The Egyptian Journal of Hospital Medicine (October 2023) Vol. 93, Page 7467- 7472

Intraperitoneal Lidocaine Instillation for Postoperative Pain Relief after Cesarean Delivery

Mohamed Zakaria Sayer Dayer*, Heba Farag Mohamed Salama, Mohamed Elsibai Anter
Department of Obstetrics and Gynecology, Faculty of Medicine, Menoufia University, Egypt
***Corresponding author:** Mohamed Zakaria Sayer Dayer, **Mobile:** (+20) 01004778794, **E-mail:** mimo_zsd@yahoo.com

ABSTRACT

Background: Despite advances in multimodal analgesia, many women still experience inadequate pain control after cesarean delivery. The intraperitoneal use of local anesthetics has proven effective in postoperative pain reduction after open or laparoscopic abdominal surgery.

Objectives: We intended to evaluate the efficacy of intraperitoneal lidocaine instillation for relieving postoperative pain in women underwent elective cesarean sections.

Patients and methods: A randomized, placebo-controlled, triple-blinded trial carried out at Department of Obstetrics and Gynecology, Menoufia University Hospital. The study comprised 70 term pregnant women underwent elective cesarean sections through the period from September 2022 to March 2023. They were randomly divided into two equal groups. **Lidocaine group** (comprised 35 participants who were administered 50 ml of 2% lidocaine intraperitoneally). **Placebo group** (comprised 35 participants who were administered 50 ml of normal saline intraperitoneally). **Primary outcome** was postoperative pain scoring (via visual analogue scale) in the first 24 hours after cesarean delivery. **Secondary outcomes** were mobilization onset, breastfeeding onset, side effects of medications, hospital stay duration, and patient satisfaction level in regard to pain control.

Results: Visual analogue pain intensity scores estimated at 4, 6 and 12 hrs after caesarean section were significantly lower among lidocaine group than placebo ($P < 0.001$). Lidocaine was significantly superior to placebo in terms of patient's overall satisfaction score with regards to pain control, the vast majority of candidates in lidocaine group (94.3%) were satisfied with their pain control versus 57.1% of candidates in placebo group ($P<0.001$).

Conclusion: Intraperitoneal lidocaine instillation is simple, safe and cost-effective option that can maximize patient's overall satisfaction with regards to post-cesarean analgesia.

Keywords: Analgesics, Lidocaine, Cesarean section, Patient' satisfaction.

INTRODUCTION

Worldwide cesarean delivery is considered the most consistently performed procedure. The cesarean delivery rating is about 52% in Egypt that stands out amongst countries with the highest CS rates worldwide after Dominican republic (56%) and Brazil(55.6%) [(1)].

Post-cesarean pain can adversely affects mother–infant interaction and breastfeeding and its control is important that mothers can recover early. The best course of action for post-cesarean analgesia should be straightforward, inexpensive, and safe. It should also provide excellent pain relief with a minimal risk of adverse consequences. Moreover, it should only involve medications that are very slightly released into breast milk and should not interfere with the mother's ability to care for the infant or the establishment of breastfeeding [(2)].

Many studies had reported use of local anesthetic medications during surgeries with beneficial results in relieving postoperative pain. The mechanism of analgesic action of local anesthetics applied by intraperitoneal route (IPLA) is mainly via local receptors by blocking the afferent peripheral nerve endings (nociceptors, pain receptors) whose cell bodies are located in the dorsal root ganglia [(3)].

The primary benefit of IPLA is that it does not have the significant side effects associated with systemically injected opioids, despite its well-established safety and convenience of usage. Since decades, laparoscopic or open abdominal surgery has documented their usage as an efficient adjuvant in postoperative multimodal analgesia [(4, 5)].

Objective: Evaluation of efficacy of intraperitoneal lidocaine instillation for relieving postoperative pain in women who had undergone elective cesarean sections.

SUBJECTS AND METHODS

This randomized, placebo-controlled, triple-blinded trial that was performed at Department of Obstetrics and Gynecology, Menoufia University Hospital through the period from September 2022 to March 2023. The aim and steps of the study protocol were explained to the participants and written informed consents were obtained.

Eighty women were recruited, 10 participants were excluded and 70 term pregnant women underwent elective cesarean sections were included. They were randomly divided into two equal groups.

Lidocaine group (comprised 35 candidates who were administered 50 ml of 2% lidocaine intraperitoneally).

Placebo group (comprised 35 candidates who were administered 50 ml of normal saline intraperitoneally), as shown in consort flow chart (figure 1).

