

## Epidural Anesthesia vs General Anesthesia in Uterine Artery Embolization

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### Abstract

**Background:** Uterine Artery Embolization (UAE) has been used worldwide for the treatment of uterine fibroids. The aim of the current study is to evaluate the effects of epidural analgesia (EDA) given only intraoperatively to those of general anesthesia (does it still affect in recovery) in women undergoing uterine artery embolization (UAE) for the treatment of systematic uterine fibroids.

**Patients and methods:** A total of 40 ASA1-III patients (ages 35-55) selected for uterine artery embolization were divided into 2 groups i.e. an epidural anesthesia group (A) and a general anesthesia group (B). Each group comprised of 20 individuals. The parameters i.e. pain scoring, incidence of nausea and vomiting, need for opioids, overall patient satisfaction score and discharge from hospital were measured. Pain intensity was measured using VAS (1–10) at 0, 1, 2, 4, 8, 12 and 24 h. Nausea lasting more than 10 min or vomiting was treated with ondansetron 4 mg. Patient satisfaction for postoperative analgesia was recorded according to a satisfaction score (poor=0, fair=1, good=2, excellent=3). All data were recorded with residents of anesthesia. Primary outcome was morphine and or pethidine, consumption in the first 24 h. Secondary outcome measures were; pain intensity, postoperative analgesic consumption, postoperative nausea and vomiting (PONV) and patient satisfaction.

**Results:** Differences in the heart rate between the 2 groups were statistically significant at all readings where group (B) patients developed less significant tachycardia compared to group (A) patients. Differences in systolic blood pressure values between the 2 groups were statistically significant lower in group (B) compared to group (A) at 2 points: after 5 min & after 10 min from induction of anesthesia. Differences in diastolic blood pressure values between the 2 groups were statistically significant lower in group (A) compared to group (B) at all times except preoperative reading. Thus the epidural anesthesia provided more hemodynamic stability than general anesthesia. Postoperative pain severity of the patients significantly decreased in each group at recovery room (time 0) and postoperative 1<sup>st</sup>, 2<sup>nd</sup>, 4<sup>th</sup>, 12<sup>th</sup> and 24<sup>th</sup> h (repeated measured variance analysis,  $p < 0.001$ ). However, the reduction of postoperative VAS scores was more in epidural anesthesia group than general anesthesia (repeated measured variance analysis, test,  $p = 0.466$ ).

**Conclusion:** Uterine artery embolization for fibroids is an effective and safe therapeutic modality for symptomatic fibroids especially for those patients who like to preserve their uterus. Recovery and time to return to normal activities is shorter than hysterectomy and open myomectomy. With the results of the present study it can be concluded that epidural anaesthesia was much better in pain relief, less sedating effect and overall patient satisfaction. Thus, epidural anaesthesia technique can be helpful for women undergoing UAE to recover faster providing good symptom relief for most patients.

**Keywords:** Epidural anesthesia; General anesthesia; Uterine artery embolization

### Introduction

Uterine fibroids or leiomyomas are benign muscular and fibroid tumors of the uterus. They are very common, with a cumulative incidence of well over 50% by age 50 [1]. Symptomatic uterine leiomyomas can cause pain, heavy bleeding, pressure effects and reduced fertility. Traditionally, definitive treatment has been through hysterectomy or myomectomy [2].

Today, Uterine Artery Embolization (UAE) has become a new standard procedure for the treatment of uterine fibroids around the world [3]. More than 100,000 procedures have been performed globally and ongoing research continues to contribute to our knowledge of this procedure. A Cochrane review by Gupta et al. [4]

