Results

Demographic data:

The demographic data show statistically non-significant difference among the three groups as regard age, body weight, height and ASA physical status as shown in table (5).

Table (5): Comparison among the three groups according to Age (years), BW (kilograms), HT (centimeters), and ASA physical status:

		N	Mean	Std. Deviation	Minimum	Maximum	f	p
Age years	M	20	48.20	14.936	15	67	2.7	>0.05
	F	20	47.75	14.227	17	50		
	N	20	47.55	14.148	15	53		
BW kilograms	M	20	79.80	18.063	40	110	2.9	>0.05
	F	20	70.45	18.805	45	105		
	N	20	64.75	22.833	38	102		
HT centimeters	M	20	167.60	13.843	130	180	2.6	>0.05
	F	20	167.25	13.591	140	185		
	N	20	167.20	13.387	116	180		
ASA	M	20	2.10	.718	1	3	0.9	>0.05
	F	20	1.80	.768	1	3		
	N	20	1.95	.686	1	3		

BW=Body weight HT=Height ASA=American Society of Anesthesia
p>0.05 Not significant
p<0.05 significant

Table (6): Comparison among the three groups according to sex:

	male		**Female**		**Total**		**X^2**	**P**
	No.	**%**	**No.**	**%**	**No.**	**%**		
M	10	50%	10	50%	20	100	----	------
F	10	50%	10	50%	20	100		
N	10	50%	10	50%	20	100		

As shown in table (6) there were no difference among the three groups as regard sex

The mean systolic blood pressure are shown in table (7)

Table (7): Comparison among the three groups according to systolic blood pressure (mmHg):

		N	Mean	Std. Deviation	Minimum	Maximum	f	P
SBP 3	M	20	141.75	11.616	120	160	10.5	<0.05
	F	20	125.00	14.690	100	150		
	N	20	133.75	7.048	120	140		
SBP 4	M	20	106.75	10.548	90	130	0.2	>0.05
	F	20	104.50	12.450	90	130		
	N	20	105.00	9.597	85	120		
SBP 8	M	20	100.50	4.840	90	110	0.5	>0.05
	F	20	102.00	13.018	85	130		
	N	20	99.25	7.122	85	110		
SBP 12	M	20	101.50	4.617	95	110	2.8	>0.05
	F	20	100.75	9.904	90	120		
	N	20	96.50	6.091	85	110		
SBP 24	M	20	101.00	4.472	90	110	0.4	>0.05
	F	20	99.25	11.502	90	120		
	N	20	99.00	4.472	90	110		

Sbp=Systolic blood pressure
p>0.05 Not significant
p<0.05 significant

As shown in table (7) and Fig (22), the systolic blood pressure showing:

At 3rd h postoperatively: in group M the mean systolic blood pressure was 141.75 ± 11.616 mmHg , and in group F the mean systolic blood pressure was 125 ± 14.690 mmHg, and in group N the mean systolic blood pressure was 133.75 ± 7.048 mmHg, and among the three groups there were statistically significant difference (f = 10.5) and (P < 0.05).

At 4th h postoperatively: in group M the mean systolic blood pressure was 104.50 ± 12.450 mmHg, and in group F the mean systolic blood pressure was 105.00 ± 9.597 mmHg,

and in group N the mean systolic blood pressure was 133.75 ± 7.048 mmHg, and among the three groups there were no statistically significant difference(f = 0.2) and (P > 0.05).

At 8th h postoperatively: in group M the mean systolic blood pressure was 100.50 ± 4.840 mmHg, and in group F the mean systolic blood pressure was 102.00 ± 13.018 mmHg, and in group N the mean systolic blood pressure was 99.25 ± 7.122 mmHg, and among the three groups there were no statistically significant difference(f = 0.5) and (P > 0.05).

At 12th h postoperatively: in group M the mean systolic blood pressure was 101.50 ± 4.617 mmHg, and in group F the mean systolic blood pressure was 100.75 ± 9.904 mmHg, and in group N the mean systolic blood pressure was 96.50 ± 6.091 mmHg, and among the three groups there were no statistically significant difference (f = 2.8) and (P > 0.05).

At 24th h postoperatively: in group M the mean systolic blood pressure was 101.00 ± 4.472 mmHg, and in group F the mean systolic blood pressure was 99.25 ± 11.502 mmHg, and in group N the mean systolic blood pressure was 99.00 ± 4.472 mmHg, and among the three groups there were no statistically significant difference(f = 0.4) and (P > 0.05).

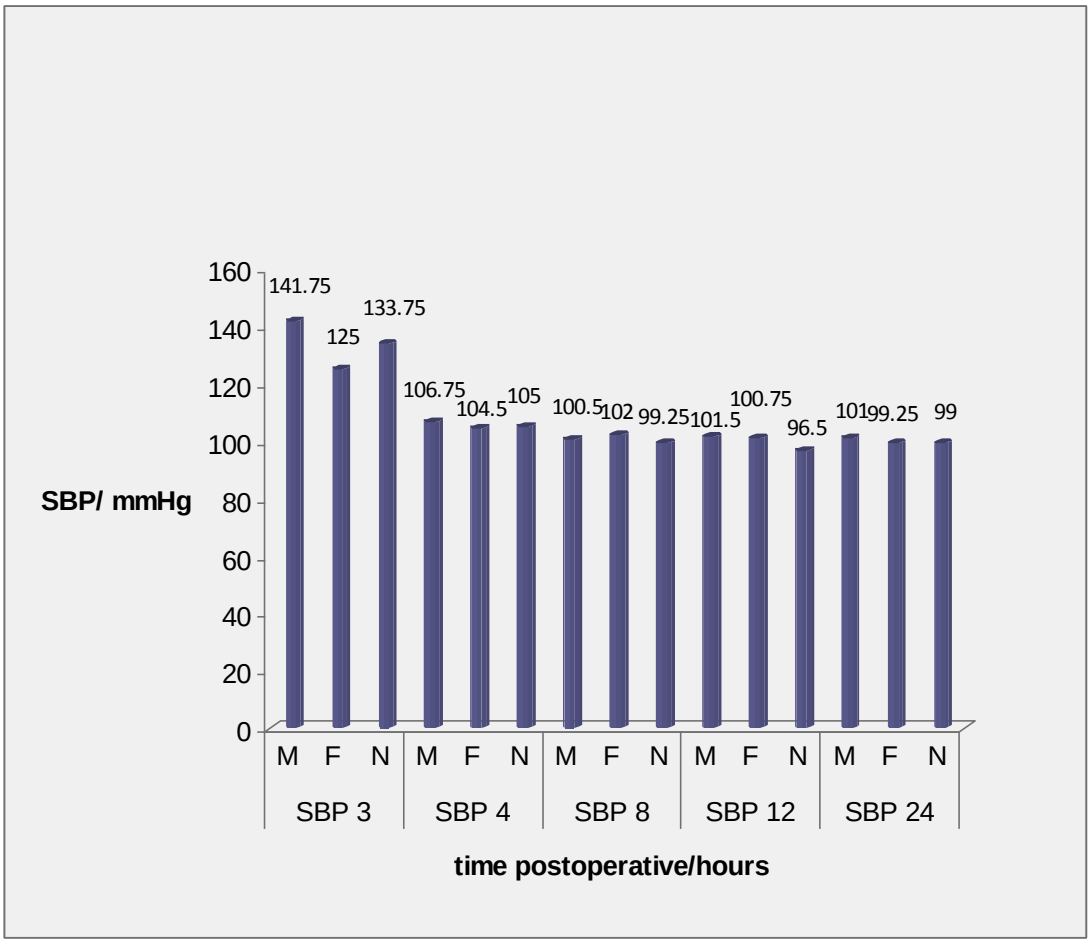

Fig (22): Comparison among the three groups according to SBP.

As regard hemodynamics as shown in table (7) and in fig(22), according to systolic blood pressure there were no statistically significant difference ($p>0.05$) except at the 3rd h which is the starting baseline data, that did not indicate any thing about the study.

The mean diastolic blood pressure are shown in table (8)

Table (8): Comparison among the three groups according to diastolic blood pressure (mmHg):

		N	Mean	Std. Deviation	Minimum	Maximum	f	p
DBP 3	M	20	88.00	5.477	80	100	12.8	<0.05
	F	20	75.75	9.904	60	95		
	N	20	84.25	7.482	70	90		
DBP 4	M	20	64.50	6.669	55	80		
	F	20	64.00	8.675	50	80	0.1	>0.05
	N	20	63.75	6.257	50	70		
DBP 8	M	20	61.75	3.726	60	70		
	F	20	64.00	7.182	55	80	3.6	<0.05
	N	20	59.75	3.024	55	70		
DBP 12	M	20	64.25	5.447	55	70		
	F	20	65.25	5.730	60	80	6.4	<0.05
	N	20	60.00	3.244	50	70		
DBP 24	M	20	62.50	5.501	50	70		
	F	20	63.50	4.894	60	70	1.5	>0.05
	N	20	61.00	3.078	60	70		

Dbp=Diastolic blood pressure
p>0.05 Not significant
p<0.05 significant

As shown in table (8) and Fig (23), the diastolic blood pressure showing:

At 3rd h postoperatively: in group M the mean diastolic blood pressure was 88.00 ± 5.477 mmHg, and in group F the mean diastolic blood pressure was 75.75 ± 9.904 mmHg, and in group N the mean diastolic blood pressure was 84.25 ± 7.482 mmHg, and among the three groups there were statistically significant difference (f = 12.8) and (P < 0.05).

At 4th h postoperatively: in group M the mean diastolic blood pressure was 64.50 ± 6.669 mmHg, and in group F the mean diastolic blood pressure was 64.00 ± 8.675 mmHg, and in group N the mean diastolic blood pressure was 63.75 ± 6.257 mmHg, and among the three groups there were no statistically significant difference (f = 0.1) and (P > 0.05).

