DISCUSSION

Laparoscopic cholecystectomy (LC) has become firmly established as the method of choice for treatment of asymptomatic gallstone because of obvious advantages of reduction of postoperative pain, better cosmetic results, quicker return to normal activities, reduction in hospital stay resulting in overall reduction in medical cost, less intraoperative bleeding, less postoperative pulmonary complications, less postoperative wound infection and reduced metabolic derangement.[225-227]

In the past few years, advanced LC has targeted older and sicker patients, rendering anaesthesia during laparoscopy more technically demanding.[228, 229] On one hand, laparoscopy can compromise the cardiovascular and respiratory function of the patients, whereas on the other, it was introduced as a safe and simple procedure that may be performed on an outpatient basis hence demanding extreme caution regarding the anaesthetic technique.[98, 228]

LC was usually done by general anaesthesia nevertheless, spinal anaesthesia can be considered as a valid option for patients with biliary disease who are poor candidates for general anaesthesia due to cardiopulmonary, hepatic or renal problems. It is less invasive technique and has lower complication and mortality rates compared with general anaesthesia.[51-54]

It provides intraoperative analgesia without any systemic drugs that makes it preferred in patients with liver or kidney diseases.[52] It also provides adequate level of analgesia for a few hours postoperatively due to the existing activity of injected agents in the subarachnoid space.[56] Hypercapnia accompanied with general anaethesia is avoided by spinal anaesthesia.[54, 55] Clinically significant alterations in pulmonary physiology are usually minimal with the neuraxial blockage produced by spinal anaesthesia.[57] It may also reduce the incidence of venous thrombosis and pulmonary embolism in high risk patients.[57]

Despite all these advantages of spinal anaethesia for LC, it is also associated with side effects. Cardiovascular side effects, principally hypotension and bradycardia, are the most important and most common physiologic changes during spinal anaesthesia. Incidence of hypotension and bradycardia in spinal anaesthesia has been reported to be 33% and 13%, respectively.[171]

Sympathetic blockade from spinal anaesthesia decreases systemic vascular resistance and induces peripheral pooling of blood leading to hypotension. Serotonin receptors in the heart wall that trigger the Bezold Jarisch reflex (BJR), participate in systemic responses to hypovolaemia.[148] Hypovolaemia stimulates these receptors in the left ventricle, induces the BJR and results in reflex bradycardia and hypotension.[148, 150]

5-hydroxytryptamine 3 receptors (5-HT3) are activated by serotonin in response to decreased blood volume.[230] Activation of these receptors, which are G protein coupled, ligand-gated fast-ion channels, results in increased efferent vagal nerve activity, frequently producing bradycardia.[148, 231-234] Thus, spinal anaesthesia causes vasodilatation, hypotension, and bradycardia by sympathetic blockade and by stimulation of BJR.[150, 151]

The aim of this study was to study the effects of ondansetrone for reduction of spinal anaesthesia induced hypotension in LC. It was carried out on 40 patients scheduled for LC by spinal anaesthesia in Alexandria Main University Hospital. They were divided into 2 groups (20 patients each).

Group I (ondansetron group): patients received intravenous ondansetron 4 mg diluted in 10 ml of normal saline over 1 min, 5 min before spinal anaesthesia.

Group II (control group): patients received normal saline 10 ml over 1 min, 5 min before spinal anaesthesia.

As regard demographic data (age, sex, gender and duration of operation), there were no significant differences between the two studied groups.

As regard heart rate changes; in group I it decreased insignificantly at 10, 15, 30, 45, 60, 75, 90, 105 and 120 minutes after intrathecal injection and after 1, 2, 3 and 6 hours postoperatively. In group II, it decreased significantly at 30, 45, 60, 75 and 90 minutes after intrathecal injection. It decreased insignificantly immediately and at 5, 10, 15, 105 and 120 minutes after intrathecal injection and at 1, 2, 3 and 6 hours postoperatively.

Comparison between the two studied groups revealed that heart rate was significantly lower in group II than in group I at 5, 10, 15, 30, 45, 60, 75, 90, 105 and 120 minutes after intrathecal injection and at one hour postoperatively. There were no other significant differences between the two groups.

