

AIM OF THE WORK

The aim of this work was to study the effect of intravenous infusion of magnesium sulphate during total knee arthroplasty procedures using spinal anaesthesia on the postoperative pain as regard the analgesic efficacy, and side effects.

PATIENTS

After approval of Local Ethics Committee and with written informed consent from patients, the present study was carried out in Al-Hadara Hospital on forty ASA (American Society of Anaesthesiologists) I and II adults patients (40-60 years) of both sexes scheduled for total knee replacement arthroplasty under spinal anaesthesia.

Exclusion criteria:

1. Any contraindications of spinal anaesthesia.
2. Opioid or analgesic abuse.
3. Prior treatment with calcium channel blockers.

Patients were randomly categorized into two equal groups (20 each) using closed envelope technique:

Group I (group M, n=20): patients received magnesium sulphate 50 mg kg⁻¹ for 15 min after spinal anaesthesia and then 15 mg kg⁻¹ h⁻¹ by continuous I.V. infusion until the end of surgery.

Group II (group S, n=20): patients received the same volume of isotonic saline over the same period.

METHODS

Preoperative evaluation and preparation:

Evaluation of the patients was carried out through:

1. Proper history taking and clinical examination.
2. Routine laboratory investigations.
3. Patients was introduced to the visual analogue scale (VAS) which consists of 10 cm line with 0 cm = no pain and 10 cm = the worst pain⁽²¹⁾.

Visual analogue scale (VAS): This consists of an ungraduated, straight 10 cm line marked at one end with the term "no pain" and at the other end "the worst possible pain". The patient makes a cross on the line at the point that best approximates to their pain intensity⁽²¹⁾.

Patients were shown how to use the VAS the day before surgery. postoperative pain were assessed every 30 minutes for the first two hours post-operatively, then every 4 hours for the first 24 hours on a linear scale with:

- a. No pain score '0'.
- b. Worst pain ever score '10'

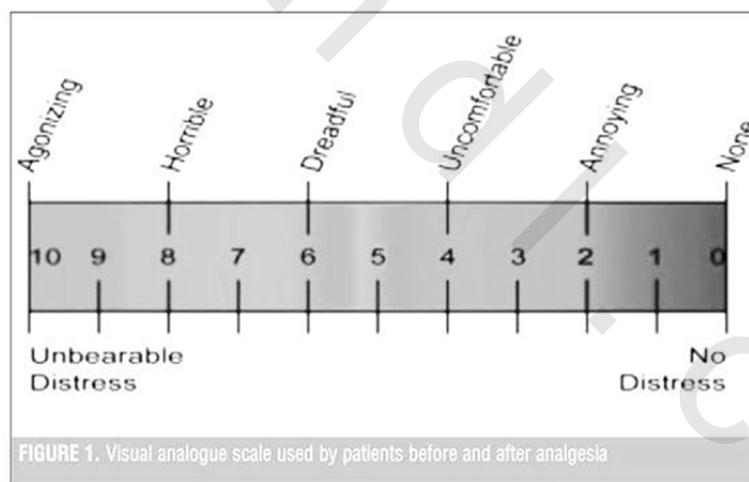


Figure (6): pain visual analogue score⁽²¹⁾

Anaesthetic technique:

- Premedication with I.V. midazolam 0.05 mg kg⁻¹ was given after transferring the patient to O.R. before spinal anaesthesia .
- Ringer's solution 500 ml was infused over 15 min before spinal anaesthesia.
- Intraoperative monitoring include non-invasive arterial pressure, ECG, and pulse oximetry using multi-channel monitor (A Drager Infinity Kappa model: DFM 17)

Methods

- Spinal anaesthesia was performed through the L4-5 interspace in the lateral decubitus position with the surgical side down. After dural puncture with a 25 G Quincke needle, hyperbaric bupivacaine 0.5% solution 12.5 mg with fentanyl 25 µg was injected intrathecally.
- Group I (group M, n=20): patients received I.V. magnesium sulphate 50 mg kg⁻¹ for 15 min after spinal anaesthesia and then 15 mg kg⁻¹ h⁻¹ (total volume 50 ml) by continuous I.V. infusion by syring pump (Ascor model: SEP 11S) until the end of surgery.
- Group II (group S, n=20): patients received the same volume of isotonic saline over the same period.
- The height of spinal block was evaluated for cold sensation 15 min after intrathecal administration of bupivacaine.
- Tourniquet was inflated to limit the blood loss.
- Intraoperative fluid loss replaced by 4 ml/kg/hr for the first 10 kg , 2 ml/kg/hr for the next 10 kg, and 1 ml/kg/hr for each kg above 20 kg. only 1 patient need 500 cc blood.
- If mean arterial pressure decreased > 20% from baseline, ephedrine 5 mg was given I.V.
- If heart rate decreased less than 55 b/min, I.V. atropine 0.5 mg was administered.
- After surgery patients were transferred to PACU:
 - For postoperative analgesia, ketorolac tromethamine (ketolac) 30 mg i.v. was given every 8 hours.
 - If VAS ≥ 4 pethidine 25 mg I.V. was given to the patients.
 - Postoperative complications as nausea, vomiting, shivering, hypotension, bradycardia and flushing were recorded.

Measurement

The following parameters were measured for each patient:

- (1) **Patient's demographic data;** including age, sex, weight and height.
- (2) **Hemodynamics data;**

- **Intra –operative :**
 - A. Heart rate (beats / min).
 - B. Mean arterial blood pressure (mmHg).
 - C. Oxygen saturation (SpO₂ %).
 - D. Respiratory rate (breath/ min).

These parameters were displayed continuously and measured before surgery and every 15 min during the procedure.

- **Post-operative;**

Mean arterial blood pressure and heart rate were recorded every 30 minutes for the first two hours post-operatively, then every 4 hours for the first 24 hours.

(3) **Postoperative pain** was assessed using visual analogue scale while the patient was lying comfortable, calm and his/her lower limb did not moved within the last five minutes.

(4) **Time for the first need for postoperative pethidine**; if VAS >4 was recorded.

(5) **Total pethidine consumption**: in the postoperative period.

The total amount of pethidine consumed within the first twenty four hours post-operatively was recorded along with the timing of each dose.

(6) **Complications**:

The incidences of any postoperative complications were recorded and managed accordingly.

Statistical analysis of the data

Data were fed to the computer and analyzed using IBM SPSS software package version 20.0.

Qualitative data were described using number and percent. Quantitative data were described using range (minimum and maximum), mean, standard deviation and median.⁽⁸⁷⁾

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'Agostino test, also Histogram and QQ plot were used for vision test.

If it reveals normal data distribution, parametric tests were 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, also paired t-test is used to analyse two paired data, comparison between different periods using ANOVA with repeated measures and Post Hoc test was assessed using LSD.⁽⁸⁸⁾

For abnormally distributed data, comparison between two independent population were done using Mann Whitney test. To compare between the different periods Wilcoxon signed ranks test was applied. Significance of the obtained results was judged at the 5% level.

RESULTS

This study was performed in Al-Hadara University Hospital on 40 patients scheduled for total knee arthroplasty under spinal anaesthesia. Subarachnoid block technique was successfully performed with no technical problems. Patients were categorized randomly into 2 groups: group I (MgSO₄) and group II (saline) 20 patients each.

1. Demographic data:

a) Age (in years): [Table I and Figure 7]

In group I (MgSO₄), age ranged between 43-60 years with the mean of 50.95 ± 5.50 years.

In group II (Saline), age ranged between 43-60 years with the mean of 52.70 ± 4.96 years.

There was no statistical significant difference between the two studied groups regarding age (P=0.298).

b) Sex: [Table II and Figure 8]

In group I, there were 13 males (65%), 7 females (35%).

In group II, there were 10 males (50%), 10 females (50%)

There was no statistical significant difference between the two studied groups regarding sex. (P=0.337).

c) Weight (Kg): [Table III and Figure 9]

In group I, the weight ranged between 90 – 110 kg with a mean value of 100.45 ± 6.37 kg.

In group II, the weight ranged between 87 – 126 kg with the mean value of 102.20 ± 11.07 kg.

There was no statistical significant difference between the two studied groups regarding weight. (P=0.545).

d) Height (cm): [Table IV and Figure 10]

In group I, the height ranged between 155.0 – 180.0 with a mean value of 170.05 ± 7.83 cm.

In group II, the height ranged between 155.0 – 180.0 with the mean value of 168.75 ± 8.54 cm.

There was no statistical significant difference between the two studied groups regarding height. (P=0.684).

Table (I): Comparison between the studied groups according to age (in years)

Patient number	Group I (MgSO₄) (n=20)	Group II (Saline) (n=20)
1	45	60
2	56	56
3	43	59
4	50	43
5	53	50
6	59	52
7	45	51
8	60	50
9	47	60
10	50	47
11	53	49
12	46	52
13	43	53
14	50	50
15	47	56
16	55	58
17	56	44
18	55	58
19	59	52
20	47	54
Min. – Max.	43.0 – 60.0	43.0 – 60.0
Mean ± SD.	50.95 ± 5.50	52.70 ± 4.96
Median	50.0	52.0
T	1.056	
P	0.298	

t: Student t-test

*: Statistically significant at $p \leq 0.05$

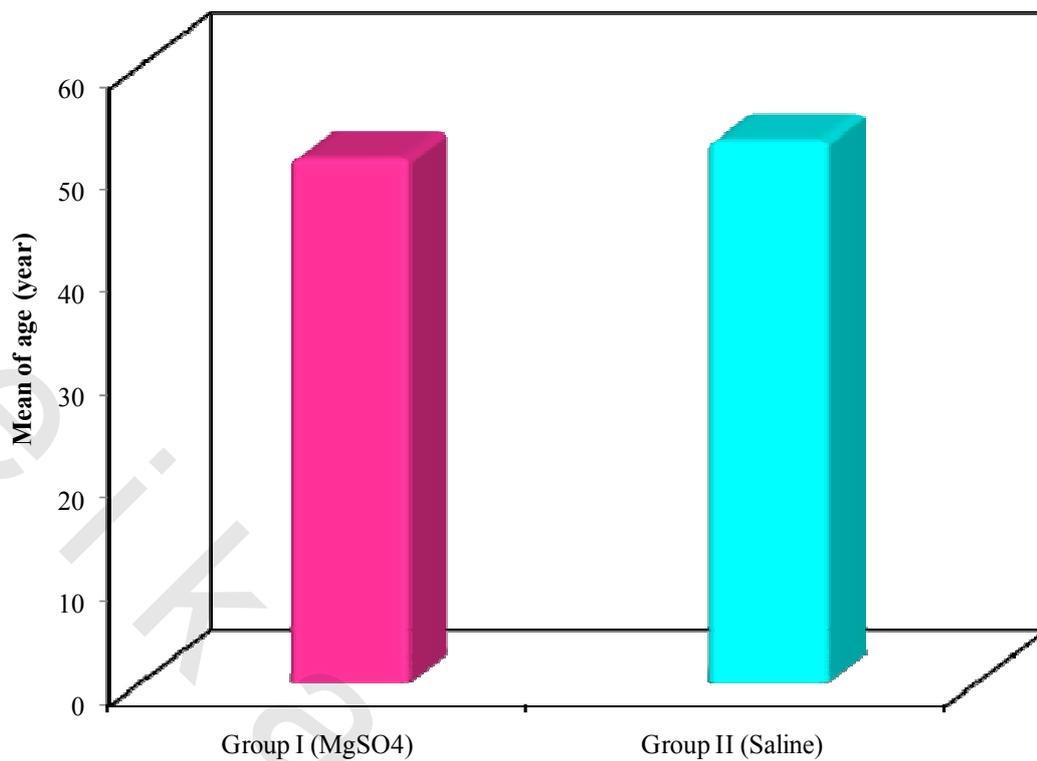


Figure (7): Comparison between the studied groups according to age (in years)