At 8th h postoperatively: in group M the mean diastolic blood pressure was 61.75 ± 3.726 mmHg, and in group F the mean diastolic blood pressure was 64.00 ± 7.182 mmHg, and in group N the mean diastolic blood pressure was 59.75 ± 3.024 mmHg, and among the three groups there were statistically significant difference(f = 3.6) and (P < 0.05).

At 12th h postoperatively: in group M the mean diastolic blood pressure was 64.25 ± 5.477 mmHg, and in group F the mean diastolic blood pressure was 65.25 ± 5.730 mmHg, and in group N the mean diastolic blood pressure was 60.00 ± 3.244 mmHg, and among the three groups there were statistically significant difference (f = 6.4) and (P < 0.05).

At 24th h postoperatively: in group M the mean diastolic blood pressure was 62.50 ± 5.501 mmHg, and in group F the mean diastolic blood pressure was 63.50 ± 4.894 mmHg, and in group N the mean diastolic blood pressure was 61.00 ± 3.078 mmHg, and among the three groups there were no statistically significant difference (f = 1.5) and (P > 0.05).

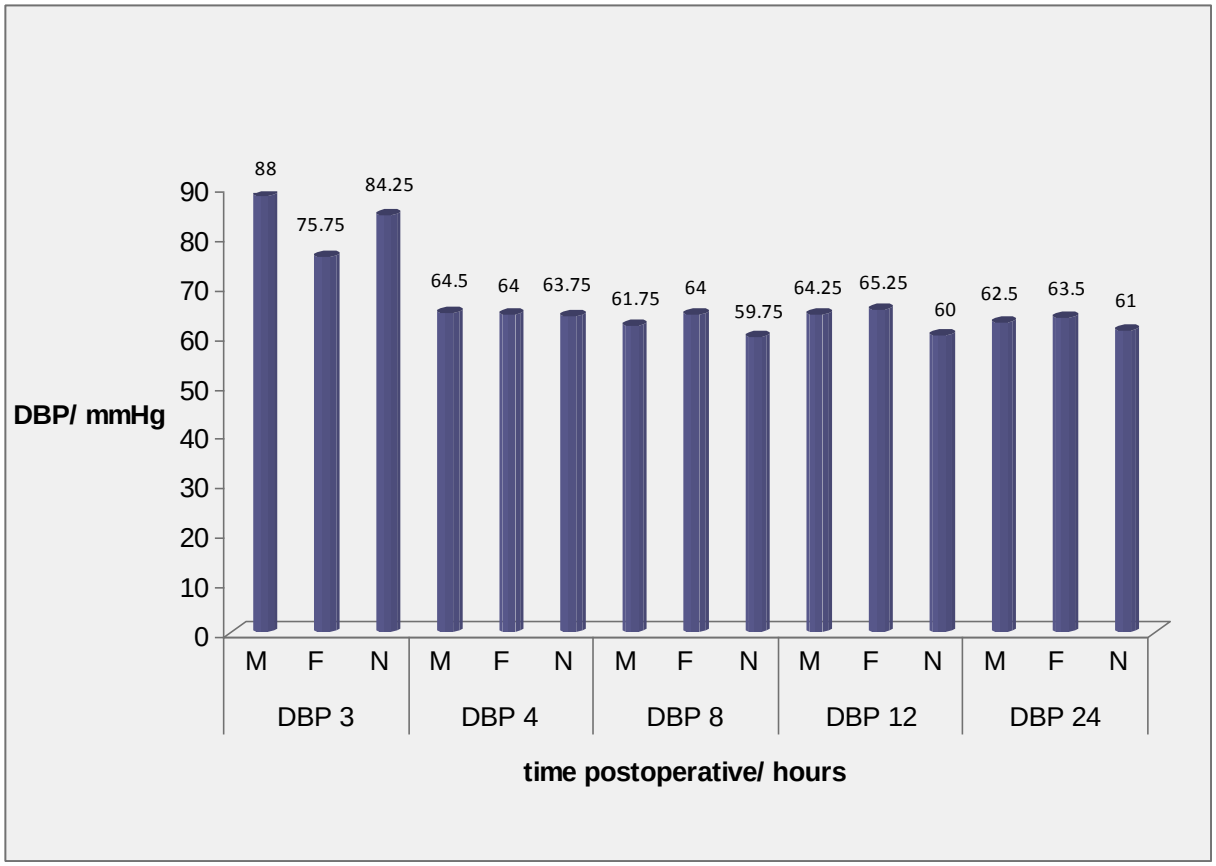

Fig (23): Comparison among the three groups according to DBP.

As regard the diastolic blood pressure as shown in table (8) and fig (23), showing statistically significant difference ($p<0.05$) in the 3rd, 8th, 12th and hours (3rd h which is the starting baseline and not denoting any thing about the study, but in 8th, 12th h the significance toward fentanyl group in having more diastolic blood pressure (64.00±7.182 and 65.25±5.730 respectively) and avoiding hypotension, denoting that group F is the best in comparison with the other two groups in providing adequate analgesia and keeping more hemodynamic stability.

The mean heat rates are shown in table (9):

Table (9): Comparison among the three groups according to heart rate (beat / minute):

		N	Mean	Std. Deviation	Minimum	Maximum	f	P
HR 3	M	20	119.25	2.936	115	125		
	F	20	117.00	6.156	110	130	1.1	>0.05
	N	20	119.00	5.758	110	130		
HR 4	M	20	107.40	4.967	100	115		
	F	20	100.45	6.809	90	116	6.4	<0.05
	N	20	102.95	6.770	95	117		
HR 8	M	20	99.70	5.038	95	114		
	F	20	92.10	5.108	80	100	10.3	<0.05
	N	20	96.80	5.872	85	110		
HR 12	M	20	95.30	5.966	90	113		
	F	20	84.25	5.087	75	93	16.9	<0.05
	N	20	91.15	7.013	80	105		
HR 24	M	20	90.05	7.007	80	113		
	F	20	81.00	4.757	75	95	10.9	<0.05
	N	20	87.70	7.020	80	105		

HR = Heart rate
p>0.05 Not significant
p<0.05 significant

As shown in table (9) and Fig (24), the heart rate showing:

At 3rd h postoperatively: in group M the mean heart rate was 119.25 ± 2.936 beat/minute, and in group F the mean heart rate was 117.00 ± 6.156 beat/minute, and in group N the mean heart rate was 119.00 ± 5.758 beat/minute, and among the three groups there were no statistically significant difference (f = 1.1) and (P > 0.05).

At 4th h postoperatively: in group M the mean heart rate was 107.40 ± 4.967 beat/minute, and in group F the mean heart rate was 100.45 ± 6.809 beat/minute, and in group N

the mean heart rate was 102.95 ± 6.770 beat/minute, and among the three groups there were statistically significant difference (f = 6.4) and (P < 0.05).

At 8th h postoperatively: in group M the mean heart rate was 99.70 ± 5.038 beat/minute, and in group F the mean heart rate was 92.10 ± 5.108 beat/minute, and in group N the mean heart rate was 96.80 ± 5.872 beat/minute, and among the three groups there were statistically significant difference (f = 10.3) and (P < 0.05).

At 12th h postoperatively: in group M the mean heart rate was 95.30 ± 5.966 beat/minute , and in group F the mean heart rate was 84.25 ± 5.087 beat/minute, and in group N the mean heart rate was 91.15 ± 7.013 beat/minute, and among the three groups there were statistically significant difference (f = 16.9) and (P < 0.05).

At 24th h postoperatively: in group M the mean heart rate was 90.05 ± 7.007 beat/minute , and in group F the mean heart rate was 81.00 ± 4.757 beat/minute, and in group N the mean heart rate was 87.70 ± 7.020 beat/minute, and among the three groups there were statistically significant difference (f = 10.9) and (P < 0.05).

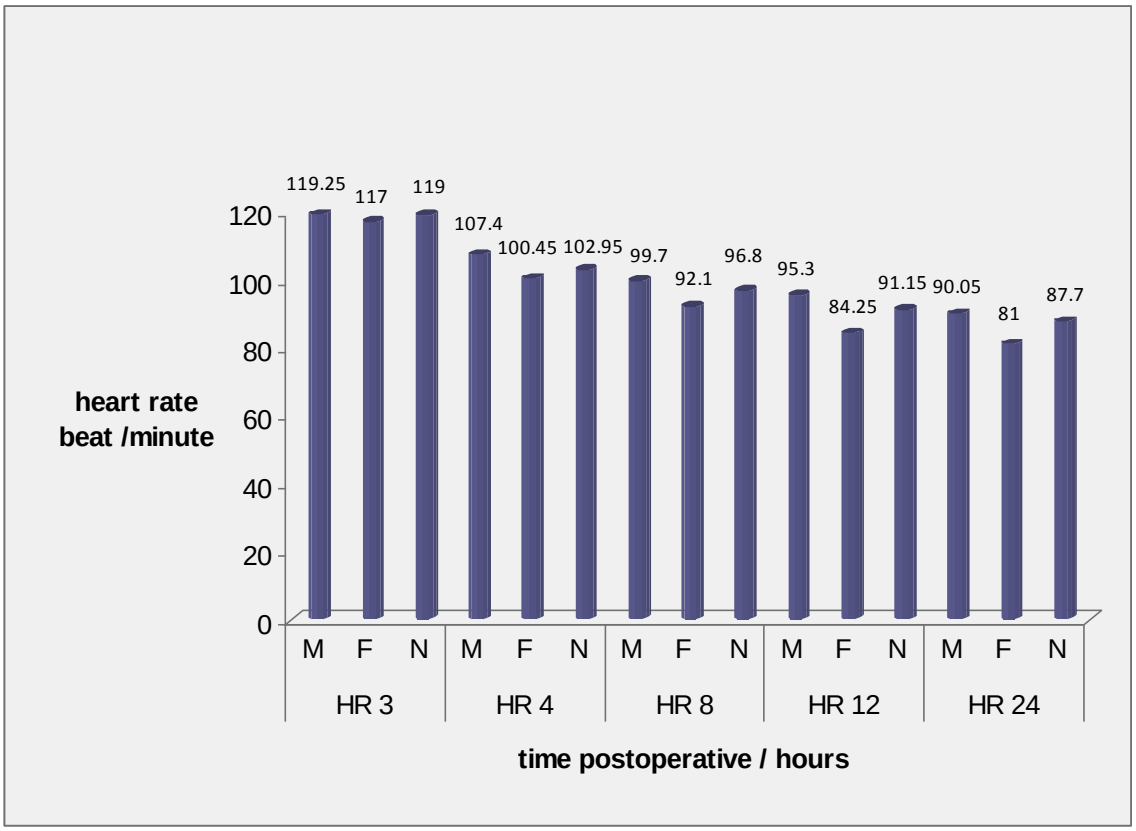

Fig (24): Comparison among the three groups according to HR.