Method of randomization: The participants were randomized using statistical package for social science (SPSS) program into two equal groups (35 participants

Received: 30/04/2023
Accepted: 26/06/2023

in each group). Group allocation was concealed in sealed opaque envelops.

Method of blinding: Each participant in this experiment got a single-use syringe filled with the drug according to her place in the trial. The health care practitioner who performed the packing, sealing, and numbering did not actively participate in the study's process. Neither the surgeon nor the investigator or women were aware, which drug she will receive (triple blinded).

Sample size calculation: Based on review of past literature, **Sorouri *et al.*** [6] who documented that pain intensity scores recorded at various time intervals were significantly diminished in lidocaine population than placebo ($P < 0.05$). The least sample size was calculated using statistics and sample size program version 6 was 58 subjects increased to 60 subjects to avoid 5% dropout and divided into 2 equal groups. The power of study was 80% and confidence level was 95%.

Inclusion criteria: Spinal anaesthesia, elective cesarean section (CS) at term, absence of medical conditions, and absence of obstetrical problems in the patient.

Exclusion criteria: General anesthesia, regional anesthesia other than spinal such as epidural/TAP block as it affects pain rating scores, hypersensitivity to local anesthetic medications, any medical disorders or obstetrical complications, refusal to participate, intraoperative adhesions or intraoperative morbidity.
Full history taking, general examination, obstetric examination and obstetric ultrasound were done.

Operative details: In all cases, cesarean section was done using spinal anesthesia through pfannestiel incision. After the uterine closure in two layers was accomplished, the blood that had accumulated in the pelvis was cleaned away using surgical cloths, leaving a rather dry pelvis. The trial medicine was put into a sterile container and drawn into a sterile 50-ml syringe after adequate hemostasis. The surgeon next sprayed 10 ml of the study medication into the uterine peritoneal surface (to standardise the research technique and decrease operator-related variations) before closing the parietal peritoneum or fascia.

Pain management protocol: Patients received regular analgesics according to WHO (World Health Organization) stepwise postpartum analgesia protocol [7]. Step one consisted of non-opioid analgesics (diclofenac sodium 75mg amp plus 1000 mg IV acetaminophen superseded by diclofenac (50 mg orally/8 hours) and acetaminophen (1000 mg orally/6 hours) until hospital discharge. Step two rescue opioid analgesia was reserved to overcome breakthrough pain (when pain cannot be adequately managed with step one non-opioid medications) and received only if commanded (Nalbuphine 20 mg amp diluted in 10 ml normal saline, 3 ml slow IV administration).

Post-operative pain assessment: Post-Cesarean pain intensity scoring was estimated (using 10-point visual analogue scale) at 1,4,6, 12 and 24 hours following Cesarean delivery, where zero = 'no pain at all', 1–3 mild, 4–6 moderate, 7–9 severe pain and 10 represents 'the worst pain ever possible'
Rating of patient's overall satisfaction level regarding their pain control was done after 24 hours using 4-point scale including strongly dissatisfied (1), dissatisfied (2), satisfied (3), and strongly satisfied (4).
Any side effects or postoperative complications were recorded (such as vomiting, fever, ileus, nausea and itching).

Primary outcome: Postoperative pain scoring (via visual analogue scale) in the earliest 24 hours after cesarean delivery.

Secondary outcomes: Mobilization onset, breastfeeding onset, any side effects of medications, hospital stay duration, and patient satisfaction level in regards to pain control.

Ethical approval: Menoufia Medical Ethics Committee of Menoufia Faculty of Medicine gave its approval to this study. All participants gave written consents after receiving all information. The Helsinki Declaration was followed throughout the study's conduction.

Statistical analysis

Utilising SPSS V.25 for Windows. Standard deviation, mean, and percentage (%) were used to describe descriptive statistics. The student t-test and the Chi square test were used to analyse the data (for comparison of quantitative data, and for comparison of qualitative data). For statistical significance, the P value was set at 0.05, and for very significant results, it was ≤ 0.001.

RESULTS

Eighty women were enlisted (10 participants were excluded, and 70 participants were included), 35 women allocated per group, as shown in CONSORT flow chart **(figure 1)**.

