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Comparison Of Percutaneous and Intraabdominal Blockades Of Iliohypogastric and Ilioinguinal Nerves For Postoperative Pain Management Of Total Abdominal Hysterectomy Patients: A Randomized Controlled Clinical Trial

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ABSTRACT

Objective: In this study we aimed to determine whether iliohypogastric and ilioinguinal nerve blockade from intraabdominal approach for the postoperative pain management of total abdominal hysterectomy patients could be a reliable and effective alternative compared to percutaneous block of IHII nerves.

Materials and Methods: This study is a randomised controlled double blind prospective clinical trial. This study was conducted in operating room, and recordings were performed in postoperative recovery unit and gynaecology clinic. Eighty seven women undergoing total abdominal hysterectomy were enrolled in this study but 82 completed the study. Patients were divided into three groups (n=29 in each), as control group (group C), percutaneous IHII block group (group PB) and intraabdominal IHII block group (group IB). Group C patients received no block procedure. The percutaneous bilateral IHII nerves block was performed after abdominal closure to group PB and intraabdominal IHII block was performed before abdominal closure to group IB. Mean arterial pressure, heart rate, pain scores, satisfaction scores, morphine consumptions and side effects were recorded at the 2nd, 6th, 12th and 24th postoperative hours.

Results: Postoperative MAP, HR results of control group were found similar in all groups. VAS scores at all postoperative hours were found to be significantly lower in the block groups PB an IB than control group. There were no significant differences in pain scores between group PB and IB at any time point. Morphine consumption data were found to be significantly lower in the PB and IB groups than in the control group.

Conclusions: Intraabdominal IHII blockade just before closure of the abdomen for relieving postoperative pain in total abdominal hysterectomy patients is as effective and safe method as conventional percutaneous IHII blockade without adverse effects.

Keywords: Iliohypogastric, ilioinguinal, nerve block, postoperative pain, morphine

Total Abdominal Histerektomi Yapılan Hastalarda Postoperatif Ağrı Tedavisinde Perkütan ve İntraabdominal İliohipogastrik-İlioinguinal Sinir Bloklarının Karşılaştırılması: Randomize-Kontrollü-Klinik Çalışma

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ÖZ

Amaç: Bu çalışmada total abdominal histerektomi yapılan hastaların postoperatif ağrı tedavisi için intraabdominal yaklaşımla iliohipogastrik ve ilioinguinal sinir blokajının, IHII sinirlerinin perkütan bloğuna kıyasla güvenilir ve etkili bir alternatif olup olamayacağını belirlemeyi amaçladık.

Yöntem: Bu çalışma, randomize, kontrollü, çift kör-prospektif bir klinik çalışmadır. Bu çalışma ameliyathanede yapıldı ve kayıtlar ameliyat sonrası derlenme ünitesinde ve kadın doğum polikliniğinde elde edildi. Total abdominal histerektomi geçiren 87 kadın bu çalışmaya dahil edildi ancak 82'si çalışmayı tamamlayabildi. Hastalar kontrol grubu (grup C), perkütan İHII blok grubu (grup PB) ve intraabdominal İHII blok grubu (grup IB) olmak üzere 3 gruba (n=29) ayrıldı. Grup C hastalarına blok işlemi uygulanmadı. Perkütan bilateral IHII sinir bloğu, grup PB'ye abdomenin kapanmasından sonra, intraabdominal IHII bloğu, grup IB'ye abdomenin kapanmasından önce uygulandı. Ameliyat sonrası 2., 6., 12. ve 24. saatlerde ortalama arter basıncı, kalp hızı, ağrı skorları, memnuniyet skorları, morfin tüketimleri ve yan etkiler kaydedildi.

