

Dexamethasone versus Ketorolac as Adjuvants to Interscalene Brachial Plexus Block in Shoulder Arthroscopy Under General Anesthesia

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Abstract

Background: The ultrasound guided Interscalene Brachial Plexus Block (IBPB) when used combined with general anesthesia has several advantages for patients scheduled for shoulder surgery. These advantages include, good control of intraoperative hemodynamics, and adequate management of postoperative pain.

Aim and Objective: This study compares the effect of adding dexamethasone versus ketorolac to bupivacaine and lidocaine mixture in US guided IBPB regarding postoperative analgesia and intraoperative hemodynamics in patients undergoing shoulder arthroscopy.

Patients and Methods: This prospective randomized, controlled study was done in Assiut University Hospitals from February 2016 to January 2017. It was approved by Assiut University Ethics Committee, and a written informed consent was obtained from all patients. Sixty patients were enrolled in the study with the following inclusion criteria, ASA I-II, age 18-60 years, scheduled for elective shoulder arthroscopy in Assiut University Hospital. Patients were indiscriminately distributed to three groups:

- Group [C] (control group) received 25ml solution: 10ml lidocaine 1%, 10ml bupivacaine 0.25% and 5mL of normal saline 0.9%.
- Group [D] (dexamethasone group) received 25ml solution: 10ml lidocaine 1%, 10ml bupivacaine 0.25% and 5mL of dexamethasone (5mg).
- Group [K] (Ketorolac group) received 25ml solution: 10ml lidocaine 1%, 10ml bupivacaine 0.25% and 5mL of ketorolac (10mg/ml) (50mg).

Sensory and motor block onset in minutes, intensity of post-operative pain assessed by Visual Analogue Score (VAS), duration of post-operative analgesia, and intraoperative hemodynamics were documented and compared between the groups.

Results: We founded that the duration of post-operative analgesia including the time for the first analgesic requirement was significantly longer in dexamethasone group with average

13.7±2 hours while it was 10.95±1.05 in ketorolac group and 11.7±3.53 in control group with. Total Rescue analgesia administration was much less in dexamethasone group in comparison with other groups but all groups did not need any additional opioid in the first day postoperative.

Conclusion: Dexamethasone provides better post-operative pain relief than ketorolac when added to mixture of lidocaine and bupivacaine in ultrasound guided interscalene block for shoulder arthroscopy under general anesthesia.

Key Words: Ketorolac – Adjuvants – Interscalene brachial plexus block – Postoperative analgesia– Shoulder arthroscopy.

Introduction

POST-OPERATIVE pain is usually one of the important concerns for the patients and for the surgical and anesthesia team. After arthroscopic shoulder surgery, severe postoperative pain is always reported. Conventionally this pain was managed by opioids with many undesirable effects as nausea, vomiting, respiratory depression ... etc.

The advancement of US guided IBPB improves the quality of the block besides adequate reduction of post-operative pain with early mobilization of shoulder joint and opioid sparing [1]. Combined IBPB with general anesthesia ensures patient comfort and surgeon satisfaction.

Adjuvants are drugs used to prolong the of local anesthetics action beyond its pharmacological characteristics so that single shot interscalene block provides a longer period of analgesia. Many agents are experimented as adjuvants like adrenaline, magnesium sulphate, dexamethasone, NSAIDs, opioids and dexmedetomidine [2].

Dexamethasone is used very widely as an adjuvant despite that its mechanism is not well evidenced yet. Some authors suggest a local vaso-

constrictive effect, resulting in reduced local anesthetic absorption [3], or a systemic anti-inflammatory effect following vascular uptake of the drug [4], or it may decrease nociceptive C-fiber activity [5].

NSAIDs as ketorolac when used perineural with local anesthetics prolongs the period of post-operative analgesia. It acts by preventing prostaglandin production and decreasing local inflammation and cytokine release [6].

