

Subrectal and Subcutaneous Wound Infiltration with Bupivacaine versus Pethidine for Post Cesarean Section Pain Relief: Randomized Controlled Trial

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Abstract

Background: Cesarean section (CS), one of the most common major operative procedures, performed all over the world. Incisional infiltration with local anesthetics is a simple, cheap and effective mean of providing good analgesia for surgical operations without any major side effects & allowing early patients' mobilization & postoperative recovery, so the purpose of study is to compare between the effect of wound infiltration with bupivacaine versus pethidine for post cesarean section pain relief. **Patients and Methods:** A randomized controlled trial (RCT) was conducted in Ain Shams University Maternity hospital in the period from August 2016 and January 2017. 100 full term pregnant females randomized into two groups: Group A (50 patients) Bupivacaine group: Subcutaneous and subrectal infiltration with 10 ml 0.25% Bupivacaine (2.5 mg/ml) diluted in 10 ml normal saline before closure of the wound was done; Group B (50 patients) Pethidine group: Subcutaneous and subrectal infiltration with 1 ml pethidine (50 mg/ml) diluted in 19 ml normal saline before closure of the wound was done. All patients had cesarean section under spinal anesthesia. Study outcome measures post-operative pain scores using visual analogue scale, post-operative analgesia requirement time to first rescue analgesia, onset of mobilization, side effect of local anesthetic, wound infection (after one week). It was registered on clinical trials.gov with ID: NCT03652116. **Results:** Visual analogue scale values differ significantly between pethidine group and that of bupivacaine at rest and on coughing at 4, 8, 12, 24 hours & analgesic consumption (P value < 0.05). There is high statistical significant difference in 1st time request analgesia per minute comparing group A to group B (P value 0.001). There is no significant difference between bupivacaine and pethidine regarding time of ambulation, side effects or com-

plications. **Conclusion:** Infiltration of the wound of cesarean section with pethidine gives effective analgesia for several hours as compared to Bupivacaine.

Keywords

Analgesia, Ambulation, Wound Infiltration, Pethidine, Bupivacaine

1. Introduction

Cesarean section (CS) is becoming one of the most common major operative procedures performed all over the world. In USA a cesarean section rate reached 26% for all births. In Egypt, a significant rise in cesarean deliveries occurred for all births to 23% in 2000 [1]. Any intervention that leads to pain relief leads to early breastfeeding. Postoperative pain after cesarean section is usually managed with opioids in combination with other forms of analgesics [2].

Different types of anesthesia are used in cesarean section as general anesthesia, spinal anesthesia, combined spinal epidural or epidural block. Local anesthetic is injected to block the nerves before cutting the skin at the beginning of the operation, or after closing the skin at the end [3].

Subcutaneous infiltration of bupivacaine relieves first hour postoperative pain in humans [4], and thereby reducing analgesic consumption [5].

Wound infiltration had more pain relief and patient satisfaction comparable with epidural analgesia [6]. Incisional infiltration with local anesthetics is a simple, cheap and effective mean of providing good analgesia for surgical operations without any major side effects without local anesthetic toxicity, wound infection and healing issues [7] & allowing early patients' mobilization & postoperative recovery [8].

Mohammad Ali *et al.* underwent a randomized clinical trial including 98 patients comparing 0.25% bupivacaine with tramadol group, it was found that at 16th and 24th hours, it became more painful in the bupivacaine group than the tramadol group, respectively ($P < 0.05$). There was no difference in postoperative anesthetic complications during the 24-hour period between the 2 groups. [9]

Ahmad A. Eldabaetal performed RCT comparing 0.25% bupivacaine versus mix of bupivacaine and magnesium sulphate versus normal saline Post-operative pain scores at rest were statistically significant highest in the control group than bupivacaine group & the least is magnesium group [10].

Another RCT was done by Reetika Chander *et al.* involving 60 patients between 0.5% bupivacaine and mix of fentanyl and bupivacaine, more postoperative pain was found in bupivacaine group than fentanyl bupivacaine group [11].