As regard heart rate as shown in table (9) and fig (24), in the hours 4th, 8th, 12th and 24th hours it was found that there were statistically significant difference ($p<0.05$) toward group F in maintaining a lower heart rate than the baseline data but not reaching the level of bradycardia, and denoting that group F is the best in comparison with the other two groups in providing adequate analgesia and keeping more hemodynamic stability.

The mean respiratory rates are shown in table (10):

Table (10): Comparison among the three groups according to respiratory rate (breath/minute):

		N	Mean	Std. Deviation	Std. Error	Minimum	Maximum	f	P
RR 3	M	20	21.50	2.164	.484	20	25		
	F	20	21.95	2.781	.622	18	28	0.3	>0.05
	N	20	21.40	1.875	.419	20	25		
RR 4	M	20	15.75	2.023	.452	13	20		
	F	20	14.50	2.606	.583	10	19	1.9	>0.05
	N	20	15.80	2.353	.526	12	20		
RR 8	M	20	13.75	1.372	.307	11	17		
	F	20	12.10	2.174	.486	8	17	1.3	>0.05
	N	20	19.75	2.487	5.923	11	132		
RR 12	M	20	13.30	0.923	.206	12	15		
	F	20	10.95	1.276	.285	8	13	1.3	>0.05
	N	20	18.70	2.968	6.030	11	133		
RR 24	M	20	13.30	0.979	.219	12	16		
	F	20	11.00	0.918	.205	10	12	22.2	<0.05
	N	20	12.30	1.342	.300	10	15		

RR = Respiratory rate
p>0.05 Not significant
p<0.05 significant

As shown in table (10) and Fig (25), the respiratory rate showing:

At 3rd h postoperatively: in group M the mean respiratory rate was 21.50 ± 2.164 breath/minute, and in group F the mean respiratory rate was 21.95 ± 2.781 breath/minute, and in group N the mean respiratory rate was 21.40 ± 1.875 breath/minute, and among the three groups there were no statistically significant difference (f = 0.3) and (P > 0.05).

At 4th h postoperatively: in group M the mean respiratory rate was 15.75 ± 2.023 breath/minute, and in group F the mean respiratory rate was 14.50 ± 2.606 breath/minute, and in

group N the mean respiratory rate was 15.80 ± 2.353 breath/minute, and among the three groups there were no statistically significant difference (f = 1.9) and (P > 0.05).

At 8th h postoperatively: in group M the mean respiratory rate was 13.75 ± 1.372 breath/minute, and in group F the mean respiratory rate was 12.10 ± 2.174 breath/minute, and in group N the mean respiratory rate was 19.75 ± 2.487 breath/minute, and among the three groups there were no statistically significant difference (f = 1.3) and (P > 0.05).

At 12th h postoperatively: in group M the mean respiratory rate was 13.30 ± 0.923 breath/minute, and in group F the mean respiratory rate was 10.95 ± 1.276 breath/minute, and in group N the mean respiratory rate was 18.70 ± 2.968 breath/minute, and among the three groups there were no statistically significant difference (f = 1.3) and (P > 0.05).

At 24th h postoperatively: in group M the mean respiratory rate was 13.30 ± 0.979 breath/minute , and in group F the mean respiratory rate was 11.00 ± 0.918 breath/minute, and in group N the mean respiratory rate was 12.30 ± 1.342 breath/minute, and among the three groups there were statistically significant difference (f = 22.2) and (P < 0.05).

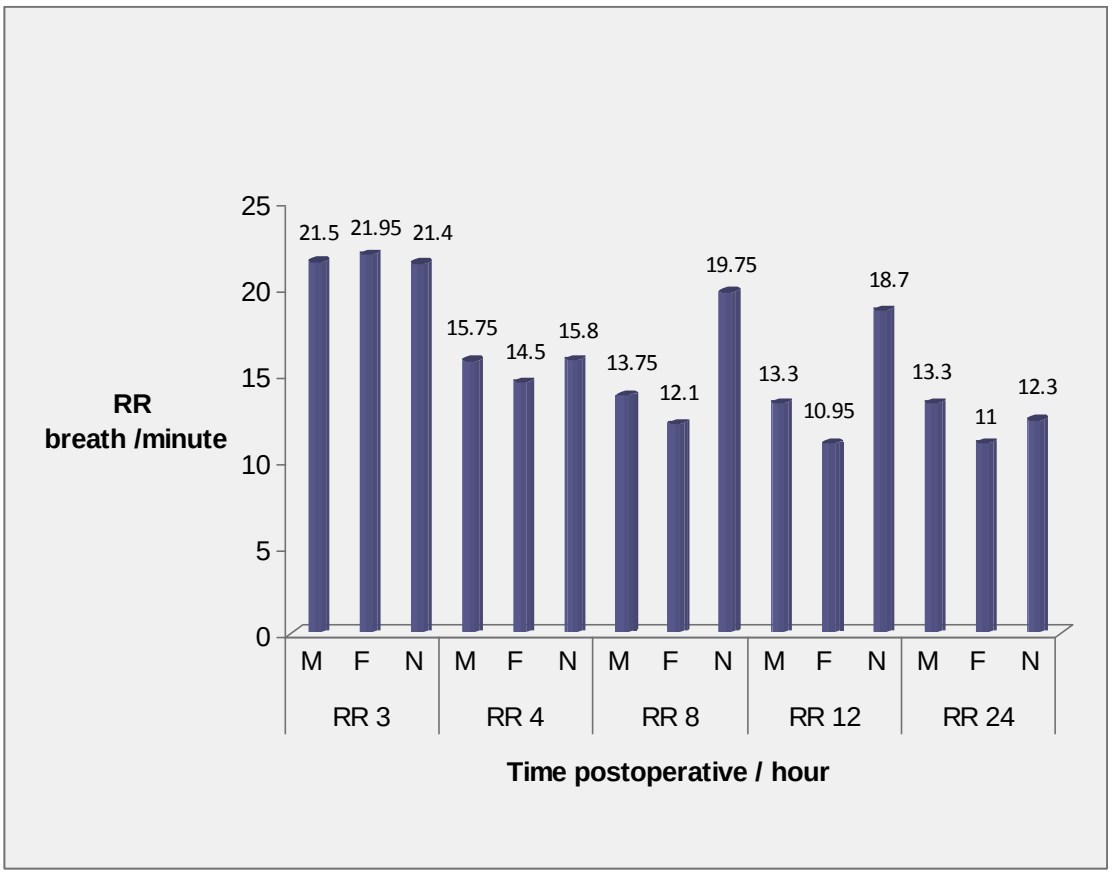

Fig (25): Comparison among the three groups according to RR.

As shown in table(10) and fig (25) as regarding to respiratory rate, it was found that there were no statistically significant difference ($p>0.05$) in all hours except at the 24th hour where the group F had 11±0.918 breath/min which was significantly lower than the other two groups meaning quite respiration that indirectly refer to good analgesia.

<u>The mean arterial blood gases (ABG) are shown in the tables;</u>

pH …….. In table (11).

PaO2 ……... In table (12).

PaCO2 ……. In table (13).

HCO3 …… In table (14).

Table (11): Comparison among the three groups according to **pH**:

		N	Mean	Std. Deviation	Std. Error	Minimum	Maximum	f	P
pH 3	M	20	7.3495	0.02305	0.00515	7.32	7.39		
	F	20	7.3535	0.02601	0.00582	7.31	7.41	0.2	>0.05
	N	20	7.3550	0.02838	0.00635	7.28	7.39		
pH 4	M	20	7.3630	0.01838	0.00411	7.33	7.39		
	F	20	7.3715	0.01981	0.00443	7.33	7.40	2.4	>0.05
	N	20	7.3785	0.02796	0.00625	7.31	7.45		
pH 8	M	20	7.3765	0.01663	0.00372	7.35	7.40		
	F	20	7.9680	0.59356	0.58063	7.30	739.00	1	>0.05
	N	20	7.3890	0.01744	0.00390	7.33	7.40		
pH 12	M	20	7.3765	0.01663	0.00372	7.35	7.40		
	F	20	7.9680	0.59356	0.58063	7.30	739.00	1	>0.05
	N	20	7.3890	0.01744	0.00390	7.33	7.40		
pH 24	M	20	7.3865	0.01137	0.00254	7.36	7.40		
	F	20	7.3915	0.02007	0.00449	7.33	7.41	3.1	>0.05
	N	20	7.3975	0.00716	0.00160	7.38	7.41		

pH = The negative logarithm to the base 10 of hydrogen ion activity
p>0.05 Not significant
p<0.05 significant

As shown in table (11) and Fig (26), the pH mean showing:

At 3rd h postoperatively: in group M the mean pH was 7.3495 ± 0.02305 , and in group F the mean pH was 7.3535 ± 0.02601 ,and in group N the mean pH was 7.3550 ± 0.02838 , and among the three groups there were no statistically significant difference (f = 0.2) and(P > 0.05).

