DISCUSSION

The choice of anaesthesia for caesarean section depends on many factors including indication for the operation, degree of urgency, the desire of the parturient and also the experience of the anaesthesiologist.[1] Regional anaesthesia has become the preferred technique as general anaesthesia has been associated with higher maternal mortality.[7]

Spinal anaesthesia for elective caesarean delivery has many advantages including being a single injection, faster, easier, more economic, need less equipped area, need lower doses of local anaesthetics yet produces a denser blocking effect, less neonatal exposure to potentially depressant drugs, decreased risk of maternal pulmonary aspiration, awake mother to witness the birth of her child and better early postoperative analgesia.[130] Spinal anaesthesia has advantages over epidural analgesia that it can be used in urgent cases as rapid analgesia and adequate muscle relaxation can be obtained.[131]

Hypotension is one of the most common complications following spinal anaesthesia for caesarean delivery, the incidence of maternal hypotension, usually defined as a decrease in systolic blood pressure more than 20 mm Hg from the pre-anaesthetic value, can be as high as 80%. These haemodynamic changes result from block of vasomotor tone which is primarily determined by sympathetic fibers arising from T5 to L1 innervating arterial and venous smooth muscles. Blocking of these nerves causes vasodilatation of the venous capacitance vessels, pooling of blood, and decreased venous return to the heart, that is accentuated by compression of the aorta and inferior vena cava by the gravid uterus when the patient is in the supine position.[132]

Since spinal anaesthesia offers major clinical advantages for caesarean delivery, several studies were done to analyze the different preventive and curative strategies for the management of hypotension during spinal analgesia for elective cesarean section. [133, 134]

The significance of maternal hypotension lies in the threat to the well-being of both mother and fetus if the reductions in the blood pressure and cardiac output are not promptly recognized and corrected. Brief episodes of maternal hypotension have lowered Apgar scores, prolonged the time to sustained respiration and produced fetal acidosis.[135,136] With short periods of hypotension (not more than 2 minutes), they have observed minimal fetal acidosis but no effect on newborn neurobehavioral findings between 2 to 4 hours of age.[137]

The current study was carried out to evaluate the efficacy of pre-emptive intravenous administration of granisetron to decrease the degree of hypotension and shivering in patients undergoing elective caesarean section under spinal anaesthesia.

The study was carried out at AL Shatby University Hospitals on 60 obstetric patients belonging to ASA physical status I and II between 20- 40 years of age and undergoing an elective lower segment caesarean section (CS), after the approval from the Local Ethical Committee and informed written consents were taken from all the patients of the study.

Patients were randomly assigned into two equal groups (30 patients for each group) according to drug(s) administrated intravenously (IV) 5 mins before spinal anaesthesia.

Group G: Patients received IV Granisteron 1mg diluted in 10 ml of normal saline.

Group S: Patient received IV Normal saline 10 ml.

In the present study there were insignificant differences between both groups as regard the parturient age, their weight, height and the duration of operation.

In the current study, there were insignificant differences in the heart rate between the two groups throughout all times of measurement although occurrence of compensatory tachycardia due to hypotesion.

This is may be due to that the level of the spinal sensory block required had not exceeded T4, i.e. there were no affection of the cardiac accelerator fibers which originate from T1-4. Also, the patients of the study were given adequate intravenous fluid preloading before the spinal anaesthesia, which compensated, to a great extent against the sympathetic block-induced by the spinal anaesthesia. Lastly, the patients of the study were chosen as young adults, ASA I-II, and with adequate cardiopulmonary reserve. [138]

Coinciding with the result of present study, Sousaan R and Moslemi F reported that there was also no evidence of bradycaria in their study on 56 parturient receiving intrathecal bupivacaine alone or combined with mini-dose of fentanyl of 25 μg. [139]

Also, Hannas et al, [140] reported that unlike tetracaine used in subarachnoid injection, hyperbaric bupivacaine caused a higher rise in catecholamines level and this is probably the reason for lower incidence of bradycardia. They also reported that changes in heart rate variability parameters in the course of spinal analgesia may reflect a decrease in sympathetic activity and a relative increase in parasympathetic activity as a result of the block and in the course of spinal analgesia, the more pronounced the changes in heart rate variability were the more distinct the hypotension.

