Research Article

Effect of Intramyometrial Injection of Epinephrine During Abdominal Myomectomy

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ABSTRACT

Aim: This study aimed to assess the effectiveness of intramyometrial injection of epinephrine in reducing blood loss in abdominal myomectomy and to compare it with pericervical tourniquet.

Materials and Methods: Randomized controlled study carried on sixty patients suffering from symptomatic uterine fibroids and counseled for abdominal myomectomy. The patients were randomized into 3 groups of twenty each: control, tourniquet and epinephrine groups. A comparative analysis of the intra and postoperative outcomes of these groups was performed assessing the duration of operation, the blood loss and the blood transfusion rate.

Results: The epinephrine group had a statistically significant lower values of the fall in haemoglobin level and a significantly lower mean operative blood loss than the tourniquet and the control groups. Furthermore, the mean duration of operation was significantly shorter in the epinephrine group.

Conclusion: Intramyometrial injection of a solution of bupivacaine (50 ml of 0.25%) plus epinephrine (0.5 ml of 1 mg/ml) is very effective in reducing intraoperative bleeding during abdominal myomectomy. This solution is significantly more effective than using Foley's urethral catheter as a pericervical tourniquet. However it offers no additional benefits over using a pericervical tourniquet regarding the need for blood transfusion.

Key Words: Bupivacaine, epinephrine, myomectomy, pericervical tourniquet, uterine fibroids

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INTRODUCTION

Uterine leiomyomata are the most frequent benign tumors affecting women. In fact, at least 20–25% of women of reproductive age are affected by uterine leiomyomata[1,2] with considerable variation according to age.[3]

Myomectomy is the commonest conservative surgical procedure offered to patients with symptomatic uterine fibroids.[4,5] Haemorrhage is still a great concern during myomectomy and expectedly, many methods have been devised for reducing such blood loss. The use of Bonney's clamp, intrauterine injection of vasopressin, preoperative administration of drugs like GnRH and misoprostol and the use of a tourniquet have all been reported.[6]

Vasopressin is a naturally occurring hormone that can cause vascular spasm and uterine muscle contraction, and hence has the potential to prevent bleeding during uterine surgery. Previous studies have demonstrated that intraoperative infiltration of vasopressin is effective in reducing blood loss during abdominal myomectomy[7] More recently, in an observational study, the effectiveness of dilute ornitin-vasopressin during laparoscopic myomectomy has been reported by Rossetti *et al*.[8] However there have been several reports of serious cardiovascular side effects following intramyometrial injection of vasopressin.[9-11]

Epinephrine is a potent vasoconstrictive agent that has a high risk of cardiovascular effects if an intravascular instillation is performed. The vasoconstrictive effect of epinephrine on tissue lasts longer than that of vasopressin. Bupivacaine is a local anaesthetic that causes vasodilatation at clinical doses, but lower doses appear to cause vasoconstriction. Bupivacaine has shown to have a vasoconstrictive activity in concentrations of ≤ 0.25%, with duration of its action between 4 and 24 h when used for local infiltration. The use of a combination of bupivacaine and low dose of epinephrine in order to minimize the cardiovascular effects of the latest without interfering with the vasoconstrictive effects on haemostasis has been documented.[12,13]

In one study on laparoscopic myomectomy, the use of bupivacaine and epinephrine was significantly more effective than placebo in reducing intraoperative bleeding, total operative time, myoma enucleation time, and subjective surgical difficulty.[12]

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Haemostatic tourniquets to reduce intraoperative bleeding have long been available.[14] The benefit of use of a uterine artery tourniquet was illustrated in a randomized trial where the use of a uterine artery tourniquet compared with no tourniquet resulted in a significant decrease in blood loss.[15]

Data conflict regarding whether tourniquet use is as effective as the use of vasopressin. Blood loss with intramyometrial vasopressin compared with use of a uterine artery tourniquet was significantly lower in one randomized trial,[8] but was comparable in another.[16]

The objective of the present study is to assess the effectiveness of intramyometrial injection of epinephrine in reducing blood loss in abdominal myomectomy and to compare it with pericervical tourniquet.

PATIENTS AND METHODS

This study was designed as a prospective randomized controlled study. Patients were recruited from the gynecology clinic of Elshatby Maternity University Hospital suffering from symptomatic fibroids that required excision by myomectomy during the period from December 2016 to June 2017. The patients were counseled for abdominal myomectomy operation.

