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Analgesic Efficacy of Ultrasound Guided Adductor canal block versus Intra-articular Injection of Bupivacaine in Arthroscopic Knee Surgeries

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Femoral nerve block (FNB) is a commonly used nerve block in patients undergoing knee surgery. Adductor canal block (ACB), is a motor-sparing block. ACB mainly blocks the saphenous nerve and the nerve to vastusmedialis while they pass through adductor canal.mIntra-articular (IA) injection of local anaesthetic has been used to provide better analgesia after arthroscopic knee surgery.The aim of the present study was to compare the intra- and postoperative analgesic effects of ultrasound guided adductor canal block with intra-articular injection of bupivacaine in arthroscopic knee surgeries. Patients and methods: The present study was carried out in Zagazig University Hospital on 32 adult patients of both sexes, physical status American Society of Anesthesiologists (ASA): I, II and scheduled for unilateral elective knee arthroscopy under general anaesthesia. Patients were randomly divided into two groups (16 patients each), group (I) of patients were performed intra-articular injection (IA) and group (II) of patients were applied adductor canal block (ACB). The procedure was done in both groupsafter that sensory assessment of the adductor canal block was done then patient transferred to the operating room after 20 minutes and routine monitoring wereapplied and measurements of basal vital signs were recorded. Results: The mean VAS at rest was1.5±0.45,1.75±0.68, 2.62±0.84, 2.8±0.73,at 2, 4, 6 and at 12 hours respectively.While, it was 1.62±0.58 at 24 hours postoperatively. In group I the mean VAS was 2.37±0.71,2.62±0.71, 4.37±1.02, 4.2±0.73, at 2, 4, 6 and at 12 hours respectively postoperative, While the mean VAS decreased to 2.25±0.44 at 24 hours postoperatively. As regarding the number of patients needed nalbuphin,only eight (50%) of the patients in group A received nalbuphine as rescue analgesia compared to 14 patients (87.5%) in intra-articular group, so, intra articular group significantly needed more nalbuphin compared to the other one. Conclusion: Adductor canal block provides good analgesia and low pain score, prolong duration of analgesia with reduction of narcotic requirement compared with intra-articular injection in arthroscopic knee surgery.

Keywords: Adductor Canal Block, Bupivacaine, Knee Surgeries and Intra-articular Injection.

INTRODUCTION

Knee arthroscopy is a common orthopedic procedure worldwide and very often is performed as day case surgery. Despite its minimally invasive nature compared to the traditional knee surgery, post-arthroscopic pain may be moderate to severe and affects patient activity and satisfaction (Rahimzadeh et al. 2017). Thus, postoperative pain relief is an important factor in the early ambulation and rehabilitation of patients

after knee arthroscopy (Memtsoudis et al. 2015). The patients generally require significant postoperative pain management modalities including use of oral or intra-muscular non-steroidal anti-inflammatory drugs,opioid-based analgesics, intra-articular injection and peripheral nerve block(Seo et al. 2017).

Several patients experience narcotic-related complications, such as sedation, respiratory depression, nausea, vomiting and constipation following excessive use of opioid analgesics (Jaeger et al. 2013). Peripheral nerve blocks offer effective analgesia and decrease the need for opioids, thereby reducing the complications associated with the use of this class of drug (Jenstrup et al. 2012). In particular, femoral nerve block is often considered the gold standard for pain relief after knee arthroscopy. However, femoral nerve block reduces quadriceps muscle strength and compromises early ambulation and rehabilitation. Moreover, it has been associated with higher risks of falls (Charous et al. 2011). The femoral nerve can be anaesthetized at a number of different locations along its course. The main theoretical advantage of blocking the femoral nerve at the level of the adductor canal compared with the more proximal block at the level of the inguinal ligament is sparing of the motor function of the anterior thigh muscles and produce a pure sensory nerve block for post-operative analgesia following knee arthroscopy (Rahimzadeh et al. 2017).

Intra-articular (IA) administration of local anaesthetic has been used to provide better analgesia after arthroscopic knee surgery and to reduce consumption and possible side effects of oral and intravenous analgesics (Wei et al. 2014). The benefit and safety of intra-articular knee injections have been confirmed by multiple studies. The supra-patellar bursa is the most common site to perform an intra-articular knee injection. It is demonstrated that ultrasound guided intra-articular knee injection with the knee in flexion offers an approach that may improve the image of the supra-patellar bursa when compared to the knee in extension (Sadeghi et al. 2017).