Patients and Methods

This prospective randomized, controlled study was done in Assiut University Hospitals from February 2016 to January 2017. It was approved by Assiut University Ethics Committee, and a written informed consent was obtained from all patients.

A computer generated list of randomized numbers used to divide patients into 3 groups. Group [C] (control group) received 25ml solution: 10ml lidocaine 1%, 10ml bupivacaine 0.25% and 5ml of normal saline 0.9%, Group [D] (dexamethasone group) received 25ml solution: 10ml lidocaine 1%, 10ml bupivacaine 0.25% and 5ml of dexamethasone (5mg) and Group [K] (Ketorolac group) received 25ml solution: 10ml lidocaine 1%, 10ml bupivacaine 0.25% and 5ml ketorolac (50mg).

Patients with positive history of any neurological, cardiac, kidney or hepatic diseases pregnant and morbid obese patients (BMI >35) and drug abusers' patients with allergy to local anesthetics, coagulopathy, contralateral pneumothorax or diaphragmatic paralysis were excluded.

All patients are prepared pre-operatively in the standard technique; venous access will be obtained in the contralateral upper limb with a 20G catheter. IV midazolam 3mg will be administered to ensure patient comfort. Oxygen will be delivered by face mask 4 l/minute. Monitoring by 5 leads ECG, pulse oximetry and noninvasive blood pressure.

US guided IBPB using the SonoAce5 ultrasound machine with high frequency linear probe (frequency 8-12 MHz) with out of plane approach.

Patients position is supine with slight elevation of the head and being directed to the surgery's opposite side. With the probe parallel to the clavicle and the sonographic beam directed to the first rib, the subclavian artery is identified easily with the brachial plexus divisions supero-lateral to it as a (bunch of grapes). Then tracing the plexus medially and cephalad along its course till the trunks are

visualized as hypoechoic structures among scalenus anterior and scalenus medius (Traceback' approach). After centering the nerve roots on the screen and infiltration of the skin with local anesthetic, the needle is inserted cranial to the probe (out of plane technique). It will appear as a bright point and by tilting the probe, the needle's tip would be identified, also movement of surrounding structures by tiny movements of the needle aids in its identification. After careful aspiration for nonappearance of blood, 1-2ml of local anesthetic is injected to confirm the needle position. Injected drug mixture spread should occur anterior and superior to the nerve structures. Avoid intramuscular injection which is visualized as augmentation of echogenicity in the muscle bulk. Stop injection if against a great resistance, as this may indicate that the needle position may be intrafascicular.

Block evaluations will be every 5 minutes for 20 minutes. Confirm block quality by loss of sensation to icepack over the dermatomal areas C4-C6 and failure to abduct arm which is called (deltoid sign). Sensory block onset is the duration elapsed between drug injection and loss of sensation. Motor block onset is the duration elapsed between drug injection and loss of motor power.

General anesthesia will be conducted to all patients with the standard technique using fentanyl 2µg/kg and propofol 2mg/kg and atracurium 0.5 mg/kg and to facilitate endotracheal intubation. Maintenance will be by isoflurane 1:2% MAC.

Intraoperative hemodynamics including heart rate and mean arterial blood pressure will be recorded at baseline (before IBPB) and after induction of GA and every ten minutes until the surgery finished. Management of any intraoperative hemodynamic events like bradycardia will be left to the attending experienced anesthetist.

The base line Visual Analogue Score (VAS) was set as the score during passive exercise before the surgery. Post-operative pain will be assessed by (VAS) score upon passive exercise of the shoulder after 4, 8, 12, 24h. VAS score ≥ 5 is considered marked pain with subsequent need to administer rescue analgesia Paracetamol 15mg/kg, is administered to them and recorded. If the pain is not alleviated 50mg meperidine IV is administered and recorded. The interval between sensory block onset to the first complain of pain post-operative is the duration of post-operative analgesia.