Cases were included in the study after fulfilling the following criteria: patient fit for surgery, suffering from symptomatic interstitial uterine leiomyomas (grade 3 to 6) and younger than 45 years of age. While patients with the following criteria were excluded from the study: adenomyosis, submucous leiomyoma (grade 0-2), pedunculated subserous leiomyoma (grade 7), cervical myoma, intraligamentry myoma, medical co morbidities like cardiovascular, hepatic, vascular, renal disease, or bleeding diathesis, and patients who had received preoperative hormonal therapy or any medication that could affect intraoperative bleeding.

After approval of Ethical Committee of the Faculty of Medicine all patients were informed about the nature of the study and an informed written consent was signed by each patient prior to participation in the study.

All selected patients were subjected to complete history taking, complete general and gynecological examination. Routine preoperative investigations were done to all patients including preoperative complete blood count (CBC) as a baseline to estimate blood loss, blood sugar profile, liver and renal function tests, hepatitis screen and coagulation profile.

Ultrasonographic scans with transvaginal and transabdominal three dimensional (3D) probes were performed to calculate leiomyoma sizes by measuring the 3 main diameters (D1, D2, D3) and applying the formula of the ellipsoid (D1 x D2 x D3 x 0.52). An arithmetic mean of the sizes was used in cases having 2 or more leiomyomas[12]

Patients were randomly allocated to one of the following groups with twenty patients in each group, allocation was done through a sealed opaque envelope: Group 1 (Control group): Conventional abdominal myomectomy operation was performed without the use of any uterine clamp, tourniquet or epinephrine injection.

Group 2 (Tourniquet group): Conventional abdominal myomectomy operation was performed with the use of Foley's catheter as a tourniquet applied at the base of the uterus close to the insertion of the uterosacral ligaments. This was tied in such a way that it temporarily impedes the blood flow in the uterine vessels and the infundibulopelvic ligaments. The Fallopian tubes and the ovaries were carefully excluded from the line of the tourniquet to avoid direct compression. This tourniquet was released intermittently (at about 10 minutes intervals) during the surgery and finally was removed after the repair of the uterus.[17] (Fig.1)

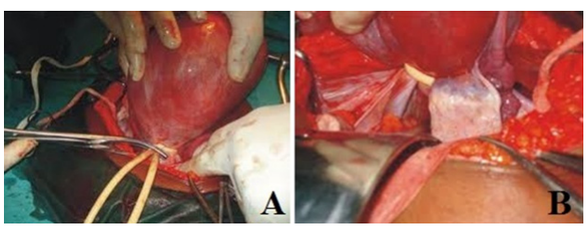

Fig. 1: (A) Anterior view. Tourniquet applied at base of uterus and held by strong artery forceps. (B) Posterior view. Tourniquet applied at base of uterus below the ovary and fallopian tubes.

Group 3 (Epinephrine group): Conventional abdominal myomectomy operation was performed after infiltration of the serosa and / or myometrium overlying the leiomyoma before uterine incision with a solution composed of 50 ml Bupivacaine Hcl 0.25% (Bucain® Weimer pharma, for Actavis Group PTC) and 0.5 mg of epinephrine Hcl (2 vials of Epinephrine® 0.25mg/1ml Misr Co. for Pharmaceutical Industries). The solution was prepared just before the procedure. Before each infiltration, aspiration was performed to avoid intravascular injection.[12]

Estimation of blood loss was done by[18] : EBL = BV X (HCTo - HCTF)/HCTave, EBL: Estimated blood loss, HCTo: Initial hematocrit (preoperative),HCTF: Final

hematocrit (3 hours postoperative), HCTave: Average hematocrit= (HCTo + HCTF)/2 and BV: Blood volume = Body weight X 60cc/kg.

STATISTICAL ANALYSIS

Data were analyzed using IBM SPSS software package version 20.0. Qualitative data were described using number and percent. Quantitative data were described using range, mean, standard deviation and median. Significance of the obtained results was judged at the 5% level. The used tests were; Chi-square test for categorical variables, to compare between different groups. Monte Carlo correction for chi-square when more than 20% of the cells have expected count less than 5. F-test (ANOVA). For normally quantitative variables, to compare between more than two studied groups, and Post Hoc test (LSD) for pair wise comparisons. Paired t-test for normally quantitative variables, to compare between two periods. Mann Whitney test for abnormally quantitative variables, to compare between two studied groups. Kruskal Wallis test for abnormally quantitative variables, to compare between more than two studied groups.

