

SELECTIVE SPINAL ANAESTHESIA AS PREEMPTIVE ANALGESIA IN LAPAROSCOPIC CHOLECYSTECTOMY

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ABSTRACT

Background: Some patients still experience considerable pain and discomfort during first 24 hours after laparoscopic cholecystectomy. About 30-40% of discharged patients may suffer from moderate to severe pain which affected stress response and prolonged the time of stay. **Objective:** the aim of study was to compare general anesthesia(GA) routine technique and selective spinal anesthesia(SSA) which used preoperative on the basis of preemptive analgesia before GA and study the efficacy on postoperative pain and stress response. **Methods:** Randomized control study enrolled 40 patients were divided into two groups, GA (control group) received GA only and SSA group received SSA before GA, 20 patients of each. Intraoperative hemodynamic were recorded. Postoperative pain scores, cumulative doses of pethidine requirements over 24 hrs, sedation scores, urinary retention, nausea, vomiting, Pruritus, and Post Dural Puncture Headache were recorded. Blood cortisol and glucose level were checked one hour preoperative and 3hours after surgery for stress response to pain. **Results:** postoperative pain score was no significant in control group compared to SSA group ($p > 0.05$) even pain score was less in SSA group in 1st hour with high significant p value < 0.001 and no opiates needed in SSA group. Preoperative and postoperative plasma cortisol levels increased in GA group and decreased in SSA group with high significant value ($p < 0.001$) but plasma glucose level was no significant preoperatively in both groups and decreased postoperative in SSA group less than GA group with high significant ($p < 0.001$). No significant differences in other postoperative parameters and in intraoperative hemodynamic between both groups by ($p > 0.05$). **Conclusion:** The study showed that SSA in preoperative as preemptive provided postoperative analgesia, reduced the stress response to pain while maintaining better hemodynamic stability with fewer side effects and no opiates requirements were needed.

Keyword: Anesthesia, General, Preemptive, Selective, Spinal.

INTRODUCTION

Laparoscopic cholecystectomy (LC) started to enjoy ever increasing popularity, it retained the advantages of shorter hospital stay, rapid return to normal activities, less pain, small incision, and less postoperative ileus compared to traditional open cholecystectomy (O.C) [1]. Although pain after LC is less intense than after OC, but still some patients experience considerable pain and discomfort during first 24 hours. About 30-40% of discharged patients may suffer from moderate to severe pain. The postoperative pain may allow patient stay in hospital to be prolonged for another day, this is lead to increase cost of procedure, and affect on stress response due to pain [2]. There was intraperitoneal local anaesthesia has been investigated for

postoperative pain relief after LC [3], but in recent years more attentions has been devoted to develop a rapid and safe technique by postoperative single shot spinal anaesthesia for pain relief [4]. Selective spinal anesthesia (SSA) was used by lidocaine which is a popular anesthetic for short procedures due to its brief duration of action as low dose, low volume, and low flow. Addition of fentanyl may improve the quality and duration of lidocaine spinal anesthesia with great hemodynamic stability[5-6]. SSA was used preoperative before giving general anaesthesia (GA) for postoperative pain relief on basis of preemptive analgesia (medical term used to describe the phenomenon by which analgesia administered before a painful stimulus decreases the intensity of the

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subsequent pain) and to control postoperative stress response due to anesthesia and surgery. The general stress response was in the form of wide spread endocrinal, metabolic and biochemical reactions throughout the body. The magnitude of response is highly dependent on the severity, the intensity and the duration of stimulus. Stress response is a complex interplay between hypothalamic pituitary axis, the classical neuro-endocrinal hormone system and autonomic nervous system [7].

METHODS

This study was conducted in anaesthesiology department, faculty of medicine Zagazig University from January 2005 to January 2007 after approval of hospital committee for researchers, postgraduate studies and continuous medical education. Informed consent was taken from every patient before entry into study. The study was conducted on 40 adult male and female patients who were scheduled for elective laparoscopic cholecystectomy, American Society of Anesthesiologists Physical Status (ASA-PS) I-II, aged 25 - 50 years and weighted 50 - 90 Kilogram(K.G.). The patients were randomly allocated into one of two equal groups: (Control group): includes 20 patients who received general anaesthesia only. (Spinal group): it included 20 patients who received selective spinal anaesthesia before general anaesthesia. All patients in the two groups were managed preoperatively as routine investigations and examinations and study laboratory investigations: blood samples were aspirated one hour before surgery and 3 hours postoperative to detect Plasma glucose concentration by routine glucose dehydrogenase method. and Cortisol concentration by radioimmunoassay. Ordinary intraoperative monitoring, Heart rate (HR), systolic blood pressure (SBP) diastolic blood pressure

