

## ***The Effect Of The Intravenous Dexmedetomidine On The Duration Of Sensory And Motor Blockade After Subarachnoid Block***

**BY**

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### **Abstract :**

**Background:** Spinal block, a known technique to obtain anaesthesia for infra umbilical surgeries. Now physician have advantage of using adjuvant to prolong the effect of intrathecal block, which can be given either intravenously or intrathecally, dexmedetomidine is one of them. We studied effect of intravenous dexmedetomidine for prolongation of duration of intrathecal block of 0.5% bupivacaine block.

**Aim:** To evaluate the effect of intravenous dexmedetomidine on sensory and motor blockade duration after subarachnoid block (SAB) with bupivacaine 0.5% .

**Methods:** a prospective ,randomized ,double blind ,placebo controlled study was carried out in general surgical operation theaters of Baghdad teaching hospital, during the period from 1st March to 30th April 2016 Fifty patients of ASA grade I , II are posted for elective infraumbilical surgeries were included in the study and randomly allocated into two groups. Group D contain 25 patients received intrathecal 0.5% hyperbaric bupivacaine , followed after 10 minutes by infusion of intravenous dexmedetomidine 1mcg/kg in 100 ml normal saline over 10 min. Group (C) contain 25 patients received intrathecal 0.5% hyperbaric bupivacaine 3ml followed after 10 minutes by infusion of same volume of normal saline as placebo .

-Person's chi-square was used to assess statistical association between categorical data. -Analysis of variance(ANOVA) was used to assess the difference between the continuous variables. level of p-value less than 0.05 was significant.

**Result:** .Duration of analgesia in group D was  $202.28 \pm 4.46$  and in group C was  $159.6 \pm 3.12$  min. highly significant (  $p < 0.0001$  ).

Duration of motor blockage in group D was  $154.44 \pm 7.06$  minutes and in group C was 131.04 min. highly significant (  $P = < 0.0001$  )

### **Conclusion :**

Administration of intravenous dexmedetomidine 10 min. after SAB ( infusion of 1mcg/kg over 10 min. ) prolongs the duration of sensory and motor block.

**Key words:** neuraxial anesthesia, dexmedetomidine , bupivacaine.

## Introduction

The spinal cord is continuous with the brainstem proximally and terminates distally in the conus medullaris as the filum terminale (fibrous extension) and the cauda equina (neural extension).<sup>(1)</sup>

Neuraxial blocks may be used alone or in conjunction with general anesthesia for most procedures below the neck. As a primary anesthetic, neuraxial blocks have proved most useful in lower abdominal, inguinal, urogenital, rectal, and lower extremity surgery. Lumbar spinal surgery may also be performed under spinal anesthesia.<sup>(2)</sup>

The principal site of action for neuroaxial blockade is believed to be the nerve root. Blockade of neural transmission (conduction) in the posterior nerve root fibers interrupts somatic and visceral sensation, whereas blockade of anterior nerve root fibers prevents efferent motor and autonomic outflow.<sup>(3)</sup>

Dexmedetomidine is an  $\alpha_2$ -agonist, exerts its clinical effects via  $\alpha_2$  receptors with sedation in the locus coeruleus, hemodynamic manifestations via direct and indirect action on the sympathetic nervous system, and a host of miscellaneous side effects.<sup>(4)</sup>

Dexmedetomidine is a unique sedative agent for several reasons:

- (1) Mechanistically, it is an  $\alpha_2$  adrenergic receptor agonist, similar to clonidine,
- (2) it provides sedation without inducing unresponsiveness or coma,
- (3) it has some analgesic effect, and
- (4) it has little effect on respiratory drive.<sup>(5)</sup>

## Patients and Methods

After obtaining the Scientific council of Anesthesia and Intensive care approval, and written informed consent from the patients, a prospective, randomized, double blind, placebo controlled study was carried out in general surgical operation theaters of Baghdad

teaching hospital, during the period from 1st March to 30th April 2016.

Forty four patients of ASA grade I, II are posted for elective infraumbilical surgeries (inguinal hernia, lower limb surgeries, trans urethral resection of prostate) were included in the study and randomly allocated into two groups (22 patients for each group). Group D (dexmedetomidine) received intrathecal 0.5% hyperbaric bupivacaine, followed after 10 minutes by infusion of intravenous dexmedetomidine 1mc/kg in 100 ml normal saline over 10 min.

