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The effects of addition fentanyl or morphine to bupivacaine in spinal anesthesia for elective cesarean

Spinal anestezi uygulanan elektif sezaryenlerde bupivakaine eklenen fentanil ve morfinin etkilerinin karşılaştırılması

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Öz

Giriş: Çalışmamızda elektif sezeryan ameliyatında intratekal bupivakaine eklenen fentanil ve morfinin etkilerini karşılaştırmayı amaçladık. Gereç ve Yöntem: Çalışmaya ASA I-II 90 hasta alındı. Grup M'e 10 mg bupivakain + 1 mg morfin, Grup B' ye 12 mg bupivakain, Grup F' ye 10 mg bupivakain+ 20 μg fentanil. Hemodinamik, motor ve sensoryal blok gelişme ve gerileme zamanları, ilk analjezik ihtiyaç zamanı ayrıca yeni doğan APGAR Skoru ve umblikal kan gazı değerleri kaydedildi. Bulgular: Maksimum sensoriyal blok zamanını Grup B'de 6,60 dakika bulundu. Operasyon başlama zamanını çalışmamızda Grup F de 8,76 dakika tespit ederek anlamlı düzeyde yüksek bulundu ($p<0,05$). Grup F' de 2 segment gerileme zamanını diğer çalışmalardan farklı ve yüksek olarak 101,3 dakika bulundu ($p<0,05$). Motor blok bitiş zamanı Grup B'de anlamlı düzeyde düşük bulundu ($p< 0,05$). İlk analjezik zamanını Grup M de 1336 dakika bulundu ($p<0,05$). Apgar skoru 1.-5. dakika değerlerinde Grup M diğer gruplardan düşük olsa da istatistiksel olarak anlamlı fark bulmadık. Sonuç: her üç grupta yeterli anestezi ve analjezi sağlandı. Ancak bupivakaine morfin eklenen grupta daha uzun süreli anestezi ve analjezi sağlandığı görüldü. Sezaryen operasyonu için bupivakaine morfin eklemenin daha etkin olduğu kanaatine varıldı.

Anahtar kelimeler: Bupivakain, fentanil, morfin, sezaryen, spinal anestezi

Abstract

Objectives: In this study, we intended to compare effects of morphine or fentanyl which are added to intratechally adminstered bupivacain for spinal anesthesia. Materials and Methods: In this study, 90 ASA I-II patients were included. Group M was 10 mg bupivacain and 1 mg morphine, group B was 12 mg bupivacain and group F was 10 mg bupivacain and 20 μg fentanyl. Hemodynamic, motor and sensorial block developing and regression times, first analgesic need time, newborn APGAR score and umbilical cord blood gas sample results were recorded. Results: Maximum sensorial block time was 6.6 minute in group B. Operation starting time was 8.76 minute in group F. In group F two segment regression time was high (101.3 minute) ($p< 0.05$). Motor block regression time was lower than other groups in group B. First analgesic administration time was 1336 minute in group M ($p< 0.05$). APGAR 1st and 5th minute scores were lower in group M but they were not statistically significant. Conclusion: As a result, optimal anesthesia and analgesia were provided in all groups. But longer anesthesia and analgesia time was seen in morphine added bupivacaine group. According to these results additional morphine to bupivacaine for caesarean operation is more effective than other strategies.

Keywords: Bupivacain, fentanyl, morphine, cesarian, spinal anesthesia

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Introduction

Caesarean section is a frequently applied operation in cases of fetal distress, dystocia, maternal diseases, abnormal presentation, bleeding, previous caesarean section and when vaginal delivery is not possible. In the previous decade, caesarean deliveries in developed countries were recorded at the rate of 21%. During a caesarean operation, the safety of the mother and fetus must be provided against the effects of all kinds of changes in the mother. Therefore, caesarean anaesthesia is a separate speciality (1).

