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# Dexamethasone added to Local Lidocaine for Infiltration along the Spinal-Epidural Needle Pathway Decreases Incidence and Severity of Backache after Gynecological Surgery

Authors' Contribution:
Study Design A
Data Collection B
Statistical Analysis C
Data Interpretation D
Manuscript Preparation E
Literature Search F
Funds Collection G

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This study was registered with the Chinese Clinical Trial Registry (ChiCTR-TRC-12002344)

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**Background:** The aim of this study was to evaluate the effect of dexamethasone added to local lidocaine infiltration on incidence and severity of backache after combined spinal-epidural anesthesia for gynecological surgery.

**Material/Methods:** We randomly allocated 160 patients to receive either local lidocaine infiltration along the pathway of the spinal-epidural needle (Group L) or local dexamethasone and lidocaine infiltration (Group DL). The incidence and scores for back pain were evaluated on the first, second, and third day (acute lumbago) and first, second, and sixth month (chronic lumbago) after surgery. Fentanyl consumption for management of back pain was recorded.

**Results:** The incidence of acute, subacute, and chronic back pain was significantly lower in the DL group than the L group ($P<0.05$ for all comparisons). The VAS score for back pain on the first and second day and first and second month, were significantly lower in the DL group than the L group ($P=0.0028$, $P=0.017$; $P<0.001$, both), but there were no significant differences on the third day and sixth month. Fentanyl consumption in the first 3 postoperative days was significantly lower in the DL group than in the L group ($P<0.001$). The incidence of back pain during the first, second, and sixth month in patients who did not have preoperative lumbago were significantly lower in the DL group than in the L group ($P<0.001$, both).

**Conclusions:** Addition of dexamethasone to local lidocaine infiltration effectively decreases the incidence and severity of back pain after combined spinal-epidural anesthesia implemented for gynecological surgery.

**MeSH Keywords:** Anesthesia • Dexamethasone • Gynecologic Surgical Procedures

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## Background

Spinal-epidural anesthesia is commonly used in gynecological surgery. The incidence of back pain after epidural anesthesia is over 20% [1–3]. It occurs rarely after spinal anesthesia [4]. This indicates that back pain may be associated with local trauma and nerve injury caused by the epidural needle, leading to aseptic periosteitis, tendonitis, ligamentous inflammation and/or osteochondritis, which result in lumbar pain [5,6].

In 2009 Muslu et al. [3] found that local administration of nonsteroidal anti-inflammatory drugs significantly relieved post-epidural low back pain. Because of its anti-inflammatory effects, dexamethasone has been used to treat post-epidural lumbar pain and to reduce the consumption of postoperative analgesics [1]. Some studies have shown that epidural injection of dexamethasone could reduce back pain [7–9]. Therefore, we hypothesized that prophylactic dexamethasone infiltration along the needle insertion pathway can decrease the incidence of lumbar pain after spinal-epidural anesthesia. The aim of this prospective, double-blinded, randomized study was to evaluate the effect of local dexamethasone infiltration on incidence and severity of lumbar pain during the first 3 days and 6 months postoperatively.

## Material and Methods

The study protocol and informed consent form were reviewed and approved by the Ethics Committee of the Second Affiliated Hospital of Harbin Medical University. From March 17, 2011 to May 17, 2012, 160 consecutive patients, ASA I-II, aged 20–60 years and scheduled for abdominal gynecologic surgery were randomly allocated by random number table, into a lidocaine group (L) and a local dexamethasone plus lidocaine group (DL). Patients were excluded if they had a history of chronic lumbar pain, a history of lumbar injury or surgery, analgesic or anticoagulant usages within the 2 weeks before surgery, hypersensitivity to NSAIDs or local anesthetics, or a history of systemic disorders such as diabetes mellitus or a disease affecting the liver, heart, or kidney. Moreover, patients with history of drug or alcohol abuse, psychiatric disorders, or surgical complications were excluded. All patients had spinal-epidural anesthesia at the same level. Patients in whom spinal-epidural needle was inserted at a different space were excluded. Patient group assignments were recorded and sealed within sequentially numbered envelopes. Three anesthesiologists participated in this study. Only the first anesthesiologist who prepared the local infiltration drugs for the study could access the randomization code. The second anesthesiologist administered anesthesia to all patients, and the third anesthesiologist observed and assessed patients' conditions in wards post-operatively and by telephone after discharge from hospital. The second and third anesthesiologists were blinded to the randomization. The same surgical team performed all surgical interventions.

