AIM OF THE WORK

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.

PATIENTS

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).

Sample size was determined by department of statistics of High Institute of Public Health.

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

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

Group S: Patients received IV Normal saline 10 ml.

Exclusion criteria:

Patients with any contraindication to neuraxial blockade, hypersenstivity to granisteron or receiving selective serotonin reuptake inhibitors (SSRI) were excluded from the study.

METHODS

Pre-operative assessment:

After approval of the local medical ethical committee and an informed written consent taken from all patients included in this study, Patients were assessed thoroughly by:

- Detailed medical and surgical history taking.
- Full clinical examination.
- Routine laboratory investigations (complete blood picture, coagulation profile, blood urea, serum creatinine and fasting blood sugar).
- Oral midazolam (0.02-0.04mg/kg) 30 minutes before admission.
- On arrival to the operating room, patients were connected to the standard monitoring (Trakmon Kontron Limited-England) including:
  - Electrocardiogram (ECG)
  - Peripheral pulse oximeter.
  - Non-invasive arterial blood pressure monitor on the dominant arm.

Anaesthetic technique:

- An intravenous access using 18- Gauge cannula was placed on the non-dominant arm/ hand of all patients.
- Each patient received 500 ml Voluven 6% or hydroxy-ethyl starch (HES); fluids were preheated to 37°C in a warmed cabinet before spinal analgesia.
- Patients were randomly allocated into two groups; (Group G) granisteron received 1mg diluted in 10 ml of normal saline and (Group S) received normal saline 10 ml 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 was kept at room temperature at 21°C. and administered intrathecally after confirmation of cerebrospinal fluid through a 25 G Quincke`s spinal needle.
- Patients were kept in left lateral position by applying wedge underneath right buttocks.
- Upper sensory levels were assessed with a piece of cotton or ice at 2min intervals till the block level achieved.
- Urinary Foley's catheter was inserted for all patients.

- Supplemental oxygen (4 L/min) was delivered via facemask during the operation.
- 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.
- All theatres in which the operations were performed and maintained at constant humidity (70%) and an ambient temperature of around 21°C.
- Maintenance of intravenous fluid were calculated as the following:

Basal requirement for the first ten kg body weight (BW) was calculated by 4ml/kg/hr, second ten kg BW was calculated by 2ml/kg/hr and each remaining kg were calculated by 1ml/kg/hr. Losses were replaced by lactated Ringer's solution.

- All patients were received oxytocin (10-20 IU) IV infusion after delivery of the fetus and placenta
- A decrease in the mean blood pressure by ≥ 20% from baseline value were controlled with IV ephedrine bolus 6mg intravenously which were repeated every 1min; if hypotension persists or recurs. Heart rate <50 beats/min were treated with 0.4mg IV atropine sulfate.[124]
- Post operative analgesia was given in the form of paracetamol 1g IV/8hrs and ketrolac 30mg in 10 ml saline IV/8hrs.

Measurements and recording:

1- Demographic data :

- Age (years)
- Body weight (kilograms).
- Height (centimeter)
- Duration of operation (minute).

2-Haemodynamic parameters:

- Heart rate in beats per minute.
- SpO2 %.
- Non-invasive arterial blood pressure. (Systolic, diastolic and mean in mmHg).
- Timing of haemodynamic parameters:
  - Preoperatively (a baseline value before giving spinal analgesia and after fluid preload).
  - 1 minute after giving spinal analgesia.
  - Every 2 minutes during the first 20 minutes after giving spinal analgesia.

3-Incidence of hypotension:

Hypotension defined as a decrease in the mean blood pressure by ≥ 20% from baseline value.

4- Total dose of ephedrine administered.

5- Time of delivery of fetus after spinal anaesthesia.

6- APGAR score: [125]

It is done at 1min and 5min.

Score 7 and above are generally normal, 4-6 fairly low and 0-3 are critically low.

Table (I): APGAR score

	0	1	2
Appearance (color)	Blue	Pink body blue extremities	All pink
Pulse (heart rate) Normally (120-160/min)	Absent	<100/min	>100/min
Grimace(reflex irritability)	Absent	Grimace	Coughing, sneezing and coughing
Attitude(muscle tone)	Flaccid	Some flexion of extremities	Active motion and good flexion
Respiratory effort (Normally 30-60/min)	Absent	Slow and irregular	Good and strong crying

7- Nausea vomiting scale (NVS): [126]

This scale was recorded throughout operative procedure and up to 6 hours post operative.

Table (II): Nausea vomiting scale [126]

Nausea vomiting scale	Nausea vomiting severity
0	No nausea or vomiting
1	Nausea alone
2	Vomiting or retching once
3	Vomiting or retching two or more times

Nausea and vomiting was treated by dexamethazone 8mg and metochlopramide 10mg

8- Shivering scale: [127]

This scale was recorded throughout operative procedure and up to 6 hours postoperative.

Table (III): Shivering scale [127]

Scale	Type of shivering	Location
0	None	No shivering was detected on palpation of masseter, neck, or chest muscles.
1	Mild	Shivering localized to the neck and thorax only.
2	Moderate	Shivering involves gross movement of upper extremities (in addition to neck and thorax).
3	Sever	Shivering involves gross movement of the trunk and upper and lower extremities.

Shivering was treated by IV pethidine 25 mg, if shivering score was (Grade 3).

9. Any complications were recorded including dizziness or headache.

Statistical analysis of the data [128]

Data were fed to the computer and analyzed using IBM ***SPSS software package version 20.0.*** [129] Qualitative data were described using number and percent. Quantitative data were described using Range (minimum and maximum), mean, standard deviation and median. Comparison between different groups regarding categorical variables was tested using Chi-square test. When more than 20% of the cells have expected count less than 5, correction for chi-square was conducted using Fisher's exact test or Monte Carlo correction. The distributions of quantitative variables were tested for normality using ***Kolmogorov-Smirnov test, Shapiro-Wilk test and D'Agstino test, also Histogram and QQ plot were used for vision test.*** If it reveals normal data distribution, parametric tests was applied. If the data were abnormally distributed, non-parametric tests were used. For normally distributed data, comparison between two independent population were done using independent t-test, comparison between different periods using ANOVA with repeated measures and Post Hoc test was assessed using Bonferroni adjusted. Correlations between two quantitative variables were assessed using Pearson coefficient. For abnormally distributed data, comparison between two independent populations were done using Mann Whitney test. Significance of the obtained results was judged at the 5% level.

RESULTS

The present 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).

Patients were randomly assigned into two equal groups (30 patients for each group) according to drug 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.

From the present study the following results were obtained:

Demographic data:

Age (years) (table IV, fig 5):

The age of patients of group G ranged between 20-38 years with a mean value 27.30±4.91 years. The age of the patients of group S ranged between 20-39 years with a mean value of 26.23±4.14 years. No statistical differences were observed between the two studied groups (P value was 0.367).

Weight (kilograms) (table V, fig6):

The weight of patients of group G ranged between 64-90 kgs with a mean value 75.23±8.08 kgs. The weight of the patients of group S ranged between 62-89 kgs with a mean value of 73.30±7.72 kgs. No statistical differences were observed between the two studied groups (P value was 0.347).

Height (centimeters) (table VI, fig7):

The height of patients of group G ranged between157-167 cm with a mean value 162.57±3.3 cm. The height of the patients of group S ranged between157-167 cm with a mean value of 161.83± 3.33cm. No statistical differences were observed between the two studied groups (P value was 0.395).

Duration of operation (minutes) (table VII, fig8):

The duration of operation in group G ranged between 28-49 minutes with a mean value 36±5.68 minutes. The duration of operation in group S ranged between 27-46 minutes with a mean value of 34.77±4.74 minutes. No statistical differences were observed between the two studied groups (P value was 0.365).

Table (IV): Comparison between the two studied groups according to age (years)

Cases No.	Age (years)	
	Granisetron group	Saline group
1	28	29
2	23	20
3	31	22
4	29	25
5	27	31
6	25	29
7	28	27
8	38	25
9	23	28
10	30	32
11	29	23
12	20	30
13	22	28
14	25	20
15	38	22
16	23	25
17	35	39
18	24	23
19	23	25
20	29	23
21	24	30
22	30	24
23	23	23
24	28	24
25	20	27
26	36	22
27	24	32
28	32	28
29	25	25
30	27	26
Min.	20.0	20.0
Max.	38.0	39.0
Mean	27.30	26.23
SD.±	4.91	4.14
t	0.909	
p	0.367	

t: Student t-test

*: Statistically significant at $p \leq 0.05$

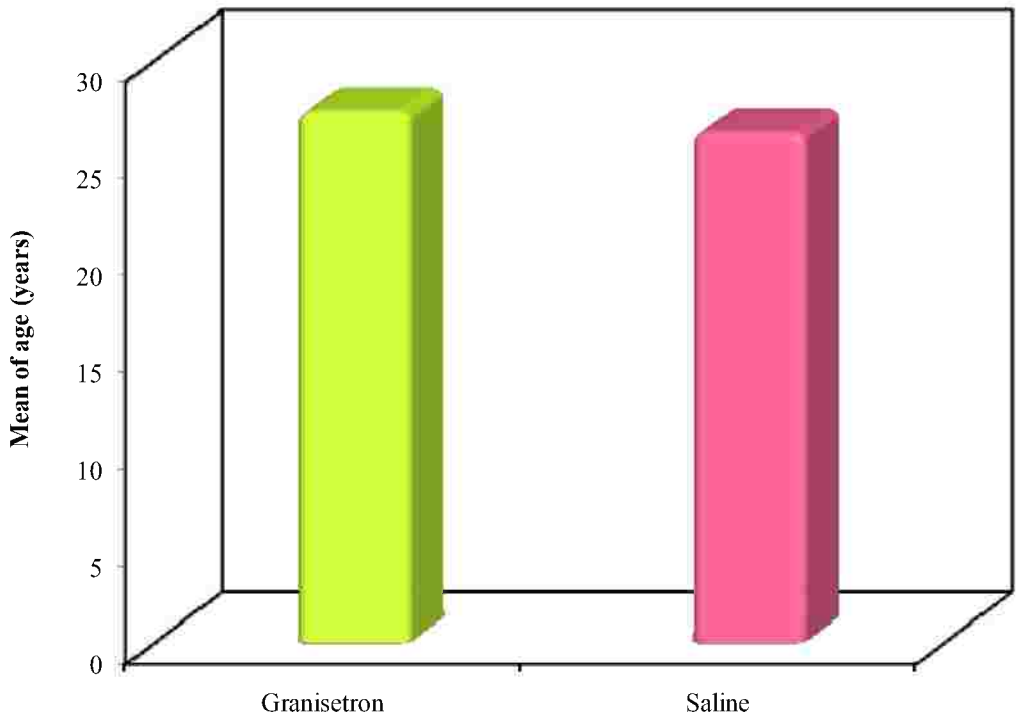

Figure (5): Comparison between the two studied groups according to age (years)