General and regional anaesthesia techniques are used in caesarean anaesthesia. In recent years regional anaesthesia has been preferred because of advantages such as the patient being conscious, safer airway management, low risk of aspiration, not causing respiratory depression in the newborn, and not causing uterus atonia (2). As one of the regional anaesthesia techniques, spinal anaesthesia has a rapid initial effect, requires low doses of local anaesthesia and provides a good quality, reliable block (3,4). To increase the quality of the anaesthesia in patients undergoing spinal anaesthesia, to extend the duration of the anaesthesia and to reduce side-effects, adjuvants are often added to local anaesthetics. The most frequently used adjuvants are opioids (5,6). The combination of opioids with local anaesthetics is known to create a more effective and longer lasting anaesthesia (7).

Of the intrathecal opioids, the most frequently used agent is fentanyl, which has been shown to be effective for 180-240 mins when applied intrathecally at a dose of 10-25μg (1). In several centres, morphine is used as analgesia following caesarean operations. Morphine epidural/intrathecal dose ratio 10/1. Between 0.2 and 1 mg single dose intrathecal administration reduces pain 24 hours. Repeat dose is not recommended. These doses was reported to not lead to major complications (8,9). In another studys, intrathecal morphine creates a long-lasting block by blocking somatic and partially visceral nociception (peritoneal irritation). However, after intrathecal application, nausea and vomiting is often encountered (7,10).

In this study it was aimed to compare the effects of adding fentanyl and morphine (1mg) to spinal bupivacaine in caesarean operations by evaluating the intraoperative and postoperative anaesthesia and analgesia quality, the haemodynamic effects on the mother and the APGAR score and umbilical arterial blood gas values of the infant.

Material and Method

Approval for the study was granted by the Clinical Research Ethics Committee (decision no: 47/ 2014) of Süleyman Demirel University Medical Faculty. Evaluation was made of the medical and anaesthesia records of patients who had been administered spinal anaesthesia in elective caesarean operations. The study comprised 90 cases aged 25-42 years of over 37 weeks gestation and ASA I-II status. The patients were separated into 3 groups of 30. Patients were excluded with a body weight > 100 kg or height < 150cm, those taking medication apart from prenatal vitamin and iron supplements, substance or alcohol dependency, known fetal anomalies, placenta previa, ablatio pregnancies, or allergy to any medication. The cases were randomly separated into 3 groups of different opioids added to the local anaesthesia. All groups received a total of 3 ml solution for each patient.

Group morphine (M) (n= 30): 10 mg bupivacaine and 1mg morphine intrathecal

Group bupivacaine (B) (n= 30): 12 mg bupivacaine intrathecal

Group Fentanyl (F) (n= 30): 10 mg bupivacaine and 20 μg fentanyl intrathecal

All the patients were evaluated from the anaesthesia monitoring forms at prespinal anaesthesia and at 1, 3, 5, 10, 15, 20, 25, 30, 40, 50, 60, 70 and 80 mins for heart rate (HR), mean arterial pressure (MAP), SpO_2, sensory block level with pinprick test and motor block level with the modified Bromage scale (0= no motor block, 1= no flexion from the hip, 2= no flexion from the knee, 3= no movement of the ankle or foot).

The patient data were evaluated with T6 sensorial block time (T6SBT), maximum sensorial block time (MSBT), operation starting time (OST), motor block starting time (MBST), 2 segment regression time (2SRT), T10 regression time (T10RT), motor block finishing time (MBFT) and first analgesia time (FAT).

In the evaluation of the newborns, umbilical cord blood gas samples were examined at 1 and 5 mins and the APGAR scores were examined from the patient monitoring form.

SPSS software was used in the data analysis. Numerical values were expressed as mean± SD. Variance analysis wa applied to repeated measurements. Demographic

data were analysed with One-Way Variance analysis. Comparisons within each time interval were made according to Anova. When a difference was determined between the 3 groups, the LSD test was used to test the difference. For categorical data, the Pearson Chi Square test was applied. A value of $p< 0.05$ was accepted as statistically significant.

Results

In the examination of the demographic data of the groups, no statistically significant difference was determined in respect of age, weight, height and operating time ($p> 0.05$) (Table 1).