In contrast to the result of the present study, Lesser et al,[141] mentioned that risk factors for bradycardia and asystole during neuraxial anaesthesia include two forms of bradycardia one caused by vagal mechanisms and the other by the sympathetic denervation of the heart. He concluded that moderate to severe bradycardia can occur at any time during neuraxial anesthesia regardless of the duration of anesthesia and that low baseline heart rate increases the risk of bradycardia.

Also, Palmese et al, [142] explained that bradycardia after spinal anaesthesia in parturients undergoing caesarean section is secondary to a relative parasympathetic dominance, increased baroreceptor activity, or induction of the Bezold Jarisch Reflex (BJR).

In the present study, the mean arterial blood pressure (MABP) decreased significantly in patients of both groups following spinal anaesthesia in spite of preloading and left lateral position. This significant decrease in MABP was due to sympathetic block. This sympathectomy cause arterial and venous vasodilatation of blood vessel in lower half of the body which lead to decrease in peripheral vascular resistance and hypotension. Also, aortocaval compression is one of the causes of hypotension in pregnant women in the supine position. [15]

Hypotension that occurred was treated with IV fluid and increments of intravenous ephedrine in a dose of 6 mg each time Also, can be repeated till MABP is corrected.[143]

Similar to the result of the present study, Ueland and colleagues, [144] compared the supine position and lateral position following spinal anaesthesia for caesarean section. They found a significant decrease in blood pressure (B.P) from 124/72 to 67/38mmHg in mothers who were placed in the supine position following the induction of spinal anaesthesia, whereas the decrease in blood pressure was less significant, averaged 100/60mmHg for mothers in the lateral position.

Mercier et al, [133] compared crystalloid preload, colloid preload and vasopressors (such as ephedrine and phenylephrine) to prevent hypotension associated with spinal anaesthesia for caesarean section. They found that crystalloid preload alone was ineffective; colloid preload was effective but might be better used as second line of treatment. They also reported that the association of vasopressors with a rapid crystalloid preloading at the time of spinal injection was the most effective.

Desalu and Kushimo,[134]compared traditional crystalloid preloading (1 L normal saline 0.9%) and ephedrine infusion (30 mg ephedrine in 1 L normal saline 0.9%). They stated that prophylactic ephedrine infusion was more effective than crystalloid preloading in the prevention of hypotension during spinal anaesthesia for elective caesarean section.

Comparing the two groups the decrease in MABP was significantly less in group G when compared to group S patients. This may be explained by the fact that granisetron inhibit BJR. Granisetron is serotonin 5-HT3 antagonist used mainly to prevent nausea and vomiting caused by cancer chemotherapy, radiation therapy and surgery. This could be explained by mechanoreceptors in the heart wall that trigger the BJR, participate in systemic responses to hyper- and hypovolaemia. In response to hypovolaemia, stimulation of cardiac sensory receptors in the left ventricle induces the BJR and results in reflex bradycardia, vasodilation and hypotension. Also, chemoreceptors are activated in response to decreased blood volume by serotonin, which is released from activated thrombocytes. Activation of 5-HT3 receptors, which are G protein coupled, ligand-gated fast-ion channels, results in increased efferent vagal nerve activity, frequently producing bradycardia. [145-148]

Similar to the result of the present study, Tsikouris et al, [149] who study the effect of granisetron on head up tilt (HUT) induce syncope. They found in their study on 17 patients undergoing head-up tilt (HUT); nine of patients were received (40µg/kg) granisetron and eight of them were received (160µg/kg), 47% of patients responded to granisetron therapy, whereas 44% and 50% of patients on the (40µg/kg) dose group and (160µg/kg) dose group had suppression of (HUT) induce syncope due to BJR. However, there does not appear to be a marked dose-response relation with granisetron.

Also, Shrestha BK et al, [150] in their study on sixty patients ASA I and II patients undergoing lower abdominal surgeries were randomized to receive either normal saline (control) or granisetron 40 mcg/kg intravenously five minutes before subarachnoid block. Heart rates, systolic blood pressure, diastolic blood pressure and mean arterial pressure were recorded every two minutes for ten minutes and then every five minutes for another twenty minutes. They found there was decrease in all measured variables of systolic blood pressure and mean arterial blood pressure when compared with baseline values in both

groups. But there was less reduction in diastolic blood pressure in granisetron group which is statistically significant at 10, 15, 20, 25 and 30 minutes and this is may be due to the effectiveness of granisetron in the prevention of the Bezold Jarisch Reflex.