At 4th h postoperatively: in group M the mean pH was 7.3630 ± 0.01838, and in group F the mean pH was 7.3715 ± 0.01981, and in group N the mean pH was 7.3785 ± 0.02796, and among the three groups there were no statistically significant difference (f = 2.4) and (P > 0.05).

At 8th h postoperatively: in group M the mean pH was 7.3765 ± 0.01663, and in group F the mean pH was 7.9680 ± 0.59356, and in group N the mean pH was 7.3890 ± 0.01744, and among the three groups there were no statistically significant difference (f = 1) and (P > 0.05).

At 12th h postoperatively: in group M the mean pH was 7.3765 ± 0.01663, and in group F the mean pH was 7.9680 ± 0.59356, and in group N the mean pH was 7.3890 ± 0.01744, and among the three groups there were no statistically significant difference (f = 1) and (P > 0.05).

At 24th h postoperatively: in group M the mean pH was 7.3865 ± 0.01137, and in group F the mean pH was 7.3915 ± 0.02007, and in group N the mean pH was 7.3975 ± 0.00716, and among the three groups there were no statistically significant difference (f = 3.1) and (P > 0.05).

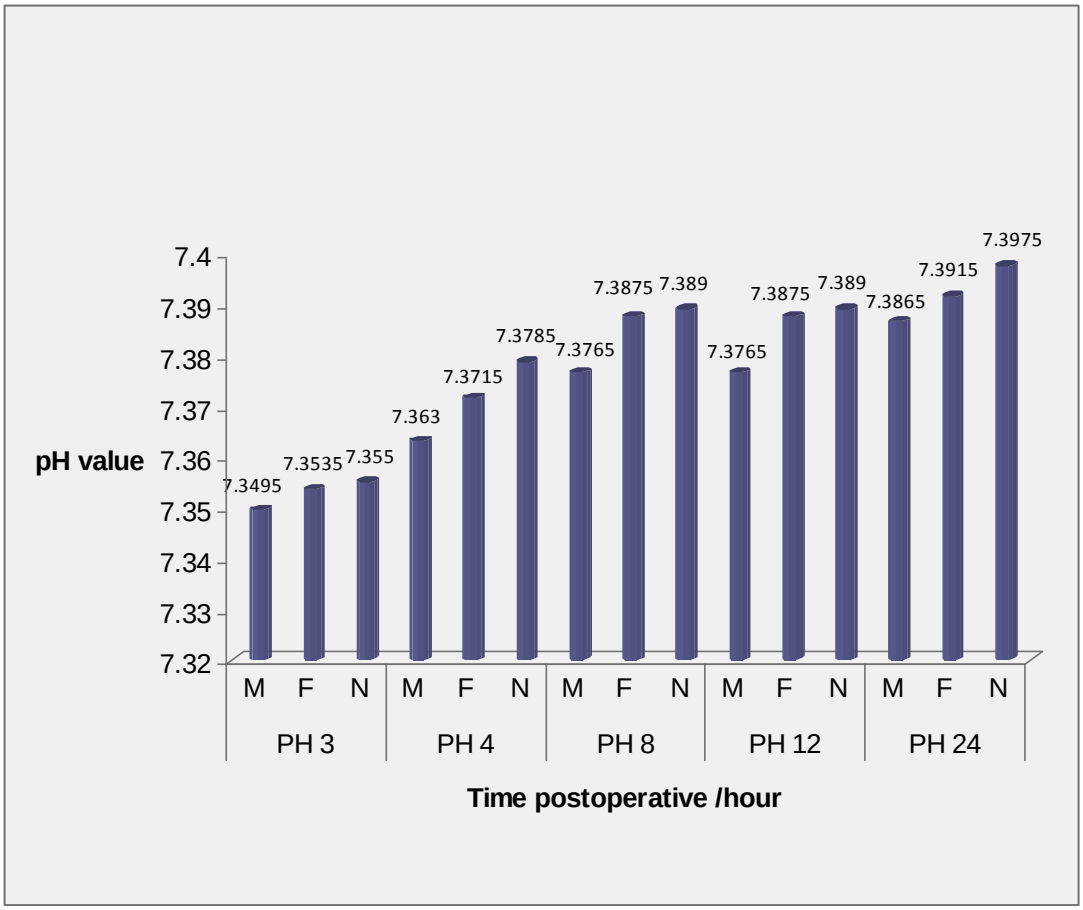

Fig (26): Comparison among the three groups according to pH.

As shown in table (11) and fig (26), there was no statically significant difference ($p>0.05$) among the three groups in any of the hours of the study as regarding to pH.

Table (12): Comparison among the three groups according to arterial oxygen tension (mmHg):

		N	Mean	Std. Deviation	Minimum	Maximum	f	P
PaO2 $_3$	M	20	87.65	4.234	80	92		
	F	20	83.95	5.286	68	90	4.2	<0.05
	N	20	87.30	3.686	75	92		
PaO2 4	M	20	91.35	4.004	83	95		
	F	20	88.95	3.187	80	95	3.6	<0.05
	N	20	91.75	3.477	80	96		
PaO2 $_8$	M	20	93.05	3.692	85	96		
	F	20	91.60	2.927	85	98	2.9	>0.05
	N	20	94.15	3.468	82	98		
PaO2 $_{12}$	M	20	93.05	3.692	85	96		
	F	20	91.60	2.927	85	98	2.9	>0.05
	N	20	94.15	3.468	82	98		
PaO2 $_{24}$	M	20	94.45	3.069	88	98		
	F	20	92.80	3.205	85	96	5.3	<0.05
	N	20	95.85	2.560	87	98		

PaO2 = pressure of O2 in arterial blood
p>0.05 Not significant
p<0.05 significant

As shown in table (12) and Fig (27), the PaO2 mean showing:

At 3rd h postoperatively: in group M the mean PaO2 was 87.65 ± 4.234 mmHg, and in group F the mean PaO2 was 83.95 ± 5.286 mmHg,and in group N the mean PaO2 was 87.30 ± 3.686 mmHg, and among the three groups there were statistically significant difference (f = 4.2) and (P < 0.05).

At 4th h postoperatively: in group M the mean PaO2 was 91.35 ± 4.004 mmHg, and in group F the mean PaO2 was 88.95 ± 3.187 mmHg ,and in group N the mean PaO2 was 91.75 ± 3.477 mmHg, and among the three groups there were statistically significant difference (f = 3.36) and (P < 0.05).

At 8th h postoperatively: in group M the mean PaO2 was 93.05 ± 3.692 mmHg, and in group F the mean PaO2 was 91.60 ± 2.927 mmHg,and in group N the mean PaO2 was 94.15 ± 3.468 mmHg, and among the three groups there were no statistically significant difference (f = 2.9) and (P > 0.05) .

At 12th h postoperatively: in group M the mean PaO2 was 93.05 ± 3.692 mmHg, and in group F the mean PaO2 was 91.60 ± 2.927 mmHg,and in group N the mean PaO2 was 94.15 ± 3.468 mmHg, and among the three groups there were no statistically significant difference (f = 2.9) and (P > 0.05).

At 24th h postoperatively: in group M the mean PaO2 was 94.45 ± 3.069 mmHg , and in group F the mean PaO2 was 92.80 ± 3.205 mmHg,and in group N the mean PaO2 was 95.85 ± 2.560 mmHg, and among the three groups there were statistically significant difference (f = 5.3) and (P < 0.05).

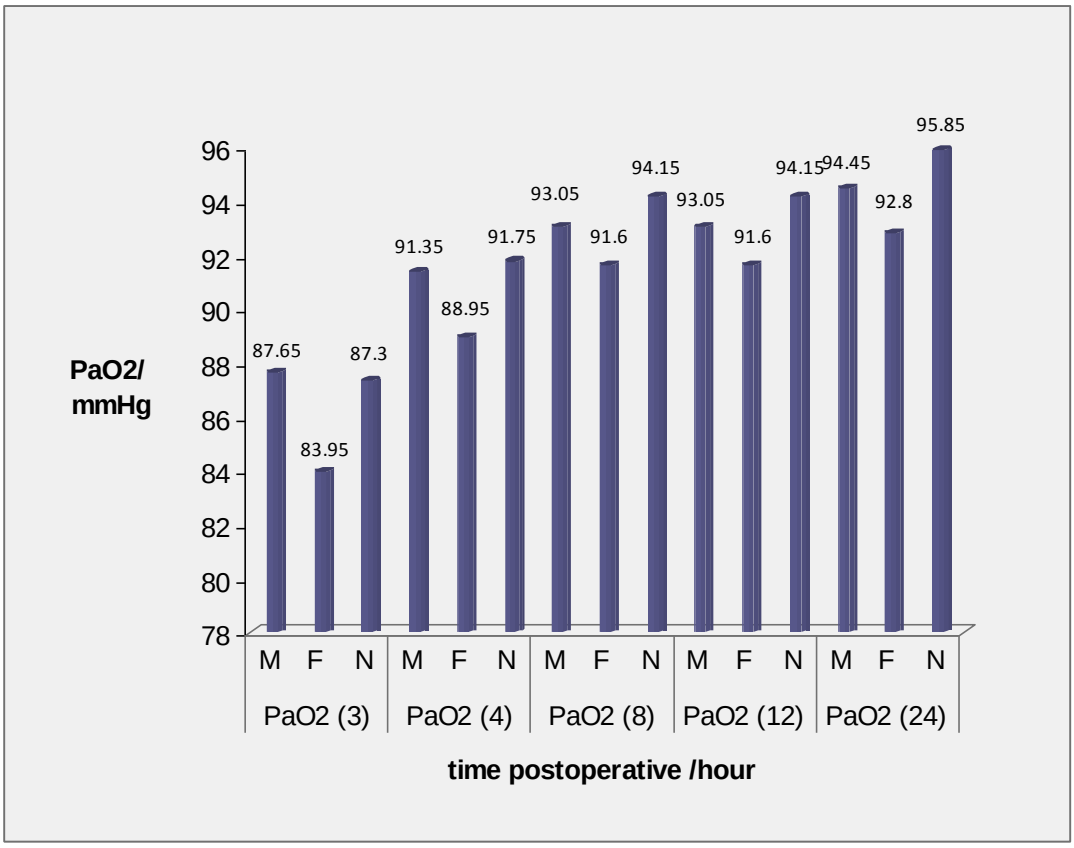

Fig (27): Comparison among the three groups according to PaO2.