Table (V): Comparison between the two studied groups according to weight (Kg)

Cases No.	Weight (Kg)	
	Granisetron group	Saline group
1	67	62
2	64	64
3	74	74
4	66	66
5	78	78
6	67	89
7	69	67
8	71	71
9	86	68
10	70	87
11	74	70
12	81	76
13	67	72
14	85	68
15	90	66
16	88	79
17	79	63
18	69	81
19	78	65
20	80	65
21	73	71
22	87	76
23	73	73
24	85	79
25	64	80
26	86	81
27	71	89
28	81	77
29	66	65
30	68	77
Min.	64.0	62.0
Max.	90.0	89.0
Mean	75.23	73.30
SD. ±	8.08	7.72
t	0.948	
p	0.347	

t: Student t-test

*: Statistically significant at $p \leq 0.05$

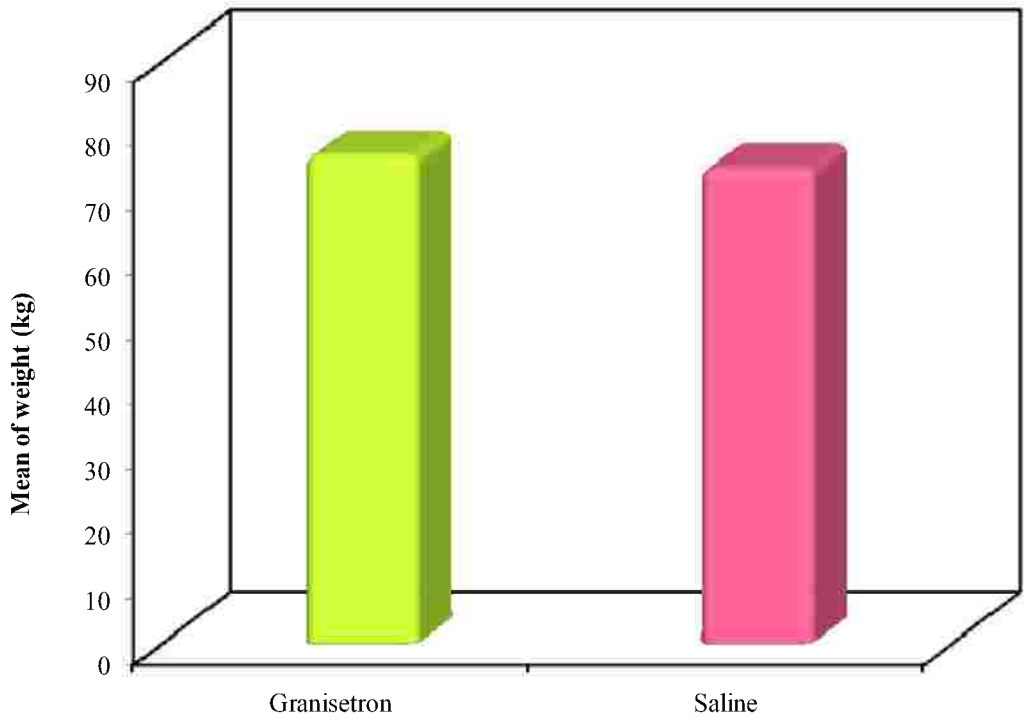

Figure (6): Comparison between the two studied groups according to weight (Kg)

Table (VI): Comparison between the two studied groups according to height (cm).

Cases No.	Height(cm)	
	Granisetron group	Saline group
1	157	158
2	160	158
3	167	165
4	157	160
5	159	159
6	160	158
7	162	163
8	158	158
9	158	167
10	160	165
11	163	161
12	165	162
13	167	160
14	159	165
15	167	159
16	160	160
17	165	167
18	165	160
19	164	163
20	167	164
21	164	167
22	163	157
23	164	158
24	164	164
25	167	167
26	159	164
27	163	160
28	162	160
29	167	159
30	164	167
Min.	157.0	157.0
Max.	167.0	167.0
Mean	162.57	161.83
SD.±	3.30	3.33
t	0.857	
p	0.395	

t: Student t-test

*: Statistically significant at $p \leq 0.05$

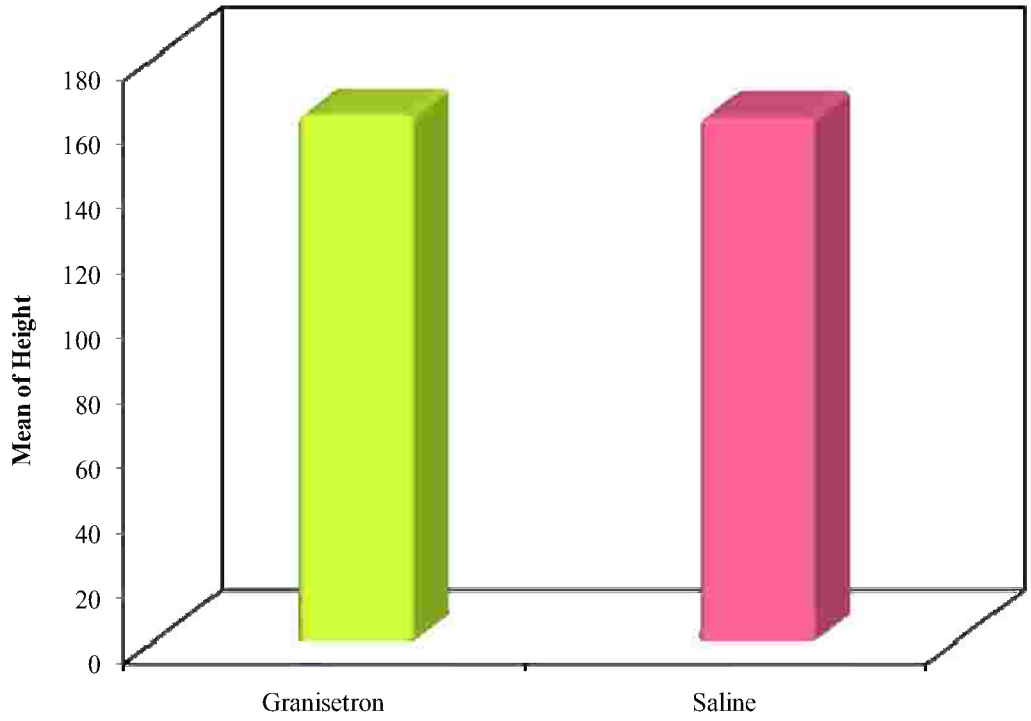

Figure (7): Comparison between the two studied groups according to height (cm)

Table (VII): Comparison between the two studied groups according to duration of operation (minute)

Cases No.	Duration of operation (minute)	
	Granisetron group	Saline group
1	49	34
2	28	32
3	41	28
4	34	31
5	28	27
6	38	41
7	35	40
8	31	38
9	37	38
10	32	32
11	34	32
12	38	41
13	46	46
14	36	32
15	30	28
16	31	35
17	40	32
18	32	34
19	29	36
20	36	38
21	33	34
22	40	34
23	34	40
24	29	39
25	45	27
26	36	28
27	48	39
28	36	34
29	35	35
30	39	38
Min.	28.0	27.0
Max.	49.0	46.0
Mean	36.0	34.77
SD. ±	5.68	4.74
t	0.913	
p	0.365	

t: Student t-test

*: Statistically significant at $p \leq 0.05$

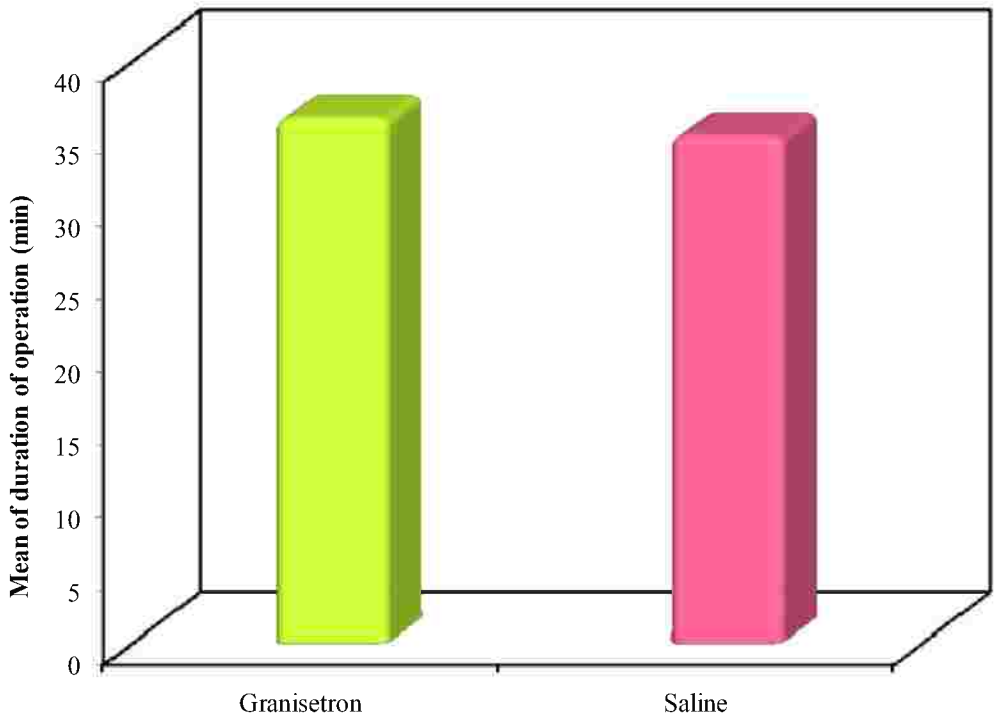

Figure (8): Comparison between the two studied groups according to duration of operation (min)

Changes in Heart Rate (beats/minute) (Tables VIII-X, Fig 9)

In group G, the mean heart rate immediately before spinal was 90.90±11.78 (beats/min). All over the periods of follow up after the spinal anaesthesia, there were statistical insignificant changes in heart rate ($p>0.05$).

