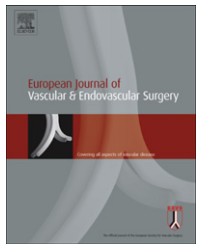
Eur J Vasc Endovasc Surg (2010) **40**, 71–75



Sexual Dysfunction after Elective Endovascular or Hand-Assisted Laparoscopic Abdominal Aneurysm Repair

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Submitted 28 December 2009; accepted 4 March 2010
Available online 18 April 2010

KEYWORDS
EVAR;
HALS;
Abdominal aortic aneurysm;
Sexual dysfunction

Abstract *Objective:* To evaluate the incidence of sexual dysfunction and retrograde ejaculation after elective endovascular aneurysm repair (EVAR) and hand-assisted laparoscopic surgery (HALS) for abdominal aortic aneurysm (AAA).
Methods: A total of 100 patients eligible for elective repair of infrarenal AAAs were randomised in two groups: EVAR and HALS. The quality of sexual function was evaluated using the International Index of Erectile Function (IIEF), a 15-item questionnaire. Patients completed the IIEF preoperatively and at 12 months. The incidence of retrograde ejaculation was also evaluated.
Results: One- and 12-month mortality rates were zero. Three patients in the EVAR group (6%) and two patients in the HALS group (4%) reported an erectile dysfunction (p = NS). The quality of sexual function at 1 year was similar in both groups: total score of 66 in the EVAR group versus 68 in the HALS group ($p = 0.66$). Retrograde ejaculation was detected in three cases in the HALS group versus no case in the EVAR group.
Conclusions: The HALS technique could be a minimally invasive alternative for sexually active males unsuitable for EVAR repair.
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Open abdominal aortic aneurysm (AAA) repair has been associated with a postoperative sexual dysfunction in 30% of male patients,[1] due to autonomic nerve injury and pelvic blood flow changes. Endovascular aneurysm repair (EVAR), which does not require dissection of the iliac bifurcation, is associated with a lower incidence of retrograde ejaculation than open repair (OR).[2–4] The Hand-Assisted Laparoscopic Surgery (HALS) technique is minimally invasive allowing a para-aortic and superior hypogastric plexus-sparing operation. In this 2-year, single centre prospective randomised trial with a 12-month follow-up, we evaluated the incidence of sexual dysfunction and retrograde ejaculation in 100 patients after EVAR and HALS for AAA repair.

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doi:10.1016/j.ejvs.2010.03.007

Materials and Methods

Study design and patient population

Between May 2006 and May 2008, 233 patients underwent AAA repair in our unit. Of these, the following were excluded from the study: 28 patients for emergency repair of ruptured aneurysm, nine patients for juxtarenal aneurysm repair, 10 patients for previous prostate surgery and 24 patients refused to take part in the study. The remaining 162 patients completed the preoperative International Index of Erectile Function (IIEF). A preoperative sexual dysfunction (class I and II) was detected in 58 patients and they were excluded from the study. A total of 104 patients were enrolled in the study and randomised into two groups:

Group A : Endovascular aneurysm repair (EVAR)
Group B : Hand-assisted laparoscopic surgery (HALS)

After randomisation, an additional four patients from the EVAR group were excluded due to a neck length $<$15 mm and/or a neck angulation $>60^\circ$ (Fig. 1).

The study was approved by the Ethical Committee and was conducted in compliance with Good Clinical Practice guidelines, and all patients gave informed written consent. Randomisation codes were generated using a validated computer method, placed in sealed envelopes, each labelled with a patient number, and opened at patient admission for AAA repair.

