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Research Article

EVALUATION OF USG GUIDED TRANSVERSUS ABDOMINIS PLANE (TAP) BLOCK WITH ROPIVACAINE AS POST - OPERATIVE ANALGESIC TECHNIQUE FOR LAPAROSCOPIC OR ROBOTIC PELVIC SURGERIES

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ABSTRACT

Background: Ultrasound guided (USG) approach to the TAP (Transversus Abdominis Plane) block provides reliable imaging of the three muscular layers of the anterolateral abdominal wall and assessment of correct needle placement and local anaesthetic injection thus potentially increasing the success rate and safety of the TAP block compared to the landmark technique. So we conducted this study to evaluate the efficacy of TAP block for post - operative pain relief after laparoscopic or robotic pelvic surgeries, assessment of the duration of analgesia as measured by time requirement of first dose of rescue analgesia, *assessment* of the quality of analgesia as measured by VAS score and any adverse effects or complications. **Methodology** A prospective, observational study was conducted at department of Anesthesiology, Kokilaben Dhirubhai Ambani Hospital and Medical Research Institute, Mumbai over 9 months.68 patients of either sex undergoing laparoscopic or robotic pelvic surgeries in hospital complying with eligibility criteria, undergoing general anesthesia with endotracheal intubation using standard anaesthesia protocol were selected.. Patients underwent a routine pre - anaesthetic check-up and pre-operative investigations as per protocol. Demographic data like age, sex, height, weight, BMI were obtained in pre - operative period. Patients were explained about the procedure and VAS score, TAP block pre – operatively and written informed consent was taken. Pre – operative heart rate, SPO_2, blood pressure, respiratory rate were recorded in Operation Theater. All patients had general anaesthesia with intermittent positive pressure ventilation. At the end of the surgery, ultrasound guided TAP block was performed with 20ml 0.2% ropivacaine on each side of the abdomen. After completion of the block procedure patients were reversed and extubated as per extubation criteria. In the post – operative period, the time of the first request for analgesia was recorded as duration of post – operative analgesia by TAP block. Vital signs (heart rate, SPO2, blood pressure, respiratory rate), VAS pain scores at immediate post – operative period (0 min) in post anaesthesia care unit (PACU), 2, 6, 12, and 24 hours post – operatively recorded. Complication/ side – effects if any were noted. **Results**: Out of 68 patients, total 18 patients did not receive any rescue analgesia for 24 hours post - operatively. Whereas duration of analgesia as assessed by time of request for 1st dose of rescue analgesic in other patients was 218.70 minutes (mean) with SD of 171.73. Comparison of VAS score at different time intervals in post operative period was found statistically significant ($p < 0.01$) where VAS score at 0 min and at 2 hours post operatively was similar with mean VAS was 1.65. At 6, 12, 24 hours post operatively mean VAS score was 1.47, 1.09, 1.03 respectively. Thus in immediate post operative period (0min) till 2 hours no change was seen in VAS score after which at different intervals mean VAS score was decreased. Total 3 patients (4.4%) found to have nausea- vomiting in post operative period but TAP block was not associated with any symptoms of local anesthetic toxicity or organ injury. Hemodynamic parameters like heart rate, blood pressure, SPO_2 and respiratory rate were clinically stable. **Conclusion**: addition of TAP block as a part of multimodal analgesia regime for laparoscopic or robotic pelvic surgeries is better option to obtain longer duration of analgesia, lower pain scores with no major side effects or complications.

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INTRODUCTION

Early pain after laparoscopic or robotic surgery is multifactorial and complex. It includes different pain components due to different pain mechanisms. Abdominal wall penetration by trocars produces somatic pain; rapid distension of the peritoneum by CO_2 insufflations results in tearing of blood vessels, traction of nerves, and release of inflammatory mediators producing visceral pain; inflammation or local irritation around the uterus and other pelvic organs or peritoneum, or both, add to tissue injury and produce visceral pain. Shoulder pain results from peritoneal insufflations especially when an exaggerated Trendelenburg position is used.

The aim of post - operative pain management is to relieve pain so that normal functions including breathing, gastrointestinal function, coughing and mobility are minimally impaired. Conventional practice of the post - operative pain management has involved the use of pharmacological agents like opioids as well as neuraxial analgesic techniques. Unfortunately, these therapies are not without potential risks and side - effects. These include nausea - vomiting, pruritus, urinary retention, constipation, respiratory depression and sedation. As a result, the goal to reduce perioperative pain has taken a multimodal approach. Multimodal or "balanced" analgesia uses a combination of opioid and non - opioid analgesics to improve pain control and minimize side - effects. These include the use of non - steroidal anti –inflammatory drugs (NSAIDs), local anaesthetics (LAs), peripheral nerve blocks, gabapentinoids and α2 adrenergic agonists. Any combination of these therapies can help to reduce the surgical stress response and improve patient outcomes such as pain control, patient satisfaction, time to discharge and return to daily activities.

LAs act on peripheral nerves by preventing sodium influx. Recent evidence even suggests that LAs have an anti - inflammatory effect as well [1][2]. Different techniques of local anaesthetic (LA) use are described in laparoscopic surgeries. They are incisional LA, intra - peritoneal LA, spinal anaesthesia, epidural anaesthesia, paravertebral block, transversus abdominis plane (TAP) block and intravenous lidocaine [3]. The exact mechanism for pain reduction remains unclear, but several explanations have been proposed, including sensory - neural block of peritoneal pain receptors [2], vagal afferent nerve block transmitting sensory visceral information into the central nervous system [3] or via the anti – inflammatory analgesic effect of LA [2].

In the last decade, a novel approach to block the abdominal wall neural afferents via the "lumbar triangle of Petit" has been described by Rafi [4] in 2001, known as transverses abdominis plane (TAP) block. By introducing the local anaesthetic into the transversus abdominis plane (TAP) via the "triangle of Petit", it is possible to block the sensory nerves of the anterior abdominal wall before they leave this plane and pierce the musculature to innervate the entire anterior abdominal wall (T6 to L1) [4][5].Amongst various techniques of TAP block, ultrasound guided technique via the "triangle of Petit" seems to hold considerable promise for patients undergoing surgical procedures involving abdominal wall incisions. . Real - time ultrasound provides reliable imaging of the three muscular layers of the anterolateral abdominal wall and assessment of correct needle placement and local anaesthetic injection thus potentially increasing the success rate and safety of the TAP block compared to the landmark technique.

So, we hypothesized that USG guided TAP block could provide safe and reliable block for adequate parietal pain control after laparoscopic or robotic pelvic surgery as a part of multimodal analgesic technique.

METHODS AND MATERIALS

Study site

Study was conducted in the department of Anesthesiology, Kokilaben Dhirubhai Ambani Hospital and Medical Research Institute, Mumbai.

A. Study population

Patients of either sex undergoing laparoscopic or robotic Pelvic surgeries in Kokilaben Dhirubhai Ambani Hospital and Medical Research Institute, Mumbai.

B. Study design

This was a prospective, observational study. After the approval of the Ethics committee of the Institute, this prospective, observational study was conducted in the given sample size. Patients complying with below mentioned eligibility criteria, undergoing general anaesthesia with endotracheal intubation using standard anaesthesia protocol were selected.

C. Sample size calculation

68 patients. Based on the literature [21], it was found that in patients who received the Transversus Abdominis Plane (TAP) block, the mean time to first analgesic requirement was 178.5 minutes with SD 45.6 minutes. For our sample size considering the expected mean time to first analgesic requirement as 194.0 minutes with SD 45.6 minutes in Transverse Abdominis Plane (TAP) Block, with a 5% allowable variation, the sample size at 95% confidence level is 68 patients.

Step wise calculation of sample size

$$N = \frac{\left[\left[(Z]_{\left(1-\alpha/2\right)} + Z_{1-\beta}\right)^2\right] * \sigma^2}{(\mu_1 - \mu_0)^2}$$

$$N = \frac{[(1.96 + 0.84)^2\ ] * 45.5^2}{(15.5)^2}$$

D. Time frame to address the study

April 2017 to December 2017.

E. Eligibility criteria

Inclusion Criteria

1. Patients with American Society of Anesthesiologist classification I - II
2. Patients with age of 18 to 80 years
3. Patients with BMI of less than or equal to 30 kg/m^2
4. Sex : Male as well as Female patients will be included
5. Patients undergoing laparoscopic or robotic pelvic surgery

Exclusion Criteria

1. Patients with American Society of Anesthesiologist classification III - IV
2. Coagulopathy

3. Allergy to Local Anaesthetics
4. Any conversion to open surgery
5. Infection at the site of the block

F. Methodology

After approval from Ethics committee of the Institute, this prospective, observational study was conducted at Kokilaben Dhirubhai Ambani Hospital and Medical Research Institute, Mumbai.

Assessment of patients

Following mentioned assessment is standard of care in our institute.

Pre operative Evaluation

Detailed history and present complaints were noted. General and systemic examination of cardiovascular, respiratory, central nervous system, gastrointestinal system was done. The following baseline investigation was done as per routine protocol required for surgery in our hospital.

1. Complete Blood Count (CBC).
2. Random Blood Sugar (RBS).
3. Renal Function Test. (RFT)
4. Coagulation Profile.
5. Electrocardiogram. (ECG)
6. Chest X-ray
7. Liver Function test (LFT) (if required)
8. 2D - echo (if required)
9. Other investigations to be done as per individual patient assessment. Preoperative fitness taken from physician team.

Pre operative order

Patients were kept nil by mouth for at least 8 hours prior to surgery. All of them were given tablet pantoprazole 40 mg orally in the morning of the day of surgery along with regular medications like anti - hypertensive, thyroid medications with sips of water. All patients were informed and explained about VAS score and USG guided TAP block pre - operatively. Further pre -operative order given as per individual patient's assessment. Written informed consent was taken from the patients for administration of anaesthesia and for administration of TAP block.

Anaesthesia management

General anaesthesia with intermittent positive pressure ventilation was given to all patients. Pre - operative heart rate, SPO2, blood pressure, respiratory rate were recorded in operation theatre as baseline vitals after connecting standard monitoring equipments like continuous electrocardiogram, pulse oximetry, non – invasive blood pressure.