RESULTS

In group I, age ranged between 30-40 years with a mean of 36.25±2.86, weight ranged between 62.0-107.0 kg with a mean of 84.05±13.62, height ranged between 155.0-172.0 cm with a mean of 164.45±5.57, in group II the age ranged between the 30-40 years with a mean of 34.45 ± 2.72, weight ranged between 68.0 – 107.0 kg with a mean of 88.05 ± 13.18, height ranged between 158.0-179.0 cm with a mean of 167.80 ± 5.74, and in group III the age ranged between 22.0-43.0 years with a mean of 43.30 ± 6.94, weight ranged between 65.0 – 104.0 kg with a mean of 86.20 ± 13.78, height ranged between 157.0-179.0 cm with a mean of 164.25 ± 7.14. There was no statistically significant difference between the three groups as regards age, weight and height (Table 1).

The tumor mass volume ranged between 27.0-1260.0 cm^3 with a mean of 508.34 ± 458.11 cm^3, 31.50-2250.0 cm^3 with a mean 600.75 ± 583.81cm^3 and 277.0-2050.0 cm^3 with a mean 546.25 ± 385.60 cm^3 in group I, II and III respectively without any significant difference. (Table 2 and Fig. 2)

Pre and postoperative haemoglobin (Hb) values and the fall in haemoglobin level: (Table 3 and Fig. 3 and 4) : The preoperative haemoglobin values ranged between 10.60 – 14.30 g/dl with a mean 12.70 ± 1.19 g/dl, 11.10-14.30 g/dl with a mean 13.10 ± 0.97 g/dl and 10.0-14.60 g/dl with a mean 13.37 ± 1.13 g/dl in group I, II and III respectively without any significant difference.

The postoperative haemoglobin values ranged between 8.70 – 12.80 g/dl with a mean 10.50 ± 1.25 g/dl, 9.40 – 13.70 g/dl with a mean 11.78 ± 1.17 g/dl and 9.40 – 14.30 g/dl with a mean 12.74 ± 1.10 g/dl in group I, II and III respectively. Group II had statistically significant higher values of postoperative haemoglobin than group I, and group III had statistically significant higher values than group II and group I (*p1=0.001*, *p2<0.001* and *p3= 0.012*)

The fall in the haemoglobin level ranged between 1.30-3.30 g/dl with a mean 2.20 ± 0.64 g/dl, 0.50-2.50 g/dl with a mean 1.32 ± 0.67 g/dl and 0.10-1.40 g/dl with a mean 0.63 ± 0.35 g/dl in the 3 groups respectively. Group II had statistically significant lower values of the fall in haemoglobin level than group I, and group III had statistically significant lower values than group II and group I (*p1<0.001*, *p2<0.001* and *p3<0.001*)

Duration of operation : In group I, the duration of operation ranged between 30.0 – 120.0 minute (min) with a mean 57.0 ± 23.92 min, in group II it ranged between 35.0 – 65.0 min with a mean 48.25 ± 9.22 min, and in group III, it ranged between 30.0 – 55.0 min with a mean 40.05 ± 9.05 min. No statistically significant difference was found between group I and group II, while there was a statistically significant shorter duration of operations in group III than groups I and II (*p1=0.222*, *p2=0.003* and *p3=0.007*) (Table 4).

Operative blood loss: The operative blood loss ranged between 423.11-1588.24 ml with a mean of 965.89 ± 326.94, 236.57-1112.68 ml with a mean of 552.69 ± 283.61, and 49.11-507.63 ml with a mean of 241.25 ± 130.74 in group I, II and III respectively. There was a statistically significant less blood loss in group II than in group I, and a statistically significant less blood loss in group III than groups I and II (*p1<0.001*, *p2<0.001* and *p3<0.001*) (Table 4 and Fig. 5)

Operative complication : No statistically significant differences were observed between the three groups regarding intraoperative hypertension. Regarding tachycardia, no statistically significant differences were observed between group I and group II, but 6 cases in group III suffered from tachycardia which was statistically significant. (p1=-, FEp2=0.020, FEp3=0.020) (Table 4)

