameter throughout 15 mm neck length.
 D2: Largest iliac diameter throughout contralateral distal fixation site.
 D3: Largest iliac diameter throughout ipsilateral distal fixation site.
 L1: Lowest renal artery to aortic bifurcation = lateral deviation/tortuosity.
 L2: Lowest renal artery to contralateral distal fixation site = lateral deviation/tortuosity.
 L3: Lowest renal artery to ipsilateral distal fixation site = lateral deviation/tortuosity.

Main Body

- From D1, select graft diameter.
- From L1, select the graft lengths.
- If choice of graft diameter or graft length is affected by other considerations, adjust accordingly.
- Using graft diameter and L1 length, complete the Main Body Order Number.

D1 mm	Graft Diameter mm
18-19	22
20-21	24
22	26
25-26	28
25-26	30
27-28	32
29-32	36

L1	d Length*	l Length**
89-105	82	112
104-118	96	128
118-122	111	141
134-148	125	155
149-163	140	170

L3	d Length*	l Length**
101-120	96	125
121-139	113	143
146-158	131	161
159-172	149	179

*Main body length on contralateral side
 **Main body length on ipsilateral side

Main Body Order Number = TFFB - - - ZT
Graft Diameter d Length/ Graft Length

ALL information must be complete:

Date: _____ Patient ID: _____

Hospital: _____

Physician Name: _____

Physician Signature: _____

Physician Phone #: _____

Physician E-mail: _____

Contralateral Iliac Leg

- From D2, select graft diameter.
- Using L2 and d length, complete the following equation.

L2

minus

d Length

=

Contralateral Working Length

- If choice of graft diameter or graft length is affected by other considerations, adjust accordingly.
- 8 and 10 mm graft diameters are also available.

Contralateral Leg (TFLE) Graft Diameters

D2 mm	Graft Diameter mm
10-11	12
12-13	14
14-15	16
16-17	18
18	20
19	22
20	24

Contralateral Leg (TFLE) Graft Lengths (mm)

Contralateral Working Length mm	Graft Length mm	Recommended Overlap cm/ft
22-43	38*	1-1.5
44-60	56	1-1.5
61-72	73	1-1.5
78-94	90	1-1.5
95-111	107**	1-1.5
112-124	124**	1-1.5

*Assure adequate distal fixation length.
 **Graft lengths 107 and 124 mm are available in 12 and 14 mm diameters only.

Contralateral Leg Order Number = TFLE - - - ZT
Graft Diameter Graft Length

Ipsilateral Iliac Leg

- From D3, select graft diameter.
- Using L3 and l length, complete the following equation.

L3

minus

l Length

=

Ipsilateral Working Length

- If choice of graft diameter or graft length is affected by other considerations, adjust accordingly.
- 8 and 10 mm graft diameters are also available.

Ipsilateral Leg (TFLE) Graft Diameters

D3 mm	Graft Diameter mm
10-11	12
12-13	14
14-15	16
16-17	18
18	20
19	22
20	24

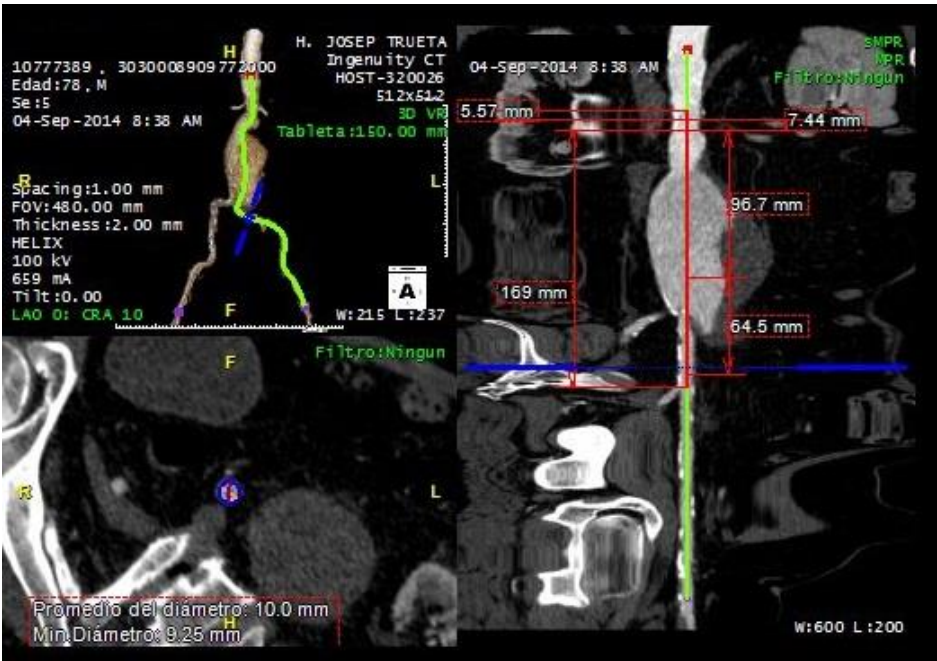
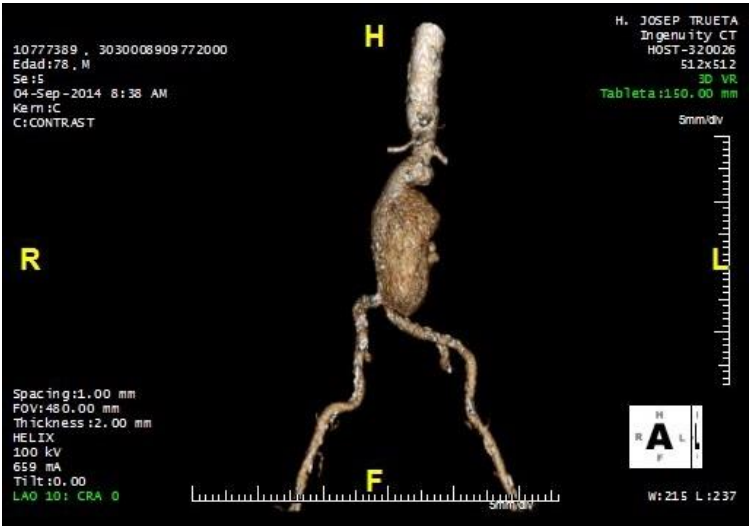
Ipsilateral Leg (TFLE) Graft Lengths (mm)

