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Comparative Study of Ultrasound - Guided Transversus Abdominis Plane Block Versus Ilioinguinal/Iliohypogastric Nerve Block& Local Wound Infiltration for Post Operative Analgesia in Inguinal Hernia in Paediatrics

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Abstract

Postoperative management of pain in pediatric population is of major concern as it reduces the incidence of complications and leads to earlier hospital discharge. to evaluate efficacy of ultra-sound guided transverses abdominus plane block versus local anaesthetic wound infiltration versus ultra-sound guided ilioinguinal /iliohypogastric nerve block with or without using of dexmedetomidine as an additive to bupivacaine, in the management of the postoperative pain in pediatric patients undergoing unilateral inguinal hernia repair. This prospective randomized blinded, controlled, clinical study,in which 140 Patients were randomized into four groups, The primary targets of this current study were FLACC score for pain and measuring the mean paracetamol consumption in 24 hours. Regarding comparison between the four groups involved in our study , the postoperative analgesia is more effective with TAP group [the gold standard] than groupII,groupIII and groupIV, the latter is being the least effective in postoperative pain control . Also the postoperative consumption of paracetamol in TAP group is lower than other groups.Using dexmedetomidine as an additive to bupivacaine provides prolonged duration of postoperative analgesia, and lowered FLACC pain scores. As regard demographic data were not significantly different between the groups . Vital parameters [heart rate, systolic and diastolic blood pressure, respiratory rate per minute] were also not significantly different between the groups. ultra-sound guided transverses abdominus plane block is more effective in postoperative analgesia when compared to local anaesthetic wound infiltration and ultra-sound guided ilioinguinal /iliohypogastric nerve block. Using dexmedetomidine as an additive to bupivacaine provides prolonged duration of postoperative analgesia, and lowered FLACC pain scores.

Keywords: Ultrasound -Guided Transversus Abdominis Plane Block, Ilioinguinal/Iliohypogastric Nerve Block, Local Wound Infiltration, Post Operative Analgesia, Inguinal Hernia.

1.Introduction

Postoperative management of pain in pediatric population is of major concern as it reduces the incidence of complications and leads to earlier hospital discharge [1]. Regional anesthesia is accepted as the cornerstone of post-operative pain relief in the pediatrics , it has the advantage of providing good post-operative analgesia as well as decreasing parenteral opioids requirements [2].

More than 80% of patients undergoing surgical procedures experience acute postoperative pain and most of them report the severity as moderate, severe, or extreme [3]**,** Evidence suggests that less than half of patients report adequate postoperative pain relief. Inadequately controlled pain negatively affects the quality of life, function, and functional recovery, the risk of post-surgical complications, and persistent postsurgical pain [4].

Surgical pain is due to inflammation from tissue trauma[i.e., surgical incision, dissection, burns] or direct nerve injury [i.e., nerve transaction, stretching, or compression]. The patient senses pain through the afferent pain pathway which can be altered by various pharmacologic agents [5]**.**

Effective control of postoperative pain remains one of the most important and pressing issues in the field of anesthesia and has a significant impact on our health care system. In many patients, pain is treated inadequately, causing them needless suffering, and they can develop complications as an indirect consequence of pain. Analgesic modalities, if properly applied, can prevent or at least minimize this needless suffering and these complications [6]**.**

Despite opioid use, moderate-to-severe pain with coughing and mobilization continues to remain high in the first 72 hours after surgery, though with significant improvement after 24 hours. In addition, use of opioids may result in significant side effects such as hypoventilation, sedation, gastric dysmotility, nausea and vomiting, which can worsen patient recovery [7].

Data on postoperative pain after surgery consistently shows moderate-to-severe pain in the first 24 hours after surgery with traditional systemic analgesic techniques, such as intravenous or intramuscular opioids, patient-controlled opioid analgesia, and multimodal analgesia with opioids combined with acetaminophen, NSAIDs, neuropathic agents, and ketamine [8].

Aim of the study to evaluate efficacy of ultra-sound guided transverses abdominus plane block versus local anaesthetic wound infiltration versus ultra-sound guided ilioinguinal /iliohypogastric nerve block with or without using of dexmedetomidine as an additive to bupivacaine, in the management of the postoperative pain in

pediatric patients undergoing unilateral inguinal hernia repair.

2.Patients and methods

2.1Patients

Prospective randomized blinded , controlled , clinical study.

Patients were randomized into four groups. An online randomization program was used to generate random number list. Patient randomization numbers were concealed in opaque envelops which were opened by the study investigator.

Sample size calculation : Considering pain rescue- analgesia consumption as the primary outcome , and taking alpha [α] error = 5% [confidence interval = 95 %] and the power of test [1-β] as 80 % , we considered that a reduction more than 25 % paracetamol consumption will be satisfactory [the effect size was 0.96] , thus , we recruited 140 patients for randomization.