Bulgular: Kontrol grubunun postoperatif OAB, KAH sonuçları tüm gruplarda benzer bulundu. Postoperatif tüm saatlerde VAS skorları PB ve IB blok gruplarında kontrol grubuna göre anlamlı olarak düşük bulundu. Herhangi bir zaman noktasında grup PB ve IB arasında ağrı skorlarında anlamlı fark yoktu. Morfin tüketim verilerinin PB ve IB gruplarında kontrol grubuna göre anlamlı derecede düşük olduğu bulundu.

Sonuç: Total abdominal histerektomi hastalarında postoperatif ağrıyı gidermek için abdomen kapatılmadan hemen önce intraabdominal IHII blokajı, yan etkisi olmayan konvansiyonel perkütan IHII blokajı kadar etkili ve güvenli bir yöntemdir.

Anahtar sözcükler: İliohipogastrik, ilioinguinal, sinir bloğu, postoperatif ağrı, morfin

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Introduction

Many patients after total abdominal hysterectomy may have the complaint of severe postoperative pain. Postoperative pain management of total abdominal hysterectomy is still a huge issue. Several techniques have been used to manage this common problem such as opioids, nerve blockades, and abdominal wall infiltrations. To our knowledge somatic pain caused by Pfannenstiel incision corresponds to L1-L2 dermatomes and is transmitted by iliohypogastric and ilioinguinal (IHII) nerves [1]. It was shown by many studies [2-5] that the blockade of IHII nerves for the management of Pfannenstiel incision pain may provide sufficient analgesia both blinded and ultrasound guided fashion. However, blockade of IHII nerves cannot relieve the visceral pain and it is necessary to use additional analgesia modalities. The most common and effective method is opiate usage for this purpose, but it is a usage limiting concern because of the addiction potential and adverse effects such as nausea, vomiting, constipation, sedation and respiratory depression [6]. Most of all, the major concern of percutaneous IHII nerves blockade is the serious complications like bowel perforations, vascular damage [7, 8]. Although, these complications are not common, if they do occur may cause serious problems [7, 8]. In light of this potentiality of complication risk we thought that using an intra-abdominal blockade technique of IHII nerves before abdominal closure may provide a reliable and effective postoperative analgesia without known complications.

In this study we aimed to determine whether iliohypogastric and ilioinguinal nerve blockade from intraabdominal approach for the postoperative pain management of total abdominal hysterectomy patients could be a reliable and effective alternative compared to percutaneous block of IHII nerves. We hypothesized intraabdominal blockade of IHII nerves would be as effective as percutaneous method with no complications or side effects.

Materials and Methods

This study was carried out in a randomized, controlled and double-blind manner after the written informed consent of patients and approval by the Cumhuriyet University Local Ethics Committee for Human Research (Decision Number: 2010-01/03 and Date: 30.11.2010). The study was planned to be performed on 87 women aged 30-65 years, with ASA I-II risk classification, undergoing total abdominal hysterectomy. Patients with one of the following were not included: history of substance abuse, allergy to any local anesthetics, progressive neurological disease, coagulation disorder, uncontrolled hypertension or diabetes mellitus, chronic inguinal pain, lower abdominal pain, inability to use a patient-controlled analgesia (PCA) (GemStarR, Abbott Hospira, USA) device due to cultural or mental status, history of abdominal surgery, unwillingness to participate, or infection at the site of the IHII nerve blockade, and bilateral block failure occurrence which was determined by pinprick test.

Before surgery, patients were informed about the study, including visual analog scale (VAS) and usage of PCA device; then, written informed consent was obtained from all participants. Patients were randomized by closed envelope technique and divided into three groups (n=29 in each), as control group (group C), percutaneous IHII block group (group PB) and intraabdominal IHII block group (group IB). Randomization was performed by an anesthetist who was blinded to the study groups. Patients were not informed about their groups. Patients were given no premedication. In the operating room, electrocardiography (ECG), pulse oximetry (SPO_2), mean arterial pressure (MAP) monitoring (Drager, Infinity Vista XL, USA) were performed. In all patients, anesthesia induction was performed by using the same standard technique with 1 μg kg^{-1} fentanyl (Fentanyl citrate, Abbott, USA), 0,6 mg kg^{-1} rocuronium (Esmeron, Organon, Netherlands) and 5-7 mg kg^{-1} thiopenthal (Ekipental, Tum Ekip Drug, Turkey). Anesthesia maintained in all patients with O_2 50 % – N_2O 50 % and Sevoflurane (Sevorane, Abbott, USA) 2 %.