In group S, the mean heart rate immediately before spinal was 89.50 ± 6.38 (beats/min). After the spinal anaesthesia and all over the period of follow up after the spinal anaesthesia, there were insignificant changes in heart rate ($p>0.05$).

On comparing both groups, no significant changes were observed all over the whole period of the study where (p values >0.05).

Table (VIII): Heart rate changes in granisetron group (beat/min)

Cases No.	Heart rate											
	Basal	**1min**	**3min**	**5min**	**7min**	**9min**	**11min**	**13min**	**15min**	**17min**	**19min**	**21min**
1	105	92	98	92	96	89	91	92	89	93	88	90
2	98	93	102	100	91	83	83	87	103	100	105	91
3	93	91	90	100	88	90	92	91	91	85	93	89
4	91	93	72	83	90	84	101	111	100	94	80	92
5	75	85	95	96	94	92	96	89	90	92	89	85
6	85	91	81	88	95	90	90	88	100	92	85	89
7	97	89	89	79	89	86	93	91	86	89	90	89
8	104	102	98	96	98	101	96	96	93	96	96	94
9	98	92	90	87	98	82	82	86	90	85	86	83
10	76	76	78	72	76	87	80	79	80	72	75	76
11	89	88	94	96	90	90	92	93	91	89	90	90
12	99	95	92	90	98	96	96	102	94	90	92	91
13	88	88	82	82	85	86	87	85	86	85	88	89
14	125	110	102	98	102	92	92	96	99	94	90	96
15	90	82	84	84	86	92	92	89	88	90	86	88
16	110	110	108	106	110	101	99	103	100	99	96	96
17	90	82	96	82	86	86	90	91	96	93	92	90
18	82	88	82	82	85	98	90	76	78	78	74	75
19	71	71	77	76	75	76	68	64	65	70	70	71
20	88	88	82	92	90	91	91	83	88	85	80	89
21	89	90	98	93	85	81	85	87	88	80	82	81
22	70	67	71	69	70	73	79	72	68	67	65	66
23	87	82	94	95	88	89	80	86	90	89	83	80
24	94	87	90	90	91	86	88	86	87	80	91	93
25	93	93	92	76	76	75	81	83	82	87	85	87
26	78	80	89	83	85	85	87	86	80	85	90	85
27	103	102	100	103	95	98	89	90	92	92	96	93
28	83	75	95	94	94	87	87	88	87	80	95	91
29	93	94	94	92	91	90	94	86	89	92	91	90
30	83	75	95	94	94	87	88	88	85	90	98	90
Min.	70.0	67.0	71.0	69.0	70.0	73.0	68.0	64.0	65.0	67.0	65.0	66.0
Max.	125.0	110.0	108.0	106.0	110.0	101.0	101.0	111.0	103.0	100.0	105.0	96.0
Mean	90.90	88.37	90.33	89.0	89.70	88.10	88.63	88.13	88.50	87.10	87.37	86.97
SD.±	11.78	10.11	9.05	9.21	8.36	6.87	6.84	8.89	8.62	8.02	8.60	7.18
P		1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.864

p: Stands for adjusted Bonferroni p-value for ANOVA with repeated measures for comparison between Base line with each other period

*: Statistically significant at $p \leq 0.05$

Table (IX): Heart rate changes in saline group (beat/min).

Cases No.	Heart rate											
	Basal	**1min**	**3min**	**5min**	**7min**	**9min**	**11min**	**13min**	**15min**	**17min**	**19min**	**21min**
1	102	94	91	93	91	88	79	81	90	79	95	92
2	94	98	85	93	92	88	86	78	85	76	80	83
3	93	82	89	92	92	88	91	91	90	94	88	96
4	94	83	94	79	79	86	81	80	80	75	80	91
5	82	75	94	86	92	87	91	90	83	90	93	95
6	94	82	82	83	84	90	90	93	85	85	82	85
7	78	80	89	74	75	79	76	82	90	76	92	93
8	86	95	94	89	87	87	85	79	83	76	80	93
9	84	84	91	93	93	88	91	78	88	85	89	89
10	94	93	94	78	74	79	80	91	81	92	92	83
11	90	80	92	93	93	87	88	76	89	79	80	88
12	89	92	84	85	85	84	91	92	80	93	95	84
13	83	81	93	79	83	84	83	92	89	81	88	79
14	94	86	88	91	90	83	89	90	90	92	92	93
15	88	89	86	87	88	83	85	83	91	93	92	83
16	86	95	80	94	89	87	85	84	91	88	87	86
17	84	92	84	88	91	90	89	95	95	82	85	83
18	94	93	94	97	79	83	84	88	89	98	92	91
19	90	91	97	104	113	92	95	94	85	89	84	89
20	89	88	83	84	84	89	85	81	81	78	79	80
21	83	84	85	83	90	91	91	83	84	89	83	81
22	94	100	102	104	99	98	101	94	84	88	89	92
23	100	103	89	90	94	93	90	91	98	88	83	83
24	91	88	94	92	92	86	80	76	87	86	88	89
25	94	93	94	99	90	92	83	87	86	83	85	88
26	80	93	87	87	79	75	85	80	94	93	90	85
27	103	98	99	97	94	94	93	92	90	83	88	89
28	82	81	79	77	77	85	84	91	82	92	90	91
29	87	84	87	83	89	90	90	93	98	92	93	93
30	83	83	80	81	80	84	85	89	90	85	80	83
Min.	78.0	75.0	79.0	74.0	74.0	75.0	76.0	76.0	80.0	75.0	79.0	79.0
Max.	103.0	103.0	102.0	104.0	113.0	98.0	101.0	95.0	98.0	98.0	95.0	96.0
Mean	89.50	88.67	89.33	88.50	87.93	87.0	86.87	86.47	87.60	86.0	87.13	87.67
SD.±	6.38	6.95	5.83	7.66	7.93	4.77	5.27	6.13	4.92	6.41	5.04	4.75
P		1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000

p: Stands for adjusted Bonferroni p-value for ANOVA with repeated measures for comparison between Base line with each other period

*: Statistically significant at $p \leq 0.05$

Table (X): Comparison between the studied groups according to heart rate (beat/min).

	Heart rate											
	Basal	**1min**	**3min**	**5min**	**7min**	**9min**	**11min**	**13min**	**15min**	**17min**	**19min**	**21min**
Granisetron												
Min.	70.0	67.0	71.0	69.0	70.0	73.0	68.0	64.0	65.0	67.0	65.0	66.0
Max.	125.0	110.0	108.0	106.0	110.0	101.0	101.0	111.0	103.0	100.0	105.0	96.0
Mean	90.90	88.37	90.33	89.0	89.70	88.10	88.63	88.13	88.50	87.10	87.37	86.97
SD.±	11.78	10.11	9.05	9.21	8.36	6.87	6.84	8.89	8.62	8.02	8.60	7.18
Saline												
Min.	78.0	75.0	79.0	74.0	74.0	75.0	76.0	76.0	80.0	75.0	79.0	79.0
Max.	103.0	103.0	102.0	104.0	113.0	98.0	101.0	95.0	98.0	98.0	95.0	96.0
Mean	89.50	88.67	89.33	88.50	87.93	87.0	86.87	86.47	87.60	86.0	87.13	87.67
SD.±	6.38	6.95	5.83	7.66	7.93	4.77	5.27	6.13	4.92	6.41	5.04	4.75
t	0.572	0.134	0.509	0.229	0.840	0.720	1.121	0.845	0.497	0.587	0.128	0.446
p	0.570	0.894	0.613	0.820	0.405	0.474	0.267	0.401	0.621	0.559	0.898	0.658

t: Student t-test

*: Statistically significant at $p \leq 0.05$

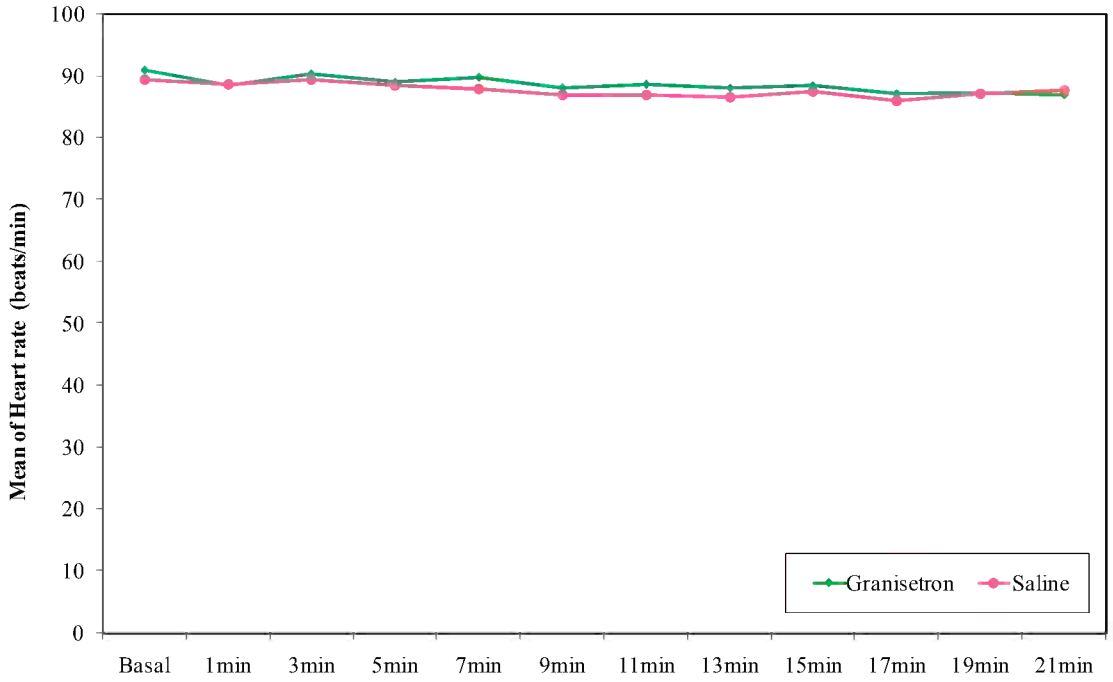

Figure (9): Comparison between the studied groups according to heart rate (beat/min).