Many studies were performed comparing wound infiltration with bupivacaine with other drugs or normal saline or between general and local anesthesia for post cesarean section analgesia studying effect on postoperative pain but what is different in this study comparing bupivacaine with pethidine which was proven to have prolonged pain free interval, so early women mobilization and decrease

the need for postoperative analgesia leading to more patient satisfaction, also the route of infiltration is unique to this study as others only used wound subcutaneous infiltration but that study used in addition subrectal route so combined effect increased postoperative analgesia.

The purpose of study to compare between the effect of wound infiltration with bupivacaine versus pethidine for post cesarean section pain relief.

2. Patients and Methods

A randomized controlled trial was conducted at Ain Shams University in the period from August 2016 and January 2017. A total of 100 full term pregnant females underwent elective cesarean section (c.s.) were recruited in the study. All women with the following criteria were included in the study: full term pregnant females more than or equal 37 weeks assigned to elective C.S. under spinal anesthesia without any previous surgeries. While women excluded were those with known hypersensitivity to bupivacaine or pethidine, or neurological and psychological disease, past history of any medical disorder (e.g. D.M.) or other medical complications during pregnancy (e.g. Anemia), also any history suggestive of abdominal adhesions as: surgical procedures, history of PID, endometriosis were excluded.

All the included women were subjected to the following: An informed consent to participation after explaining the nature, scope and possible consequences of the clinical study in simple form to the patient, proper full history was taken including: Personal history (Maternal age, weight, height); Obstetric history; Gravidity, Parity, previous pregnancy induced hypertension, Previous operative delivery, PID or endometriosis history; Any associated complication during pregnancy; Menstrual history (Last menstrual period); Maternal medical history (Hypertension & Coagulopathies). Examination: 1) General examination: a) Vital signs b) Chest and heart examination ii. Abdominal examination: a) Gestational age b) Fetal weight, amount of liquor, fetal lie and presentation, fetal heart sounds c) Uterine contractions and scar of previous surgeries. Investigations: CBC, Liver Function, Kidney function, Prothrombin time (PT) and prothrombin concentration (PC) Obstetric ultrasound study: For assessment of gestational age, implantation site of the placenta and fetal weight. Lower uterine segment cesarean section (LSCS) was done as follows: standard spinal anesthesia was administered. No pre-operative oral or intravenous analgesia was given. Steps of LSCS: All patients underwent lower uterine segment cesarean section through a pfannenstiel incision. A urinary catheter was inserted systematically before the C.S and was left in place for hours. Then the patients were randomized into 2 groups: Each set contained a syringe of 20 ml for wound infiltration; the contents of the syringe differed according to group Group A (n = 50 women): 10 ml 0.25% Bupivacaine (2.5 mg/ml) diluted in 0 ml normal 0.9% saline before closure of the wound was done. Group B (n = 50 women): 1 ml of pethidine (50 mg/ml) diluted in 19 ml normal 0.9% saline before closure of the wound was done, saline fills the 20 ml syringe after filling the syringe with drug.

Subrectal and subcutaneous wound infiltration by the syringe was performed by the blinded surgeon with unlabeled syringe.

The surgeon injected the needle to a depth of 1 cm and aspirates before injection to avoid intravascular injection of the product. In case of aspiration blood in the syringe, the needle was withdrawn and reintroduced. The subcutaneous tissue is infiltrated on each of upper and lower edges of the incision then closure of the skin was done. Injection of large volumes into the fatty layers, which are relatively devoid of nerve supply, was avoided to limit the total dose of local anesthetic needed.

Additional rescue analgesia in the form of intravenous paracetamol was given, according to visual analogue scale (VAS) when equal to or more than three. Post-operative assessment: primary outcome post-operative pain scores using VAS was assessed, secondary outcomes as post-operative analgesia requirement, time to first rescue analgesia, onset of mobilization, side effect of local anesthetic, (evaluation of any complication or side effects up to 24 hours after the surgery), patient satisfaction, wound infection (after one week).

Pain Assessment: was done using a point visual analogue scale (VAS) after 30 minutes, 2, 4, 6, 8, 12, 24 hours post-operatively. It consists of 100 mm horizontal or vertical straight line with two ends as illustrated in **Figure 1**.