Table (II): Comparison between the studied groups according to sex

Patient number	Group I (MgSO₄) (n=20)	Group II (Saline) (n=20)
1	Male	Male
2	Male	Male
3	Male	Female
4	Female	Female
5	Male	Female
6	Male	Male
7	Female	Female
8	Female	Male
9	Male	Female
10	Male	Male
11	Male	Male
12	Male	Female
13	Male	Female
14	Female	Male
15	Male	Male
16	Female	Female
17	Female	Male
18	Female	Female
19	Male	Female
20	Male	Male
Male	13 (65.0%)	10 (50.0%)
Female	7 (35.0%)	10 (50.0%)
χ^2	0.921	
p	0.337	

χ^2 : Chi square test

*: Statistically significant at $p \leq 0.05$

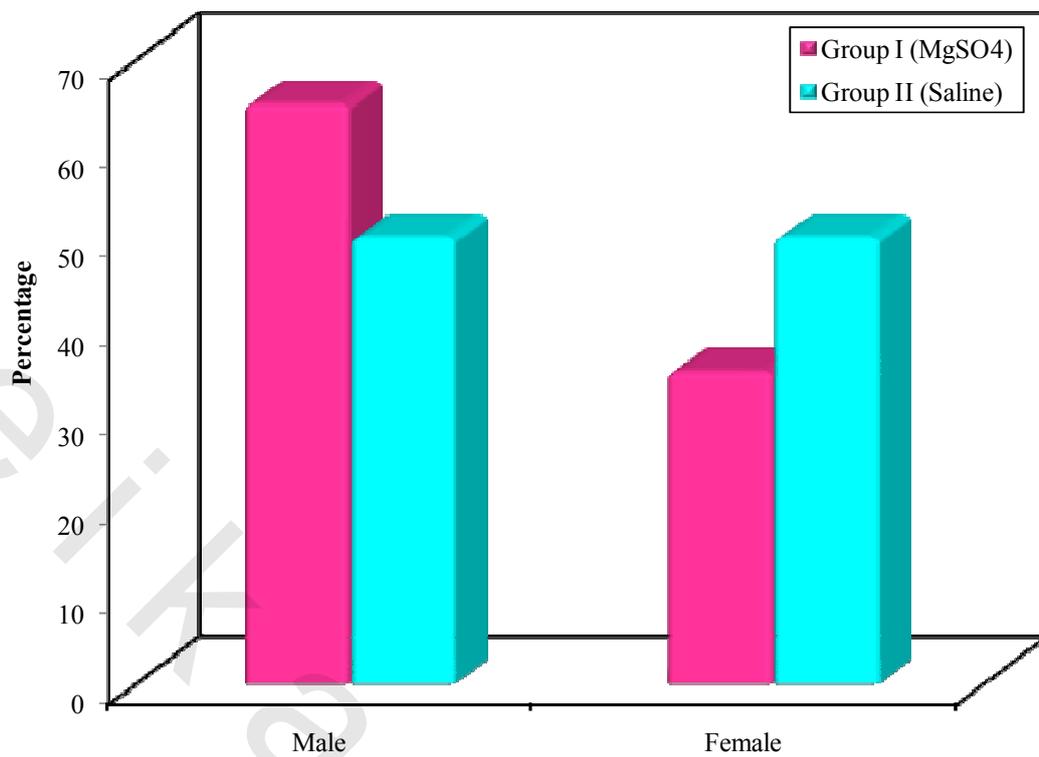


Figure (8): Comparison between the studied groups according to sex

Table (III): Comparison between the studied groups according to weight (in kg)

Patient number	Group I (n=20)	Group II (n=20)
1	105	120
2	109	103
3	99	105
4	90	112
5	95	99
6	90	107
7	103	100
8	90	110
9	100	103
10	110	95
11	96	90
12	95	101
13	101	88
14	105	93
15	101	126
16	107	95
17	110	90
18	100	120
19	104	100
20	99	87
Min. – Max.	90.0 – 110.0	87.0 – 126.0
Mean ± SD.	100.45 ± 6.37	102.20 ± 11.07
Median	100.50	100.50
t	0.613	
p	0.545	

t: Student t-test

*: Statistically significant at $p \leq 0.05$

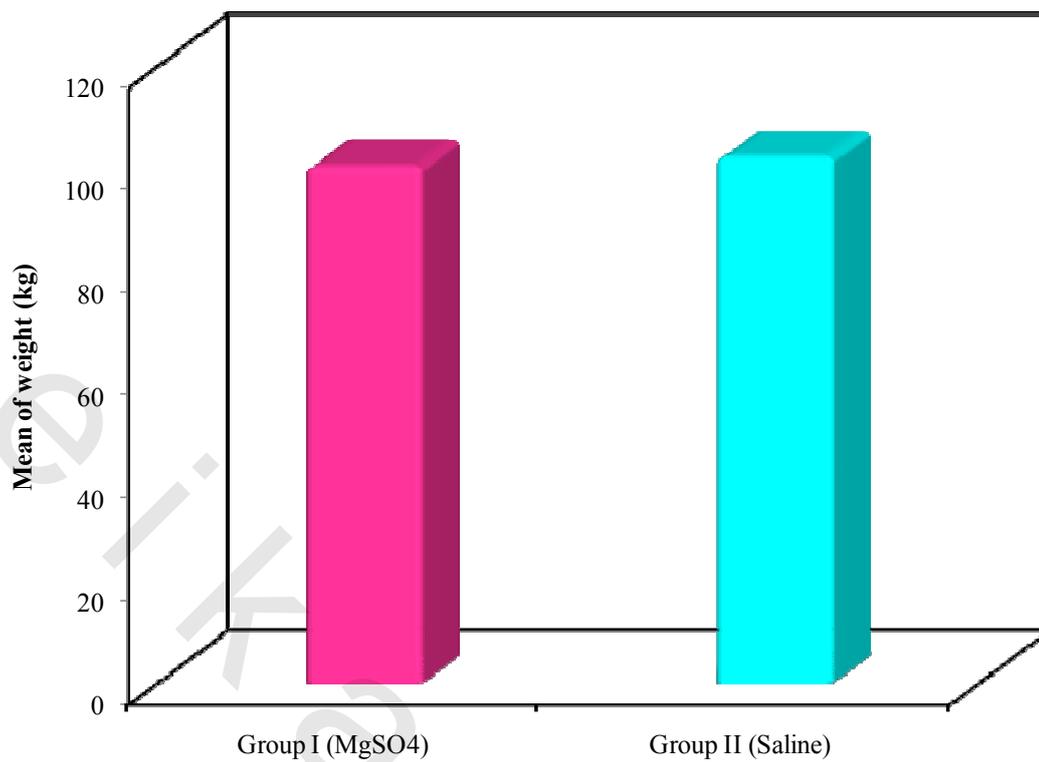


Figure (9): Comparison between the studied groups according to weight (in kg)

Table (IV): Comparison between the studied groups according to height (in cm)

Patient number	Group I (n=20)	Group II (n=20)
1	170	180
2	169	180
3	175	155
4	159	165
5	177	157
6	180	165
7	160	163
8	155	180
9	171	165
10	178	175
11	180	165
12	177	169
13	173	170
14	167	180
15	169	179
16	159	157
17	160	177
18	169	160
19	175	163
20	178	170
Min. – Max.	155.0 – 180.0	155.0 – 180.0
Mean ± SD.	170.05 ± 7.83	168.75 ± 8.54
Median	170.50	167.0
Z	0.407	
p	0.684	

Z: Z for Mann Whitney test

*: Statistically significant at $p \leq 0.05$

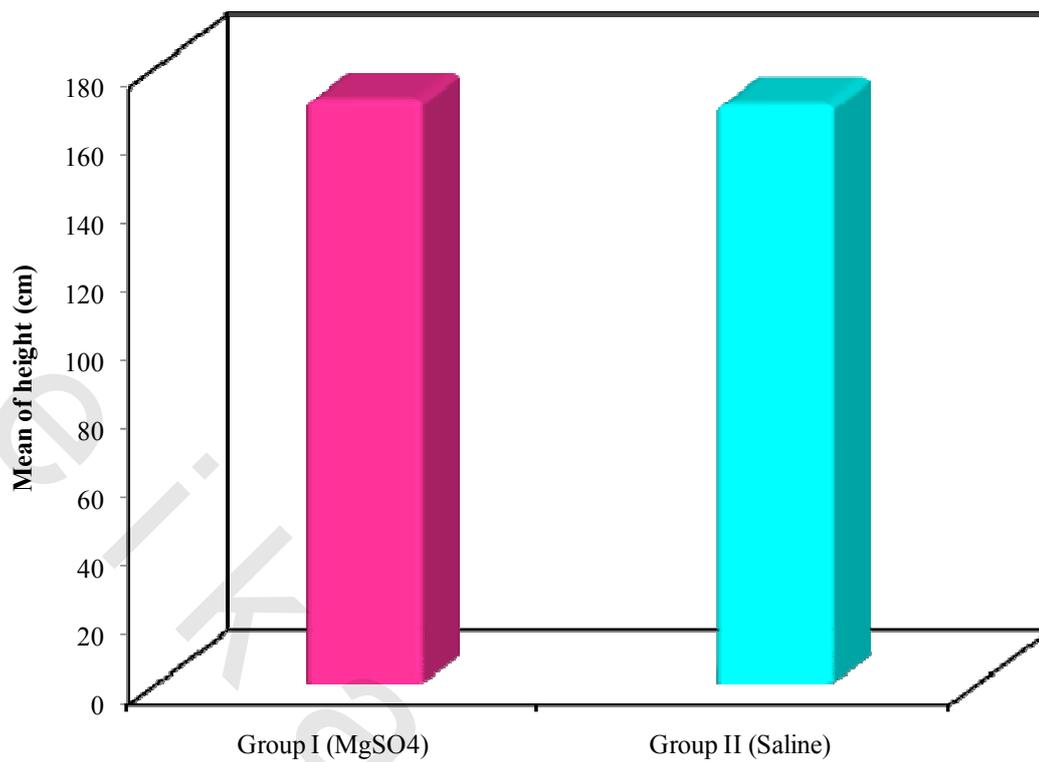


Figure (10): Comparison between the studied groups according to height (in cm)

2.Hemodynamic data:

A. Heart rate (in beats per minute): [Tables V- VII and Figure 11]

- **In group I (MgSO4): [Table V, Fig 11]**

- Preoperatively, the mean heart rate was 73.95 ± 10.79 beat/ min.
- No significant changes in the heart rate were observed at all interval times intraoperatively, immediately postoperative and at 30, 60,90, 120 min, 4 hrs and 8 hrs postoperatively.
- Significant increase in the heart rate was observed after 12, 16, 20 and 24 hrs postoperatively where p value were 0.008, 0.008, 0.024 and 0.006 respectively.

- **In group II (saline): [Table VI, Fig 11]**

- Preoperatively, the mean heart rate was 78.90 ± 10.45 beat/ min.
- No significant changes in the heart rate were observed at all interval times intraoperatively and postoperatively.