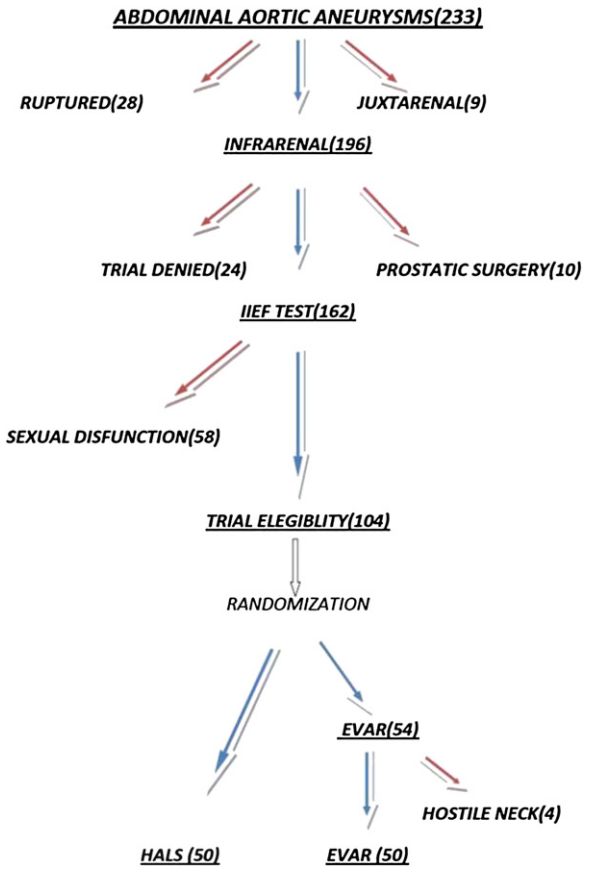

Figure 1 Study design and randomization process (patients).

Preoperative assessment

Investigations in all patients included duplex scanning of the aorta, lower limbs and cervical arteries. In addition, a standard contrast-enhanced spiral computed tomography (CT) scan with images acquired at 3-mm intervals was performed.

The cardiopulmonary examination included echocardiography, functional respiratory evaluation and determination of arterial blood gas levels. Renal insufficiency was defined as an estimated CrCl level $<$ 30 ml dl^{-1} according to Cockcroft and Gault.[5]

The quality of sexual function was evaluated preoperatively and at 1 year postoperatively using the IIEF, a 15-item, self-administered questionnaire. The maximum IIEF score is 75 and the minimum IIEF score is 5, with higher scores indicating greater erectile function. The 15 questions of the IIEF can be grouped into five response domains that address key elements of sexual dysfunction: erectile function, orgasmic function, sexual desire, intercourse satisfaction and overall satisfaction.[6–10] Based on the final score, the patients were divided in three classes: severe erectile dysfunction (class I, total score $<$11), moderate erectile dysfunction (class II, total score 11–21), and no erectile dysfunction (class III, total score $>$21). Preoperatively, all patients were in class III. Aspects relating to retrograde ejaculation were also evaluated but were not included in the IIEF test. No patients were lost at follow-up. Morbidity and mortality were evaluated for both groups at 1 (perioperative) and 12 months.

Operative procedures

Group A: Endovascular aneurysm repair (EVAR)
The endografts were positioned just below the lower renal artery and, when possible, proximally to the hypogastric artery ostium. The endografts used were Talent and Endurant (Medtronic, Minneapolis, MN, USA). The digital angiography C arm used was Philips, mobile C arm system BV Pulsera (Philips Electronics, the Netherlands).

Group B: Hand-assisted laparoscopic surgery (HALS)
The patients were placed supine on the operating table with a pillow under the lumbar region to raise the aortic area. The operating surgeon was positioned to the right of the patient, and the camera holder was to the left of the surgeon. A second assistant was located to the left of the patient. A 6–8 cm midline mini-laparotomy incision was made ending just at the umbilical level. The first 12 mm trocar, for insertion of a 30° viewing laparoscope, inserted through an umbilical incision with an open technique, enables the abdominal cavity to be visualised and insufflated with carbon dioxide to a pressure of 8 mm Hg. A 50-mm diameter Omniport was inserted into the surgical incision. The left hand of the operator was introduced into the abdomen through the Omniport (hand-assisted). Two additional 5-mm ports for insertion of 30° instruments (scissors, forceps and dissectors) were placed transversally