showed that uterine artery embolization had overall patient satisfaction rates similar to those of myomectomy and hysterectomy for the same indication, with faster recovery times, shorter hospital stays, and a quicker return to routine activities. Uterine artery embolization (UAE) using embolic particles (PVA, Gelfoam) to occlude the uterine arteries, have been reported as a relatively safe, effective, and durable nonsurgical alternative to hysterectomy in diminishing fibroid-related symptoms [5]. The procedure is done either under general anesthesia or epidural anesthesia. General anesthesia offers a very rapid and reliable onset, control over the airway and ventilation and potentially less hypotension. Advances in analgesia/anesthesia have improved patient satisfaction and perioperative outcomes. Epidural anesthesia/analgesia is one of these advances that is gaining rapid acceptance due to a perceived reduction in morbidity and overall patient satisfaction. Many beneficial aspects of epidural anesthesia have been reported, including better suppression of surgical stress, positive effect on postoperative nitrogen balance, more

stable cardiovascular hemodynamics, reduced blood loss, better peripheral vascular circulation, and better postoperative pain control [6,7].

The aim of the current study is to evaluate the effects of epidural analgesia (EDA) given only intraoperatively to those of general anesthesia (does it still affect in recovery) in women undergoing uterine artery embolization (UAE) for the treatment of systematic uterine fibroids.

## Patients and Methods

After approval of Institutional ethics committee, written informed consents were taken from all patients. A total of 40 ASA I-III patients (ages 35-55) selected for uterine artery embolization at Saad specialist hospital, Kingdom of Saudi Arabia, Eastern province, Al Khobar participated in this prospective study from 1st of January 2015 till December 31st, 2016. The women were divided into 2 groups i.e. an epidural anesthesia group (A) and a general anesthesia group (B). Each group comprised of 20 individuals. The parameters i.e. pain scoring, incidence of nausea and vomiting, need for opioids, overall patient satisfaction score and discharge from hospital were measured.

Epidural anesthesia was administered in the sitting position in the operating room at the level of L3-L4 after skin preparation by iodine and local anesthesia using xylocaine 2% 5ml volume using the negative pressure technique (loss of resistance), then insertion of the epidural catheter is done, subarachnoid and intravenous placement was ruled out by a test dose of lidocaine 1% and epinephrine 1:2000. Peripheral venous access was obtained and patients received premedication; midazolam 3-5 mg. External monitoring was established, a bolus of 1000 cc of crystalloid was given. Epidural block was established by bolus administration of 0.5% bupivacaine+fentanyl 50 µg until a T-4 level was established. During the procedure, 0.25% bupivacaine+fentanyl 2 µg/ml infusion at a rate of 6-10 ml/h was continued to maintain appropriate anesthesia. The epidural catheter was removed at the end of the procedure.

In general anesthesia group all patients received midazolam 3-5 mg before the induction of anesthesia and monitored with three leads electrocardiography, pulse oximetry, noninvasive blood pressure and capnography. General anesthesia was induced with fentanyl 1-2 mcg/kg, propofol 1.5-2 mg/kg and tracheal tube was facilitated with atracurium 0.5 mg/kg. Anesthesia was maintained with isoflurane 1.5% and O<sub>2</sub>/air mixture with a fraction of 40% inspired O<sub>2</sub>. Fentanyl 25 µg in bolus doses was given intravenously if the mean blood pressure (MBP) or heart rate exceeded 20% of the preoperative value. Hypotension was defined as a decrease of more than 20% of the base line MBP and was treated with increments of 6 mg bolus doses of ephedrine iv and 250 ml of lactated ringer solution.

After recovery from anesthesia, patients were shifted to post-anesthetic care unit (PACU) for the first 2 h. Postoperative analgesia was provided with morphine (10 mg), pethidine (50 mg) according to the severity of pain (VAS more than 3), and paracetamol (1 gm) every 4 h.

Pain intensity was measured using VAS (1-10) at 0, 1, 2, 4, 8, 12, and 24 h. Nausea lasting more than 10 min or vomiting was treated with ondansetron 4 mg. Patient' satisfaction for postoperative analgesia was recorded according to a satisfaction score (poor=0, fair=1, good=2, excellent=3). All data were recorded with residents of anesthesia.