All patients were premedicated with oral midazolam 0.05 $mg \cdot kg^{-1}$. In the operating room, acetated Ringer's solution was infused at 10 $mL \cdot kg^{-1} \cdot h^{-1}$. BP, HR, and SpO2 were continuously monitored throughout the operation. The patients in group L received 4 mL of 1% lidocaine for local infiltration, and patients in group DL received 4 mL of a mixture containing 1% lidocaine and 5 mg of dexamethasone.

The patients were placed in a lateral decubitus knee-chest position. Local infiltrations with a 27-gauge (3 cm) needle of the skin, subcutaneous tissue, interspinal ligaments, and muscle with either 1% lidocaine alone or with dexamethasone added was performed. The anesthesiologist introduced the epidural needle (17-gauge) at the L2-3 or L3-4 interspace via the midline approach. After identification of the epidural space by loss of resistance to air, the spinal needle (25-gauge) was inserted to puncture the dura, and 15 mg of 0.5% bupivacaine were injected when free flow of cerebrospinal fluid was observed. After injection of bupivacaine, 5 cm of the epidural catheter was inserted into the epidural space. The patients received additional 5 mL 0.5% bupivacaine whenever they complained of pain. The total amount of supplementary bupivacaine was recorded. If the BP and HR were 30% below their baseline values, ephedrine and atropine were administered intravenously. In case of failure of spinal-epidural anesthesia, patients were excluded from the study and replaced with general anesthesia. All the operations were performed in the supine position. After the operation, epidural morphine 20 $\mu g \cdot kg^{-1}$ was given for postoperative analgesia, and then the epidural catheter was removed. In the ward, patients were placed in a supine position without a pillow to prevent postoperative headaches. When patients complained of wound pain and the visual analog scale (VAS) was greater than 4, 1 μg/kg fentanyl intravenously was given.

The third anesthetist assessed acute back pain in the ward on the 1st, 2nd and 3rd day (D1, D2 and D3 timepoints, respectively). During assessment, the patients were placed in the knee-chest position and asked whether they felt back pain. The score of pain was assessed by a 10-point VAS, where 0 equals to "no pain" and 10 equals to "the worst pain". If VAS score was greater than 4, 1 μg/kg of intravenous fentanyl was prescribed for the patient. However, when the patients reported that they were suffered back pain at anytime during postoperative 3 days, even though not at the assessment time point (24, 48 and 72 hour), the third anesthetist would assess the back pain and inject the fentanyl (1 $\mu g \cdot kg^{-1}$). If patients complained of wound pain, they received same dose of fentanyl. When this happened at the time of back pain evaluation, assessment of lumbago was delayed for 2 hours following fentanyl injection. Total consumption of fentanyl in each patient





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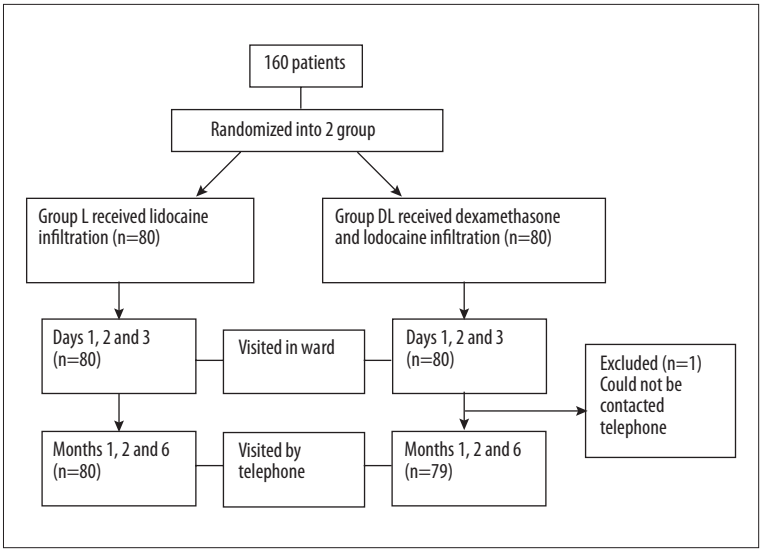


**Figure 1.** A schematic of patient enrollment.

within 72 hours postoperatively was recorded. In the postoperative 1st, 2nd and 6th month, the third anesthesiologist assessed the back pain of patients by telephone with the same method during 3 postoperative days (asking the following questions: 1. Have you performed strenuous exercise after surgery? 2. Have you experienced any injury or other surgeries after previous surgery? 3. Have you felt lumbar pain lately? If so, what is the score? Did you ever take medicine or any other treatments to relieve the pain? 4. Have you suffered from any other discomforts such as localized or lower limb paresthesias and unilateral or bilateral sciatic leg pain?). Any analgesic used for back pain after discharge from hospital was recorded. The incidence and score of lumbar pain were assessed with the same ways used in ward. During the first month, the patients were forbidden to engage in heavy exercise and labor to avoid aggravating back pain. Patients were divided into 2 categories; chronic back pain accompanied with and without acute back pain.

