Original Article

Comparison of Duration of Spinal Anesthesia with Lidocaine or Lidocaine plus Epinephrine between Addicts and Non-addicts

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Abstract

Background: Duration of spinal anesthesia depends on the type of anesthetic agent, dosage and additive materials such as epinephrine, ephedrine and opioid. We compared the duration of spinal anesthesia with lidocaine 5% with or without epinephrine in addict and non-addict patients undergoing inferior limb fracture surgery.

Methods: This single blinded randomized clinical trial was performed on 201 males (height ranged 150-180 cm) who referred to the Shahid Bahonar Hospital of Kerman for the inferior limb fracture. Their physical class was matched to the American association standard class 1 and 2, and they were appropriate candidates for the spinal anesthesia. The addict or non-addict groups were each divided into two subgroups. 75 mg of 5% lidocaine was prescribed for one subgroup, and the other subgroup received 75 mg of 5% lidocaine plus 0.2 mg epinephrine. The level of primary anesthesia was elevated to T6. Duration of returning to the 4 primary sensory levels was measured since baseline.

Findings: A significant increase in the duration of anesthesia level in both addict and non-addict patients receiving lidocaine plus epinephrine was observed compared to the subgroups receiving lidocaine alone ($P < 0.01$). Duration of decrease in sensory level in addict subgroups receiving lidocaine or lidocaine plus epinephrine was lower compared to non-addict patients ($P < 0.001$). In addict subgroup receiving lidocaine alone, a significant decrease was observed in the time needed for decrease in sensory level ($P < 0.01$).

Conclusion: According to the results of this study, regardless of the anesthetic agent being used, duration of spinal anesthesia was shorter in addict patients compared to non-addict ones. Addition of epinephrine to lidocaine 5% increased the duration of spinal anesthesia in both addict and non-addict patients.

Keywords: Spinal anesthesia, Addict, Lidocaine, Epinephrine

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Introduction

Sedation during and following the surgery is among the most important factors considered by anesthesiologists in surgical operations. Today, effective reduction of pain during local anesthesia and extending duration of this sedation have become possible for most patients through further use of pharmacology science and acquiring knowledge about application of the best method for anesthesia. Thus, anesthesiologists in the last two decades have been seeking for the combinations of medicines administered in spinal anesthesia to improve the quality and level of anesthesia and sedation during and following the operation. In addition, they have been seeking for the ways for reducing dosage of administered medicines, and consequently, lowering their adverse side-effects. Spinal anesthesia is one of the common techniques of sedation that reduces patient's pain during surgical operations on lower limbs. Spinal anesthesia is a kind of blockage in spinal nerves which leads to symptomatic blockage, sensory analgesia, and motional blockage depending on dosage of local anesthetic medicine.[1,2] In the absence of contraindication for spinal anesthesia, this method is widely used and adopted in many surgical interventions such as orthopedics, urology and midwifery.[2] Other drugs added to local anesthetic medicine included epinephrine, phenylephrine, ephedrine, colloidine, narcotics and recently neostigmine that is an anticholinesterase, all result in lengthening of sedation and anesthesia duration.[3]

Spinal anesthesia is sometimes preferred to general anesthesia in addicts depending on patient circumstances and anesthesiologist's preference. As anesthetic method is modified, drugs such as ketamine, opioids, propofol, and benzodiazepines are prescribed for extending the sedation, unconsciousness, and patient's comfort. Addition of each of aforementioned items will be followed by their own short-term or long-term complications. Pain threshold in addicts is lower than ordinary people who are not addicted to opium due to several reasons including change in function, sensitivity reduction, or decrease in opioids' receptors. Nevertheless, they are more resistant against narcotics and analgesic drugs.[4-7]