about 5–6 cm to the left and the right of the first port, 4 cm above the first trocar. The table was temporarily tilted to a 25° Trendelenburg and 10° right lateral decubitus position. The retroperitoneum overlying the anterior wall of the aorta was opened using standard procedures. The origin of the inferior mesenteric artery was noted, and the artery was divided or evaluated for reimplantation or ligation. The anterior and lateral walls of the aorta were dissected from the left renal vein to the aortic bifurcation. The laparoscopic surgical procedure was completed and all trocars removed. A self-retaining abdominal retractor, Omnitrack (Pilling Weck Europe, St Faget, France), was inserted. A laparoscopic aortic clamp (B/Braun-Aesculap, Tuttlingen, Germany) was introduced into the abdominal cavity through the mini-laparotomy opening. A heparin bolus (50 UI kg^{-1}) was administered intravenously, and the aorta was clamped. If an aortic tube or an aorta-bilateral common iliac artery bypass graft has to be placed, a releasable laparoscopic clamp (B/Braun-Aesculap, Tuttlingen, Germany) is placed around each common iliac artery. If the distal anastomosis has to be performed to the external iliac or femoral arteries through separate incisions, the common iliac arteries are legated. An end-to-end aortoprosthetic anastomosis under direct vision was then performed. Depending on the operation scheduled, the distal anastomosis or anastomoses were made conventionally on the distal aorta and on the iliac or femoral arteries. Finally, the retroperitoneum, the port sites, the mini-laparotomy and the groin incisions were closed in the normal way.

Statistical methods

Continuous variables are summarised as mean ± standard deviation when normally distributed, and as median and interquartile range when asymmetrically distributed. Categorical variables are presented as numbers and percentages. Percentages were rounded off to the whole number. Differences between continuous variables were compared by two-tailed unpaired Student's *t*-test if normally distributed, and by the Mann–Whitney *U*-test if asymmetrically distributed. Categorical variables were compared by two-tailed Fisher's exact test. Results were stratified by treatment method. A probability value of less than 0.05 was considered to indicate statistical significance. Data were analysed using SPSS for Windows, version 15.0 (SPSS, Inc, Chicago, IL, USA).

Results

The baseline characteristics of the 100 patients enrolled in the study are compared in Table 1.

Patients in group B (HALS) were younger than patients in group A (EVAR): 61 versus 69 years; ($p = 0.002$). There was no significant difference in the diameter of the aorta in the two groups: 5.7 ± 2.1 (group A) versus 5.9 cm ± 1.8 (group B). The cardiovascular risk factors and co-morbidity were similar in both groups. The perioperative mortality rate was zero. There was no statistical difference between the two groups in length of hospital stay: 3.4 days in group A and 4.2 days in group B. Surgery duration was longer for patients of group B: 178 ± 39 versus 125 ± 45 min in group A ($p = 0.05$). In the EVAR group, an average 2.6 grafts were implanted per patient. To permit the positioning of the device, in eight patients an iliac percutaneous transluminal angioplasty (PTA) was necessary. In four cases, a type I endoleak was noticed and an aortic cuff was positioned just above the endograft during the same operation; three type II endoleaks were not corrected but were monitored over time. In five cases, the ostium of one hypogastric artery was covered without previous coil embolisation, because, at the time of the study, stent grafts with side branches were not available in our hospital. Respiratory complications were rare in both groups (A: 1%, B: 0%). Leg ischaemia was higher in Group A at 4% versus group B at 2% ($p = 0.04$). Wound revision was necessary in 2% of patients in each group. Two patients in the HALS group developed laparoceles, one of whom needed a surgical repair. One patient in the EVAR group experienced a limb graft thrombosis on postoperative day 7, successfully treated with thrombolysis and stenting of the limb graft (Excluder, Gore). One patient had, at 8 months, a late thrombosis of a limb graft (Talent, Medtronic) and underwent a femoro-femoral crossover bypass with a PTFE graft (Propaten, W.L. Gore & Associates, Flagstaff AZ, USA).

Table 1 General features of the study group.