Headaches, lower limb paresthesia, and unilateral or bilateral sciatic leg pain were recorded in wards during the first 3 postoperative days. Puncture site infection was monitored at the 1st, 2nd, and 6th months in the hospital.

### Statistical analysis

Sample size was based on previous studies that indicate that the incidence of lumbar pain on the first day after epidural anesthesia in non-obstetric patients was approximately 20% [1,2]. To achieve a statistical power of more than 80%, with a significance criteria ($\alpha$) of 0.05, Seventy-one patients were needed in each group to detect a difference of 15% in the incidence of back pain between the two groups (PASS, 2008, 2008, Kaysville, Utah) All the data were analyzed using the SPSS 13.0 (IBM, Armonk, NY, USA). Normally distributed data including age, weight, height, operation time, anesthesia puncture time were presented as the mean (SD) and analyzed using unpaired t-test. The non-normally distributed data (number of punctures) was analyzed by Kruskal-Wallis H test. The incidence (percentage) and severity of back pain (VAS score) were analyzed using the Kruskal-Wallis H test and the *P* value was calibrated with the Benjamini & Hochberg method. *P* values <0.05 were considered statistically significant.

## Results

A schematic for patient enrollment is presented in Figure 1. The demographic data, data of anesthesia puncture and surgeries, fentanyl requirements for wound pain and dosage of epidural bupivacaine are shown in Table 1. They were comparable between two groups. One patient in group DL was excluded because she was out of contact.

The incidence and severity of acute and chronic back pain in both study groups is shown in Figures 2 and 3.The incidence of pain was significantly lower in the DL group at all observation timepoints. Table 2 shows the incidence of chronic back pain in patients without acute back pain between groups, which was significantly lower in the DL group at all observation timepoints.

Regarding pain severity, at D1 and D2 timepoints, the VAS scores were significantly lower in group DL. At D3, the VAS score in group DL was lower than in group L, but the difference was not significant. At M1 and M2 timepoints, the VAS scores were significantly lower in group DL but there was no significant difference at M6. During the first post-operative day, there were 11 patients in group L and 4 patients in group DL who requested fentanyl for lumbar pain. In the second post-operative day, there were 4 patients in group L who requested





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**Table 1.** Patient characteristics of the two groups.

| | | Group L (n=80) | Group DL (n=79) |
|---|---|---|---|
| Age (y) | | 44.8±2.9 | 46.7±2.8 |
| Weight (kg) | | 62.5±8.8 | 63.4±7.6 |
| Height (cm) | | 161.8±5.9 | 161.4±4.8 |
| Type of surgery n (%) | Ovarian cancer | 10 (12.5) | 13 (16.45) |
| | Uterine fibroids | 25 (31.25) | 27 (34.18) |
| | Ovarian cysts | 21 (26.25) | 20 (25.31) |
| | Ectopic pregnancy | 3 (3.75) | 4 (5.06) |
| | Adenomyosis | 12 (15.00) | 13 (16.25) |
| | Cervical cancer | 9 (11.25) | 7 (8.8) |
| | Operation time (min) | 68.7 (17.2) | 69.6 (14.1) |
| Anesthesia puncture (min) | | 2.9±0.4 | 2.8±0.8 |
| Number of punctures | | 1 (1–3) | 1 (1–1.5) |
| Fentanyl for surgical pain (μg) | | 2899±69 | 2974±78 |
| Patients needing bupivacaine (n)% | | 16 (20) | 18 (22.78) |

Group L – lidocaine group; Group DL – local dexamethasone plus lidocaine group. The data were presented as mean ± standard deviation, median (quartile), or number (percentage). There was no significant difference in demographic data, data of anesthesia puncture and surgeries, fentanyl requirements for wound pain, or dosage of epidural bupivacaine between the two groups.