A couple of studies have attributed the reason for variation in production and performance of endogenous peptides to increased entry of exogenous narcotics; these studies have assumed this phenomenon as a factor for alleviation of pain threshold and increasing the response to stimulus in addicted people.[6,8] Based on clinical findings, anesthesia or sedation duration is shorter in addicted patients compared to non-addicted ones[6,8] and therefore, anesthesiologist is forced to apply supplementary drugs to alleviate patient's pain throughout the surgical operation or to change the technique from spinal to general anesthesia. Change of anesthesia method and emergence of patient's pain would give rise to patient's anxiety and apprehension as well as problems associated with controlling the anesthesia scenario. Length of spinal anesthesia is specifically important both to avoid impairing surgeon's performance due to early recovery prior to the end of operation and also in terms of start of pain feeling and patient's irritability due to surgery when sedation is no longer working. Taking into account that prevalence of addiction to narcotics in Iran is 2.26% according to in the most recent report of United Nations Office on Drugs and Crime (UNODC) in August 2011, and that Iran ranks as the second country of the world in terms of narcotics consumption[9] and because of lower pain threshold in addicted people, the current study was attempted to analyze duration of spinal anesthesia by 5% lidocaine with and without epinephrine in addicts and non-addicts who were candidates for orthopedic surgery of lower organs.

Methods

In a single-blinded randomized clinical trial during August 2010 to August 2011, 201 male patients admitted in Kerman Shahid Bahonar Hospital, Iran, were recruited. Inclusion criteria included male patients with age of 51-65 years and height range of 150-180 cm that reported no neurological disorders in the past and present time, and meanwhile, were content with spinal anesthesia. The participants had fractures in lower limbs and physical class of 1 and 2 according to American Standard Association. Following initial examination and confirmation of absence of contraindications for spinal anesthesia and submission of consent forms, the patients were divided into two groups of addicted and non-addicted individuals. Each

group was divided into two subgroups; one received 5% lidocaine and another one received 5% lidocaine plus 0.2 mg epinephrine regardless of the operation type and duration. Addicted persons were determined based on their own statements. They were supposed to have taken narcotics at least for one year and withdrawal symptoms should have been clearly observed in the case of quitting. Non-addicted persons were expected not to have taken any narcotic drug during the last two years. Exclusion criteria were as follows: failure of primary sensory level to the sixth lumbar vertebral level or having higher anesthesia, body mass index above 35 and below 20 kg/m^2, alcohol consumption, having any contraindication for performing spinal anesthesia, addiction period less than 1 year for addicted persons, and taking narcotics within the last two years for the non-addicted group. In operation room, after full monitoring of patient (blood pressure, pulse-oxymetry and electrocardiography), 500-750 ml of ringer serum were injected to all patients in 10-15 minutes.

With the patients in sitting position, 75 mg of lidocaine 5.0% in dextrose 7.5% were injected using sport needle number 34 through 3-4 intervertebal space into the subarachnoid space of a group of patients under absolutely steril conditions. In the other group, 75 mg of lidocaine 5.0% and dextrose 7.5% plus 0.2 mg epinephrine at a rate of 0.2 ml/second were similarly injected. The patients were immediately allowed to lay back on the bed and primary sensory level was reached to the sixth lumbar vertebra level (in fact to the xiphoid level) by changing slope of operation room bed. Reduction of sensory level was checked every ten minutes by stimulating paient's flanks with needle. Our criterion was recovery of 4 sensory levels compared to the primary sensory level (recovery of sensory perception level to navel periphery or tenth vertebrae). Duration of sensory level recovery was expressed as an integer multiplier of 10.

Data Analysis

Data of all four groups were registered as 1-4 codes in a checklist and then. Using SPSS software version 17, the data were analyzed by Student's t-test, one-way ANOVA, and chi-square tests. P-value less than 5 percents was chosen as the significance limit.

Results

201 patients were recruited. In the non-addicted group, 51 individuals received lidocaine and 50 persons were given lidocaine plus epinephrine. In the addicted group, 56 individuals received lidocaine and 44 persons were given lidocaine and epinephrine (Table 1).