Intravenous cannulation with large bore cannula to be established and intravenous fluids were started. Premedication with inj. glycopyrolate (0.004mg/kg) and inj. midazolam (0.02mg/kg) was given to all patients. Patients were pre - oxygenated for 3 minutes with 100% oxygen and induced with inj. fentanyl (1.5 - 2mcg/kg), inj. Propofol (2 - 3mg/kg) and relaxation achieved with inj. atracurium (0.5 - 1mg/kg), patient ventilated with O_2 + air + sevoflurane 1 - 2% for 3 minutes to facilitate endotracheal intubation. Patients were intubated with cuffed endotracheal tube.

General anaesthesia maintained with O_2 + air with sevoflurane/ desflurane (+ inj. atracurium) with appropriate MAC to maintain heart rate and blood pressure near pre – induction values with End Tidal Carbon Dioxide ($ETCO_2$) value to be kept between 30 – 35 mmHg. Inj. Fentanyl was supplemented as needed. Ventilation was controlled (IPPV). Intra operatively, patients were given trendelenberg's position to facilitate surgical access. Intra – abdominal pressure was kept around 10 - 12 mmHg. All the patients received isotonic fluid for intra – operative fluid requirements. Inj. Paracetamol 15 - 20 mg/kg along with inj. Ondansatron 0.08 mg/kg intravenously was given in intra operative period.

After completion of surgery, under strict asepsis, Transversus Abdominis Plane (TAP) block was performed bilaterally under ultrasonographic guidance with a sonosite portable ultrasound device and a linear 5 - 13 MHz ultrasound transducer. Once the external oblique abdominal muscle (EOAM), internal oblique abdominal muscle (IOAM) and transversus abdominal muscle (TAM) were visualized at the level of the mid – axillary line between the 12^{th} rib and the iliac crest, the puncture area and the ultrasound probe were prepared in a sterile manner. Now, identification of the neuro - fascial plane between IOAM and TAM done, block was perfomed with 20G quincke spinal needle. The needle was directed to approach the Transversus Abdominis Plane (TAP) with "in plane" ultrasound guided technique. Once the tip of the needle was placed in the space between the IOAM and TAM, 20 ml of inj. Ropivacaine (0.2%) was injected on each side after negative aspiration. The drug was seen spreading in Transversus Abdominis Plane (TAP) as a hypoechoic density.

After completion of the block, patients reversed with inj. neostigmine 0.05 mg/kg + inj. glycopyrolate 0.01 mg/kg intravenously and extubated after fulfilling criteria for extubation. In the post operative period patients received continuous intravenous fluid at the rate of 1 – 2 ml/kg/hour till the period of starvation. In our institute as a multimodal approach for pain relief inj. paracetamol 15-20 mg/kg every 6 hourly in post – operative period given to all patients. Patients with a VAS score of 4 or more received rescue analgesic inj. diclofenac sodium 75mg in (diluted in 100ml normal saline) intravenously.

In post operative period following outcome measures were recorded:

1. The time of the first request for post – operative analgesia after surgery was recorded as duration of post - operative analgesia by TAP block.
2. Post – operative pain was assessed by using Visual Analog Scale (VAS) at immediate post operative period (0min), 2hours, 6hours, 12hours and 24hours period.
3. Hemodynamic parameters (heart rate, SPO2, blood pressure, respiratory rate) were recorded at immediate post – operative period (0 min) in post – anaesthesia care unit (PACU), 2, 6, 12, and 24 hours post – operatively.
4. Complications/ side – effects due to TAP block were noted.

G. Statistical methods

Descriptive and inferential statistical analysis were carried out in the present study. Results on continuous measurements were presented on Mean ± SD and results

on categorical measurement were presented in number (%). Level of significance was fixed at p = 0.05 and any value less than or equal to 0.05 was considered to be statistically significant. Repeated measures Analysis of variance (ANOVA) was used to find the significance of study parameters within the group (at different time intervals). Further post hoc analysis was carried out if the values of ANOVA test were significant. The Statistical software IBM SPSS statistics 20.0 (IBM Corporation, Armonk, NY, USA) was used for the analysis of the data and Microsoft word and Excel were used to generate graphs, tables etc**.**

RESULTS

We conducted a prospective observational study for evaluation of USG guided Transversus Abdominis Plane (TAP) Block with ropivacaine as a post operative analgesic technique for laparoscopic or robotic pelvic surgeries. 68 patients satisfying the inclusion and exclusion criteria were included in the study.

Distribution of cases based on Gender and Age

Table 1 Distribution of Cases Based On Gender and Age

Variables	Sub-groups	n	%
Gender	Male	8	11.8
	Female	60	88.2
Age (Mean ± SD)		45.90 ± 13.72	

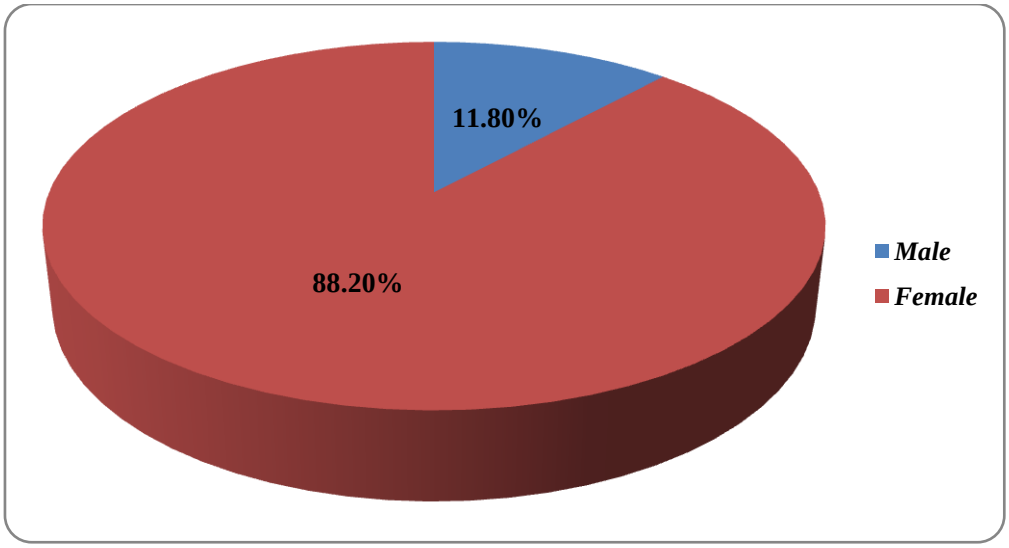

Chart 1 Distribution of Cases Based on Gender

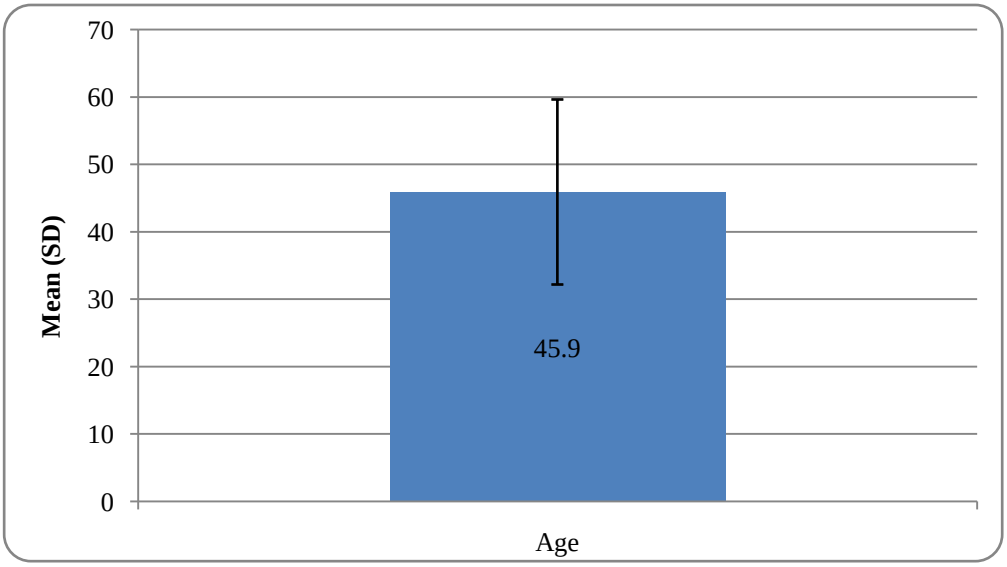

Chart 2 Distribution of cases based on age

Table no 1 and Chart no 1 shows distribution of cases based on gender. Out of 68 patients, 8 (11.8%) patients were male and 60 (88.2%) were female.

Table no1 and Chart no 2 shows distribution of cases based on age group. Mean age was 45.90 years with standard deviation (SD) of 13.72.