In agreement with the results of the present study, **T. Sahoo** [156] et al studied the effect of ondansetron on fifty-two females during cesarean section under spinal anaesthesia. They found that 4 mg ondansetron given intravenously five minutes before induction of spinal anaesthesia decreased the incidence of bradycardia.[156]

Also, **Marashi SM**[154] et al compared the effect of intravenous ondansetron with placebo on two hundred and ten patients for attenuation of spinal-induced hypotension and shivering during lower limb orthopaedic surgeries. They found that administration of two different doses of intravenous ondansetron, (6 or 12 mg) significantly attenuated spinal induced bradycardia. However, there was no significant difference between the two doses of ondansetron.[154]

In contrast with the results of the present study, **Owczuk R** [235] et al evaluated the effect of intravenous ondansetron for reduction of spinal induced haemodynamic changes on seventy-one patients scheduled for urologic surgeries. They found that administration of intravenous (8 mg) ondansetron did not affect the incidence of bradycardia after spinal anaesthesia.[235]

The decrease in incidence of bradycardia associated with the spinal anaesthesia in the ondansetron group may be attributed to the effects of ondansetron by blocking 5-HT_3 receptors and preventing the Bezold-Jarisch reflex.

According to **Saxena and Villalon** [236, 237] intravenous bolus injections of 5-HT, phenylbiguanide and 2-methyl-5-HT in anaesthetized rats, rabbits, cats, dogs and guinea pig elicit short lasting bradycardia that can be blocked by a 5-HT3 receptor antagonist.[236, 237] The result of the study demonstrated that the bradycadia due to 5-HT injection results from an effect on cardiac receptors, specifically 5-HT3, stimulating the Bezold-Jarisch reflex.[236, 237]

As regard mean arterial blood pressure (MABP); in group I, it decreased insignificantly immediately and 5 minutes after intrathecal injection. It decreased significantly after 10, 15 and 30 minutes after intrathecal injection. There were no other significant changes throughout the times of measurement intra or postoperatively.

In group II, it decreased insignificantly immediately and 5 minutes after intrathecal injection. It decreased significantly after 10, 15, 30, 45, 60 and 75 minutes after intrathecal injection. There were no other significant changes throughout the times of measurement intra or postoperatively. Comparison between the two studied groups revealed that; there were no significant differences between the two groups immediately and at 5 minutes after intrathecal injection. It was significantly lower in group II than in group I at 10, 15, 30, 45, 60, 75, 90, 105 and 120 minutes after intrathecal injection. There were no significant differences in the postoperative period.

In agreement with the results of the present study, **T. Sahoo** [156] and his collegues found that; giving 4 mg ondansetron intravenously five minutes before induction of spinal anaesthesia decreased the incidence of hypotension.[156] Patients in ondansetron group required significantly less vasopressors.[156]

Also, **Marashi SM** [154] et al found in their study that administration of two different doses of intravenous ondansetron (6 or 12 mg) significantly attenuated spinal induced hypotension.[154]

Also, **Owczuk R** [235] et al observed a lesser decrease in mean, systolic and diastolic arterial pressure with ondansetron administration.[235]

In contrast with the results of the present study, **Ortiz-Gomez** [238] et al evaluated the effect of intravenous ondansetron on maternal haemodynamics during elective caesarean delivery under spinal anaesthesia. They found that intravenous different doses of ondansetron (2, 4 or 8mg) had a little effect on incidence of hypotension in healthy parturients undergoing spinal anaesthesia.[238]

Spinal anaesthesia causes vasodilatation, hypotension, and bradycardia by sympathetic blockade and by BJR stimulation leading to vagus nerve stimulation.[239] Ondansetron prevented the serotonin-induced BJR, suppressed venodilatation, augmented venous return to the heart and resulted in a lesser reduction in systolic and mean arterial blood pressure.[157] Blockade of the 5-HT3 receptor antagonizes the BJR induced by serotonin.[157]

As regard arterial oxygen saturation, in group I and II there was no significant change in intraoperative or postoperative periods compared to preoperative readings. Comparison between the two studied groups revealed that; there was no significant difference through intraoperative and postoperative periods.

In agreement with the results of the present study, **Meng Wang** [240] et al studied one hundred and fifty parturient women to determine the optimal dosage of ondansetron for prevention of maternal hypotension after spinal anaesthesia during cesarean delivery. They found that; incidence of maternal hypotension was significantly lower after administration of 4 or 6 mg ondansetron intravenously 5 minutes before intrathecal injection without any significant change in the oxygen saturation. They concluded that, the optimal dose of ondansetron preloading was 4 mg during cesarean delivery.[240]

Also, **T. Sahoo** [156] et al and **Owczuk R** [235] et al found similar results in their studies with no significant differences between the studied groups.

