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A Prospective, Randomized Study Comparing Ultrasound Guided Bilateral Transversus Abdominis Plane Block with Bilateral Ilioinguinal, Iliohypogastric Nerve Blocks in Patients Undergoing Lower Segment Cesarean Section

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KEYWORDS
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ABSTRACT:

Introduction: Post-operative pain treatment with regional nerve blocks can provide effective pain relief with minimal side effects of systemic analgesics. Transversus abdominis plane block, Ilioinguinal & Iliohypogastric using ultrasound guidance is a ubiquitous, component of multimodal analgesia with the added advantage of providing analgesia post operatively in lower abdomen surgeries. There is a paucity of literature comparing these two regional anesthesia options for post-operative pain in LSCS patients.

Objectives: To compare ultrasound guided B/L transversus abdominis plane block and ultrasound guided ilioinguinal, iliohypogastric nerve blocks for post-operative analgesia lower segment caesarean section.

Methods: This was a prospective, randomized, double blinded controlled study in which the enrolled 60 participants were randomly divided into two groups (30 in each group). Patients in group I received Ultrasound-guided TAP block using (n=30) 0.375% Ropivacaine 20ml on either side. Patients in group II received Ultrasound-guided IIN and IHN block using (n=30)0.375% Ropivacaine 10ml on either side. Both the blocks were compared . Observations were recorded in terms of visual analogue scale (VAS) (0–10).

Results: Comparison of both treatments showed significant difference in the VAS Dyn score between the I and II group with p =0.042. Both blocks did not have any side effects or misguidance due to USG. However, TAP blocks were relatively easier to perform than IIN/IH. Both groups had similar total additional analgesic consumption in 24 hrs which is not statistically significant.

Conclusion: In patients undergoing elective or emergency caesarean section, USG guiding IIN and IH nerve blocks are equally efficient at providing analgesia like ultrasound-guided transversus abdominis plane blocks. We also conclude that 10 ml Inj ropivacaine 0.375% used to block the ilioinguinal and iliohypogastric nerves, is as effective as 20 ml of injection ropivacaine 0.375% used in TAP block with ultrasound guidance.

1. Introduction:

Analgesia that is effective after surgical procedures is crucial for promoting early mobilisation, appropriate newborn protection (including nursing and bonding of parent and child), minimising the risk of post-op complications and fatality[1]. Analgesia protocol must achieve objectives of treating the woman and her unborn child with safe and effective analgesia with few side effects[1]. After a caesarean section, postoperative analgesia requires a multimodal strategy. Systemic or neuraxial opioids are frequently used to manage postoperative pain. Single-shot neuraxial analgesic treatments that use long-acting opioids or PCA epidural narcotic provide effective analgesia; however, these treatments are frequently combined with symptoms such as nausea, vomiting, itchiness, can decrease the overall comfort of patients. It is also feasible to combine these approaches with the use of long-acting opioids[2]. Regional anaesthesia combined with local anaesthetics can minimise or completely eliminate use of opioids and the negative effects that follow. Patients undergoing caesarean sections benefit significantly from postoperative analgesia when neural afferent resource to abdominal barrage is directly blocked, as is the case with abdominal field blocks such the TAP, IIN/IH nerve blocks[3].

The type of anaesthetic to be administered to the mother depends on a number of variables, including the reason

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for the procedure, any concurrent medical conditions in the mother, and patient desire. When performing spinal anaesthesia, also known as a subarachnoid block, a little amount of LA is injected into the SAB. This results in a severe blockade of the motor, sensory, and sympathetic nervous systems. The broad adoption of this method can be attributed to the following advantages: a conscious patient, a reduced stress response to surgery, a reduction in lung problems, a reduction in blood loss, and less postoperative pain[4].

On the flip side, some issues with specific drawbacks have been raised, including unfavourable hemodynamic reactions like hypotension, extended motor blockage, urine retention, and post-spinal migraines.