The patient was asked to mark on the line the pain she feels. The use of standard 10 mm visual analogue scale (VAS) for scoring pain was explained to the patient during the pre-operative visit represented 0 = no pain and 10 = the most severe pain and was repeated on coughing.

Total analgesic consumption according to value of VAS 24 hours postoperatively was calculated. Amount of analgesic consumed according to VAS: VAS < 3 No analgesic, 3 - 6500 mg paracetamol analgesic, 6 - 8 1000 mg paracetamol consumed, >8 1500 mg paracetamol used.

Time of ambulation: Patient was asked about time at which she started ambulation post-operatively.

Randomization: was done using computer random sequence generated by excel sheet divided them into equal groups.

Allocation concealment: patients fulfilling inclusion and exclusion criteria were allocated into one of the two groups A and B by using consecutively numbered sealed opaque envelopes.

Blinding: staff members responsible for either transdermal or transrectal infiltration with anesthetic drug or anesthesia team which prepare were blinded to each patient's allocation group.

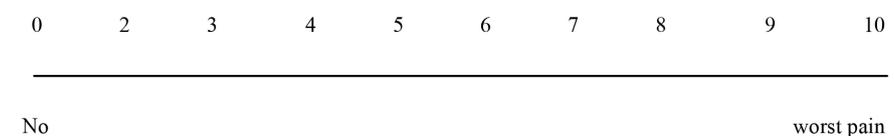


Figure 1. Line of visual analogue scale.

Ethics: The study was approved from the Ethical Committee of the Department of Obstetrics and Gynecology, Faculty of Medicine, Ain Shams University and fulfilling declaration of Helsinki ethical principles for medical research involving human subjects 2001.

Sample size justification:

A sample of 50 women per group was calculated using power and sample size calculation program version 3 using mean difference in VAS 0.4 ± 0.5 power of study = 80% and α error = 0.05 [11].

The statistical analysis:

Data were statistically described in terms of mean \pm standard deviation (\pm SD), median and range, when appropriate. Comparison between the study groups was done using Chi-squared test in comparing proportions and Independent T test in comparing means and standard deviations. P values less than 0.05 was considered statistically significant and P value less than 0.001 is considered highly significant. All statistical calculation were done using computer program (SPSS), statistical package for the social science; SPSS INC. Chicago, IL USA, version for Microsoft Windows

3. Results

A total of 100 pregnant women was eligible for inclusion in the study between August 2016 and January 2017. Previously mentioned exclusion criteria were applied

Table 1 shows demographic data for both groups. There are no statistical difference between the two groups as regarding age, weight, height, gestational, age, Gravidity, parity as demonstrated in **Table 1**.

Table 2 shows Visual Analogue scale comparing the two groups. There is statistical significant difference in visual analogue scale values at rest and on coughing as demonstrated in **Table 2(a)** & **Table 2(b)**.

When comparing both groups there was a significant degree of analgesia in Pethidine group as shown by decreased pain scores of visual analogue scale after 4 hours and 12 hours post-operatively at rest and on coughing.

Table 3 shows First time request analgesia (minutes) in both groups. There is statistical highly significant difference in 1st time request analgesia per minute comparing group A to group B. Patients in Pethidine group requested analgesia later with a significant prolonged pain free interval than patients in Bupivacaine group.

Table 4 shows analgesic consumption in both groups (%). Patients in Pethidine group consumed less analgesia than those in Bupivacaine group.

Table 5 shows nausea, Vomiting, Metoclopramide consumption and Satisfaction scores (%). There is no statistical highly significant difference regarding Nausea, Vomiting, Metoclopramide consumption and Satisfaction scores between either groups.

Table 6 shows mean arterial blood pressure, heart rate and respiratory rate at 4, 8, 12, 24 hours postoperative in both groups. Concerning vital data between

Table 1. Demographic data for both groups.