Primary outcome was morphine and or pethidine, consumption in the first 24 h. Secondary outcome measures were; pain intensity, postoperative analgesic consumption, postoperative nausea and vomiting (PONV) and patient satisfaction

The VAS was given to each patient at the time of her arrival in the recovery room, which was considered as hour 0. Each patient recorded her pain tolerance at postoperative hours (h) 0, 2, 4, 8, 12, and 24. No pain scored 0 points, while worst possible pain for the patient was scored with 10 points. The pain scoring was reviewed by an anesthesiologist. All contraindication to epidural anesthesia, American Society of Anesthesiologists (ASA) status>III, age<18 or >55 years, receiving analgesia less than 4 h prior to enrollment, presence of complicated hypertension, recent hemorrhage, fever of more than 38°C or history of allergy to local anesthetics or meperidine were excluded from the study.

## Sample size

The sample size was calculated using Epi-Info software statistical package created by World Health organization and center for Disease Control and Prevention, Atlanta, Georgia, USA version 2002. The sample size was calculated at N=20

The criteria used for sample size calculation were as follows:

- 95% confidence limit
- 80% power
- The ratio between experimental and control groups is 1:1
- Expected outcome in in treatment group is double times better than control groups. (40-80% of optimal required)

## Statistical analysis

The software SPSS vs. 15.0 for Windows (SPSS Inc, Chicago, IL, United States) was used for statistical analysis. Normally distributed data are presented as mean ± (SD) and were analyzed using Student's t test and two-way analysis of variance with repeated measures and post hoc Dunnett test as appropriate. A significance level of 5% was considered as critical value.

## Results

The demographic data of the study group A and B are mentioned in Table 1. No statistically significant difference was obtained.

Factor	Epidural (N=20)			General Anaesthesia (N=20)			P value
Age (years)	45 ± 3.04			48 ± 2.4			0.2
Height (cm)	161 ± 2.34			159 ± 3.5			1.21
Weight (kg)	72.3 ± 4.56			73.5 ± 3.76			3.86
Presence of systemic disease	ASA I 17	ASAII 3	ASAIII 0	ASA I 16	ASAII 4	ASAIII 0	
Values are expressed as Means ± SD							

Table 1: Demographics of the study group.

Differences in the heart rate between the 2 groups were statistically significant at all readings where group (B) patients were significantly

less tachycardic compared to group (A) patients. Differences in systolic blood pressure values between the 2 groups were statistically significant lower in group (B) compared to group (A) at 2 points: after 5 min & after 10 min from induction of anesthesia. Differences in

diastolic blood pressure values between the 2 groups were statistically significant lower in group (A) compared to group (B) at all times except preoperative reading. Thus, the epidural anesthesia provided more hemodynamic stability than general anesthesia (Table 2).

Vital signs	Epidural Anaesthesia		General Anaesthesia		P Value
	Mean	± Sd	Mean	± Sd	
<b>Preoperative Heart rate</b>	89.00	± 11.095	90.63	± 14.288	1.191
• Systolic Blood pressure	119.16	± 14.51	123.16	± 8.56	0.746
• Diastolic Blood pressure	68.00	± 9.737	71.50	± 10.368	0.848
<b>After 5 min Heart rate</b>	86.00	± 12.36	88	± 19.055	<0.05*
• Systolic Blood pressure	96.83	± 15.68	127.66	± 14.13	
• Diastolic Blood pressure	51.61	± 14.284	72.16	± 9.530	
<b>After 10 min Heart rate</b>	86.50	± 14.45	86.33	± 16.4	<0.05*
• Systolic Blood pressure	95.63	± 9.142	121.83	± 12.793	
• Diastolic Blood pressure	52.50	± 8.977	73.50	± 11.828	
<b>After 15 min Heart rate</b>	88.66	± 14.99	90.66	± 16.6	<0.05*
• Systolic Blood pressure	110.50	± 14.991	115.00	± 9.595	0.172
• Diastolic Blood pressure	64.33	± 10.416	84.83	± 11.852	<0.05*
<b>After 30 min Heart rate</b>	86.4	± 11.05	89	± 9.8	<0.05*
• Systolic Blood pressure	110.3	± 11.18	112	± 11.3	
• Diastolic Blood pressure	68	± 10.9	75	± 15.3	
<b>After 45 min Heart rate</b>	68.4	± 10.5	80	± 9.4	<0.05*
• Systolic Blood pressure	109.2	± 11.3	112	± 11.3	
• Diastolic Blood pressure	62	± 13.4	77	± 14.7	
<b>1 h postoperatively Heart rate</b>	78	± 14.5	83	± 10.4	<0.05*
• Systolic Blood pressure	110	± 12.2	115	± 9.5	
• Diastolic Blood pressure	63	± 10.7	77	± 11.4	
<b>6 h postoperatively Heart rate</b>	69	± 13.4	78	± 16.3	<0.05*
• Systolic Blood pressure	112	± 12.9	118	± 13.2	
• Diastolic Blood pressure	61	± 14.1	75	± 11.5	
<b>12 h postoperatively Heart rate</b>	73	± 13.2	75	± 13.2	<0.05*
• Systolic Blood pressure	110	± 13.4	118	± 14.4	
• Diastolic Blood pressure	64	± 13.4	78	± 10.4	