Bupivacaine is often used for IA analgesia because of its extended period of active effectiveness. The analgesic efficacy of IA bupivacaine, especially single-administration bupivacaine, has been studied because its effect on postoperative pain is conceptually simple. However, there are conflicting reports on the efficacy of single-administration IA bupivacaine (Sun et al. 2015). Therefore, the present studyaimed to compare the intra- and postoperative analgesic effects of ultrasound guided adductor canal block with intra-articular injection of bupivacaine in arthroscopic knee surgeries.

MATERIALS AND METHODS

The present study was carried out in Zagazig University Hospital on 32 adult patients. The inclusion criteria: is a patients of both sexes, physical status with American Society of Anesthesiologists (ASA) I, II and scheduled for unilateral elective knee arthroscopy under general anaesthesia.

Patients were randomly divided into two groups (16 patients each), group (I) of patients were performed intra-articular injection (IA) and group (II) of patients were applied adductor canal block (ACB).

All patients included in this study were subjected to full history, complete physical examination and routine laboratory investigations. Also patients have been informed of the procedure and trained to use the visual analogue scale . Upon arrival to the regional anaesthesia room basal monitoring of vital signs were measured and recorded, intravenous cannula was inserted.

Adductor canal block Technique (Group A):

Blocks were done in a manner similar to a technique previously described by Kirkpatrick et al. (2010). Patients in group (2) were placed in a supine position with the extremity to be blocked slightly externally rotated with knee flexion 30degree, the thigh prepared, ultrasound probe was placed in the inner middle third of the thigh, halfway between anterior superior iliac spine (ASIS) and the patella. The transducer was placed in a transverse orientation to visualize the femoral artery in short axis deep to the Sartorius muscle. The skin was infiltrated with 1% lidocaine. A 21-gauge, 100-mm, short-bevel needle (Stimuplex; B-Braun) was inserted under ultrasound guidance in an in-plane technique to position the needle tip anterolateral to the artery and just deep to the posterior fascia of the Sartorius muscle. After completion of the procedure, a sterile dressing was placed over the needle insertion site.

Intra-articular injection technique (Group I):

Group (1) was performed under ultrasound guidance by placing the patient in supine position with the patient’s knee in approximately 900 of

flexion with the leg hanging off the side of the bed. A high-frequency transducer ultrasound probe is directed medially toward the joint space. The needle was then directed under the transducer toward the joint until the needle tip directly penetrated the synovial membrane and the bevel was wholly within the intra-articular space, then (20ml 0.25%) of bupivacaine and adding (50 µg) fentanyl was injected in the patient knee joint. The needle was then extracted, and firm pressure applied to the puncture site according to method of Sibbitt et al. (2011).

After patients of both groups had been anaesthetized, the tourniquet was inflated, the surgical field was sterilized, and a standard arthroscopy technique was performed through an anterolateral and anteromedialportal (Radwan et al. 2013).

Analgesic protocol:

In both groups iv infusion perfalgan (15mg/kg)was given at the end of operation and every 6 hours postoperatively for 24 hours. If the patient complained pain despite of perfalgandose, rescue analgesics was given to the patient in the form of 5mg nalbuphine IV and can be repeated every3-6 hours if needed, not exceeding the maximum dose 160mg/day.

Visual analogue Scale (VAS):

VAS was used to assess post-operative pain where 0 means no pain and 10 means maximum pain.

As well, assessment of pain score at rest and with joint flexion movement performed at 2, 4,6 ,12 and 24 hours post operatively.

Statistical analysis:

Data collected analyzed using Microsoft Excel software and SPSS version 20.0. According to the type of data qualitative represent as number and percentage, quantitative continues group represent by mean±SD, the following tests were used to test differences for significance; and association of qualitative variable by Chi square test (X2). Differences between quantitative independent groups by t test. P value was set at <0.05 for significant results &>0.005 for non-significant result.

RESULTSAND DISCUSSION

The attainable results showed that, postoperative VAS in group A, the mean VAS at rest was1.5±0.45,1.75±0.68, 2.62±0.84, 2.8±0.73,at 2, 4, 6 and at 12 hours respectively. While,it was 1.62±0.58 at 24 hours postoperatively. In group I the mean VAS was 2.37±0.71, 2.62±0.71, 4.37±1.02, 4.2±0.73, at 2, 4, 6 and at 12 hours respectively postoperative, While the mean VAS decreased to 2.25±0.44 at 24 hours postoperatively (Table 1).