	Group A N = 50	Group B N = 50	P value	
Age (years)	27.73 ± 3.47	28 ± 4.37	0.733	NS
Weight (kg)	85.10 ± 6.764	86.23 ± 6.872	0.170	NS
Height (cm)	163.43 ± 5.929	160.73 ± 5.771	0.400	NS
G.A (wk)	38.17 ± 1.38	37.80 ± 1.15	0.186	NS
Gravidity	2.84 ± 1.6	2.97 ± 1.87	0.709	NS
Parity	1.35 ± 0.82	1.76 ± 1.68	0.230	NS

Data are expressed as mean ± standard deviation. NS = Non Specific; P > 0.05 = not significant; P < 0.05 = highly significant; CPD = Cephalo Pelvic Disproportion.

Table 2. (a). VAS between both groups at rest at 4, 8, 12, 24 hours; (b) VAS between both groups on coughing at 4, 8, 12, 24 hours.

(a)

Time (at rest)	Group A (Bupivacaine) N = 50	Group B (Pethidine) N = 50	P value
4 h	2.9 ± 1	2.5 ± 0.6	0.02*
8 h	3 ± 1	2.7 ± 0.9	0.118
12 h	3.6 ± 1	3.1 ± 0.9	0.01*
24 h	2.3 ± 0.7	2.1 ± 0.4	0.0825

Data are expressed as mean ± standard deviation. NS = Non Specific; P > 0.05 = not significant; P < 0.05 = highly significant.

(b)

Time (on coughing)	Group A (bupivacaine) N = 50	Group B (Pethidine) N = 50	P value
4h	3.7 ± 1.7	2.9 ± 1	0.005
8h	3.8 ± 1.9	3.2 ± 1.4	0.0753
12h	4.7 ± 2.1	3.3 ± 1.4	0.001
24h	2.8 ± 1.4	2.2 ± 0.8	0.0099

Data are expressed as mean ± standard deviation. NS = Non Specific; P > 0.05 = not significant; P < 0.05 = highly significant.

Table 3. First time request analgesia (minutes) in both groups.

Bupivacaine group	Pethidine group	P-Value
277.67 ± 41.413	314.33 ± 56.059	0.001*

Data are expressed as mean ± standard deviation. NS = Non Specific; P > 0.05 = not significant; P < 0.05 = highly significant.

the two groups there was no significant statistical difference in mean arterial blood pressure, heart rate and respiratory rate.

Table 7 shows time of ambulation in both groups. There is no statistical significant difference in time of ambulation in hours as comparing group A to group B.

Table 4. Analgesic consumption in both groups (%).

Time	Group A (bupivacaine) N = 50	Group B (Pethidine) N = 50	P value	
4 h	53.3%	33.3%	0.0446*	NS
8 h	46.7%	33.3%	0.173	NS
12 h	66.7%	60%	0.489	NS
24 h	23.3%	6.7%	0.0207*	NS

Data are expressed as mean \pm standard deviation. Data are expressed as mean \pm standard deviation. NS = Non Specific; P > 0.05 = not significant; P < 0.05 = highly significant.

Table 5. Nausea, Vomiting, Metoclopramide consumption and Satisfaction scores (%).

Side effects	Bupivacaine group	Pethidine group	P value	
Nausea (%)	10 (20%)	11 (22%)	0.807	NS
Vomiting (%)	10 (20%)	9 (18%)	0.799	NS
Metoclopramide consumption (%)	10 (20%)	9 (18%)	0.799	NS
Satisfaction scores				
Poor	10 (20%)	6 (12%)	0.277	NS
Good	25 (50%)	28 (56%)	0.549	NS
Very good	10 (20%)	10 (20%)	1.000	NS
Excellent	5 (10%)	6 (12%)	0.750	NS

Data are expressed as mean \pm standard deviation. NS = Non Specific; P > 0.05 = not significant, P < 0.05 = highly significant.

Table 6. Mean arterial blood pressure, heart rate and respiratory rate at 4, 8, 12, 24 hours postoperative in both groups.