Data are expressed as mean and standard deviation.  
\*Statistically significant. (P-value of statistical significance<0.05)

**Table 2:** Comparison of heart rate, systolic and diastolic blood pressure in epidural and general anesthesia.

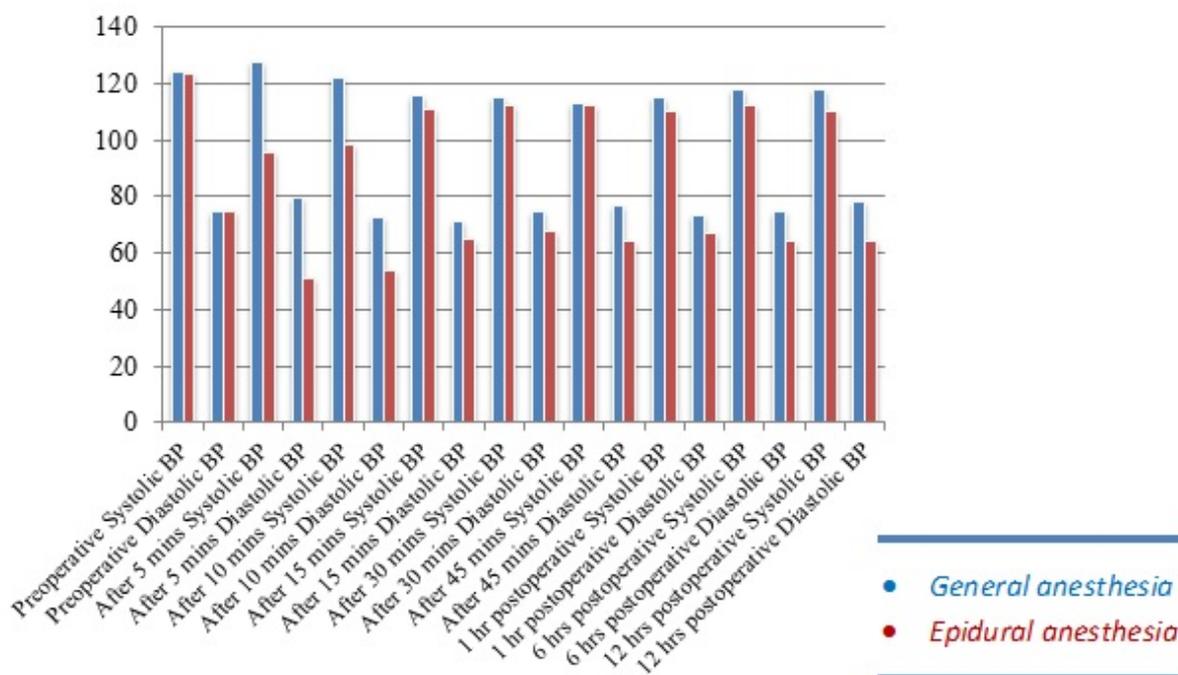


Figure 1: Vital signs comparison of epidural vs. general anaesthesia.