Members of the study group involved in obtaining functional data were blinded to randomization for the period of data acquisition and analysis.

2.2 Inclusion criteria

ASA physical status: I and II , Type of operation:- Patients undergoing Unilateral inguinal herniorrhaphy under general anesthesia .

2.2.1Groups allocation

140 Patients were randomly allocated into the four groups:-

Group I :- received unilateral ultrasound guided transverses abdominis plane block as follow :-

•Group 1B :- 20 patients received ultrasound guided transverses abdominis plane block with 0.3 ml/kg of bupivacaine 0.25% alone.

•Group 1D:-20 patients received ultrasound guided transverses abdominis plane block with 0.3 ml/kg of bupivacaine 0.25% mixed with1µg/kg dexmedetomidine.

Group II :- received local anaesthetic wound infiltration as follow: -

•Group II B:-20 patients received local anaesthetic wound infiltration with 0.2 ml/kg of bupivacaine 0.25% alone.

•Group II D:- 20 patients receivedlocal anaesthetic wound infiltration with 0.2 ml/kg of bupivacaine 0.25% mixed with1µg/kg dexmedetomidine.

Group III:- received ultrasound guided Ilioinguinal / Iliohypogastric Nerve blockas follow:-

•Group III B:-20 patients receivedultrasound guided Ilioinguinal / Iliohypogastric Nerve block with 0.3 ml/kg of bupivacaine 0.25% alone.

•Group III D:-20 patients receivedultrasound guided Ilioinguinal / Iliohypogastric Nerve block with 0.3 ml/kg of bupivacaine 0.25% mixed with1µg/kg dexmedetomidine.

Group IV:- [control]20 patients received regular analgesics .

2.2.2 Exclusion criteria

Local skin infection at the site of injection, Patients with known allergy to one of the used drugs and Patients with coagulation disorders or on anticoagulant therapy.

2.3 Methods

One day before surgery all patients were interviewed to explain FLACC score, also routine investigations were fulfilled. Before the induction of general anaesthesia, Intravenous access [IV] was established and monitoring of the patients. Induction of general anaesthesia in patients undergoing inguinal herniorrhaphy were premedicated with atropine at a dose of 0.01-0.02mg/kg.

After pre-oxygenation with 100% oxygen for 3-5 minutes, general anesthesia was induced with inhalation of sevoflurane [6-8%] in oxygen followed by atracurium 0.5 mg/kg to facilitate endotracheal intubation . fentanyl 1 mcg/kg was given for intraoperative analgesia.

End tidal CO2 was monitored with capnography. Anesthesia was maintained with sevoflurane 2% and atracurium 0.1 mg/kg as a maintenance dose till the end of the procedure.Heart rate was continuously monitored and blood pressure/ 5 minutes was maintained within ± 20% of the preoperative baseline.

Activation of regional block at the end of the surgical procedure with recording of parameters in the post-operative period. The ultrasound used for the block, we had used [GE " LOGIQ P5" ultrasound machine] with 5 -12 MHz probes and colour Doppler imaging capability.

The study protocol was approved by the institutional ethical committee of Benha university hospitals. Informed patient's parents [or guardians] written consent was obtained before enrolment in the study.

2.3 Statistical methods

Data management and statistical analysis were done using SPSS vs.25. [IBM, Armonk, New York, United states]. Numerical data was summarized as means and standard deviations. Categorical data was summarized as numbers and percentages. Comparisons between study groups were done using Kruskal Wallis test for numerical data. Pairwise analysis was done in case of significant overall effect. All pairwise were Bonferroni adjusted. Categorical data was compared using Fisher's exact test. P values less than 0.05 were considered significant.

3. Results

Patient groups characteristics, in Table (1)

There were no significant differences in pulse rate between all groups at different times.

There were no significant differences in systolic blood pressure between all groups at different times.

There were no significant differences in diastolic blood pressure between all groups at different times.

There were no significant differences in respiratory rate between all groups at different times.

- At 1 & 2h

There was an overall significance between groups [P value was <0.001]. Pairwise analysis revealed that mean FLACC was significantly higher in group IV [5] compared to all other groups.

- At 6 hours

There was an overall significance between groups [P value was <0.001]. Pairwise analysis revealed that mean FLACC was significantly higher in group IV [5] compared to all other groups and mean FLACC in group ID was significantly lower [2] compared to all other groups.

- At 12 hours
- At 24 hours

There was an overall significance between groups [P value was <0.001]. Pairwise analysis revealed that mean FLACC was significantly lower in group ID [4] compared to all other groups., Fig (1).