Time	MAP (mean \pm SD)			HR (mean \pm SD)			RR (mean \pm SD)		
	Group A	Group B	P	Group A	Group B	P	Group A	Group B	P
4 h	80 \pm 0.6	80 \pm 0.6	1	89 \pm 8	90 \pm 10	0.582	11.5 \pm 1	12 \pm 2	0.118
8 h	80 \pm 0.5	80 \pm 0.6	1	89 \pm 8	90 \pm 13	0.644	12 \pm 1	12 \pm 2	1
12 h	80 \pm 0.8	80 \pm 0.9	1	92 \pm 9	90 \pm 11	0.322	11 \pm 2	11 \pm 1	1
24 h	80 \pm 0.4	80 \pm 0.5	1	87 \pm 6	85 \pm 9	0.194	11 \pm 1	11 \pm 2	1

MAP=Mean Arterial pressure; HR = Heart rate; RR = Respiratory rate. ata are expressed as mean \pm standard deviation.

Table 7. Time of ambulation (hours) in both groups.

Bupivacaine group	Pethidine group	P-Value	
4.37 \pm 1.57	3.93 \pm 1.36	0.1374	NS

Data are expressed as mean \pm standard deviation. NS = Non Specific. P > 0.05 = not significant, P < 0.05 = highly significant.

Table 8 shows complications and wound infection rates; there was no significant difference between patients in both groups.

4. Discussion

This study compared between the effect of wound infiltration with bupivacaine versus pethidine on post cesarean section pain for primary outcome pain scores using VAS, first time request analgesia, total amount of analgesia, time of ambulation, side effects and wound infection as secondary outcomes.

It should be remembered that tissue response to surgery-induced injury initiates nociception, inflammation, and hyperalgesia [12]. So agents with different mechanisms of action modulate this cascade. Local anesthetic agents modulate peripheral pain transduction by inhibiting the transmission of noxious impulses from the site of injury [13]. Furthermore, despite the fundamental differences in mechanism of action, basic science investigations suggest that both local anesthetic agents decrease peripheral and central sensitization via direct central nervous system effect [14].

The results of our study revealed no significant difference in demographic data as regards to (Age, weight, height, Gestational age, Gravidity, parity, number. When comparing both groups there was a significant pain relief in Pethidine group as shown by decreased pain scores of visual analogue scale after 4 hours and 12 hours post-operatively at rest and on coughing.

According to Cochrane researchers local anesthetics are part of integrated pain management strategies for cesarean section operation, provided that consideration is given to the cost. Local anesthetics can be given in addition to regional anesthetics, to manage pain during and after operations. The local anesthesia is either injected to block nerves in abdominal wall or applied directly to the wound.

Concerning the first time request analgesia and analgesic consumption there was a significant difference; patients in Pethidine group requested analgesia later with a significant prolonged pain free interval and lower total analgesic consumption than patients in Bupivacaine group.

Comparing the results of the current study to those of other researchers who conducted similar study regarding the first time request analgesia and analgesic consumption; the researchers reviewed data from studies, the results of their

Table 8. Complications and wound infection rates.

Complications	Bupivacaine Group	Pethidine Group	P value	
Hypotension	3(6%)	1(2%)	0.309	NS
Respiratory depression	0	0	1	NS
Cardiac depression	0	0	1	NS
Urine retention	0	0	1	NS
Wound infection	1(2%)	2(4%)	0.559	NS

study are in agreement with our study with a highly significant difference regarding first time request analgesia which was earlier in Bupivacaine group and a significant difference regarding the reduction in analgesic consumption in Pethidine group [15].

Also, Trotter TN. *et al.* study showed, that subrectal and subcutaneous wound infiltration with bupivacaine did not decrease analgesic requirements on the first postoperative day after lower segment cesarean section as did Pethidine [3].

Although nausea and vomiting are major side effects of systemic opioid used for postoperative analgesia [14], on the other hand local anesthetics in our study revealed decreased incidence of nausea and vomiting and there was no significant difference in side effects or metoclopramide consumption between the two groups of the study which comes in agreement with [11].

In this study, patient satisfaction was significantly higher in pethidine group compared with bupivacaine groups in contrast to Jabalameli. *et al.* Who found no statistical difference between pethidine and bupivacaine as regards satisfaction [11].

Subrectal and subcutaneous pethidine infusion analgesia has an advantage of being acceptable than conventional intramuscular bolus injections to both patients and ward staff [16].

