

Sedation and Local Anesthesia can be the First Choice for Endovascular Repair of Abdominal Aortic Aneurysms

Abdominal Aort Anevrizmalarının Endovasküler Tamirinde Sedasyon ve Lokal Anestezi İlk Tercih Olarak Kullanılabilir

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ABSTRACT Objective: The aim of this study was to report and analyse the results of our patients undergoing elective endovascular aneurysm repair (EVAR) under local anesthesia. **Material and Methods:** Between April 2004 and August 2012, a total of 137 consecutive patients (80 men, median age 76 years, range 61 to 88 years) underwent elective EVAR under LA. We compared mortality, morbidity, surgical and endovascular difficulties and endoleaks between the procedures performed under local and epidural anesthesia (EA). **Results:** LA was applied in 127 (97%), EA was performed in 7 (5.1%) and general anesthesia (GA) was performed in 3 patients (2.1%). Anesthetic conversion from LA to GA was necessary in 3 patients (2.1%). Four patients were morbid obese. Three patients were having re-operations. Anxiety and airway obstruction during the procedure was the causes for conversion to GA. Overall 30-day mortality rate was 0.79 %, with the one patient in LA group. There were 4 type I endoleaks in patients with in challenging aneurysm morphologies regardless, of the type of anesthesia. The number of type 2 endoleaks was 13 (9.4%). Paraplegia developed in one patient in the EA group. **Conclusion:** LA is feasible and offers advantages regardless of being obese or not or having previous surgery in the inguinal region in vast majority of patients.

Key Words: Aorta, abdominal; endovascular procedures

ÖZET Amaç: Elektif endovasküler abdominal aorta tamiri (EVAR) yapılan hastalarda lokal anestezi kullanımının sonuçlarını irdelemeyi amaçladık. **Gereç ve Yöntemler:** Nisan 2004 ve Ağustos 2012 arasında tedavi olan ardışık 137 hastaya (80 erkek, median yaş 76 yıl, aralık: 61-88 yıl) lokal anestezi ile elektif EVAR uygulandı. Mortalite, morbidite, cerrahi ve endovasküler güçlükler ile endoleakler irdelendi. **Bulgular:** Lokal anestezi 127 hastada (%97), epidural anestezi 7 hastada (%5,1) ve genel anestezi 3 hastada uygulandı (%3,1). Dört hasta morbid obez idi. Üç hastada re-operasyon yapılmaktaydı. İşlem sırasında hava yolu tıkanması ve endişe, genel anesteziye dönme sebebi idi. LA grubundaki bir hastada 30 günlük genel mortalite oranı %0,79 idi. Anestezi şekline bağımsız olarak zor anevrizma morfolojisine bağlı olarak 4 hastada tip I endoleak mevcuttu. Tip 2 endoleak sayısı 13 idi (%9,4). Epidural anestezi grubundan bir hastada parapleji gelişti. **Sonuç:** Lokal anestezi uygulanabilir bir yöntem olup, morbid obez veya kasık bölgesinde geçirilmiş operasyon olmasından bağımsız olarak, hastaların büyük bir çoğunluğunda avantaj sağlayabilen bir yöntemdir.

Anahtar Kelimeler: Aort, abdominal; endovasküler prosedürler

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Patients who are candidates for abdominal aortic surgery represent a group carrying a high risk of significant morbidity and mortality due to the nature of the surgery and the commonly associated comorbidities. Therefore, endovascular aneurysm repair (EVAR) has become a very good alternative. The performance of EVAR procedures can be feasi-

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ble under multiple types of anesthesia, including general, epidural, spinal and local anesthesia (LA).^{1,2} There is growing evidence that the use of regional or local anesthesia may confer a reduction in postoperative complications in patients undergoing EVAR.^{1,2} The aim of this study was to report and analyse the results of a our patients undergoing EVAR under LA.