In the present study, the insignificant changes of arterial oxygen saturation may be attributed to; firstly**:** the dose of local anaesthetic used while designing the study was enough to reach desired levels, without involvement of the intercostal muscles and diaphragm during spinal blockade.[125] Secondly; supplemental oxygen administration through a face-mask throughout the whole procedure.

As regard end tidal carbondioxide ($etco_2$), in group I it increased significantly at 15, 30, 45, 60, 75, 90, 105 and 120 minutes after intrathecal injection. In group II it increased significantly at 15, 30, 45, 60, 75, 90, 105 and 120 minutes after intrathecal injection. Comparison between the two studied groups revealed that; there was no significant differencebetween the two groups throughout the whole intraoperative period.

In agreement with the results of the present study, **Tiwari. S** [241] et al studied two hundred and thirty five patients to evaluate spinal versus general anaesthesia technique for LC. They noticed no differences in the level of carbon dioxide in patients anaesthetized by either techniques. They concluded that; LC done under spinal anaesthesia as a routine anaesthesia of choice is feasible and safe.[241]

Also, **Kar M**[57] et al studied three hundred patients selected prospectively for LC under low-pressure (8 mmHg) pneumoperitoneum under spinal anaesthesia. They recorded that; operation was successfully performed in 291 patients without major complications, four patients refused operation under spinal anaesthesia, spinal anaesthesia was converted to general anaesthesia in two patients due to severe shoulder pain and the operation was converted to open cholecystectomy in three patients. Mean oxygen saturation was 97.6% and mean $etco_2$ was 38. All patients were satisfied on follow up.[57]

In the present study, changes in the ($etco_2$) may be attributed to: first, spinal block did not involve intercostal muscles or diaphragm.[125] Second, all patients were given supplemental oxygen throughout the time of operation. Third, insufflation during operation was done by low pressure technique (< 12 mmHg), thus flow and amount of carbon dioxide used and absorbed during operation was lower than that of high pressure, with less absorption of carbon dioxide and less pressure over the diaphragm.[109, 112]

As regard incidence of nausea and vomiting, in group I, there were no significant changes intra and postoperatively. In group II it increased significantly at 15, 30, 45 and 75 minutes after intrathecal injection. It also increased significantly at 1, 2, 3 and 4 hours postoperatively. Comparison between the two studied groups revealed that nausea and vomiting score was significantly higher in group II than in group I at 15, 45 and 75 minutes after intrathecal injection intraoperatively and at 5 hours postoperatively. There were no other significant differences between the two groups intra and postoperatively.

In agreement with the results of the present study, **White PF** [242] et al compared antiemetic efficacy of oral granisetron (1 mg) to intravenous ondansetron (4 mg) in a laparoscopic surgeries. They found that ondansetron was more cost-effective than granisetron for routine antiemetic prophylaxis as a part of a multimodal regimen in patients undergoing either outpatient or inpatient laparoscopic surgery.[242]

Also, **Helmy SA**[243] evaluated prophylactic antiemetic efficacy and safety of preoperative intravenous ondansetron (4mg) in comparison with droperidol (1.25 mg), metoclopramide (10 mg) and placebo in 160 patients undergoing laparoscopic cholecystectomy under total intravenous anaesthesia. He found that; incidence of nausea and vomiting was significantly lower between 1 h and 4 h after surgery in the ondansetron group compared with the droperidol, metoclopramide and placebo groups. Incidence of nausea was

similar in the four groups in the other study periods: 0-1 h and 4-24 h. Incidence of vomiting was lower in the ondansetron, droperidol and metoclopramide groups than in the placebo group between 1 and 4 h but was the same between 4 and 24 h. As a result of the lower incidence of nausea and vomiting between 1 h and 4 h in the ondansetron group, the overall incidence of nausea and vomiting was lower during the first 24 h after surgery in this group than in the other three groups.[243]