Table 1: Demographic data

	Group M (n = 30)	Group B (n = 30)	Group F (n = 30)	p
Age	29.60 ± 5.3	29.70 ± 5.4	30.00 ± 1.0	0.959
Height (cm)	164.37 ± 5.9	164.57 ± 19.3	162.80 ± 5.1	0.824
Weight (kg)	75.0 ± 11.7	77.03 ± 9.2	74.17 ± 8.6	0.52
Duration of surgery (min)	45.00 ± 9.7	41.50 ± 10.4	44.33 ± 9.7	0,357

p <0.05: significant

When heart rate (HR) values were examined, the values of the fentanyl group at 1, 3, 5 and 10 mins were found to be statistically significantly low compared to those of the bupivacaine and morphine groups ($p< 0.05$) (Figure 1).

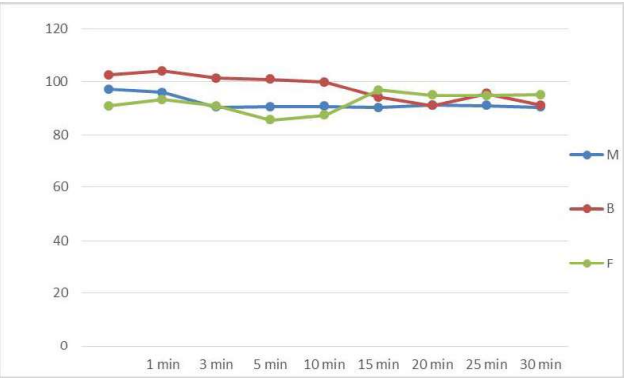

Figure 1. The mean heart rate values of the groups

In the evaluation of mean arterial pressure (MAP), the fall in the values of the morphine group at 15, 20, 25 and 30 mins was statistically significant compared to the fentanyl and bupivacaine groups ($p< 0.05$). There was no statistical significance between the groups in the other MAP values ($p> 0.05$) (Figure 2).

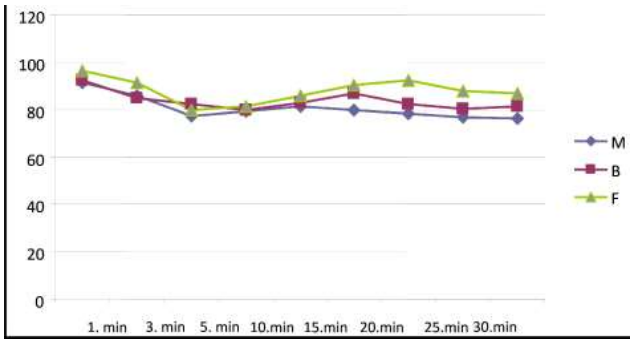

Figure 2. The mean arterial pressure values of the grous

In the evaluation of the SpO_2 values, the basal, 1, 3, 15 and 20-min values of the bupivacaine group were statistically signficantly low compared to those of the morphine and fentanyl groups ($p< 0.05$). No other statistically significant difference was seen between the groups in terms of the other SpO_2 values ($p> 0.05$) (Figure 3). There was not respiratory depression (diminished respiratory rate and elevated $PaCO_2$) all groups.

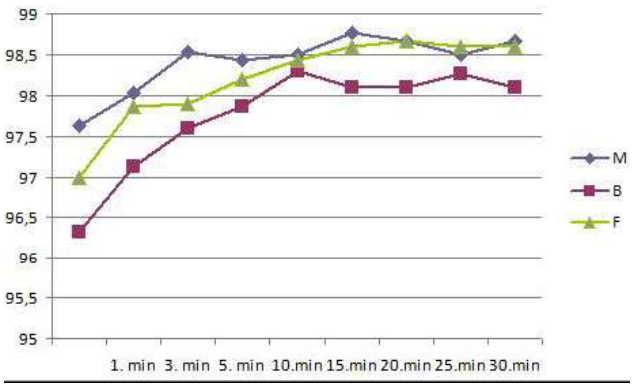

Figure 3. The mean SpO2 values of the groups

The sensory block levels at the 1st min were evaluated as 93.4% T12 and over in the morphine group and as 73.3% in the bupivacaine group and 90% in the fentanyl