Using the lumbar triangle as an anatomic reference point, Dr. Rafi in Ireland was the first person to describe TAP block in 2001. Hebbard in 2007 was the first person to explain the ultrasound technique used to diagnose the TAP block. It is a method of regional anaesthesia in which a limited anaesthetic is set down in space in between muscles, specifically the core slanted muscle and transverse abdominal muscle, with the intention of inhibiting the T7 L1 nerves. It does not relieve pain in anterior and lateral abdominal walls where the visceral peritoneum is located. This block has regarded as method of providing post-op analgesia following a variety of surgical procedures, including appendicectomy, correction of hernia, C- section, abdominoplasty, hysterectomy, and prostatectomy. However, there have only been a handful of studies that have used Transverse Abdominal plane block as a method of administering anaesthesia. Despite the fact that Transverse Abdominis Plane block has been described in medical literature to have very high success rate with a very low risk of problems, the TAP block is still not widely used, and there is inertia around its implementation into clinical setting(4).

Following a caesarean delivery, it is of the utmost necessity to administer appropriate postoperative analgesia in order to promote early mobility, infant care, and reduce postsurgical morbidity. It is an utmost necessity. In order for the analgesic regimen to be successful, it must meet the aim of supplying safe and efficient painkillers with a minimal number of side effects for both the mother and the child. Opioids are typically the first point of call in a multimodal analgesic regimen, and their use is necessary to provide adequate analgesia. On the other hand, opioids are known to have adverse effects that are dose dependent; as a result, methods that reduce the requirement for opioids may be advantageous for this particular population.

A method of regional anaesthesia known as TAP block numbs the parietal peritoneum in addition to cutaneous and muscles of anterior abdominal wall. Transversus Abdominis Plane blocks continue to be underused despite the fact that there is a reasonably minimal risk of problems and a high success rate when employing contemporary procedures. In 2001, Rafi was the first person to explain this block. He referred to it as a modified abdominal sector block (RAFI), and it involved a focused single shot of anaesthetic being released into the TAP, which is a location that is traversed by significant nerve branches. Rafi was the first person to provide a description of this procedure.(5) TAP block is a potential method that has been demonstrated to be an efficient modality for treating post-operative pain in LSCS patients.

Both ilioinguinal and iliohypogastric nerves have their origins in L1 spinal root, with T12 making varied contributions. The L1 dermatome is responsible for the somatic discomfort that is caused by the Pfannenstiel incision, which is performed during LSCS procedures. Only a few trials have shown its effectiveness in LSCS when compared to the control group[6].

Regional nerve blocks may effectively relieve post-operative pain while minimising the harmful effects of systemic analgesics. TAP block is a potential strategy that has been discovered to be an efficient technique for controlling post-operative pain in patients who have LSCS[7].

Comparative research between these two types of regional anaesthesia to treat post-operative pain in LSCS patients is scarce in the academic literature. As a result, purpose of this investigation is to assess and contrast post-surgical analgesic value profiles of these blocks.

2. Objectives:

To compare ultrasonogram guiding B/L TAP block & Ultrasonography guiding IIN, IH nerve block for post-operative analgesia in lower segment caesarean section

Primary Objective

- To compare duration of analgesic effect between the blocks, measured as time from administration of block to

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request of first rescue analgesic or first VAS score more than 4.

Secondary objective

- To compare total analgesic requirement in doses postoperatively in first 24hrs
- To compare VAS score at time points (zero, thirty minutes, second hour, fourth hour, sixth hour, eighth hour, twelfth hour, twenty-four hour)

3. Methods:

The present study was carried out at the Department of Anaesthesiology & Critical Care of Chettinad Hospital and Research Institute, Kelambakkam from March 2023 to August 2024. It was prospective, randomized, double blinded study with 30 patients per group will be enrolled into the study. Patients in group **I (T)** received Ultrasound-guided TAP block using (n=30) 0.375% Ropivacaine 20ml on either side. Patients in group **II (I)** received Ultrasound-guided IIN&IHN block using (n=30)0.375% Ropivacaine 10ml on either side. Pregnant patients coming for elective or emergency LSCS, American Society of Anaesthesiologists (ASA) physical status classes II, patients with age of around 18–40 years were included in the study. Patients with BMI > 35 kg/m^2, Weight less than 50kg, known allergy to local anaesthetics, coagulopathies, raised intracranial pressure, Local infection at site of injection, History of heart block, dysrhythmias, neurological diseases and patient refusal were excluded from the study. Institutional Human Ethics Committee approved the study.

