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Orginal research article

PULMONARY RECRUITMENT MANEUVRE(PRM) VERSUS SUBDIAPHRAGMATIC DRAIN ON POST OPERATIVE NAUSEA AND VOMITING(PONV) IN LAPROSCOPIC ABDOMINAL SURGERIES: A COMPARATIVE STUDY.

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Abstract :

Background: Laparoscopic procedures have gained upper hand over open surgeries in reducing hospital stay. With the advent of minimally invasive techniques there is potential to bypass the abdominal wall altogether for visceral access and resection reducing the need for analgesia, though post-operative symptoms like nausea and vomiting may increase the duration.

Objectives:-1.To compare the effect of pulmonary recruitment maneuver and Sub diaphragmatic drain on incidence of PONV.

2. To evaluate the haemodynamic changes during pulmonary recruitment maneuver.

Methods and study design:- A total of 60 patients belonging to ASA I and ASA II, planned for laparoscopic abdominal surgeries were randomly divided into two groups. In one group patients were placed in Trendelenburg position and CO2 was removed by means of PRM with trocar sleeve fully open. In another group a subdiaphragmatic drain was placed planned to evacuate the residual CO2. Reduction in Post-operative nausea and vomiting(0-3 scale) was observed as primary outcome and hemodynamic parametersduring PRM was also noted.

Results: Study included 60 patients. Demographic data was comparable between both the groups .Post-operative nausea and vomiting was significantly lower in pulmonary recruitment maneuver group ($P<0.05$) at 6, 12, 24and 48 hours compared to subdiaphragmatic group. Hemodynamic parameters remained stable throughout the recruitment maneuver

Interpretation and conclusion : Pulmonary recruitment maneuver offers a benefit in reducing postoperative nausea and vomiting with no adverse events in laparoscopic abdominal surgeries

Keywords: PRM, PONV , Haemodynamic changes

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Introduction:

Laparoscopic technique has gained popularity in recent years.[1] The term laparoscopy is derived from Greek word (lapor- flank or soft, scope- to look), it is performed by insufflating the abdomen with gas so the intra-abdominal contents can be visualized without being in direct contact to the surgeon's hands[2] as it is beneficial to patients in terms of reduction in incision size (1cm), With the advent of minimally invasive techniques there is potential to bypass the abdominal wall altogether for visceral access and resection reducing the need for analgesia. reduced postoperative discomfort, shorter duration or recovery and decreased incidence of surgical wound infection. All of these aspects add to shorter hospital stay and reduced perioperative morbidity. Nonetheless laparoscopic surgery has its own specific risks resulting from physiological changes correlating to creation of pneumoperitoneum or due to individual techniques.[3]These advances in technique still have significant post operative symptoms like nausea and vomiting which occurs in 40% to 75% of individuals and may increase the duration of hospital stay post operatively.[4]

Although the exact mechanism for post operative nausea and vomiting in laproscopic surgeries is unknown some of the risk factors are carbon dioxide insufflations and bowel manipulation and other hypothesis states that carbon dioxide increases the cerebral blood flow which results in nausea and vomiting.

Following cholecystectomy a polyethylene tube drain is placed between the diaphgram and liver and connected to closed suction reservoir . This leads to evacuation of residual CO2 by subdiaphragmatic drain which consequently results in a reduction of post operative nausea and vomiting. [5]

Positive pressure ventilation inflates the lungs leading to descend of diaphragm. Thus increasing intraperitonial pressure which facilitates the removal of residual carbon dioxide through the trocars. .[6]

Pulmonary recruitment maneuvre(a simple clinical maneuvre done by increasing intrapulmonary pressure)is easy and safe to perform but is less frequently used in clinical practice . Hence we are going to investigate the effect of this simple clinical technique-pulmonary recruitment maneuvre to reduce post operative nausea and vomiting and compare it with subdiaphragmatic drain to reduce post operative nausea and vomiting in patients undergoing laproscopic abdominal surgeries.

Objectives of the study

1.To compare the effect of pulmonary recruitment maneuver and Sub diaphragmatic drain on incidence of PONV.