MATERIAL AND METHODS

A total of 137 consecutive patients undergoing infrarenal EVAR between 2004 and 2012 were analysed in this retrospective study. Our protocol was using epidural anesthesia when we first started EVAR, but the clinic protocol has changed since 2005, and we started to use LA after we operated 7 patients under epidural anesthesia. The main reason for changing the anesthesia strategy was paraplegia in one patient after epidural anesthesia. Emergency procedures such as dissections and ruptured aneurysms were excluded from the study. There were two groups in the study. In group I, LA was applied in 127 patients (97%), and in group II epidural anesthesia (EA) was applied in 7 seven patients (5.1%). Anaesthetic conversion from LA to general anesthesia (GA) was necessary in 3 patients (2.1%). For preoperative risk stratification, the patients were scored using the American Society of Anesthesiologists (ASA) classification. The same team performed all procedures, which included cardiovascular surgeons, interventional radiologists and anesthesiologists in a peripheral angiography suite. All patients received a detailed explanation of the procedure before surgery, and the study was approved by the hospital review board. The following stent grafts were used: Talent (Medtronic, Santa Rosa, CA, USA; n=84), and Excluder (W.L. Gore & Associates, Flagstaff, AZ, USA; n=53). Demographic data such as gender, age, patient status, risk factors, and body mass index were recorded and compared between the groups (LA, GA and epidural anesthesia). Patient data were collected from the computer-based data system.

Endovascular treatment was indicated for aneurysms greater than 5.5 cm in diameter. All diagnoses were made by computerized tomography

angiograms, and the preoperative measurements were made by the same team. All patients were evaluated by the Anesthesia and Cardiology Departments for determining the risk status according to ASA. Patients were not allowed to get any oral feeding 8 hours before the procedure. In the preoperative period, the medications of the patients were continued except antiaggregant agents. Pre-medication was administered with midazolam. A radial arterial line, two peripheral venous catheters (14 or 16 gauge) and a urinary Foley catheter were placed. Routinely, a central venous catheter was used in all patients (jugular vein).

Intraoperative monitoring included continuous electrocardiogram (ECG), invasive arterial blood pressure, transcutaneous oxygen saturation, and urine output. Cefazolin sodium was administered intravenously (IV) as the antibiotic prophylaxis in the operating room. Oxygen was supplied by nasal cannula, mask, or an endotracheal tube, when necessary. LA was achieved using lidocaine 1% into the femoral cut down site (maximum dose 4 mg/kg). For intravenous sedation, propofol was used. Clinical end point of the sedation titration was the minimal amount of propofol that created a still operation field but maintained the airway. If necessary, a fentanyl bolus was given (50-150 mg IV) for pain treatment. Femoral artery was accessed via a cut down under direct vision, and the arteriotomy site was closed with 6/0 propylene sutures.

When GA was mandatory after failure of LA, it was done in the standard fashion. GA was induced with fentanyl 0.7-2.0 mg/kg or sufentanil 0.2-0.6 mg/kg, followed by oxygenation and administration of etomidate 0.1-0.4 mg/kg. After loss of the lash reflex, patients were ventilated by a mask with 100% O₂, and rocuronium in an intubation dose of 0.6 mg/kg was injected. After that, maintenance doses of etomidate were given, or the patient was ventilated with isoflurane. Anesthesia was maintained with a mixture of fentanyl, rocuronium, and an oxygen-isoflurane mixture.

Lumbar spinal anesthesia was delivered through a 26 Gauge needle using a marcaine 0.5% solution as a single bolus of 15-17.5 mg. Lumbar

epidural anesthesia was delivered through an epidural catheter, when epidural anesthesia was used.