Prior to enrolment all study participants were explained the risks and benefits associated with the study in a language they understand, following which an informed written consent was obtained. Secrecy was maintained with regards to information of study participants.

Data Collection Tools:

All pertinent parameters were detailed in an ordered study proforma.

Patients who fulfill the eligibility criteria will be enrolled, after explaining the study, written and informed consent will be obtained. Patients to be familiarized with the use of visual analogue scale (VAS) (0–10) for the assessment of pain where 0 meant no pain and 10 worst pain imaginable, during preanesthetic visit in the evening prior to surgery. Standard anti-aspiration prophylaxis will be given for all patients. After shifting to OT, before Subarachnoid block a 18G intravenous access will be secured and standard monitors will be attached including electrocardiogram (ECG), non-invasive blood pressure (NIBP) and pulse oximeter SpO2. A standard anesthesia protocol will be followed. Patient will be in sitting position, under strict aseptic precautions parts will be prepared, with 2% chlorhexidine and draped. L3-L4 or L4-L5 space will be identified, after infiltrating with 2% lignocaine, spinal anesthesia will be administered using 26G or 27G Quincke needle, subarachnoid space will be identified with free flow of cerebro spinal fluid, then 2ml of 0.5% hyperbaric Bupivacaine with 25mcgs fentanyl (0.5ml), a total volume of 2.5ml will be given. Hemodynamics will be monitored simultaneously. Before skin incision maximum level of sensory blockade and motor blockade will be documented. Patients will be randomized into either of the two groups (T or I) based on a computer-generated random code and allotted by sequentially numbered opaque envelopes. After skin closure and completion of surgery, after re-checking sensory and motor levels, under aseptic precaution study block will be performed by a performer independent of the principal investigator under USG guidance (Esoate Mylab25gold) using 23G spinal needle and drug 0.375% Ropivacaine with volume respective to the study will be administered.

Immediate post time point of the study block will be considered as 0 min, hemodynamics, level of sensory and motor blockade and VAS will be assessed, post-operatively, the patient will be moved to the PACU, where they will get 4 hours of observation. Further follow up of the patient for next 24 hrs in labour ward. Post-operatively, at the designated time-points, patients will be assessed for Pain (static & dynamic) using Visual Analogue Scale (VAS)- on both sides. Level of sensory block using cold swab test- on both sides - Modified Bromage Score will be used for the assessment of motor block. Time at which first request of rescue analgesia or time for VAS > 4 in the first 24 hrs. is noted. During the first twenty-four hours following surgery, a routine course of post-op analgesics will be administered as per protocol.

The patients received Inj. Paracetamol 900mg in 100ml N.S 8^{th} hourly for the first 24 hours. If the patients' VAS is more than or equal to four in the first four hours following surgery, they will be given an injection of tramadol at a dose of 2 mg/kg intravenously, followed by

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an injection of ondansetron at a dosage of 4 mg Intravenously. For persistent VAS ≥4 in this period, Injection Ketorolac 30mg intravenously. Number of doses of additional analgesics (Tramadol and ketorolac) administered in the first 24 hours will be noted. Hemodynamic changes (HR, SBP& DBP and SPO2 saturation) will be noted. Any complications will be acknowledged & managed accordingly.