Group C (control) patient received intrathecal 0.5% hyperbaric bupivacaine 3ml followed by infusion of same volume of normal saline as placebo.

### Inclusive criteria:

- 1-Age 18 -60 year
- 2-American society of anesthesiologists (ASA) I,II.
- 3- Height 160 -175 cm
- 4- Weight 65- 80 kg

### Exclusive Criteria:

- 1- Contraindicated cases for spinal anesthesia.
- 2- Patient on antihypertensive drugs.
- 3- Patients on sedative medications, antidepressant in the week prior to surgery.

### Study design

After collection of data from patient file, a clinical examination was performed by general examination, vital signs measurement. Monitors (ECG, NIBP, HR, SPO2) were attached after receiving patient in operator room. Two wide bore iv line (g 18) was used and all patients were loaded with 10 ml/kg normal saline for each patient before starting with spinal anesthesia. Patients were divided into two groups (group D and group C).

Spinal anesthesia was performed for all patient as following:

Under aseptic condition, in a sitting position, identification the level of L3-L4, using midline technique, using 25 gauge needle, injection of 15mg of hyperbaric bupivacaine 0.5% (3 ml) were used in spinal anaesthesia.

Then the patient put in supine position immediately after the spinal injection. All patients continue to receive crystalloid fluid.

Vital signs monitoring with (ECG, NIBP, HR, SPO2) recorded before injection and during operation and recorded every 5 minutes during operation, and every 15 min. after ending of surgery until 120 min. Upper level of sensory block was observed after 5 minutes of spinal anesthesia by bilateral loss of cold temperature sensation. Motor blockade was checked by modified Bromage scale

< 90 or decreased more than 20 % base line ) crystalloid fluid

### statistical analysis

The continuous variables were presented as mean and standard deviation. The categorical variables were presented by (frequency and percentages in tables). -Person's chi-square was used to assess statistical association between categorical data. -Analysis of variance (ANOVA) was used to assess the difference between the continuous variables. level of p-value less than 0.05 was significant.

The surgical operation started when the sensory block reached T6 and modified Bromage scale reach 3. 10 min. after spinal anesthesia patients in group D received 1 mcg/kg of dexmedetomidine as infusion in 100 ml normal saline over 10 min. while patients in group C received 100 ml of normal over 10 min. as placebo.

The sensory level checked every 15 min. In cases of hypotension (systolic blood pressure

## The result

The demographic data (age, height, weight, gender), duration of surgery were comparable and shown no significant p values, type of surgeries was uniformly distributed between the groups. as shown in table "1".

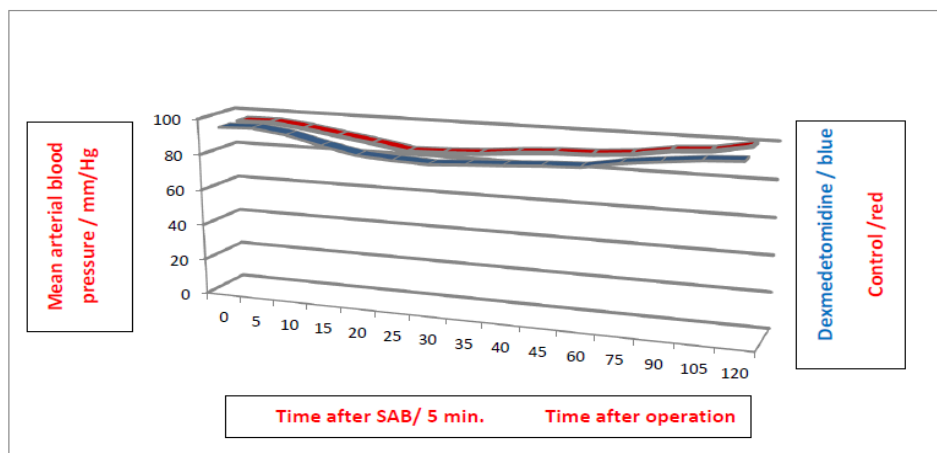
**Table"1" demographic data of the two groups**