(DBP) and respiratory rate(RR) monitoring were done as mean value. All were taken preoperative before induction, after induction of anaesthesia, after intubation, at surgical incision, at the beginning of pneumoperitoneum, after 5, 10, 15 and 20minutes and then every 15 min until the end of surgery. Postoperative pain was measured by Visual Analogue Scale(VAS).No premedication and preload fluid for both groups. In control group patients were anesthetized by (1-2 ug/kg I.V.) fentanyl, thiopentone (2.5 %) in a dose of(4-6 mg/kg I.V.) and succinylcholine (1mg/kg I.V.) was used to facilitate tracheal intubation. Anaesthesia was maintained by 1 % halothane and muscle relaxation was maintained with bolus dose of pancronium(0.05mg/kg I.V.) and repeated small doses as required. The lungs were ventilated with ventilator settings adjusted to obtain end tidal carbon dioxide (32-36) mmHg increased respiratory rate and decreased tidal volume. Slight Trendlenburg position was maintained during operation. At the end of the procedure, all anaesthetics were withdrawn with reversal of neuromuscular block by neostigmine(2.5 mg with 0.5 mg atropine I.V.). The patient was extubated when breathing and patient tidal volume was adequate and full clinical recovery of neuromuscular blockade was achieved IV boluses of pethidine were given to achieve adequate pain relief and total pethidine doses over 24hrs period were calculated. SSA was done before induction of general anaesthesia in SSA group, with the patients in sitting position and the back was prepared, cleaned and scrubbed. A midline approach was used, after subcutaneous lignocaine (1%) 2 ml as infiltration at the insertion site of spinal needle. A25 gauge spinal needle was inserted at the selected intervertebral space (L2-3 or L3-4), the orifice of the needle was placed cephalad and spinal solution was

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rapidly injected in 10-15 seconds. The solution was consisted of 2 % lignocaine (2% in a dose of 1 ml) (20mg) with fentanyl 25 ug in 0.5 ml and completed to 3 ml by sterile water, this was hypobaric solution and had specific gravity 1.002. Patients remained sitting position for one minute after which they were allowed to lie down, and operating room table was placed in reversed Trendelenburg position for 6-8 min to facilitate cephalad spread of the hypobaric solution, then the table was returned flat for induction of anaesthesia as in GA group. The operating room table was put in Trendelenburg after gas insufflations. After giving of spinal anaesthesia and before induction of GA the onset and level of sensory block was noted using pinprick every 2 min until the level had stabilized in dermatomes between T6-9 and any complications or adverse effects in form of hypotension, bradycardia, nausea, vomiting, chest discomfort, pruritus, shivering or respiratory depression were noted and treated accordingly before induction of GA. All patients' groups' data were collected at 2, 4, 6 and 24 hours postoperatively for Postoperative pain, Postoperative analgesia: Pethidine intravenous (IV) according to the patient's request and the total dose of pethidine was calculated. The data were collected mainly in post anaesthesia care unit (PACU) with the postoperative regimen of collection of data postoperatively: Urinary retention was assessed on 3 scales: 0 =no retention , 1 =urinary retention but resolved spontaneously , 2 =urinary retention resolved by catheterization. Postoperative nausea and vomiting (PONV): All patients in both groups with special concern of spinal group were assessed according to 4 points score: 0 = none , 1 = mild, 2 = moderate, 3 = severe. Pruritus was assessed for its incidence and time of occurrence and if it was abolished by drugs or spontaneously

without any medication .Any respiratory depression can be assessed by estimation of respiratory rate and oxygen saturation by using pulse oximeter. Post dural puncture headache (PDPH) was assessed for its occurrence . Mild degree and self limiting was treated by reassurance, simple analgesia Non Steroid Anti Inflammatory (NSAIDS) and bed rest. Moderate to severe by reassurance, NSAIDS, bed rest in addition to good hydration, caffeine, and even dural blood patch.