Among those who only received lidocaine, 8 persons had 4 sensory levels reduction within 10 minutes, 36 persons within 20 minutes, and 7 persons within 7 minutes. In patients who were administered by lidocaine and epinephrine, nobody showed reduction in sensory perception level within the first ten minutes; 11 and 39 persons had 4 sensory levels reduction within 20 and 30 minutes, respectively. Altogether, the four sensory levels reduction based on the primary sensory level were as follows: 8 persons within 10 minutes, 37 persons within 20 minutes, and 46 persons within 30 minutes. Generally, duration of reduced sensory perception in the group receiving epinephrine plus lidocaine was longer than the value in the group who received lidocaine only (P = 0.003) (Table 1).

In the addicted group who had received only lidocaine, duration of reduced sensory

Table 1. Comparison of addicts and non-addict groups for durations of sensory level recovery in 10, 20, and 30 minutes after spinal anesthesia

		Duration (minutes)			
		10 n (%)	20 n (%)	30 n (%)	Total n (%)
Non-addict	Lidocaine	8 (15.7)	36 (70.6)	7 (13.7)	51 (100)
	Lidocaine + Epinephrine	0	11 (22.0)	39 (78.0)	50 (100)
Addict	Lidocaine	23 (38.9)	30 (55.6)	3 (5.6)	56 (100)
	Lidocaine + Epinephrine	9 (21.4)	24 (52.4)	11 (29.2)	44 (100)
Total		40 (19.3)	101 (50.3)	60 (30.5)	201 (100)

level was longer than the addicted group receiving only lidocaine (P < 0.001). Duration of reduced sensory perception was longer in the addicted group who had received epinephrine and lidocaine than the addicted group receiving the same medicines (P < 0.001). Overall, comparative analysis among four groups revealed that duration of reduced sensory perception was longer in non-addicted groups (P < 0.001) and this parameter was affected by addition of epinephrine to lidocaine (P < 0.001) (Figure 1).

Patients' ages were in the range of 15-56 years with average age of 37 ± 16 years. It was observed that age had no effect on duration of spinal anesthesia (P = 0.460). Weight of patients with average value of 61 ± 7 kg also exhibited no impact on the duration of spinal anesthesia. Height did not affect the duration of spinal anesthesia too (P = 0.140) (Table 2).

Discussion

Findings of the current study showed that duration of spinal anesthesia in opium addicts is shorter than non-addicts and these people are more resistant against impacts of anesthetic medicines. As a result, in the case of prolonged surgery, addicted persons would require more medicine for anesthesia and probably supplementary drugs for sedation during and after operation. Impact of narcotic compounds on body pain system is not merely through classical narcotic receptors such as mu, kappa, and delta[10,11] but instead many studies have implied that these compounds are able to influence numerous receptors in the central and peripheral nervous systems.[1,5,6,8] Receptors of local anesthetic medicines are among those which might interfere with opioid receptors.[12,13] A number of investigations have shown that receptors of spinal anesthesia medicines are