2. To evaluate the haemodynamic changes during pulmonary recruitment maneuver.

Subjects and Methods:

Source of data:

Patients undergoing elective laparoscopic abdominal surgery under general anaesthesia in hospitals attached to Bangalore Medical College and Research Institute.

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Methods Of Collection Of Data:

A. **Study design:** Randomized open labelled study.
B. **Study period:**October 2021 to October 2022.
C. **Place of study**: Patients undergoing elective laparoscopic abdominal surgery under general anaesthesia in hospitals attached to Bangalore medical college and research institute.

D. Sample size:

The sample size calculation is

Based on the patient study conducted on 10 patients assuming equal variance and standard deviation, (SBP), sample size can be calculated as follows.

$$n = \frac{2(Z\alpha + Z_{1-\beta})^2 \sigma^2}{d^2} = \frac{2(1.96+0.84)^2 \text{ X } (12.1)^2}{10^2} = 22.95$$

n = 23 in each group

Where Zα= standard table value for 95% CI =1.96

$Z_{1-\beta}$ = Standard table value for 80% Power = 0.84

d= effect size

considering a droup out rate of 10% final sample size will be

n =23 + 10% of 23 = 25.3 = 26 in each group.

n=26 , a minimum of 30 patients would be required in each group of 2.

E. Inclusion Criteria :

1. Patients who all willing to give written /informed consent.
2. Patients aged 18-60 years of both genders.
3. Patients with ASA-1 and ASA-2.
4. Patients scheduled for elective laparoscopic abdominal surgeries under general anaesthesia.

F. Exclusion Criteria:

1. Patients refusing to give consent.
2. Patients with ASA-3 and ASA-4.
3. Pregnant women.
4. Patients with pre-existing pulmonary diseases- COPD,Tuberculosis.

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Methodology:

After obtaining written informed consent participation consent and approval from institutional ethical committee, patients will be randomly allocated to one of the two groups using numbers generated from www.random.org

A proforma will be used to collect the data which includes patient's demographic parameters,indication for surgery, the anaesthetic details, intra operative and post-operative monitoring .

P value (Probability that the result is true) of <0.05 was considered as statistically significant after assuming all the rules of statistical tests.

Assessment tools.

1. Questionaries-Patient were asked regarding post operative nausea and vomiting following surgery at 0hr, 6hrs, 12hrs, 24hrs and 48 hours.

Post operative nausea and vomiting was assessed using a 3 point PONV grading scale

Where, 0 = no nausea,

i. 1 = only nausea

ii. 2 = retching/ 1 episode of vomiting

iii. 3 = more than one episode of vomiting.

Outcome measures:

Efficacy parameters (Clinical outcome parameters)

1. Post-operative nausea and vomiting.

Safety and tolerability parameters

1. Haemo-dynamic changes – Heart rate, systolic blood pressure, diastolic blood pressure, mean arterial pressure

H. STATISTICAL ANALYSIS:

Data will be analysed by Descriptive statistics such as mean, median, standard deviation, interquartile range, percentages, tables and graphs wherever applicable.

Student 't' test will be used to see the significant difference between 2 groups. Analysis of variance will be used to see the significant difference between 3 or more groups. Chi square test will be used to see the qualitative variables .p<0.05 will be considered statistically significant .Data will be entered in microsoft excel and analysed by SPSS version 20.0.

Results:

In our study we compared the effect of PRM on PONV to Subdiaphragmatic drain group(non PRM group) following laparoscopic abdominal surgeries. Sixty patients were allocated to one of the two groups. Group A (n=30) received Pulmonary recruitment maneuvre. Group B (n=30) Subdiaphragmatic drain group