Distribution of cases based on ASA classification, Procedure types and Height -Weight – BMI

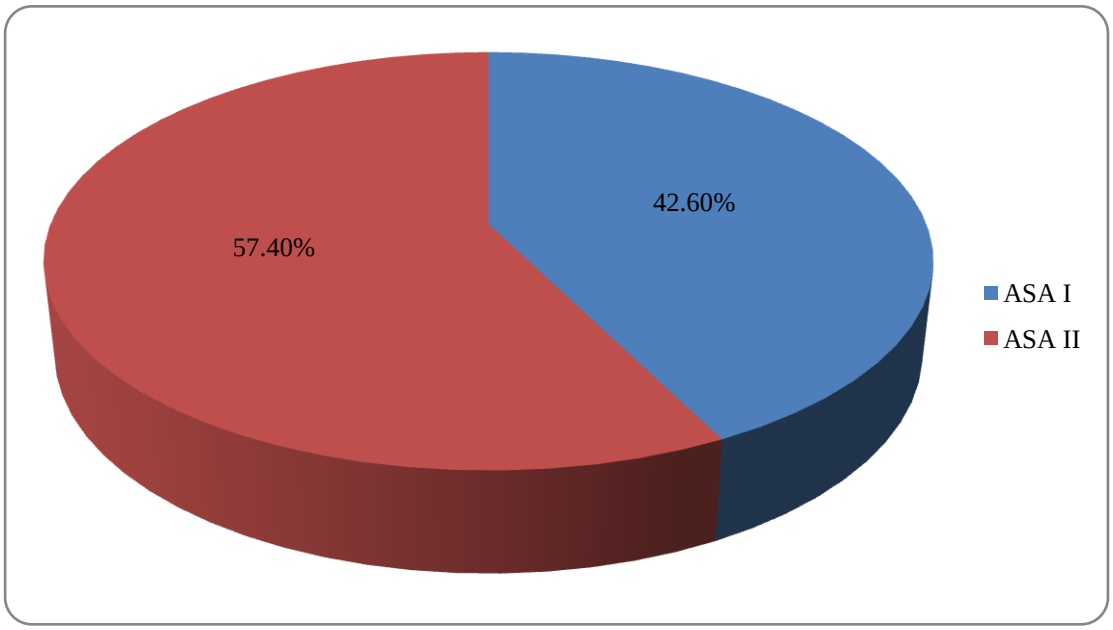

Chart 3 Distribution of cases based on asa classification

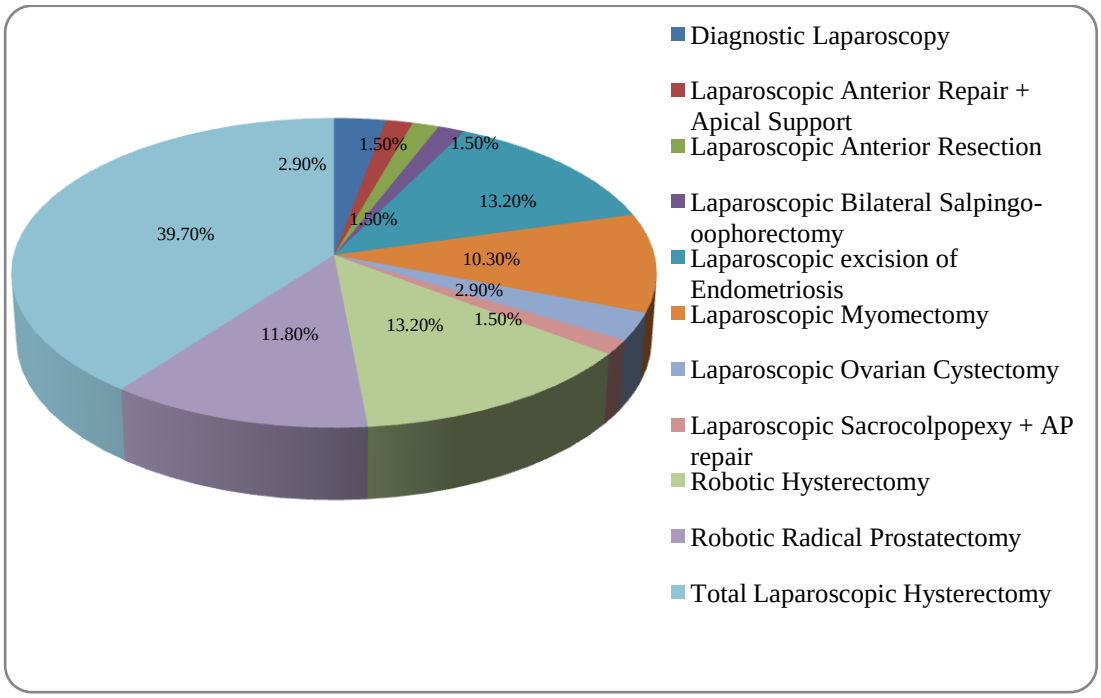

Chart 4 Distribution of cases based on procedure type

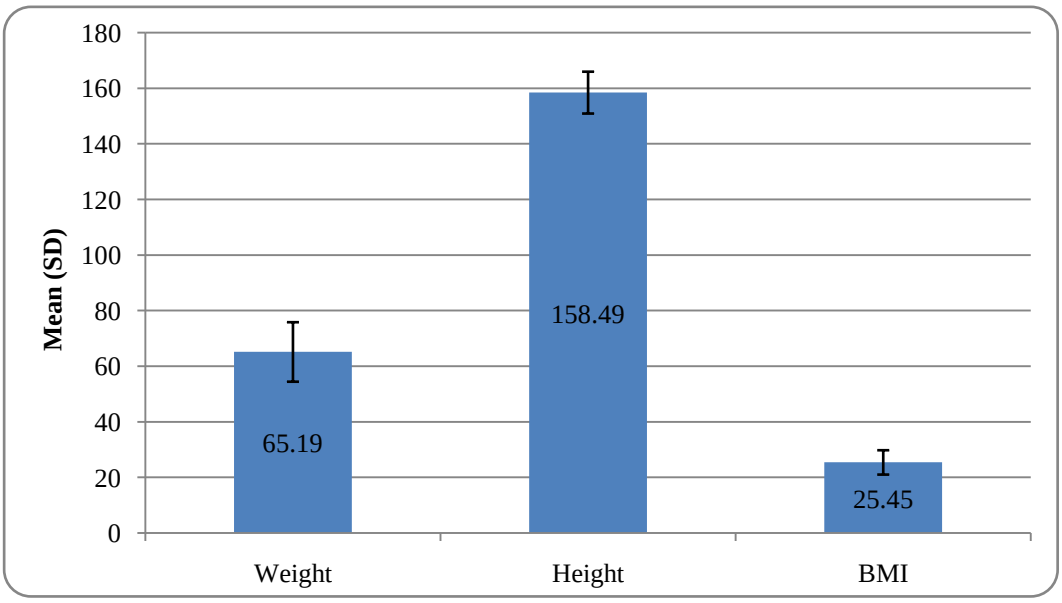

Table 2 Distribution of cases based on height -weight – bmi

Variables	Sub-groups	n	%
ASA	**1**	29	42.6
	2	39	57.4
Procedure	**Diagnostic Laparoscopy**	2	2.9
	Laparoscopic Anterior Repair + Apical Support	1	1.5
	Laparoscopic Anterior Resection	1	1.5
	Laparoscopic Bilateral Salpingo-oophorectomy	1	1.5
	Laparoscopic excision of Endometriosis	9	13.2
	Laparoscopic Myomectomy	7	10.3
	Laparoscopic Ovarian Cystectomy	2	2.9
	Laparoscopic Sacrocolpopexy + AP repair	1	1.5
	Robotic Hysterectomy	9	13.2
	Robotic Radical Prostatectomy	8	11.8
	Total Laparoscopic Hysterectomy	27	39.7
Weight (Mean ± SD)		65.19 ± 10.70	
Height (Mean ± SD)		158.49 ± 7.53	
BMI (Mean ± SD)		25.45 ± 4.38	

Table no 2 and Chart no 3 shows distribution of cases (n=68) based on ASA classification. 29 (42.6%) patients belonged to ASA class I whereas 39 (57.4%) patients belonged to ASA class II.

Table no 2 and Chart no 4 shows distribution of cases based on type of procedures in study population. In this study major cases were of total laparoscopic hysterectomy (39.7%), followed by robotic hysterectomy (13.2%) and laparoscopic excision of endometriosis (13.2%).

Table no 2 and Chart no 5 shows distribution of cases based on demographic data like height, weight and BMI. Patients had mean height of 158.49 cm with SD of 7.53, mean weight of 65.19 kgs with SD of 10.70 and mean BMI of 25.45 kg/m^2 with SD of 4.38.

Analysis of Heart rate at different time intervals

Table 3 Comparison of the heart rate {mean (sd)} at different time intervals using repeated measures anova test

Time interval	N	Mean	Std. Deviation	F value (Wilk's Lambda)	P value
Baseline	68	88.19	13.585	**9.660**	**<0.001****
0min	68	88.60	14.831		
2 hours	68	81.69	12.580		
6 hours	68	79.59	10.066		
12 hours	68	78.74	8.357		
24 hours	68	78.12	7.864		

(p< 0.05 - Significant*, p < 0.001 - Highly significant**)

{Bonferroni corrections (Post hoc analysis)}

	Baseline	0min	2 hours	6 hours	12 hours	24 hours
Baseline	-	0.830	**<0.001****	**<0.001****	**<0.001****	**<0.001****
0min	0.830	-	**<0.001****	**<0.001****	**<0.001****	**<0.001****
2 hours	**<0.001****	**<0.001****	-	0.109	**0.043***	**0.006***
6 hours	**<0.001****	**<0.001****	0.109	-	0.396	0.138
12 hours	**<0.001****	**<0.001****	**0.043***	0.396	-	0.421
24 hours	**<0.001****	**<0.001****	**0.006***	0.138	0.421	-