Statistical analysis:

All statistical analyses were performed using Statistical Package for the Social Sciences SPSS

statistics Version 20 (SPSS Inc., Chicago, IL, USA). Data were reported as mean and SD or number. Shapiro-Wilk tests was used to assess normal distribution. Categorical data were reported as percentages and were analyzed using the Chi-square test. Continuously variable data such were analyzed using Anova or Kruskal-Wallis test. A *p*-value of <0.05 was considered statistically significant.

Results

We enrolled 60 patients in this study with 20 patients in each group. There was no significant difference between groups regarding age, weight, height, BMI, sex, and ASA status.

Post-operative analgesia and first analgesic requirement:

VAS baseline showed insignificant difference among all groups. VAS at 4, 8, 12 hours were significantly lower in the dexamethasone group in comparison with other groups, but there was insignificant difference between ketorolac and control groups at the same postoperative hours. VAS at 24 hours showed insignificant difference among all groups.

Time to first analgesic demand was significantly longer in the dexamethasone group with mean 13.7±2 hours. It was 10.95±1.05 hours in the ketorolac group and 11.7±3.53 hours in the control group. There was insignificant difference between ketorolac and control groups.

Onset of sensory and motor block:

The onset of both sensory and motor block was significantly shorter in dexamethasone group in comparison with other groups. Its mean was 9±4.17 minutes and 9±3.08 minutes respectively. There was insignificant difference between ketorolac group and control group.

Rescue analgesia:

In the dexamethasone group the total dose of paracetamol was significantly lower than the control group. Also it was lower in the ketorolac group when compared with the control group. There was insignificant difference between dexamethasone and ketorolac group. To be noticed that no supplemental opioids were given to any patients in the first 24 hours post-operative.

Intraoperative hemodynamics:

There was insignificant difference between all groups regarding heart rate and MAP at baseline or at the end of operation. During surgery both

heart rate and MAP showed variable variations among all groups with no group showed marked superiority than the others. However, all groups showed adequate control of heart rate and MAP which provided a good surgical field for shoulder arthroscopy.

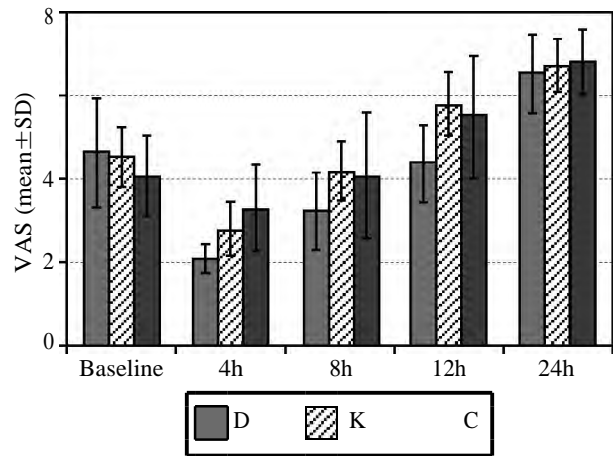


Fig. (1): Comparison between groups regarding VAS.

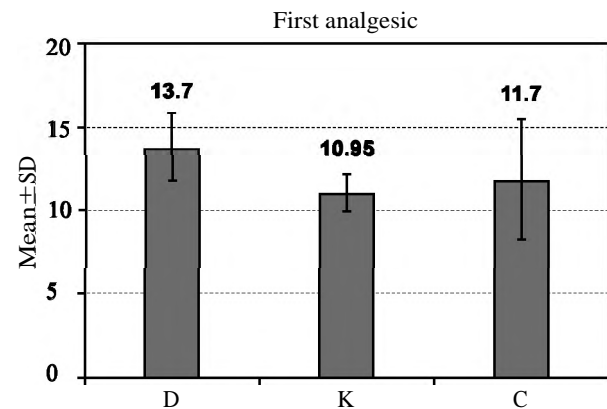


Fig. (2): Comparison between groups regarding first analgesic requiremen.