Total abdominal hysterectomy was performed by standard Pfannenstiel incision and transverse incision of inferior uterine segment by same surgeon. Intraabdominal and percutaneous IHII nerve blocks were performed before abdominal closure by the same anesthesiologist.

Nerve block technique

Group C patients received no block procedure. The percutaneous bilateral IHII nerves block was performed with a multi-injection technique. In group PB, after the palpation of anterior superior iliac spine (ASIS) on skin a 25 gauge (G) Whitacre needle (B. Braun Melsungen AG, Germany) was inserted percutaneously from 2 cm medial and 2 cm superior of ASIS with 90° angle to the skin. The needle was advanced with a loss of resistance and 4 ml 0.5% levobupivacaine injection was performed under the fascia of the external oblique muscle. Needle was pulled until subcutaneous area and the needle was then directed to superiorly, with an angle of 45 degree, 4 ml 0.5% levobupivacaine injected, in turn, inferiorly, with an angle of 45 degree, 4 ml 0.5% levobupivacaine injected. The same infiltration procedure was repeated on the contra-lateral side. All injections were done after a negative aspiration test every 2 ml. A total dose of 24 ml of 0.5% levobupivacaine bilaterally injected.

In group IB, the intraabdominal block of IHII nerves was performed with a standardized method. The anterior superior iliac spine (ASIS) was palpated within the abdomen and a 25 G Whitacre needle was inserted at a point of 4-5 cm medial to the ASIS by the peritoneum (Figure 1). The needle was inserted until a loss of resistance was noted upon piercing the fascia of the internal oblique muscle. The needle was directed and

advanced to the ASIS and after a negative aspiration test, 4 ml of 0.5% levobupivacaine was infiltrated into the internal oblique muscle layers. The needle was then returned to the peritoneum, and using the same loss of resistance technique, the needle was directed and advanced 5cm cranial to the ASIS; again, after a negative aspiration test, another 4 ml of 0.5% levobupivacaine solution was infiltrated into the area between the internal oblique and transversus abdominis muscles. The needle was then returned to the peritoneum and directed to superiorly, and in turn, inferiorly at angles of 15-20 degree on the same horizontal plane, and another 2 ml of 0.5% levobupivacaine solution was infiltrated into each side (total 4 ml) after a negative aspiration test. The elliptic area above the ASIS in Figure 1, especially the area marked in red, was the infiltration area at the internal oblique and transverse plane by infiltration from the peritoneal side. The same infiltration procedure was repeated on the contra-lateral side. A total, 24 ml of local anesthetic solution was injected bilaterally. In all patients, an intraabdominal bilateral IHII nerve block was performed in sterile fashion by the same anesthetist.