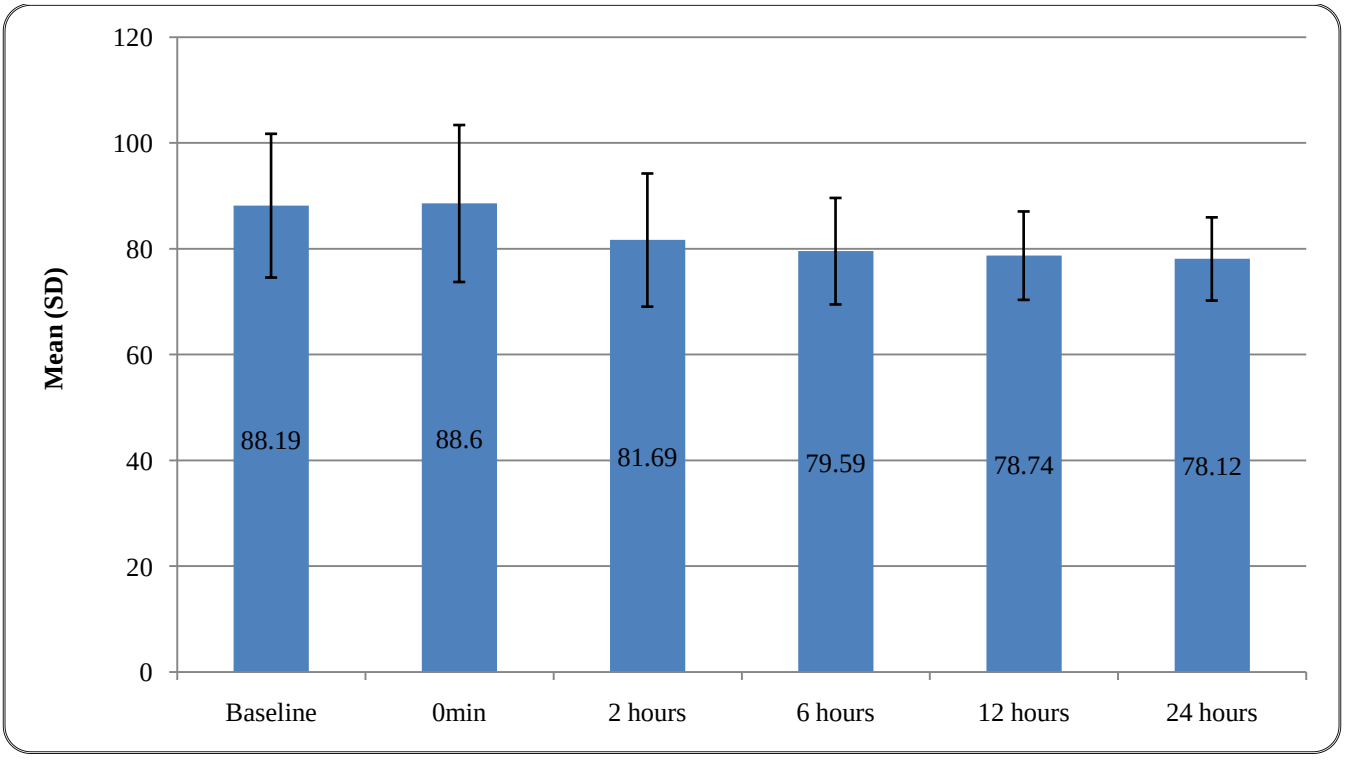

Chart 6 Comparison of the heart rate {mean (sd)} at different time intervals using repeated measures anova test

Table no 3 and Chart no 6 shows comparison of Heart rate at different time intervals using repeated measures ANOVA test which was found to be statistically significant ($p < 0.001$).

Analysis of Systolic blood pressure at different time intervals

Table 4 Comparison of the blood pressure (systolic) {mean (sd)} at different time intervals using repeated measures anova test

Time interval	*N*	*Mean*	*Std. Deviation*	*F value (Wilk's Lambda)*	*P value*
Baseline	68	139.93	21.731	**12.084**	**<0.001****
0min	68	131.28	16.936		
2 hours	68	126.88	16.466		
6 hours	68	123.61	13.185		
12 hours	68	119.94	13.050		
24 hours	68	120.66	10.801		

($p < 0.05$ - Significant*, $p < 0.001$ - Highly significant**)

{Bonferroni corrections (Post hoc analysis)}

	Baseline	*0min*	*2 hours*	*6 hours*	*12 hours*	*24 hours*
Baseline	-	**0.007***	**<0.001****	**<0.001****	**<0.001****	**<0.001****
0min	**0.007***	-	0.391	**0.005***	**<0.001****	**<0.001****
2 hours	**<0.001****	0.391	-	1.000	**0.012***	**0.015***
6 hours	**<0.001****	**0.005***	1.000	-	0.201	0.671
12 hours	**<0.001****	**<0.001****	**0.012***	0.201	-	1.000
24 hours	**<0.001****	**<0.001****	**0.015***	0.671	1.000	-

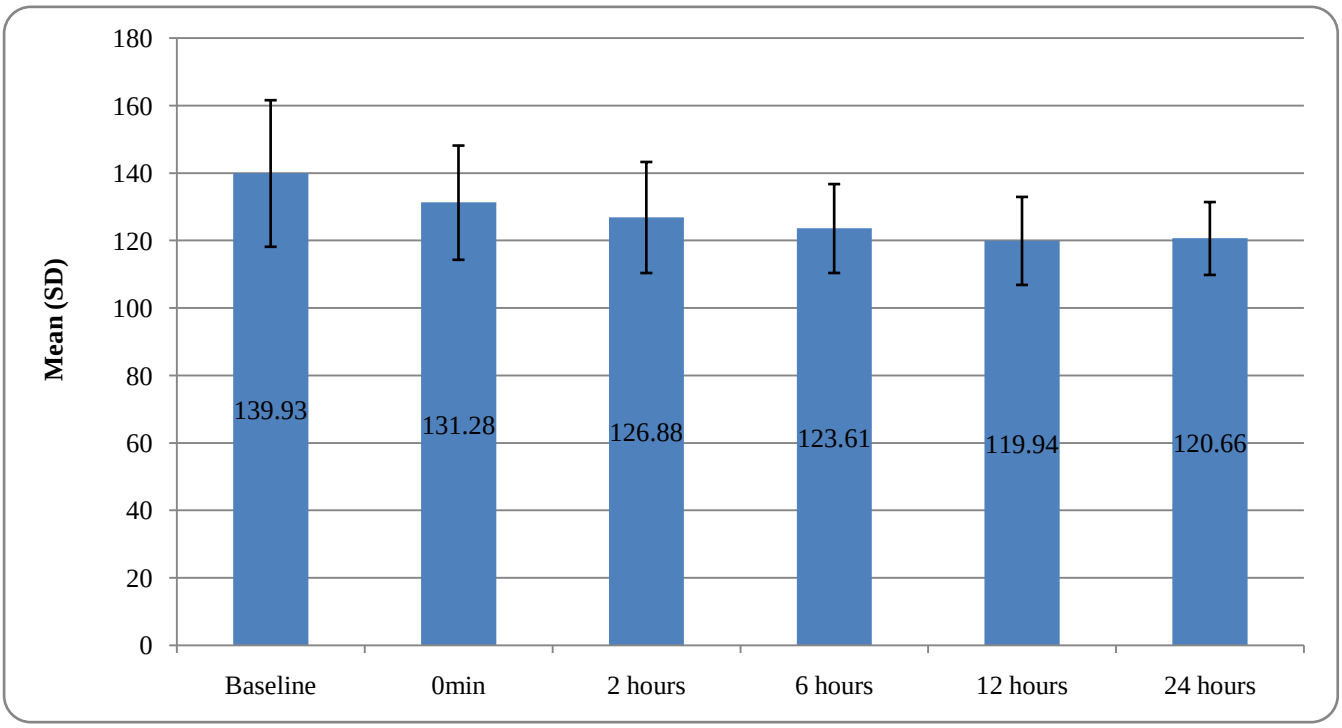

Chart 7 Comparison of the blood pressure (systolic) {mean (sd)} at different time Intervals using repeated measures anova test

Table no 4 and Chart no 7 shows comparison of systolic blood pressure at different time intervals using repeated measures ANOVA test which was found to be statistically significant (p<0.001).

Analysis of diastolic blood pressure at different time intervals

Table 5 Comparison of the blood pressure (diastolic) {mean (sd)} at different time intervals using repeated measures anova test

Time interval	*N*	*Mean*	*Std. Deviation*	*F value(Wilk's Lambda)*	*P value*
Baseline	68	79.29	9.918	**6.809**	**<0.001****
0min	68	77.49	10.197		
2 hours	68	73.74	9.947		
6 hours	68	73.47	7.137		
12 hours	68	72.32	7.824		
24 hours	68	71.68	8.511		

(p< 0.05 - Significant*, p < 0.001 - Highly significant**)
{Bonferroni corrections (Post hoc analysis)}

	Baseline	***0min***	***2 hours***	***6 hours***	***12 hours***	***24 hours***
Baseline	-	0.215	**<0.001****	**<0.001****	**<0.001****	**<0.001****
0min	0.215	-	**0.011***	**0.002***	**<0.001****	**<0.001****
2 hours	**<0.001****	**0.011***	-	0.815	0.275	0.128
6 hours	**<0.001****	**0.002***	0.815	-	0.290	0.130
12 hours	**<0.001****	**<0.001****	0.275	0.290	-	0.491
24 hours	**<0.001****	**<0.001****	0.128	0.130	0.491	-