Changes in Mean arterial blood pressure (mmHg) (Tables XI-XII, Fig 10):

In group G, the mean value of MABP immediately before spinal anaesthesia was 93.63±10.32 mmHg. MABP decreased significantly during the whole periods of measurements 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.

In group S, the mean value of MABP immediately before spinal anaesthesia was 88.67±11.86 mmHg. MABP decreased significantly during the whole period of measurements 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 MABP showed no significant changes between two groups before spinal anaesthesia where (p value =0.089). Comparison between the two studied groups showed significant decrease in MABP in group S patients when compared to group G patients immediately after spinal anaesthesia 1,3,5,7,9,11,13 and 15 mins after spinal anaesthesia where p values ≤ 0.040, 0.021, 0.001, 0.003, 0.026, 0.003, 0.008 and 0.039. No significant changes were observed after 17, 19 and 21mins where p values were 0.060, 0.350 and 0.078.

Table (XI): MABP changes in group G patients (mmHg).

Cases No.	Mean arterial blood pressure (mmHg)											
	Basal	**1min**	**3min**	**5min**	**7min**	**9min**	**11min**	**13min**	**15min**	**17min**	**19min**	**21min**
1	102	83	83	95	86	75	60	64	87	86	67	86
2	96	78	54	60	83	78	59	68	69	68	75	93
3	100	90	67	76	83	92	100	81	82	78	85	83
4	86	87	49	52	55	69	67	74	60	62	62	69
5	87	86	91	92	94	83	70	76	83	83	91	92
6	97	79	80	80	66	60	63	80	73	75	74	87
7	110	105	105	100	81	60	66	80	81	105	83	81
8	97	79	80	80	66	63	80	62	66	70	75	73
9	92	83	70	74	83	70	74	71	83	82	70	92
10	70	60	64	80	65	63	60	71	68	64	87	86
11	90	80	76	65	71	89	88	63	65	65	63	70
12	76	53	66	83	90	91	93	84	88	88	78	90
13	103	83	63	83	96	83	80	100	90	83	100	96
14	83	83	74	68	59	78	56	60	67	63	67	72
15	103	96	98	70	88	73	76	69	84	78	83	81
16	108	96	79	77	67	56	55	68	60	60	66	68
17	96	93	84	84	87	88	80	93	77	83	80	87
18	76	53	66	84	93	80	84	88	93	78	90	88
19	107	90	80	76	63	55	76	80	56	73	87	83
20	100	96	90	66	69	73	76	88	69	76	67	86
21	82	63	75	55	62	63	65	59	64	55	65	76
22	80	75	71	65	55	60	63	70	75	88	82	78
23	100	96	85	82	75	68	66	67	62	72	85	83
24	102	66	45	85	97	73	74	68	55	60	62	69
25	90	80	76	65	71	89	88	63	65	76	71	88
26	97	93	87	84	87	84	88	95	80	91	93	95
27	85	73	66	56	63	70	70	66	65	63	76	73
28	100	90	67	76	83	92	100	81	82	78	85	79
29	91	82	46	86	86	80	78	85	96	97	88	96
30	103	80	65	93	100	80	77	83	78	88	93	100
Min.	70.0	53.0	45.0	52.0	55.0	55.0	55.0	59.0	55.0	55.0	62.0	68.0
Max.	110.0	105.0	105.0	100.0	100.0	92.0	100.0	100.0	96.0	105.0	100.0	100.0
Mean	93.63	81.70	73.40	76.40	77.47	74.60	74.40	75.23	74.10	76.27	78.33	83.33
SD.±	10.32	12.80	14.33	12.14	13.36	11.31	12.28	11.02	11.34	11.91	10.65	9.08
p		<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	0.017*

p: Stands for adjusted Bonferroni p-value for ANOVA with repeated measures for comparison between Base line with each other period

*: Statistically significant at $p \leq 0.05$

Table (XII): MABP changes in group S patients (mmHg).

Cases No.	Mean arterial blood pressure (mmHg)											
	Basal	**1min**	**3min**	**5min**	**7min**	**9min**	**11min**	**13min**	**15min**	**17min**	**19min**	**21min**
1	102	97	82	65	63	70	73	76	82	68	76	86
2	83	63	60	43	61	66	59	63	62	65	67	72
3	90	80	70	73	85	68	76	80	67	62	73	71
4	94	71	93	56	68	52	72	65	70	68	75	83
5	76	66	67	73	60	52	68	73	76	73	93	95
6	86	63	42	70	71	62	53	64	63	60	68	72
7	95	85	83	79	89	96	68	58	53	76	83	89
8	84	70	62	50	76	91	47	55	62	76	73	78
9	90	77	63	54	62	74	57	54	57	63	76	73
10	101	75	70	93	86	80	78	77	73	80	81	89
11	70	63	61	50	55	62	56	64	63	67	68	70
12	92	78	73	66	67	76	83	81	76	83	79	90
13	103	81	62	66	84	66	75	65	63	70	75	76
14	90	77	70	56	66	67	70	78	70	60	63	65
15	77	56	68	89	77	84	75	67	70	75	78	76
16	101	75	77	63	60	61	74	78	83	67	73	72
17	93	80	70	65	50	53	65	63	45	65	67	73
18	70	65	53	52	47	56	60	61	65	66	67	71
19	70	63	62	55	53	61	65	65	78	73	72	76
20	85	75	70	55	65	63	70	71	75	73	76	81
21	90	80	57	59	57	48	63	67	72	76	83	82
22	73	50	53	60	65	61	57	63	67	70	73	76
23	112	110	56	53	90	89	69	89	82	92	90	93
24	72	67	63	60	56	61	65	62	64	65	70	73
25	76	65	63	45	55	53	60	62	63	64	67	77
26	95	83	73	66	53	60	60	63	70	73	75	77
27	92	73	48	63	74	72	49	66	69	70	78	76
28	112	110	54	50	78	89	69	89	92	90	89	92
29	95	69	74	77	79	69	73	48	52	79	99	100
30	91	71	70	77	68	65	66	69	64	68	73	72
Min.	70.0	50.0	42.0	43.0	47.0	48.0	47.0	48.0	45.0	60.0	63.0	65.0
Max.	112.0	110.0	93.0	93.0	90.0	96.0	83.0	89.0	92.0	92.0	99.0	100.0
Mean	88.67	74.60	65.63	62.77	67.33	67.57	65.83	67.87	68.27	71.23	76.0	79.20
SD.±	11.86	13.42	10.75	12.18	12.14	12.58	8.71	9.69	9.95	7.94	8.40	8.75
p		<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	0.005*

p: Stands for adjusted Bonferroni p-value for ANOVA with repeated measures for comparison between Base line with each other period

*: Statistically significant at $p \leq 0.05$

Table (XII): Comparison between the studied groups according to mean arterial blood pressure (mmHg).

	Mean arterial blood pressure (mmHg)											
	Basal	**1min**	**3min**	**5min**	**7min**	**9min**	**11min**	**13min**	**15min**	**17min**	**19min**	**21min**
Granisetron												
Min.	70.0	53.0	45.0	52.0	55.0	55.0	55.0	59.0	55.0	55.0	62.0	68.0
Max.	110.0	105.0	105.0	100.0	100.0	92.0	100.0	100.0	96.0	105.0	100.0	100.0
Mean	93.63	81.70	73.40	76.40	77.47	74.60	74.40	75.23	74.10	76.27	78.33	83.33
SD.±	10.32	12.80	14.33	12.14	13.36	11.31	12.28	11.02	11.34	11.91	10.65	9.08
Saline												
Min.	70.0	50.0	42.0	43.0	47.0	48.0	47.0	48.0	45.0	60.0	63.0	65.0
Max.	112.0	110.0	93.0	93.0	90.0	96.0	83.0	89.0	92.0	92.0	99.0	100.0
Mean	88.67	74.60	65.63	62.77	67.33	67.57	65.83	67.87	68.27	71.23	76.0	79.20
SD.±	11.86	13.42	10.75	12.18	12.14	12.58	8.71	9.69	9.95	7.94	8.40	8.75
t	1.730	2.097*	2.375*	4.343*	3.075*	2.277*	3.116*	2.749*	2.117*	1.926	0.943	1.795
p	0.089	0.040*	0.021*	<0.001*	0.003*	0.026*	0.003*	0.008*	0.039*	0.060	0.350	0.078