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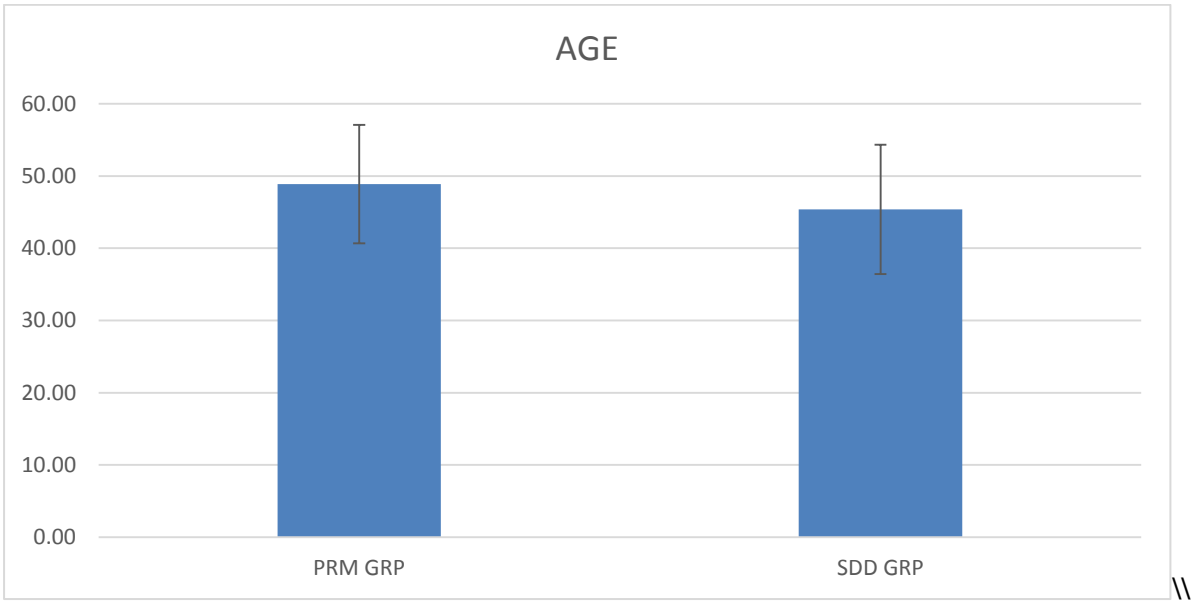
DEMOGRAPHIC PARAMETERS:-

There was no significant difference in terms of age, sex between the two groups.

Age distribution comparison between two groups.

AGE			
	PRM GRP	SDD GRP	p value
MEAN	48.87	45.37	0.05986318
SD	8.20	8.95	

Mean age of subjects in Group A was 48.87 ± 8.20 years, in Group B, Mean age was 45.37 ± 8.95 years. There is no significant difference in Age between Group A and Group B as P value >0.05



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Bar diagram showing Age distribution comparison between two groups.

Gender distribution comparison between two groups

GENDER					
	PRM GRP		SDD GROUP		chi test
MALE	20	67%	16	53%	0.4292
FEMALE	10	33%	14	47%	

67% (20) of the participants in the Group A were male and other 33% (10) of the participants were Female. 53% (16) of the participants in the Group B were male and 47 % (14) of the participants female. There is no significant difference in gender between PRM group and Control group as P Value > 0.005

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Bar diagram showing Sex distribution comparison between two groups.

Hemodynamic parameters comparison Pre PRM and Post PRM.

	HEART RATE	SBP	DBP	MAP	SPO2
Pre PRM VS					
PRM	0.4724	0.2246	0.3422	0.1297	0.7677
30 seconds	0.9848	0.4892	0.7506	0.5125	0.7791
1 minute	0.6645	0.5803	0.5820	0.9774	0.3433
2 minute	0.6704	0.7285	0.5138	0.4939	0.2208
5 minutes	0.5957	0.9444	0.1839	0.3459	0.2883

There is no significant difference in heart rate, systolic blood pressure, diastolic blood pressure, mean arterial pressure and oxygen saturation in Pre PRM period, During PRM and After PRM at 30 sec ,1 min , 2 mins and 5 mins as p value >0.05 at all intervals.