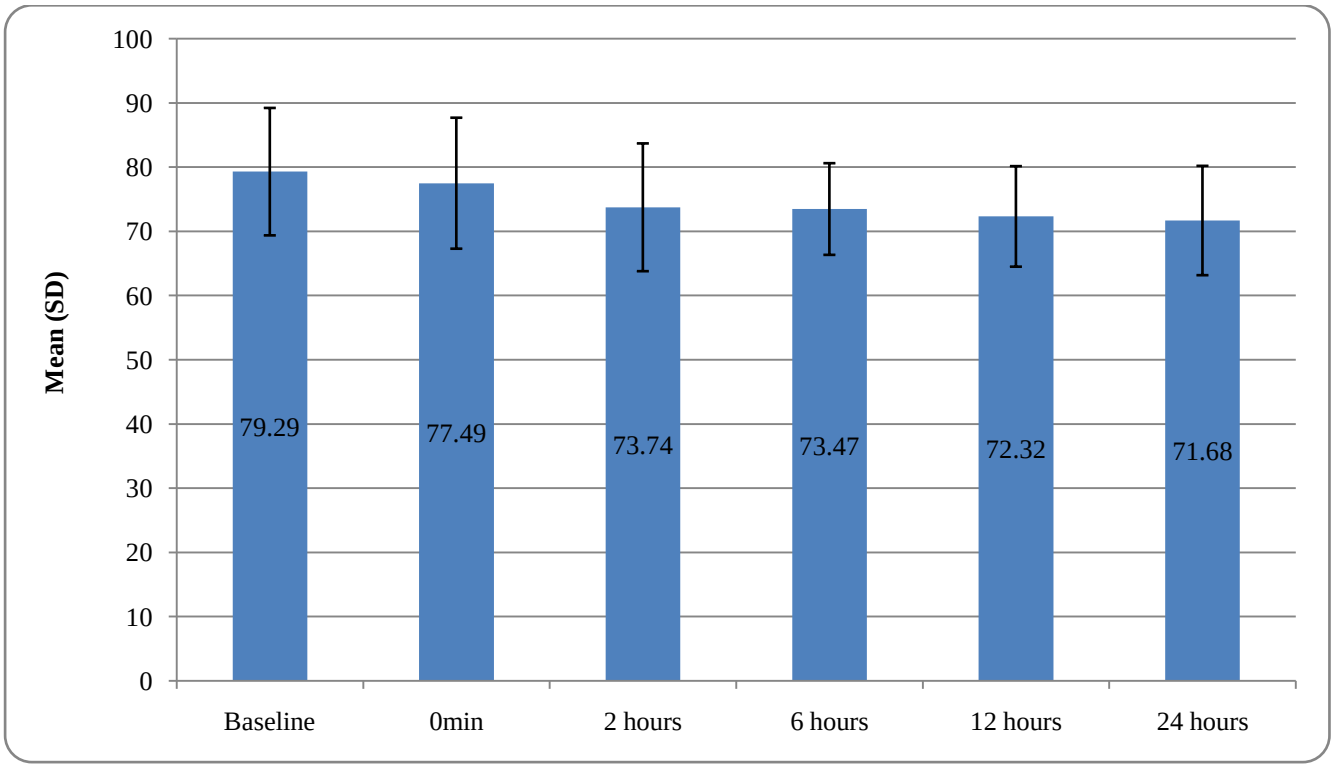

Chart 8 Comparison of the blood pressure (diastolic) {mean (sd)} at different time intervals Using repeated measures anova test

Table5 and chart no 8 shows comparison of diastolic blood pressure at different time intervals using repeated measures ANOVA test which was found to be statistically significant ($p < 0.001$).

Analysis of SPO_2 at different time interval

Table 6 Comparison of the spo2 {mean (sd)} at different time interval using repeated measures anova test

Time interval	*N*	*Mean*	*Std. Deviation*	*F value (Wilk's Lambda)*	*P value*
Baseline	68	99.75	0.632	**168.696**	**<0.001****
0min	68	99.99	0.121		
2 hours	68	99.50	0.723		
6 hours	68	98.31	0.797		
12 hours	68	98.09	0.663		
24 hours	68	98.00	0.669		

(p< 0.05 - Significant*, p < 0.001 - Highly significant**)

{Bonferroni corrections (Post hoc analysis)}

	Baseline	*0min*	*2 hours*	*6 hours*	*12 hours*	*24 hours*
Baseline	-	**0.004***	**0.040***	**<0.001****	**<0.001****	**<0.001****
0min	**0.004***	-	**<0.001****	**<0.001****	**<0.001****	**<0.001****
2 hours	**0.040***	**<0.001****	-	**<0.001****	**<0.001****	**<0.001****
6 hours	**<0.001****	**<0.001****	**<0.001****	-	**0.013***	**0.005***
12 hours	**<0.001****	**<0.001****	**<0.001****	**0.013***	-	0.292
24 hours	**<0.001****	**<0.001****	**<0.001****	**0.005***	0.292	-

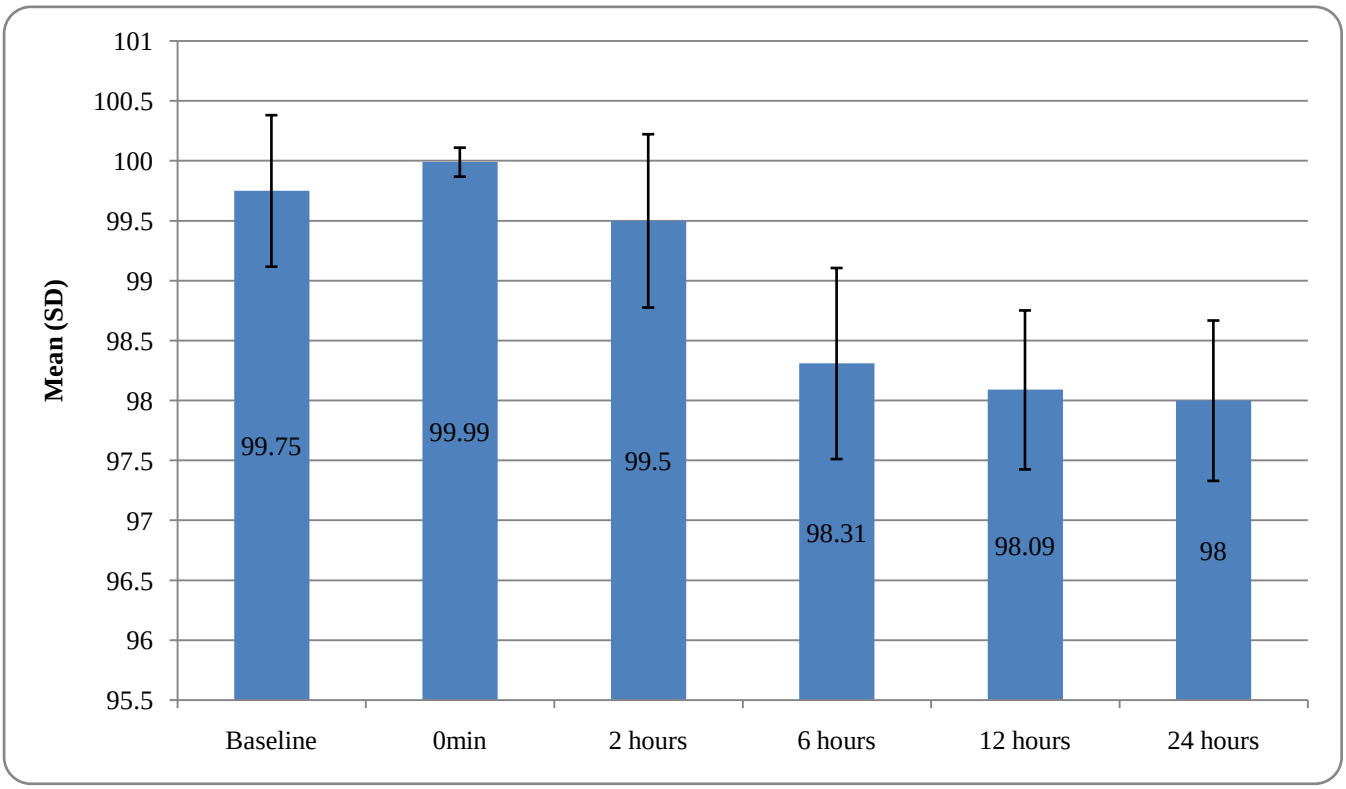

Chart 9 Comparison of the spo2 {mean (sd)} at different time intervals using repeated measures anova test

Table 6 and chart no 9 shows comparison of the SPO2 {Mean (SD)} at different time intervals using repeated measures ANOVA test which was found to be statistically significant ($p < 0.001$).

Analysis of respiratory rate at different time intervals

Table 7 Comparison of the respiratory rate {mean (sd)} at different time intervals using repeated measures anova test.

Time interval	*N*	*Mean*	*Std. Deviation*	*F value(Wilk's Lambda)*	*P value*
Baseline	68	16.35	1.336	**3.492**	**0.008***
0min	68	17.06	1.563		
2 hours	68	17.18	1.803		
6 hours	68	17.15	1.213		
12 hours	68	17.03	1.119		
24 hours	68	16.97	1.119		

(p< 0.05 - Significant*, p < 0.001 - Highly significant**)

{Bonferroni corrections (Post hoc analysis)}

	Baseline	*0min*	*2 hours*	*6 hours*	*12 hours*	*24 hours*
Baseline	-	**0.002***	**0.004***	**<0.001****	**0.003***	**0.005***
0min	**0.002***	-	0.641	0.721	0.899	0.699
2 hours	**0.004***	0.641	-	0.888	0.496	0.349
6 hours	**<0.001****	0.721	0.888	-	0.321	0.203
12 hours	**0.003***	0.899	0.496	0.321	-	0.531
24 hours	**0.005***	0.699	0.349	0.203	0.531	-