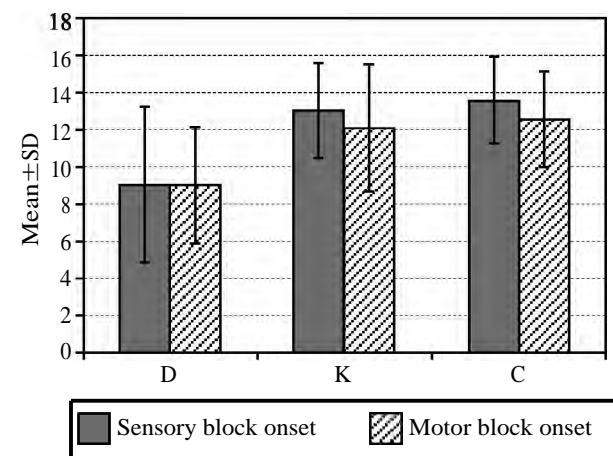


Fig. (3): Comparison between groups regarding sensory and motor block onset.

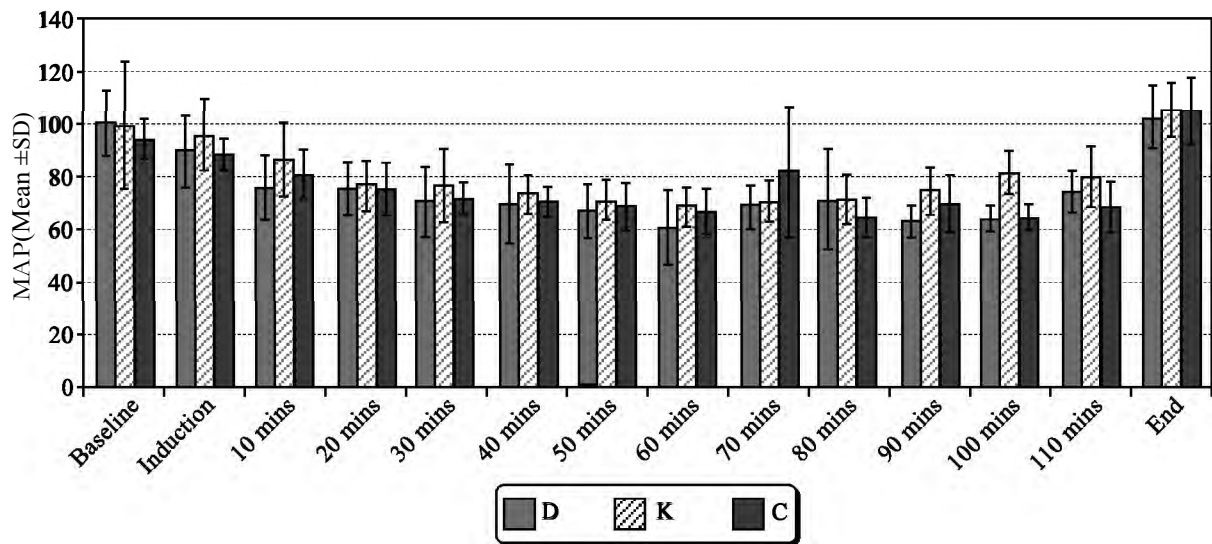


Fig. (4): Comparison between studied groups regarding MAP.