In patients received adductor canal block, the mean VAS distribution at joint flexion was 2.75±0.68, 2.75±0.68, 4.0±1.03 and 5.05±1.04 at 2, 4, 6 and 12 hours postoperatively respectively. While it decreased to 2.62±0.51 at 24 hours postoperatively. In group I, the meanVAS was 3.75±0.68, 4.12±1.2, 5.87±1.0 and 5.15±0.44,at 2, 4, 6 and 12 hours postoperative time respectively. While it decreased to 2.5±0.51 at 24 hours postoperatively (Figure 1).

As regarding the number of patients needednalbuphin,only eight (50%) of the patients in group A received nalbuphine as rescue analgesia compared to 14 patients (87.5%) in intra-articular group, so, intra articular group significantly needed more nalbuphin compared to the other one (Table 2).

Concerning time of first request of analgesia;in group (I) showed early time of first request of analgesia in comparison to group (A) ($p<0.05$), (7.12±0.8 vs 9.62±1.02 hrs, respectively). There was no significant difference (P=0. 072) between the two groups as regards the total nalbuphin consumption (6.54±2.1 vs 6.54±2.1 mg for A and I groups respectively) Adductor canal group showed significantly longer duration of analgesia (11.85±2.12hr) in comparison to intra-articular group (9.21±1.87hr)as shown in (Table 3).

All patients in both groups were satisfied with the type of analgesis provided as both groups showed no complications related to the block or the drugs used throughout the whole study time. However the degree of satisfaction was higher in adductor canal block in comparison to intra-articular group (p=0.02), as more patients with ACB expressed excellent and good satisfaction compared with intra-articular injection group (Table 4).

Knee arthroscopy is a common orthopedic procedure worldwide and very often is performed as day case surgery. Although arthroscopic procedures are minimally invasive surgeries, post-arthroscopic pain may be moderate to severe and affects patient activity. Various modalities are used for analgesia by systemic and multiple non-systemic approaches such as local anesthetic infiltration, peripheral nerve block, intra-articular injection, and neuraxial blockade (Ghodki et

al.,2018).

Table 1: Post-operative visual analogue scale score at rest.

	Adductor canal Group (N=16)	Intra articular Group (N=16)	T	P
VAS_Rest_2	1.5±0.45	2.37±0.71	-4.550	0.00**
VAS_Rest_4	1.75±0.68	2.62±0.71	-2.953	0.006*
VAS_Rest_6	2.62±0.84	4.37±1.02	-4.140	0.00**
VAS_Rest_12	2.8±0.73	4.2±0.73	-2.139	0.041*
VAS_Rest_24	1.62±0.58	2.25±0.44	-5.000	0.00**

VAS: visual analogue scale, * significant p <0.05, ** highly significant p<0.001 Data expressed as men ± standard deviation

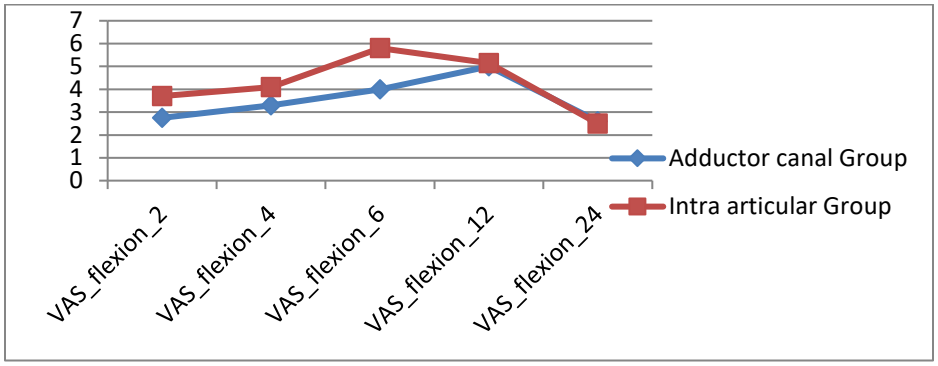

Figure 1: VAS on flexion at different post-operative times.

Table 2: Number of patients needNalbuphin.

			GROUP		Total	X2	P
			Adductor canal Group (A)	Intra articular Group (I)			
Number of patient needed Nalbuphin	Not need	N	8	2	10	5.23	0.02*
		%	50.0%	12.5%	31.2%		
	Need	N	8	14	22		
		%	50.0%	87.5%	68.8%		

* Significant p<0.05, Data expressed as number and percentage

Table 3: analgesic and other outcomes results.