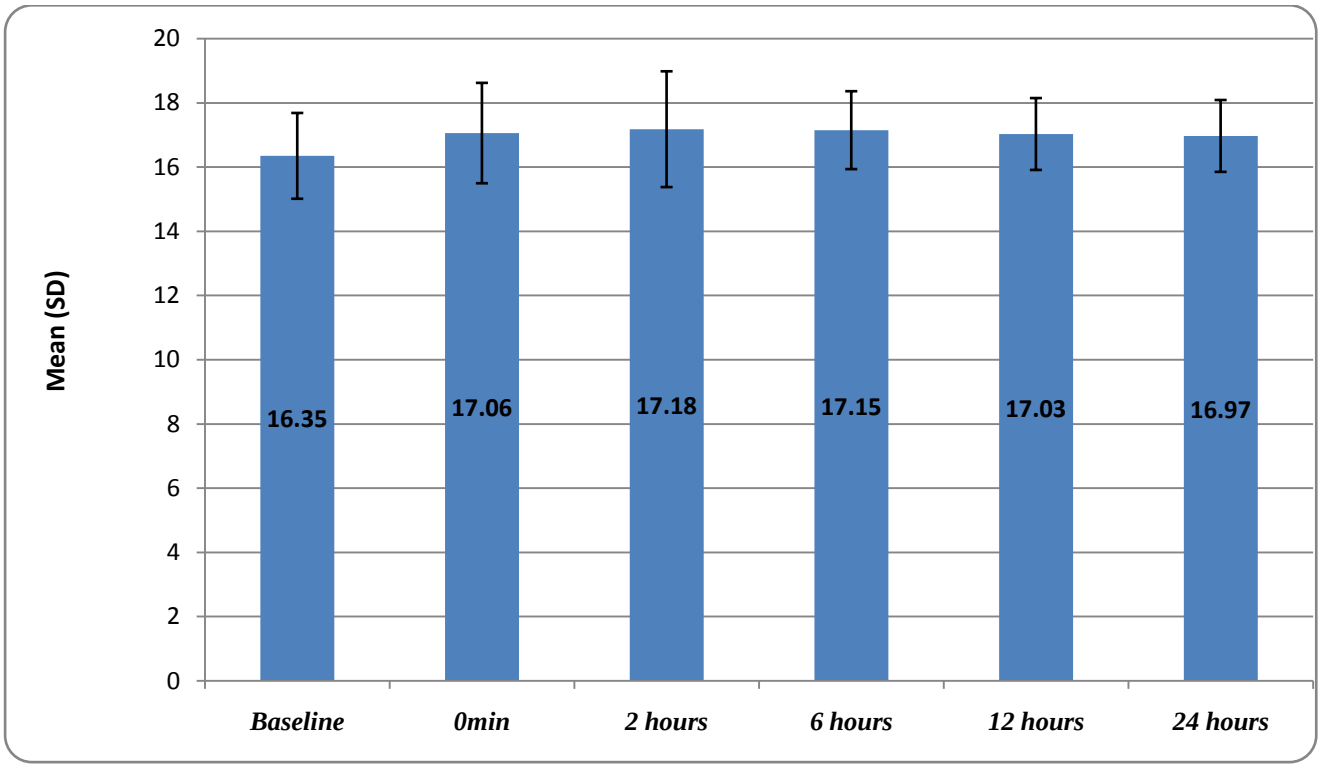

Chart 10 comparison of the respiratory rate {mean (sd)} at different time intervals using repeated measures anova test

Table no 7 and chart no 10 shows comparison of the Respiratory rate {Mean (SD)} at different time intervals using repeated measures ANOVA test which was found to be statistically significant (p <0.001).

Analysis of VAS score at different time intervals

Table 8 Comparison of the vas scores {mean (sd)} at different time intervals using repeated measures anova test

Time interval	*N*	*Mean*	*Std. Deviation*	*F value (Wilk's Lambda)*	*P value*
0min	68	1.65	1.422	**5.542**	**<0.001****
2 hours	68	1.65	1.267		
6 hours	68	1.47	1.139		
12 hours	68	1.09	1.004		
24 hours	68	1.03	0.946		

(p< 0.05 - Significant*, p < 0.001 - Highly significant**)
{Bonferroni corrections (Post hoc analysis)}

	0min	***2 hours***	***6 hours***	***12 hours***	***24 hours***
0min	-	1.000	1.000	0.115	**0.040***
2 hours	1.000	-	1.000	**0.050***	**0.014***
6 hours	1.000	1.000	-	0.070	**0.002***
12 hours	0.115	**0.050***	0.070	-	1.000
24 hours	**0.040***	**0.014***	**0.002***	1.000	-

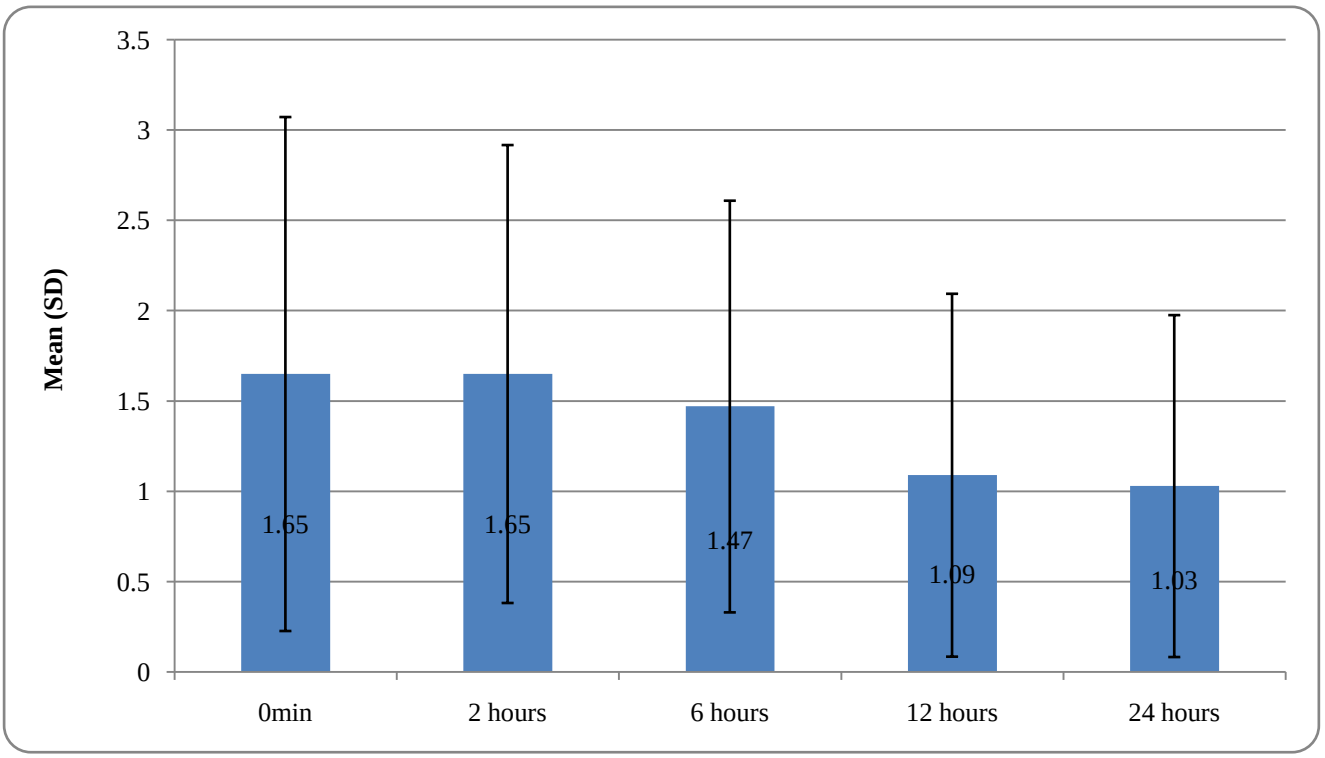

Chart 11 Comparison of the vas scores {mean (sd)} at different time intervals using repeated measures anova test

Table no 8 and chart no 11 shows comparison of the VAS scores {Mean (SD)} at different time intervals using repeated measures ANOVA test which was found to be statistically significant ($p < 0.001$). Mean (with SD) VAS score at 0 min, 2 hours, 6 hours, 12 hours and 24 hours found to be 1.65 (SD 1.422), 1.65 (SD 1.267), 1.47 (SD 1.139), 1.09 (SD 1.004) and 1.03 (SD 0.946) respectively.

Distribution based on time of request of 1st dose of rescue analgesic

Table 9 Time of request for 1st dose of rescue analgesia

Variables	***Sub-groups***	***n***	***%***
1st dose of rescue analgesia	**Not required**	18	26.5
	Required	50	73.5
If required then time of dose (Mean ± SD)		218.70 ± 171.73	