group at L1-5 and below. The sensory block at 3 mins was seen to be 93.3% in the morphine group, 73.3% in the fentanyl group and 53.3% in the bupivacaine group at T10 and over. The sensory block level at 5 mins was evaluated as T6 and above in all the patients in the morphine group, at 96.7% in the bupivacaine group and at 70% in te fentanyl group. At 10 mins, the sensory block level was evaluated as T6 and above in all the groups. At 1 min, 86.6% of patients in the morphine group, 56.6% in the bupivacaine group and 10% in the fentanyl group were evaluated as 1 and above on the Bromage scale. At 3 min, 90% of patients in the morphine group, 76.7% in the bupivacaine group and 16.6% in the fentanyl group were evaluated as 2 and above on the Bromage scale. At 5 min, 100% of patients in the morphine and bupivacaine groups and 86.7% in the fentanyl group were evaluated as 2 and above on the Bromage scale. At 10 min, all patients in all the groups were evaluated as 2 and above on the Bromage scale. When the values of T6SBT, 2SRT and T10RT were examined, the values of the morphine group were found to be statistically significantly low ($p< 0.05$). No statistically significant difference was determined between the groups in terms of the MSBT values ($p> 0.05$). The OST and MBST values were found to be statistically significantly higher in the fentanyl group compared with the morphine and bupivacaine groups ($p< 0.05$). The MBFT values of the bupivacaine group were determined to be statistically significantly low ($p< 0.05$). The FAT values of the morphine group were found to be statistically significantly high compared to the bupivacaine and fentanyl groups ($p< 0.05$) (Table 2).

Table 2: Block characteristics

	Group M	Group B	Group F	P
T6 SBT	3.56 ± 1.6 *	6.20 ± 8.4	6.66 ± 1.8	0,043
Max.SBT	7.63 ± 3.1	6.60 ± 2.0	7.80 ± 1.9	0.124
OST	6.50 ± 2.1	7.43 ± 4.4	8.76 ± 2.2◆	0,024
MBOT1	2.30 ± 1.1	2.23 ± 0.9	2.90 ± 1.1◆	0,039
2 SRT	82.06 ± 19.9 *	107.83 ± 26.0	101.33 ± 29.7	0,001
T10RT	111.10 ± 25.5 *	131.16 ± 23.7	134.33 ± 31.6	0,001
MBET2	233.73 ± 47.5	184.00 ± 26.7•	244.00 ± 59.7	0,011
FAT	1336 ± 270.0 *	178.06 ± 32.9	235.33 ± 68.1	0,001

* Group M compared with group B and group F, $p <0.05$: significant
• Group B comparison with group M and group F
◆ Group F compared with Group B and Group M
T6SBT: T6 sensory block time, MSBT: The maximum sensory block time, OST: Operation start time, MBOT1: Motor block onset time, 2SRT: Two segment regression time, T10 RT: T10 Regression time, MBET2: Motor block end time, FAT: First analgesic time

In the umbilical cord blood gas analysis of the newborns, the pH values of the fentanyl group were statistically significantly low compared to those of the morphine and bupivacaine groups ($p< 0.05$). The umbilical cord blood gas CO_2 values of the newborns in the fentanyl group were found to be staistically significantly high compared to those of the morphine and bupivacaine groups ($p< 0.05$). The umbilical blood gas base deficit (BD) values of the newborns in the bupivacaine group were found to be statistically significantly high compared to those of the morphine and fentanyl groups ($p< 0.05$) (Table 3).

Table 3: Umbilical cord blood gas analysis

	Group M	Group B	Group F	P
PH	7.297±0.01	7.295±0.02	7.255±0.10	0,022*
PCO_2	42.30±2.8	41.75±1.1	47.06±8.0	0,001*
PO_2	26.23±1.9	26.51±1.9	28.55±8.0	0,142
HCO_3	19.29±1.1	19.40±0.8	19.59±2.3	0.758
BA	3.83±1.6	6.53±1.0	3.73±2.54	0,001*
*p <0.05: significant				

No statistically signficant difference was determined between the groups in terms of APGAR scores at 1 and 5 mins ($p> 0.05$) (Table 4).