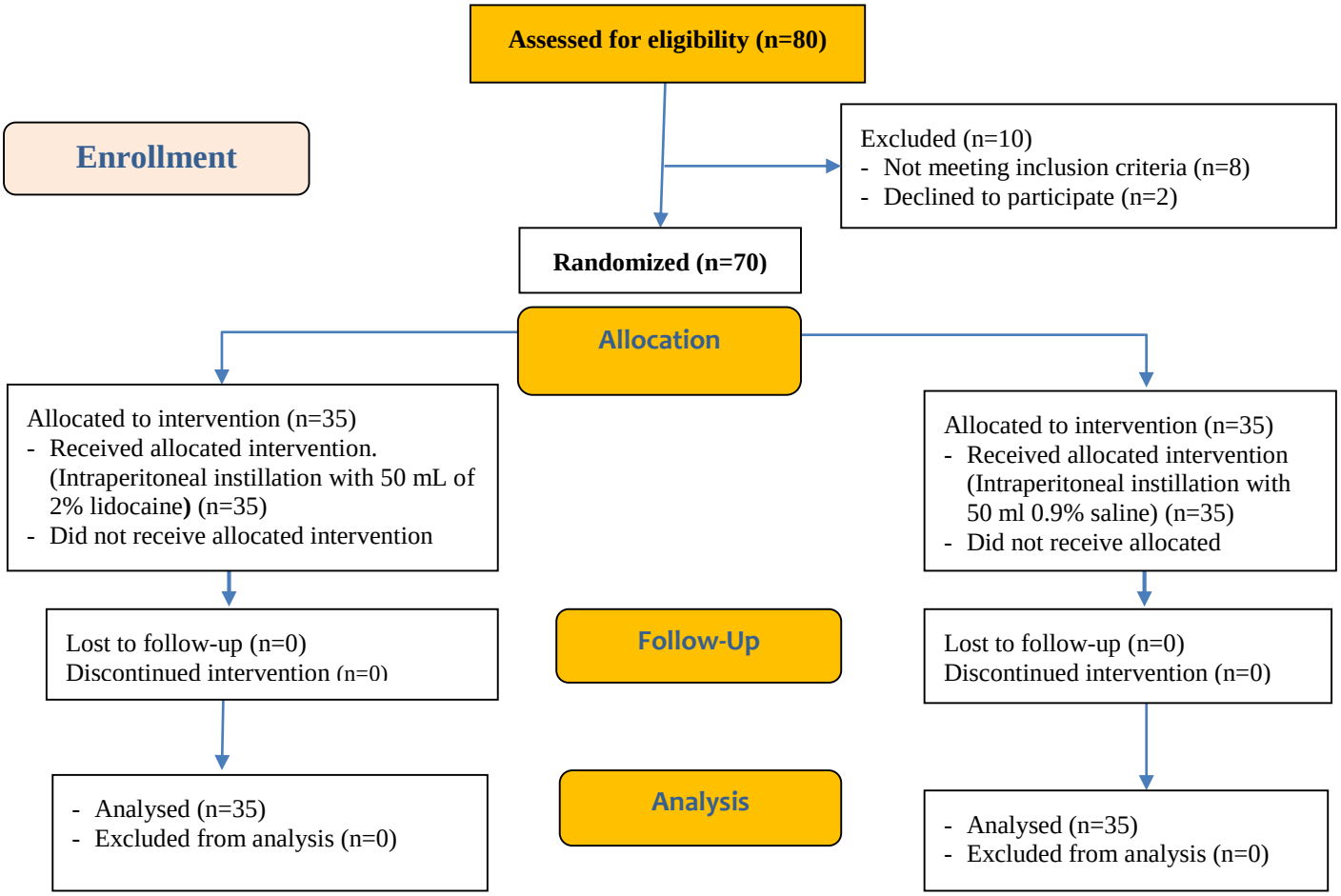

Figure (1): The CONSORT flow chart.

Table (1) showed no statistically significant differences were observed between groups regarding maternal age, gestational age, previous Cesarean sections and operative time.

Table (1): General, obstetric and surgical characteristics.

Studied variables	Lidocaine (N=35)	Placebo (N=35)	Test of sig.	P Value
Age (years) Mean ±SD Range	23.9±1.8 21-28	24.1±1.8 21-28	t-test 0.465	0.643
Gestational age (weeks) **Mean ±SD** **Range**	38.2±0.84 37- 40	38.6±0.88 37- 40	t-test 1.45	0.149
Previous C.S. **1** **2** **3** **4** **5**	 4 (11.4%) 10 (28.6%) 13 (37.1%) 6 (17.1%) 2 (5.7%)	 2 (5.7%) 11 (31.4%) 14 (40%) 5 (14.2%) 3 (8.6%)	X2= 1.04	0.714
Operative time (minutes) Mean ±SD Range	71.1±4.7 (60-81)	70.3±4.9 (60-81)	t-test 0.697	0.488

CS: Cesarean section SD: standard deviation x^2: chi square test.