Need for blood transfusion (Table 5) :In group I, two cases needed postoperative blood transfusion, while

in group II and group III, there was no need for blood transfusion without significant difference (X^2=2.765, ^{MC}p=0.329)

Febrile morbidity (Table 5) : In group I, two cases suffered from postoperative febrile morbidity, while in group II and group III, no cases suffered from postoperative febrile morbidity with no significant difference(X^2=2.765, ^{MC}p=0.329)

Duration of hospitalization (Table 5):The post-operative duration of hospitalization ranged between of 36-120 hrs with a mean of 51.60 ± 24.96, 36-48 with a mean of 40.20 ± 5.87, and 36-48 with a mean of 40.0 ± 5.51 in the three groups respectively without significant difference (*P=0.099*).

Table I: Comparison between the different studied groups according to demographic data

	Control (n = 20)	Tourniquet (n = 20)	Epinephrine (n = 20)	F	*P*
Age (year)					
Min. – Max.	30.0 – 40.0	30.0 – 40.0	22.0 – 43.0	0.905	0.410
Mean ± SD.	36.25 ± 2.86	34.45 ± 2.72	43.30 ± 6.94		
Median	36.50	35.50	35.50		
Weight (Kg)					
Min. – Max.	62.0 – 107.0	68.0 – 107.0	65.0 – 104.0	0.438	0.648
Mean ± SD.	84.05 ± 13.62	88.05 ± 13.18	86.20 ± 13.78		
Median	85.50	87.00	89.0		
Height (Cm)					
Min. – Max.	155.0 – 172.0	158.0 – 179.0	157.0 – 179.0	2.078	0.135
Mean ± SD.	164.45 ± 5.57	167.80 ± 5.74	164.25 ± 7.14		
Median	165.0	168.50	161.0		

F: F test (ANOVA)

Table 2-: Comparison between the different studied groups according to tumor mass volume

	Control (n = 20)	Tourniquet (n = 20)	Epinephrine (n = 20)	$^{KW}\chi^2$	*p*
Tumor mass volume(cm^3)					
Min. – Max.	27.0 – 1260.0	31.50 – 2250.0	277.0 – 2050.0		
Mean ± SD.	508.34 ± 458.11	600.75 ± 583.81	546.25 ± 385.60	0.269	0.874
Median	399.75	476.25	465.25		

$^{KW}\chi^2$: Chi square for Kruskal Wallis test

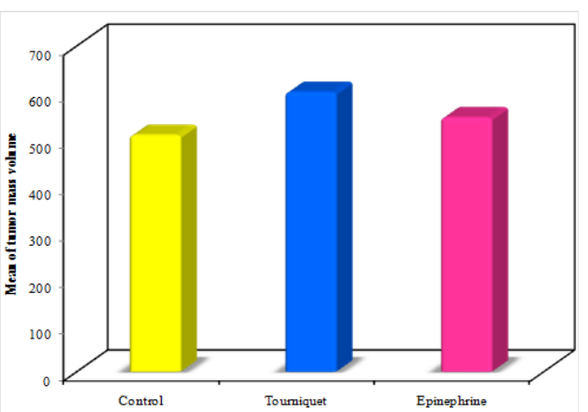

Fig. 2: Comparison between the different studied groups according to tumor mass volume

Table 3: Comparison between the different studied groups according to Hb and Hb fall level

		Control (n = 20)	Tourniquet (n = 20)	Epinephrine (n = 20)	F	*P*
Hb	**Pre-operative**					
	Min. – Max.	10.60 – 14.30	11.10 – 14.30	10.0 – 14.60		
	Mean ± SD.	12.70 ± 1.19	13.10 ± 0.97	13.37 ± 1.13	1.876	0.163
	Median	12.75	13.35	13.60		
	Post-operative					
	Min. – Max.	8.70 – 12.80	9.40 – 13.70	9.40 – 14.30		
	Mean ± SD.	10.50 ± 1.25	11.78 ± 1.17	12.74 ± 1.10	18.321*	<0.001*
	Median	10.70	11.85	12.85		
	Sig. bet. groups	p1=0.001*, p2<0.001*, p3=0.012*				
	Fall level					
	Min. – Max.	1.30 – 3.30	0.50 – 2.50	0.10 – 1.40		
	Mean ± SD.	2.20 ± 0.64	1.32 ± 0.67	0.63 ± 0.35	38.239*	<0.001*
	Median	2.0	1.05	0.60		
	Sig. bet. groups	p1<0.001*, p2<0.001*, p3<0.001*				