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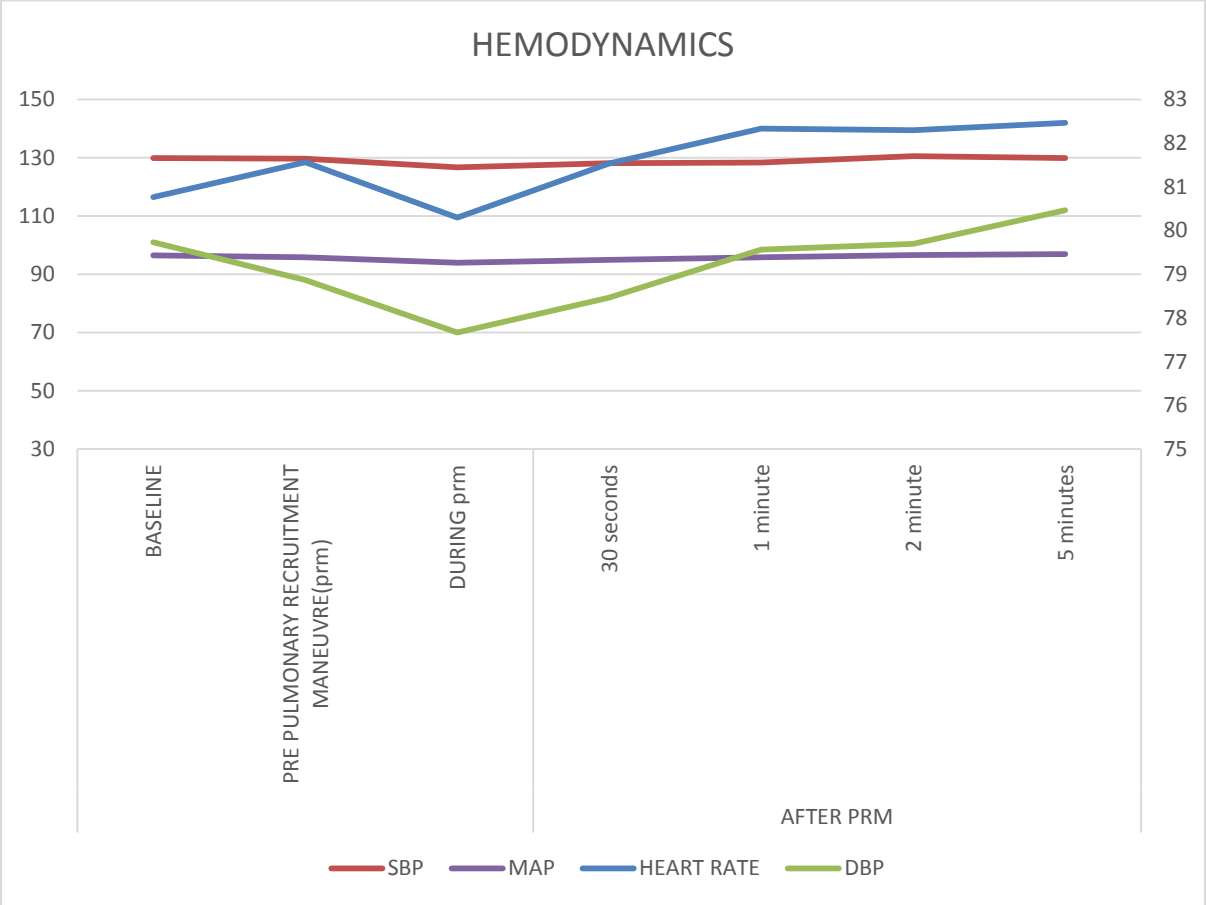

Line diagram showing Hemodynamic parameters comparison Pre PRM and Post PRM.

Comparison of the Two Groups in Terms of post operative nausea and vomiting .