Ondansetron acts selectively on 5-HT_3 receptors, which have been located in two systems: centrally in the emetic circuit of the area postrema and nucleus solitaries and peripherally on the afferent terminals of the vagus nerve in the gut.[220, 244] Serotonin is released by the enterochromaffin cells of the small intestine in response to chemotherapeutic agents and may stimulate vagal afferents (via 5-HT3 receptors) to initiate the vomiting reflex. It is not certain whether ondansetron's antiemetic action is mediated centrally, peripherally, or in both sites.[220, 245] Ondansetron is used primarily for prophylaxis or treatment of postoperative nausea and vomiting (PONV) in intravenous doses of 4 mg and 8 mg.[196]

As regard sedation score, in group I, It decreased significantly at 45, 60, 90, 105 and 120 minutes after intrathecal injection. It also decreased significantly at 1, 2, 3, 4, 5 and 6 hours postoperatively. In group II, It decreased significantly at 60, 75, 90, 105 and 120 minutes after intrathecal injection. It also decreased significantly at 1, 2, 3, 4, 5 and 6 hours postoperatively. Comparison between the two studied groups revealed that, there was no significant difference in the whole period of operation and in the postoperative period.

In agreement with the results of the present study, **Abouleish El** [246] et al evaluated the effects of ondansetron on seventy four full term parturients during elective caesarean section under spinal anaesthesia. They concluded that intravenous administration of 4 mg ondansetron after cord clamping was not associated with any sedative effects.[246]

Also, **Marashi** [154] et al in their study found that; there was no sedative effect associated with administration of ondansetron intravenously to prevent spinal induced hypotension.[154]

In the present study, sedation score readings may be attributed to addition of nalbuphine as a sedative effect after intrathecal injection. Effects of ondansetron were evaluated in controlled trials to prevent postoperative nausea and vomiting and the incidence of side effects on central nervous system was very rare.[247]

As regard patient satisfaction score, in group I, 45% of patients were extremely satisfied, 40% were satisfied and 15% were neither satisfied nor dissatisfied. In group II, 20% were extremely satisfied, 30% were satisfied, 30% were neither satisfied nor dissatisfied and 20% were dissatisfied. Comparison of the two studied groups revealed that it was significantly higher in group I than in group II.

In agreement with the results of the present study, **Kalavaini V** [248] et al compared between spinal versus general anaesthesia for LC on fifty patients. They found that spinal anaesthesia as the sole anaesthetic technique is feasible, safe and cost effective with high patient satisfaction for elective LC.[248]

Also, **Sangeeta Tiwari** [241] et al evaluated spinal anaesthesia as a sole anaesthetic technique for LC on 234 patients. They found that LC done under spinal anaesthesia as a routine anaesthesia of choice is feasible and safe. Spinal anaesthesia can be recommended to be the anaesthetic technique of choice for conducting LC.[241]

Patients' satisfaction in the present study may be attributed to: first, in ondansetron group there was less haemodynamic changes and stable heart rate and blood pressure which decreased amount of vasopressors needed to maintain stability of the haemodynamics after spinal anaesthesia with less sensation of palpitation and tachycardia. Second, in ondansetron group there was less incidence of nausea and vomiting in intraoperative and postoperative periods. Third, the intensity of pain was minimal due to postoperative analgesia provided by local anaethetic agent and fentanyl.

As regard surgeon satisfaction score, in group I, 50% of surgeons were extremely satisfied, 40% were satisfied and 10% were neither satisfied nor dissatisfied. In group II, 15% were extremely satisfied, 35% were satisfied, 45% were neither satisfied nor dissatisfied and 5% were dissatisfied. Comparison of the two studied groups revealed that, it was significantly higher in group I than in group II.

In agreement with the results of the present study, **Kar M** [57] et al evaluated spinal anaesthesia as a technique of choice for low pressure LC on three hundred patients. They reported that; the operation was successfully performed in 291 patients without major complications.

There was decreased postoperative pain and decreased incidence of nausea and vomiting. Four patients denied operation under spinal anaesthesia. All surgeons and patients were satisfied on follow up.[57]

Also, **Imbelloni L** [42] studied 369 patients to compare thoracic to lumbar spinal anaesthesia for LC and low pressure CO2. He found that LC can be performed successfully under spinal anaesthesia with low-pressure pneumoperitoneum of CO2 and the use of lumbar puncture and low doses of hyperbaric bupivacaine provided better hemodynamic stability, less hypotension, and shorter duration of sensory and motor blockade than thoracic spinal anaesthesia with conventional doses.[42]

Also, **Bessa S** [52] et al compared spinal anaesthesia to general anaesthesia in 180 patients undergoing day case LC (DCLC). They found that DCLC performed under spinal anesthesia was feasible, safe, associated with less postoperative pain, lower incidence of postoperative nausea and vomiting and therefore lower incidence of overnight stay compared to LC performed under general anesthesia.[52]

Surgeons' satisfaction in the present study may be attributed to; ondansetron given in group I decreased incidence of nausea and vomiting during operation which decreased straining movements. There was less incidence of hypotesion which maintained good perfusion to the tissues and almost normotensive state which provided good circumstances to do haemostasis during operation.