- **Comparison between the two groups as regard heart rate: [Table VII, Figure 11]**

- There was no statistically significant difference between the two studied groups regarding heart rate at all times of measurements except at 90 min and 4 hrs postoperatively where p value were 0.025 and 0.026 respectively.

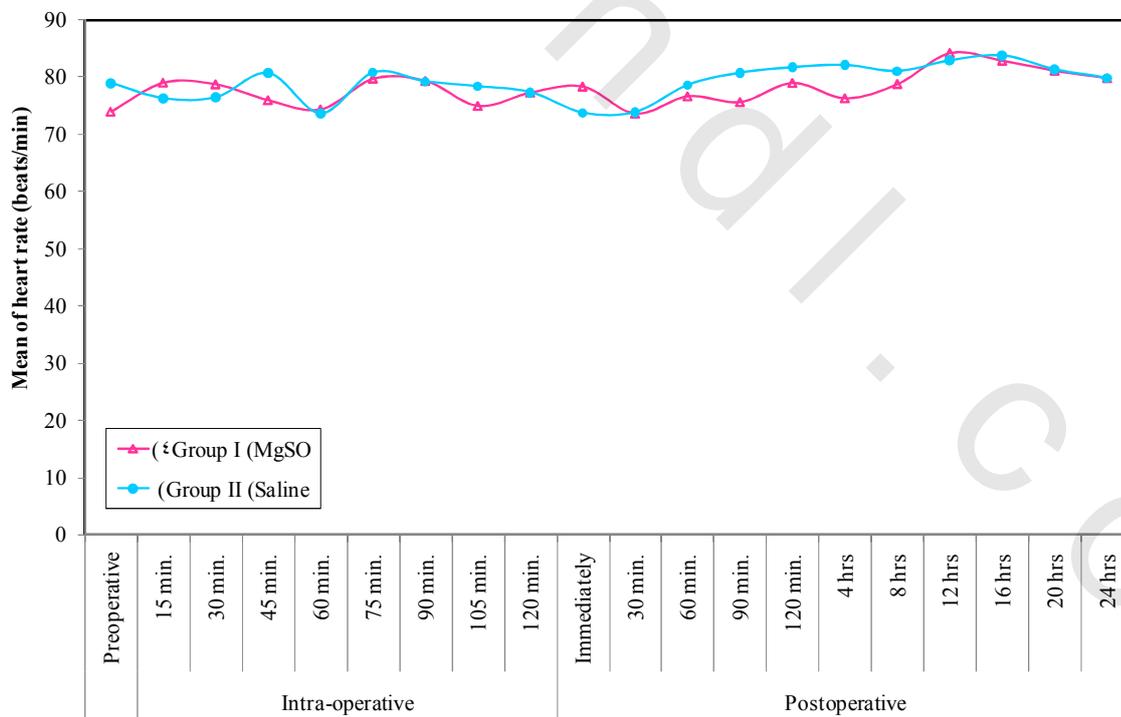


Figure (11): Comparison between the studied groups according to heart rate (beat/min).

Table (V): Descriptive analysis of patients according to heart rate changes in group I (beat/min)

patient number	Heart rate																				
	Pre-operative	Intra-operative								Postoperative											
		15 min.	30 min.	45 min.	60 min.	75 min.	90 min.	105 min.	120 min.	Immediately	30 min.	60 min.	90 min.	120 min.	4 hrs	8hrs	12hrs	16hrs	20hrs	24hrs	
1	70	65	91	65	83	79	63	72	70	76	93	80	73	85	73	82	86	71	80	83	
2	74	85	73	82	68	69	80	81	89	92	76	83	82	68	69	80	81	89	82	80	
3	75	86	91	66	71	74	68	66	69	71	64	85	83	74	87	80	79	74	70	70	
4	62	95	93	85	73	90	62	74	95	88	82	66	66	70	77	76	95	77	70	80	
5	71	70	55	92	65	79	82	91	73	70	73	73	82	78	79	80	81	89	80	79	
6	69	90	91	64	62	65	87	80	62	79	85	74	87	69	79	74	70	70	78	70	
7	92	92	65	54	64	86	75	94	81	80	68	79	67	87	77	93	87	89	90	93	
8	73	83	74	87	69	79	74	70	70	83	69	61	74	67	70	67	87	87	80	80	
9	60	68	85	84	65	86	87	86	78	91	63	87	73	90	70	74	95	90	93	79	
10	79	83	85	77	65	91	87	69	79	89	64	76	65	91	87	69	79	80	89	85	
11	70	94	79	67	87	77	93	87	89	69	64	88	88	79	81	72	93	88	79	80	
12	87	68	86	63	81	92	57	69	73	61	66	86	77	93	87	89	90	87	80	79	
13	65	71	92	77	88	85	74	58	89	60	63	78	79	93	80	85	78	80	86	80	
14	60	86	77	86	81	81	93	67	86	81	69	92	73	90	62	74	95	90	88	70	
15	87	67	66	74	68	65	86	61	64	93	72	86	85	83	82	87	84	95	75	89	
16	75	79	61	80	70	67	83	62	64	68	84	66	70	77	75	74	79	74	84	89	
17	90	60	69	88	88	79	81	72	93	69	61	74	75	74	79	77	79	80	81	83	
18	64	90	76	66	79	93	80	85	78	85	90	64	70	71	68	80	86	80	80	70	
19	63	75	89	81	87	90	92	83	70	73	83	63	69	69	63	85	82	85	80	71	
20	93	74	77	81	73	68	83	72	74	89	83	72	75	72	81	78	79	83	78	87	
Min.	60.0	60.0	55.0	54.0	62.0	65.0	57.0	58.0	62.0	60.0	61.0	61.0	65.0	67.0	62.0	67.0	70.0	70.0	70.0	70.0	
Max.	93.0	95.0	93.0	92.0	88.0	93.0	93.0	94.0	95.0	93.0	93.0	92.0	88.0	93.0	87.0	93.0	95.0	95.0	93.0	93.0	
Mean	73.95	79.05	78.75	75.95	74.35	79.75	79.35	74.95	77.30	78.35	73.60	76.65	75.65	79.0	76.30	78.80	84.25	82.90	81.15	79.85	
SD.	10.79	10.73	11.38	10.45	9.01	9.36	10.42	10.34	10.07	10.35	10.08	9.30	7.0	9.20	7.44	6.69	6.82	7.10	5.98	6.91	
Median	72.0	81.0	78.0	78.50	72.0	79.0	81.50	72.0	76.0	79.50	70.50	77.0	74.50	77.50	78.0	79.0	83.0	84.0	80.0	80.0	
p		0.147	0.239	0.550	0.955	0.113	0.159	0.794	0.372	0.197	0.881	0.446	0.466	0.083	0.297	0.053	0.008*	0.008*	0.024*	0.006*	

p: p value for Wilcoxon signed ranks test for comparing between pre and postoperative

*: Statistically significant at $p \leq 0.05$

Table (VI): Descriptive analysis of patients according to hear rate changes in group II (beat/min)

patient number	Heart rate																				
	Pre-operative	Intra-operative								Postoperative											
		15 min.	30 min.	45 min.	60 min.	75 min.	90 min.	105 min.	120 min.	Immediately	30 min.	60 min.	90 min.	120 min.	4 hrs	8hrs	12hrs	16hrs	20hrs	24hrs	
1	92	62	86	78	71	89	76	80	63	65	93	83	85	80	80	80	88	86	81	80	
2	64	69	63	79	80	71	77	81	81	82	87	70	73	74	77	74	73	73	71	74	
3	85	67	76	83	85	76	87	86	67	76	69	67	70	71	74	73	74	70	70	70	
4	62	80	81	81	95	82	86	63	93	81	85	79	80	81	81	80	80	91	89	81	
5	66	89	72	62	81	75	71	86	93	71	62	85	85	81	89	91	92	92	89	90	
6	80	91	61	87	67	76	68	68	62	71	79	79	80	82	77	86	87	88	88	80	
7	75	76	70	88	63	80	86	80	63	67	63	91	90	90	89	85	88	89	84	88	
8	92	80	80	95	62	79	95	79	94	75	84	71	75	76	87	83	91	93	94	79	
9	94	71	86	78	69	79	70	64	84	82	69	87	89	88	86	85	85	84	82	85	
10	68	85	95	84	83	91	95	91	82	75	82	73	75	84	80	80	88	81	86	77	
11	83	75	65	69	83	74	71	84	72	79	62	80	80	75	76	73	77	74	74	79	
12	64	93	80	84	61	89	93	65	79	63	72	85	90	85	87	77	83	81	80	83	
13	82	69	84	85	62	93	66	68	75	63	64	73	75	78	76	79	78	78	70	71	
14	75	78	74	85	66	63	61	94	64	84	67	88	90	90	89	88	85	83	85	86	
15	90	73	75	84	62	78	77	77	64	79	60	82	82	88	91	84	83	83	81	83	
16	92	61	57	73	68	63	87	84	95	77	91	82	85	85	80	80	80	88	86	82	
17	76	71	91	75	70	93	91	62	88	91	62	80	83	82	78	82	80	81	76	85	
18	72	65	87	76	89	88	69	89	90	67	84	73	75	88	87	83	91	94	81	74	
19	85	86	81	95	64	83	92	75	64	61	60	61	67	75	76	77	74	74	70	68	
20	81	84	65	72	92	93	66	91	73	66	83	83	85	80	81	80	80	91	89	81	
Min.	62.0	61.0	57.0	62.0	61.0	63.0	61.0	62.0	62.0	61.0	60.0	61.0	67.0	71.0	74.0	73.0	73.0	70.0	70.0	68.0	
Max.	94.0	93.0	95.0	95.0	95.0	93.0	95.0	94.0	95.0	91.0	93.0	91.0	90.0	90.0	91.0	91.0	92.0	94.0	94.0	90.0	
Mean	78.90	76.25	76.45	80.65	73.65	80.75	79.20	78.35	77.30	73.75	73.90	78.60	80.70	81.65	82.05	81.0	82.85	83.70	81.30	79.80	
SD.	10.45	9.58	10.52	8.18	11.18	9.22	11.13	10.23	12.09	8.28	11.37	7.71	6.89	5.62	5.48	4.82	5.92	7.20	7.33	5.99	
Median	80.5	75.5	78.0	82.0	69.5	79.5	77.0	80.0	77.0	75.0	70.50	80.0	81.0	81.50	80.50	80.0	83.0	83.50	81.50	80.50	
p		0.478	0.444	0.490	0.199	0.550	0.896	0.926	0.751	0.117	0.156	0.852	.572	.304	.212	.379	0.232	.145	.600	.794	

p: p value for Wilcoxon signed ranks test for comparing between pre and postoperative