Ipsilateral Working Length mm	Graft Length mm	Recommended Overlap cm/ft
20-25 graft diameter 10-14	39	1-2
20-25 graft diameter 11-15	56	1-3
36-42	56	1-3
43-59	73	1-3
60-76	90	1-3
77-93	107*	1-3
94-124	124*	1-3

*Graft lengths 107 and 124 mm are available in 12 and 14 mm diameters only.

Ipsilateral Leg Order Number = TFLE - - - ZT
Graft Diameter Graft Length

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15.5. PARTICIPANT DATA SHEET**PARTICIPANT DATA SHEET***Clinician must fill patient's data*

NAME:

FIRST and SECOND SURNAME:

DIRECTION:

DATE:

(____/____/____)

DATE OF BIRTH:

TELEPHONE:

EMAIL:

SEX: MALE ☐ FEMALE ☐**PHYSICAL EXPLORATION:**

Height (cm):

BMI (kg/m²):

Weight (kg):

Blood pressure:

Abdominal perimeter (cm):

Heart rate:

PERSONAL ANTECEDENTS:

ALLERGIES:

REGULAR MEDICATION:

Drug name	Dosage (mg/ml, once/twice a day)

SURGICAL MEDICAL HISTORY (check the box if the patient has any of the following):

COPD	<input type="checkbox"/>	Diabetes	<input type="checkbox"/>
Hypertension	<input type="checkbox"/>	Alcoholism	<input type="checkbox"/>
CAD (coronary artery disease)	<input type="checkbox"/>	Arrhythmia	<input type="checkbox"/>
CHF (congestive heart failure)	<input type="checkbox"/>	Dementia	<input type="checkbox"/>
Peripheral vascular disease	<input type="checkbox"/>	Connective tissue disease	<input type="checkbox"/>
Cerebrovascular disease	<input type="checkbox"/>	Thromboembolic disease	<input type="checkbox"/>
Coagulopathy or bleeding disorder	<input type="checkbox"/>	Renal failure	<input type="checkbox"/>
Heart valve disease	<input type="checkbox"/>	Prior abdominal surgery	<input type="checkbox"/>
Hyperlipidemia	<input type="checkbox"/>	Prior cardiac surgery	<input type="checkbox"/>
Liver disease	<input type="checkbox"/>	Prior percutaneous coronary intervention	<input type="checkbox"/>

Any other disease _____

TOBACCO CONSUMPTION:

Do you smoke at present?

Yes, regularly ☐ No, I have never smoked ☐ Former smoker ☐

If you answered former smoker, how long ago did you stop smoking?

0-1 years ☐ 1-5 years ☐ >5 years ☐

How old were you when started smoking?

Approximately how many cigarettes/cigars smoked/smoke a day?

FAMILIAR ANTECEDENTS:

Family history of abdominal aortic aneurysm

YES ☐

NO ☐

If the answer is yes, do they have been received endovascular AAA repair?

YES ☐

NO ☐

PREOPERATIVE INFORMATION:

ASA (American Society of Anesthesiologists classification)

I ☐

II ☐

III ☐

IV ☐

V ☐

Maximum aneurysm diameter (mm):

Neck angle to aneurysm sac (degrees):

Proximal neck length (mm):

Aortic bifurcation diameter (mm):

INTRAOPERATIVE INFORMATION:

Vascular access

PEVAR ☐

EVAR ☐

Total procedure time (min) _____

Sheath size required (Frenches) _____

POSTOPERATIVE INFORMATION

Discharged within the first 48 postoperative hours

YES ☐

NO ☐

Need of extra analgesia

YES ☐

NO ☐

Femoral access complication YES ☐ NO ☐

Global patient satisfaction with the intervention

0 <input type="checkbox"/>	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>
Extremely dissatisfied	Not at all satisfied	Slightly satisfied	Moderately satisfied	Very satisfied	Completely satisfied

Postoperative groin discomfort or pain

0 <input type="checkbox"/>	1 <input type="checkbox"/>	2 <input type="checkbox"/>	3 <input type="checkbox"/>	4 <input type="checkbox"/>	5 <input type="checkbox"/>
No discomfort	Minimal discomfort	Mild discomfort	Moderate pain	Severe pain	Intolerable pain

15.6. CHRONOGRAM

		Jan 2014 Feb 2014	Feb 2014 Feb 2016	Feb 2016 Apr 2016	Apr 2016 Aug 2016	Aug 2016 Oct 2016	Oct 2016 Jan 2017
Meeting and coordination phase	All the team						
Patients recruitment and interventions	Investigators and collaborators						
Data collection and processing data base	All the team						
Data analysis	Investigators and statistical consultant						
Interpretation of results	Investigators						
Publications	Investigators						