Postoperative Time	Epidural (N=20)	General Anaesthesia (N=20)
0 h	6.8 (0-9)	7.4 (0-10)
1 h	3.6 (1-7)	4.3 (3-7)
2 h	2.7 (0-6)	3.9 (2-6)
4 h	2.7 (0-6)	3.1 (0-8)
12 h	2.1 (0-5)	2.4 (0-6)
24 h	2.0 (0-5)	2.0 (0-4)

Table 3: Comparison of postoperative pain measurement by VAS in epidural and general anaesthesia.

Type of Anaesthesia	Epidural Anaesthesia		General Anaesthesia		P Value
	Mean	± Sd	Mean	± Sd	
Operating room time (in mins)*	105	± 2.94	104.67	± 3.20	0.676
PACU (Post Anaesthesia Care Unit) time (in mins)*	45	± 0.18	44.00	± 0.23	0.902

\*Data are expressed as mean and standard deviation.

Table 4: Comparison of total recovery time in epidural and general anaesthesia.

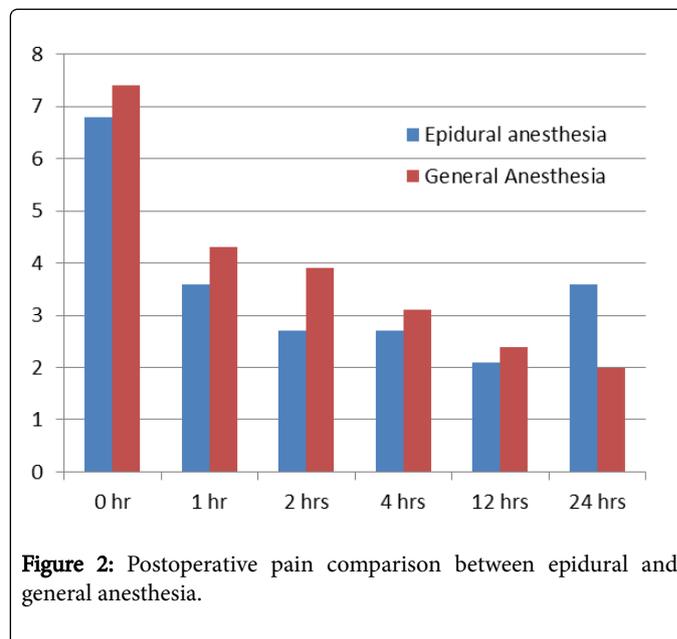
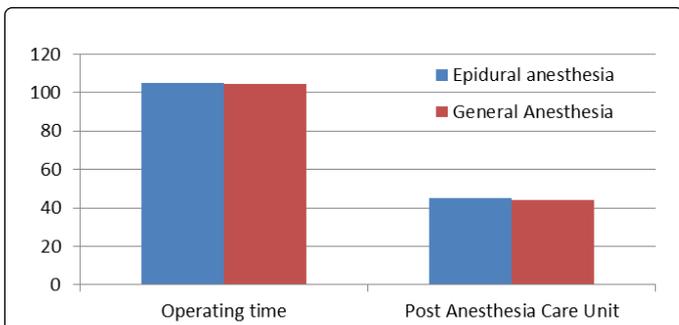


Figure 2: Postoperative pain comparison between epidural and general anaesthesia.

Postoperative pain severity of the patients significantly decreased in each group at recovery room (time 0) and postoperative 1<sup>st</sup>, 2<sup>nd</sup>, 4<sup>th</sup>, 12<sup>th</sup> and 24<sup>th</sup> h (repeated measured variance analysis, p<0.001). However, the reduction of postoperative VAS scores was more in epidural anaesthesia group than general anaesthesia (repeated measured variance analysis, test, p=0.466) (Table 3).