PONV						
	PRM			SDD		p value
0 hr						
NO NAUSEA	0	30	0%	30	0%	1
ONLY NAUSEA	1	0		0		
RETCHING/1 EPISODE OF VOMITING	2	0		0		
MORE THAN 1 EPISODE OF VOMITING	3	0		0		
6 hr						
NO NAUSEA	0	26	13%	17	43%	0.02191
ONLY NAUSEA	1	4		13		
RETCHING/1 EPISODE OF VOMITING	2	0		0		
MORE THAN 1 EPISODE OF VOMITING	3	0		0		
12 hr						
NO NAUSEA	0	26	13%	16	46%	0.01012
ONLY NAUSEA	1	4		14		
RETCHING/1 EPISODE OF VOMITING	2	0		0		
MORE THAN 1 EPISODE OF VOMITING	3	0		0		
24 hr						

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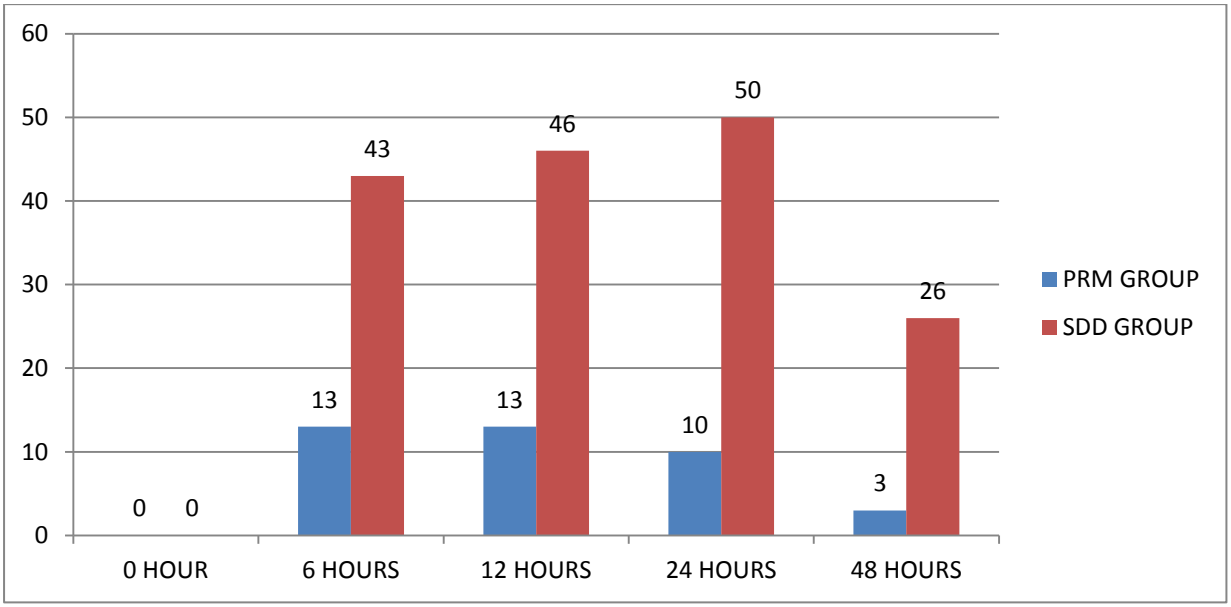
NO NAUSEA	0	27	10%	15	50%	0.002001
ONLY NAUSEA	1	3		12		
RETCHING/1 EPISODE OF VOMITING	2	0		3		
MORE THAN 1 EPISODE OF VOMITING	3	0		0		
48 hr						
NO NAUSEA	0	29	3%	22	26%	0.02569
ONLY NAUSEA	1	1		8		
RETCHING/1 EPISODE OF VOMITING	2	0		0		
MORE THAN 1 EPISODE OF VOMITING	3	0		0		

The incidence of post operative nausea and vomiting was significantly lower in PRM GROUP compared to SDD GROUP at 6, 12, 24 and 48 respectively as $p<0.05$.

At 6 , 12, 24 and 48 hours, the incidence of post operative nausea and vomiting was significantly lower in PRM GROUP (13%, 13%, 10% and 3% respectively) than in SDD GROUP(43%, 46%, 50% and 26% respectively ; $p = 0.021$, $p = 0.010$, $p = 0.002$ and $p = 0.025$ respectively).