As shown in table (12) and fig (27) as regarding to PaO2, it was found that there were no statistically significant difference ($p>0.05$) in all hours except at the 3rd h and the 24th hour, where the statistical significance in the 3rd h did not indicate any thing as it was the baseline data for starting the observations, but the statistical significance in the 24th h was toward group N, as it had 95.85±2.560 mmHg, which was the highest PaO2 than the other two groups meaning quite respiration and adequate ventilation that indirectly refer to good analgesia that was also achieved by the neostigmine infusion.

Table (13): Comparison among the three groups according to arterial carbon dioxide tension (mmHg):

		N	Mean	Std. Deviation	Minimum	Maximum	f	P
$PaCO_{23}$	M	20	40.25	2.936	38	45		
	F	20	41.90	3.597	30	45	1.3	>0.05
	N	20	40.60	3.485	35	50		
$PaCO_2$ 4	M	20	54.55	78.279	35	387		
	F	20	38.40	2.501	35	45	0.9	>0.05
	N	20	36.90	2.864	34	45		
$PaCO_{28}$	M	20	35.55	1.959	33	40		
	F	20	36.35	3.422	33	50	1.2	>0.05
	N	20	35.15	1.814	33	40		
$PaCO_2$ 12	M	20	35.55	1.959	33	40		
	F	20	36.35	3.422	33	50	1.2	>0.05
	N	20	35.15	1.814	33	40		
$PaCO_2$ 24	M	20	34.25	1.333	33	38		
	F	20	34.40	3.560	24	45	0.4	>0.05
	N	20	33.80	1.322	33	38		

$PaCO_2$ = pressure of CO2 in arterial blood
p>0.05 Not significant
p<0.05 significant

As shown in table (13) and Fig (28), the PaCO2 mean showing:

At 3rd h postoperatively: in group M the mean PaCO2 was 40.25 ± 2.936 mmHg , and in group F the mean PaCO2 was 41.90 ± 3.597 mmHg,and in group N the mean PaCO2 was 40.60 ± 3.485 mmHg, and among the three groups there were no statistically significant difference (f = 1.3) and (P > 0.05).

At 4th h postoperatively: in group M the mean PaCO2 was 54.55 ± 78.279 mmHg, and in group F the mean PaCO2 was 38.40 ± 2.501 mmHg,and in group N the mean PaCO2 was 36.90 ± 2.864 mmHg , and among the three groups there

were no statistically significant difference (f = 0.9) and (P > 0.05).

At 8th h postoperatively: in group M the mean PaCO2 was 35.55 ± 1.959 mmHg, and in group F the mean PaCO2 was 36.35 ± 3.422 mmHg,and in group N the mean PaCO2 was 35.15 ± 1.814 mmHg, and among the three groups there were no statistically significant difference (f = 1.2) and (P > 0.05).

At 12th h postoperatively: in group M the mean PaCO2 was 35.55 ± 1.959 mmHg, and in group F the mean PaCO2 was 36.35 ± 3.422 mmHg,and in group N the mean PaCO2 was 35.15 ± 1.814 mmHg, and among the three groups there were no statistically significant difference (f = 1.2) and (P > 0.05).

At 24th h postoperatively: in group M the mean PaCO2 was 34.25 ± 1.333 mmHg, and in group F the mean PaCO2 was 34.40 ± 3.560 mmHg,and in group N the mean PaCO2 was 33.80 ± 1.322 mmHg, and among the three groups there were no statistically significant difference (f = 0.4) and (P > 0.05).

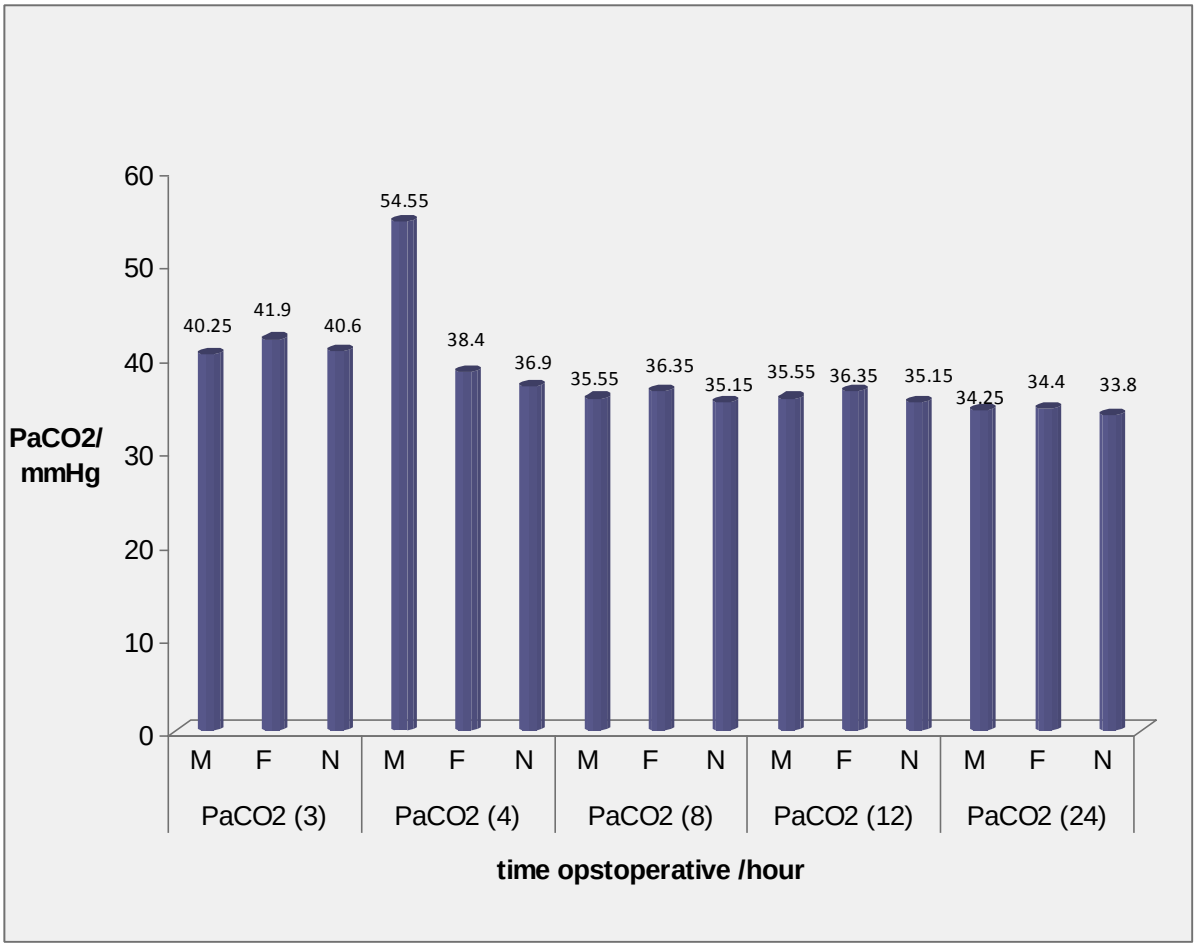

Fig (28): Comparison among the three groups according to PaCO2.

As shown in table (13) and fig (28), there was no statically significant difference ($p>0.05$) among the three groups in any of the hours of the study as regarding to PaCO2.

Table (14): Comparison among the three groups according to arterial level of bicarbonate (mmol/L):

		N	Mean	Std. Deviation	Minimum	Maximum	f	p
HCO_3 3	M	20	19.50	1.504	16	22		
	F	20	19.95	2.460	16	26	0.3	>0.05
	N	20	19.80	1.704	15	23		
HCO_3 4	M	20	21.05	1.276	18	23		
	F	20	21.53	2.144	18	25	0.8	>0.05
	N	20	21.70	1.490	18	24		
HCO_3 8	M	20	22.15	0.933	20	23		
	F	20	22.95	2.121	18	26	1.5	>0.05
	N	20	22.75	1.209	20	24		
HCO_3 12	M	20	22.15	0.933	20	23		
	F	20	22.95	2.121	18	26	1.5	>0.05
	N	20	22.75	1.209	20	24		
HCO_3 24	M	20	23.00	.858	21	24		
	F	20	23.74	1.851	18	26	1.9	>0.05
	N	20	23.55	0.686	22	24		

HCO3 = Bicarbonate level in the blood
p>0.05 Not significant
p<0.05 significant

As shown in table (14) and Fig (29), the HCO3 mean showing:

At 3rd h postoperatively: in group M the mean HCO3 was 19.50 ± 1.504 mmol/L, and in group F the mean HCO3 was 19.95 ± 2.460 mmol/L , and in group N the mean HCO3 was 19.80 ± 1.704 mmol/L , and among the three groups there were no statistically significant difference (f = 0.3) and (P > 0.05).