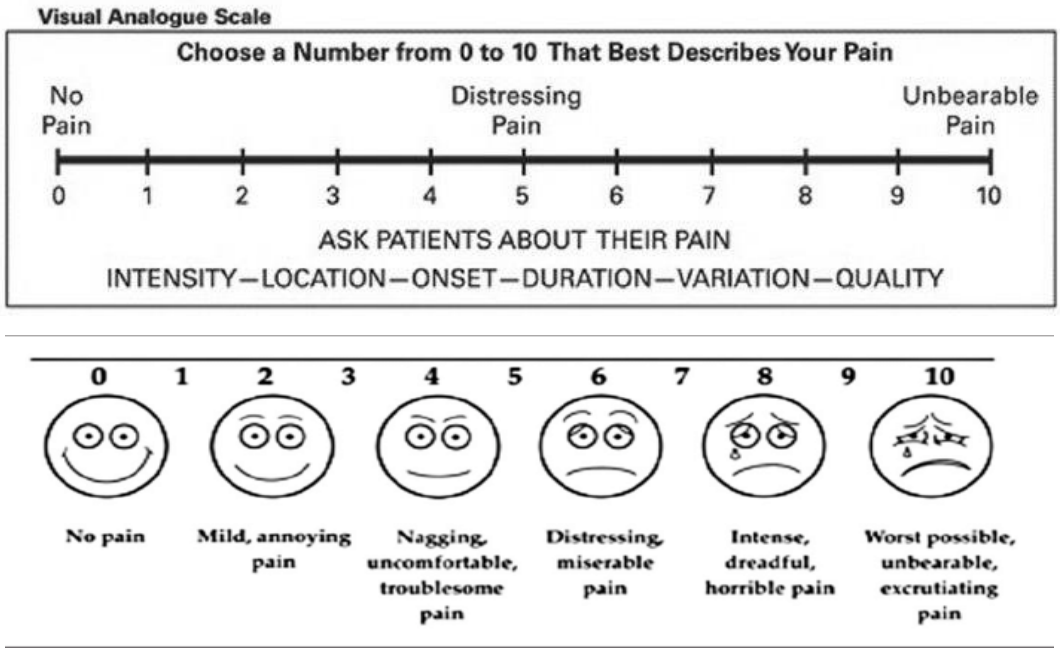

Figure 1: Showing visual analogue scale (1)

4. Statistical analysis:

The utilisation of descriptive statistics such as the mean in addition to the standard deviation for the continuous variables was a part of the process of analysing the demographic data. Additionally, frequency breakdowns and percentage breakdowns were provided for the categorical groups. In order to determine the degree of connection between the categorical variables, the chi-square test was carried out. The dependent variables "VAS STATIC", "VAS DYN", Hemodynamic variables such as "HR", "SBP", "DBP" were measured at 9-time points baseline, 30mins,1hour, 2hours,4hours,6hours, 8hours,12hours and 24hours.Sphericity assumption by Mauchly's Test was not specific for the HR,SBP,VAS($p<0.001$) and for the DBP value sphericity assumption was met. To overcome the issue of sphericity, Repeated Measure ANOVA with Greenhouse-Geisser was performed and for the DBP, Repeated Measures ANOVA with Sphericity assumed analysis was performed.

A P-value of less than 0.05 was considered statistically significant. Data will be entered in Excel and analysed using SPSS software.

5. Results:

The study included 60 female patients who had LSCS under spinal anaesthesia, with equal distribution of 30 patients among the 2 groups. Patients in group **I** received Ultrasound-guided TAP block using (n=30) 0.375% Ropivacaine 20ml on either side. Patients in group **II** received Ultrasound-guided IIN&IHN block using (n=30) 0.375% Ropivacaine 10ml on either side.

Table 1. Descriptive analysis of age (years), weight (kg), height (cm) and BMI (kg/m^2) expressed as mean ± standard deviation (SD) for each group

	GROUP I		GROUP II		P value
	Mean	SD	Mean	SD	

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Age	27.3	3.4	27.2	4.2	0.947
Height(cm)	154.1	5.2	156.6	5.9	0.092
Ht (m)	1.5	0.1	1.6	0.1	0.092
BMI	28.1	3.8	28.8	5.3	0.556

There were no significant differences with respect to age, weight, height and BMI among the two groups. The results shows that there is no significant difference in the mean age between group I & II (p=0.947). Similarly, for the mean difference between the height, BMI of the patient between the I & II groups were not statistically significant where p =0.092 and 0.556 respectively (Table 1).