Procedure time, fluoroscopy time, and the contrast amount given were compared between the two groups. Procedure time did not include the time necessary for the placement of the epidural or regional anesthetic agents

In the postoperative period, cardiac, respiratory and renal complications, intensive care unit (ICU) and hospital stay times, and endoleaks were compared between the groups. Renal failure was defined as the need for temporary or permanent dialysis or a increase in creatinine levels (more than 1.5 mg/dL). Respiratory complications were defined as the occurrence of pneumonia, respiratory failure requiring pharmacologic intervention, or ventilatory support. Cardiac complications were defined when there was the presence of precordial pain, electrocardiographical changes, an increase of the cardiac enzymes, the symptoms and signs of pulmonary congestion, and ventricular failure. Endoleaks were categorised as described by White et al.³

STATISTICAL ANALYSIS

In this study, normally distributed continuous variables are shown as mean±standard deviation (SD). Continuous variables which were not distributed normally are shown as median (%25-%75), and Mann Whitney U test was performed. Categorical variables are shown as frequency and percentage (%), and Fisher Exact Chi square test was performed. We used SPSS 17.0 (SPSS Chicago, Illinois) program for the statistical analysis. $p < 0.05$ was considered as statistically significant

RESULTS

The demographic characteristics and comorbidities of the patients undergoing EVAR are summarized in Table 1. There were no significant differences for the demographic data between the groups. There were 4 morbid obese patients in LA group and 3 patients had a previous operation in the groin. Anaesthetic conversion from local to gen-

TABLE 1: The demographic data.

	Local anesthesia (n=127 patients, 97%)	Epidural anesthesia (n=7 patients, 5.1%)	p value
Gender (Female)	47 (80 male)	3 (4 male)	0.356
Age	74.1±3.6	72.7±3.1	0.1
ASA III	74 (58%)	2 (28%)	0.125
ASA IV	26 (20.4%)	2 (28%)	0.044
Smoking	76 (59.8%)	5 (71%)	0.427
Hypertension	94 (74%)	5 (71%)	0.588
COPD	42 (33%)	4 (57.1%)	0.183
Hyperlipidemia	39 (30.7%)	4 (57.1%)	0.148
Body mass index	26 (19-37)	25 (17-34)	0.237

ASA: American Society of Anesthesiologists; COPD: Chronic obstructive pulmonary disease.

eral anesthesia was necessary in 3 patients (2.3%). Anxiety (2 patients) and airway obstruction during the procedure were the causes for conversion to GA. Transfusion of blood products was not required in any patient undergoing EVAR. There was not a statistically significant difference in procedure time, fluoroscopy time or the contrast amount used ($p=0.59$, 0.67 and 0.61 respectively). In 95 patients, intravenous sedation was used in combination with LA. No allergic reactions developed due to LA.

Overall 30-day mortality rate was 0.79 %, with the one patient in LA group. In that patient, there was a conversion to GA. The cause of death was multi-organ failure triggered by pneumonia. The patient was a 85-year-old male with ASA IV status. Cardiac complications were observed in four patients (3 in LA, 1 in epidural group) (myocardial infarction, atrial fibrillation in two patients and congestive heart failure). Pulmonary complications included decompensation of pre-existing chronic obstructive pulmonary disease requiring ventilatory support in two patients, pneumonia and pleural effusion. Renal complications (4 patients) included contrast-induced acute renal failure in three patients, and these patients recovered after 2 or 3 dialysis periods without being dialysis dependent permanently. One patient with compensated renal failure became dialysis dependent (in that patient LA to GA conversion was neces-

sary). Mean contrast volume was 163±53 ml. There were no statistically significant differences between the groups for postoperative complications. There was no accidental coverage of renal arteries. ICU and hospital stay times were significantly shorter in LA group ($p=0.034$). There was no conversion to open surgery. In one patient, bilateral lower extremity paralysis occurred due to epidural anesthesia. Access-related complications were observed in two patients (one groin haematoma and one groin infection). None of these access sites required surgery. Postoperative pain management was handled by use of steroidal anti-inflammatory drugs, paracetamol or opioids, when needed. Postoperative pain management was not different between the groups. Patients were mobilized in the first postoperative day.

Type I endoleak was observed in four patients (2.7%). Three type I endoleaks were observed in the LA group and one in GA group with challenging aneurysm morphologies, short landing zones and angulated necks. The solution for type I endoleaks were maintained by endovascular procedures. There were 23 type II endoleaks in LA group and one in epidural anesthesia group. There was one type III endoleak in LA group.