*: Statistically significant at $p \leq 0.05$

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

	Heart rate																			
	Pre-operative	Intra-operative								Postoperative										
		15 min.	30 min.	45 min.	60 min.	75 min.	90 min.	105 min.	120 min.	Immediately	30 min.	60 min.	90 min.	120 min.	4 hrs	8 hrs	12 hrs	16 hrs	20 hrs	24 hrs
Group I																				
Min.	60.0	60.0	55.0	54.0	62.0	65.0	57.0	58.0	62.0	60.0	61.0	61.0	65.0	67.0	62.0	67.0	70.0	70.0	70.0	70.0
Max.	93.0	95.0	93.0	92.0	88.0	93.0	93.0	94.0	95.0	93.0	93.0	92.0	88.0	93.0	87.0	93.0	95.0	95.0	93.0	93.0
Mean	73.95	79.05	78.75	75.95	74.35	79.75	79.35	74.95	77.30	78.35	73.60	76.65	75.65	79.0	76.30	78.80	84.25	82.90	81.15	79.85
SD.	10.79	10.73	11.38	10.45	9.01	9.36	10.42	10.34	10.07	10.35	10.08	9.30	7.0	9.20	7.44	6.69	6.82	7.10	5.98	6.91
Median	72.0	81.0	78.0	78.50	72.0	79.0	81.50	72.0	76.0	79.50	70.50	77.0	74.50	77.50	78.0	79.0	83.0	84.0	80.0	80.0
Group II																				
Min.	62.0	61.0	57.0	62.0	61.0	63.0	61.0	62.0	62.0	61.0	60.0	61.0	67.0	71.0	74.0	73.0	73.0	70.0	70.0	68.0
Max.	94.0	93.0	95.0	95.0	95.0	93.0	95.0	94.0	95.0	91.0	93.0	91.0	90.0	90.0	91.0	91.0	92.0	94.0	94.0	90.0
Mean	78.90	76.25	76.45	80.65	73.65	80.75	79.20	78.35	77.30	73.75	73.90	78.60	80.70	81.65	82.05	81.0	82.85	83.70	81.30	79.80
SD.	10.45	9.58	10.52	8.18	11.18	9.22	11.13	10.23	12.09	8.28	11.37	7.71	6.89	5.62	5.48	4.82	5.92	7.20	7.33	5.99
Median	80.5	75.5	78.0	82.0	69.5	79.5	77.0	80.0	77.0	75.0	70.50	80.0	81.0	81.50	80.50	80.0	83.0	83.50	81.50	80.50
Z	1.530	0.785	0.731	1.205	0.555	0.258	0.027	0.907	0.027	1.489	0.176	0.542	2.240*	1.084	2.226*	1.185	0.474	0.488	0.530	0.150
p	0.126	0.432	0.465	0.228	0.579	0.797	0.978	0.364	0.978	0.136	0.860	0.588	0.025*	0.279	0.026*	0.236	0.635	0.626	0.596	0.881

Z: Z for Mann Whitney test

*: Statistically significant at $p \leq 0.05$

B) Mean arterial blood pressure: [Tables VIII-X and Figure 12]

• **In group I (MgSO4): [Table VIII, Fig 12]**

- Preoperatively, the MABP was 94.70± 10.33 mmHg.
- No significant changes in the MABP were observed at all interval times intraoperatively, immediately postoperative and at 30, 60,90 postoperatively.
- Significant increase in the MABP were observed after 120 min, 4, 8, 12, 16, 20 and 24 hrs postoperatively where p value were 0.028, 0.014, 0.005, 0.003, 0.002, 0.001, 0.009 respectively.

• **In group II (saline): [Table IX, Fig 12]**

- Preoperatively, the MABP was 93.25±8.88 mmHg.
- No significant changes in the MABP were observed at all interval times intraoperatively, immediately postoperative and at 30, 60,90 postoperatively
- Significant increase in the MABP were observed after 120 min, 4, 8, 12, 16, 20 and 24 hrs postoperatively where p value were 0.036, 0.022, 0.007, 0.001, 0.007, 0.001, 0.002 respectively.

• **Comparison between the two groups as regard MABP: [Table X, Figure 12]**

- There were no statistical significant differences between the two studied groups regarding MABP at all interval time (P>0.05).

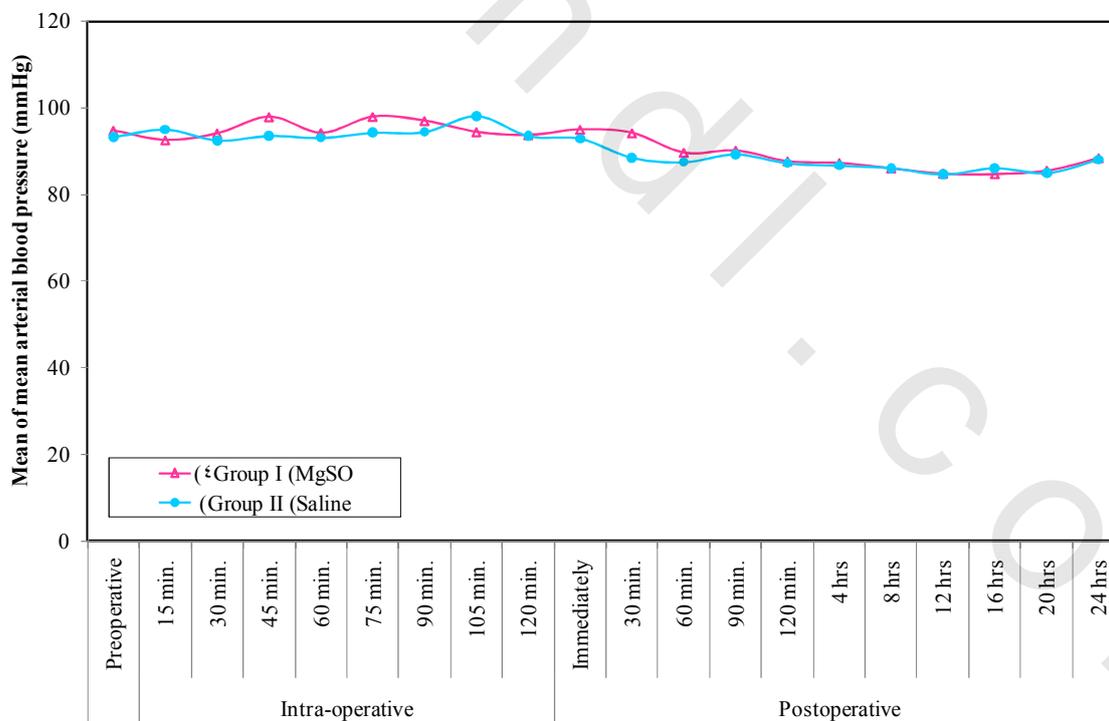


Figure (12): Comparison between the studied groups according to mean arterial blood pressure (mmHg)

Table (VIII): Descriptive analysis of patients according to changes in mean arterial blood pressure in group I (mmHg)

patient number	Mean arterial blood pressure																				
	Pre-operative	Intra-operative								Postoperative											
		15 min.	30 min.	45 min.	60 min.	75 min.	90 min.	105 min.	120 min.	Immediately	30 min.	60 min.	90 min.	120 min.	4 hrs	8hrs	12hrs	16hrs	20hrs	24hrs	
1	81	90	85	93	93	97	105	96	91	90	90	95	90	86	91	90	87	86	84	84	
2	85	85	98	106	107	99	101	99	86	103	103	110	100	90	90	91	91	88	83	89	
3	100	97	91	98	110	109	109	102	103	84	68	68	70	78	80	79	80	80	82	85	
4	105	81	110	93	84	81	102	81	86	90	90	88	90	85	84	82	81	82	87	90	
5	105	98	100	63	89	95	103	92	92	90	90	84	85	79	80	80	75	77	80	89	
6	91	100	96	104	95	105	97	96	87	99	99	80	80	82	83	83	78	79	82	90	
7	101	102	90	107	95	104	92	82	93	109	109	81	83	85	82	80	80	81	91	97	
8	87	60	98	104	86	107	86	92	96	103	103	72	75	78	80	79	80	77	80	82	
9	92	107	88	109	81	104	83	86	110	104	104	100	100	91	92	91	87	88	89	90	
10	109	109	105	101	108	96	100	98	101	83	83	84	85	82	84	83	80	80	81	89	
11	109	105	94	89	87	97	80	106	85	91	91	101	105	90	90	88	90	89	89	88	
12	89	97	91	100	107	103	104	89	85	102	102	85	90	92	95	93	93	97	87	91	
13	80	65	96	82	95	104	88	96	88	85	85	99	100	95	90	88	90	88	88	88	
14	103	80	97	110	107	66	101	109	91	88	88	108	101	100	97	89	85	88	91	90	
15	81	99	83	81	87	108	100	87	102	93	93	83	84	83	85	82	81	80	82	84	
16	90	102	60	107	103	98	86	107	91	94	94	81	82	84	83	85	85	88	89	88	
17	80	103	92	110	88	90	107	90	81	94	94	95	100	97	90	90	88	90	87	87	
18	99	90	106	107	63	92	105	83	106	105	105	89	90	90	91	92	91	87	88	89	
19	98	93	98	102	99	103	101	107	96	110	110	102	105	100	90	88	88	84	82	92	
20	109	88	104	91	100	100	89	90	104	82	82	88	88	87	89	88	87	86	89	86	
Min.	80.0	60.0	60.0	63.0	63.0	66.0	80.0	81.0	81.0	82.0	68.0	68.0	70.0	78.0	80.0	79.0	75.0	77.0	80.0	82.0	
Max.	109.0	109.0	110.0	110.0	110.0	109.0	109.0	109.0	110.0	110.0	110.0	110.0	105.0	100.0	97.0	93.0	93.0	97.0	91.0	97.0	
Mean	94.70	92.55	94.10	97.85	94.20	97.90	96.95	94.40	93.70	94.95	94.15	89.65	90.15	87.70	87.30	86.05	84.85	84.75	85.55	88.40	
SD.	10.33	13.16	10.65	12.07	11.60	10.11	8.72	8.68	8.20	8.81	10.43	11.34	10.0	6.77	5.10	4.66	5.11	5.13	3.75	3.28	
Median	95.0	97.0	96.0	101.50	95.0	99.50	100.5	94.0	91.5	93.50	93.50	88.0	90.0	86.50	89.50	88.0	86.0	86.0	87.0	89.0	
p		0.517	0.808	0.410	0.883	0.400	0.485	0.918	0.700	0.942	0.882	0.173	0.183	0.028*	0.014*	0.005*	0.003*	0.002*	0.001*	0.009*	

p: Stands for LSD p-value for ANOVA with repeated measures for comparison between pre with each other period