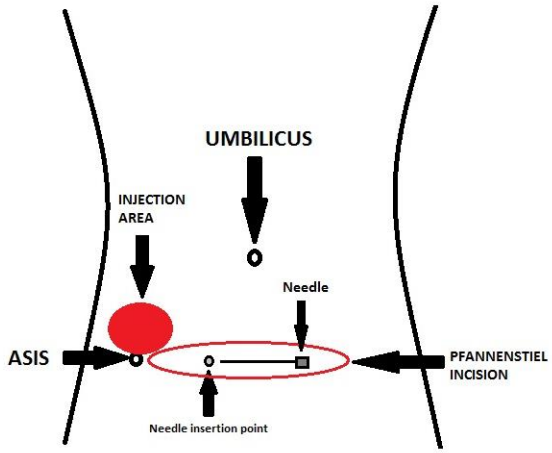

Figure 1. Infiltration area with intraabdominal block of IHII nerves

At the recovery room all patients received a 0.1 mg kg^{-1} loading dose of intravenous morphine, by PCA device. The PCA device was set for 1 mg bolus dose with 10 min lock-up interval. Presence and adequacy of the IHII block were blindly assessed by the pinprick test in the recovery room, after the patient had an Aldrete score of 9. MAP, HR, ten cm long visual analog scale (VAS) score, patient satisfaction score (1: dissatisfaction, 2: moderate dissatisfaction, 3: satisfaction, and 4: complete satisfaction), adverse effects (nausea, vomiting, itching) were recorded at the 2^{nd}, 6^{th}, 12^{th} and 24^{th} postoperative hours. In all patients, PCA was finished at the end of the 24^{th} postoperative hour. Twelve and 24 hours morphine consumption values were recorded. These test and records were carried out by same anesthesiologist blinded to patients' groups.

It was planned to administer 75 mg IM diclofenac sodium (Deflamat 75 mg, Tripharma, Turkey) to the patients who had a VAS score ≥5 during the postoperative period.

Statistical analysis

The amount of morphine consumption at 24 hours was the primary end-point for statistical analysis. A power analysis based on a pilot study in which amount of postoperative morphine consumption was found to be 47±12 mg of control group, 32±10 mg of intraabdominal block and 31±9 of percutaneous block showed that three groups of 29 patients each would be required to demonstrate a 25 % difference in postoperative morphine consumption with control group and with α=0.01, ß=0.20.

All data were analysed with SPSS program (ver 15.0). Data were presented as mean ± SD. Demographic data and morphine consumption data were compared with analysis of variance. Patient satisfaction and pain score data were analyzed with the Kruskal-Wallis and Mann-Whitney U-tests. The chi-square test was used for the ratios of nausea, vomiting, itching and additional analgesic requirement. A *p* value of less than 0.05 was considered significant.

Results

A total of 87 patients were enrolled in our study. Three patients were excluded from group PB (n=26) and 2 patients from group IB (n=27) due to bilateral unsuccessful blockade which were assessed by pinprick test on Pfannenstiel incision area. The control group included 29 patients and so a total of 82 patients were completed and included to our study. There were no significant differences between groups regarding demographic data and duration of the surgery (Table 1).

Table 1. Demographic data and duration of operation

	Group PB (n=26)	Group IB (n=27)	Group C (n=29)
Age (year)	46.24±7.91	47.35±7.29	50.00±9.30
Height (cm)	160.92±6.78	160.17±6.32	159.86±7.58
Weight (kg)	77.80±14.91	73.64±12.30	75.58±12.41
ASA I/II (n)	10/16	10/17	11/18
Duration of operation (min)	68.04±12.72	65.60±12.03	66.72±10.78

All values were given as mean ± SD.
PB: Percutaneous block, IB: Intraabdominal block, C: Control

The HR values were not found different between the groups in postoperative period. Besides, no significant differences were seen in the terms of postoperative MAP values between groups.

The success of blockade was evaluated by the pinprick test, in the block groups and found no significant differences between groups PB and IB about block success. Naturally, there was no loss of sensation in any patients of control group.

VAS scores at the 2nd, 6th, 12th and 24th postoperative hours were found to be significantly lower in the block groups than control group (p<0.05) (Figure 2). However, there were no significant differences about VAS scores between group PB and IB at any time point.

When morphine consumptions of 12 and 24 hours were assessed, morphine consumption was found to be significantly lower in the PB and IB groups than the control group at both time points (p<0.05) and similar between group PB and IB (Table 2).