Statistical analysis

Data were entered checked and analyzed using Epi-Info version 6 and SPSS for windows version 18 . Data were presented as mean \pm SD (standard deviation) , number and percentage. Comparing between two groups by student t-test and chi-square test. P value $<$ 0.05 was considered statistically significant , $>$ 0.05 was no significant, and $<$ 0.001 was high significant.

RESULTS

There was no significant differences between two groups with respect to clinical demographic characteristics as (table 1) as p value between both groups was $>$ 0.05. Hemodynamic Intraoperative showed no significant differences between two groups as mean heart rate, diastolic blood pressure and systolic blood pressure as (table 2) with p value was $>$ 0.05. Postoperative pain by VAS in control group was 6.5 ± 0.5 but SSA group was VAS of 3.5 ± 0.5 in first hour with high significant p value $<$ 0.001 . Opiates were used only in control group as (table 3). One hour preoperative plasma cortisol level in SSA group was 595.8 ± 120.4 nmol/L more than control group which was 517.3 ± 104.2 nmol/L with high significant (P $<$ 0.001) but clinically no significant difference as same preoperative conditions. And 3 hour postoperatively it decreased in SSA group less than control group as 428.08 ± 89.4 and 585.8 ± 99.4

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nmol/L respectively with high significantly value ($P < 0.001$). One hour preoperative plasma glucose level in SSA group was 105.9 ± 8.4 mg/dl and in control group was 110 ± 7.5 mg/dl with no significant differences between two groups ($P > 0.05$) but 3 hours postoperative plasma glucose level was increased in control group to 119.2 ± 8.4 mg/dl and decreased in SSA group to 89.9 ± 10.4 mg/dl with high significant difference $p = 0.06$ ($P < 0.001$) as

(table 4). Only 20 % delaying of voiding urine showed in SSA group not need for urinary catheterization with no significant difference with GA group ($P > 0.05$). (PONV) was 25 % in control group and 35 % in SSA group with no significant difference ($P > 0.05$), No Pruritus in both groups , and PDPH by 10 % in SSA group with no significant difference with GA group ($P > 0.05$) but clinically was significant as (table 5).

Table(1); clinical demographic characteristics in two groups:

Variable	Control group	SSA group	P value
Age	39.2 ± 10.3	41.7 ± 11.45	0.46 (NS)
B.W.	69.9 ± 7.3	71.4 ± 8.1	0.54 (NS)
Sex (M/F)	13/7	17/3	0.14 (NS)
ASA (I/II)	19/1	15/5	0.18 (NS)

Values are presented by mean \pm SD (standard deviation) or numbers. ASA; American society of anesthesiology physical status, B.W.; body weight, F; female, M; male, P value; probability value, NS; No significant if $p > 0.05$.

Table (2); Intraoperative Hemodynamic in two groups:

variable	Control group	SSA group	p value
HR:	66.5 ± 8.1	69.9 ± 5.4	0.12
SBP:	101.4 ± 9.7	102.7 ± 10.2	0.68
DBP:	64.5 ± 6.1	65.7 ± 6.7	0.55

Values are presented as mean \pm SD and p value. DBP; diastolic blood pressure, HR; heart rate, SBP; systolic blood pressure. P value was no significant if > 0.05 .

Table (3); Postoperative pain score by VAS scale and opiates requirements in two groups:

Variable	Control group	SSA group	p value
1hr:	6.5 ± 0.5	3.5 ± 0.5	< 0.001 (HS)
4hrs:	4.5 ± 0.5	4.3 ± 0.4	0.16
6hrs:	5.0 ± 0.1	4.5 ± 0.5	0.17
24hrs:	3.5 ± 0.5	3.0 ± 0.3	0.11
Total pethidine doses	100 ± 50 mg	0.0	

Values are presented by mean \pm SD and p value. Hr; hour. $P > 0.05$ no significant, < 0.001 (HS) was high significant.

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Table(4); preoperative and postoperative plasma cortisol and glucose levels in two groups:

Variable	Control group	SSA group	p value
Preoperative cortisol plasma level 1hr (nmol/L)	517.3 ± 104.2	595.8 ± 120.4	< 0.001 (HS)
Postoperative cortisol plasma level 3hrs(nmol/L)	585.8 ± 99.4	428.08 ± 89.4	< 0.001 (HS)
Preoperative glucose level 1hr(mg/dl)	110.7 ± 7.5	105.9 ± 8.4	> 0.05 (NS) (0.06)
Postoperative glucose level 3hrs(mg/dl)	119.2 ± 8.4	89.9 ± 10.4	< 0.001 (HS)

Values are presented by mean ± SD and p value.