Concerning vital data between the two groups there was no significant statistical difference in mean arterial blood pressure, heart rate and respiratory rate. This finding is comparable to other studies stated by Altunkaya H. *et al.*, Langlois G. *et al.* [17] [18].

As regard the time of ambulation; there was no significant difference between patients in both groups in the present study which agrees with Jabalameli. *et al.* study [11].

Regarding complications (hypotension, respiratory depression, cardiac depression, urine retention and wound infection); there were no significant difference between women of both groups.

In agreement with our study Kristek and Colleagues reported no significant difference in the occurrence of complications as local wound infection in the groups of patients with post-operative intercostal nerve blockade and post-thoracotomy catheter analgesia after catheter was in place for 72 hours [19].

Mohammad Ali *et al* underwent a randomized clinical trial including 98 patients, eligible for elective C/S under general anesthesia comparing 0.25% bupivacaine with tramadol group, it was found that there was no significant difference between these 2 groups in their pain scores until 16 hours ($P > 0.05$). However, at the 16th and 24th hours, the mean VAS scores were higher significantly in the bupivacaine group than the tramadol group, respectively ($P < 0.05$). There was no difference in nausea and vomiting nor respiratory depression during the 24-hour period between the 2 groups [9].

Ahmad A. Eldaba *et al.* performed RCT of 120 patients who were prepared for elective cesarean section comparing 0.25% bupivacaine versus mix of bupivacaine and magnesium sulphate versus normal saline Post-operative pain scores

at rest were statistically significant highest in the control group then bupivacaine group & the least is magnesium group. There was statistically significant increase in pain during movement in the control group versus others at 2, 4, 12, 24 h post-operatively ($P < 0.0001$). The incidence of post-operative nausea and vomiting was reduced in patients received magnesium plus bupivacaine block versus others ($P < 0.0001$) [10].

Another RCT was done by Reetika Chander *et al.* involving 60 patients. The patients were randomized into two groups of 30 patients each: receiving 0.5% bupivacaine versus mix of fentanyl and bupivacaine, more postoperative pain was found in bupivacaine group than fentanyl bupivacaine group. The postoperative pain at two hours was marked in bupivacaine group (40%) compared to 3% in fentanyl group. At 24 hours postoperative analgesia requirement (number of doses) was found to be less in fentanyl group compared to bupivacaine group [20].

Supporting the analgesic effect of wound infiltration with local anesthesia, another study was done by Roopa Sachidananda *et al.* found that subcutaneous wound infiltration with tramadol and bupivacaine prolongs the pain-free period and decrease analgesic consumption after caesarean section as compared to bupivacaine alone in 60 pregnant women of age, underwent elective caesarean section under spinal anesthesia, while it also enhances the patient satisfaction [21].

Cost of treatment, which seems to be considerably higher in the wound infiltration technique, may become an important disadvantage of this method from the health care officers point of view. Schurrmj reported that additional costs associated with this technique may limit its widespread use in clinical practice [22].

Contrarily, Forastiere and co-workers reported that postoperative wound infiltration improved pain relief, decreased hospital stay and resulted in the overall savings of approximately 273 Euros per patient [23]. Either to confirm or reject this observation more detailed cost-benefit studies have to be undertaken to calculate real costs of this method as compared to other analgesic regimens. Such studies should consider not only effects on the pain control, but also the cost of complications, the cost of hospital stay, patient recovery and functional outcome.

Limitation of the Study

So, one of the limitations of this study cost, also not studying women with previous caesarean sections or any previous procedure leading to adhesions which may increase pain postoperative pain, other issue to compare between obese and non obese women as regards the technique as some of the drug may infiltrate fat tissue, also the study depends on technique of infiltration subcutaneous and subrectal which is surgeon dependant.

5. Conclusion

Infiltration of the wound of cesarean section with Pethidine gave effective

analgesia for several hours, decreased systemic analgesic consumption, decreased patient ambulation time and prolonged first time request analgesia compared to Bupivacaine.

This technique could be considered as an integral part of analgesic protocol in patients scheduled for cesarean section. It aims to give optimal pain relief with minimal side effects, without interfering with the mother child relationship, allowing early mobilization and favoring post-operative rehabilitation.