At 4th h postoperatively: in group M the mean HCO3 was 21.05 ± 1.276 mmol/L, and in group F the mean HCO3 was 21.53 ± 2.144 mmol/L, and in group N the mean HCO3 was

21.70 ± 1.490 mmol/L, and among the three groups there were no statistically significant difference (f = 0.8) and (P > 0.05).

At 8th h postoperatively: in group M the mean HCO3 was 22.15 ± 0.933 mmol/L, and in group F the mean HCO3 was 22.95 ± 2.121 mmol/L, and in group N the mean HCO3 was 22.75 ± 1.209 mmol/L, and among the three groups there were no statistically significant difference (f = 1.5) and (P > 0.05).

At 12th h postoperatively: in group M the mean HCO3 was 22.15 ± 0.933 mmol/L, and in group F the mean HCO3 was 22.95 ± 2.121 mmol/L, and in group N the mean HCO3 was 22.75 ± 1.209 mmol/L, and among the three groups there were no statistically significant difference (f = 1.5) and (P > 0.05).

At 24th h postoperatively: in group M the mean HCO3 was 23.00 ± 0.858 mmol/L, and in group F the mean HCO3 was 23.74 ± 1.851 mmol/L, and in group N the mean HCO3 was 23.55 ± 0.686 mmol/L, and among the three groups there were no statistically significant difference (f = 1.9) and (P > 0.05).

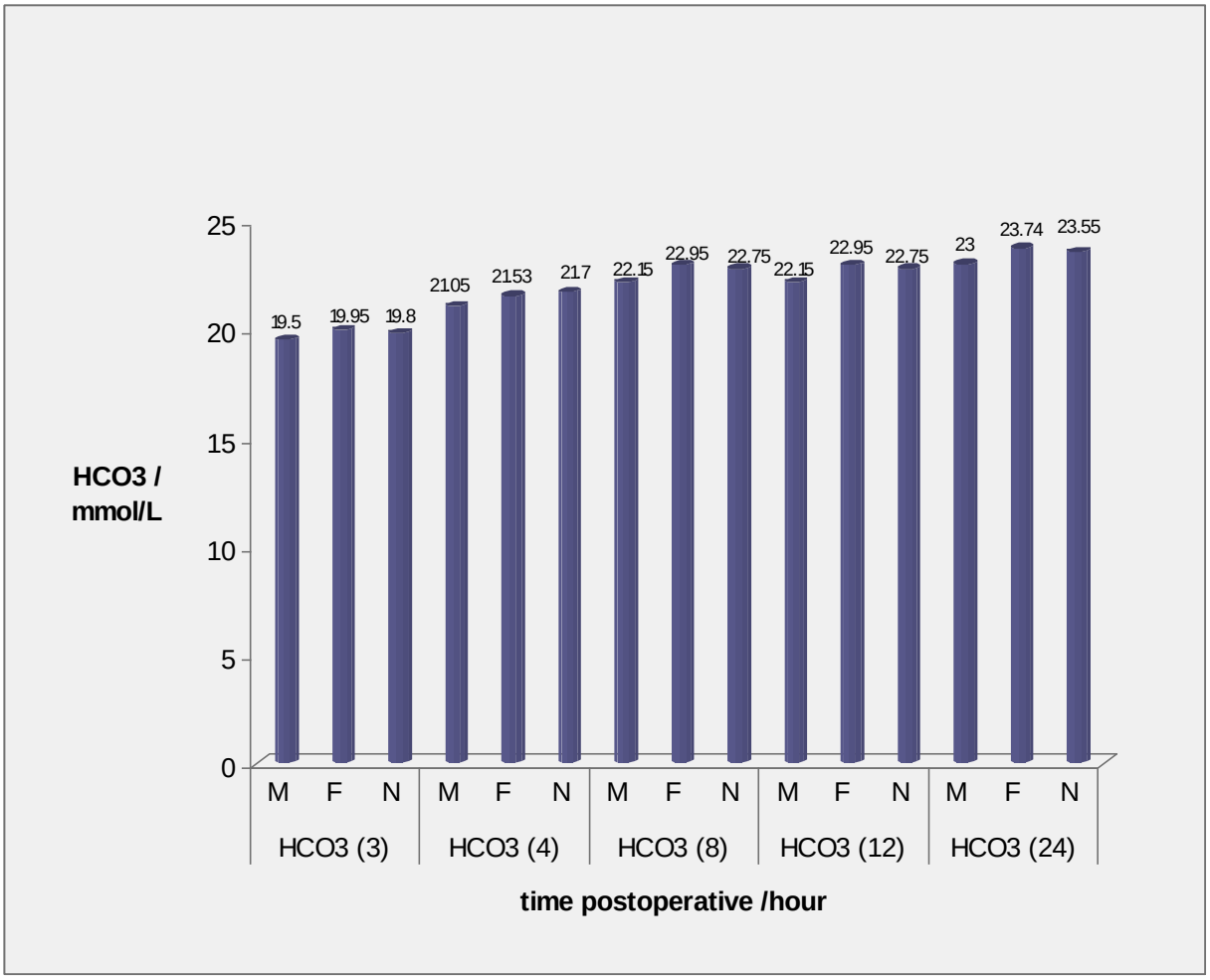

Fig (29): Comparison among the three groups according to HCO3.

As shown in table (14) and fig (29), there was no statically significant difference ($p>0.05$) among the three groups in any of the hours of the study as regarding to HCO3 level.

Table (15): Comparison among the three groups according to visual analogue scale:

		N	Mean	Std. Deviation	Minimum	Maximum	f	p
VAS 3	M	20	4.00	0.000	4	4		
	F	20	4.00	0.459	3	5	0	>0.05
	N	20	4.00	0.000	4	4		
VAS 4	M	20	3.00	0.000	3	3		
	F	20	2.95	0.510	2	4	0.5	>0.05
	N	20	3.05	0.224	3	4		
VAS 8	M	20	1.50	0.607	1	3		
	F	20	0.60	0.503	0	1	14.01	<0.05
	N	20	0.95	0.510	0	2		
VAS 12	M	20	1.65	0.489	1	2		
	F	20	0.70	0.470	0	1	25.01	<0.05
	N	20	1.00	0.324	0	2		
VAS 24	M	20	1.70	0.470	1	2		
	F	20	0.85	0.489	0	2	16.4	<0.05
	N	20	1.05	0.510	0	2		

VAS = Visual analogue scale
p>0.05 Not significant
p<0.05 significant

As shown in table (15) and Fig (30), the mean of visual analogue scale showing:

At 3rd h postoperatively: in group M the mean VAS was 4.00 ± 0.000, and in group F the mean VAS was 4.00 ± 0.459, and in group N the mean VAS was 4.00 ± 0.000, and among the three groups there were no statistically significant difference (f = 0) and (P > 0.05).

At 4th h postoperatively: in group M the mean VAS was 3.00 ± 0.000, and in group F the mean VAS was 2.95 ± 0.510, and in group N the mean VAS was 3.05 ± 0.224, and among

the three groups there were no statistically significant difference (f = 0.5) and (P > 0.05).

At 8th h postoperatively: in group M the mean VAS was 1.50 ± 0.607, and in group F the mean VAS was 0.60 ± 0.503, and in group N the mean VAS was 0.95 ± 0.510, and among the three groups there were statistically significant difference (f = 14.1) and (P < 0.05).

At 12th h postoperatively: in group M the mean VAS was 1.65 ± 0.489, and in group F the mean VAS was 0.70 ± 0.470, and in group N the mean VAS was 1.00 ± 0.324, and among the three groups there were statistically significant difference (f = 25.01) and (P < 0.05).

At 24th h postoperatively: in group M the mean VAS was 1.70 ± 0.470, and in group F the mean VAS was 0.85 ± 0.489, and in group N the mean VAS was 1.05 ± 0.510, and among the three groups there were statistically significant difference (f = 16.4) and (P < 0.05).