t: Student t-test
*: Statistically significant at $p \leq 0.05$

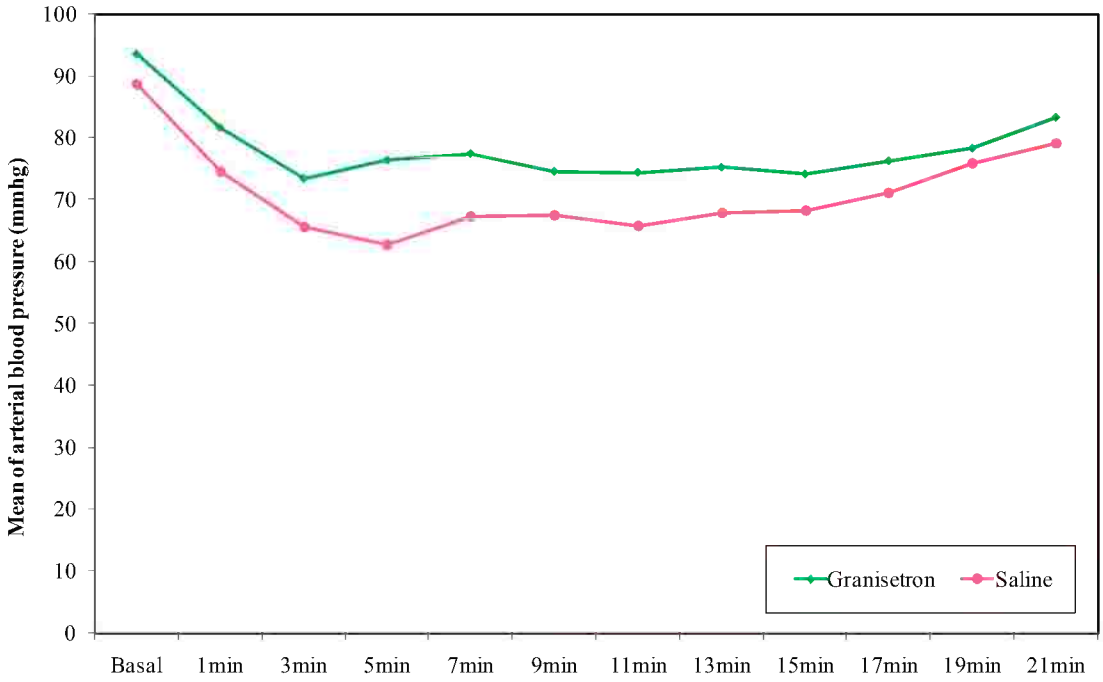

Figure (10): Comparison between the studied groups according to mean arterial blood pressure (mmHg).

Changes in Oxygen Saturation (SpO2%) (Tables XIV - XVI, Fig 11).

In group G, it was found that the mean of oxygen saturation on O_2 mask 4L/min, immediately before spinal anaesthesia, ranged from 97-100 (%) with a mean of 98.8±0.9%. All over the time periods of study after the spinal anaesthesia, there were insignificant changes as regard the oxygen saturation where (p value >0.05).

In group S, the mean of oxygen saturation on O_2 mask 4L/min, immediately before spinal anaesthesia, ranged from 97-100 (%) with a mean of 98.57±0.9%. All over the time periods of follow up after the spinal anaesthesia, there were statistical insignificant changes in the oxygen saturation where (p value >0.05).

Comparison between the two studied groups showed statistical insignificant differences at all the measured times (p>0.05).

Table (XIV): Changes in Oxygen saturation in patients of group G (%).

Cases No.	Oxygen saturation											
	Basal	**1min**	**3min**	**5min**	**7min**	**9min**	**11min**	**13min**	**15min**	**17min**	**19min**	**21min**
1	99	99	100	100	100	99	99	99	100	100	99	100
2	100	99	99	99	99	99	99	99	99	99	99	99
3	99	98	99	99	99	100	100	99	99	98	100	99
4	98	97	98	98	98	99	98	98	97	98	98	98
5	98	98	98	98	98	98	98	98	98	98	99	99
6	99	99	98	98	99	98	98	99	99	98	99	99
7	99	98	99	99	99	99	98	98	98	99	100	100
8	98	98	97	98	97	98	97	97	98	97	98	98
9	99	98	100	99	100	98	98	98	98	99	99	100
10	100	98	98	98	98	97	98	98	99	98	98	98
11	98	99	97	97	100	96	97	97	98	98	99	100
12	98	99	99	98	98	100	100	99	96	98	99	99
13	98	99	97	100	97	97	98	98	98	97	97	98
14	99	97	98	100	100	99	99	98	98	98	98	100
15	97	98	98	98	97	97	98	98	98	99	98	98
16	99	100	97	98	98	99	99	99	100	100	100	100
17	99	97	100	96	98	98	98	97	97	99	99	98
18	99	98	97	97	99	99	98	98	98	99	100	100
19	99	97	98	98	96	97	98	98	98	97	99	100
20	100	97	99	98	98	98	98	100	100	100	99	100
21	100	100	97	97	100	100	97	97	98	100	100	99
22	100	100	99	99	98	98	98	98	99	100	99	100
23	98	99	97	99	99	98	98	99	99	98	100	100
24	100	100	99	99	100	100	100	99	99	99	99	100
25	98	97	98	97	98	98	99	97	98	98	98	98
26	97	97	98	97	97	97	98	98	98	99	97	98
27	98	99	98	96	95	96	98	98	96	98	99	99
28	99	97	98	97	98	99	97	98	98	98	98	97
29	98	98	97	97	98	97	97	96	97	97	99	98
30	100	99	98	99	98	98	100	99	99	99	99	99
Min.	97.0	97.0	97.0	96.0	95.0	96.0	97.0	96.0	96.0	97.0	97.0	97.0
Max.	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Mean	98.8	98.3	98.2	98.1	98.3	98.2	98.3	98.1	98.2	98.5	98.8	99.0
SD.±	0.9	1.0	0.9	1.1	1.2	1.1	0.9	0.9	1.0	0.9	0.8	0.9
p		1.000	0.303	0.354	1.000	0.579	1.000	0.109	0.270	1.000	1.000	1.000

t: Student t-test.
*: Statistically significant at $p \leq 0.05$.

Table (XV): Changes in Oxygen saturation in patients of group S (%).

Cases No.	Oxygen saturation											
	Basal	1min	3min	5min	7min	9min	11min	13min	15min	17min	19min	21min
1	98	98	97	98	97	98	98	97	97	98	98	98
2	99	97	98	98	98	98	99	98	98	98	99	98
3	99	98	97	98	99	97	98	97	97	98	99	98
4	98	98	98	96	97	98	98	96	96	97	99	98
5	98	99	98	99	98	97	98	99	98	96	99	98
6	98	98	98	99	98	98	98	99	98	98	99	99
7	99	99	98	99	97	97	96	98	98	7	97	98
8	99	98	97	95	94	96	97	97	99	96	100	99
9	98	97	98	98	97	98	98	99	98	98	98	100
10	97	98	98	99	97	99	98	97	98	97	98	98
11	98	96	97	99	97	99	98	98	98	98	97	100
12	100	98	97	99	97	99	97	99	99	98	98	99
13	98	97	98	98	99	98	98	98	97	97	99	97
14	97	96	98	97	97	98	98	98	97	98	99	98
15	100	99	98	98	98	98	98	99	98	99	99	99
16	99	97	98	98	98	99	100	99	99	100	99	99
17	99	100	99	98	99	98	98	98	98	99	99	100
18	97	98	97	97	98	97	98	97	97	98	100	97
19	100	99	98	99	99	98	98	98	97	97	98	98
20	99	98	97	98	98	98	98	98	97	98	100	99
21	99	99	97	97	97	98	99	98	97	98	98	99
22	99	99	98	98	98	98	98	98	98	98	98	100
23	99	98	98	98	98	99	100	100	100	99	99	99
24	98	98	98	98	97	99	100	98	98	97	100	100
25	98	99	99	99	99	99	98	98	98	98	99	99
26	97	96	98	98	97	98	98	98	98	99	97	98
27	100	97	99	100	99	100	100	99	98	98	99	99
28	100	99	99	98	98	98	98	97	98	98	99	99
29	98	99	98	99	99	98	98	98	98	98	100	99
30	99	98	98	98	98	97	97	98	98	99	98	98
Min.	97.0	96.0	97.0	95.0	94.0	96.0	96.0	96.0	96.0	7.0	97.0	97.0
Max.	100.0	100.0	99.0	100.0	99.0	100.0	100.0	100.0	100.0	100.0	99.0	100.0
Mean	98.57	98.0	97.9	98.1	97.7	98.1	98.2	98.0	97.8	94.9	98.7	98.7
SD.±	0.9	1.0	0.6	1.0	1.0	0.8	0.9	0.9	0.8	16.6	0.9	0.8
p		0.473	0.071	1.000	0.074	1.000	1.000	0.722	0.042	1.000	1.000	1.000

t: Student t-test.
*: Statistically significant at $p \leq 0.05$.

Table (XVI): Comparison between the studied groups according to Oxygen saturation (%).

	Oxygen saturation											
	Basal	**1min**	**3min**	**5min**	**7min**	**9min**	**11min**	**13min**	**15min**	**17min**	**19min**	**21min**
Granisetron												
Min.	97.0	97.0	97.0	96.0	95.0	96.0	97.0	96.0	96.0	97.0	97.0	97.0
Max.	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Mean	99.0	98.0	98.0	98.0	98.0	98.0	98.0	98.0	98.0	99.0	99.0	99.0
SD.±	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Saline												
Min.	97.0	96.0	97.0	95.0	94.0	96.0	96.0	96.0	96.0	7.0	97.0	97.0
Max.	100.0	100.0	99.0	100.0	99.0	100.0	100.0	100.0	100.0	100.0	99.0	100.0
Mean	98.57	98.0	97.9	98.1	97.7	98.1	98.2	98.0	97.8	94.9	98.7	98.7
SD.±	0.9	1.0	0.6	1.0	1.0	0.8	0.9	0.9	0.8	16.6	0.9	0.8
t	0.845	1.140	1.442	0.0	1.915	0.522	0.426	0.453	1.711	1.184	0.603	1.601
p	0.402	0.259	0.155	1.000	0.060	0.604	0.672	0.652	0.092	0.241	0.549	0.115

t: Student t-test.
*: Statistically significant at $p \leq 0.05$.