This protocol could be applied by all members of obstetrical team for all cesarean sections performed under spinal anesthesia, except in cases of contraindications to the use of local anesthetics.

Disclosure Statement

No potential conflict of interest was reported by the authors.

Informed Consent

Informed consent was obtained from all individual participants included in the study.

Ethical Approval

All procedures performed in studies involving human participants were in accordance with ethical standards of the Ethical committee of the department of obstetrics and gynecology faculty of medicine, Ain Shams University.

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Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

References

- [1] Khawaja, M., Jurdi, R. and Khasholian, K.T. (2004) Perimortum Cesarean Delivery: Were Our Assumptions Correct? *American Journal of Obstetrics and Gynecology*, **192**, 1916-1921.
- [2] Novy, M.J. (1991) The Normal Puerperium. In: Pernoll, M.L., Ed., *Current Obstetrics & Gynecologic Diagnosis and Treatment*, Appleton & Lange, Connecticut, 260.

- [3] Trotter, T.N., Hayes-Gregson, P., Robinson, S., Cole, L., Coley, S. and Fell, D. (1991) Wound Infiltration of Local Naesthetic after Lower Segment Cesarean Section. *Anaesthesia*, **46**, 404-407. <https://doi.org/10.1111/j.1365-2044.1991.tb09558.x>
- [4] Kucuk, C., Kadiogullari, N., Canoler, O. and Savli, S. (2007) A Placebo-Controlled Comparison of Bupivacaine and Ropivacaine Instillation for Preventing Postoperative Pain after Laparoscopic Cholecystectomy. *Surgery Today*, **37**, 396-400. <https://doi.org/10.1007/s00595-006-3408-1>
- [5] Ranta, P.O., Ala-Kokko, T.I. and Kukkonen, J.E. (2006) Incisional and Epidural Analgesia after Cesarean Delivery: A Prospective, Placebo-Controlled, Randomised Clinical Study. *International Journal of Obstetric Anesthesia*, **15**, 189-194. <https://doi.org/10.1016/j.ijoa.2006.02.003>
- [6] Kushner, D.M., LaGalbo, R., Connor, J.P., Chappell, R., Stewart, S.L. and Hartenbach, E.M. (2005) Use of a Bupivacaine Continuous Wound Infusion System in Gynecologic Oncology: A Randomized Trial. *Obstetrics & Gynecology*, **106**, 227-233. <https://doi.org/10.1097/01.AOG.0000171111.68015.af>
- [7] Wu, C.L., Cohen, S.R., Richman, J.M., *et al.* (2005) Efficacy of Postoperative Patient-Controlled and Continuous Infusion Epidural Analgesia versus Intravenous Patient-Controlled Analgesia with Opioids: A Meta-Analysis. *Anesthesiology*, **103**, 1079-1088. <https://doi.org/10.1097/00000542-200511000-00023>
- [8] Kehlet, H., Jensen, T.S. and Woolf, C.J. (2006) Persistent Postsurgical Pain: Risk Factors and Prevention. *Lancet*, **367**, 1618-1625. [https://doi.org/10.1016/S0140-6736\(06\)68700-X](https://doi.org/10.1016/S0140-6736(06)68700-X)
- [9] Sahmeddini, M.A., Azemati, S. and Motlagh, E.M. (2017) Local Infiltration of Tramadol versus Bupivacaine for Post Cesarean Section Pain Control: A Double-Blind Randomized Study. *Iranian Journal of Medical Sciences*, **42**, 235-241.
- [10] Eldaba, A.A., Amr, Y.M. and Sobhy, R.A. (2013) Effect of Wound Infiltration with Bupivacaine or Lower Dose Bupivacaine/Magnesium versus Placebo for Postoperative Analgesia after Cesarean Section. *Anesthesia, Essays and Researches*, **7**, 336-340. <https://doi.org/10.4103/0259-1162.123227>
- [11] Jabalmeli, *et al.* (2012) Intra Incisional Injection Tramadol, Pethidine, Bupivacaine Analgesia.
- [12] Woolf, C.J. and Chong, M.S. (1993): Preemptive Analgesia—Treating Postoperative Pain by Preventing the Establishment of Central Sensitization. *Anesthesia & Analgesia*, **77**, 362-379. <https://doi.org/10.1213/00000539-199377020-00026>
- [13] Zohar, E., Shapiro, A. and Eidinov, A. (2006) Post Cesarean Analgesia: The Efficacy of Bupivacaine Wound Instillation with and without Supplemental Diclofenac. *Journal of Clinical Anesthesia*, **18**, 415-421. <https://doi.org/10.1016/j.jclinane.2006.01.001>
- [14] Fukuda, K. (2005) Intravenous Opioid Anesthetics. In: Miller, R.D., Ed., *Miller's Anesthesia*, 6th Edition, Elsevier Churchill Livingstons, Philadelphia, 415.
- [15] Nadhima, H.H. and Zahra's, M.S. (2010) The Effect of Local Anaesthetic Infiltration on Postoperative Pain after Cesarean Section. *Journal of surgery Pakistan*, **15**, 131-134.
- [16] Gleeson, R.P., Rodwell, S., Shaw, R. and Seligman, S.A. (1990) Post Cesarean Analgesia Using a Subcutaneous Pethidine Infusion. *International Journal of Gynecology & Obstetrics*, **33**, 13-17. [https://doi.org/10.1016/0020-7292\(90\)90648-5](https://doi.org/10.1016/0020-7292(90)90648-5)
- [17] Altunkaya, H., Ozer, Y., Kargi, E., Ozkocak, I., Hosnuter, M. and Demirel, C.B. (2004) The Postoperative Analgesic Effect of Tramadol When Used as Subcutaneous Local Anesthetic. *Anesthesia & Analgesia*, **99**, 1461-1464.