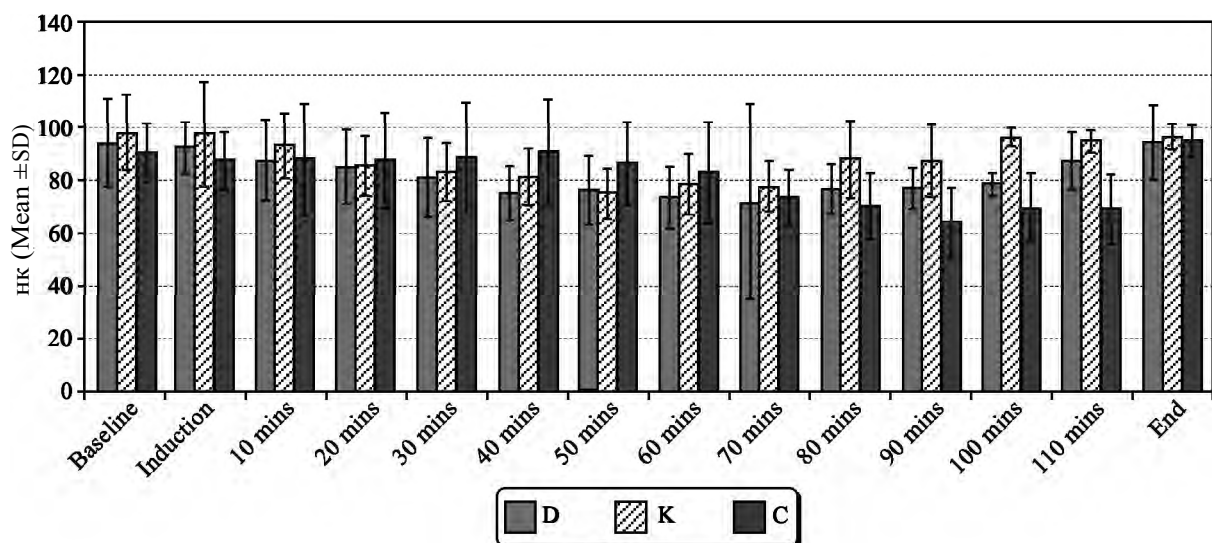


Fig. (5): Comparison between groups regarding heart rate.

Table (1): Comparison between groups regarding demographic data.

	D	K	C	p-value
Age	36.70- 11.1	33.25- 9.15	30.7- 7.72	0.138
Sex:				
Male	11(55%)	15 (75%)	16 (80%)	0.189
Female	9 (45%)	5 (25%)	4 (20%)	
Weight	84.65- 4.85	83.25- 6.83	84.1- 7.57	0.792
Height	173.2- 5.16	171.15- 6.91	170.4- 2.26	0.213
BMI	28.28- 2.46	28.41- 1.98	28.98- 2.69	0.623
ASA:				
Grade I	17 (85%)	16 (80%)	18 (90%)	0.676
Grade II	3 (15%)	4 (20%)	2 (10%)	

Table (2): Comparison between groups regarding VAS & first analgesic.

VAS	D	K	C	<i>P</i> ₁	<i>P</i> ₂	<i>P</i> ₃
Baseline	4.65±1.31	4.55±0.69	4.1±0.97	0.758	0.094	0.168
4h	2.12±0.36	2.8±0.62	3.3±1.03	<0.001**	<0.001**	0.071
8h	3.25±0.91	4.2±0.7	4.1±1.50	0.001**	0.037*	0.788
12h	4.4±0.94	5.8±0.77	5.5±1.47	<0.001**	0.008**	0.424
24h	6.55±0.94	6.7±0.66	6.8±0.77	0.555	0.326	0.694
First analgesic (hours)	13.7±2	10.95±1.05	11.7±3.53	0.001**	0.011*	0.331

*p*₁: Comparison between D & K. *p*₂: Comparison between D & C. *p*₃: Comparison between K & C.

Table (3): Comparison between groups regarding sensory and motor block onset.

	D	K	C	<i>P</i> ₁	<i>P</i> ₂	<i>P</i> ₃
Sensory block onset (minutes)	9±4.17	13±2.51	13.5±2.35	<0.001**	<0.001**	0.614
Motor block onset (minutes)	9±3.08	12±3.4	12.5±2.56	0.003**	0.001**	0.604

Table (4): Comparison between studied groups regarding rescue analgesia.

	D	K	C	<i>P</i> ₁	<i>P</i> ₂	<i>P</i> ₃
Rescue analgesia (dose in mill volume)	155±51.04	180±61.56	245±51.04	0.001**	0.154	0.001**

Table (5): Comparison between groups regarding MAP.