There were no significant differences between groups as regard nausea and vomiting P value was 1.0

Paracetamol use showed overall significance between groups [P value was <0.001]. Pairwise analysis revealed that mean paracetamol was significantly lower in group ID [66.5 mg/24h] compared to groupsIB [173mg/24h], IIB [334 mg/24h], IIIB [311.4mg/24h] and IV [519 mg/24h]. Paracetamol use was significantly lower in group IB [173 mg/24h] compared to groups IIB [334 mg/24h], IIIB [311.4 mg/24h] and IV [519 mg/24h]. Also paracetamol use was significantly lower in groups IID [168 mg/24h] and IIID [155.7 mg/24h] compared to group IV [519 mg/24h] Fig (2).

Table (1) General characteristics in the study groups

		Group IB	Group ID	Group IIB	Group IID	Group IIIB	Group IIID	Group IV	P value
Age [ys]	Mean ±SD	4.15 ±1.98	3.8 ±2.01	4.05 ±1.85	3.95±1.98	3.65±2	4.7 ±2.05	4.75 ±2.09	0.903
Gender	Males	17 [85.0]	16 [80.0]	16 [80.0]	17 [85.0]	18 [90.0]	16 [80.0]	17 [85.0]	0.991
	Females	3 [15.0]	4 [20.0]	4 [20.0]	3 [15.0]	2 [10.0]	4 [20.0]	3 [15.0]	
Weight[kg]	Mean ±SD	17.3 ±3.96	16.4 ±4.01	16.75 ±3.59	16.6 ±3.99	16.75 ±3.95	16.95 ±3.66	17.1 ±4.05	0.993
Duration [min]	Mean ±SD	43 ±7	44 ±10	45 ±9	46 ±10	45 ±9	43 ±9	45 ±8	0.946