*: Statistically significant at $p \leq 0.05$

Table (IX): Descriptive analysis of patients according to changes in mean arterial blood pressure in group II (mmHg)

patient number	Mean arterial blood pressure																			
	Pre-operative	Intra-operative								Postoperative										
		15 min.	30 min.	45 min.	60 min.	75 min.	90 min.	105 min.	120 min.	Immediately	30 min.	60 min.	90 min.	120 min.	4 hrs	8hrs	12hrs	16hrs	20hrs	24hrs
1	86	94	90	91	87	95	106	110	104	101	101	86	90	92	95	93	93	97	87	88
2	86	95	82	94	105	85	105	81	100	104	104	99	99	100	89	88	92	95	90	86
3	83	82	89	89	88	110	85	95	107	91	91	85	85	87	89	85	79	86	83	83
4	104	98	105	81	98	82	109	108	99	80	65	66	70	75	74	78	80	79	80	90
5	91	63	98	94	93	85	82	94	81	83	83	105	110	100	99	97	91	91	90	89
6	80	106	88	89	101	82	98	99	89	107	107	82	85	86	85	85	83	82	87	87
7	91	107	94	86	79	88	85	104	79	89	68	68	70	78	75	84	83	82	81	88
8	105	83	85	97	110	81	90	91	92	90	90	91	95	85	79	80	80	77	79	90
9	102	110	106	86	82	102	84	102	91	98	98	108	110	95	93	90	93	97	91	95
10	93	92	109	104	80	93	98	109	101	95	95	94	95	90	86	86	83	87	82	83
11	81	93	93	106	91	103	91	98	84	87	65	68	70	75	84	83	82	83	81	81
12	93	109	103	84	88	103	88	85	91	94	94	101	101	87	90	88	86	88	85	90
13	107	105	88	107	91	106	94	110	90	95	95	101	100	90	92	93	93	90	87	95
14	100	104	60	87	110	92	100	88	92	81	81	89	90	85	84	79	83	88	83	89
15	84	100	95	84	96	104	89	102	110	98	68	68	70	77	80	80	81	79	85	80
16	89	104	84	107	86	91	99	94	106	89	89	105	105	99	97	88	85	83	82	88
17	110	97	88	110	91	90	93	95	99	90	90	85	85	86	87	85	85	87	89	90
18	92	85	99	88	95	91	85	102	92	80	80	84	90	94	89	86	83	88	83	90
19	94	91	97	104	80	100	106	86	80	109	109	83	84	80	86	88	77	78	87	90
20	94	81	96	82	110	101	101	108	82	96	96	81	81	83	80	86	81	85	87	89
Min.	80.0	63.0	60.0	81.0	79.0	81.0	82.0	81.0	79.0	80.0	65.0	66.0	70.0	75.0	74.0	78.0	77.0	77.0	79.0	80.0
Max.	110.0	110.0	109.0	110.0	110.0	110.0	109.0	110.0	110.0	109.0	109.0	108.0	110.0	100.0	99.0	97.0	93.0	97.0	91.0	95.0
Mean	93.25	94.95	92.45	93.50	93.05	94.20	94.40	98.05	93.45	92.85	88.45	87.45	89.25	87.20	86.65	86.10	84.65	86.10	84.95	88.05
SD.	8.88	11.81	10.78	9.53	10.04	8.90	8.42	8.87	9.47	8.51	13.64	13.20	12.89	7.88	6.83	4.88	5.06	5.95	3.59	3.93
Median	92.5	96.0	93.50	90.0	91.0	92.5	93.5	98.5	92.0	92.50	90.50	85.50	90.0	86.50	86.50	86.0	83.0	86.50	85.0	89.0
p		0.592	0.802	0.926	0.945	0.756	0.673	0.089	0.949	0.900	0.203	0.082	0.216	0.036*	0.022*	0.007*	0.001*	0.007*	0.001*	0.002*

p: Stands for LSD p-value for ANOVA with repeated measures for comparison between pre with each other period

*: Statistically significant at $p \leq 0.05$

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

	Mean arterial blood pressure																			
	Pre-operative	Intra-operative								Postoperative										
		15 min.	30 min.	45 min.	60 min.	75 min.	90 min.	105 min.	120 min.	Immediately	30 min.	60 min.	90 min.	120 min.	4 hrs	8 hrs	12 hrs	16 hrs	20 hrs	24 hrs
Group I																				
Min.	80.0	60.0	60.0	63.0	63.0	66.0	80.0	81.0	81.0	82.0	68.0	68.0	70.0	78.0	80.0	79.0	75.0	77.0	80.0	82.0
Max.	109.0	109.0	110.0	110.0	110.0	109.0	109.0	109.0	110.0	110.0	110.0	110.0	105.0	100.0	97.0	93.0	93.0	97.0	91.0	97.0
Mean	94.70	92.55	94.10	97.85	94.20	97.90	96.95	94.40	93.70	94.95	94.15	89.65	90.15	87.70	87.30	86.05	84.85	84.75	85.55	88.40
SD.	10.33	13.16	10.65	12.07	11.60	10.11	8.72	8.68	8.20	8.81	10.43	11.34	10.0	6.77	5.10	4.66	5.11	5.13	3.75	3.28
Median	95.0	97.0	96.0	101.50	95.0	99.50	100.5	94.0	91.5	93.50	93.50	88.0	90.0	86.50	89.50	88.0	86.0	86.0	87.0	89.0
Group II																				
Min.	80.0	63.0	60.0	81.0	79.0	81.0	82.0	81.0	79.0	80.0	65.0	66.0	70.0	75.0	74.0	78.0	77.0	77.0	79.0	80.0
Max.	110.0	110.0	109.0	110.0	110.0	110.0	109.0	110.0	110.0	109.0	109.0	108.0	110.0	100.0	99.0	97.0	93.0	97.0	91.0	95.0
Mean	93.25	94.95	92.45	93.50	93.05	94.20	94.40	98.05	93.45	92.85	88.45	87.45	89.25	87.20	86.65	86.10	84.65	86.10	84.95	88.05
SD.	8.88	11.81	10.78	9.53	10.04	8.90	8.42	8.87	9.47	8.51	13.64	13.20	12.89	7.88	6.83	4.88	5.06	5.95	3.59	3.93
Median	92.5	96.0	93.50	90.0	91.0	92.5	93.5	98.5	92.0	92.50	90.50	85.50	90.0	86.50	86.50	86.0	83.0	86.50	85.0	89.0
t	0.476	0.607	0.487	1.265	0.335	1.228	0.941	1.315	0.089	0.767	1.484	0.565	0.247	0.215	0.341	0.033	0.124	0.769	0.517	0.306
p	0.637	0.547	0.629	0.214	0.739	0.227	0.353	0.196	0.929	0.448	0.146	0.575	0.806	0.831	0.735	0.974	0.902	0.447	0.608	0.761

t: Student t-test

*: Statistically significant at $p \leq 0.05$

C) Arterial oxygen saturation (on oxygen face mask) (%): [Tables XI-XIII and Figure 13]

• **In group I; [Table XI, Fig 13]**

- Preoperatively the mean value of arterial oxygen saturation was 97.80 ± 1.58 %.
- There was no significant change in SPO₂ % throughout the times of measurement intraoperatively.

• **In group II ; [Table XII, Fig 13]**

- Preoperatively the mean value of arterial oxygen saturation was 97.45 ± 1.93 %.
- There was no significant change in SPO₂ % throughout the times of measurement intraoperatively.

• **Comparison between the two groups as regard arterial oxygen saturation: [Table XIII, Figure 13]**

- There were no statistical significant differences between the two studied groups as regards SPO₂ throughout the times of measurement intraoperatively ($P > 0.05$).

Results

Table (XI): Descriptive analysis of patients according to SPO₂ % in group I (%) intraoperatively

Patient number	SPO ₂								
	Preoperative	15min	30min	45min	60min	75min	90min	105min	120min
1	98	96	99	99	100	95	96	100	98
2	96	96	97	98	98	97	98	99	98
3	100	99	100	95	100	96	96	96	97
4	98	97	95	96	97	96	98	97	95
5	100	98	99	99	98	100	99	98	99
6	96	96	95	96	100	98	99	95	98
7	97	99	100	100	95	100	98	100	96
8	98	95	95	96	98	97	95	95	97
9	95	95	96	95	98	97	98	98	98
10	96	99	98	99	96	95	99	99	99
11	97	97	96	100	100	97	97	96	95
12	97	95	100	99	96	100	100	96	99
13	100	100	97	95	99	97	100	95	100
14	99	100	98	98	95	100	100	98	96
15	97	97	95	100	96	96	97	98	100
16	98	95	96	95	98	96	96	98	98
17	96	99	97	96	97	97	97	100	100
18	99	100	95	97	97	97	95	97	96
19	99	100	97	97	96	99	95	98	96
20	100	97	98	96	97	98	100	96	100
Min.	95.0	95.0	95.0	95.0	95.0	95.0	95.0	95.0	95.0
Max.	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Mean	97.80	97.50	97.15	97.30	97.55	97.40	97.65	97.45	97.75
SD.	1.58	1.88	1.79	1.84	1.64	1.64	1.76	1.67	1.68
Median	98.0	97.0	97.0	97.0	97.5	97.0	98.0	98.0	98.0
p		0.474	0.174	0.409	0.617	0.391	0.782	0.563	0.926

p:Stands for LSD p-value for ANOVA with repeated measures for comparison between pre with each other period

*: Statistically significant at $p \leq 0.0$

Results

Table (XII): Descriptive analysis of patients according to SPO₂ % in group II (%) intraoperatively

Patient number	SPO ₂								
	Preoperative	15min	30min	45min	60min	75min	90min	105min	120min
1	99	96	96	95	96	95	100	97	97
2	97	96	97	99	97	95	97	99	96
3	100	100	99	96	100	95	95	99	96
4	95	100	98	97	95	97	97	95	99
5	98	98	98	95	99	97	99	97	99
6	99	96	97	96	100	96	99	95	97
7	100	99	95	98	100	99	96	95	95
8	98	100	100	99	95	99	100	95	99
9	95	99	100	100	98	98	96	99	98
10	95	96	100	96	95	95	96	98	95
11	96	97	95	95	97	99	97	97	95
12	97	95	95	95	96	99	99	95	95
13	95	97	96	95	98	97	96	97	95
14	98	96	99	95	98	95	98	95	95
15	99	99	97	100	95	98	96	99	98
16	95	99	97	100	98	96	96	99	96
17	100	97	97	99	98	98	99	96	100
18	99	100	96	96	100	98	100	98	99
19	95	95	95	99	95	98	95	95	95
20	99	95	99	99	98	96	95	100	97
Min.	95.0	95.0	95.0	95.0	95.0	95.0	95.0	95.0	95.0
Max.	100.0	100.0	100.0	100.0	100.0	99.0	100.0	100.0	100.0
Mean	97.45	97.50	97.30	97.20	97.40	97.00	97.30	97.00	96.80
SD.	1.93	1.85	1.75	1.99	1.85	1.52	1.78	1.78	1.74
Median	98.0	97.0	97.0	96.5	98.0	97.0	97.0	97.0	96.5
p		0.930	0.804	0.699	0.909	0.427	0.757	0.456	0.194

p:Stands for LSD p-value for ANOVA with repeated measures for comparison between pre with each other period

*: Statistically significant at $p \leq 0.05$

Results

Table (XIII): Comparison between the studied groups according to SPO₂ (%)