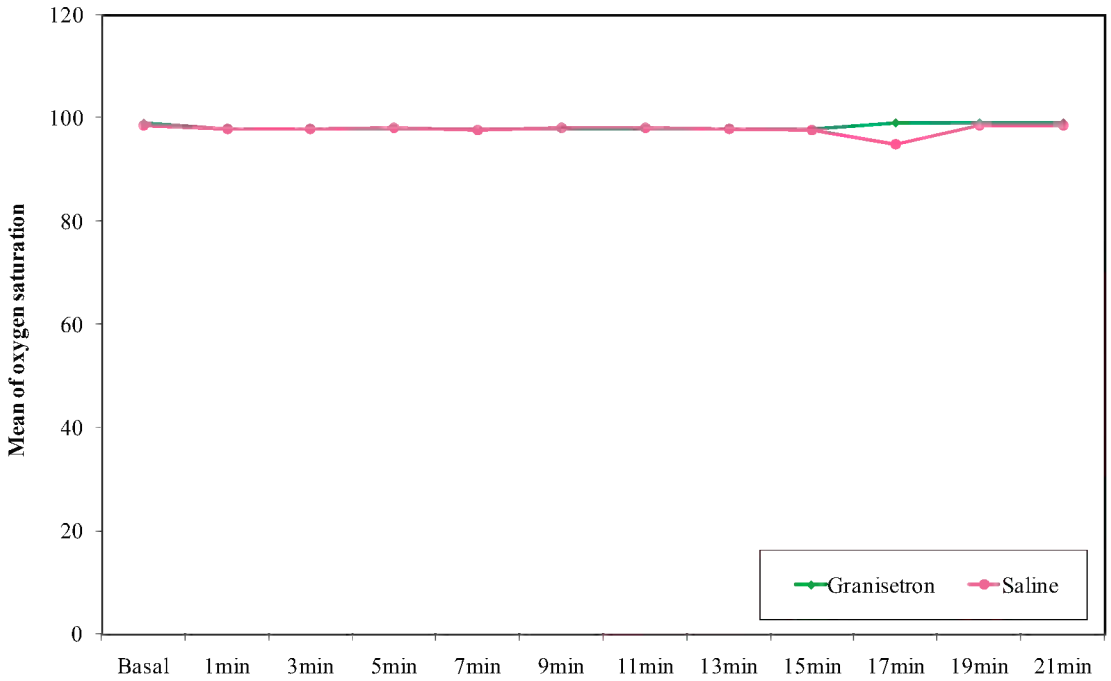

Figure (11): Comparison between the studied groups according to Oxygen saturation (%).

Total dose of ephedrine (mg) (table XVII, fig 12):

In group G, the dose of ephedrine ranged from 0.0-20 mg with mean 5.33 ± 7.30 mg while in group S dose of ephedrine ranged from 0.0-30 mg with mean 10.67 ± 8.68mg. 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).

Also, 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.

Table (XVII): Comparison between the two studied groups according to ephedrine requirements (mg).

Cases No.	Total dose of ephedrine (mg)	
	Granisetron group	**Saline group**
1	0	0
2	12	6
3	0	0
4	6	6
5	0	6
6	0	12
7	0	0
8	0	12
9	0	12
10	0	0
11	0	6
12	6	0
13	6	0
14	6	6
15	0	6
16	12	0
17	0	6
18	6	12
19	12	6
20	0	6
21	0	18
22	6	18
23	0	6
24	12	0
25	0	12
26	0	6
27	6	12
28	0	12
29	6	12
30	0	0
No **Yes**	18 (60.0%) **12 (40.0 %)**	9 (30.0%) **21 (70.0%)**
χ^2	5.455*	
p	0.020*	
Min. **Max.** **Mean** **SD.±** **Median**	0.0 12 5.33 7.30 0.0	0.0 18 10.67 8.68 10
Z	2461*	
p	0. 014*	

χ^2: Chi square test
Z: Z for Mann Whitney test
*: Statistically significant at $p \leq 0.05$

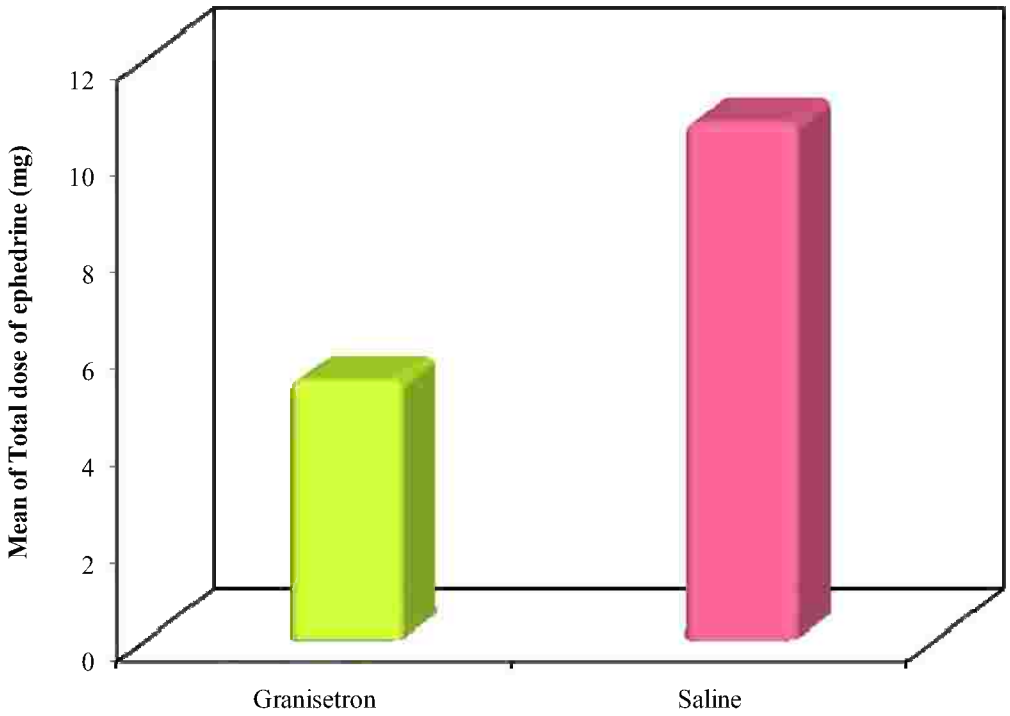

Figure (12): Comparison between the two studied groups according to ephedrine requirements (mg)

Incidence of hypotension (table XVIII, fig 13).

In group G, incidence of hypotension (40%), while in group S was (70%). There was statistical significant decrease in incidence of hypotension in group G than group S, where p value was 0.020.

Table (XVIII): Comparison between the two studied groups according to incidence of hypotension.

	Granisetron group (n = 30)		Saline group (n = 30)		χ^2	p
	No.	%	No.	%		
Incidence of hypotension						
No	18	60	9	30	5.455*	0.020*
Yes	12	40	21	70		

χ^2:Chi-square test
*: Statistically significant at $p \leq 0.05$

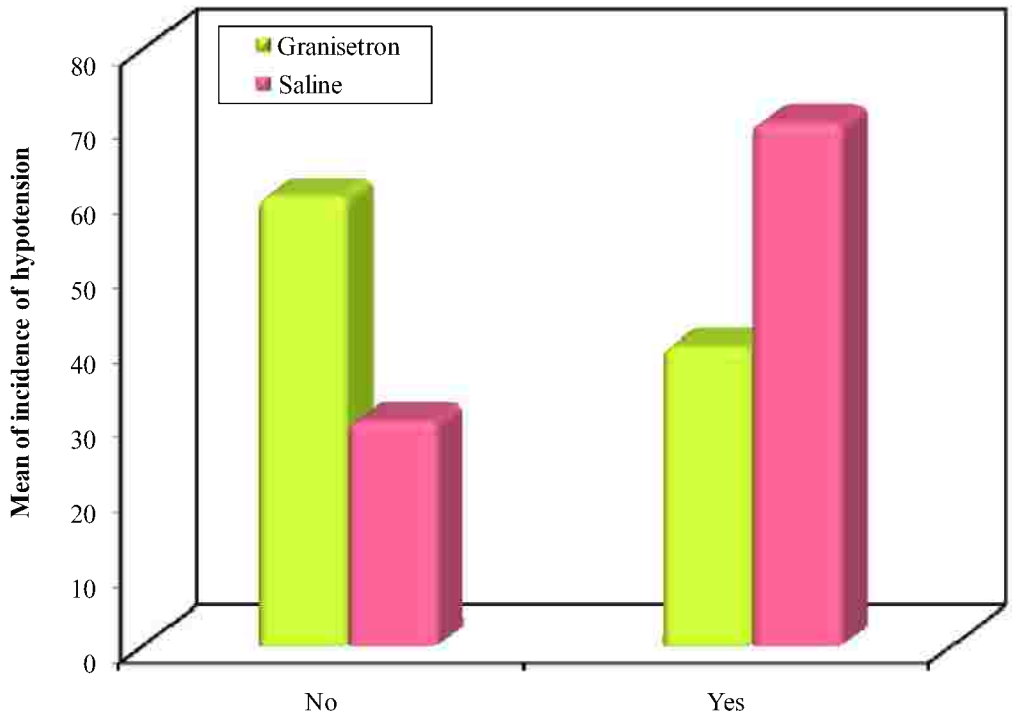

Figure (13): Comparison between the two studied groups according to incidence of hypotension.

Time for delivery of the fetus (min) (table XIX, fig 14).

The Time for 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 insignificant differences between the studied groups (P=0.636).

Table (XIX): Comparison between the two studied groups according to time for delivery of fetus (min).