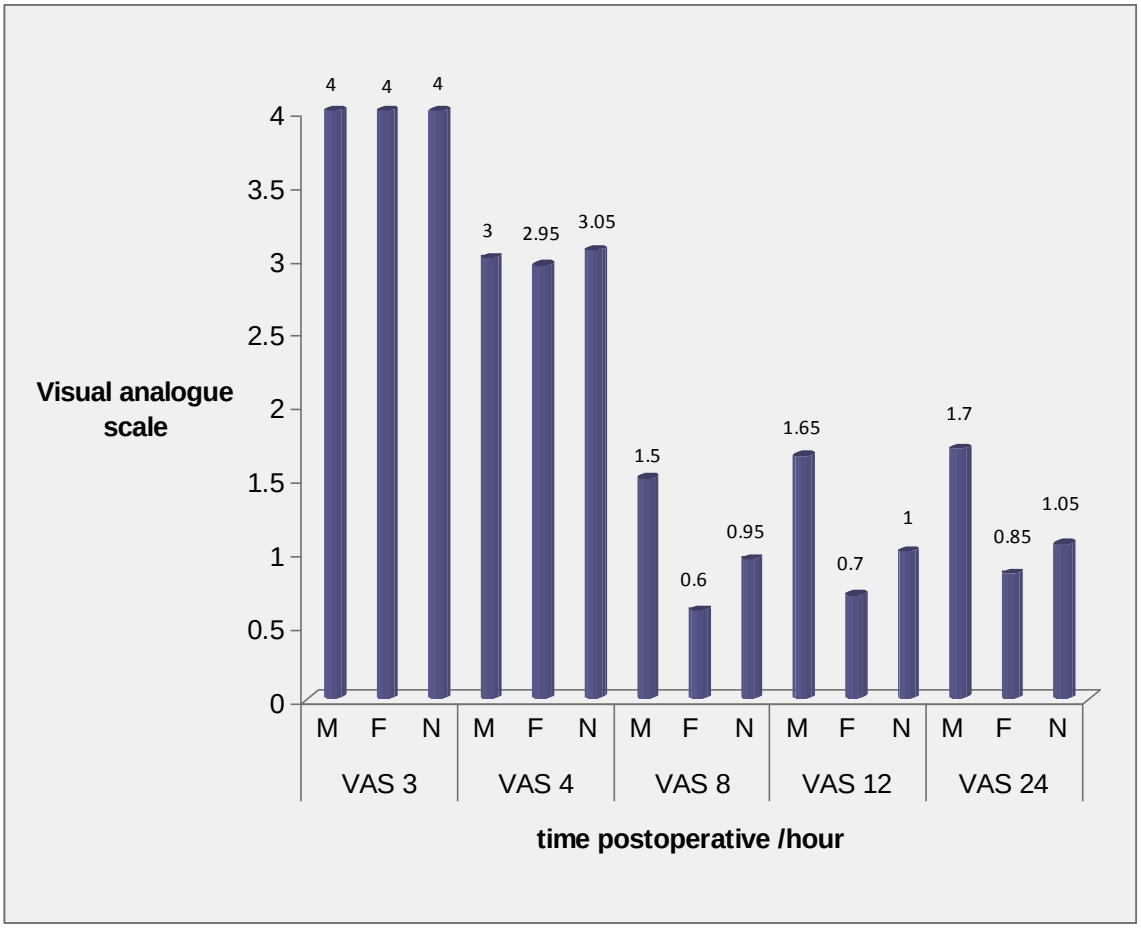

Fig (30): Comparison among the three groups according to VAS.

As shown in table (15) and fig (30) as regarding to VAS, it was found that there were statistically significant difference ($p<0.05$) toward group F in maintaining a lower VAS scores with means (0.60± 0.503, 0.70±0.470, and 0.85±0.489) in the hours 8th, 12th and 24th hours respectively (denoting more analgesia) toward group F, making group F is the best in comparison with the other two groups.

Table (16): Comparison among the three groups according to verbal numerical rating scale:

	group	N	mean	Std. Deviation	Minimum	Maximum	f	p
VRS 3	M	20	8.00	.000	8	8		
	F	20	7.90	.788	6	10	0.3	>0.05
	N	20	8.00	.000	8	8		
VRS 4	M	20	6.00	.000	6	6		
	F	20	5.90	.788	4	8	0.7	>0.05
	N	20	6.10	.447	6	8		
VRS 8	M	20	3.00	1.214	2	6		
	F	20	1.20	1.005	0	2	14.01	<0.05
	N	20	1.90	1.021	0	4		
VRS 12	M	20	3.30	.979	2	4		
	F	20	1.40	.940	0	2	25.01	<0.05
	N	20	2.00	.649	0	4		
VRS 24	M	20	3.40	.940	2	4		
	F	20	1.70	.979	0	4	16.4	<0.05
	N	20	2.10	1.021	0	4		

VRS = VERBAL RATING SCALE
p>0.05 Not significant
p<0.05 significant

As shown in table (16) and Fig (31), the mean of the verbal numerical rating scale showing:

At 3rd h postoperatively: in group M the mean VRS was 8.00 ± 0.000, and in group F the mean VRS was 7.90 ± 0.788, and in group N the mean VRS was 8.00 ± 0.000, and among the three groups there were no statistically significant difference (f = 0.3) and (P > 0.05).

At 4th h postoperatively: in group M the mean VRS was 6.00 ± 0.000, and in group F the mean VRS was 5.90 ± 0.788, and in group N the mean VRS was 6.10 ± 0.447, and among the three groups there were no statistically significant difference (f = 0.7) and (P > 0.05).

At 8th h postoperatively: in group M the mean VRS was 3.00 ± 1.214, and in group F the mean VRS was 1.20 ± 1.005, and in group N the mean VRS was 1.90 ± 1.021, and among the three groups there were statistically significant difference (f = 14.01) and (P < 0.05).

At 12th h postoperatively: in group M the mean VRS was 3.30 ± 0.979, and in group F the mean VRS was 1.40 ± 0.940, and in group N the mean VRS was 2.00 ± 0.649, and among the three groups there were statistically significant difference (f = 25.01) and (P < 0.05).

At 24th h postoperatively: in group M the mean VRS was 3.40 ± 0.940, and in group F the mean VRS was 1.70 ± 0.979, and in group N the mean VRS was 2.10 ± 1.021, and among the three groups there were statistically significant difference (f = 16.4) and (P < 0.05).

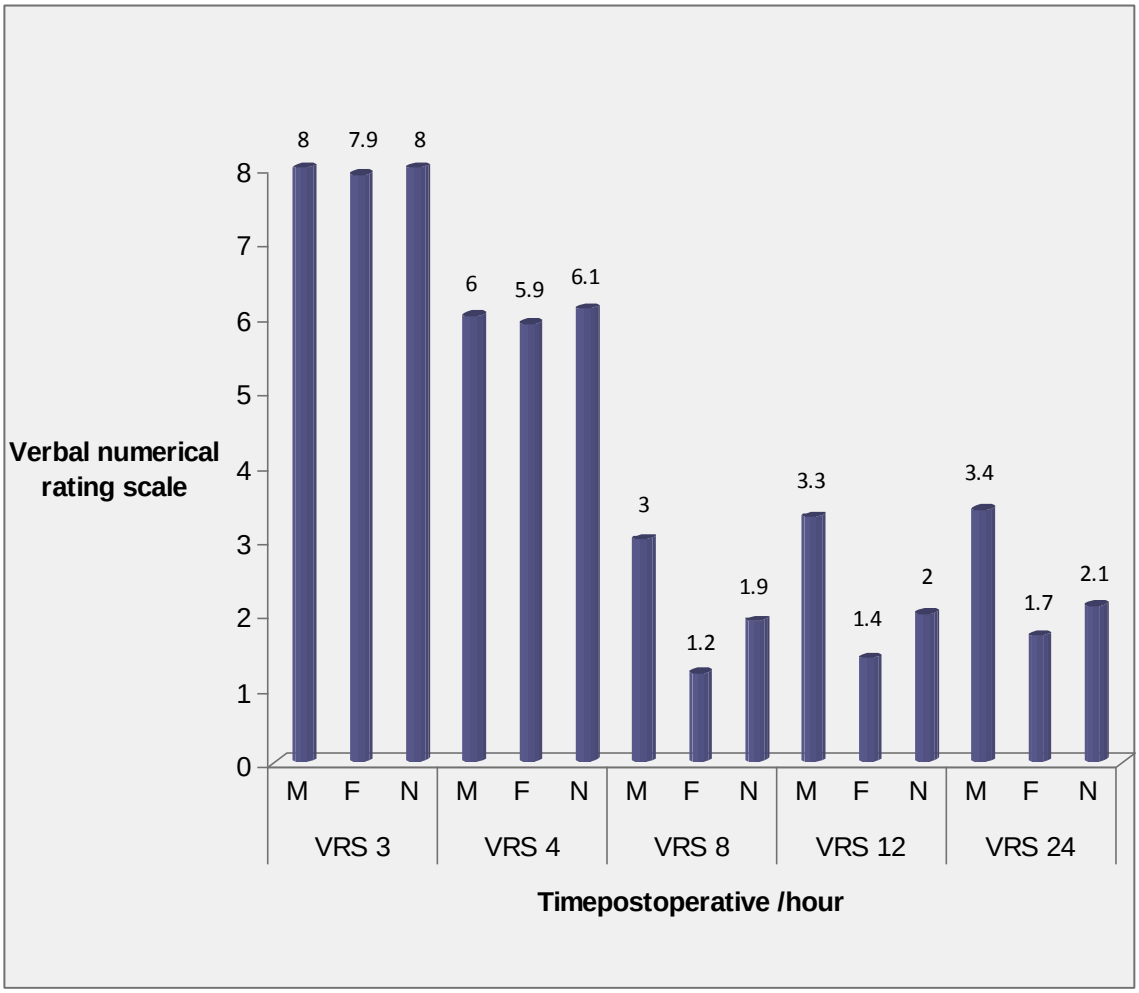

Fig (31): Comparison among the three groups according to VRS.

As shown in table (16) and fig (31) as regarding to VRS, it was found that there were statistically significant difference ($p<0.05$) toward group F in maintaining a lower VRS scores in the hours 8th, 12th and 24th hours respectively (denoting more analgesia) toward group F, making group F is the best in comparison with the other two groups.

Table (17): Comparison among the three groups according to Ramsay sedation scale:

		N	Mean	Std. Deviation	Minimum	Maximum	f	p
RSS 3	M	20	1.05	0.224	1	2		
	F	20	1.00	0.000	1	1	1	>0.05
	N	20	1.00	0.000	1	1		
RSS 4	M	20	2.00	0.000	2	2		
	F	20	2.00	0.000	2	2	------	-----
	N	20	2.00	0.000	2	2		
RSS 8	M	20	2.00	0.324	1	3		
	F	20	2.30	0.657	1	3	3.6	<0.05
	N	20	1.95	0.224	1	2		
RSS 12	M	20	2.00	0.000	2	2		
	F	20	2.40	0.503	2	3	12.6	<0.05
	N	20	2.00	0.000	2	2		
RSS 24	M	20	2.00	0.000	2	2		
	F	20	2.20	0.410	2	3	4.7	<0.05
	N	20	2.00	0.000	2	2		

RSS = Ramsay sedation scale
p>0.05=Not significant
p<0.05=significant

As shown in table (17) and Fig (32), the mean of Ramsay sedation scale showing:

At 3rd h postoperatively: in group M the mean RSS was 1.05 ± 0.224, and in group F the mean RSS was 1.00 ± 0.000, and in group N the mean RSS was 1.00 ± 0.000, and among the three groups there were no statistically significant difference (f = 1) and (P > 0.05).