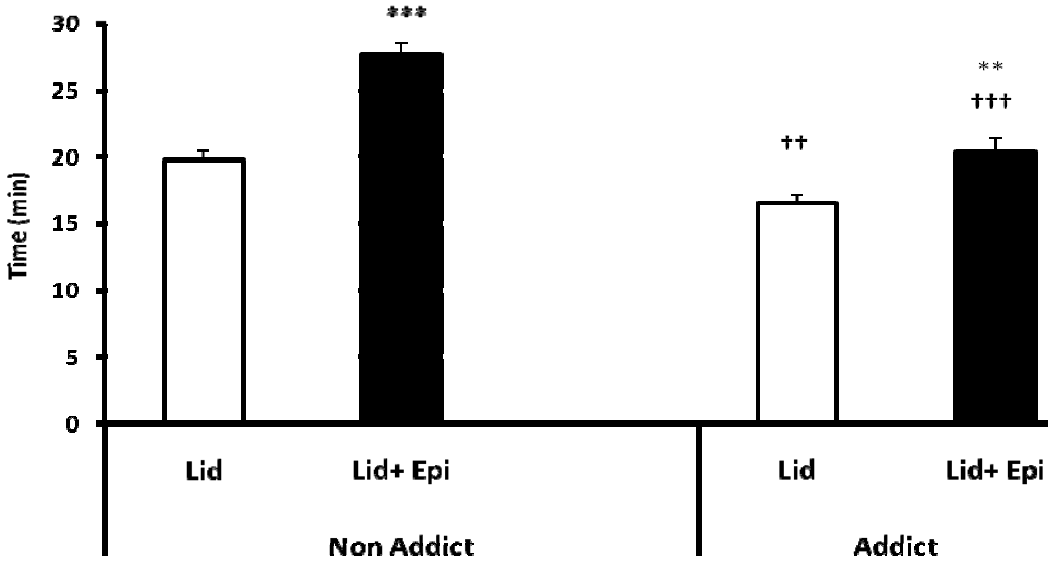

Figure 1. Comparison of duration of sensory perception level recovery in addicts and non-addicts in the presence of lidocaine (Lid) and lidocaine plus epinephrine (Epi)
**P < 0.01; ***P < 0.001 for duration of sensory level recovery for lidocaine + epinephrine compared to only lidocaine in addicted and non-addicted patients
††P < 0.01; †††P < 0.001 for duration of sensory level recovery in addicted and non-addicted patients

Table 2: Average ages, heights, and weights of patients in addicted and non-addicted groups who have received lidocaine or lidocaine + epinephrine for local anesthesia

		Mean			Standard deviation		
		Weight	Height	Age	Weight	Height	Age
Non Addict	Lidocaine	59.569	167.059	39.549	0.775	0.851	2.263
	Lidocaine + Epinephrine	59.660	166.020	38.600	0.737	0.891	2.176
Addict	Lidocaine	64.000	168.590	36.018	1.048	0.860	2.170
	Lidocaine + Epinephrine	64.704	167.204	35.250	0.959	1.047	2.323

analogous to narcotic receptors in some areas of body, especially inside the spine in certain directions, particularly in terms of function and structure.[12-14] Consequently, according to findings of the present study and taking into account the interference of opoid receptors and local sedatives, it seems that following declining adjustment phenomenon in narcotic receptors and increased tolerance to these drugs in addicted people, some degrees of resistance against effects of spinal anesthetic medicines might occur inside the body including spine. Lower pain threshold has been reported for addicted individuals compared to non-addicted people and low pain threshold is normally accompanied with exceeded tolerance against narcotic drugs.[8,14] In the addicted people, this reduction in threshold of response to sensory stimuli and elevated tolerance against medicines might occur for local anesthetic medicines too. Overall, these variations could lead to shortening the duration of sensory blockage by local anesthetic medicines in addicts compared to the non-addicts.

Duration of spinal anesthesia is a function of many variables. These variables include the method used for anesthesia, utilization of vascular tightening agents for reducing medicine removal from vicinity of the respective nerve, and amount of administered medicine because larger amount of medicine contributes to longer anesthesia duration.[7] Lidocaine is among the medicines extensively used for spinal anesthesia in under-waist surgical operations and duration of anesthesia by lidocaine is between 45 to 60 minutes while most orthopedic surgeries need longer time. Thus, the methods with least complication and longest possible anesthesia duration shall be applied. Adding vascular tightening agents such as epinephrine to the spinal anesthetic medicine is among the most recognized techniques. Epinephrine is capable of extending duration of lidocaine-induced spinal anesthesia for an additional 30 minutes.[15,16] Yet, the major question of the current research was whether this increased duration of anesthesia by epinephrine is equal for all patients or not. The answer to this question was found by applying epinephrine together with lidocaine in addicts and non-addicts. Addition of 0.2 mg epinephrine to 5.0% lidocaine in spinal anesthesia resulted in extension of anesthetic duration in both addicted and non-addicted groups. Epinephrine is a symptomatic medicine and if added to lidocaine or any other spinal anesthetic drug with dosage of 0.1 to 0.4 mg, it will be able to lengthen anesthesia duration through contracting vessels of the injected area, and ultimately, gradual absorption and reducing removal of anesthetic substance.[15,16] The factors of age, weight, and height had no impact on anesthesia duration. However, duration of spinal anesthesia expectedly slightly decreased with increasing weight in both groups.