Bar chart showing comparison on PONV between PRM Group and SDD Group.

Discussion:-

Post operative nausea and vomiting after laparoscopic surgeries an important problem after a procedure which is designed for minimal discomfort.

The exact mechanism for post operative nausea and vomiting in laparoscopic surgeries is unknown. Some of the risk factors are carbon dioxide insufflations and bowel manipulation(Apfel et al.2004)[7] and other hypothesis states that carbon dioxide increases the cerebral blood flow which also results in nausea and vomiting(Ahmed et al.2012).[8]

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The pulmonary inflation is a simple and safe method, which does not need additional cost or side effect . At the end of the surgery we placed patient in Trendelenburg position ,Pulmonary recruitment maneuver was performed consisting of 6 inflations over 1 minute with maximum pressure of 30 to 40 cm of H2O, it inflates the lungs , lowers the diaphragm and increase intraperitoneal pressure , that eliminates CO2 gas from the abdominal cavity. Changes in haemodynamics (heart rate, systolic blood pressure, diastolic blood pressure, mean arterial pressure and oxygen saturation) was noted before, during and after the maneuver. The surgeon will be instructed to keep the trocar sleeve fully open to allow the CO2 gas to escape . The patients will then be placed in neutral position, trocars removed and abdominal incisions will be closed. This randomiseed double blinded trial evaluated the effect of PRM on post operative nausea and vomiting following laparoscopic abdominal surgeries. Interestingly in our study found that the percentage of patient experiencing post operative nausea and vomiting with in 48 hours after surgery was significantly lower in PRM group. At 6 , 12, 24 and 48 hours, the incidence of post operative nausea and vomiting was significantly lower in PRM group (13%, 13%, 10% and 3% respectively) than in SDD group (43%, 46%, 50% and 26% respectively ; $p = 0.021$, $p = 0.010$, $p = 0.002$ and $p = 0.025$ respectively). These results are in agreement with those of **Saroha S et**[4] al conducted a simple pulmonary recruitment manoeuvre to reduce post operative nausea and vomiting after laparoscopy and concluded that PONV was significantly reduced in intervention group at 0,4,8,12 and 24 hours ($p<0.05$).

Wen Tsai H et al,[2011] did a prospective randomized controlled trial on 158 women undergoing laparoscopic surgery for gynaecologial lesions were who assigned to three groups PRM group, intraperitoneal normal saline infusion (INSI) group and control group. It was concluded that both PRM and INSI could effectively reduce post operative nausea and vomiting after laparoscopic surgery. [9]

Zafer Nursal T et al,(2003) did a prospective randomized controlled trial on 70 patients undergoing laproscopic cholecystectomy were randomized into two demographically and clinically comparable groups; drainage and control. Post operative pain, nausea and vomiting were measures by verbal grading and visual analogue scale 2-72 hour postoperatively. It was concluded that subdiaphragmatic drain offers only minor if any benefit on post operative pain, nausea and vomiting after laproscopic cholecystectomy, and this effect is probably clinically irrelevant. [10]

Ahmed Al-Rekabi A et al (2018) did a prospective randomized studyin 100 patients undergoing laproscopic cholecystectomy. Patients were randomized into 2 groups control and invention group.It was concluded that use of drain in uncomplicated laproscopic cholecystectomy has a little to offer and has no importance. The use of drain increases the rate of surgical site wound infection and hospital stay. [11]

Hemodynamic parameters:-

There was no statistical significant differences in hemodynamic parameters like heart rate , systolic blood pressure, diastolic blood pressure, mean arterial blood pressure and oxygen saturation at- pre PRM, during PRM and after PRM periods.

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In a study conducted by **Saroha S et al**[4] there was no statistical difference found between two groups pertaining to hemodynamics.

No side effects was observerved during the study.

Conclusion:-

Pulmonary recruitment maneuvre is simple clinical technique which when performed at the end of laparoscopic surgeries reduces post operative , nausea and vomiting, hence it is simple and easy enough to be implemented in daily clinical practice.

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