Hr; hour, nmol/L; nanomole per liter ,mg/dl; milligram per deciliter; HS; high significant if p value < 0.001, NS; no significant if p value > 0.05.

Table(5); Postoperative adverse reactions in both groups:

Variable	Control group	SSA group	p value
Urine retention:	0/20	4/20 (20 %)	0.11
PONV:	5/20 (25 %)	7/20 (35 %)	0.49
PRURITIS:	0/20	0/20	1.0
PDPH:	0/20	2/20 (10 %)	0.48

Values are presented in numbers , percentage and p value.

PDPH; Post Dural puncture Headache, PONV; postoperative nausea and vomiting, P value; probability value , > 0.05 (No significant), < 0.05 is (significant).

DISCUSSION

Postoperative pain is still a very important to be studied to find different safe measures for pain control. Most common medical causes of delayed discharge after ambulatory or one day surgery are pain, drowsiness and PONV [8-9].The present work was done for studying a method to reduce postoperative pain after LC on the basis of preemptive analgesia by using of combination of local anesthetics and opioids intrathecally before surgical incision and before GA. The concept of preemptive analgesia has its origin in the idea that painful stimuli, if not

prevented by administration of preoperative analgesic drugs, could lead to spinal sensitization and neurospasticity process resulting in increased pain intensity and duration after surgery.[10-11].In the study; Patients under GA alone exhibited sever to moderate pain two hours postoperatively (VAS ± 6.5) which needed postoperative pethidine injection. Patients preserved moderate pain after 6 hrs (VAS ± 5) needing more pethidine. It declined to mild pain 24 hrs after operation (VAS ± 3). In the SSA group, the same sequence was followed but at lower level.VAS 3.5, 4.5 and 3 were

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reported after 2, 4, 6, and 24 hrs respectively necessitating no pain management. Although the difference between pain scores were statistically non significant, they appeared to be clinically significant especially in 1st hour. Preoperative SSA by hypobaric lidocaine solution decreased postoperative somatic and visceral pain in agreement with data was reported by Michaloliakou et al. 1996. [4] . The combination of local anaesthesia with fentanyl are infused neuroaxially at adequate concentration could provide sufficient analgesia provide early postoperative ambulation with agreement of George; et al. 2006 [5,12-13]. Both opioids and local anesthetic block before incision delayed request for analgesia and more impressive in combination as Vadivelu et al. 2010. And Vaghadia 1998.[14-15]. SSA acts as preemptively on spinothalamic tract to prevent hyper excitability elicited by surgery. Modern clinical anesthesia used low concentration of volatile anesthetics which abolish consciousness but may still sensitization of cord so should be combined with preemptive local and regional anesthetic blocks more often, This proved by in the present study and in agreement with study of Vaghadia et al. 1998. And Pamela et al. 2002.[16,22]. From the results of the present study, no change on conscious level of the patients postoperatively was detected. Hemodynamic effects of pneumoperitoneum in both groups showed no significant changes because the SSA before selects sensation. The key factor in the development modern anaesthesia and surgery is the safe outcome. The general response of anaesthesia and surgery is in form of endocrinal, metabolic, and biochemical reactions throughout the body. The magnitude of response is highly dependent on the severity, intensity and duration of stimulus reflected on postoperative pain. Pain is triggered as

complex interplay between hypothalamic pituitary axis, the classical neuroendocrinal hormone system and autonomic neuron system in form of the stress response or the alarm reaction [7] so cortisol level was selected as end result of stress response and plasma glucose for biochemical detection as guidelines for postoperative pain relief. In GA alone when comparing preoperative to postoperative values of the cortisol level was increased and the glucose level was increased but with SSA and GA, plasma cortisol and glucose levels were decreased. So it was apparent that when postoperative pain deceased in SSA group, the endocrinal stress response and biochemical stress response deceased leading to good recovery, good healing of wounds, good immunity against infection, early discharge from hospital with decrease the cost of procedure which was matched with results reported by Kehlet et al. 1998 and Aono et al. 1998[18-19]. The pneumoperitoneum might have respiratory changes [17] , Results showed that respiratory effect was noted by comparison between preoperative basal and postoperative after 24 hrs in both groups as respiratory rate and oxygen saturation and no significant differences between groups. Postoperative urine retention was noted in both groups: patient under GA were showed no urine retention and SSA group was showed some delaying of voiding of 20 % this mild retention resolved without urinary catheterization in agreement with Moemen 2003.[20]. Postoperative nausea and vomiting, in control group 20% as 4 patients after 2hrs and only one patient after 4 hrs but in SSA was one patient after 2hrs but 4 patients after 4 hrs and only 2 patients after 24 hrs, it was accepted and mild complications with agreement of Thune et al. 1995 [21]. Postoperative pruritus was not recorded in any patients in both groups .however, with disagreement with the