**Figure 3:** Comparison of total recovery time in epidural and general anaesthesia.

Complications	Epidural Anaesthesia N=20	General Anaesthesia N=20	P Value
Nausea	1.8%	6%	p < 0.001
Vomiting	2%	5%	p < 0.05

**Table 5:** Comparison of complications in epidural and general anaesthesia.

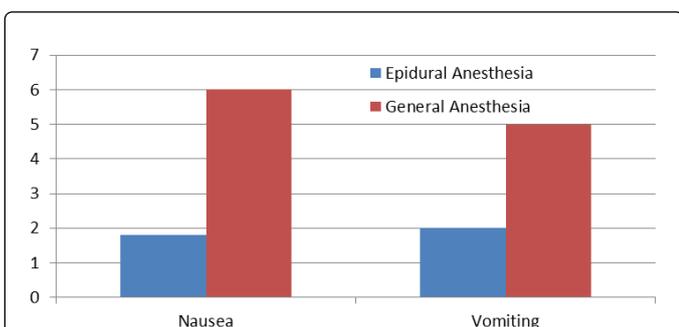
Type of Analgesia	Epidural Anaesthesia N=20	General Anaesthesia N=20	P Value
Morphine time requested (in min)	96	35	0.65
Dose at 12 h postoperative (mg)	19.2	35.3	< 0.1
Dose at 24 h	61.4	82.2	0.1
Meperidine time requested (in min)	243	185	0.4
Dose at 12 h postoperative (mg)	135	187	0.99
Dose at 24 h	120	144	0.6

**Table 6:** Comparison of the analgesia dose given between epidural and general anaesthesia.

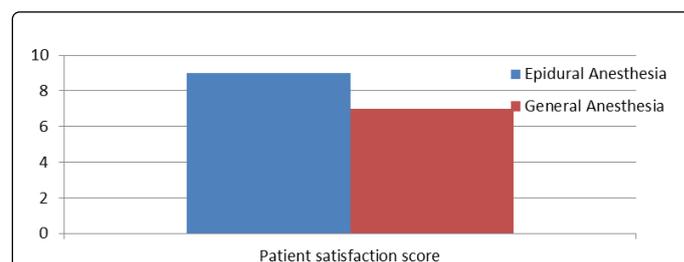
The patients were handed over a survey form wherein they were asked to rate on a scale of 10 their overall experience preoperatively to postoperatively. The overall patient satisfaction rate was calculated by taking out the mean.

Type of Analgesia	Epidural Anaesthesia N=20	General Anaesthesia N=20	P Value
Morphine time requested (in mins)	96	35	0.65
Dose at 12 h postoperative (mg)	19.2	35.3	< 0.1
Dose at 24 h	61.4	82.2	0.1
Meperidine time requested (in mins)	243	185	0.4
Dose at 12 h postoperative (mg)	135	187	0.99
Dose at 24 h	120	144	0.6

**Table 7:** Comparison of the analgesia dose given between epidural and general anaesthesia.



**Figure 4:** Comparison of complications in epidural and general anaesthesia.



**Figure 5:** Comparison of patient satisfaction score in epidural and general anaesthesia.

	Epidural Anaesthesia	General Anaesthesia	P Value

Patient Satisfaction Score	9 (7-10)*	7 (7-10)	<0.001
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**Table 8:** Comparison of patient satisfaction score in epidural and general anaesthesia.

## Discussion

Uterine leiomyomas are the most common benign pelvic tumors in women over 35 years. Most of women are asymptomatic; however, 20% may present with symptoms that are either abnormal uterine bleeding or bulk-related symptoms [8,9]. Hysterectomy has been the traditional treatment for symptomatic fibroids; however, it is associated with 1-3% incidence of major complications. Uterine artery embolization (UAE) is a treatment option for uterine fibroids to improve abnormal bleeding and pain/pressure symptoms, indicated for premenopausal woman who failed hormonal management and want to avoid surgery [10,11]. The American College of Obstetricians has recommended UAE as an option for women who wish to retain their uterus [12].

Fixed and extensive pain management protocol is crucial when performing UAE. Many protocols have been described for UAE, varying from standard epidural anaesthesia to patient-controlled analgesia (PCA) in combination with NSAIDs and paracetamol [13]. Thus, the current study was conducted to compare the efficacy of epidural anaesthesia and general anaesthesia amongst females undergoing uterine artery embolism.