MAP	D	K	C	<i>P</i> ₁	<i>P</i> ₂	<i>P</i> ₃
Baseline	100.65±12.51	99.65±24.18	94.23±7.95	0.848	0.220	0.300
Induction	89.75±13.38	95.8±13.49	88.33±5.95	0.698	0.045*	0.101
10 mints	76.35±12.3	86.35±13.79	81.2±9.58	0.011*	0.207	0.181
20 mints	75.8±10.33	76.85±9.16	75.97±10.2	0.739	0.958	0.779
30 mints	70.65±13.21	76.8±14.02	72.03±6.55	0.103	0.711	0.205
40 mints	69.8±14.68	73.75±7.14	71.03±5.89	0.218	0.699	0.395
50 mints	67±10.78	71.55±7.86	68.97±9.24	0.130	0.510	0.387
60 mints	61.65±14.07	69±7.45	67.23±8.35	0.032*	0.100	0.584
70 mints	69±8.54	70.8±7.78	82.43±24.49	0.691	0.009**	0.023*
80 mints	71.71±19.07	72.05±8.74	64.44±7.65	0.937	0.098	0.059
90 mints	63.52±5.84	74.5±8.71	69.93±10.3	0.001**	0.053	0.131
100 mints	64.33±5.35	81.78±8.4	64.73±5.39	0.001**	0.887	0.001**
110 mints	74.36±8.16	80.4±11.46	68.67±9.62	0.167	0.157	0.007**
End	102.7±12.18	105.1±10.26	105±12.36	0.517	0.535	0.978

Discussion

Interscalene brachial plexus block had become a reliable method to control acute post-operative pain in shoulder surgeries either surgical or arthroscopic. IBPB provides adequate post-operative analgesia, better intraoperative hemodynamic control and significantly reduce opioid consumption.

A lot of trials have been done to prolong the effect of IBPB like indwelling catheter insertion or adding adjuvants to prolong the effect of local anesthetics beyond its pharmacological characteristics.

In our randomized controlled trial, we compared dexamethasone versus ketorolac or placebo (saline) when added to a mixture of 10ml lidocaine 1% and 10ml bupivacaine 0.25% in 60 patients undergoing elective shoulder arthroscopy under general anesthesia.

The primary outcome of this study is the duration of post-operative analgesia which was significantly lower as evidenced by VAS at 4, 8, 12 hours in the dexamethasone group in comparison with other two groups, but there was insignificant difference between ketorolac and control groups at the same post-operative hours.

Also longer time for the first analgesic requirement with average 13.7 ± 2 hours in dexamethasone group compared with 10.95 ± 1.05 hours in the ketorolac group and 11.7 ± 3.53 hours in the control group but there was insignificant difference between ketorolac and control groups.

Secondary outcomes:

Onset of both sensory and motor block was shorter significantly in dexamethasone than other groups. Insignificant difference was seen between ketorolac group and control group.

The total dose of paracetamol (rescue analgesia) was significantly lower in dexamethasone group when compared with the control group. Also it was lower in the ketorolac group when compared with the control group. Finally, there is insignificant difference between dexamethasone and ketorolac group regarding the total dose of paracetamol.

Also all groups showed adequate control of intraoperative hemodynamics regarding heart rate and mean arterial pressure.

Similar to our results, a systematic review and meta-analysis of perineural dexamethasone for regional anesthesia done by Albrecht et al., in 2015 concluded that dexamethasone showed longer duration of analgesia when injected to either long or intermediate acting local anesthetics. Similarly, dexamethasone had lower scores of pain at both rest and active movements in the first 24 hours postoperative. Also, lower morphine supplementation was needed [4].

Another systematic review and meta-analysis of randomized trials by Choi in 2014 also supported our results and concluded that dexamethasone prolonged the analgesic duration for long-acting local anesthetics from 730 to 1306min and for intermediate from 168 to 343min. Motor block was increased from 664 to 1102min [7].

Cummings et al., had also evidenced that dexamethasone prolonged significantly the analgesic duration of IBPB with ropivacaine (~1.9-fold) or bupivacaine (~1.5 fold) [8].