	Adductor canal Group	Intra articular Group	T	P
Time of first request of analgesia /h	9.62±1.02	7.12±0.8	7.520	0.00**
Total nalbuphinconsumtion dose/mg	6.25±2.3	6.54±2.1	1.863	0.072
Duration of analgesia/h	11.85±2.12	9.21±1.87	3.863	0.001**

Table 4: The degree of satisfaction in the studied groups.

	Adductor canal Group	Intra articular Group	X^2	P
Excellent	4 (25.0%)	2 (12.5%)		
Good	10 (62.5%)	4 (25.0%)	9.028	0.02*
Fair	1 (6.25%)	8 (50.0%)		
Poor	1 (6.25%)	2 (12.5%)		

Data expressed as number and percentage *****significant p<0.0

The present study was performed To compare the analgesic effects of ultrasound guided adductor canal block with intra-articular injection

of bupivacaine in arthroscopic knee surgeries, the obtained results indicated the efficacy of adductor canal block as analgesic modality for patients undergoing arthroscopic knee surgeries manifested by significant difference in comparison to intra-articular injection as regards VAS as a pain score, duration of analgesia, total amount of rescue analgesia consumption, first time request of analgesia and patient satisfaction.

The results of current study demonstrated that the patients received adductor canal block was lower in pain score, and they had longer duration of postoperative analgesia. This is compatible with a study conducted by kejriwal et al.2018 who reported that out of 60 patients, 30 were randomized to the control group (no block) and 30 to the intervention group SNB (saphenous nerve block). SNB group showed significantly lower postoperative VAS score in comparison to control group, furthermore, the number of patients who received rescue analgesia in the first 24h postoperatively were lower in SNB group for ACL reconstruction.

In other study conducted by Ludwingson et al. 2016 the investigating team found that single-injection ACB (adductor canal block) offered good pain control and significant decrease in dose of nalbuphine taken. Also, Chisholm et al. 2014 who conducted comparing the adductor canal block with femoral nerve block on adequate pain control following ACLR (Arthroscopic ACL repair). They stated that there was no significant difference between the two groups in pain score and opioid consumption within postoperative 24 hours. A study by Abdallah et al.2015 who suggested that ACB preserves quadriceps strength and provides no inferior postoperative analgesia for outpatients undergoing ACLR. The results of current work are in concordance with these two studies as regarding the quality of pain relief and decreasing of total analgesic consumption in adductor canal block group.

The results of the current work demonstrated that patients received intra-articular local an aesthetic showed low pain score, low analgesic consumption, with short duration of analgesia. That is in agreement with Moinicheet al.1999 who reported that intra-articular injection for postoperative pain relief after arthroscopic surgery. These studies showed improved pain relief with low pain score compared to the control group (VAS reductions of between 10 and 35mm) early (1-4 hours) postoperatively. Also they found that consumption of supplementary analgesia was reduced 10-15% of up to 4 hours, so, they concluded that there was weak evidence for reduction of postoperative pain after intra-articular injection which although being small to moderate and of short of duration, may be of clinical significance in day care surgery. In study conducted by Sun et al., 2015 who included 28 RCTs showed that the IA injection of bupivacaine is effective for pain control in the first 24h following arthroscopic knee surgery, However most of the RCTs in this analysis reported no effect or only very short (less than12 hour) duration effect of single administration intra-articular bupivacaine compared to placebo for pain control.

In the present study Patient satisfaction with pain control was rated on a four point scale: 4=Excellent, 3=Good, 2=Fair and 1=Poor.The patients satisfaction with pain control showed good satisfaction in both groups with significant difference in quality of pain control, the patients in the ACB group were more satisfied with pain control than the intra-articular group. This agreed with a study of Kim et al.2014) who concluded that, there was good patient satisfaction with pain control with adductor canal block. A study by Memtsoudis et al.(2015) who reported similar findings regarding patient satisfaction. It is important to know that the level of patient satisfaction was directly related to the quality of pain control in all of these studies. In a smaller study by Ishiguro et al.(2013) who stated an observational results in a cohort of patients receiving an ACB after total knee replacement and reported good satisfactory results in respect to pain control. The current results are supported by findings reported by Ghodki etal.2018 as they reported that Patient satisfaction score was statistically significant on POD1(postoperative day1) in the ACB in comparison with FNB.

CONCLUSION

Adductor canal block provides good analgesia and low pain score, prolong duration of analgesia with reduction of narcotic requirement compared with intra-articular injection in arthroscopic knee surgery.

CONFLICT OF INTEREST

The authors declared that present study was performed in absence of any conflict of interest.

AUTHOR CONTRIBUTIONS

All author contributed in all parts of the paper.

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