The Effect of Systemic Morphine on Analgesic Level in Spinal Anesthesia

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=국문초록=

Morphine 정주가 척추마취의 레벨에 미치는 영향

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척추마취는 국소마취제를 지주막하강에 주입하여 척수신경 전근과 후근을 차단하는 방법으로 하복부나 하지 수술 뿐 아니라 만성 통증과 암성 통증의 치료에도 이용되고 있는데 마취시간이나 재통시간의 연장 및 적절한 피부분절의 마취나 진통의 달성은 척추마취에서 중요한 사항이다. 본 연구에서는 morphine정주가 척추마취에 어떤 영향을 주는지 알아보기 위해 척추마취하에서 하지 수술을 받은 40명의 환자를 대상으로 척추마취를 시행한 80분에 척추마취 레벨, 수축기 및 이완기 혈압, 맥박 그리고 호흡수를 조사한후 morphine 10 mg을 정맥내로 주사후 20분후에 척추마취 레벨과 혈압, 맥박, 호흡수를 조사하여 다음과 같은 결과를 얻었다.

1) 척추마취 레벨은 morphine 투여전 $T_{7.5\pm0.32}$에 비해 morphine 투여 20분후에 $T_{6.0\pm0.31}$로 의의있게 상승하였다($p<0.005$).

2) 수축기 및 이완기 혈압과 맥박수는 morphine 투여전과 투여후에 의의있는 변화가 없었다.

3) 호흡수는 morphine 투여전에 비해 투여후 감소가 있었다($p<0.005$).

이상의 결과로 척추마취하에서 수술을 시행할 때나 통증치료시 전신적으로 morphne을 투여하여 마취와 진통부위를 넓일 수 있을 것으로 사료된다.

핵심어: Morphine, 척수마취, 레벨

INTRODUCTION

Spinal anesthesia is ideal for operations of the lower abdominal and lower extremities because it is the easiest to perform. Occasionally, we have experienced an inadequate level of spinal anesthesia due to an inadequate dose and positioning. At that time, we performed general anesthesia or adminstered supplementary analgesics to give an adquate anesthetic state for surgery. While administering small doses of morphine to patients undergoing surgery under spinal anesthesia, we observed rostral spread of sensory analgesia.

The present study was designed to evaluate

the effect of low doses of systemic morphine on the level of spinal analgesia produced by intrathecal tetracaine.

PATIENTS AND METHODS

Forty patients who were scheduled for lower extremities surgery under spinal anesthesia were studied. Patients who were receiving tranquilizers and analgesics before the operation, or patients with CNS disorder, were excluded from the study.

On arrival of the patient in the operating room, blood pressure, ECG, and heart rate were monitered. Before lumbar pucture, 500 ml of lactated Ringer's solution was administered intravenously.

With the patient in the left lateral position and after subcutaneous infiltration with 2% lidocaine, 0.5% hyperbaric tetracaine HCl (Tetocaine^{R}) 3 ml(15 mg) plus epinephrine 0.3 mg was injected intrathecally at the L_{3-4} interspace. All patients remained in the supine position for 20 min, after then they could change positions.

Eighty minutes after the intrathecal injection, the level of analgesia was assessed by a blinded observer. Pinprick sensation was assessed bilaterally using a 25 gauge needle in a cephalad to caudad direction. To assess the level we used 3 landmarks such as umbilicus(T_{10}), xyphoid process(T_6) and nipple line(T_4). Also we monitered the blood pressure(systolic and diastolic BP), the pulse rate and the respiratory rate.

After the spread of spinal analgesia was assessed, 1 ml of a solution of morphine 10 mg was administered intravenously. Changes in pinprick sensation and the blood pressure, the pulse rate and the repiratory rate were noted 20 minutes later(100 min after intrathecal injection).

RESULTS

Patient characteristics are shown in table 1.

Mean analgesic level at 80 minutes after intra-thecal injection of 15 mg hyperbaric tetocaine was $T_{7.5\pm0.32}$ and 20 minutes after morphine 10 mg injection was $T_{6.0\pm0.31}$ ($p<0.01$).