F: F test (ANOVA), Sig. bet. grps was done using Post Hoc Test (LSD)
p1: *p value* for Paired t-test for comparing between pre and post operative in each group
p1: *p value* for comparing between Control and Tourniquet
p2: *p value* for comparing between Control and Epinephrine
p3: *p value* for comparing between Tourniquet and Epinephrine
*: Statistically significant at $p \leq 0.05$

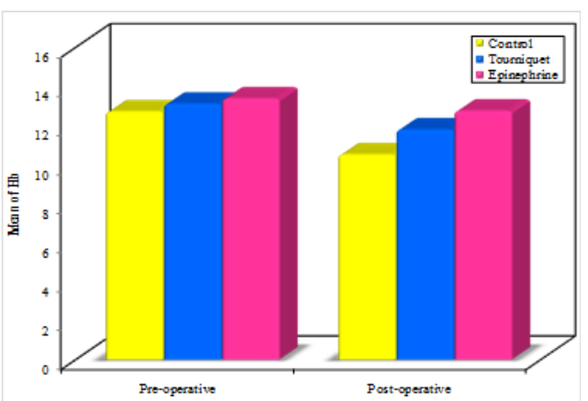

Fig. 3: Comparison between the different studied groups according to pre and postoperative Hb

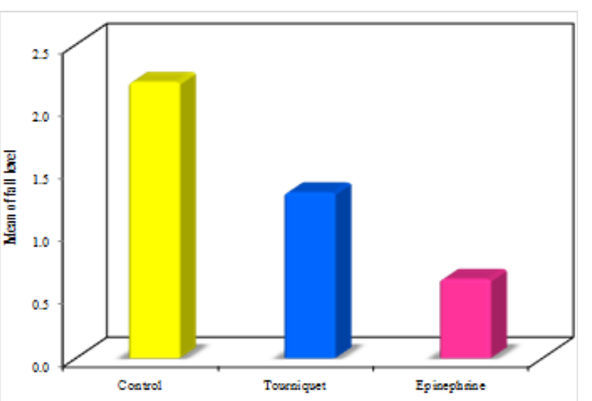

Fig. 4: Comparison between the different studied groups according to fall in Hb level

Table 4: Comparison between the different studied groups according to duration of operation, amount of blood loss and operative complications

	Control (n = 20)		Tourniquet (n = 20		Epinephrine (n = 20)		Test of sig.	*P*
	No.	%	No.	%	No.	%		
Duration of operation								
Min. – Max.	30.0 – 120.0		35.0 – 65.0		30.0 – 55.0			
Mean ± SD.	57.0± 23.92		48.25 ± 9.22		40.05 ± 9.05		$^{KW}\chi^2$= 11.463*	0.003*
Median	50.0		45.0		36.0			
Sig. bet. grps	p1=0.222, p2=0.003*, p3=0.007*							
Amount of blood loss								
Min. – Max.	423.11 - 1588.24		236.57 - 1112.68		49.11 - 507.63			
Mean ± SD.	965.89 ± 326.94		552.69 ± 283.61		241.25 ± 130.74		$^{KW}\chi^2$= 36.044*	<0.001*
Median	877.48		488.61		228.51			
Sig. bet. grps	p1<0.001*, p2<0.001*, p3<0.001*							
Operative complications								
HTN	0	0.0	0	0.0	2	10.0	χ^2= 2.765	^{MC}p=0.321
Tachycardia	0	0.0	0	0.0	6	30.0	10.575*	^{MC}p=0.002*
Sig. bet. grps	p1=-, FEp2=0.020*, FEp3=0.020*							

$^{KW}\chi^2$: Chi square for Kruskal Wallis test, Sig. bet. grps was done using Mann Whitney test
χ^2: Chi square test
MC: Monte Carlo for Chi square test
FE: Fisher Exact for Chi square test
p1: *p value* for comparing between Control and Tourniquet
p2: *p value* for comparing between Control and Epinephrine
p3: *p value* for comparing between Tourniquet and Epinephrine
*: Statistically significant at $p \leq 0.05$