Conclusion

Findings of the current research indicated that the people addicted to opioids are more resistant against effects of local anesthetic medicines. Addition of epinephrine to 5.0% lidocaine leads to extended duration of spinal anesthesia in both addicted and non-addicted groups. Consequently, this finding shall be taken into account for addicts that need spinal anesthesia. Suitable solution shall be also devised to reduce the required dosage for such patients and also mitigating the side effects associated with further administration of local anesthetic medicines.

Conflict of Interest: The authors have no conflict of interest.

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مقاله پژوهشی

مقایسه مدت زمان بی‌حسی نخاعی با لیدوکایین و لیدوکایین همراه با اپی‌نفرین در بیماران معتاد و غیر معتاد تحت جراحی ارتوپدی اندام تحتانی

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چکیده

مقدمه: مدت بی‌حسی نخاعی به نوع داروی بی‌حسی دهنده، مقدار دارو و اضافه کردن داروهایی مانند اپی‌نفرین، افدرین و مخدر وابسته است. هدف از این مطالعه، مقایسه مدت زمان بی‌حسی نخاعی با لیدوکایین ۵ درصد با و بدون اپی‌نفرین در بیماران معتاد و غیر معتاد مبتلا به شکستگی اندام تحتانی بود.

روش‌ها: مطالعه حاضر به صورت کارازمایی بالینی بر روی ۲۰۱ بیمار مرد با قد ۱۸۰-۱۵۰ سانتی‌متر و با کلاس فیزیکی ۱ و ۲ منطبق با استاندارد انجمن آمریکا صورت گرفت. نمونه‌گیری به صورت تصادفی و یک سو کور در بیماران مراجعه کننده به بیمارستان شهید باهنر کرمان که دچار شکستگی اندام تحتانی بوده و داوطلب بی‌هوشی به روش بی‌حسی نخاعی بودند، انجام شد. هر کدام از دو گروه معتاد و غیر معتاد به دو زیر گروه تقسیم شدند. به یک زیر گروه، ۷۵ میلی‌گرم لیدوکایین ۵ درصد و گروه دیگر ۷۵ میلی‌گرم لیدوکایین ۵ درصد همراه با ۰/۲ میلی‌گرم اپی‌نفرین تزریق شد و سطح حسی اولیه به مهره ششم پشتی (Thoracic) رسانده شد. مدت زمان برگشت ۴ سطح حسی از حس اولیه اندازه‌گیری گردید.

یافته‌ها: افزایش معنی‌داری در مدت زمان کاهش سطح بی‌حسی در گروه‌های معتاد و غیر معتاد که اپی‌نفرین به لیدوکایین اضافه شده بود در مقایسه با گروهی که لیدوکایین به تنهایی گرفته بودند، مشاهده شد ($P < ۰/۰۱$). مدت زمان کاهش سطح حسی در گروه معتاد چه لیدوکایین به تنهایی و یا لیدوکایین همراه با اپی‌نفرین دریافت کرده بودند، نسبت به گروه غیر معتاد کاهش معنی‌داری نشان داد ($P < ۰/۰۰۱$). در افراد معتاد گروه دریافت کننده لیدوکایین به تنهایی نسبت به گروه لیدوکایین همراه با اپی‌نفرین در مدت زمان کاهش سطح حسی کاهش معنی‌داری مشاهده شد ($P < ۰/۰۱$).

نتیجه‌گیری: با توجه به مطالعه حاضر، می‌توان حدس زد که صرف نظر از نوع داروی بی‌حسی دهنده نخاعی، مدت زمان بی‌حسی نخاعی در افراد معتاد کوتاه‌تر از افراد غیر معتاد است و افزودن اپی‌نفرین به لیدوکایین ۵ درصد در انجام بی‌حسی نخاعی باعث افزایش مدت زمان بی‌حسی نخاعی در هر دو گروه معتاد و غیر معتاد شد.

واژگان کلیدی: بی‌حسی نخاعی، معتاد، لیدوکایین، اپی‌نفرین

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