A repeated measure ANOVA with a Sphericity Assumed determined that the difference between the mean value of the DBP value was not statistically significant over a period in the assessment stages [(F (8,464) =0.997, p =0.438)]. There is no significant difference in the DBP score between the T and I group over a period [F (8,464) =1.223, p=0.283]. Over a period, there is change in the hemodynamics variables and also between the T & I group .

Table 2. Comparison of postoperative VAS score at 0,30min,1, 2,4,6,8,12, 24hour follow-ups across the group

DYNAMIC	**GROUP (MEAN±SD)**		**TOTAL (N=60)**	**P VALUE**
TIME INTERVAL	**GROUP I (VAS SCORE) N=30**	**GROUP II (VAS SCORE) N=30**		
0mins	.00±.000	.00±.000	.00±.000	p=0.129
30mins	.00±.000	.03±.183	.02±.129	p=0.129
1hour	.07±.365	.33±.758	.20±.605	p=0.129
2hours	.80±1.243	.67±.959	.73±1.103	p=0.129
4hours	1.471±.042	2.031±.066	1.751±.083	p=0.129
6hours	2.37±1.402	3.00±1.017	2.68±1.255	p=0.129
8hours	3.70±1.264	4.20±1.095	3.95±1.199	p=0.129
12hours	4.13±.730	4.33±.758	4.23±4.23	p=0.129
24hours	4.33±.758	4.73±.980	4.53±.892	p=0.129

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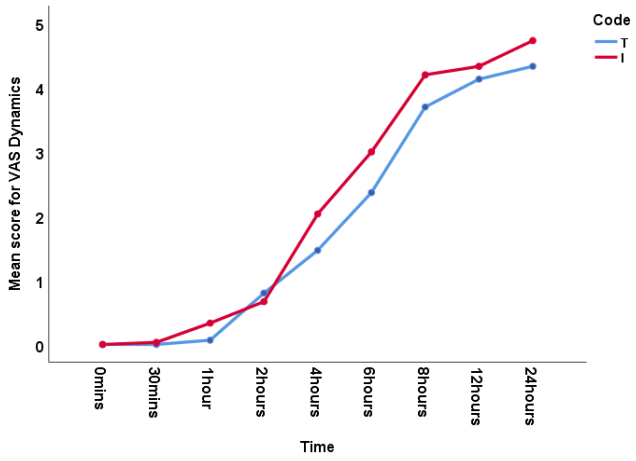

Fig. 2

A repeated measure ANOVA with a Greenhouse-Geisser correction determined the difference between the mean value of the VAS Dyn Score was statistically significant over a period in the assessment stages [F (4.569,264.986) =341.249, p < 0.001)].

There is no significant difference in the VAS Dyn score between the I and II group over a period [F (4.569,264.986) =1.754, p=0.129)] (Table 2; Fig.2).

Table 3. VAS STATIC

STATIC	GROUP (MEAN±SD)		TOTAL (N=60)	P VALUE
TIME INTERVAL	GROUP I (VAS SCORE) N=30	GROUP II (VAS SCORE) N=30		
0mins	.00±.000	.00±.000	.00±.000	p=0.293
30mins	.00±.000	.03±.183	.02±.129	p=0.293
1hour	.07±.365	.33±.758	.20±.605	p=0.293
2hours	.53±.900	.60±.932	.57±.909	p=0.293
4hours	1.33±1.093	1.90±1.185	1.62±1.166	p=0.293
6hours	2.30±1.264	2.87±1.252	2.58±1.279	p=0.293
8hours	3.63±1.299	4.10±1.185	3.87±1.255	p=0.293
12hours	4.13±.900	4.47±.860	4.30±.889	p=0.293
24hours	4.33±.758	4.73±.980	4.53±.892	p=0.293