	EVAR	HALS	
Patients	50	50	ns
Age	69.6	61.2	0.01
Follow-up (months)	12	12	ns
Cardiovascular risk factors			
Diabetes	36(72%)	33(66%)	0.4
Hypertension	47(94%)	48(96%)	0.7
Hyperlipemia	21(42%)	24(48%)	0.3
Smoke	40(80%)	38(76%)	0.7
Obesity	06(12%)	8(16%)	0.5
Co-morbidity			
Chronic Obstructive Pulmonary Disease	27(54%)	17(34%)	0.04
Coronary Artery disease	08(16%)	09(18%)	0.6
Acute Myocardial infarction	07(14%)	06(12%)	0.5
Features of aortic disease			
Aneurysm	50 (100%)	50 (100%)	ns
Iliac aneurysm	19 (38%)	16 (32%)	0.1
Iliac thrombus	21 (42%)	22 (44%)	0.8
Massive calcifications	11 (22%)	10 (20%)	0.8

The quality of sexual function at 1 year, evaluated using the IIEF test, was similar in both groups: total score 66 (interquartile, from 63 to 70) in the EVAR group and 68 (interquartile, from 64 to 73) in the HALS group ($p = 0.66$ Mann–Whitney *U*-test), (Fig. 2). Three patients in the EVAR group (6%) and two patients in the HALS group (4%) reported an erectile dysfunction (p = NS) and were placed in class I or II (Fig. 3).

A retrograde ejaculation was detected in three patients in the HALS group versus no patients in the EVAR group. The follow-up was at 12 months. The one- and 12-month patient survival was 100%.

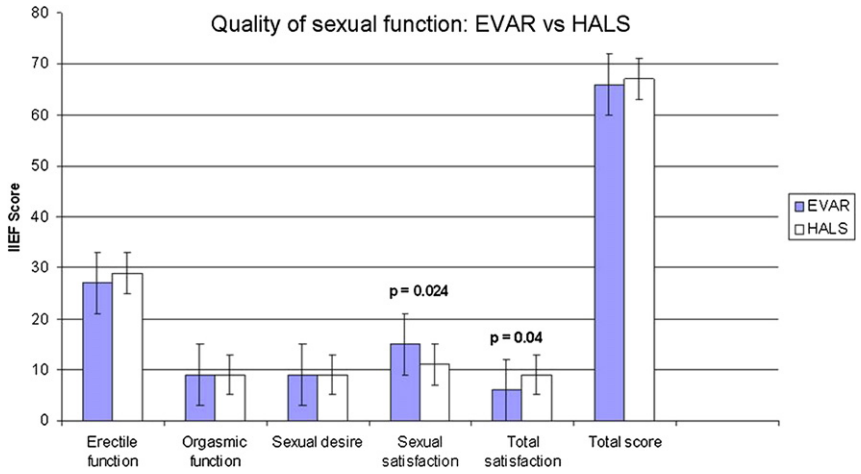

Figure 2 Quality of sexual function in EVAR and HALS.

Discussion

After open aortic repairs, patients reported significantly increased sexual dysfunction during the first postoperative year.[11–13] Few reports addressing the impact of open repair OR and EVAR on sexual functioning have been published. In the available literature, most studies are retrospective in nature and focussed primarily on impotence and erectile dysfunction after conventional open AAA repair.[3]

The hypogastric arteries are the major blood supplies to the pelvic organs and buttock musculature and in addition, in the presence of inferior mesenteric arterial insufficiency, provide important collateral circulation to the left colon. Extensive cross-pelvic communication between the two internal iliac arteries permits the ligation or exclusion of one hypogastric artery. Unilateral hypogastric artery occlusion results in new sexual dysfunction in approximately 10% of patients, but this increases significantly with bilateral internal iliac occlusion.[3,14] Perioperative ligation or exclusion of both hypogastric arteries can lead to various degrees of pelvic ischaemia: bladder and bowel dysfunction, colon ischaemia and hip and buttock claudication.