Mean systolic and diastolc blood pressures at 80 minutes after the spinal anesthesia were 110 $\pm$2.3 mmHg and 66$\pm$1.4 mmHg and after the injection of morphine 10 mg were 105$\pm$2.4 mmHg and 64$\pm$2.2 mmHg.

Mean pulse rate was 73$\pm$1.9 beats/min. at 80 minutes after spinal anesthesia and was 70$\pm$2.0 beats/min. at 20 minutes after injection of morphine 10 mg($p<0.01$).

Mean respiratory rate 80 minutes after spinal anesthesia was 18$\pm$0.5 rates/min. and was 17$\pm$

Table 1. Patient Characteristics

	Patients(n=40)
Age(yr)	33.7$\pm$10.5
Weight(kg)	60.8$\pm$ 9.9
Height(cm)	167.3$\pm$ 7.1

Table 2. Changes of Spinal Analgesia Level, Blood Pressure, Pusle Rate, and Respiratory Rate before and after Injection of Morphine

	Spinal analgesia level	BP(sBP/dBP) (mmHg)	PR (beats/ min)	RR (rates/ min)
BIM	$T_{7.5\pm0.32}$	109$\pm$2.0/66$\pm$1.4	73$\pm$1.9	18$\pm$0.5
AIM	$T_{6.0\pm0.31}$ **	105$\pm$2.4/64$\pm$2.2	70$\pm$2.0**	17$\pm$0.5

BIM: before injection of morphine,
AIM: after injection of morphine
BP: blood pressure, (sBP: systolic blood pressure, dBP: diastolic blood pressure)
PR: pulse rate, RR: respiratory rate
**: $p<0.001$

0.5 rates/min. 20 minutes after injection of morphine.

DISCUSSION

Spinal anesthesia follows placement of local anesthetic solution into subarachnoid space, most often at the lumbar level. In 1899 in Germany, August Bier and assistant injected cocaine into their subarachnoid spaces to produce spinal anesthesia[1]. Today, spinal anesthesia is one of the most common technique in regional anesthesia, used for anesthesia for operations, management of chronic and cancer pain, and diagnosis. Satisfactory spinal anesthesia requires that the block extend to the dermatomes needed for the operation, lasts longer than the procedure, and is profound enough to block all sensory modalities. Distribution of local anesthetic solutions in cerebrospinal fluid is influenced principally by ① the baricity of the solution, ② contour of the spinal canal, and ③ position of the patient during and in the first few minutes after the placement of drug into the subarachnoid space[2]. Sometimes, inadequate anesthesia such as low level and short duration disturbs the anesthesiologist and the surgeon. In order to extend the anesthesia duration, we use the local anesthetics vasoconstrictors[3]. We have experienced that systemic morphine relieved pain from inadequate spinal anesthesia.

The results of the present study show that morphine, administered intravenously increased the cephalad spread of sensory analgesia produced by intrathecal tetracaine. The mechanism of this interaction between systemic morphine and intrathecal tetracaine administered is not clear. In surgical trauma state, there may be a summation of the continuing afferent input due to peripheral nociceptors adjacent to the site of surgical manupulation as well as surgical injury-triggered increase in spinal cord excitability[4]. If spinal anesthesia is inadequate, a patient could feel pain because of perceiving a nociceptive stimuli from the operation site.

The explanation for this interesting phenomenon-ie, a possible synergistic effect of systemic morphine and spinal tetracaine on spread of sensory analgesia is not entirely clear. A more likely explanation is that systemic morphine turns on off-cells[5] in the rostral ventral medulla with secondary inhibition of nociceptive transmission at the spinal level. In experimental studies, this mechanism has been shown to contribute to the analgesic effect of systemic morphine[5,6]. This systemic morphine, by activating descending inhibitory pain modulatory circuits, may counteract the injury-triggered increase in peripheral afferent input and excitability in the cord, thereby indirectly maintaining the efficacy of spinal blockade with tetracaine. Systemic morphine has been shown to decrease spinal blood flow[7]. This may reduce absorption of local anesthetic, increasing the duration rather than the spread of sensory block. Therefore, changes in spinal cord flow is not likely to affect the spread of sensory block. Our findings may indicate a potential role for systemic morphine in the maintenance of adequate analgesia in patients undergoing spinal anesthesia.

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