In the present study, statistically significant difference was obtained in the systolic and diastolic blood pressure. Epidural anesthesia was more hemodynamically stable than general anesthesia (Table 2 and Figure 1).

In the present study, statistically significant difference was obtained in the decrease in pain score in most of the time measured after surgery till patients discharge. Similar results were reported in studies conducted by various authors where epidural anaesthesia has better pain relief than systemic opioids or general anaesthesia [14-16]. In the present study, postoperative pain severity of the patients significantly decreased in each group at recovery room (time 0) and postoperative 1<sup>st</sup>, 2<sup>nd</sup>, 4<sup>th</sup>, 12<sup>th</sup> and 24<sup>th</sup> h. Hence the reduction of postoperative VAS scores was more in epidural anaesthesia group than general anaesthesia (Table 3).

In the present study, the operating time and the postanesthesia care unit time was found to be similar in both the groups with no statistically significant difference (Table 4 and Figure 2). Similar results were obtained by studies conducted by Catro-Alves et al. He compared spinal anaesthesia and general anaesthesia for elective hysterectomy and assessed recovery by using the global quality of recovery-40 questionnaire (QoR-40) upto 48 h after surgery but not beyond [17]. Liu et al. conducted a study amongst elderly patients undergoing knee arthroplasty in general anaesthesia or peripheral block and followed intraoperative and postoperative course up to day 7 with the Postoperative Quality of Recovery Scale (Postop QRS) tool. The intraoperative and early postoperative course favoured the block technique, but at day 7 no difference was found. Resumption of activities of daily living and patient satisfaction were similar between the two groups [18].

In the present study, statistically significant difference was obtained in the postoperative complication of nausea and vomiting (Figure 3). A lower percentage of these symptoms were obtained in the epidural

group as compared to the general anesthesia group (Tables 5 and 6). Epidural anesthesia may afford particular advantages in the outpatient setting (Figure 4). The somnolence, pain, nausea and vomiting that may be associated with the use of general anesthesia can result in unscheduled hospital admission or prolonged hospital stay, which can decrease patient satisfaction [19]. Epidural anesthesia has been shown to improve postoperative pain control and decrease nausea and vomiting, somnolence, and recovery time. It has also shown reduction in the number of unexpected hospital admissions post operatively [20].

In the present study, the epidural group had a higher score for overall patient satisfaction than the general anesthesia group (Table 7).

Thus, the overall results of the current study showed that epidural anesthesia has better and superior postoperative results as compared to general anesthesia. The epidural group females had less recovery time, postoperative nausea and vomiting as compared to general anesthesia group, thereby having a higher overall satisfaction rate (Table 8 and Figure 5).

## Conclusion

Uterine artery embolization for fibroids is an effective and safe therapeutic modality for symptomatic fibroids especially for those patients who like to preserve their uterus. Recovery and time to return to normal activities is shorter than hysterectomy and open myomectomy. With the results of the present study it can be concluded that epidural anesthesia was much better in pain relief, less sedating effect and overall patient satisfaction. Thus, epidural anesthesia technique can be helpful for women undergoing UAE to recover faster providing good symptom relief for most patients.