Also, Owczuk et al,[151] verified the hypothesis that blockade of type 3 serotonin receptors by intravenous ondansetron administration may reduce hypotension and bradycardia induced by spinal anaesthesia in non-obstetric patients. Seventy-one patients were selected and randomized for the study. Thirty-six patients received intravascular ondansetron 8 mg and thirty-five patients received a placebo of normal saline five minutes prior to the administration of spinal anaesthesia. Hemodynamic measurements were recorded at designated intervals prior to and after administration of spinal anaesthesia. The authors of this study reported higher minimal systolic and mean blood pressure values in patients who were given 8mg intravenous ondansetron before spinal anaesthesia, compared to patients in the placebo group.

In contrast to the result of present study, Mowafi et al,[152] in their study on sixty patients undergoing elective caesarean section under spinal anaesthesia were randomly divided into three groups (20 pregnant females of ASA I–II physical status in each group). Group O received intravenous 4 mg ondansetron diluted in 10 ml normal saline and injected over 1 min, 5 min before spinal anaesthesia, group G given intravenous 1 mg granisetron by the same route and group S given 10 ml normal saline. Mean arterial blood pressure, heart rate, vasopressor use, sensory, and motor blockade were assessed. They found that IV granisetron prior to intrathecal bupivacaine had no effects on the haemodynamic variables. These differences between the effects of ondansetron and granisetron although both of them from the same category and the same mechanism of action may be due to the action of ondansetron on mixed receptors and the high selectivity of granisetron on 5-HT3 receptors but minimal affinity of it for other 5-HT receptors, adrenergic, histaminic, dopaminergic, or opioid receptors

In the present study, there were insignificant differences between the two groups regarding oxygen saturation all through the measuring intervals which may be attributed to the non involvement of the intercostal muscles and/or diaphragm during motor blockade as a result of the small doses of the local anaesthetics, [153] and the supplemental oxygen administration through a face-mask throughout the whole procedure. [154]

Siriussawakul et al, [155] study the effect of supplemental oxygen (O_2) through nasal cannula versus having no supplement (i.e., room air only) in uncomplicated caesarean deliveries under spinal anaesthesia and benefits for both mother and infant of administering supplemental. Healthy parturients at term undergoing elective caesarean section under spinal anaesthesia were randomly allocated into two groups: an oxygen group (n = 170), who received 3 LPM oxygen via a nasal cannula; and a room-air group (n = 170), who were assigned to breathe room air. Maternal oxygen saturation was measured continuously by using pulse oximeter. The desaturation was determined by oxygen saturation <94% over 30 seconds. Umbilical cord gases and Apgar scores were collected followed delivery of the infant. All maternal desaturation events occurred in 12 parturients assigned to the room-air group. Most events were concurrent with hypotension. The umbilical venous partial pressure of oxygen was significantly higher in the oxygen group. The other blood gas measurements and Apgar scores were not significantly different between the two groups.

In the present study, we found that there was no significant difference between two studied group regarding APGAR score monitoring of newborn after 1min and 5min.

Similar to the present study, Sayed and Ezatt,[156] in their study on 117 ASA I-II parturient women undergoing elective caesarean delivery were enrolled. Patients were randomly allocated into two groups: group G (n = 58) received 3 mg in 3ml granisetron intravenously and group P (n = 59) received 3 ml intravenous normal saline before performing spinal anaesthesia. Spinal anaesthesia was performed in all patients using 10 mg heavy bupivacaine 0.5% and 15 µg fentanyl. They found that no significant differences between both groups regarding APGAR score at 1 min.