	SPO ₂								
	Preoperative	15min	30min	45min	60min	75min	90min	105min	120min
Group I									
Min.	95.0	95.0	95.0	95.0	95.0	95.0	95.0	95.0	95.0
Max.	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Mean	97.80	97.50	97.15	97.30	97.55	97.40	97.65	97.45	97.75
SD.	1.58	1.88	1.79	1.84	1.64	1.64	1.76	1.67	1.68
Median	98.0	97.0	97.0	97.0	97.5	97.0	98.0	98.0	98.0
Group II									
Min.	95.0	95.0	95.0	95.0	95.0	95.0	95.0	95.0	95.0
Max.	100.0	100.0	100.0	100.0	100.0	99.0	100.0	100.0	100.0
Mean	97.45	97.50	97.30	97.20	97.40	97.00	97.30	97.00	96.80
SD.	1.93	1.85	1.75	1.99	1.85	1.52	1.78	1.78	1.74
Median	98.0	97.0	97.0	96.5	98.0	97.0	97.0	97.0	96.5
t	0.628	0.0	0.268	0.165	0.272	0.801	0.626	0.825	1.758
p	0.534	1.000	0.790	0.870	0.787	0.428	0.535	0.414	0.087

t: Student t-test

*: Statistically significant at $p \leq 0.05$

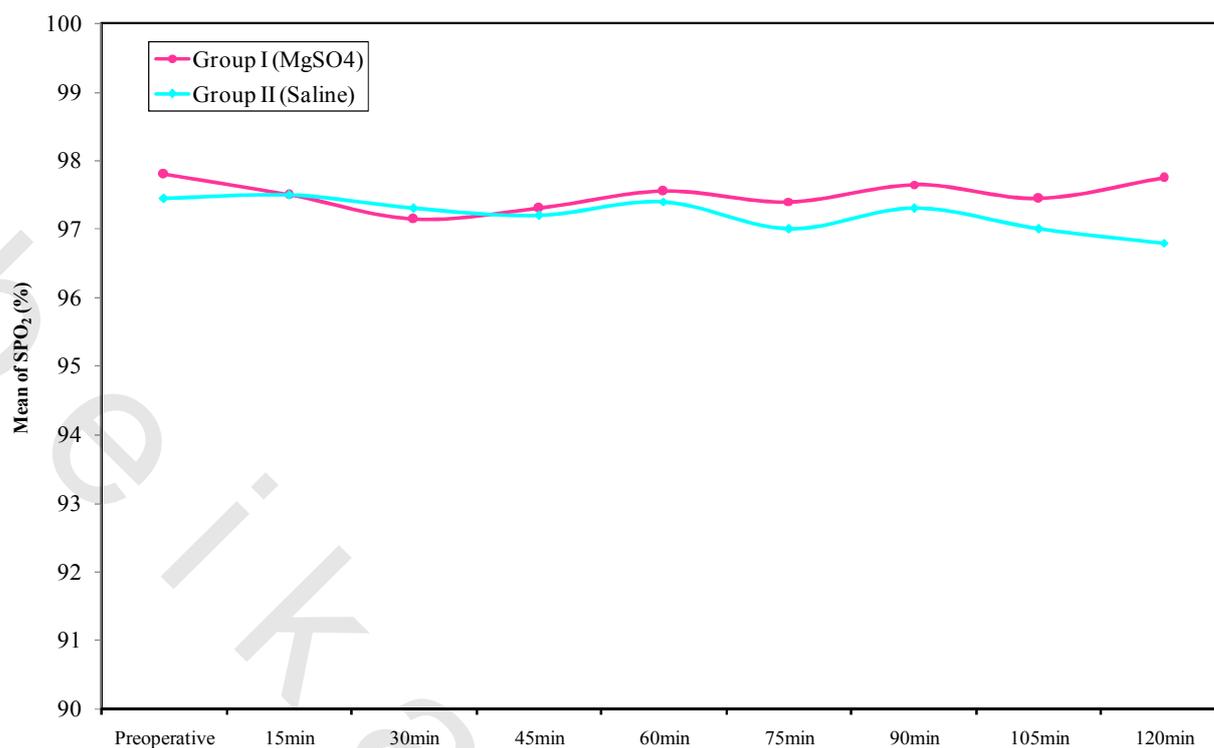


Figure (13): Comparison between the studied groups according to SPO₂

D) Respiratory rate (breath per min): [Tables XIV- XVI and figure 14]

• **In group I ; [Table XIV, Fig 14]**

- Preoperatively, the mean value of respiratory rate was 13.45 ± 1.7 breath/min.
- Significant increase in the R.R. was observed intraoperatively at 15, 30, 45, 60, 75, 90, 105, 120 min where p value were 0.013, 0.023, <0.001, <0.001, 0.005, 0.002, 0.001, 0.001 respectively.

• **In group II ; [Table XV, Fig 14]**

- Preoperatively, the mean value of respiratory rate was 12.90 ± 1.74 breath/min.
- No significant changes in the R.R. were observed intraoperatively at 15, 30, 45, 60, 75, 90, 105 min.
- Significant change in R.R. was observed intraoperatively at 120 min where p value was 0.030.

• **Comparison between the two groups as regard respiratory rate: [Table XVI, Figure 14]**

- No statistical significant difference was observed as regard R.R. between the two groups at all times of measurement except at 45, 60 min intraoperatively where p value were 0.001 and 0.002 respectively.

Results

Table (XIV): Descriptive analysis of patients according to respiratory rate changes in group I (breath/min)

Patient number	Respiratory rate								
	Baseline	15 min	30 min	45 min	60 min	75 min	90 min	105min	120min
1	13	12	9	10	10	9	10	11	12
2	14	12	11	10	10	10	11	13	14
3	11	11	11	10	9	12	14	13	11
4	12	11	10	9	11	11	12	12	12
5	12	11	11	9	11	10	11	11	12
6	12	12	12	11	10	12	11	11	10
7	15	14	15	10	12	10	10	10	12
8	11	12	12	10	9	9	10	11	11
9	13	12	10	9	10	11	12	14	14
10	12	10	12	10	10	9	12	10	10
11	12	12	11	11	11	11	10	12	12
12	15	11	10	10	10	11	11	10	13
13	14	14	16	10	12	14	14	13	13
14	16	18	16	11	10	12	12	13	14
15	18	16	12	11	9	12	11	12	15
16	13	10	9	11	10	10	12	11	12
17	14	15	16	12	11	14	14	13	13
18	14	13	15	17	12	12	12	12	14
19	13	12	12	10	15	14	12	11	12
20	15	14	14	16	18	20	14	12	12
Min.	11.0	10.0	9.0	9.0	9.0	9.0	10.0	10.0	10.0
Max.	18.0	18.0	16.0	17.0	18.0	20.0	14.0	14.0	15.0
Mean	13.45	12.60	12.20	10.85	11.0	11.65	11.75	11.75	12.40
SD.	1.76	2.04	2.33	2.08	2.15	2.52	1.37	1.16	1.35
Median	13.0	12.0	12.0	10.0	10.0	11.0	12.0	12.0	12.0
p		0.013*	0.023*	<0.001*	<0.001*	0.005*	0.002*	0.001*	0.001*

p:Stands for LSD p-value for ANOVA with repeated measures for comparison between pre with each other period

*: Statistically significant at $p \leq 0.05$

Results

Table (XV): Descriptive analysis of patients according to respiratory rate changes in group II (breath/min)

Patient number	Respiratory rate								
	Baseline	15 min	30 min	45 min	60 min	75 min	90 min	105min	120min
1	14	12	12	12	10	10	12	13	14
2	13	13	13	12	12	10	12	13	13
3	16	16	15	14	12	14	14	14	15
4	12	12	11	11	11	12	12	12	12
5	13	13	12	11	12	13	13	13	12
6	12	11	13	16	18	14	14	13	12
7	14	14	12	12	11	11	12	14	14
8	16	17	17	15	14	13	12	12	14
9	13	12	12	11	11	12	13	12	12
10	12	11	11	13	13	12	12	12	12
11	15	14	14	13	13	14	14	14	14
12	10	10	10	12	12	13	11	11	10
13	11	12	14	14	14	13	12	12	10
14	14	15	15	16	18	12	10	12	14
15	12	12	11	11	14	11	12	12	12
16	12	13	13	15	15	12	11	11	12
17	10	10	12	12	13	12	11	11	11
18	14	13	14	15	16	11	12	12	10
19	11	12	13	12	12	11	12	13	11
20	14	14	13	13	14	12	13	12	13
Min.	10.0	10.0	10.0	11.0	10.0	10.0	10.0	11.0	10.0
Max.	16.0	17.0	17.0	16.0	18.0	14.0	14.0	14.0	15.0
Mean	12.90	12.80	12.85	13.0	13.25	12.10	12.20	12.40	12.35
SD.	1.74	1.82	1.66	1.69	2.20	1.21	1.06	0.94	1.50
Median	13.0	12.50	13.0	12.50	13.0	12.0	12.0	12.0	12.0
P		0.606	0.874	0.827	0.580	0.088	0.069	0.135	0.030*

p:Stands for LSD p-value for ANOVA with repeated measures for comparison between pre with each other period

*: Statistically significant at $p \leq 0.05$

Results

Table (XVI): Comparison between the two studied groups according to respiratory rate (breath/min)

	Respiratory rate								
	Baseline	15 min	30 min	45 min	60 min	75 min	90 min	105min	120min
MgSO₄									
Min.	11.0	10.0	9.0	9.0	9.0	9.0	10.0	10.0	10.0
Max.	18.0	18.0	16.0	17.0	18.0	20.0	14.0	14.0	15.0
Mean	13.45	12.60	12.20	10.85	11.0	11.65	11.75	11.75	12.40
SD.	1.76	2.04	2.33	2.08	2.15	2.52	1.37	1.16	1.35
Median	13.0	12.0	12.0	10.0	10.0	11.0	12.0	12.0	12.0
Saline									
Min.	10.0	10.0	10.0	11.0	10.0	10.0	10.0	11.0	10.0
Max.	16.0	17.0	17.0	16.0	18.0	14.0	14.0	14.0	15.0
Mean	12.90	12.80	12.85	13.0	13.25	12.10	12.20	12.40	12.35
SD.	1.74	1.82	1.66	1.69	2.20	1.21	1.06	0.94	1.50
Median	13.0	12.50	13.0	12.50	13.0	12.0	12.0	12.0	12.0
t	0.992	0.327	1.015	3.587*	3.271*	0.720	1.162	1.942	0.111
p	0.327	0.745	0.316	0.001*	0.002*	0.476	0.252	0.060	0.912

t: Student t-test

*: Statistically significant at $p \leq 0.05$

Results

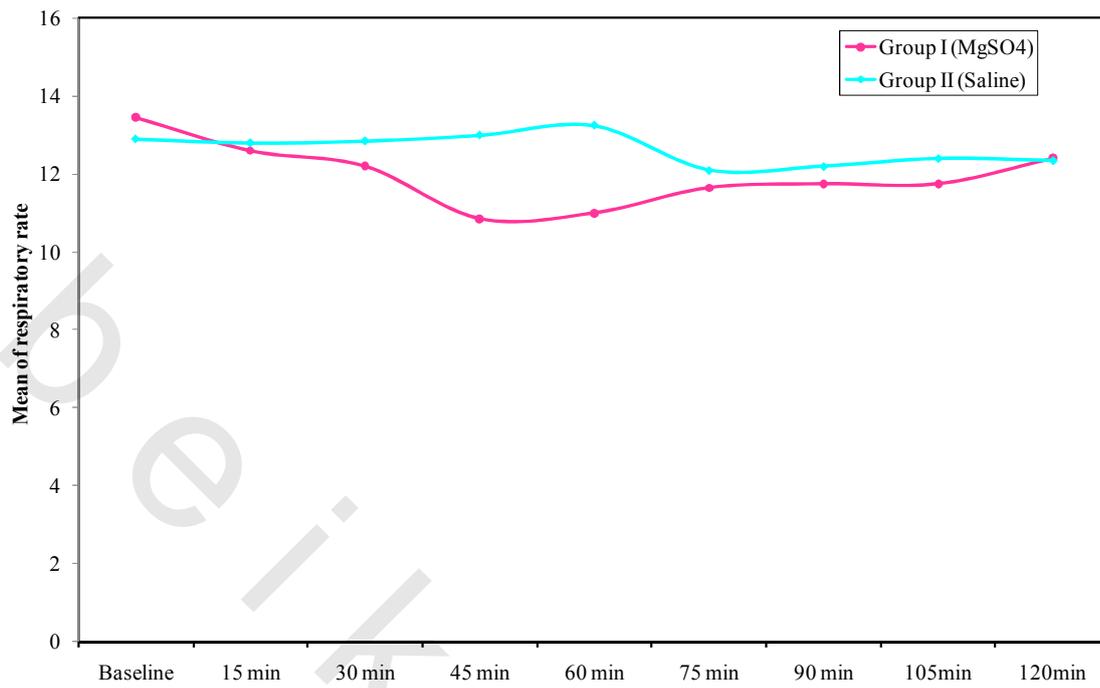


Figure (14): Comparison between the two studied groups according to respiratory rate

3. Visual analogue scale (VAS): [Tables XVII-XIX and Figure 15]

- **In group I: [Table XVII, Fig 15]**

- 30 minutes postoperatively, the mean VAS was 0.1 ± 0.3 .
- Significant changes in the VAS were observed postoperatively at 90 min, 2, 4, 8, 12, 16, 20 and 24 hrs where p value were 0.046, 0.026, <0.001, <0.001, <0.001, 0.001, 0.002, 0.002 respectively.