|                                  | <b>Dex. Group</b>         | <b>Control Group</b>      | <b>P.value</b> | <b>Significance</b>        |
|----------------------------------|---------------------------|---------------------------|----------------|----------------------------|
| <b>Age</b>                       | <b>35.88+_<br/>9.2</b>    | <b>33.24 +_<br/>7.96</b>  | <b>0.37</b>    | <b>Not<br/>Significant</b> |
| <b>Weight /kg</b>                | <b>65.96+_<br/>8.2</b>    | <b>67 +_7.96</b>          | <b>0.64</b>    | <b>Not<br/>Significant</b> |
| <b>Height /cm</b>                | <b>164.96</b>             | <b>161.12++_<br/>9.6</b>  | <b>0.17</b>    | <b>Not<br/>Significant</b> |
| <b>Duration<br/>Of operation</b> | <b>52.12 +_<br/>10.99</b> | <b>49.36 +_<br/>14.61</b> | <b>0.453</b>   | <b>Not<br/>Significant</b> |
| <b>Gender m/f</b>                | <b>13/ 9</b>              | <b>14/8</b>               | <b>0.557</b>   | <b>Not<br/>significant</b> |

**Monitoring of mean arterial blood pressure show more decrease in these data in group D than in group C but with no significant p value as shown in table " 2 " and figures " 1 ".**

**Table " 2 " mean arterial blood pressure /mmHg**

| <b>Time /minute</b> | <b>Dexmedetomidine group Mean of MAP/mmHg</b> | <b>Control group Mean of MAP/mmHg</b> | <b>p. value</b> |
|---------------------|---|---------------------------------------|-----------------|
| Zero                | 95.04   | 94.95                                 | <b>0.79</b>     |
| 5                   | 95.9+_1.1                                     | 95.9+_1.17                            | <b>0.88</b>     |
| 10                  | 93.2+_0.8                                     | 93.2+_0.7                             | <b>0.76</b>     |
| 15                  | 88+_0.7                                       | 88+_0.7                               | <b>0.48</b>     |
| 20                  | 83.8+_0.8                                     | 84.1+_0.88                            | <b>0.30</b>     |
| 25                  | 83.6+_0.6                                     | 84+_0.8                               | <b>0.40.</b>    |
| 30                  | 82.6+_0.4                                     | 83.2+_1.1                             | <b>0.052</b>    |
| 35                  | 83.2+_0.7                                     | 83.2+_0.6                             | <b>0.52</b>     |
| 40                  | 83.2+_0.6                                     | 83.4+_0.8                             | <b>0.35</b>     |
| 45                  | 83.4+_0.8                                     | 83.5+_1.1                             | <b>0.65</b>     |
| 60                  | 85.9+_1.6                                     | 86.4+_1.4                             | <b>0.29</b>     |
| 75                  | 89.5+_0.59                                    | 89.86+_0.35                           | <b>0.28</b>     |
| 90                  | 93.2+_3.4                                     | 93.9+_3.2                             | <b>0.27</b>     |
| 105                 | 97.40+_1.09                                   | 97.5+_1.05                            | <b>0.5</b>      |
| 120                 | 93.2+_20/20.8                                 | 93.4+_20.                             | <b>0.9</b>      |



**Figure ( 1) mean arterial pressure in the two groupes**  
**Monitoring of heart rate show more decrease in heart rate in D group than in C group with significant value as shown in table " 3 " and figure "2 "**

**Table " 3 " heart rate**

| Time | dexmedetomidine | Control    | P VALUE |
|------|-----------------|------------|---------|
| 0    | 75.4+_1         | 75.2+_ 0.6 | 0.5     |
| 5    | 76.3            | 76.2       | 0.7     |
| 10   | 76.18+_1.6      | 76.3+_1.8  | 0.7     |
| 15   | 71.5+_2.7       | 73.6+_2.6  | 0.01    |
| 20   | 68.18+_3.9      | 74.8+_3.04 | 0.01    |
| 25   | 65.4+_5         | 72.9+_2    | 0.01    |
| 30   | 62.5+_5         | 69.3+_5    | 0.001   |
| 35   | 61.1+_4         | 67.04+_5   | 0.002   |
| 40   | 61.1+_4         | 65.2+_5    | 0.01    |
| 45   | 63.1+_10        | 65+_9      | 0.6     |
| 60   | 69.5+_2         | 69.3+_3    | 0.76    |
| 75   | 67.1+_15        | 67.7+_15   | 0.8     |
| 90   | 70+_15          | 69+_15     | 0.86    |
| 105  | 80.01+_16       | 79.1+_16   | 0.9     |
| 120  | 83.12+_15       | 85.2+_16   | 0.76    |

Monitoring of the duration of sensory , motor block in both groups show more duration in group D than group C with significant value as shown in table " 4 , 5" , figure "3 ,4" .