As regard complications, in group I 10% of patients had shoulder pain and there was no incidence of respiratory depression, chest pain, postdural puncture headache (PDPH), pruritis or urine retention. In group II 5% had shoulder pain, 5% had PDPH and there was no incidence of respiratory depression, chest pain, pruritis or urine retention. Comparison of the two studied groups revealed that; there were no significant differences in incidence of complications.

In agreement with the results of the present study, **T. Sahoo**[156] et al, **Marashi**[154] et al and **Owczuk**[235] et al found no significant differences in the incidence of side effects and complications in their studies.

Also, **Trabelsi W** [249] et al evaluated the effect of ondansetron on the occurrence of hypotension and on neonatal parameters during spinal anaesthesia for elective caesarean section. They found that prophylactic intravenous ondansetron (4 mg) had a significant effect

on the incidence of hypotension in healthy parturients undergoing spinal anaesthesia with bupivacaine and sufentanil for elective caesarean delivery without any side effects.[249]

In the present study, decreased incidence of shoulder pain may be attributed to application of low pressure pneumoperitoneum (< 12 mmHg) with low amount and pressure of carbondioxide that may irritate the diaphragm. Decreased incidence of respiratory depression may be attributed to administration of low dose of fentanyl (25µg) intrathecally with minimal effect on respiratory centers also it may be attributed to sparing of diaphragm and intercostals muscles during spinal block. Decreased incidence of PDPH may be attributed to usage of 25 gauge spinal needle and giving preload intravenous fluids.

Evolutional changes in the LC had made it a vulnerable surgical solution of biliary diseases to wide range of targeted age groups and patients with other comorbidities, which made the anaesthetic technique more difficult to deal with such patients.[228]

Studies were made on performing LC by using spinal block instead of general anaesthesia. It provides many advantages over general anaesthesia hence its usage become more accepted by surgeons and patients than before.[248] In the present study ondansetron provided more satisfaction and acceptance by reducing bradycardia and hypotension which are the most common side effects of spinal block. It also prevented the incidence of nausea and vomiting which were the annoying thought that disturb surgeons and making them prefer general anaesthesia in the past. It also decreased the incidence of pruritis that occurs with addition of adjuvant to intrathecal block like fentanyl or morphia.[216-218]

SUMMARY

LC is a minimally invasive procedure and one of the most common operations that has gained worldwide acceptance as standard surgery for gallstones disease. It is usually performed under general anaesthesia. It does not require cutting of abdominal muscles, resulting in less pain, quicker healing, improved cosmetic results, and fewer complications such as infection and adhesions. Most patients can be discharged on the same or the following day of surgery and can return to any type of occupation in about a week. It can be done by multiple incisions or by single incision through the umbilicus. These patients often recover faster than traditional methods, and have an almost invisible scar.

Spinal anaesthesia is a less invasive technique and has less complications and mortality rates compared with general anaesthesia. It provides intraoperative analgesia and muscle relaxation in conscious and compliant patients without any systemic drugs that makes it preferred in patients with liver or kidney diseases. It avoids the risks of hypoxia or hypercapnia accompanied with general anaethesia. It also provides potent postoperative analgesia with a lesser consumption of systemic opioid than general anaesthesia.

At the same time, spinal anaesthesia may be associated with complications. The most common complications are hypotension and bradycardia. Hypotension after spinal anaesthesia is initially due to a blockade of sympathetic fibers leading to a drop in systemic vascular resistance. Spinal-induced bradycardia is multifactorial but is in part due to the Bezold-Jarisch Reflex. This reflex is mediated by serotonin receptors within the wall of the ventricle in response to systemic hypotension. These receptors, the 5HT3 subtype, cause an increase efferent vagal signaling when bound by serotonin released during hypovolemic states, clinically leading to bradycardia and further hypotension.