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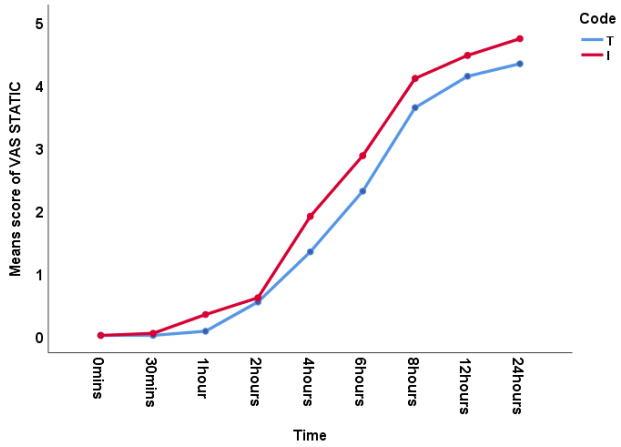

Fig. 3

The difference between the mean value of the VAS Static Score was statistically significant over a period in the assessment stages [F (4.382,254.178) =360.246, p<0.001)].

There is no significant difference in the VAS Static score between the I and II group over a period [F (4.382,254.178) =1.240, p=0.293)] (Table 3; Fig.3). Over a period, there is significant difference between the VAS STATIC and VAS DYN score but there is no difference in the score VAS STATIC and VAS DYN between the groups T & I.

Table 4. Comparison of postoperative VAS score of static and dynamic at 4,6,8,12hour follow-ups across the groups I and II

Group Statistics	Code	N	Mean	SD	P value
VAS STATIC_4hours	I	30	1.3	1.1	0.059
	II	30	1.9	1.2	
VAS DYN_4hours	I	30	1.5	1	0.042
	II	30	2	1.1	
VAS STATIC_6hours	I	30	2.3	1.3	0.086
	II	30	2.9	1.3	
VAS DYN_6hours	I	30	2.4	1.4	0.05
	II	30	3	1	
VAS STATIC_8hours	I	30	3.6	1.3	0.151
	II	30	4.1	1.2	
VAS DYN_8hours	I	30	3.7	1.3	0.107
	II	30	4.2	1.1	
VAS STATIC_12hours	I	30	4.1	0.9	0.148
	II	30	4.5	0.9	
VAS DYN_12hours	I	30	4.1	0.7	0.302
	II	30	4.3	0.8	

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Table 4 showed that the there is significant difference in the VAS Dyn 4 hours score between the I and II group and p =0.042.

Table 5. Comparison of Duration of analgesia & Total additional analgesic consumption

TOTAL ADDITIONAL ANAGESIC CONSUMED IN 24 HRS	CODE		CODE		
	N	%	N	%	P Value
	I		II		
0	18	60	10	33.3	0.07
50	2	6.7	11	36.7	
100	5	16.7	5	16.7	
150	4	13.3	3	10	
200	1	3.3	1	3.3	
Duration of ANALGESIA	N	%	N	%	
4	1	3.3	1	3.3	0.392
6	6	20	7	23.3	
8	14	46.7	19	63.3	
9	1	3.3	0	0	
12	8	26.7	3	10	

	CODE		CODE		P value
	I		II		
	Mean	SD	Mean	SD	
DURATION OF ANALGESIA	8.6	2.3	7.8	1.8	0.159
Total Additional Analgesic consumed	46.7	64.2	56.7	55.3	0.521

Mean total Additional Analgesic, Inj. Tramadol consumed in 24 hours in Tap group is 46.7 mg. Mean total Additional Analgesic, Inj. Tramadol consumed in 24 hours in IIN/IH group mean value of 56.7 mg. The mean difference between the I and II group was not statistically significant difference (p = 0.521) (Table 5).

The duration of analgesia between the groups I and II was not significant where p =0.159.

6. Discussion:

TAP block performed by way of ultrasound is an important component of multimodal analgesia, providing alleviation of pain both intra-operatively, and post-operatively. The TAP block has been compared with control groups and additives but there was a paucity and very few studies are present in comparing with IIN/IH block The IIN and IH nerve arise from L1 spinal root with variable contributions from T12. The somatic pain generated by the Pfannenstiel incision for LSCS surgeries falls under the L1 dermatome. A few studies have reported its efficacy in LSCS, compared to control. There is a paucity of literature comparing these two regional anaesthesia options for post-operative pain in LSCS patients. Hence the goal of the present research is at comparing post-operative analgesic efficacy profile of these two blocks.