Table 4 Newborn apgar score

	Group M	Group B	Group F	P
1 min	7.33 ± 0.4	7.57 ± 0.6	7.67 ± 0.7	0.131
5 min	9.23 ± 0.4	9.37 ± 0.4	9.27 ± 0.6	0.621

p <0.05: significant

No statistically significant difference was determined between the groups in terms of side-effects of headache and nausea (p> 0.05) (Figure 4).

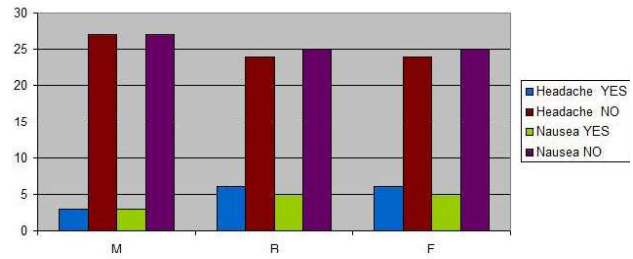

Figure 4. The frequency of side-effects

Discussion

In comparison with general anaesthesia for caesarean operations, regional anaesthesia is accepted as a preferable technique due to reduced maternal mortality, the avoidance of difficult intubation, aspiration and the risk of intraoperative awareness which can be seen in general anaesthesia, reduced uterus atonia and its associated blood loss (11-14). Some authors have even claimed that general anaesthesia is 'unacceptable' for elective caesarean operations when there is no contraindication (15). Two survey studies conducted in Turkey in 2 different years have shown that although the application of obstetric regional anaesthesia has not yet reached the level of western countries, there has been a substantial increase compared with previous years (16). One of the most important factors in this increase has been more widespread training given in the application of obstetric anaesthesia.

Adjuvant agents added to local anaesthetic agents can be defined as opioid and non-opioid (17,18). The addition of opioids to intrathecal local anaesthetics is known to increase the analgesia quality thereby reducing the dose of local anaesthetic (19). In addition, in cases which have received intrathecal opioid application, it has been shown that there have been reduced side-effects such as intraoperative nausea and vomiting due to the manipulation of the uterus and peritoneal structures (20). By increasing the duration of anaesthesia and analgesia, spinal opioids have been reported to have positive effects on the postperative comfort of the patient (21). There are ongoing studies to define the ideal doses of opioids and local anaesthetics (22-25).

In a study by But et al comparing the effects of fentanyl (25 μg) or morphine (100 mcg) added to bupivacaine (7.5 mg) in caesarean operations, a significant difference was determined between the groups in terms of haemodynamic parameters. The systolic arterial pressure values were determined to be significantly low in all 3 groups after spinal anaesthesia and the fall was seen to be greater in the fentanyl group (26). In a study by Fidan et al investigating the effects of fentanyl, morphine and alfentanyl added to intrathecal bupivacaine in caesarean operations, the haemodynamics of all the groups were reported to be within normal clinical limits and there was no difference between the groups (27) In the current study, the MAP values of the morphine group were found to be low at 15, 20, 25 and 30 mins but there was no statistically significant difference compared with the basal values. The HR values of the fentanyl group were observed to be low compared to those of the morphine and bupivacaine groups at basal, 1, 3, 5 and 10 mins but the decrease was not statistically significant.

Subaşı et al reported the motor block start time to be 1.37 mins in a study of the addition of 25 μg fentanyl to 7.5 mg bupivacaine (28). Different from this study, the motor block start time in the current study was found to be mean 2.23 mins.

In a study by Seyhan et al, 9 mg bupivacaine was administered to Group I, 8 mg bupivacaine +10 μg fentanyl to Group II, 7 mg bupivacaine + 20 μg fentanyl to Group III and the maximum sensorial block time was found to be 573.9, 412.7 and 393.2 seconds respectively, with no significant difference determined between the groups. However, the time of first analgesia was found to be 175.3 mins in Group III, which was determined to be statistically significantly longer than in Group I. The motor block finishing time was found to be 120.6 mins in Group I (29).

Şahinler et al added 20 μg fentanyl to 12.5 mg bupivacaine and reported maximum sensorial block time as 5.67 mins, 2 segment regression time as 75.9 mins, T10 regression time as 124.4 mins and the first analgesia time as 150.5 mins (30). In the current study, the first analgesia time was found to be 1336 mins in the morphine group, 178.06 mins in the bupivacaine group and 235.33 in the fentanyl group.