In the present study nausea and vomiting were significantly less in group G than S parturients. This is due to maternal hypotension after induction of spinal anaesthesia lead to decrease in cerebral blood that may trigger the vomiting center to induce emesis due to hypoxia. Also, peritoneal traction and exteriorization of uterus.[157] During caesarean section, like other abdominal surgeries, the physical disruption and manipulation of abdominal viscera may cause the release of humoral substances including 5-HT, which may stimulate 5-HT3 receptors on the afferent vagus nerves, triggering the emetic reflex especially in awake patients.[158]

Nausea and vomiting during regional anaesthesia for caesarean section is 50%- 80% without prophylactic antiemetic. The etiology of emetic symptoms in these cases is complex. The effects of spinal anaesthesia on women on their labor period are different from those observed in non-obstetric patients and this is due to high level of progesterone that causes smooth muscle relaxation, delayed gastric empty, increase gastric acidity and increase gastro-esophageal reflux.[159,160]

Nausea and vomiting were treated with metoclopramide in a dose of 10 mg and Dexamethazone 8mg.[161]

Five major neuro-transmitter systems appear to play important roles in mediating the emetic response, viz. dopaminergic, histaminic (H1), cholinergic, muscarinic, and 5HT3.[162]

Similarly to the result of the present study, Fujii et al,[163] who performed their study on 80 parturients received granisetron 40 µg/kg or placebo (n = 40 each) intravenously, immediately after clamping of the fetal umbilical cord. Nausea, vomiting, and adverse events were observed for 24 h after administration of spinal anaesthesia. Prophylactic use of 40 µg/kg granisetron is effective for preventing emetic episodes during spinal anaesthesia for caesarean delivery.

Conciding with the result of present study, Dasgupta et al, [164] who studied 80 women (ASA I–II) aged 22–35 years undergoing elective caesarean delivery were recruited for the study. Group G received intravenously Granisetron 40 µg/kg and Group P received placebo (0.9 % saline) immediately after clamping of the fetal umbilical cord. Nausea, vomiting, and adverse events were then observed for 24 h after administration of spinal anesthesia. They found that incidence of nausea and vomiting during and 24hrs after spinal anaesthesia 20% in group G and 55% in group P. Granisetron is highly effective for preventing nausea and vomiting during and after spinal anaesthesia for caesarean section.

Also, Fujii et al.[165] In their study on 120 patients received granisetron 3mg, droperidol 1.25mg, metoclopramide 10mg or placebo (saline) (n=30 of each) IV immediately after clamping of the foetal umbilical cord. Nausea, vomiting and safety assessments were performed during and after spinal anaesthesia for caesarean section. The incidence of intraoperative, post-delivery nausea and vomiting was 13%, 17%, 20% and 63% after administration of granisetron, droperidol, metoclopramide and placebo, respectively. Granisetron is highly effective for preventing nausea and vomiting during and after spinal anaesthesia for caesarean section. Droperidol and metoclopramide are effective for the prevention of intraoperative, post-delivery emesis, but are ineffective for the reduction of the incidence of postoperative emesis and this may due to longer duration of action of granisetron for 24h compared with other drugs.

Similarly, Gupta et al,[166] in their study on 90 patient undergoing laparoscopic surgeries. The patients were divided into three groups of 30 patients each. In group G (granisetron), patients received 40 mcg/ kg intravenously 3 min before induction. Group O (ondansetron) patients received 80 mcg/ kg intravenously 3min prior to induction while group C (saline) patients received 3 ml of 0.9% normal saline as control. All the patients were selected for general anaesthesia and observations were made for pulse rate, blood pressure, nausea, vomiting and side effects of the drugs under study up to 12 hours postoperatively. The frequency of nausea was 10%, 30% and 40% in group-G, group-O and group-C respectively .The statistical analysis shows that granisetron is significantly efficient for prevention of post-operative nausea and vomiting (PONV) ($p<0.05$) in comparison to ondansetron and is highly significant ($p<0.01$) in comparison to control group. As far as the side effects of the drugs are concerned, postoperative headache, dizziness, diplopia and shivering was significantly higher in ondansetron groups. Thus, it was concluded that intravenous granisetron 40 mcg/ kg intravenously is superior to ondansetron 80 mcg/ kg as a prophylactic antiemetic in laparoscopic surgeries in controlling PONV with less side effects.