Reinhart et al., found that adding ketorolac to lidocaine for ankle block contributed to longer duration and better quality analgesia after foot surgery compared with 1.73% plain lidocaine or 1.73% lidocaine plus intravenous ketorolac which may support our results regarding lower dose of rescue analgesia and opioid sparing founded in ketorolac group when compared with the placebo group [6].

Also Silviu Brill and Miguel Plaza at 2004 published brief review about non-narcotic adjuvants effect in the duration and quality of analgesia after knee arthroscopy, they concluded that ketorolac when administered intra-articular after knee arthroscopy may reduce postoperative pain [9].

Our results were similar to the study done by Basenko et al., who concluded that adding 30mg ketorolac to 40ml bupivacaine 0.25% for brachial plexus block prolonged the duration of postoperative analgesia with no significant modification of hemodynamic parameters [10].

Conclusion:

Dexamethasone provides more effective postoperative analgesia than ketorolac when added to mixture of lidocaine and bupivacaine in combined ultrasound guided interscalene block and general anesthesia for shoulder arthroscopy.

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الإفادات النافذة غير النارية بالدماع : طرق العلاج والتدخل الجراحي

إستخدام عقار الديكساميثازون أو الكيترولاك كعوامل مساعدة فى إحصار ما بين العضلات الأخمعية إسترشادا بالموجات الفوق صوتية فى جراحات مناظير الكتف تحت المخدر العام.

إن التخدير الموضعى للضفيرة العضدية ما بين العضلات الأخمعية - إسترشادا بالموجات الفوق صوتية - حينما يتم إستخدامه مع التخدير الكلى فى جراحات مناظير الكتف يوفر عديد من المزايا مثل علاج ألم ما بعد العملية. وفى هذه الدراسة نفاارن ما بين عقارى الديكساميثازون أو الكيترولاك كعوامل مساعدة من حيث علاج ألم ما بعد العملية وفترة تسكين الألم وأيضا العلامات الحيوية أثناء إجراء الجراحة.

تمت هذه الدراسة فى مستشفى جامعة أسيوط على ٦٠ مريض من الجنسين وتتراوح أعمارهم ما بين ١٨-٦٠ سنة، وذلك بعد أخذ موافقة لجنة الأخلاقيات بكلية الطب جامعة أسيوط وكذلك أخذ موافقة كتابية مبنية على العلم من المريض. كل المرضى تم حقنهم بخليط من ١٠مل من عقار الليدوكيين تركيز ١٪ و ١٠مل من عقار البيوبيبيكسين تركيز ٠.٢٥٪، ثم يتم توزيع المرضى عشوائيا إلى ثلاث مجموعات كل مجموعة ٢٠:

• المجموعة الأولى: يضاف ٥مل من محلول الملح ٠.٩٪.

• المجموعة الثانية: يضاف ٥مل من عقار الديكساميثازون تركيز ١مجم لكل ١مل.

• المجموعة الثالثة: يضاف ٥مل من عقار الكيترولاك تركيز ١٠مجم لكل مل.

يتم متابعة وتسجيل كل من الوقت الذى بدأ فيه إحصار الحركة والإحساس بعد التخدير الموضعى، العلامات الحيوية للمرضى فى أثناء العملية، قياس شدة الألم بعد الجراحة، تسجيل أول وقت لطلب المسكن بعد العملية وكذلك عدد مرات إعطاء المسكنات.

البحث خلص إلى أن مدة تسكين علاج الألم بعد العملية كانت أطول كثيرا عند إستخدام عقار الديكساميثازون بمتوسط ساعات 2 ± 13.7 بالمقارنة بعقار الكيترولاك والذى كان متوسط مدة تسكين الألم 1.05 ± 10.9 ساعة، وقد لوحظ أيضا أن جرعة المسكنات التى تم إستخدامها فى مجموعة الديكساميثازون كانت أقل من المجموعات الأخرى.