Table (2) showed that means of visual analogue scale scores estimated at 4, 6 and 12 hrs after Cesarean section were diminished significantly among lidocaine compared to placebo (P<0.001). There were no documented statistically significant differences between groups regarding visual analogue scale pain scoring at 1 hr and 24 hrs.

Table (2): Visual analogue scale scores estimated at various time intervals following Cesarean delivery in the studied groups

Studied variables	Lidocaine (N=35)	Placebo (N=35)	t-test	P-value
VAS 1h Mean ±SD Range	2.31±0.676 (1-3)	2.6± 0.67 (1-3)	1.81	0.074
VAS 4h Mean ±SD Range	2.26±0.56 (1-4)	3.80±0.759 (3-5)	9.73	**< 0.001***
VAS 6h Mean ±SD Range	2.77±0.973 (1-4)	4.00±0.907 (3-5)	5.47	**<0.001***
VAS 12h Mean ±SD Range	3.60±0.812 (3- 5)	5.20±0.759 (4-6)	8.57	**<0.001***
VAS 24h Mean ±SD Range	3.90±0.53 (3-5)	4.20±0.759 (3-5)	1.91	0.061

VAS: Visual analogue scale SD: standard deviation *Significant

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Table (3) showed that number of participants requesting rescue analgesia to overcome breakthrough pain at various time intervals after Cesarean section was not different significantly between the studied groups.

Table (3): Rescue analgesia requirements at various time intervals following Cesarean section

Studied variables		Lidocaine (N=35)		Placebo (N=35)		X2	P-value
		No	%	No	%		
1h	+ve	0	0.0	0	0.0	0.00	1.00
	-ve	35	100	35	100		
4h	+ve	5	14.28	12	34.28	3.80	0.051
	-ve	30	85.71	23	65.72		
6h	+ve	10	28.57	16	45.72	2.20	0.137
	-ve	25	71.42	19	54.28		
12h	+ve	18	51.42	21	60.00	0.521	0.470
	-ve	17	48.57	14	40.00		
24h	+ve	5	14.28	7	20.00	0.403	0.525
	-ve	30	85.71	28	80.00		

x^2: chi square test

Table (4) showed that mean onset of mobilization following Cesarean delivery was significantly earlier among participants of lidocaine group than those of placebo group (183.5 ± 36.35 minutes *versus* 215.7 ± 57.4 minutes) (P<0.05). Regarding onset of breast feeding, there were no recorded statistically significant differences between the studied groups. Lidocaine was significantly superior to placebo in terms of patient's overall satisfaction in regards to pain control, the majority of patients in lidocaine group (94.3%) were satisfied with their pain control versus 57.1% of patients in placebo group (P<0.001).

Table (4): Mobilization onset, breastfeeding onset, hospital stay duration and patient' overall satisfaction level with regards to pain control among study groups

Studied variables	Lidocaine (N=35)	Placebo (N=35)	Test of sig.	P-Value
Onset of mobilization (min) Mean ±SD	183.5±36.35	215.7±57.4	t-test 2.80	**0.006***
Onset of breast feeding (min) Mean ±SD	100.1±24	113±62	t-test 1.14	0.255
Hospital stay (hours) Mean ±SD	24.34±2.02	26.74±9.2	t-test 1.50	0.136
Patient satisfaction Satisfied Unsatisfied	**No (%)** 33 (94.3%) 2 (5.7%)	**No (%)** 20 (57.1%) 15 (42.9%)	X2 13.1	**<0.001***

*Significant SD: standard deviation x2: chi square test.

Table (5) showed that there were no recorded significant differences between the studied groups regarding incidence of postoperative complications (e.g. postpartum fever and paralytic ileus) or drug side effects**.**

Table (5): Incidence of postoperative complications or drug side effects among study groups.

Studied variables		Lidocaine (N=35) N (%)	Placebo (N=35) N (%)	X2	P-value
Drug side effects	No side effects	30 (85.7%)	35 (100%)	2.91	0.087
	Nausea	1 (2.9%)	0 (0.0%)		
	Vomiting	0 (0.0%)	0 (0.0%)		
	Itching	4 (11.4%)	0 (0.0%)		
Postoperative complications	No complications	33 (94.3%)	31 (88.6%)	0.729	0.393
	Fever	1 (2.9%)	2 (5.7%)		
	Paralytic ileus	1 (2.9%)	2 (5.7%)		

x2: chi square test

DISCUSSION

We intended to test the effectiveness of intraperitoneal lidocaine instillation for postoperative pain relief in women who had elective Cesarean sections.