- **In group II: [Table XVIII, Fig 15]**

- 30 minutes postoperatively, the mean VAS was 0.3 ± 0.6 .
- Significant changes in the VAS were observed postoperatively at 90 min, 2, 4, 8, 12, 16, 20 and 24 hrs where p value were 0.008, 0.001, <0.001, <0.001, <0.001, <0.001, <0.001, <0.001 respectively.

- **Comparison between the two groups: [Table XIX, Figure 15]**

- The mean VAS was significantly higher in Group II than in group I at 90 min, 2, 4, 12, 20 and 24 hrs where p value were 0.023, 0.004, 0.024, 0.012, 0.010, 0.008 respectively.

Results

Table (XVII): Descriptive analysis of patients according to VAS in group I (MgSO₄)

patient number	VAS									
	30 min	60 min	90 min	2 hr	4 hr	8 hr	12 hr	16 hr	20 hr	24 hr
1	0	0	1	1	3	2	1	0	0	0
2	0	0	0	0	1	5	4	3	1	1
3	0	0	0	0	1	0	0	0	0	0
4	1	1	1	1	3	3	5	2	2	2
5	0	0	1	1	2	2	2	2	0	0
6	0	0	0	0	0	1	1	2	1	0
7	0	1	1	3	3	6	2	0	0	0
8	0	0	0	0	2	2	1	0	0	0
9	0	0	0	0	3	1	1	0	0	0
10	1	1	1	3	4	6	2	3	1	1
11	0	0	0	2	2	3	5	1	1	1
12	0	0	0	0	1	1	2	2	2	2
13	0	0	0	0	1	1	1	1	1	1
14	0	0	0	0	2	3	3	4	6	2
15	0	0	0	0	1	2	2	1	1	1
16	0	0	0	0	2	2	2	3	6	2
17	0	0	1	1	1	2	1	1	0	0
18	0	0	0	0	1	1	2	2	2	2
19	0	0	0	0	0	0	2	1	1	1
20	0	0	0	0	2	3	3	3	2	1
Min.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Max.	1.0	1.0	1.0	3.0	4.0	6.0	5.0	4.0	6.0	2.0
Mean	0.1	0.2	0.3	0.6	1.8	2.3	2.1	1.6	1.4	0.9
SD.	0.3	0.4	0.5	1.0	1.1	1.7	1.3	1.2	1.8	0.8
Median	0.0	0.0	0.0	0.0	2.0	2.0	2.0	1.5	1.0	1.0
P		0.317	0.046*	0.026*	<0.001*	<0.001*	<0.001*	0.001*	0.002*	0.002*

p: p value for Wilcoxon signed ranks test for comparing between pre and postoperative

*: Statistically significant at $p \leq 0.05$

Results

Table (XVIII): Descriptive analysis of patients according to VAS in group II (Saline)

patient number	VAS									
	30 min	60 min	90 min	2 hr	4 hr	8 hr	12 hr	16 hr	20 hr	24 hr
1	0	0	1	1	2	4	3	2	2	1
2	0	0	1	2	5	3	5	3	1	1
3	0	0	0	0	1	1	3	2	1	1
4	0	0	0	0	3	6	4	3	3	3
5	0	0	1	2	5	1	2	2	1	1
6	0	0	0	1	4	2	2	1	1	1
7	0	0	0	1	1	2	2	2	2	2
8	0	0	2	2	3	4	6	3	3	3
9	0	0	0	1	1	2	2	5	2	2
10	0	0	2	2	5	3	2	2	2	2
11	0	0	1	1	2	2	2	1	1	0
12	0	0	0	2	2	2	4	4	3	3
13	0	0	1	1	2	2	3	2	2	1
14	1	1	0	0	4	1	1	1	1	1
15	1	1	2	2	2	2	4	1	1	1
16	0	0	1	3	6	3	3	2	2	2
17	1	1	1	2	2	3	4	2	2	1
18	2	2	2	2	3	3	6	4	3	3
19	0	0	0	1	1	2	2	2	3	2
20	0	0	2	2	3	5	3	3	2	2
Min.	0.0	0.0	0.0	0.0	1.0	1.0	1.0	1.0	1.0	0.0
Max.	2.0	2.0	2.0	3.0	6.0	6.0	6.0	5.0	3.0	3.0
Mean	0.3	0.3	0.9	1.4	2.9	2.6	3.2	2.4	1.9	1.7
SD.	0.6	0.6	0.8	0.8	1.5	1.3	1.4	1.1	0.8	0.9
Median	0.0	0.0	1.0	1.5	2.5	2.0	3.0	2.0	2.0	1.5
P		1.000	0.008*	0.001*	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*

p: p value for Wilcoxon signed ranks test for comparing between pre and postoperative

*: Statistically significant at $p \leq 0.05$

Results

Table (XIX): Comparison between the two studied groups according to VAS

	VAS									
	30 min	60 min	90 min	2 hr	4 hr	8 hr	12 hr	16 hr	20 hr	24 hr
MgSO₄										
Min.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Max.	1.0	1.0	1.0	3.0	4.0	6.0	5.0	4.0	6.0	2.0
Mean	0.1	0.2	0.3	0.6	1.8	2.3	2.1	1.6	1.4	0.9
SD.	0.3	0.4	0.5	1.0	1.1	1.7	1.3	1.2	1.8	0.8
Median	0.0	0.0	0.0	0.0	2.0	2.0	2.0	1.5	1.0	1.0
Saline										
Min.	0.0	0.0	0.0	0.0	1.0	1.0	1.0	1.0	1.0	0.0
Max.	2.0	2.0	2.0	3.0	6.0	6.0	6.0	5.0	3.0	3.0
Mean	0.3	0.3	0.9	1.4	2.9	2.6	3.2	2.4	1.9	1.7
SD.	0.6	0.6	0.8	0.8	1.5	1.3	1.4	1.1	0.8	0.9
Median	0.0	0.0	1.0	1.5	2.5	2.0	3.0	2.0	2.0	1.5
Z	0.917	0.471	2.271*	2.880*	2.255*	1.090	2.518*	1.943	2.576*	2.633*
P	0.359	0.637	0.023*	0.004*	0.024*	0.276	0.012*	0.052	0.010*	0.008*

Z: Z for Mann Whitney test

*: Statistically significant at $p \leq 0.05$

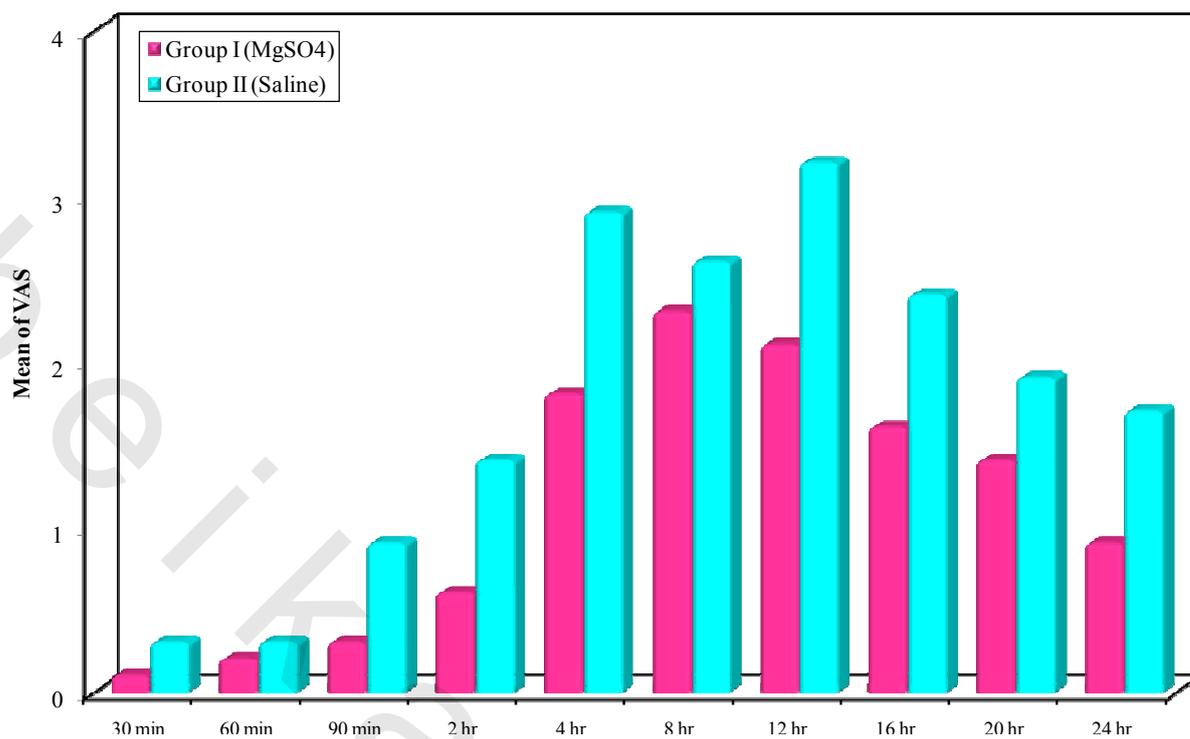


Figure (15): Comparison between the two studied groups according to VAS

4. Time for the first need for postoperative analgesia: [table XX and figure 16]

• **In group I ; [Table XX, Fig 16]**

Postoperatively, thirteen patients didn't require additional analgesia in the form of pethidine. Seven patients required pethidine supplements. The time for these supplements ranged from 4.0 – 20.0 hrs with the mean value of 11.43 ± 5.38 hrs.

• **In group II ; [Table XX, Fig 16]**

Postoperatively, four patients didn't require additional analgesia in the form of pethidine. Sixteen patients required pethidine supplements. The time for these supplements ranged from 4.0 – 16.0 hrs with the mean value of 7.25 ± 3.92 hrs.