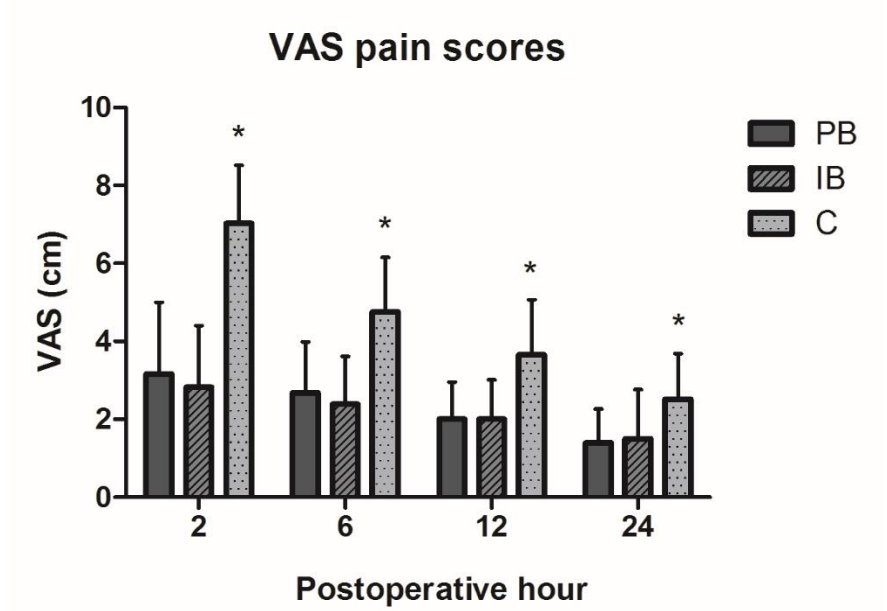

Figure 2. VAS scores

Satisfaction score values were significantly higher in block groups than in control group (p<0.05) (Table 2). Additional analgesic (Diclofenac Sodium) need in first 12 postoperative hours was significantly lower in the block groups than control group (p<0.05), while there was no significant difference at the 24th hour between groups (Table 2).When postoperative adverse effects were assessed, there were no difference between group PB and IB, while control group had significantly more nausea, vomiting, and itching than groups of PB and IB (p<0.05). There were no other side effect or block complications in any patients.

Table 2. Satisfaction scores, morphine consumptions and side effects

	Group PB (n=26)	Group IB (n=27)	Group C (n=29)
Satisfaction score	3.32±1.06	3.35±1.06	2.06±0.88*
Morphine Consumption over 12h (mg)	17.32±5.54	16.53±5.44	22.89±5.75*
Morphine Consumption over 24h (mg)	23.76±7.85	23.07±7.14	42.79±9.84*
Nausea (+/-)	3/23	4/23	13/16*
Vomiting (+/-)	2/24	2/25	9/20*
Itching (+/-)	1/25	1/26	9/20*

All values were given as mean ± SD.
PB: Percutaneous block, IB: Intraabdominal block, C: Control
*p<0.05 When Group C compared to Group PB and IB

Discussion

The results of this study indicate that intraabdominal IHII nerve blockade for postoperative pain management of hysterectomy operations is as safe and effective method as percutaneous IHII block to reduce postoperative pain and analgesic drug requirement. The VAS score and morphine consumption at the 12th postoperative hour in the block groups were significantly lower compared to the control group.

Conventional percutaneous IHII nerve blockade technique has been used in postoperative pain management of Pfannenstiel incisions [4]. In the present study, we performed an IHII nerve blockade from inside of the abdominal wall and compared it with percutaneous approach. We believe that the intraabdominal approach is easy to access between the internal oblique and transverse muscles. As the nerves have a parallel course on the coronal plane between these muscles, the likelihood of blockade increases because of infiltrative local injection at a perpendicular plane to the above-mentioned course [9]. In addition, complications reported with the percutaneous method, such as colon perforation [7] or pelvic hematoma [8] could not be seen with the intraabdominal approach. To our knowledge, this is the first study which compares a conventional percutaneous IHII block method with an intraabdominal IHII blockade approach in total abdominal hysterectomy operations.