Our data revealed that there were no significant differences detected between study groups regarding age, gestational age and previous CS. Similar findings were noted by study done by **Shahin and Osman** [8]. The current study concluded that intraperitoneal lidocaine administration significantly minimize pain scores estimated at 4, 6 and 12 hrs after elective cesarean delivery than placebo but has no significant pain reducing effect at 24 hrs post-cesarean. In agreement with our observations, **Marks and his colleagues** [4] recognized an overall decline in pain intensity scores measured at 1-2 hours postoperatively following gynecologic laparoscopy in response to intraperitoneal application of local anesthetic while no difference was noted at 24 hours pain score. **Patel and his colleagues** [9] also showed that score of pain at 2 hours after cesarean delivery was lower significantly in lidocaine study group and regarding 24 hours pain score, it was not different significantly between groups.

Also, **Dagasan** [10] conducted a study involved 150 pregnant women underwent elective cesarean sections and reported that 2 h pain scores were lower significantly in local anesthetic group compared to placebo [10].

In our setting, number of participants requesting rescue analgesia to overcome breakthrough pain at various time intervals following caesarean section was not different significantly between the studied groups. Consistent with our results, **Patel and his colleagues** [9] reported that the total doses of morphine consumed to overcome progressive pain was similar between lidocaine and placebo**.** Also, **Dagasan** [10] concluded that there were no detected significant differences in postoperative rescue analgesic consumption among study groups.

In contrast to our findings, **Anwar and his colleagues** [2] reported that total 24 hours pethidine consumption was significantly decreased in intraperitoneal lidocaine group than control. Also, **Shahin and Osman** [8] reported that intraperitoneal application of lidocaine was accompanied with lower morphine consumption than placebo.

In our study, mean onset of mobilization after cesarean delivery was significantly earlier among participants of lidocaine group than those of placebo (183.5±36.35 minutes *versus* 215.7±57.4 minutes) (P<0.05). Regarding onset of breast feeding, there were no observed statistically significant differences between

groups. Lidocaine was significantly superior to placebo in terms of patient's overall satisfaction score. Concerning pain control, the vast majority of candidates in lidocaine group (94.3%) were satisfied with their pain control versus 57.1% of candidates in placebo group (P<0.001)**.** Our results are confirmed by **Riad and his colleagues** [(11)] who found that median time to mobilization was 3 hours among lidocaine population *versus* 6 hours in control group and this difference was statistically significant [(11)].

Regarding the incidence of postoperative complications (e.g. postpartum fever & paralytic ileus) or drug side effects, there were no detected statistically significant differences between the studied groups

Also, a study by **Anwar and his colleagues** [(12)] reported that postoperative vomiting were less frequently encountered in intraperitoneal lidocaine group than in control, but this was not statistically significant [(2)].

As well, **Shahin and Osman** [(8)] reported that morphine undesirable side effects (nausea, drowsiness or vomiting) were more significantly encountered among controls, compared to lidocaine groups (P<0.001) as the lidocaine groups consumed significantly less morphine amount [(8)].

STRENGTH POINTS: First, the present study was designed as randomized placebo-controlled triple-blinded. Second, no participants were lost to follow-up during the study duration. Third, it was the first study protocol in Menoufia University Hospitals to detect whether intraperitoneal application of lidocaine is an effective measure for relieving postoperative pain in women underwent elective caesarean sections.

LIMITATIONS: First, despite standardization of intraperitoneal instillation procedure (by explaining it with the operating surgeons before study initiation), we cannot control inter-operator related differences. Second, post-cesarean pain rating was scored using 10-point visual analogue scale which is simple & easy measure of pain intensity but unfortunately imprecise. Third, relatively small sample size. So, further studies including large samples are desired to define the optimal dose and detect any possible long-term outcomes of lidocaine as local anesthetic in post-cesarean delivery pain relief.

CONCLUSION

Intraperitoneal lidocaine instillation is simple, safe and cost effective option that can maximize patient's overall satisfaction with regards to post-cesarean analgesia.

Financial support and sponsorship: Nil.
Conflict of Interest: Nil.

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