Cases No.	Time of delivery of fetus (min)	
	Granisetron group	Saline group
1	5	8
2	5	7
3	7	7
4	5	6
5	6	6
6	7	6
7	5	5
8	3	6
9	7	8
10	6	7
11	9	6
12	9	5
13	7	5
14	7	6
15	6	6
16	6	10
17	7	3
18	8	8
19	3	5
20	9	8
21	8	3
22	8	9
23	6	8
24	6	8
25	7	3
26	5	7
27	8	6
28	7	6
29	7	5
30	5	5
Min.	3.0	3.0
Max.	9.0	10.0
Mean	6.47	6.27
SD.±	1.55	1.70
t	0.476	
p	0.636	

t: Student t-test

*: Statistically significant at $p \leq 0.05$

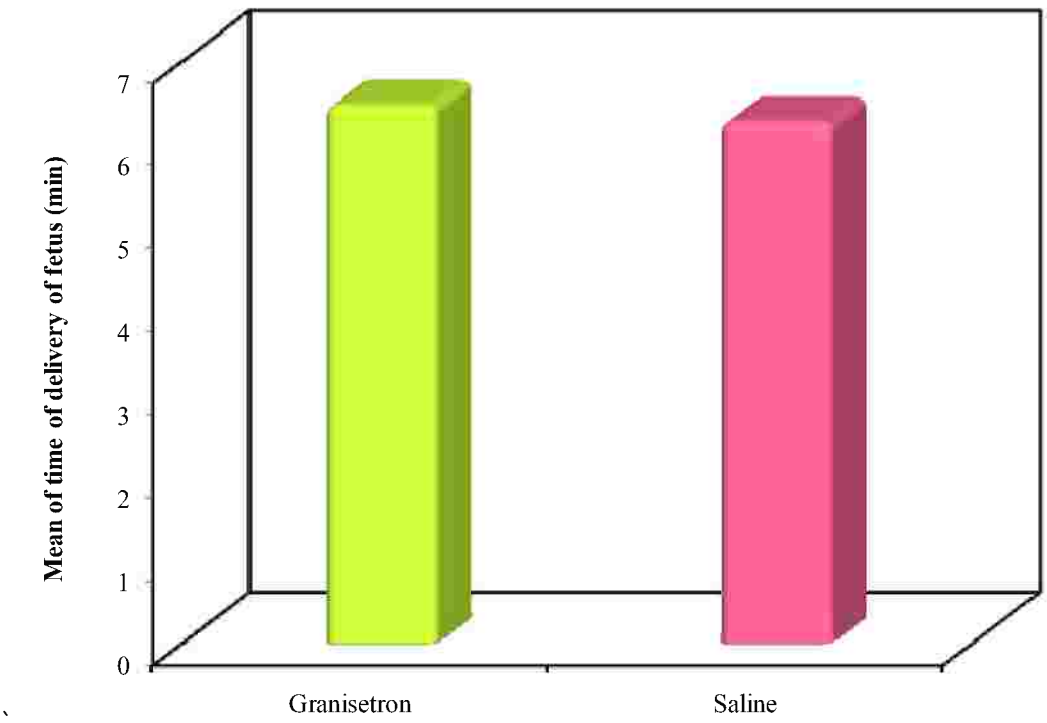

Figure (14): Comparison between the two studied groups according to time of delivery for fetus (min).

APGAR score (table XX, fig15):

In group G, it was found that the mean of APGAR score at 1min after delivery of the fetus ranged from 7-10 with a mean of 8.93±0.8 (p=0.477). At 5min the score ranged from 9-10 with a mean of 9.80±0.41 (p=0.094).

In group S, it was found that the mean of APGAR score at 1min after delivery of the fetus ranged from 7-10 with a mean of 8.77±0.97 (p=0.477). At 5min the score ranged from 9-10 with a mean of 9.60±0.50 (p=0.094).

There were statistical insignificant differences between the studied groups (P=0.477).

Table (XX): Comparison between the two studied groups according to APGAR score

Cases No.	APGAR score			
	1 min.		5 min.	
	Granisetron group	Saline group	Granisetron group	Saline group
1	9	9	10	10
2	8	8	10	10
3	10	9	10	9
4	8	8	9	9
5	9	10	10	10
6	9	9	10	10
7	10	9	10	10
8	7	8	9	9
9	9	8	10	9
10	9	10	10	10
11	10	10	10	10
12	8	10	9	10
13	8	9	9	10
14	8	8	10	10
15	9	7	10	9
16	9	8	10	10
17	9	8	10	9
18	10	7	10	9
19	10	7	10	10
20	10	9	10	9
21	8	9	10	9
22	8	10	9	10
23	9	10	10	10
24	10	8	10	9
25	9	9	10	9
26	10	10	10	10
27	9	10	10	10
28	9	9	10	10
29	9	9	10	10
30	8	8	9	9
Min.	7.0	7.0	9.0	9.0
Max.	10.0	10.0	10.0	10.0
Mean	8.93	8.77	9.80	9.60
SD.±	0.83	0.97	0.41	0.50
t	0.715		1.703	
p	0.477		0.094	
p_1			<0.001*	<0.001*

t: Student t-test
p_1: p value for Paired t-test for comparing between 1min. and 5min.
*: Statistically significant at $p \leq 0.05$

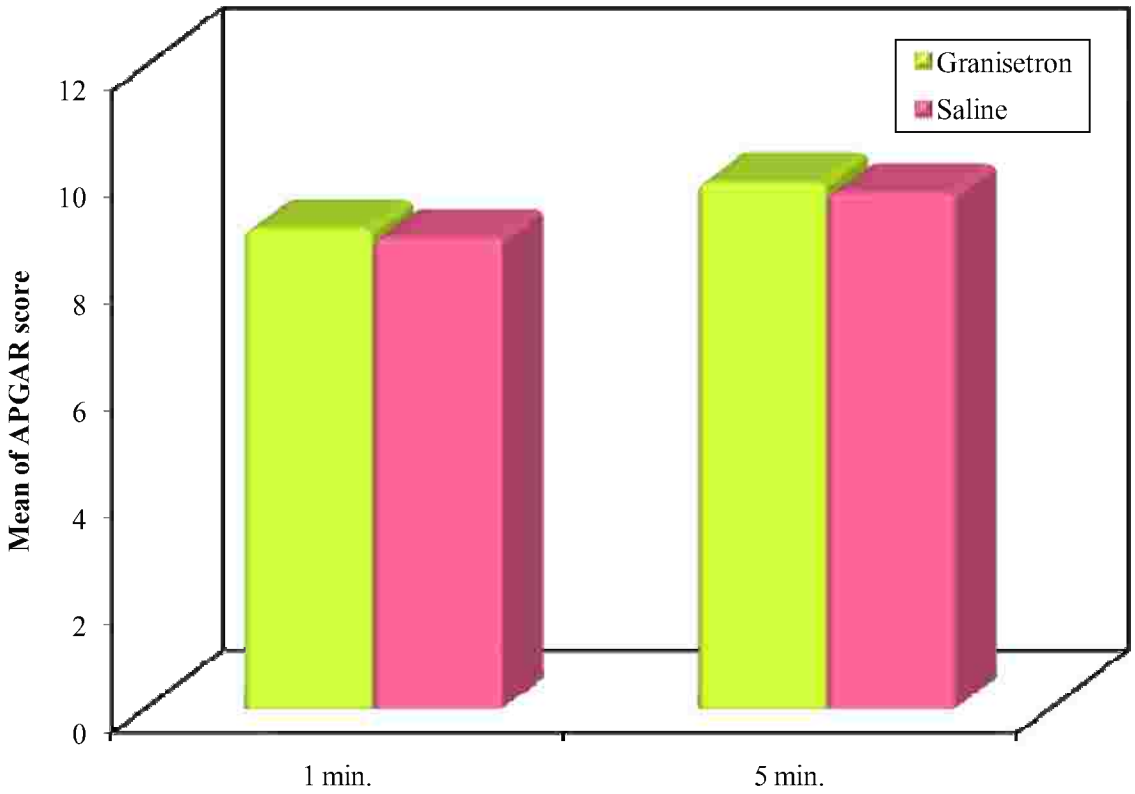

Figure (15): Comparison between the two studied groups according to APGAR score (min)

Nausea and vomiting scale (table XXI, fig 16):

Incidence of nausea and vomiting in group G was (36, 7%) and the severity ranged from 0-2, with a mean of 0.30± 0.60, while in group S was (63, 3%) and ranged from 0-3, with a mean of 0.97±0.93. There were statistical significant decrease in the incidence of nausea and vomiting in group G than Group S. (P=0.002).

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

Table (XXI): Comparison between the two studied groups according to nausea and vomiting scale.