<https://doi.org/10.1213/01.ANE.0000135640.21229.A0>

- [18] Langlois, G., Estèbe, J.P., Gentili, M.E., Kerdilès, L., Mouilleron, P. and Ecoffey, C. (2002) The Addition of Tramadol to Lidocaine Does Not Reduce Tourniquet and Postoperative Pain during IV Regional Anesthesia. *Canadian Journal of Anesthesia*, **49**, 165-168. <https://doi.org/10.1007/BF03020489>
- [19] Kristek, J., Kvoliks, S., Šakić, K., Has, B. and Prlić, L. (2007) Intercostal Catheter Analgesia Is More Efficient vs. Intercostals Nerve Blockade for Post-Thoractomy Pain Relief. *Collegium Antropologicum*, **31**, 561-566.
- [20] Chander, R., Liddle, D., Kaur, B. and Varghese, M. (2011) Wound Infiltration with Plain Bupivacaine as Compared with Bupivacaine Fentanyl Mixture for Postoperative Pain Relief after Abdominal Surgery. *Anesthesia, Essays and Researches*, **5**, 142-146.
- [21] Sachidananda, R., Joshi, V., Shaikh, S.I., Umesh, G., Mrudula, T. and Marutheesh, M. (2017) Comparison of Analgesic Efficacy of Wound Infiltration with Bupivacaine versus Mixture of Bupivacaine and Tramadol for Postoperative Pain Relief in Caesarean Section under Spinal Anaesthesia: A Double-Blind Randomized Trial. *Journal of Obstetric Anaesthesia and Critical Care*, **7**, 85-89.
- [22] Schurr, M.J., Gordon, D.B., Pellino, T.A. and Scanlon, T.A. (2004) Continuous Local Anaesthetic Infusion for Pain Management after Outpatient Inguinal Herniorrhaphy. *Surgery*, **136**, 761-769. <https://doi.org/10.1016/j.surg.2004.06.016>
- [23] Forastiere, E., Sofra, M., Giannarelli, D., Fabrizi, L. and Simone, G. (2008) Effectiveness of Continuous Wound Infusion of 0.5% Ropivacaine by On-Q Pain Relief System for Postoperative Pain Management after Open Nephrectomy. *British Journal of Anaesthesia*, **101**, 841-847. <https://doi.org/10.1093/bja/aen309>