In contrast to the result of the present study, Balki et al,[167]in their study on 176 parturients ASA I–II undergoing elective caesarean delivery. After administration of 10 mL/kg of lactated Ringer's solution, spinal anaesthesia was administered with 0.75% hyperbaric bupivacaine 15 mg, fentanyl 10 microgram, and morphine 100 microg. Systolic blood pressure was maintained at 100% of baseline with aliquots of phenylephrine. Oxytocin 0.5 IU was administered IV upon delivery followed by a maintenance infusion. The patients received either granisetron 1 mg or normal saline IV immediately after cord clamping. In case of persistent intraoperative nausea and vomiting (IONV), rescue dimenhydrinate 50 mg IV was administered. The incidence of post delivery IONV was 20.4% in the granisetron group and 17.0% in the control group. The requirement for rescue antiemetic (8% vs. 6.8%, $P = 0.77$) were similar in the granisetron and control groups. This is may be due to use of intrathecal opioids especially morphine which increase incidence of nausea and vomiting. [168]

In this study the incidence of shivering was reduced in group G compared to group S patients and shivering is due to increase heat loss by peripheral vasodilatation caused by sympathectomy. Also, we avoid exposure of the patients to cold environment in method of keeping the operating rooms at 21°C and all patients were covered with one layer of surgical drapes over the chest, thighs and calves during the operation and one cotton blanket over the entire body after operation body cavity exposure, hyperbaric bupivacaine

0.5% was kept at room temperature at 21°C before intrathecal injection. Also, intravenous fluid was kept warm.

Serotonin is a biological amine found in the brain and spinal cord, has a role in neurotransmission and studies suggested that the serotonergic system has a role in control of post anaesthetic shivering. [77]5-hydroxytryptamine may influence both heat production and heat loss pathways. Granisetron is 5-HT_3 receptor antagonist and this may explain its use for control of shivering. [56]

Shivering was treated by IV pethidine 25 mg, if shivering score was (Grade 3). [78] It was given to two patients in group G and four patients in group S.

Similarly to the result of present study, Bock and colleagues,[169]mentioned in their study that dolasetron 1mg.kg decreases the incidence of shivering from 62% to 27% and to 17% for patients who received granisetron.

Also, Sajedi and colleagues,[170]carried out a study which evaluated the efficacy of granisetron in comparison with pethidine and tramadol in preventing post-anaesthetic shivering in patients undergoing elective orthopedic surgery under general anaesthesia and found that the number of patients with observable shivering was 57% in group P (placebo), 27% in group G (granisetron), 21% in group T (tramadol), and 18% in group M (Pethidine). Granisetron significantly reduced the incidence of shivering in comparison with placebo (P = 0.013). So they concluded that the prophylactic use of granisetron 40 µg/kg is as effective as pethidine (0.4 mg/kg) and tramadol (0.1 mg/kg) in preventing post-anaesthetic shivering.

Also, Iqbal A et al, [171] in their study performed on ninety patients aged 20-60yrs, ASA physical status I and II, were randomly allocated to receive either normal saline (Group S, n=30) as negative control, pethidine 25mg (Group P, n=30) as positive control or granisetron 40mcg.kg^{-1} (Group G, n=30) intravenously before induction. They found that granisetron 40mcg.kg^{-1} was as effective as pethidine 25mg in preventing shivering related to general anaesthesia, without causing the adverse effect in patient with high expectancy of shivering and postoperative nausea and vomiting.

Our results coincide with those of Eldaba and Amr, [172]who studied the effect of pretreatment with intravenous granisetron 10 µg/kg intravenously diluted in 10 ml saline in reducing postoperative shivering after spinal anaesthesia in children aged 2-5 years in comparison with placebo. They found that shivering did not occur in any patient in group G; it occurred in 15% of patients in group P.

Similar to the present study, Sagir et al, [173] compared placebo, ketamine, granisetron and combination of ketamine and granisetron in prevention of shivering caused by regional anaesthesia. The study was performed on 160 ASA I and II undergoing urological surgery. After 15min shivering was observed in 22 patients of group p, 6 in group G, 7 in group GK and zero group K. Although they found that ketamine was more effective than granisetron in preventing shivering developed during regional anaesthesia, they found that granisetron effectively reduced shivering.