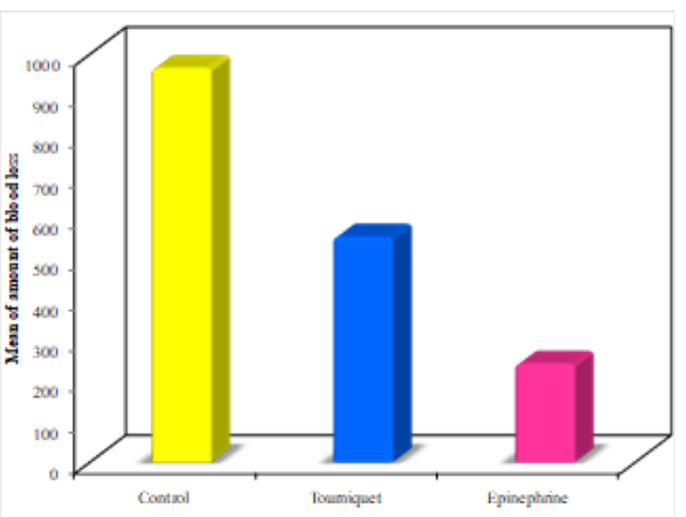

Fig. 5: Comparison between the different studied groups according to amount of blood loss

Table 5: Comparison between the different studied groups according to need for blood transfusion, febrile morbidity and duration of hospitalization

	Control (n = 20)		Tourniquet (n = 20)		Epinephrine (n = 20)			^{MC}p
	No.	%	No.	%	No.	%		
Need of blood transfusion								
Negative	18	90.0	20	100.0	20	100.0	χ^2=2.765	0.329
Positive	2	10.0	0	0.0	0	0.0		
Febrile morbidity								
Negative	18	90.0	20	100.0	20	100.0	χ^2=2.765	0.329
Positive	2	10.0	0	0.0	0	0.0		
Duration of hospitalization								
Min. – Max.	36.0 – 120.0		36.0 – 48.0		36.0 – 48.0			
Mean ± SD.	51.60 ± 24.96		40.20 ± 5.87		40.0 ± 5.51		$^{KW}\chi^2$= 4.631	0.099
Median	48.0		36.0		36.0			

χ^2: Chi square test

MC: Monte Carlo for Chi square test

$^{KW}\chi^2$: Chi square for Kruskal Wallis test

DISCUSSION

Uterine fibroid, is the most common type of benign tumors encountered in gynecological practice. The prevalence of this tumor ranges from 5% to 80% with considerable variation according to age and population studied[19].

Surgical interventions still predominate the treatment strategy. Myomectomy in most cases is the best option for women who are interested in preserving their fertility. However, intraoperative hemorrhage remains a challenge.

Review of literature revealed two studies investigating the use of bupivacaine plus epinephrine during gynaecological operations. The first was carried out by Zullo *et al*.[12] who used bupivacaine plus epinephrine during laparoscopic myomectomy, while Gilabert-Estelles *et al*.[20] tested the use of epinephrine and levobupivacaine in laparoscopic excision and reconstruction of intact cornual ectopic pregnancy.

To the author's knowledge, to date no studies investigated the use of bupivacaine plus epinephrine during abdominal myomectomy.

In the present study, the mean operative blood loss was 965.89, 552.69 and 241.25 ml in the control, tourniquet and epinephrine groups respectively. This was comparable to Ikechebelu *et al*.[17] study where it was 515.7 ml for the tourniquet group, and to Fletcher *et al*.[7] study where it was 512.7 ml for the tourniquet group, and relatively lower than that of Helal *et al*.[21] study where it was 823.23 ml for the tourniquet group, and higher than Alpetkin *et al*.[22] study with only 286.4 ml for the tourniquet group.

On the other hand, the mean operative blood loss for the epinephrine group was higher than that of Zullo *et al*.[14] study where it was just 143.9 ml. To be noted, Zullo *et al.* studied the use of epinephrine during laparoscopic myomectomy, hence the lower values of blood loss may be attributed to the difference in the operation technique and smaller tumor mass volume of fibroids selected for laparoscopic myomectomy.

In the present study, the mean operative duration was 57.0 min, 48.25 min and 40.05 min in the control, tourniquet and epinephrine groups respectively. It was not significantly different between the control and tourniquet groups while it was significantly shorter in the epinephrine group. This may be due to better heamostasis and better line of demarcation which facilitated enucleation in the epinephrine group.