Table " 4 " duration of sensory blocked in minutes

| Dexmedetomidine Group/ minutes | Mean    | Control group /minutes   | Mean   | P value |
|--------------------------------|---------|--------------------------|--------|---------|
| 195,195,197,198,198            | 202.18+ | 155,155 ,156,156,156     | 159.68 | <0.0001 |
| 199,199,200,200,200            | -       | 157,157,,158,158,159,159 | +_3.2  |         |
| ,201,202,203,203               | 4.7     | ,160,160,161,,161,162,   |        |         |
| ,203,203,,206,208,             |         | 162,163,164,164,165,165  |        |         |
| 208,210,210,210                |         |                          |        |         |

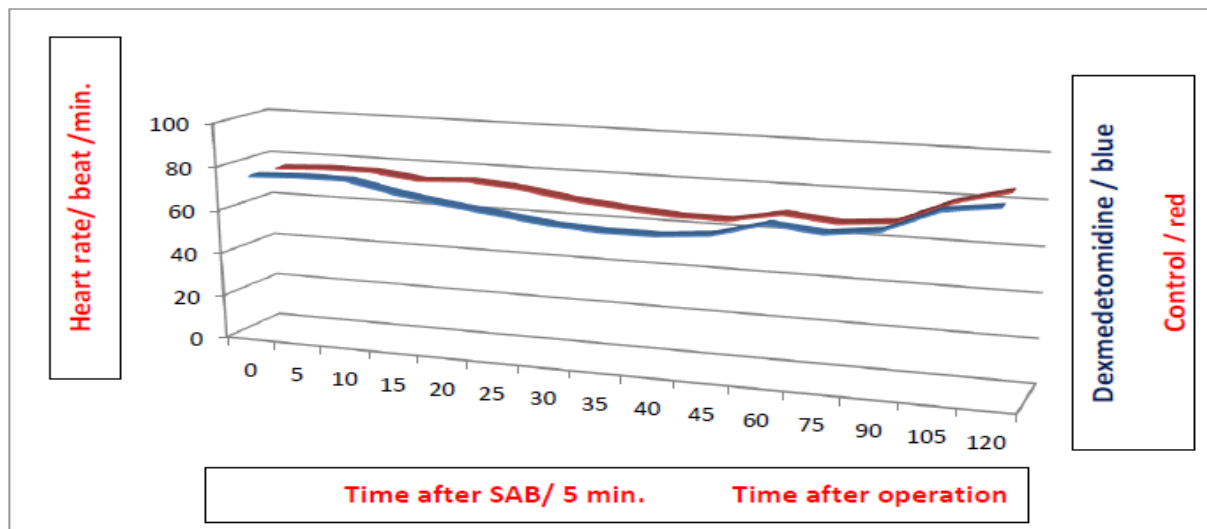
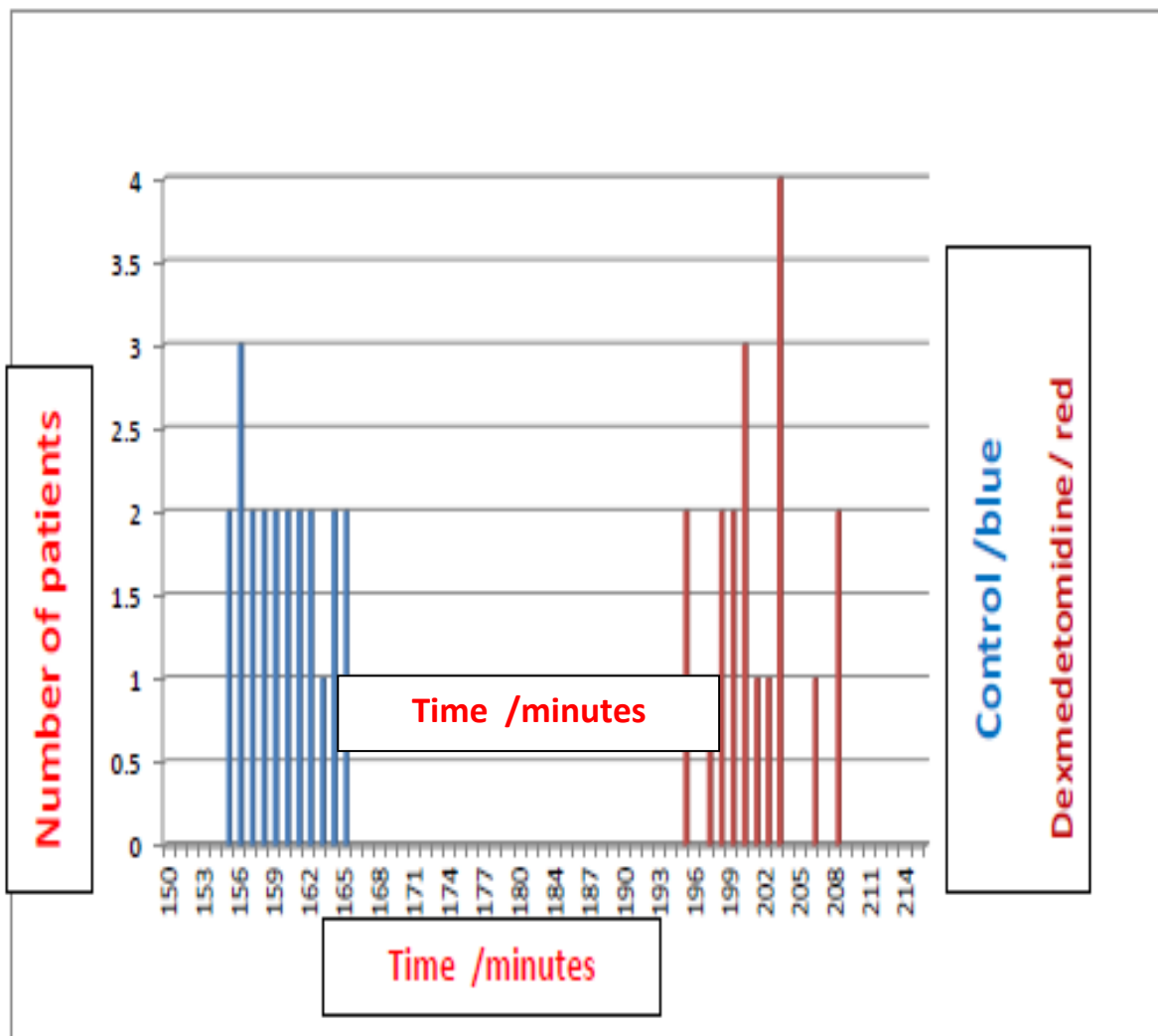