• **Comparison between the two groups: [Figure 16]**

The time for first need of analgesia was significantly shorter in group II than group I for the patients who required pethidine supplements. ($P=0.004$)

Table (XX): Comparison between the studied groups according to 1st Analgesic request (in hours).

patient number	Group I (MgSO ₄) (n=20)	Group II (Saline) (n=20)
1	-	4
2	8	4
3	-	-
4	12	8
5	-	4
6	-	4
7	8	-
8	-	8
9	-	16
10	4	4
11	12	4
12	-	12
13	-	-
14	16	4
15	-	8
16	20	4
17	-	12
18	-	12
19	-	-
20	-	8
Min. – Max.	4.0 – 20.0	4.0 – 16.0
Mean ± SD.	11.43 ± 5.38	7.25 ± 3.92
Median	12.0	6.0
No	13 (65%)	4 (20%)
Yes	7 (35%)	16 (80%)
χ^2	8.286*	
p	0.004*	

χ^2 : Chi square test

*: Statistically significant at $p \leq 0.05$

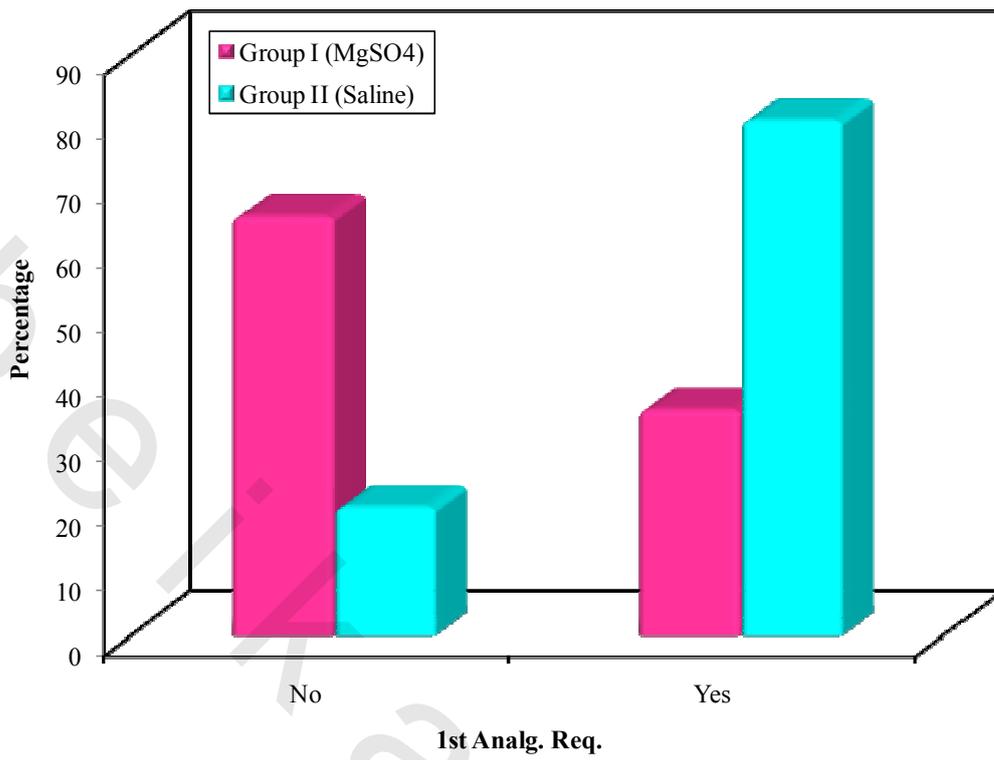


Figure (16): Comparison between the studied groups according to 1st analgesic request

5. Total dose of analgesic consumption (in milligrams of pethidine) in the 24-hour postoperative period: [Table XXI and Figure 17]

• **In group I ; [Table XXI, Fig 17]**

Total dose of analgesic consumption in the 24-hour postoperative period ranged from 0.0–50.0 with the mean value of 12.50 ± 19.02 . Four patients in group I consumed 25 mg pethidine and 3 patients consumed 50 mg pethidine.

• **In group II ; [Table XXI, Fig 17]**

Total dose of analgesic consumption in the 24-hour postoperative period ranged from 0.0–50.0 with the mean value of 26.25 ± 17.16 . Eleven patients in group II consumed 25 mg pethidine and 5 patients consumed 50 mg pethidine.

• **Comparison between the two groups:[Figure 17]**

Total dose of analgesic consumption in the 24-hour postoperative period was significantly higher in group II than in group I ($P=0.015$).

Table (XXI): Comparison between the studied groups according to Total pethidine consumption

patient number	Group I (MgSO₄) (n=20)	Group II (Saline) (n=20)
1	0	25
2	50	50
3	0	0
4	25	50
5	0	25
6	0	25
7	25	0
8	0	50
9	0	25
10	50	25
11	25	25
12	0	50
13	0	0
14	50	25
15	0	25
16	25	25
17	0	25
18	0	50
19	0	0
20	0	25
Min. – Max.	0.0 – 50.0	0.0 – 50.0
Mean ± SD.	12.50 ± 19.02	26.25 ± 17.16
Median	0.0	25.0
Z	2.431*	
p	0.015*	

Z: Z for Mann Whitney test

*: Statistically significant at $p \leq 0.05$

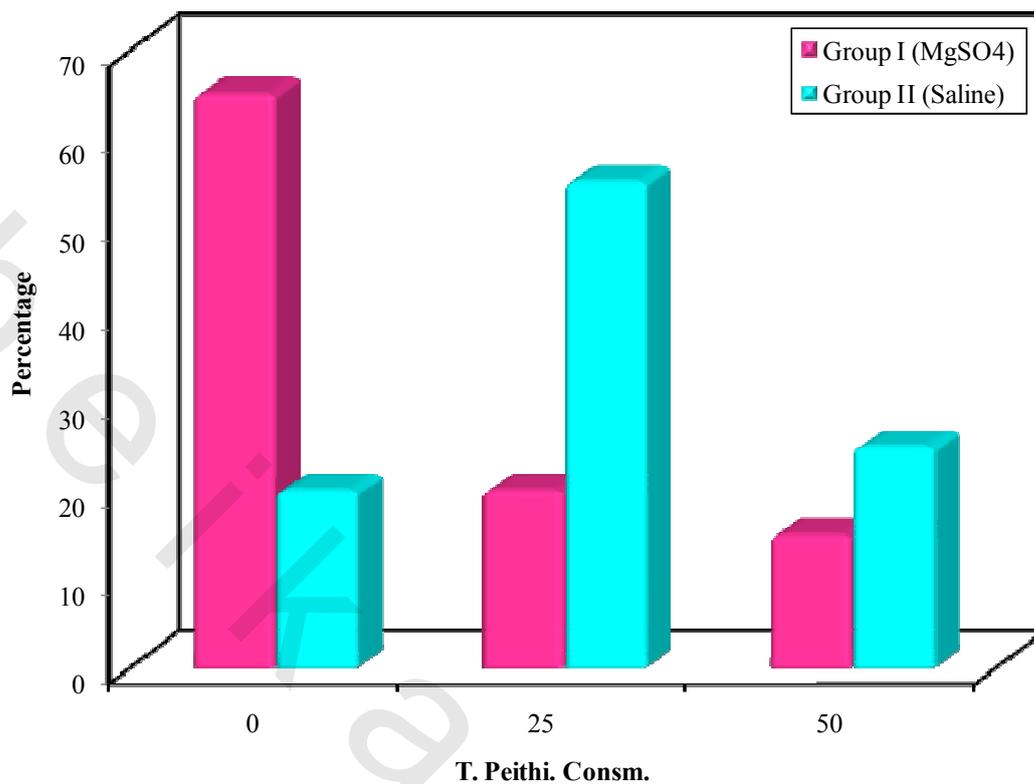


Figure (17): Comparison between the studied groups according to the Pethidine Consumption.

6. Postoperative side effects: [Table XXII and Figure 18]

There was no statistically significant difference between the two studied groups regarding perioperative side effects.

Nausea occurred in 6 patients in group I and in 2 patients in group II. Nausea was transient and disappeared spontaneously without treatment.

Vomiting occurred intraoperatively in 1 patient in group I and in 1 patient in group II. Vomiting was treated immediately by head down and tilt to the left and administration of dexamethasone 8 mg.

Shivering occurred in 2 patients in group I and in 1 patient in group II and treated by active warming.

Hypotension occurred in 3 patients in group I and in 1 patient in group II and treated by ephedrine 5 mg I.V.

Bradycardia occurred in 1 patient in group I and in didn't occur in group II and treated by 0.5 atropine mg I.V.

Flushing occurred in 1 patient in group I and did not occurred in group II and was transient and disappeared spontaneously without treatment.

Table (XXII): Comparison between the studied groups according to complication

	Group I (MgSO ₄) (n=20)		Group II (Saline) (n=20)		χ^2	FE p
	No.	%	No.	%		
Nausea	6	30.0	2	10.0	2.500	0.235
Vomiting (V)	1	5.0	1	5.0	0.0	1.000
Shivering	2	10.0	1	5.0	0.360	1.000
Hypotension	3	15.0	1	5.0	1.111	0.605
Bradycardia	1	5.0	0	0.0	1.026	1.000
Flushing	1	5.0	0	0.0	1.026	1.000

χ^2 : Chi square test

FE: Fisher Exact test

*: Statistically significant at $p \leq 0.05$

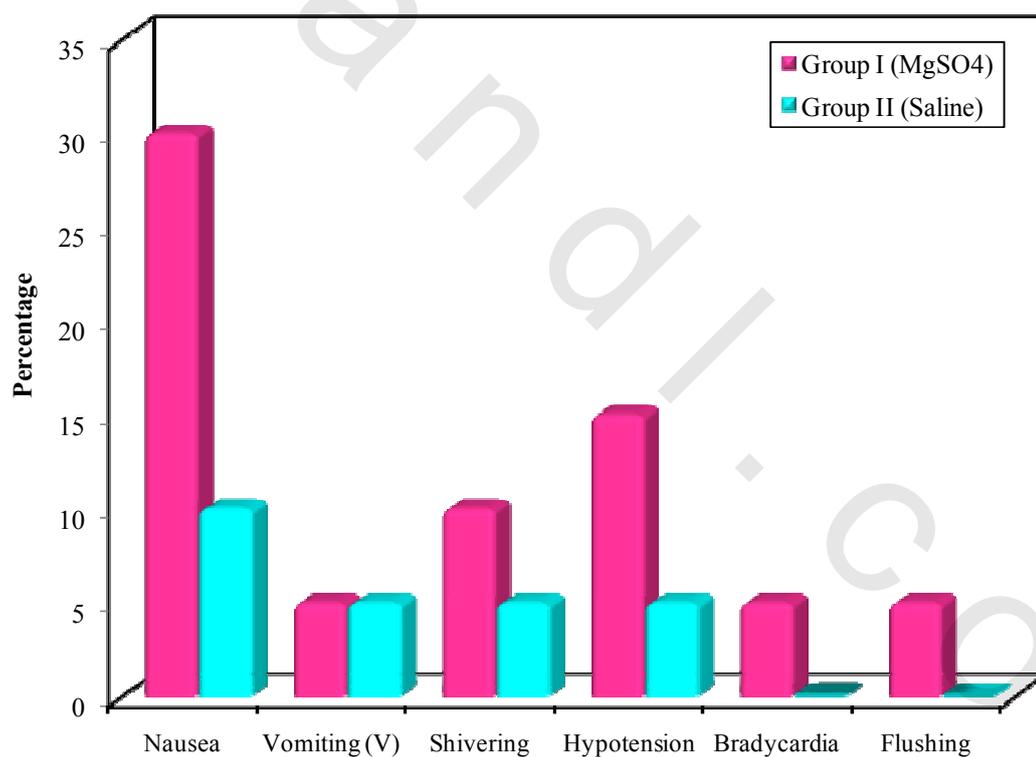


Figure (18): Comparison between the studied groups according to complication