On other hand, Sayed and Ezatt. [156] in their study on 117 ASA I-II parturient women undergoing elective caesarean delivery were enrolled. Patients were randomly allocated

into two groups: group G (n = 58) received 3 mg in 3ml granisetron intravenously and group P (n = 59) received 3 ml intravenous normal saline before performing spinal anaesthesia. Spinal anaesthesia was performed in all patients using 10 mg heavy bupivacaine 0.5% and 15 µg fentanyl. They found that prophylactic intravenous administration of 3 mg granisetron before spinal anaesthesia in parturients undergoing elective caesarean section did not significantly decrease the incidence or severity of shivering and this is may be due to the use of warm intravenous fluid, warm bupivacaine and keeping theater warm in our study, reduce the incidence and severity of shivering.

In the present study, comparison between the two studied groups according to incidence of complications showed statistical insignificant differences and the complications recorded, e.g. (headache, constipations….etc) may be due to complications of spinal anaesthesia not the drug.

Many studies have confirmed the efficacy of granisetron in the prevention of postoperative nausea, vomiting and the prevention of shivering without causing respiratory and cardiovascular side effects and prolongation of recovery time. This agreed with Sajedi et al. [170] which compare the efficacy of granisetron, meperidine, tramadol and placebo in prevention of shivering. They found that the frequency distribution of complications was higher in the meperidine and tramadol groups in comparison with the granisetron and placebo groups.

Also, the result of the present study agreed with Dasgupta et al. [164] found no difference in the incidence of adverse effects between granisetron group and saline group for parturients under spinal anesthesia for cesarean delivery.

SUMMARY

Regional anaesthesia has become the preferred technique for caesarean delivery. Compared to general anaesthesia, regional anaesthesia is associated with reduced maternal mortality, the need for fewer drugs, more direct experience of childbirth, faster neonatal-maternal bonding, decreased blood loss and excellent postoperative pain control.

Hypotension is one of the most common complications following spinal anaesthesia for caesarean delivery. The significance of maternal hypotension lies in the threat to the well-being of both mother and fetus if the reductions in the blood pressure and cardiac output are not promptly recognized and corrected. Brief episodes of maternal hypotension have lowered Apgar scores, prolonged the time to sustained respiration, and produced fetal acidosis.

Since spinal anaesthesia offers major clinical advantages for caesarean delivery, several studies were done to analyze the different preventive and curative strategies for the management of hypotension during spinal analgesia for elective cesarean section.

The aim of this study is to evaluate the efficacy of pre-emptive intravenous administration of granisetron to decrease the degree of hypotension and shivering in patients undergoing elective caesarean section under spinal anaesthesia.

The current study was carried out in the department of anaesthesia, Al Shatby University hospital, on 60 obstetric patients, aged 20-40 years old, ASA I-II, scheduled for elective caesarean section under spinal anaesthesia, after the approval from the Local Ethical Committee and informed written consents from all the patients of the study.

Patients were randomly allocated into two equal groups (30 patients each); group S (Control group) and group G (granisetron group).

All patients had carried out elective caesarean section under spinal anaesthesia. An intravenous access using 18Gauge cannula was placed on the non-dominant arm/ hand of all patients.Each patient received 500 ml Voluven 6% or hydroxy-ethyl starch (HES) before spinal anaesthesia. Patients were randomly allocated into two group (Group G) granisteron 1mg diluted in 10 ml of normal saline and (Group S) normal saline 10 ml was given over 1 min 5min before spinal anaesthesia. The spinal technique performed with the patient in the sitting position at L3-4. Hyperbaric bupivacaine 0.5% (5mg/ml) 12.5 mg were administered intrathecally after confirmation of cerebrospinal fluid through a 25 G Quincke`s spinal needle. Supplemental oxygen (4 L/min) was administered by a simple face mask during the operation.

Hypotension is defined as a decrease in systolic blood pressure more than 20 mm Hg from the preanaesthetic value and bradycardia is defined as less than 60 beats per minute. Hypotension was treated with increments of 10 mg of ephedrine IV, bradycardia with 0.5 mg of atropine IV. Metoclopramide 10 mg and dexamethasone 8 mg were administered for nausea and vomiting. Pethidine was given if shivering score was grade 3.

Hemodynamic measurements (heart rate, mean arterial blood pressure, oxygen saturation), total dose of ephedrine, time of delivery of fetus, incidence of nausea and vomiting, incidence of shivering all were recorded and statistically analyzed.