Figure " 2 " heart rate

Figure " 3" duration of sensory blockade





| Dexmedetomidine Group / minutes  | Mean            | Control group /minutes   | Mean               | P value |
|--|-----------------|--|--------------------|---------|
| 141,143,143,145,146<br>148,148,150,152,154,156,<br>157,157,159,159,160,160<br>,161,162,162,163,164 | 154.9-<br>+7.03 | 120,121,122,123,123<br>125,125,128,129,130,130,132<br>,134,135,135,135,<br>136,137,138,139,140,140 | 130.7<br>+<br>6.48 | <0.0001 |

Table "5" duration of motor blockade in minutes

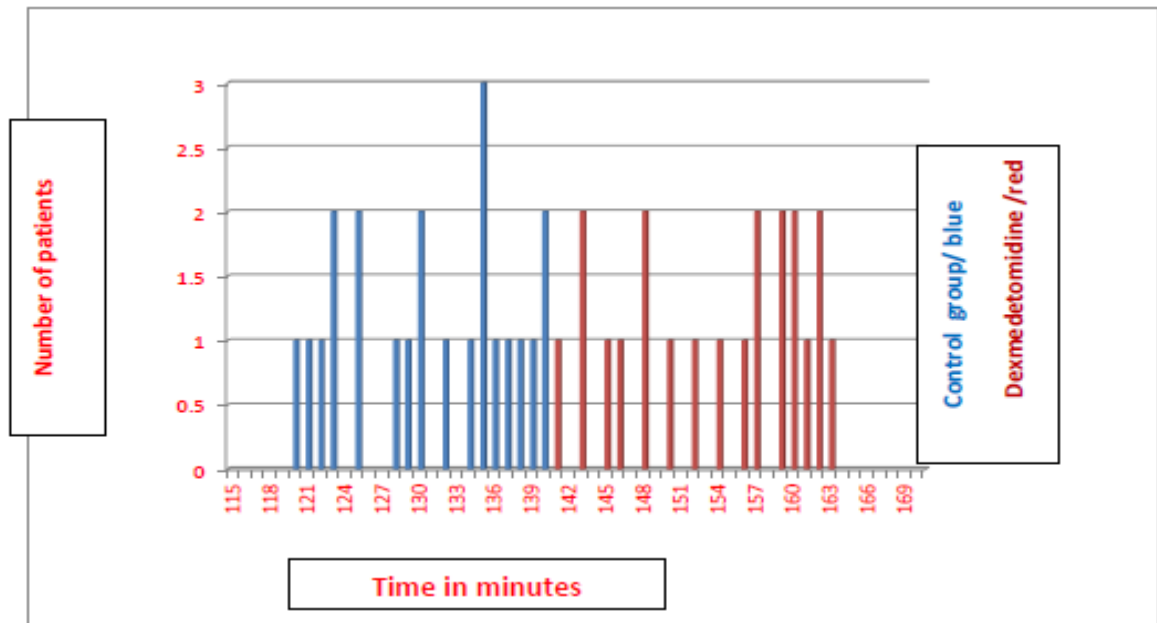


Figure " 4" duration of motor blockade in minutes

## Discussion

Spinal (intrathecal/subarachnoid), anesthesia is commonly used in a wide variety of procedures. Additional medications are frequently added to the local anesthetic or intravenously to modify its effects ,to increase the efficacy or potency of local anesthetic drugs when given concurrently. Neuraxial adjuvants are used to improve or prolong analgesia and decrease the adverse effects associated with high doses of a single local anaesthetic agent. In addition to their dose sparing effects, neuraxial adjuvants are also utilized to increase the speed of onset of neural blockade (reduce latency), improve the quality and prolong the duration of neural blockade. <sup>(6,7,8)</sup> ).

In our study we assess the role of  $\alpha_2$  agonist dexmedetomidine in the duration of sensory and motor blocked . Analgesic effects of dexmedetomidine. is manly mediated by alpha 2 C and alpha 2 A receptors present on the neurons of superficial dorsal horn in lamina II, when activated, it inhibits the release of pro-nociceptive transmitters namely substance P and glutamate and hyperpolarize spinal interneurons inhabiting signal transmission <sup>(9,10)</sup>

dexmedetomidine produces a greater degree of differential blockade by preferentially blocking the myelinated A-alpha-fibers involved in motor conduction <sup>(11)</sup>.

In our study group D has longer analgesic time than group C (202.28+4.46 in D group compared to 159.6 +3.12 in C group ) with significant p value of <0.0001

As Abdallah, at el....<sup>(12)</sup> study in which A total of 364 patients were analyzed from 7

intermediate to high-quality randomized controlled trials. When IV dexmedetomidine accompanied spinal anesthesia, sensory block duration was prolonged by at least 34% (point estimate: 38%),  $P < 0.00001$ .

And as [Chilkunda N. Dinesh](#) el at .... <sup>(13)</sup> ) in which they give 1mic/kg dexmedetomidine over 10 min. followed by 0.5 mic/kg /h till end of the surgery .in which there is prolongation of duration of sensory blocked with p value of <0.001 .

and ([SS Harsoor](#), et al. <sup>(14)</sup> ) in which the patients received 0.5 mic /kg over 10 min. prior to SAB followed by 0.5 mic/kg /min. for the duration of surgery ,which reveal longer duration of sensory blocked in the group which received dex. With p value (<0.001 ) .

In Jyotsna Kubre et al. study <sup>(15)</sup> ) in which the patient received 0.5 mic /kg over 10 min .45 min. after SAB , there is prolongation in the sensory blocked in dex. group with p value <0.0001 .

in our study group D has longer duration of motor blockade than group C (154.44 +\_7.065 in group D ,131.4+\_ 6.48 in group C ) with significant p value < 0.0001 .

AS IN [Chilkunda N. Dinesh](#) el at .... <sup>(13)</sup> ) in which the motor blocked more prolong in dex. group with p value <0.001

In [SS Harsoor et al.](#) <sup>(14)</sup> in which the motor blocked is prolonged in dex. gro(up with p value <0.001

As Abdallah, at el....<sup>(12)</sup> study in which in which the motor blocked more prolong in dex. group with p value <0.00001

In our study show significant difference in heart rate which decrease more in group D than in group C with significant p value of < 0.0001 as [Chilkunda N. Dinesh et al.](#)<sup>(12)</sup> in which the decrease in heart rate was more in group D with p value of <0.001 .