We searched the older studies in the literature, before planning and performing our study and concluded that the single injection techniques were not ideal for producing an effective IHII block. Both Ganta *et al.*[3] and Bunting *et al*.[10] preferred a bilateral single injection and the ability of this methodology to reproducibly generate an effective IHII block is unclear because neither group reported their block success rate. In a later IHII-CS study, Huffnagle *et al*. [5] they used a single injection and reported a 50% incidence of block failure. Multiple injections along the nerve pathways appeared to be the logical alternative. Our multi-level method produced a more IHII block success rate than single injection studies.

Due to the advantages that we mentioned above we preferred to use a multi-level injection technique in our study and the block failure rates were 13.8% and 3.4% in group PB and IB respectively, in contrast to the study of Huffnagle *et al*.[5]. The high failure rates of conventional blind IHII blockade method led the investigators to use different methods involving various injection points and doses or ultrasound-guided technique. In the study of Bell et al. [11], a technique of multi-level injections for IHII blockade was recommended with a success rate of up to 95%. In the study in which benefits and limitations of multi-level IHII nerve blockade in the control of post-cesarean pain were investigated, Bell et al. [11] reported that there were two variables which hindered complete assessment of the technique in the previous studies: blockade method and follow-up after intervention.

In a study of Oriola *et al.*[12] on hysterectomy patients it was observed that an up to 50% decrease in morphine consumption in the initial 48 h after surgery when simple ilioinguinal block was performed. In these patients, there were no significant difference in pain scores between nerve block patients and control group patients, a finding in contrast with our VAS data reported here.

In the conventional percutaneous IHII nerve blockade, the injection point for the blockade is at 2-2.5 cm medial and superior to the ASIS. Willschke et al. [13] indicated a change in the depth of the ilioinguinal nerve in association to body weight in children. In considering the studies [2, 9, 13] on this issue, we concluded that these two nerves run together on the same plane in a quadrangular area, which is limited by lines linking the following points: points at the ASIS, at 5 cm cranial and posterior to the ASIS, at 3 cm medial to the ASIS and the point located on the third centimeter of the line plotted from the ASIS to the umbilicus. While these nerves have higher probability of being in the internal oblique muscle at the caudal part of this quadrangle, they run between the transverse abdominal and internal oblique muscles at the cranial part. Therefore, we preferred a different injection place for our novel intraabdominal IHII block technique, as we suggest that blinded blockade on the internal oblique and transverse abdominal muscle plane by infiltration using a needle inserted from 4-5 cm medial to the ASIS in this quadrangular area would be more efficient.

There are many trials that studied percutaneous IHII blockade for post-cesarean pain as cesarean operations had same Pfannenstiel incision as abdominal hysterectomies. In a study of Hufnagle et al. [5] IHII nerve blocks were studied for post-cesarean pain and found significant analgesic effect and lower morphine consumption values in block groups as similar to our results. Bunting et al. [10] studied the analgesic effects of IHII nerve block for post-cesarean pain and found lowered pain scores with lowered analgesic use.

Although the positive results of IHII blockade there is a study of Wehbe et al. [14] with a negative result of IHII for postoperative pain. They enrolled the patients undergoing laparotomy via Pfannenstiel incision received injection of either 0.5% bupivacaine + 5 mcg/ml epinephrine for IINB or saline of equivalent volume given to the same site. They found no significant analgesic effect of IHII blockade.

In a recent study of Owen et al.[15] conventional transversus abdominis plane (TAP) block was compared to intra-abdominal TAP block and they found intraabominal technique easier, safer and equally effective similar to our results.

Finally, we conclude that using same local anesthetic doses, intraabdominal IHII blockade just before closure of the abdomen for relieving postoperative pain in total abdominal hysterectomy patients is as effective and safe method as conventional percutaneous IHII blockade. We couldn't find any superiority of each method on other. However, we consider that there is still a huge need for further studies before using commonly in clinical practice as a standard postoperative pain management technique.

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