## References

- Baird DD, Dunson DB, Hill MC, Cousins D, Schectman JM (2003) High cumulative incidence of uterine leiomyoma in black and white women: ultrasound evidence. *Am J Obstet Gynecol* 188: 100-107.
- Rischbieter P, Sinclair C, Lawson A, Ahmad S (2016) Uterine artery embolisation as an effective choice for symptomatic fibroids: Five-year outcome. *S Afr J Radiol* 20: 1-5.
- Dariushnia SR, Nikolic B, Stokes LS, Spies JB (2014) Quality improvement guidelines for uterine artery embolization for symptomatic leiomyomata. *J Vasc Interv Radiol* 25: 1737-1747.
- Gupta JK, Sinha A, Lumsden MA, Hickey M (2014) Uterine artery embolization for symptomatic uterine fibroids. *Cochrane Database Syst Rev* 16: CD005073.
- Firouznia K, Ghanaati H, Jalali AH, Shakiba M (2013) Uterine artery embolization for treatment of symptomatic fibroids: a review of the evidence. *Iran Red Crescent Med J* 15: e16699.
- Modig J, Karlström G (1987) Intra- and post-operative blood loss and haemodynamics in total hip replacement when performed under lumbar epidural versus general anaesthesia. *Eur J Anaesthesiol* 4: 345-355.
- Hawker GA, Mian S, Kendzerska T, French M (2011) Measures of adult pain: Visual analog scale for pain (vas pain), numeric rating scale for pain (nrs pain), mcgill pain questionnaire (mpq), shortform mcgill pain questionnaire (sfmpq), chronic pain grade scale (cpgs), short form36 bodily pain scale (sf36 bps), and measure of intermittent and constant osteoarthritis pain (icoap). *Arthritis Care Res* 63: S240-S252.
- Bérczi V, Valcseva É, Kozics D, Kalina I, Kaposi P, et al. (2015) Safety and Effectiveness of UFE in Fibroids Larger than 10 cm. *Cardiovasc Intervent Radiol* 38: 1152-1156.
- Toor SS, Jaber A, Macdonald DB, McInnes MD, Schweitzer ME, et al. (2012) Complication rates and effectiveness of uterine artery

- embolization in the treatment of symptomatic leiomyomas: a systematic review and meta-analysis. *AJR Am J Roentgenol* 199: 1153-1163.
10. Chittawar PB, Kamath MS (2015) Review of nonsurgical/minimally invasive treatments and open myomectomy for uterine fibroids. *Curr Opin Obstet Gynecol* 27: 391-397.
  11. Spies JB (2016) Current role of uterine artery embolization in the management of uterine fibroids. *Clin Obstet Gynecol* 59: 93-102.
  12. American College of Obstetricians and Gynecologists (2008) ACOG practice bulletin. Alternatives to hysterectomy in the management of leiomyomas. *Obstet Gynecol* 112: 387.
  13. Zupi E, Pocek M, Dauri M, Marconi D, Sbracia M, et al. (2003) Selective uterine artery embolization in the management of uterine myomas. *Fertil Steril* 79: 107-111.
  14. Benzon HT, Wong HY, Belavic Jr AM, Goodman I, Mitchell D, et al. (1993) A randomized doubleblind comparison of epidural fentanyl infusion versus patientcontrolled analgesia with morphine for postthoracotomy pain. *Anesth Analg* 76: 316-322.
  15. Hjortso N, Neumann P, Frøsig F, Andersen T, Lindhard A, et al. (1985) A controlled study on the effect of epidural analgesia with local anaesthetics and morphine on morbidity after abdominal surgery. *Acta Anaesthesiol Scand* 29: 790-796.
  16. Negre I, Gueneron J, Jamali S, Monin S (1994) Preoperative analgesia with epidural morphine. *Anesth Analg* 79: 298-302.
  17. Catro-Alves LJS, De Azevedo VLF, Braga TFDF, Goncalves AC, De Oliveira Jr GS (2011) The effect of neuraxial versus general anesthesia techniques on postoperative quality of recovery and analgesia after abdominal hysterectomy: a prospective, randomized, controlled trial. *Anesth Analg* 113: 1480-1486.
  18. Liu J, Yuan W, Wang X, Royse C, Gong M, et al. (2014) Peripheral nerve blocks versus general anesthesia for total knee replacement in elderly patients on the postoperative quality of recovery. *Clin Interv Aging* 9: 341-350.
  19. Parnass SM, McCarthy RJ, Bach BR, Corey ER, Hasson S, et al. (1993) Beneficial impact of epidural anesthesia on recovery after outpatient arthroscopy. *Arthroscopy* 9: 91-95.
  20. Mulroy M (1988) Regional anesthesia: when, why, why not. *Outpatient Anesthesia*. JB Lippincott, Philadelphia, USA, pp. 82-91.