Only two case needed blood transfusion in the control group, while there was no need for blood transfusion in the tourniquet and epinephrine groups. This is in agreement with Alpetkin *et al*.[22] study where blood transfusion was necessary in only two patients from the control group. Similarly, Ikechebelu *et al*.[17] study found that mean blood transfusion rate during myomectomy for the tourniquet group was 0.24 unit which was lower than that of the no-tourniquet group with 1.00 unit transfusion rate.

The mean values for postoperative haemoglobin and fall in haemoglobin level in the control group were (10.50 g/dl and 2.20 g/dl respectively), in the tourniquet group the mean values were (11.78 g/dl, and 1.32 g/dl respectively), while in the epinephrine group they were (12.74 g/dl, and 0.63 g/dl respectively). The

tourniquet group had significantly higher postoperative values of haemoglobin and lower values of postoperative haemoglobin fall than the control group, while the epinephrine group had significantly higher postoperative values of haemoglobin and lower values of postoperative haemoglobin fall than the other groups.

Similar findings were reported by Alptekin *et al*.[22] study which found that the tourniquet significantly reduced postoperative haemoglobin fall than the control group. Also, Helal *et al*.[21] study found that the mean values for post operative haemoglobin and haemoglobin fall in the tourniquet group were (10.1g/dl, 1.4 g/dl) which are relatively similar to the results of the present study.

In the present study, no significant difference has been found between the groups regarding postoperative febrile morbidity. The same was stated by Ikechebelu[17] as there was no significant difference with respect to complication. Similarly, Zullo *et al*.[12] study found that no significant intra or postoperative complications were observed.

Repeat laparotomy for the management of haematomas with the tourniquet technique has been reported by Darwish et al.[23] who concluded that tourniquet is frequently associated with haematoma formation and recommended that it should not be used during myomectomy. In fact, this complication has not been encountered in the present study. This may be due to meticulous closure of the incision, and caring for accurate hemostasis.

In the present study, the mean postoperative duration of hospitalization was 51.60, 40.20 and 40.0 hrs in the control, tourniquet and epinephrine groups respectively without significant difference. This was comparable to Zullo *et al*.[12] study where only 2 women were discharged later than 48 hours after surgery. However, it was relatively shorter than Helal *et al*.[21] study where postoperative hospital stay in the tourniquet group was 5 days.

Epinephrine induces a vasoconstrictive effect on tissue that lasts longer than that of vasopressin. Two hypothetical risks may result from this pharmacological action. Firstly, it is possible that the vasoconstrictive action is not dissipated during surgery, and an inaccurate haemostasis may be performed with an occulted postoperative bleeding. Secondly, the long duration of vasoconstriction could induce tissue damage. It is well known that bupivacaine induces a local vasodilatation that could partially counter balance the vasoconstrictive effect of epinephrine and minimize its cardiovascular effects[24,25].

Zullo *et al*.[12] found that no particular side effect was detected during surgery after injecting Epinephrine/Bupivacaine solution, and only transient and non significant increase in blood pressure and heart rate were observed.

This is in agreement with the present study which showed that in the epinephrine group, only two cases recorded transient increase in blood pressure for around 10 minutes, while there was no effect in control and tourniquet groups, without significant difference regarding the effect on blood pressure.

As regards heart rate, six cases (30%) in the epinephrine group recorded an increase in heart rate which was transient and recovered spontaneously within five to ten minutes, while there was no heart rate change in control and tourniquet groups. This finding may be attributed to the possible intravascular leakage of the solution especially when injecting large amounts of the solution around large sized myomas.

In summary, intramyometrial injection of a solution of bupivacaine (50 ml of 0.25%) plus epinephrine (0.5 ml of 1 mg/ml) is very effective in reducing intraoperative bleeding during abdominal myomectomy. This solution is significantly more effective than using Foley's urethral catheter as a pericervical tourniquet. The injection of this solution may induce transient increase in heart rate, however, it has neither short nor long term side effects. On the other hand, it offers no additional benefits over using a pericervical tourniquet regarding the need for blood transfusion, postoperative febrile morbidity, and duration of hospitalization.

CONFLICT OF INTERESTS

There are no conflicts of interest.

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