Karaman et al reported T10 sensorial block time as 4.1 mins in the morphine group and 3.8 mins in the fentanyl group, the maximum sensorial block time as 7.6 and 7.5 mins respectively, the T10 regression time as 164 and 148.9 mins, motor block finishing time as 278 and 225 mins and the first analgesia time as 20.5 hours in the morphine group and 4.2 hours in the fentanyl group (25).

In the current study, the maximum sensorial block time was determined as 7.63 mins in Group M, 6.60 mins in Group B and 7.8 mins in Group F. Although in contrast to the Karaman et al study, the Group F value was found to be higher than the Group M value in the current study, it was not statistically significant ($p > 0.05$). The maximum sensorial block time as determined by Şahinler et al at 5.67 mins was 2 mins lower than that of the current study (30). Seyhan et al (29) determined lower values than those of the current study with 9.5 mins in the bupivacaine group, 6.8 mins in the 10μg fentanyl group and 6.5 mins in the 20 μg fentanyl group.

Karaman et al (25) did not find any significant difference between the groups in terms of the operation start time values, whereas in the current study, Group F at 8.76 mins was found to be at a statistically significantly high level ($p < 0.05$). In a study by But et al (26), the operating starting time values were found to be 14.44 mins in Group I, 15.38 in Group II and 15.33 in Group III and in the current study these values were determined as 6.50 in Group M, 7.43 in Group B and 8.76 in Group F. Although the fentanyl group was found to be at a statistically significantly high level, the level was extremely low compared to the But et al study.

Şahinler et al determined the 2 segment regression time as 75.92 mins in the bupivacaine group (30). Subaşı et al added 25 μg fentanyl to 7.5 mg bupivacaine and found the 2 segment regression time to be 82.7 mins (28). In the current study, the 2 segment regression time was determined as different from other studies and high at 101.3 mins.

In a study by Choi et al, using 12 mg bupivacaine and 12 mg bupivacaine+ 10 μg fentanyl, the T10 regression times were found to be 126 and 142 mins respectively (30). Karaman et al determined T10 regression time as 164 mins in the morphine group and 148 mins in the fentanyl group (25), while Şahinler et al found the T10 regression time to be 124 mins in the bupivacaine group (30). In the current study, the T10 regression times were determined as 111 mins in Group M, 131 in Group B and 134 in Group F. The value in Group M was found to be statistically significantly lower. The values of the current study were seen to be higher than those of Choi et al and Şahinler et al and lower than those of Karaman et al.

Seyhan et al found the motor block finishing time to be 120 mins in Group I, 103 mins in Group II and 88 mins in Group III (29), while Karaman determined values of 278 mins in the morphine group and 225 mins in the fentanyl group (25). In the current study the motor block finishing time was determined as 233 mins in Group M, 184 mns in Group B and 244 mins in Group F. Group B was found to be statistically significantly low.

In a review by Dahl et al, the mean first analgesia time was 120 mins (range, 60- 240 mins) in 10 studies using only bupivacaine, mean 27 hours (range, 11 -29 hours) in 3 studies using bupivacaine+ morphine and 4 hours (range, 2-13 hours) in 7 studies using bupivacaine+ fentanyl (32). Different studies have shown different times for a requirement for first analgesia following different doses of morphine and fentanyl added to bupivacaine in spinal anaesthesia (Table 5).

Table 5 The first analgesic time

Literature	First analgesic time
Subaşı and his friends (28) Bupivacaine + fentanyl	173 min
Seyhan and his friends. (29) Bupivacaine Bupivacaine + fentanyl 10μg Bupivacaine + fentanyl 20μg	108 min 145 min 175 min
Sahinler and his friends (30) Bupivacaine	150 min
Karaman and hisfriends [25] Bupivacaine + morphine	1130 min

In the current study, the time of requirement for first analgesia was determined as 1336 mins in Group M, 178 mins in Group B and 235 mins in Group F. Although the bupivacaine +morphine groups were determined as different in all the studies, they were similar to the values in the current study. The results of Group B where only bupivacaine was used were higher than those of other studies and the values of Group F showed a similarity to those in the review by Dahl et al.