Ondansetron is a serotonin 5-HT_3 receptor antagonist used to prevent nausea and vomiting caused by cancer chemotherapy, radiation therapy and surgery. It also has off-label use for treatment of hyperemesis gravidarum. It has been safely used to blunt the Bezold-Jarisch Reflex, resulting in less bradycardia and hypotension first in animals and later in humans undergoing spinal anesthesia.

The aim of this work was studying the effects of ondansetrone for reduction of spinal analgesia induced hypotension in LC.

Patients and Methods:

After approval of the local ethics committee and an informed written consent from each patient, the current study was carried out in Alexandria Main University Hospital on 40 patients undergoing LC under spinal anaesthesia; in a prospective, randomized study. The sample size was determined by High Institute of Public Health, Biostatistics Department. Inclusion criteria: Patient of American Society of Anesthetists (ASA) physical status I or II, operations lasting from one to two hours. Exclusion criteria: Patients with contraindications to spinal anaesthesia, (Patient refusal, low fixed cardiac output states, infection at or near site of injection and neurological deficit), history of hypersensitivity to ondansetron or local anaesthetic agents, patients receiving selective serotonin reuptake inhibitors or migraine medications and those who were converted to general anaesthesia.

Patients were divided randomly into two groups:

Group I: patients received intravenous ondansetron 4 mg diluted in 10 mL of normal saline over 1 min, 5 min before spinal anaesthesia.

Group II: patients received intravenous normal saline 10 mL over 1 min, 5 min before spinal anaesthesia.

Preoperative evaluation of the patients was carried out through proper history taking and clinical examination routine laboratory investigations. A peripheral 18-gauge i.v. cannula was inserted. All patients received Ringer's solution 10 mL/kg given over 30 min as a preload. They were divided into two groups as mentioned before. Standard monitoring was established using a multichannel monitor Drager infinity vista xl, Germany. After injection of the studied solution by five minutes, patients were placed in the sitting position and skin was prepared with betadine 10%. At the puncture site, 2 ml of 2% lidocaine were injected subcutaneously. The puncture was performed at L_{2-3} interspace using a 25 gauge Quinke spinal needle and injection of 3ml of 0.5% hyperbaric bupivacaine plus 0.5 ml fentanyl (25µg). After injection, patients were in the supine position till the level of sensory block reached T4. When the sensory block reached T4 dermatome and Bromage score 3 (patient can not flex ankles, knees or hips) surgery was allowed to start. Sedation was given in the form of 4 – 6 mg nalbuphine. Oxygen by face mask was given at 6 L/min throughout the

procedure. Intraoperative fluid infusions were calculated and given according to body weight. Surgery was started by small incision at the umbilicus through which abdominal cavity was entered. The surgeon inflated the abdominal cavity by low pressure pneumoperitoneum (<12 mmHg) with carbon dioxide to create a working space. The camera was placed through the umbilical port and the abdominal cavity was inspected. Additional ports were opened inferior to the ribs at the epigastric, midclavicular, anterior, axillary positions through which surgery was done.

Measurements:

The following demographic data were measured for each patient: age (years), sex (male / female), weight (kg) and duration of the operation (minutes). Haemodynamic measurements included; heart rate, mean arterial blood pressure and arterial oxygen saturation. These parameters were measured before and immediately after intrathecal injection and then at 5, 10, 15 minutes, and then every 15 minutes till the end of the procedure, then hourly for six hours postoperatively. End tidal carbondioxide was measured by a capnomask before intrathecal injection, immediately after injection and then every 15 minutes till the end of the procedure. Nausea and vomiting score was assessed every 15 minutes till the end of the procedure and then hourly for six hours postoperatively. Sedation was estimated using Ramsey sedation scale every 15 minutes till the end of the procedure and then hourly for six hours postoperatively. Patient and surgeon satisfaction were assessed at the end of the procedure at the recovery room using patient and surgeon satisfaction scores. Complications for example: respiratory depression, shoulder pain, PDPH, nausea and vomiting, chest pain, pruritis and hypersensitivity reaction were reported and properly treated.

Results:

As regard demographic data: There were no significant differences between the two groups as regards age (P=0.644), sex (P = 0.749), weight (P = 0.629) and duration of the operation (P = 0.852).