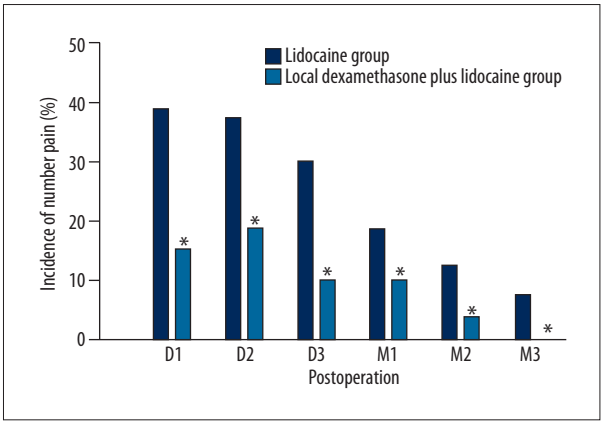


**Figure 2.** Incidence of lumbar pain in the 2 groups. D1, 1st day; D2, 2nd day; D3, 3rd day; M1, 1st month; M2, 2nd month; M6, 6th month. The data are presented as percentage. * $P<0.05$.

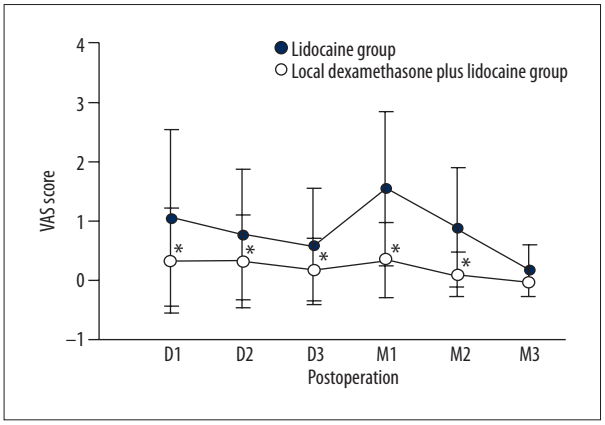


**Figure 3.** VAS scores of the 2 groups. D1, 1st day; D2, 2nd day; D3, 3rd day; M1, 1st month; M2, 2nd month; M6, 6th month. Values are expressed as the mean ± standard deviation. * $P<0.05$.

**Table 2.** Incidence of lumbar pain at 1st, 2nd and 6th months in patients without acute back pain in the two groups*.

| | Group L (n=80) | Group DL (n=79) | *P* |
|---|---|---|---|
| M 1 | 45.00% | 17.72% | <0.001** |
| M 2 | 41.25% | 3.79% | <0.001** |
| M 6 | 11.25% | 0.00% | <0.001** |

Group L – lidocaine group; Group DL – local dexamethasone plus lidocaine group; M1 – 1st month; M2 – 2nd month; M6 – 6th month.
* The data were presented percentage. ** By Kruskal-Wallis H test.





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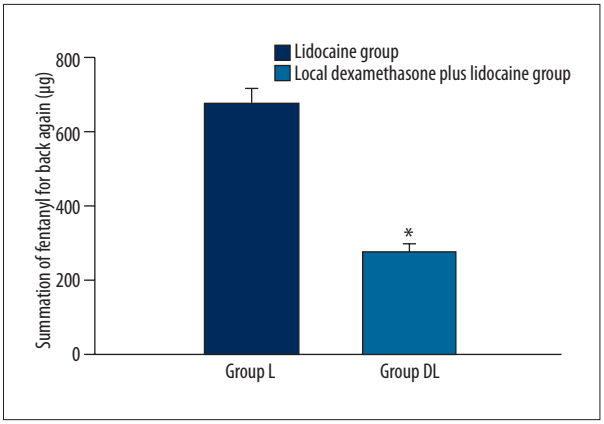


**Figure 4.** Summation of fentanyl for back pain during the postoperative 3 days. Group L, lidocaine group; Group DL, local dexamethasone plus lidocaine group. Values are expressed as the mean ± standard deviation. * $P<0.05$.

fentanyl for lumbar pain. In this study, the third anesthetist injected fentanyl for back pain in the 2 groups at any time when VAS score was over 4, not only at the postoperative 24, 48, or 72 hour timepoint. Therefore, the VAS score was lower than 4 when we assessed the patients at postoperative hours24, 48, or 72 hour. The total consumption of fentanyl was significantly lower in group DL than group L during the postoperative 3 days (Figure 4). After discharge from hospital, no patient needed additional analgesics for lumbar pain.

There was no headache or puncture site infection in the 2 study groups. Eleven patients (5 patients in group L and 6 patients in group DL) reported lower limb paresthesia, and 5 patients (2 patients in group L and 3 patients in group DL) reported unilateral sciatic leg pain during the first 3 post-operative days. In post-operative months 1–6, there were 5 patients (2 patients in group L and 3 patients in group DL) who reported lower limb paresthesia and 2 patients (2 patients in group DL) with unilateral paresthesia in the 2 groups. There were no significant differences in the incidence of adverse events between the 2 groups.