DISCUSSION

Abdominal aortic aneurysm (AAA) is a life-threatening conditions, and a successful outcome depends on many factors, including surgical and anesthetic expertise, adequate hospital infrastructure to deal effectively with complications (e.g. cardiology, critical care and renal support) and also general cooperation on perioperative management between different specialties. As in all fields of surgery, developments have occurred in the direction of minimally invasive techniques to reduce mortality, morbidity, and discomfort to patients, In vascular surgery, this direction has been embodied by the development of endovascular aneurysm repair. EVAR has been performed under regional or general anesthesia. Since mortality, postoperative complications, and length of stay are the consequences of surgical and anesthetic techniques, a change in the latter may contribute to reduce mor-

idity and costs after EVAR. As experience in EVAR has increased, the use of regional/local anesthesia has also increased. There is growing evidence that the use of regional or local anesthesia may confer a reduction in postoperative complications in patients undergoing EVAR.¹⁻⁷ Despite this growing evidence, it still has not become accepted on a large scale as a first-line anesthesia option, and is only applied in a small percentage of EVAR patients. Reasons include the possibility for optimised imaging and exact placement of the graft, a traditional surgical attitude preferring GA, or the fear for either emergency anaesthetic (LA to GA) or surgical conversion (EVAR to open repair) due to intra-operative complications.⁸⁻¹¹ The use of LA in EVAR was described in small studies. De Virgilio et al.¹ reported a retrospective study of 71 patients treated under LA compared with 158 patients treated under GA.⁸ No differences in cardiopulmonary complications were observed between the GA and LA groups. In our series, the complication rate was not different between the groups.

Blood loss, volume of ionized contrast, and exposure to radiation were also not different between the groups. Some studies report a very low anesthesiological conversion rate (1%) which compares favourably with our rate of 2.3 %.⁸ This might be explained by their more rigid contraindications for LA. A concern of LA is the issue of airway security, especially when sedation is applied. This resulted in anesthetic conversion in one patient in our study. Other reasons for conversion to GA in the remaining two patients included patient movements caused by anxiety and discomfort. Some patients also failed holding their breaths for a prolonged time period. All of these factors have negative effects on the imaging quality in LA, and thus precise endograft placement. Fortunately, we did not experience any misplacement due to this issue.

Allergic reactions due to LA are problems. There was no allergic reaction due to LA.

Another issue is the patient's and surgeon's discomfort. Patient movements are caused by dis-

comfort or persistent coughing. In addition, many patients were not capable of holding their breath for a prolonged time period. All these factors may have an impact on imaging quality in LA, and thus precise endograft placement. This situation may lead to multiple images, and more exposure to radiation. Therefore, we may comment that extremely challenging anatomies may be a relative contraindication for LA at present. We experienced 4 renal complications with to challenging morphology.

In our series, patients operated under GA spent significantly longer time in the operating room, in the recovery room, and in the hospital when compared to those operated under LA. In one patient with epidural anesthesia there was paraplegia, and 3 patients operated under GA had comorbid situations, and this may be the reason of prolonged ICU and hospital stay. Today, the discharge time after EVAR is decreasing, and routine ICU stay for EVAR patients has been abandoned in some centers, which may lead us to think about the ways to decrease the financial burden of the procedure.

This study has limitations due to its retrospective design and small number of patients operated under general and epidural anesthesia. Besides, pulmonary complications related to GA are lacking, because there is not a control group. However, we may comment that LA is feasible and offers advantages regardless of the patient being obese or not or having previous surgery in the inguinal region. Another potential advantage of LA may be the discomfort of the patient caused by overstretching the arterial system by the delivery sheath, which can alert the physician of the risk of injury or rupture. Although the recently published practice guidelines of the Society of Vascular Surgery categorise the level of recommendation and evidence for the use of regional anesthesia or LA for EVAR as weak and low, respectively.¹¹ We believe that LA and sedation can be used safely in patients who are candidates for endovascular stent grafting with low mortality and morbidity.

Conflict of Interest

Authors declared no conflict of interest or financial support.

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