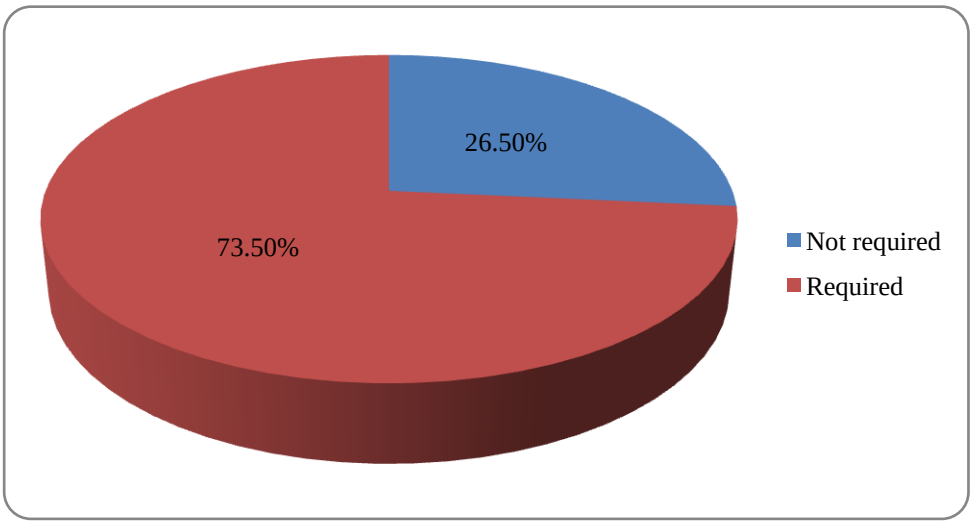

Chart 12 12 Dose of rescue analgesia requirement

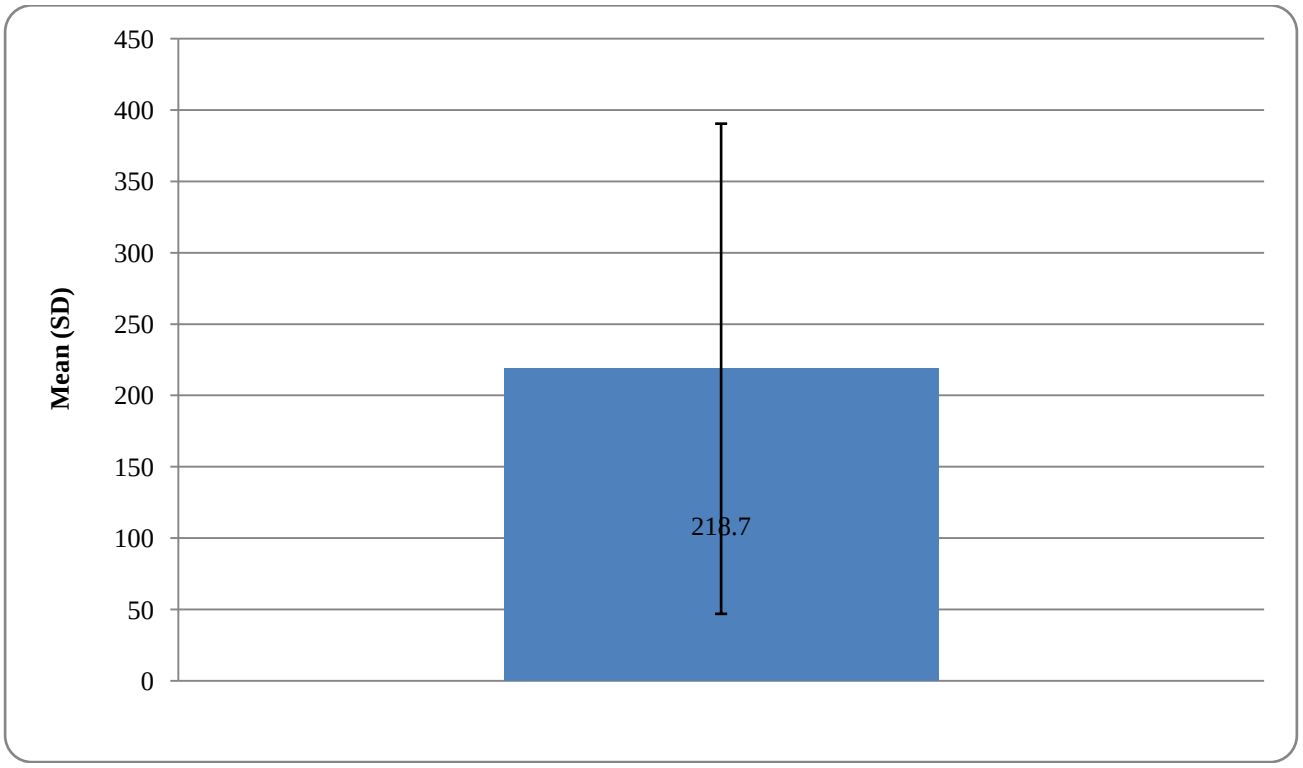

Chart 13 Time of 1st dose of rescue requirement

Table no 9 and chart no 12-13 shows distribution of cases based on time of request for 1st dose of rescue analgesia. Out of 68 patients, 18 patients (26.5%) did not receive any rescue analgesia during first 24 hours post operatively. Other 50 patients who required rescue analgesia had mean time of 218.7 minutes with SD of 171.73.

Distribution of cases based on site of pain and side effects/ complications

Table 10 Distribution of cases based on site of pain and side effects/ complications

Variables	*Sub-groups*	*n*	*%*
Site of pain	**Flank**	10	14.7
	Generalized Abdomen	14	20.6
	NA	18	26.5
	Umbilical	16	23.5
	Umbilical + flank	5	7.4
	Umbilical + Left flank	3	4.4
	Umbilical + Right flank	2	2.9
Side effect/ Complications	**No**	65	95.6
	Nausea & vomiting	3	4.4

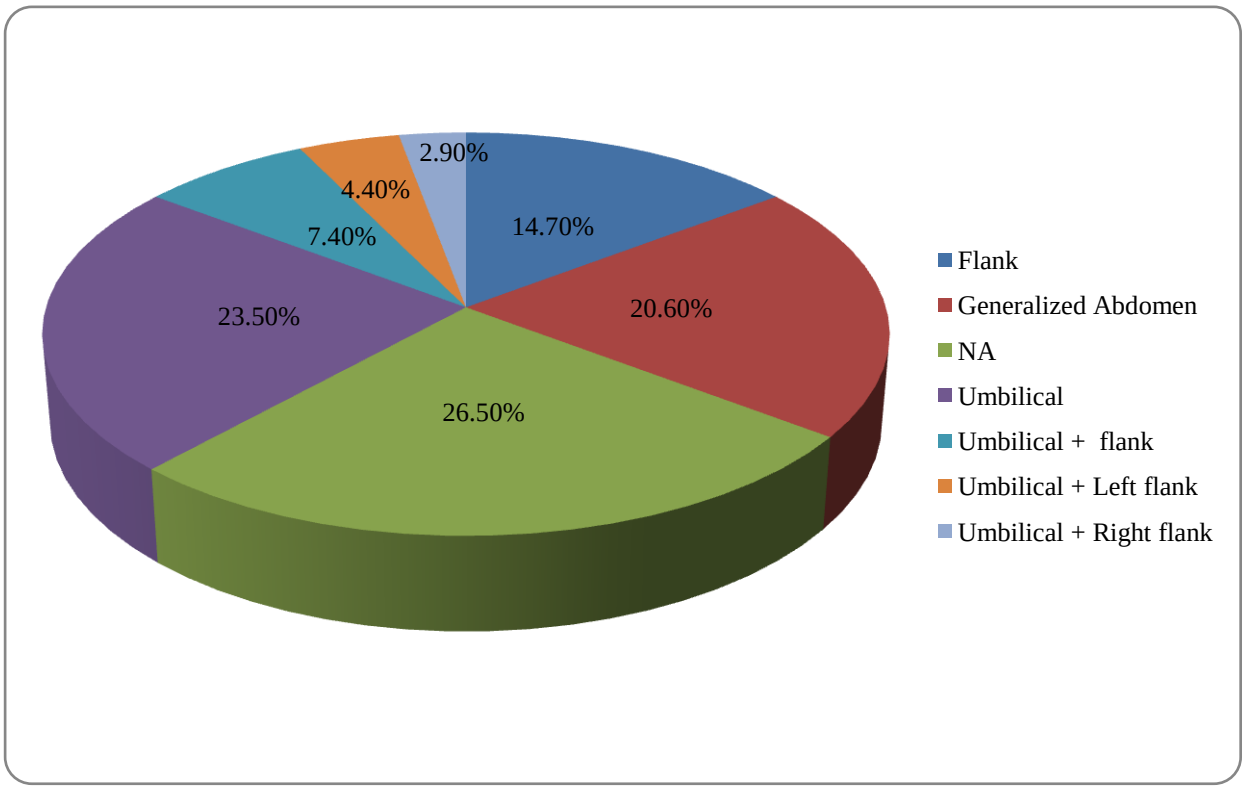

Chart 14 Distribution of cases based on site of pain

Table no 10 and chart no 14 shows distribution of cases based on site of pain. Out of 68 patients, 18 patients (26.5%) did not complain of pain at any site. In rest of the patients, most common site of pain was umbilical (23.5%) followed by generalized abdominal pain (20.6%).

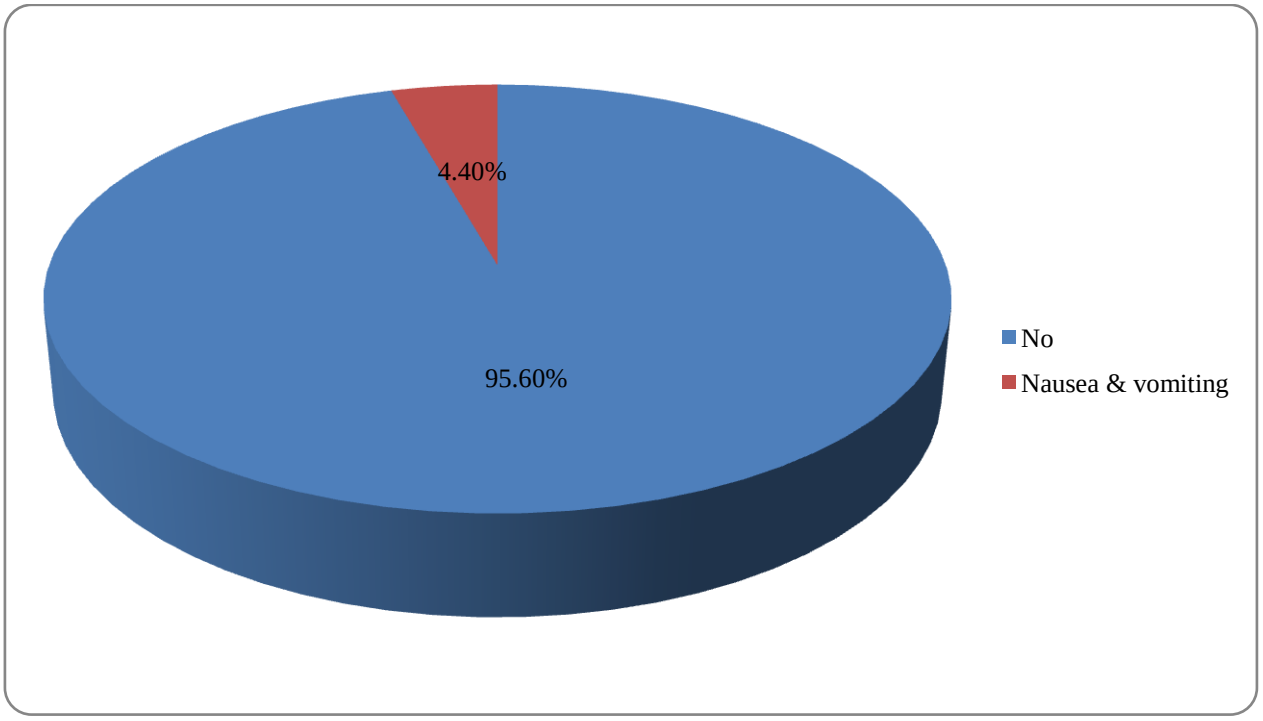

Chart 15 Distribution of cases based on side effects/complications

Table no 10 and chart no 15 shows distribution of cases based on side effects/ complications. Out of 68 patients, 3 patients (4.4%) had nausea and vomiting. Other side effects like local anaesthetic toxicity, hematoma formation, organ injury was not observed in any of the patients.

DISCUSSION

Post-operative pain has undesirable physiological and psychological consequences such as morbidity, delayed recovery and patient dissatisfaction. Thus, the development of safe and well tolerated analgesic techniques that provide optimal post operative pain relief is of utmost importance.