## Discussion

The primary outcome of this study was incidence of back pain. Secondary outcomes were lumbar pain as measured by the VAS score and analgesic consumption for back pain.

This study demonstrated that prophylactic local dexamethasone could decrease the incidence of acute and chronic back pain, and also lower VAS for back pain following combined spinal-epidural anesthesia. We also found that dexamethasone for local infiltration can decrease the incidence of chronic back pain in patients without acute back pain.

Spinal-epidural anesthesia is commonly used in gynecological surgery, but low back pain after epidural anesthesia is a common and significant problem. Low back pain is multifactorial and is associated with local trauma caused by the epidural needle [5,6], the body mass index, surgical position and time, and number of epidural attempts [10]. Anesthesiologists can only decrease these risk factors by minimizing local trauma. Local tissue trauma causes local pain [11], tissue edema, and the release of pro-inflammatory factors, chemokines, substance P, and vasoactive intestinal peptide [12]. Additionally, acute nociception of puncture site leads to release of TNF-α, IL-1β and IL-8, which in turn contributes to the release of peripheral hyperalgesic mediators [13]. For example, induction of cyclo-oxygenase-2 and activation of phospholipase A2 leads to intraspinal prostaglandin synthesis, which results in a peripheral and central hyperalgesic state [14,15].

Muslu et al. [3] in 2009 and Wang et al. [16] in 1998 found that local administration of nonsteroidal anti-inflammatory drug with lidocaine could reduce the incidence and severity of post-epidural backache better than lidocaine alone. Muslu et al. [3] in 2009 locally administered lornoxicam to lessen the incidence of back pain, but the authors could not evaluate its effect on chronic back pain because the half-life of lornoxicam is less than 4 hours. Other studies have also shown that dexamethasone could reduce postoperative pain and analgesic consumption [1,2,17,18].

Dexamethasone is a long-acting corticosteroid; its effects last for 36–54 hours. A local dexamethasone infiltration can inhibit the inflammation of local trauma and the release of inflammatory factors for over 36 hours. Therefore, dexamethasone can significantly decrease the incidence of acute back pain in the first 3 postoperative days. The analgesic effect of dexamethasone for local infiltration may be associated with the direct inhibition of local inflammation. Inflammation plays a key role in pain, and many studies have reported that inflammatory cytokines may be involved in pain processes [19–21]. Dexamethasone, a well-known anti-inflammatory drug, is widely used to treat inflammation. Additionally, dexamethasone can inhibit phospholipase A2 and the expression of cyclo-oxygenase-2 during inflammation, reducing the synthesis of prostaglandins [22,23], which play a major role in pain.

We investigate the effect of dexamethasone on acute and chronic back pain and found that dexamethasone reduced the incidence of both acute and chronic back pain. This effect may be associated with anti-inflammation and inhibition of peripheral hyperalgesic state. Inflammatory mediators can modulate nociception and contribute to the amplification and persistence of pain [21,24–27]. Local dexamethasone infiltration can inhibit the peripheral hyperalgesic state via inhibition of pro-inflammatory factors and cytokines.





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Interestingly, we found dexamethasone significantly decreased the incidence of chronic back pain in patients without acute back pain. We could not understand the mechanism of how these patients without preoperative back pain and acute back pain experienced chronic back pain after combined spinal-epidural anesthesia. These patients might have had local trauma caused by the epidural needle, needed to resume work or other physical labor resulting in chronic back pain, or due to dexamethasone's effects of anti-inflammation and inhibition of phospholipase A2 and cyclo-oxygenase-2 to reduce the incidence of chronic back pain in patients without acute back pain.

In this study, the incidence of lumbar pain was significantly higher than that reported by Hakim et al. in 2012 [7], this may be due to differences in methods of pain assessment, in our study, the pain was evaluated in knee-chest position, which was not used in study of Hakim.

### Limitations

In this study, we did not compare the effect of different methods of administration of dexamethasone, including intravenous injection and epidural injection. Further research is needed to compare the effect of different administration methods of dexamethasone on postoperative lumbar pain. In the future, we also will focus on the mechanism in patients suffering chronic back pain without acute back pain. In addition, this method is suitable for laparotomy but not minimally invasive surgery such as laparoscopic surgery and robotic surgery, which are currently widely used in gynecological surgery. Laparoscopic surgery may provide a better outcome and fewer complications than traditional laparotomy [28].

## Conclusions

The addition of dexamethasone to local lidocaine infiltration decreases the incidence and VAS score of lumbar pain after gynecological non-laparoscopic surgery. It also reduces the dosage of supplementary analgesics required after combined spinal-epidural anesthesia.

### Conflict of interest

The authors have no conflicts of interest.

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