Cases No.	Nausea and vomiting scale	
	Granisetron group	Saline group
1	0	1
2	2	2
3	0	0
4	0	0
5	1	2
6	0	1
7	0	0
8	0	3
9	0	1
10	0	0
11	1	1
12	0	0
13	0	0
14	1	1
15	0	2
16	0	0
17	0	1
18	1	2
19	2	0
20	0	1
21	0	3
22	0	1
23	0	0
24	0	1
25	0	2
26	0	2
27	0	1
28	0	0
29	0	1
30	1	0
0	23(76.7%)	11(36.7%)
1	5(16.7%)	11(36.7%)
2	2(6.7%)	6(20.0%)
3	0(0.0%)	2(6.7%)
Min.	0.0	0.0
Max.	2.0	3.0
Mean	0.30	0.97
SD.±	0.60	0.93
Median	0.0	1.0
Z	3.163*	
p	0.002*	

Z: Z for Mann Whitney test.
*: Statistically significant at $p \leq 0.05$

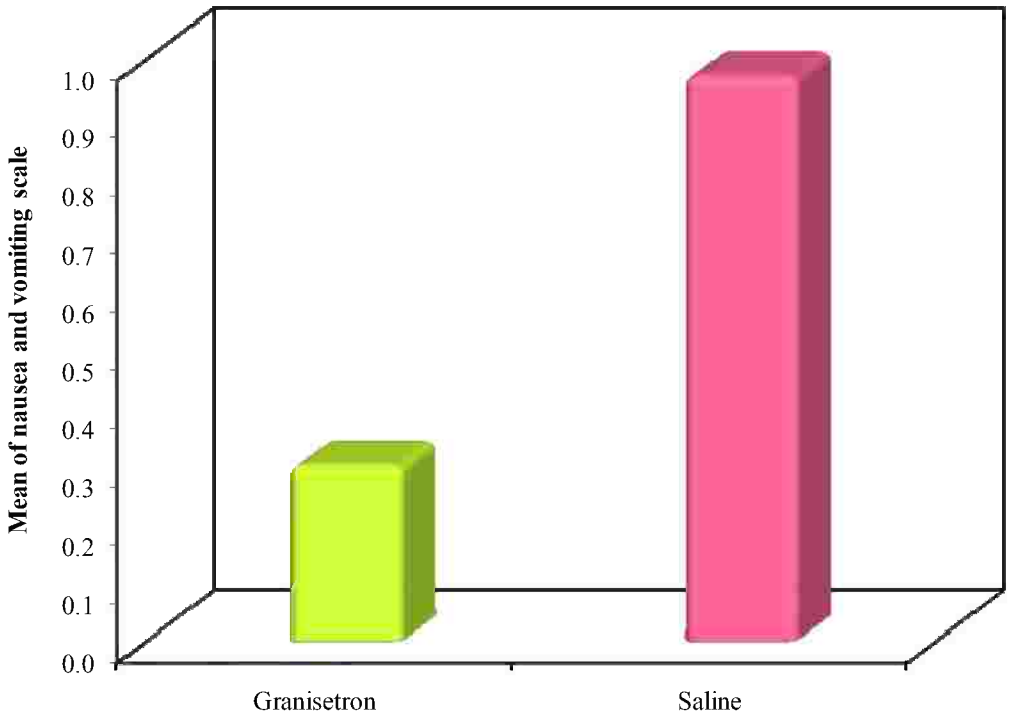

Figure (16): Comparison between the two studied groups according to nausea and vomiting scale

Shivering scale (table XXII, fig 17):

In group G, incidence of shivering was (20%) and severity ranged from 0-3 with mean of 0.04, while in group S was (46.6%) and also ranged from 0-3 with mean of 0.87. Comparison between the two studied groups, showed the incidence of shivering was significantly less in Group G than Group S. $p = 0.028$.

Table (XXII): Comparison between the two studied groups according to shivering scale.

Cases No.	Shivering scale	
	Granisetron group	Saline group
1	0	0
2	0	1
3	0	0
4	1	0
5	0	3
6	0	0
7	0	0
8	3	1
9	0	1
10	0	0
11	0	2
12	1	0
13	0	3
14	0	0
15	0	2
16	0	0
17	3	2
18	0	1
19	0	3
20	0	0
21	0	1
22	0	0
23	2	0
24	0	1
25	0	2
26	0	0
27	0	0
28	0	0
29	2	3
30	0	0
Min.	0.0	0.0
Max.	3.0	3.0
Mean	0.40	0.87
SD.±	0.89	1.11
Median	0.0	0.0
No shivering Shivering	24 (80%) 6 (20%)	16 (53.3%) 14 (46.6%)
χ^2	4.800*	
p	0.028*	

χ^2: Chi square test *: Statistically significant at $p \leq 0.05$

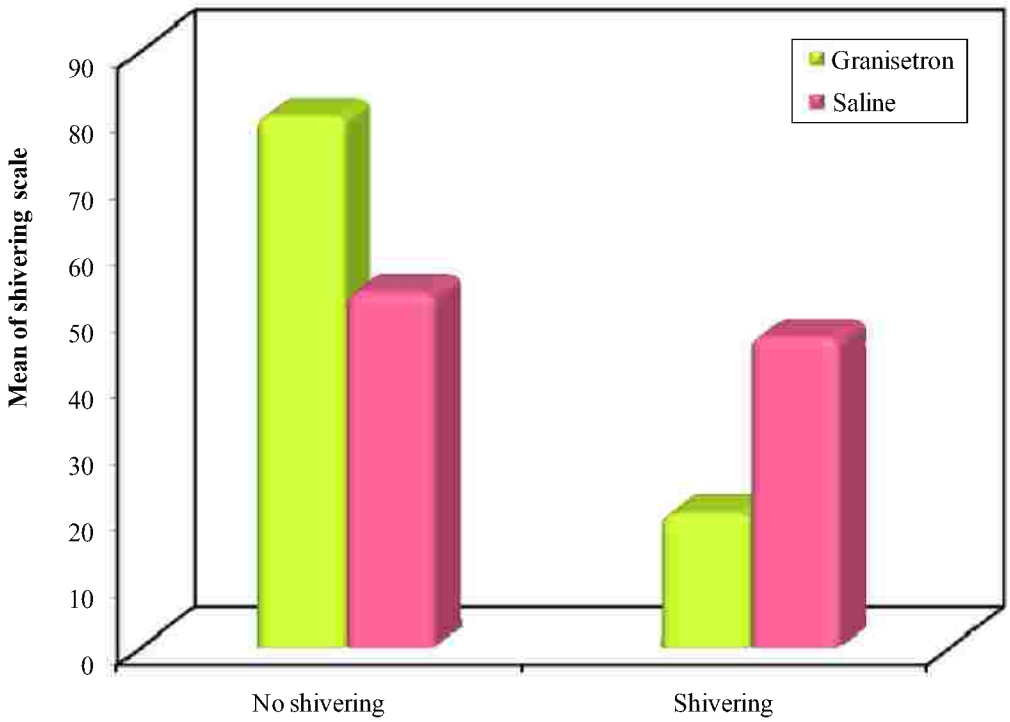

Figure (17): Comparison between the two studied groups according to shivering scale

Incidence of complications (table XXIII, fig 18).

- Dizziness occurred in 5 patient (16,67%) in Group G and 3 patient (10%) in Group S (p=0.240)
- Headache occurred in 2 patients (6,7%) in Group G and 1 patients (3,3%) in Group S (p=1.000)
- Constipation occurred in 2 patient (6,67%) in Group G and 2 patients (6,67%) in Group S (p=1.000)
- Myalgia occurred in 1 patients (3,33%) in Group G and 1 patients (3,33%) in Group S (p=1.000)

Comparison between the two studied groups showed statistical insignificant differences (p>0.05)

Table (XXIII): Comparison between the two studied groups according to incidence of complications.

	Granisetron group (n = 30)		Saline group (n = 30)		χ^2	^{FE}p
	No.	%	No.	%		
Incidence of complications						
Dizziness	5	16.67	3	10.00	2.009	0.240
Headache	2	6.7	1	3.3	0.0351	1.000
Constipation	2	6.67	2	6.67	0.0	1.000
Myalgia	1	3.33	1	3.33	0.0	1.000

χ^2:Chi-square test
FE: Fisher Exact test
t*: Statistically significant at $p \leq 0.05$

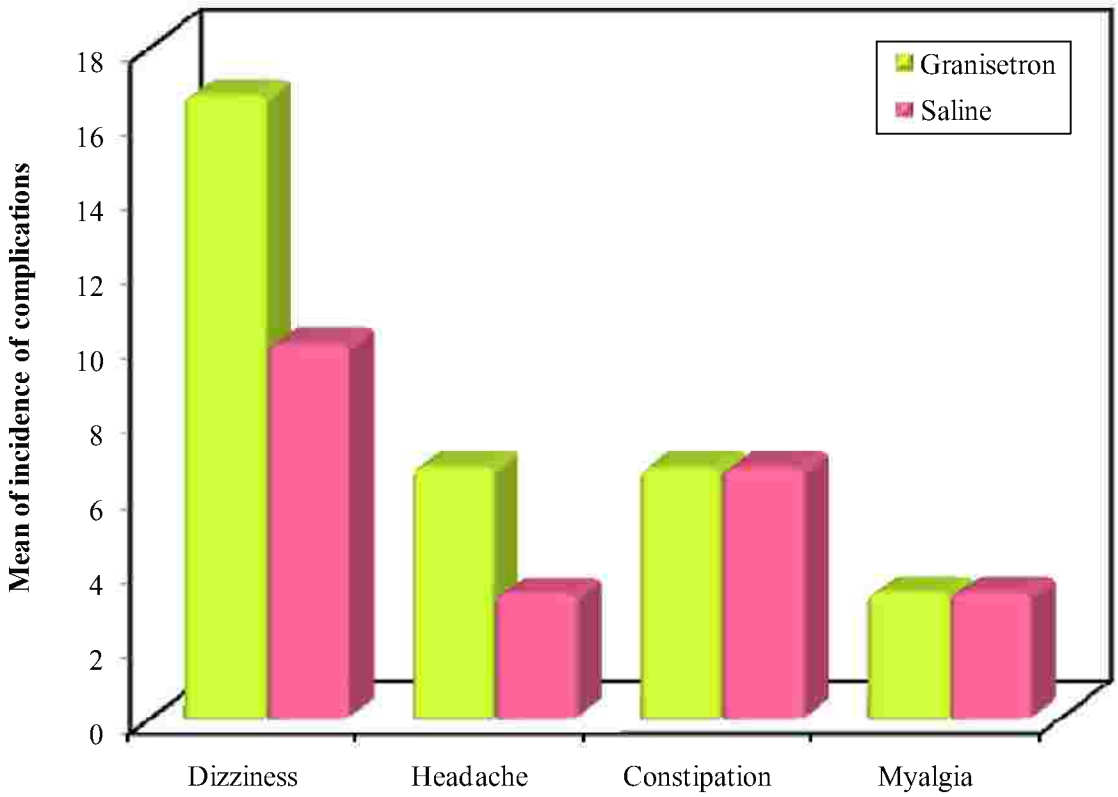

Figure (18): Comparison between the two studied groups according to incidence of complications.