As regard heart rate changes; in group I it decreased insignificantly at 10, 15, 30, 45, 60, 75, 90, 105 and 120 minutes after intrathecal injection and after 1, 2, 3 and 6 hours postoperatively. In group II, it decreased significantly at 30, 45, 60, 75 and 90 minutes after intrathecal injection. It decreased insignificantly immediately and at 5, 10, 15, 105 and 120 minutes after intrathecal injection and at 1, 2, 3 and 6 hours postoperatively.

Comparison between the two studied groups revealed that heart rate was significantly lower in group II than in group I at 5, 10, 15, 30, 45, 60, 75, 90, 105 and 120 minutes after intrathecal injection and at one hour postoperatively. There were no other significant differences between the two groups.

As regard mean arterial blood pressure (MABP); in group I, it decreased insignificantly immediately and 5 minutes after intrathecal injection. It decreased significantly after 10, 15 and 30 minutes after intrathecal injection. There were no other significant changes throughout the times of measurement intra or postoperatively. In group II, it decreased insignificantly immediately and 5 minutes after intrathecal injection. It decreased significantly after 10, 15, 30, 45, 60 and 75 minutes after intrathecal injection. There were no other significant changes throughout the times of measurement intra or postoperatively. Comparison between the two studied groups revealed that; there were no significant differences between the two groups immediately and at 5 minutes after intrathecal injection. It was significantly lower in group II than in group I at 10, 15, 30, 45, 60, 75, 90, 105 and 120 minutes after intrathecal injection. There were no significant differences in the postoperative period.

As regard arterial oxygen saturation, in group I and II there was no significant change in intraoperative or postoperative periods compared to preoperative readings. Comparison between the two studied groups revealed that; there was no significant difference through intraoperative and postoperative periods.

As regard end tidal carbondioxide ($etco_2$), in group I it increased significantly at 15, 30, 45, 60, 75, 90, 105 and 120 minutes after intrathecal injection. In group II it increased significantly at 15, 30, 45, 60, 75, 90, 105 and 120 minutes after intrathecal injection. Comparison between the two studied groups revealed that; there was no significant difference between the two groups throughout the whole intraoperative period.

As regard incidence of nausea and vomiting, in group I, there were no significant changes intra and postoperatively. In group II it increased significantly at 15, 30, 45 and 75 minutes after intrathecal injection. It also increased significantly at 1, 2, 3 and 4 hours postoperatively. Comparison between the two studied groups revealed that nausea and vomiting score was significantly higher in group II than in group I at 15, 45 and 75 minutes

after inrtathecal injection intraoperatively and at 5 hours postoperatively. There were no other significant differences between the two groups intra and postoperatively.

As regard sedation score, in group I, It decreased significantly at 45, 60, 90, 105 and 120 minutes after intrathecal injection. It also decreased significantly at 1, 2, 3, 4, 5 and 6 hours postoperatively. In group II, It decreased significantly at 60, 75, 90, 105 and 120 minutes after intrathecal injection. It also decreased significantly at 1, 2, 3, 4, 5 and 6 hours postoperatively. Comparison between the two studied groups revealed that, there was no significant difference in the whole period of operation and in the postoperative period.

As regard patient satisfaction score, in group I, 45% of patients were extremely satisfied, 40% were satisfied and 15% were neither satisfied nor dissatisfied. In group II, 20% were extremely satisfied, 30% were satisfied, 30% were neither satisfied nor dissatisfied and 20% were dissatisfied. Comparison of the two studied groups revealed that it was significantly higher in group I than in group II.

As regard surgeon satisfaction score, in group I, 50% of surgeons were extremely satisfied, 40% were satisfied and 10% were neither satisfied nor dissatisfied. In group II, 15% were extremely satisfied, 35% were satisfied, 45% were neither satisfied nor dissatisfied and 5% were dissatisfied. Comparison of the two studied groups revealed that, it was significantly higher in group I than in group II.

As regard complications, in group I 10% of patients had shoulder pain and there was no incidence of respiratory depression, chest pain, postdural puncture headache (PDPH), pruritis or urine retention. In group II 5% had shoulder pain, 5% had PDPH and there was no incidence of respiratory depression, chest pain, pruritis or urine retention. Comparison of the two studied groups revealed that; there were no significant differences in incidence of complications.

Conclusions:

LC can be performed under spinal anaesthesia, whenever indicated, without significant side effects. Intravenous ondansetron (4mg) decreases the incidence of spinal induced hypotension and bradycardia. Premedication with intravenous ondansetron (4mg) decreases the incidence of nausea and vomiting significantly intra and postoperatively.