At 4th h postoperatively: in group M the mean RSS was 2.00 ± 0.000, and in group F the mean RSS was 2.00 ± 0.000, and in group N the mean RSS was 2.00 ± 0.000, and among the three groups there were no statistically significant

difference (no P value) or (f value) i.e. the three groups had the same results at that hour.

At 8th h postoperatively: in group M the mean RSS was 2.00 ± 0.324, and in group F the mean RSS was 2.30 ± 0.657, and in group N the mean RSS was 1.95 ± 0.224, and among the three groups there were statistically significant difference (f = 3.6) and (P < 0.05).

At 12th h postoperatively: in group M the mean RSS was 2.00 ± 0.000, and in group F the mean RSS was 2.40 ± 0.503, and in group N the mean RSS was 2.00 ± 0.000, and among the three groups there were statistically significant difference (f = 12.6) and (P < 0.05).

At 24th h postoperatively: in group M the mean RSS was 2.00 ± 0.000, and in group F the mean RSS was 2.20 ± 0.410, and in group N the mean RSS was 2.00 ± 0.000, and among the three groups there were statistically significant difference (f = 4.7) and (P < 0.05).

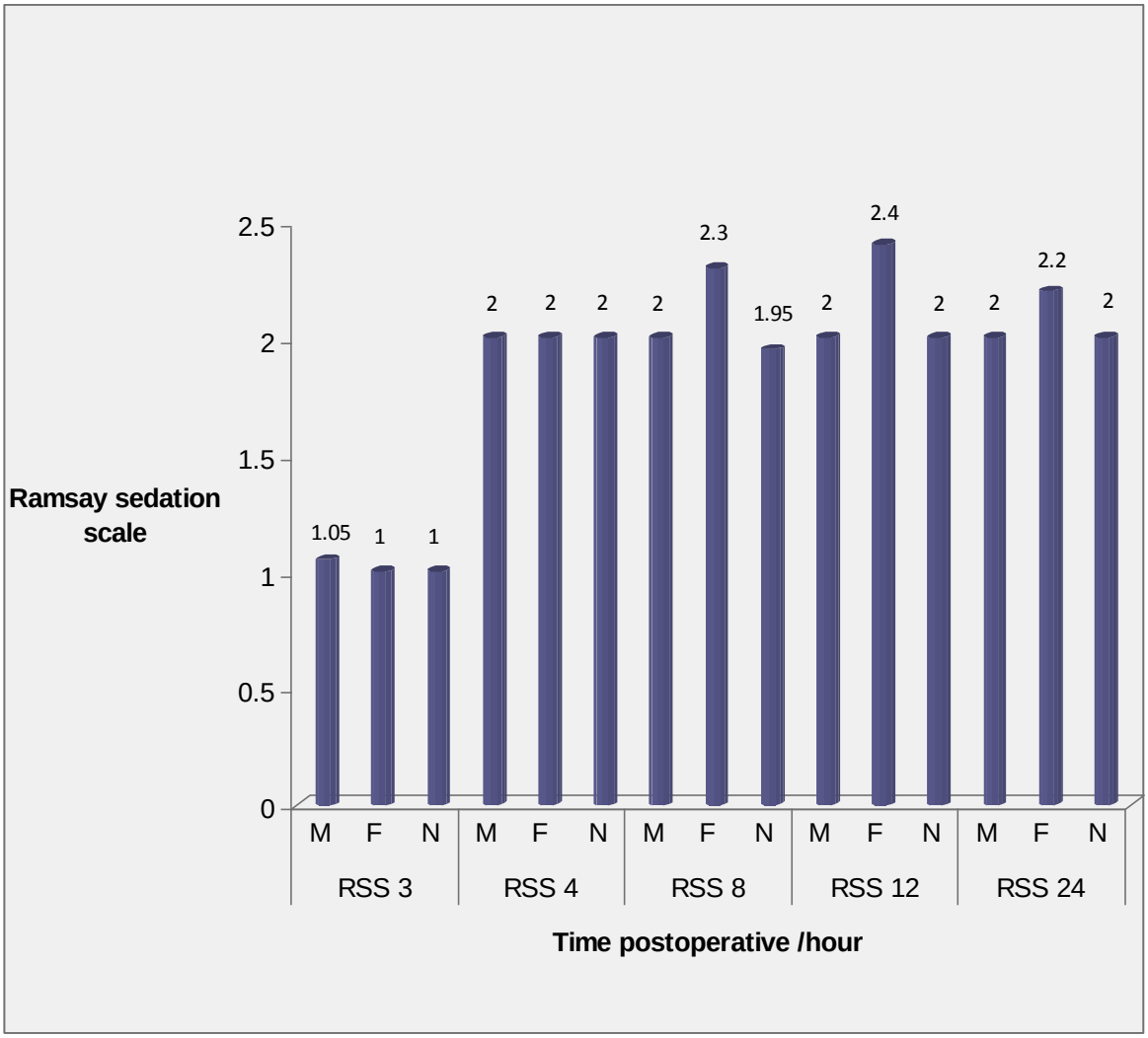

Fig (32): Comparison among the three groups according to RSS.

As shown in table (17) and fig (32) as regarding to RSS, it was found that there were statistically significant difference ($p<0.05$) toward group F in maintaining a higher RSS scores in the hours 8th, 12th and 24th hours respectively (denoting more analgesia) toward group F, making group F is the best in comparison with the other two groups.

Table (18): Comparison among the three groups according to complications:

	Complications		No complications		Total		X^2	p
	No.	%	No.	%	No.	%		
M	5	25	15	75	20	100	6.9	<0.05
F	1	5	19	95	20	100		
N	8	40	12	60	20	100		

P> 0.05 not significant
P< 0.05 significant

As shown in table (18) and Fig (33), all the patients were divided into complicated and non complicated, showing (P < 0.05) there was statistically significant difference between the three groups.

The complications in the table (18) are collectively noted not in details, so I explain the complications as follow:

In group M: only 5 patients i.e., 25% of the patients of this group are complicated (2 patients developed hypotension and 3 other patients developed nausea and vomiting).

In group F: only one patient i.e., 5% developed hypotension only.

In group N: we have 8 patients complicated i.e., 40% of the patients of this group (3 patients developed hypotension and 5 other patients developed nausea and vomiting).

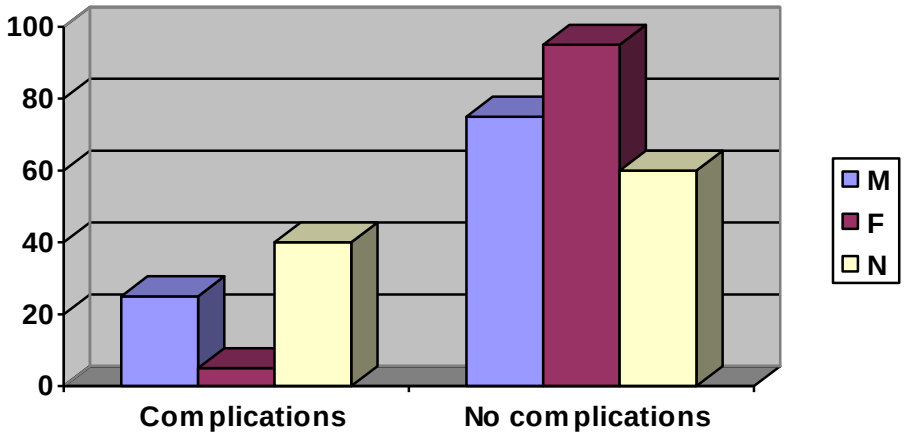

Fig (33): Comparison among the three groups according to complications.

To summarize the results

As regard our comparative study between the 3 groups (, **M** = magnesium, **F** =Fentanyl, **N** = Neostigmine) we found that: **group F** has the best results in comparison with the other 2 groups (**M, N**).

According to : visual analogue scale (VAS) , verbal numerical rating scale (VRS) , sedation scale(Ramsay sedation scale), hemodynamics parameters (systolic blood pressure, diastolic blood pressure , and heart rate) , respiratory rate , arterial blood gases (ABG) as regard (pH , PaO2 , $PaCO_2$, HCO_3) :

As regard the complications:

In group F: only one patient i.e., 5% developed hypotension only.

In group M: only 5 patients i.e., 25% of the patients of this group are complicated (2 patients developed hypotension and 3 patients developed nausea and vomiting).

In group N: we have 8 patients complicated i.e., 40% of the patients of this group (3 patients developed hypotension and 5 patients developed nausea and vomiting).

Through our study, we fined that failed technique to reach the epidural space had occurred in one patient only in each group and that patient had replaced by another one, who was scheduled for thoracotomy and also in group **M** we met one patient who had failed the analgesic technique in that patient and also that patient had been replaced by another patient, who was scheduled for thoracotomy, all this replacement to keep all groups to be equal in number to be 20 patients.

In comparing group **F** with group **M**, it was found that:

Group **F** is superior to group **M** as regard to better hemodynamic stability, better respiratory parameters, better pain scores, better sedation scores, and lower rate of complications.

* In comparing group **F** with group **N**, it was found that:

Group **F** is superior to group **N** as regard to better hemodynamic stability, better respiratory parameters, better pain scores, better sedation scores, and lower rate of complications.

* In comparing group **M** with group **N,** it was found that:

Group **N** is superior to group **M** as regard to better hemodynamic stability, better respiratory parameters, better pain scores, better sedation scores but group **M** had a lower number of complicated patients than that in group **N.**

So if we arrange and put the three groups in order scheme; we will find that group F > group N > group M.

According to this order we can say that the addition of fentanyl to bupivacaine and the infusion of their combination (fentanyl 2ug/ml + bupivacaine 0.125%) in the thoracic epidural catheter is the best combination in controlling acute postthoracotomy pain.