In a 2018 study, Kirti Kamal et al.[8] evaluated the effectiveness of US guided block vs IIN/IH nerve block for post-operative analgesic in patients having hernia repairs on 60 ASA-PS I & II patients. In Group I, the time to the first rescue analgesia was 319.8 115.2 minutes, while in Group II, it was 408 116.4 minutes (P =

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0.005). Tramadol was needed in the first four hours by seven patients (23.33%) in Group I and two (6.67%) in Group II. In neither group did any patients get IV diclofenac. Diclofenac tablets were given on average at 200 mg in Group I and 172.5 mg in Group II (P = 0.004)[8].

The present research was a prospective, double blinded randomized controlled study, done at Chettinad Hospital and Research Institute, from march 2022 till August 2023. Sixty patients who underwent elective or emergency LSCS, classified under ASA-PS I & II were considered for study.

30 Patients in Group (I) received Ultrasound-guided TAP block using 0.375% Ropivacaine 20ml on either side. 30 Patients in Group (II) received Ultrasound-guided IIN&IHN block using 0.375% Ropivacaine 10ml on either side. Patients who were assigned into either of the two groups depicted nearly similar demographic parameters such as age, height, weight and BMI. There appeared to be no statistical significance in between the groups on those terms.

After block patient was assessed at time intervals till 24th hour from 0th hour. The duration of analgesic effect between the blocks, measured as time from administration of block to request of first rescue analgesic or first VAS score more than 4.

In both the groups, patients did not request for the rescue analgesic Inj. Diclofenac 75mg in the first 4 hrs. In the group TAP 18 patients did not ask for additional analgesic Inj. Tramadol 50 mg and in Group IIN/IH 10 patients did not ask for additional analgesic. The analgesia duration between groups T & I was not statistically significant where p =0.159. The VAS at rest was equivalent in both groups in the initial post-operative period and for the first 90 minutes following surgery. However, there was a significant difference between the T & I group for the VAS Dyn 4 hour score (p =0.042).

Demographic and hemodynamic comparison results and the immediate post op VAS score results coincide with study of Kirti Kamal et al.[8] Inj. Diclofenac 75 mg were not requested by the patients in both the groups in the study conducted by Kirti Kamal et al.[8]

In contrast, the group that received the IIN/IHN block in the Kirti Kamal trial had a substantially lower VAS score at rest than just the group that received the TAP block (P 0.05). After then, even though the IIN/IHN group's VAS score remained lower, the difference was not determined to be statistically significant.

In our study over a period, there is substantial difference between the VAS STATIC and VAS DYN score but there is no difference in the score VAS STATIC and VAS DYN between the groups I & II, which contrasting with the above study.

In our study, a TAP block was carried out with 20 millilitres of 0.375% ropivacaine on each side. This procedure is comparable to that used by McDonnell et al.[9] who used 1.5 milligrams per kilogramme of 0.75% ropivacaine to achieve a bilateral TAP block for caesarean delivery (to a maximal dose of 150 mg).

We did not add a control group that did not utilise a block because both of the strategies we were comparing have documented analgesic efficacy compared to the control. Since, number of studies have shown that a single dosage of intramuscular tramadol between 50 and 100 milligrams can give excellent postoperative analgesia, we decided to use Tramadol as a rescue analgesic.

The quantity of postoperative morphine consumption in the first 24 hours was significantly decreased by ultrasound-guided TAP block, according to G. Niraj et al.[3].

Conclusion and Recommendation:

In patients undergoing elective or emergency caesarean section, USG guiding IIN and IH nerve blocks are equally efficient at providing analgesia like ultrasound-guided transversus abdominis plane blocks. We also conclude that 10 ml Inj ropivacaine 0.375% used to block the ilioinguinal and iliohypogastric nerves, is as effective as 20 ml of injection ropivacaine 0.375% used in TAP block with ultrasound guidance.

Recommendations:

1. The study can be conducted replicated in other settings
2. The study can be conducted with larger samples

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