In As Abdallah, at el....<sup>(12)</sup> study there were more decrease in HR in group D with p vale <0.004 .

But in [SS Harsoor et al.](#)<sup>(14)</sup> study the difference in bradycardia was not significant with p value of <0.055.

### Conclusion

Single dose of iv dexmedetomidine ( in 1 mic /kg over 10 min. ) which is given 10 min. after spinal anesthesia ( 3 ml of bupivacaine ) has

significant prolongation of the duration of both sensory and motor blockade with no more effect on the blood presser but with more effect on the heart rate causing bradycardia.

### RECOMMENDATION

The anesthesiologist can use dexmedetomidine as adjuvant with spinal anesthesia for getting more sensory and motor blocked duration .

-Can use dexmedetomidine in dose of 1 mic /kg over 10 min. ( 10 min. after SAB) without causing large decrease in blood presser .

-Advise to do more research about the proper dose and time for giving dexmedetomidine to reach the proper adjuvant function with less haemodynamically effect.

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## تأثير اعطاء مادة ديكسميديتوميدتين وريديا على مدة الحصار الحسي والحركي للمريض بعد التخدير الشوكي

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د. جبار عبد الزهرة واجد

### الخلاصة

التخدير الشوكي، وهي تقنية معروفة للتخدير للعمليات الجراحية تحت السرة. وفي الوقت الحاضر فان الاطباء يستطيعون استخدام مواد مساعدة لإطالة تأثير التخدير الشوكي، وهذه المواد يمكن أن تعطى إما عن طريق الوريد أو زرقها في القناة الشوكية ، ديكسميديتوميدتين هو احد هذه المواد . في هذا البحث تم دراسة تأثير مادة الديكسميديتوميدتين في الوريد لإطالة مدة التخدير الشوكي باستخدام مادة بوبيفكين ٠.٥٪.

### الهدف:

لتقييم تأثير ديكسميديتوميدتين الوريدي على مدة الحصار الحسي والحركي بعد استخدام بوبيفكين ٠.٥٪ للتخدير الشوكي .

### طريقة البحث:

شمل البحث خمسين مريضاً من الدرجة الأولى والثانية حسب تصنيف ( ASA ) ممن تجرى لهم عمليات باردة تحت السرة ، تم تقسيم المرضى عشوائياً إلى مجموعتين: المجموعة الأولى ( D ) تم استخدام ٣ مل من ٠.٥٪ بوبيفكين ذو الضغط العالي، للتخدير الشوكي ، ثم بعد فترة ١٠ دقائق تم اعطاء ديكسميديتوميدتين بجرعة ( ١ mic / كغ ) توضع في ١٠٠ مل من محلول ملحي (نورمال سالين ) خلال ١٠ دقائق عن طريق التسريب الوريدي .

المجموعة الثانية ( C ) تم استخدام ٣ مل من ٠.٥٪ بوبيفكين ذو الضغط العالي، للتخدير الشوكي ثم بعد ١٠ دقائق تم اعطاء ١٠٠ مل نورمال سالين عن طريق التسريب الوريدي.

### النتائج:

تمت مقارنة المتغيرات الديموغرافية ونوع وفترة العمليات الجراحية بين المجموعتين وكانت النتائج متقاربة اما بالنسبة الى فترة تسكين الالم في المجموعة D ( كانت ٢٠٢.٢٨ + ٤.٤٦ ) دقيقة وفي المجموعة C كانت ( ١٥٩.٦ + ٣.١٢ ) دقيقة. مع قيمة احتمالية تصل الى اقل من (٠.٠٠٠١).

وكانت مدة الحصار الحركي في مجموعة D ( 7.06 + 154 0.44 ) دقيقة وفي مجموعة C ( 131.04 ) دقيقة ، مع قيمة لاحتمالية اقل من ( ٠.٠٠٠١ )

### الاستنتاجات :

ان اعطاء المريض ديكسميديتوميدتين بجرعة ( ١ ميكروغرام / كغ خلال ١٠ دقائق ) يطيل مدة الحصار الحسي والحركي للمريض بعد اجراء التخدير الشوكي

**الكلمات المفتاحية:** التخدير الشوكي ، ديكسميديتوميدتين، بوبيفكين