In the present study there were insignificant differences between both groups as regard the parturient age, weight, height and the duration of operation.

It was found that there were insignificant differences between the two studied groups as regard HR immediately before spinal. All over the period of follow up after the spinal anaesthesia, there were insignificant differences between the two studied groups in heart rate.

There were significant decrease in MABP in group S than group G at all the measured times. Mean of MABP in group G, immediately before spinal anaesthesia, ranged from 70-110 mmHg with a mean of 93.63±10.32 mmHg. Intra-operatively, it decrease significantly at 1, 3, 5, 7, 9, 11,13,15, 17, 19 and 21 min, with mean value 81.70 ± 12.80, 73.40± 14.33, 76.40 ± 12.14, 77.47 ± 13.36, 74.60 ± 11.31, 74.40 ± 12.28, 75.23 ±11.02, 74.10 ±11.34, 76.27±11.91, 78.33 ±10.65, 83.33 ±9.08 respectively. Where p value were <0.001, <0.001, <0.001, <0.001, <0.001, <0.001, <0.001, <0.001, <0.001, <0.001 and <0.017.

While in group S, it was found that the mean of MABP, immediately before spinal anaesthesia, ranged from 70-112 mmHg with mean of 88.67±11.86 mmHg. Intra-operatively, it decrease significantly from baseline at 1, 3, 5, 7, 9, 11, 13, 15, 17, 19 and 21 min, with mean value 74.60 ± 13.42, 65.63 ± 10.75, 62.77 ± 12.18, 67.33 ± 12.14, 67.57 ± 12.58, 65.83 ± 8.71, 67.87 ± 9.69, 68.27 ±9.95, 71.23±7.94, 76.0 ± 8.40, 79.20 ± 8.75 respectively. Where p value were <0.001, <0.001, <0.001, <0.001, <0.001, <0.001, <0.001, <0.001, <0.001, <0.001 and <0.005.

Comparison between the two studied groups as regard oxygen saturation showed insignificant differences at all the measured times.

There was statistical significant decrease in incidence of hypotension in group G than group S.

Comparison between the two studied groups showed statistical significant increase in total dose of ephedrine in group S than group G at all the measured times (p= 0.013). Number of patients who did not require ephedrine supplements were significantly more, in group G about (18) and group S about (9), where p value =0.020.

There were statistical insignificant differences between the studied groups as regard time of delivery of the fetus from skin incision in group G ranged between 3-9 (min), with a mean of 6.47±1.55, while in group S ranged 3-9, with a mean of 6.27±1.70.

There were statistical significant decrease in nausea and vomiting in group G than Group S. With mean of 0.30± 0.60 in group G, while in group S a mean of 0.97±0.93.

Comparison between the two studied groups as regard the incidence of shivering was significantly less in Group G than Group S.

Comparison between the two studied groups as regard complication showed statistical insignificant differences.

CONCLUSION

1. Hypotension is the most frequent complication of spinal anaesthesia in caesarean section and represents about 55–100%. This occurs in spite of each patient were received 500 ml Voluven 6% or hydroxy-ethyl starch (HES) and were kept in left lateral position by applying wedge underneath right buttocks.

2. Intravenous administration of granisetron decreases the degree of hypotension and total dose of ephedrine in patients undergoing elective caesarean section under spinal anaesthesia.

3. Although all patients were covered with surgical drapes over the chest, thighs and calves during the operation to keep patients warm. Also, hyperbaric bupivacaine was kept at room temperature at 21°C before intrathecal injection; theatres in which the operations will be performed will be maintained at constant humidity (70%) and an ambient temperature of around 21°C. Shivering represents about 46% in women receiving neuraxial blockade for labour or CS.

4. Granisetron decrease incidence of shivering in patients undergoing elective caesarean section under spinal anaesthesia and may be as effective as other drugs like pethidine, tramadol and ketamine without causing their side effects.

5. Granisetron has no effect on the fetus as it is evidence in APGAR score and also has no maternal complications.

6. Granisetron can be routinly used as strong antiemetic in management of nausea and vomiting in patients undergoing elective caesarean section under spinal anaesthesia.