Various methods and medications are used in post operative pain management. The most common approach to post operative pain relief is multimodal analgesia using NSAIDs, opioids and local anaesthetics. Opioids are effective for treatment of post operative pain but can cause adverse effects such as nausea, vomiting, decreased gastrointestinal motility, respiratory depression and sedation which further increases the morbidity of the patient. Local anaesthetic infiltration does not relieve deep muscular pain and NSAIDs causes' haemostasis alteration, renal dysfunction, gastrointestinal haemorrhage. So we thought of an alternative technique in the form of TAP block at the end of surgery as it is a technique free from significant side effects of opioid and NSAIDs as well as inadequacy of local infiltration.

TAP block has been utilized as a part of multimodal regime for post operative analgesia following various surgical procedures such as large bowel resection[8], open appendicectomy[9], retropubic prostatectomy[10],nephrectomy[11], hernia repair [12], laparoscopic cholecystectomy[13][14] and cesarean section [15]. The use of the TAP block in women undergoing single - incision laparoscopic colectomy has enabled these procedures to be carried out as daycare cases with improved efficiency and cost effectiveness

So we chose to study the effectiveness of USG guided Transversus Abdominis Plane (TAP) Block with ropivacaine as a post operative analgesic technique for laparoscopic or robotic pelvic surgeries.

TAP blocks with ropivacaine 0.25% and 0.5% reduces pain, decreases opioid consumption, and provides earlier discharge readinesss which is associtaed with better quality of recovery. Risk of local anesthetic neurotoxicity can be reduced with lower doses of ropivacaine (0.25%) while maintaining improvement in quality of recovery and post operative analgesia [7]. So in our study we decided to use 0.2% ropivacaine as a local anesthetic agent for post operative analgesia.

We shall discuss our points under following points:

1. Demographic data.
2. ASA physical status and type of surgeries.
3. Hemodynamic parameters.
4. Time of requirement of first rescue analgesic.
5. Quality of analgesia as measured by VAS scale.
6. Site of pain.
7. Side effects or complications.

Demographic data

Out of 68 patients, there were 8 (11.8%) males and 60 (88.2%) females in our study. The mean age of patients was 45.9 years with standard deviation of 13.72. This was similar to the study done by **Venkatraman R *et al*** [28] and **Bhattacharjee S *et al*** [24], where mean age was 45.36 ± 10.48 (n=30) and 46.1 ± 5.6 (n=45) respectively.

In our study the average height of the patients was 158.49 cm with standard deviation of 7.53 which is similar to study done by **Baaj JM *et al*** [17]**, Kawahara Ryoko *et al*** [27] and **Srivastava U *et al*** [26] where mean height was 156.53 ± 4.12 (n=20) and 158 (148-172) (n=60) and 153 ± 5, respectively.

In our study the average weight of the patients was 65.19 kgs with standard deviation of 10.70 which is similar to study done by **Srivastava U *et al*** [26] where mean weight was 68 ± 5.

Average BMI was found to be 25.45 kg/m^2 with standard deviation of 4.38 which is similar to study conducted by Venkatraman **R *et al*** [28] where mean BMI was 26 ± 4.

ASA physical status and type of surgeries

Out of 68 patients, 29 (42.6%) of cases were belonged to ASA classification I whereas 39 (57.4%) of cases belonged to ASA classification II. **Venkatraman R *et al*** [28], **Bhattacharjee S *et al*** [24], **Sharma P *et al*** [21]**, Kawahara Ryoko *et al*** [27], **Baaj JM *et al*** [17] included ASA classification I and II patients, like our study.

In our study, majority of cases were of total laproscopic hysterectomy (39.7%), followed by robotic hysterectomy (13.2%) and laparoscopic excision of endometriosis (13.2%). In our study, 11.8% of cases were of robotic prostatectomy and 1.5% of cases of colon surgery also included. In the study by **Mahran E *et al*** [30] laparoscopic assisted robotic colorectal surgery (40%), cystectomy (33.3%) and hysterectomy (26.7%) cases were included**.** In the study by **Sharma P *et al*** [21] abdominal hysterectomy (8 out of 30), exploratory laparotomy (15 out of 30) and caesarean delivery (7 out of 10) cases were included

Hemodynamic parameters

In our study hemodynamic parameters like heart rate, blood pressure (systolic and diastolic pressure), oxygen saturation, respiratory rate were recorded pre - operatively and post - operatively at different time intervals. Clinically all patients were stable in pre – operative and post operative period.

Time of requirement of first rescue analgesic

Duration of analgesia in our study (time of first analgesic requirement) is 218.7 minutes with SD of 171.73 minutes. There are total 18 patients in our study did not require rescue analgesia for 24 hours. The cause of prolonged duration of analgesic effect following single shot TAP block is not entirely clear but may be explained by the fact that the TAP is relatively poor vascularized and therefore drug clearance may be slowed by reduced absorption into the blood stream. This prolonged analgesia was also likely due to the extension of the local anaesthetic drug into the paravertebral space [31].

Bhattacharjee S *et al* [24] found that the duration of analgesia was 290 minutes in TAP block with 0.25% bupivacaine group. They reported that 4 patients did not receive any rescue analgesia for 24 hours. So their result shows that duration of post operative analgesia prolongs with TAP block.

Venkatraman R *et al* [28] in their study found that duration of post operative analgesia with TAP block lasted for 440 minutes and significant reduction in consumption of analgesics in 24 hours. They also reported that 2 patients did not receive any rescue analgesia for 24 hours.

Sharma P *et al* [21] in their study noted that the first request for rescue analgesic was at 178 minutes with TAP block. Overall,

they found reduced analgesic requirement during first 24 post operative hours.

Saxena A *et al* [29] in their study found that first request of analgesic was significantly prolonged in TAP block group with mean time of 210 minutes with SD of 146.2.

Quality of analgesia as measured by VAS scale

In our study we have recorded VAS score at 0min (immediate post op period in PACU), 2 hours, 6 hours, 12 hours and 24 hours in post operative period with mean VAS score of 1.65, 1.65, 1.47, 1.09, 1.03 respectively. Thus in immediate post operative period (0min) till 2 hours no change was seen in VAS score after which at different intervals mean VAS score was decreased. With statistical analysis VAS score at different intervals was found to be statistically significant ($p < 0.001$).

Bhattacharjee S *et al* [24] established the superiority of TAP block in providing immediate post operative analgesia reflected by a lower VAS score both at res and with activity.

Venkatraman R *et al* [28] in their study found that there was no distinction in VAS scores at 0, 2, 24 hours between the two groups. They found lower VAS score in TAP group for post operative analgesia.

Sharma P *et al* [21] in their study found that TAP block by landmark technique improves VAS score in first 24 hours.

Mahran E *et al* [30] in their study found that VAS score both at rest and during coughing were significantly lower in TAP group for first 12 hours post operatively**.** At 24 hours, there were no significant differences in VAS score both at rest and during cough between two groups.

Yu N *et al* [6] in their study found that there was a significantly lower pain score in the TAP group at 24 hours post operatively. However, no significant difference was detected at any other point, which suggests that TAP block is effective for relatively long-lasting analgesia.

Baaj JM *et al* [17] in their study reported reduced post operative VAS score by 25% compared with control group in first 24 hours.

1.Site of pain

In our observational study 18 patients did not complain pain at any site for 24 hours (26.5%). The most common site of pain was in the umbilical region (23.5%) followed by generalized abdominal pain (20.6%). In our study we did not find any case having shoulder tip pain (referred pain) which is due to irritation of C4 nerve root of phrenic nerve.

Side effects or complications

Bhattacharjee S *et al* [24] in their study reported 8 cases of post operative nausea vomiting without any other significant complications.

Zhao X *et al* [25] in their meta - analysis reported increased incidence of post - operative nausea vomiting due to TAP block

Venkatraman R*et al* [28] in their study did not report any complication due to TAP block.

Mahran E *et al* [30] **in** their study found no difference between the two groups with respect to post operative nausea – vomiting. No other complications were detected.

Griffiths JD *et al* [18] [23] in their study found that TAP blocks can result in elevated plasma ropivacine concentrations which may be associated with neurotoxicity.

Torup H *et al* [20] in their study found that bilateral TAP blocks with 20 ml 0.5% w/v ropivacaine gave rise to potentially toxic peak blood concentrations of total ropivacaine in one third of the patients.

Farooq M *et al* [16] in their study reported needle perforation of liver due to blind landmark technique of TAP block.

Lancaster P *et al* [19] in their study reported peritonitis secondary to liver injury caused by ultrasound guided TAP block technique.

In our study post operative nausea - vomiting was found in 3 (4.4%) patients during first 24 hours. Other side effects like local site infection, hematoma formation, local anaesthetic toxicity, bowel perforation, difficulty ambulating or fall and injury secondary to spread of local anaesthetic to nerves of buttocks, lateral thigh or leg in distribution of femoral nerve were also looked for. In our study we did not see any of these side effects or complications.

Another important concern is LA toxicity due to intravascular injection (like dizziness, tinnitus, perioral numbness and tingling, lethargy, seizures, signs of cardiac toxicity like atrio - ventricular conduction block, arrhythmia, cardiac arrest) particularly when bilateral blocks are performed as administration of local anaesthetic between fascia layers is associated with fast absorption kinetics. In our study we did not find any of these features suggestive of LAs toxicity.

CONCLUSION

The conclusion from study was that 18 patients did not receive any rescue analgesia for 24 hours post operatively. Whereas duration of analgesia as assessed by time of request for 1st dose of rescue analgesic in other patients was 218.70 minutes (mean) with SD of 171.73. Comparison of VAS score at different time intervals in post operative period was also found statistically significant ($p < 0.01$) where VAS score at 0 min and at 2 hours post operatively was simliar with mean VAS of 1.65. At 6, 12, 24 hours post operatively mean VAS score was 1.47, 1.09, 1.03 respectively. Total 3 patients (4.4%) found to have nausea vomiting in post operative period but TAP block was not associated with any symptoms of local anaesthetic toxicity or organ injury.

Hence, Ultrasound guidance makes TAP block easy, precise and safe technique. Addition of TAP block as a part of multimodal analgesia regime for laparoscopic or robotic pelvic surgeries is an attractive option to obtain longer duration of analgesia, lower pain scores with no major side effects or complications.

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