Respiratory depression (diminished respiratory rate and elevated $PaCO_2$) was common after 1 or 2,5 mg intrathecal morphine (9). In this study, there was not respiratory depression all groups.

In the evaluation of newborn respiratory functions, in the blood gas analysis, generally a value of umbilical artery pH< 7.2 is accepted as fetal acidosis. However, in recent studies this limit has been challenged and it has been proposed that the limit defining acidosis should be 7.0 (33). Ratcliffe et al reported that regional anaesthesia is more beneficial to the newborn than general anaesthesia (34). However, hypotension which may develop may lead to fetal acidosis by reducing uterus perfusion. In a study which evaluated infants born by caesarean section using general, epidural and spinal anaesthesia, the incidence of fetal acidosis (pH< 7.1) was reported at 4.67% in spinal anaesthia, 2.39% in epidural anaesthesia and statistically significantly high compared to general anaesthesia (35).

Mancuso et al (36) compared spinal anaesthesia and general anaesthesia and no difference was found in blood gas pH values. In a study by Uğur et al, comparing the efficacy and safety of adding 0.1 mg morphine or 20 μg fentanyl to intrathecal 0.5% 10 mg bupivacaine in caesarean operations, it was reported that intrathecal fentanyl and morphine had no negative effect on the wellbeing of the neonate and the conclusion was drawn that intrathecal opioids at the studied doses added to bupivacaine in elective caesarean operations can be used safely without any risk to the newborn (37).

In the neonatal blood gas analysis of But et al (26), values were determined of 7.29 in Group I (7.5 mg bupivacaine), 7.33 in Group II (7.5 mg bupivacaine + 25 μg fentanyl) and 7.35 in Group III (7.5 mg bupivacaine + 0.1 morphine) and the difference between Groups I-III was determined to be statistically significant. Seyhan et al (29) determined values of 7.25 in Group I (9 mg bupivacaine), 7.24 in Group II (8 mg bupivacaine + 10 μg fentanyl) and 7.27 in Group III (7 mg bupivacaine + 20 μg fentanyl). Karaman et al (26) determined 7.29 in the morphine group and 7.34 in the fentanyl group. In the current study, the pH values in the umbilical cord blood gas were determined as 7.29 in the morphine group, 7.29 in the bupivacaine group and 7.25 in the fentanyl group. Although the fentanyl group value was statistically significantly low, it was not evaluated as neonatal acidosis.

In a study comparing the Apgar scores from the use of regional and general anaesthesia, no difference was found in the Apgar scores (38). Mancuso et al researched the short-term effects of spinal and general anaesthesia on newborns and it was found that a high number of newborns in the general anaesthesia group had depressed respiration and the 1-5 min Apgar scores in the spinal group were higher (36). In studies where morphine or fentanyl was added to bupivacaine, no signficant difference was determined between the Apgar scores of the groups (26,38). In the current study, although the 1-5 min Apgar scores of the morphine group were lower than those of the other groups, the difference was not statistically significant.

Besides the beneficial effects of intrathecally administered opioids, there are side-effects. These may be nausea and vomiting, itching, headache, urine retention and respiratory depression. In the current study, nausea and headache were investigated as they are often encountered. Nausea and vomiting in caesarean operations may occur due to various factors. Generally nausea and vomiting occur as a result of hypotension due to reduced cerebral blood flow and in cases where the block level is insufficient, there may be tightening of peritoneal structures during the operation. In the studies of Weigl et al (39), no significant difference was found in side-effects in the morphine and fentanyl groups. But et al also found no difference between groups (26). In the current study, although the incidence of side effects was seen to be lower in the morphine group, there was no signifcant difference between the groups.

In conclusion, sufficient anaesthesia and analgesia was provided in all three groups of this study. Supporting these findings, it was concluded that the addition of morphine to intrathecally administered bupivacaine in caesarean operations provided long-lasting anaesthesia and analgesia. In addition, the incidence of side-effects associated with the application of morphine was found to be similar to that of the other groups.

Conflict of interest
The authors declare that there was no conflict of interest in the preparation or at any stage of this study.
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