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previous reports that incidence of it with SSA was 60 % [16,20]. Postoperative PDPH was noted as complication in 2 patients in SSA group after 6-24 hrs which appeared in about 10 % in SSA but no incidence of headache in control group, so this little percentage may disappear by using 26-27 gauge needle instead of 25 gauge needle as advised in previous study by Pittoni etal. 1995 [23].

CONCLUSIONS

SSA was used on basis of preemptive analgesia before LC under GA has some great advantages and little disadvantages. There was a decrease in postoperative pain score with no need for using postoperative opioids but only enough NSAIDS. This had benefits in early discharge and decreases the cost of procedure. SSA did not affect hemodynamic or respiratory functions during operation with good recovery and decreases pain. Decreased pain score postoperatively decreased the stress responses either endocrinal and biochemical in form of cortisol and glucose, which was helpful in recovery, healing of wounds and good immunization. Postoperative spinal adverse reaction like urine retention was little and easily managed. Low % of PONV, no pruritus and mild PDPH, which self controlling and not need for any management helping rapid discharge from hospital and decrease the cost of the procedure and safe discharge of patients [12].

RECOMMENDATIONS

More applications of SSA before GA for LC are recommended to be used on a wide future scale in another laparoscopies and on ambulatory anesthesia.

Tables footnotes:

Table (1); clinical demographic characteristics of patients in two groups.

Table(2); Intraoperative hemodynamic in two groups.

Table(3); postoperative pain score by VAS and opiates requirements in two groups.

Table(4); plasma cortisol and glucose levels one hour preoperative and 3 hours postoperative in two groups.

Table(5); postoperative adverse reactions in two groups.

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الملخص العربي

المقدمة:

يعاني مرضى استئصال المرارة بالمنظار من ألآم حادة في اليوم الأول للجراحة تتراوح ما بين متوسطة إلي شديدة مما قد يؤثر علي زيادة مدة الإقامة في المستشفى أو يزيد التأثير السلبي للألم علي المريض.

هدف البحث:

استخدام التخدير النصفى الانتقائى قبل التخدير العام كنوع من أنواع السيطرة المبكرة الوقائية للألم قبل الجراحة ومقارنته بالتخدير العام الروتينى.

طرق البحث:

دراسة إحصائية متزامنة تشمل أربعين مريض: تقسم إلي مجموعتين، المجموعة الأولى: تشمل عشرين مريض ويتم تخديرهم التخدير العام مع إعطاء مسكنات للألم عند الحاجة. المجموعة الثانية وتشمل عشرين مريضاً ويتم عمل التخدير النصفى الانتقائى قبل التخدير العام بواسطة حقن عقار الليدوكاين وعقار الفنتانيل في قناة الحبل الشوكي. يتم تسجيل العلامات الحيوية أثناء الجراحة وبعد الجراحة يتم قياس معدل الألم وكمية المسكنات من مشتقات المورفين في خلال أربعة وعشرين ساعة وقياس معدل الوعي واحتباس البول والقئ والغثيان والحكة الجلدية والصداع الناتج من المخدر النصفى ومعدل الجلوكوز والكورتيزول قبل العملية بساعة وبعدها بثلاث ساعات.

النتائج:

مجموعة التخدير النصفى الانتقائى سجلت نسبة قليلة من الإحساس بالألم مع عدم استخدام أي نوع من المسكنات مع ثبات العلامات الحيوية وانخفاض معدل الجلوكوز والكورتيزول بعد العملية وقلة الآثار الجانبية بنسب إحصائية قليلة.

الاستنتاج:

التخدير النصفى الانتقائى قبل التخدير العام في عمليات استئصال المرارة بالمنظار قد يستعمل كأحد الوسائل للسيطرة علي ألآم ما بعد العملية علي أساس السيطرة المبكرة الوقائية للألم.