Male potency depends on a neurogenically instigated vasodilation of the penile corpora cavernosum. Although

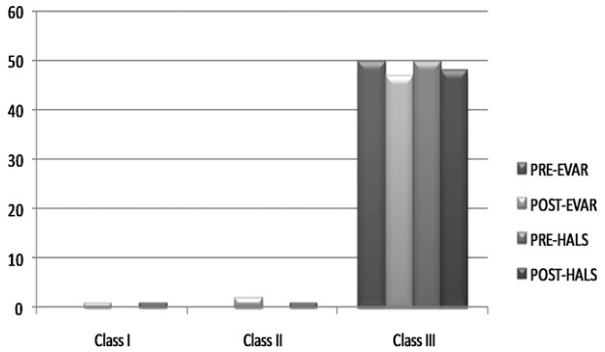

Figure 3 Comparative International Index of Erectile Function (IIEF) Scores before and after Endovascular aneurysm Repair (EVAR) and Hand-Assisted Laparoscopic Surgery (HALS) for abdominal aortic aneurysm.

parasympathetic innervation (arising from the second to fourth lumbar segments) primarily initiates the erectile response to sexual stimulation, and the sympathetic chain (11th thoracic to 2nd lumbar segments) induces ejaculation, considerable intercommunication and overlap exists between both pathways at the level of the para-aortic and superior hypogastric plexuses. Dissection along the anterior surface of the aorta and over the left iliac artery can injure the neural bundles running from the spinal cord. Diminished nerve stimulation and an impaired vascular response, due to arterial disease, ligation or exclusion of one or both hypogastric arteries, can result in erectile dysfunction. In addition to trauma-related autonomic neuropraxia and impaired hypogastric flow, the act of cross-clamping the aorta during open repair could result in pelvic and penile ischaemia, an effect exacerbated by perioperative hypotension as in cases of emergency repair. Finally, on completion of the graft inlay, venting thrombo-embolic debris down the internal iliac artery is often performed, as it is deemed preferable to risking peripheral limb artery embolic occlusion.[6,9,14–16]

Xenos et al.[1] compared erectile function after OR and EVAR in a retrospective study. They found significantly decreased sexual functioning after OR but no deterioration after EVAR.

The randomised DREAM trial also compared sexual function after OR and EVAR.[6]

Although surgery did not result in a significant difference in the proportion of patients reporting sexual dysfunction between the two groups, the impact of surgery on sexual function in the OR group was greater than in the EVAR group, despite a higher number of internal iliac arteries being lost or sacrificed in the EVAR group.[17] On the other hand, a recent prospective study comparing the sexual function after EVAR and OR demonstrated a decrease of sexual activity in both groups: however, when only those patients with some interest in sexual activity were analysed, a small significant impairment in quality of erection could be found in the EVAR group.[18]

In our study, the univariate analysis of patients with iliac aneurysm, iliac and hypogastric thrombus showed statistical significative differences regarding the incidence of

Table 2 Anatomic features of patients with sexual dysfunction: an univariate analysis.

Variable	EVAR	HALS
Patients treated	50	50
Peripheral ischemic complications	0.23	0.36
Iliac aneurysm	0.022	0.025
Iliac thrombus	0.03	0.04
Neck thrombus	0.5	0.7
Thrombus into the aneurysm	0.4	0.35
Hypogastric thrombus	0.04	0.035
Preoperative myocardial infarction	0.1	0.1

sexual dysfunction, whereas no differences were noticed for neck thrombus (Table 2). Total score evaluation of the IIEF test showed no statistical differences between the two groups. Therefore, avoiding hypogastric debris embolisation during the operation, using the video-assisted operation technique to spare the para-aortic and superior hypogastric plexuses as well as saving hypogastric patency could all explain the low incidence of sexual dysfunction in our HALS repair group.

In conclusion, preservation of sexual function should be among the factors considered when weighing treatment options for an abdominal aortic aneurysm in sexually active males. EVAR and HALS repair, in our study, were associated with a low incidence of erectile dysfunction. The HALS technique could be a minimally invasive alternative for sexually active males unsuitable for EVAR repair.

Conflict of Interest/Funding

None

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