Kruskal Wallis test was used. Fisher's exact test was used for gender

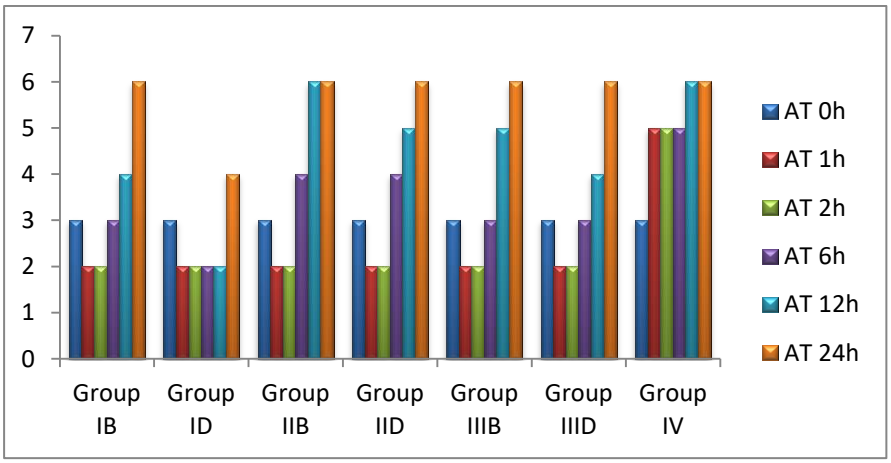

Fig (1) Post-operative FLACC at different times in study groups

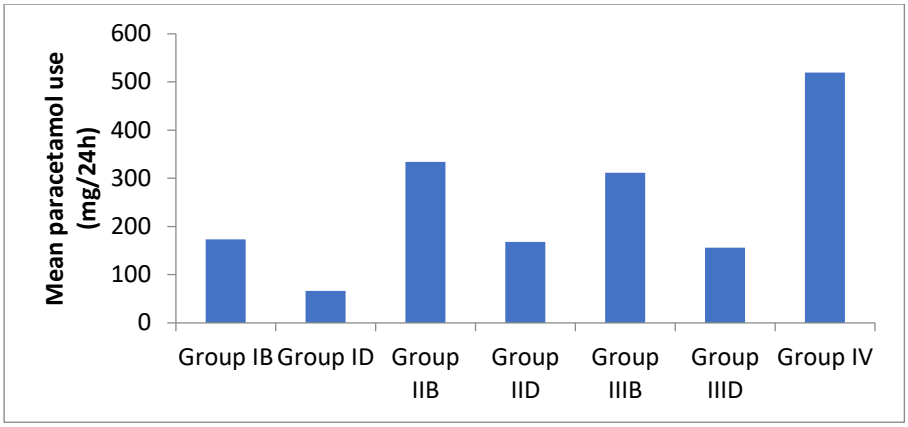

Fig (2) Total Paracetamol consumption in different study groups

4. Discussion

The present study goes with Gavrilovska-Brzanov et al. [9] they studied evaluation of anesthesia profile in pediatric patients after inguinal hernia repair with caudal block or local wound infiltration. the anesthesia and recovery profile was assessed in sixty pediatric patients undergoing inguinal hernia repair. Enrolled children were randomly assigned to either Group Caudal or Group Local infiltration. For caudal blocks, Caudal Group received 1 ml/kg of 0.25% bupivacaine; Local Infiltration Group received 0.2 ml/kg 0.25% bupivacaine. Investigator who was blinded to group allocation provided postoperative care and assessments. Postoperative pain was assessed. Motor functions and sedation were assessed as well.they found that the two groups did not differ in terms of patient characteristic data and surgical profiles and there weren't any hemodynamic changes between groups. Regarding the difference between groups for analgesic requirement there were two major points - on one hand it was statistically significant $p < 0.05$ whereas on the other hand time to first analgesic administration was not statistically significant $p = 0.40$. There were significant differences in the incidence of adverse effects in caudal and local

Group including: vomiting, delirium and urinary retention.Their conclusion was local wound infiltration insures safety and satisfactory analgesia for surgery.Compared to caudal block it is not overwhelming. Caudal block provides longer analgesia, however complications are rather common.

Scott Dingemanet al. [10] compared efficacy of ultrasonography-guided Bilateral Rectus Sheath Block [BRSB] and local anesthetic infiltration [LAI] in providing postoperative analgesia after pediatric umbilical hernia repair. They found that median FACES scores in the PACU were lower in the BRSB group compared with the LAI group at 10 minutes [0 vs 1; P = .04], 30 minutes [0 vs 1; P = .01], and 40 minutes or later [0 vs 1; P = .03]. Fewer doses of opioid and non opioid medications were given to the BRSB group compared with the LAI group [5 vs 11 doses for opioids; 5 vs 10 for non opioids].their conclusion was that in the PACU, ultrasonography-guided BRSB after umbilical hernia repair in children is associated with lower median FACES scores and decreased use of opioid and non opioid medications compared with LAI.

The current study goes with Neha Kanojia and Sharmila Ahuja, [11] they done comparison of transverses abdominis plane block and caudal block for postoperative analgesia in children undergoing lower abdominal surgery. In which 60 children aged 1- 12 years were randomly allotted into 2 groups to receive either USG TAP block with 0.3ml/kg of 0.2% ropivacaine or caudal block with 1ml/kg of 0.2% ropivacaineafter induction of anesthesia. parameters observed included duration of analgesia by modified VAS scale, total analgesic requirement in 24 hours, quality of analgesia and adverse effects.They found that mean VAS scores were lower in both the groups for first 3-4 hours postoperatively. subsequently, number of patients with mean VAS score >3 rose more rapidly in group Caudal as compared to group TAP. Time to rescue analgesia in group TAP was 7.41 ± 0.78 hours whereas in group Caudal was 5.07 ± 0.69 hours and this difference was statistically significant. The difference was not statistically significant for total analgesic requirement between the two groups. Quality of analgesia was good in both the groups. No adverse effects were reported in both the groups.they found that the duration of analgesia was significantly longer in children who received TAP block as compared to caudal block and it is a good alternative for providing postoperative analgesia.

The present study goes with Mehrdad Hosseinpour et al. [12] they compare the effects of pre and post incisional infiltration of the

surgical area with bupivacaine on cortisol and prolactin release and postoperative pain in patients undergoing inguinal hernia repair.They found that postoperatively, the plasma concentration of cortisol and prolactin in local anesthesia group were significantly lower than placebo group [P = 0.001 and P = 0.013, respectively]. Visual Analog Scale [VAS] in local anesthesia group was significantly lower than placebo group in 12, 24, 48 and 72hrs after operation [P < 0.0001, for all four]. Also, there was a significant correlation between the two groups according to rescues analgesic [P < 0.0001]. they found that the usage of local anesthesia is a safe, effective and feasible procedure as decreases the cortisol and prolactin hormones, postoperative pain and analgesic drugs consumption.

The Current study doesn't go with Kirti Kamal et al.[13] They compared USG guided TAP Vs IIN/IHN block for post-operative analgesic efficacy in patients undergoing inguinal hernia surgery.In which Sixty adult patients with American Society of Anesthesiologsts' grade I or II were included. After general anaesthesia, patients in Group I received USG guided unilateral TAP block using 0.75% ropivacaine 3 mg/kg [maximum 25 mL] and those in Group II received IIN/IHN block using 10 mL 0.75% ropivacaine. Postoperative rescue analgesia was with tramadol [intravenous] IV ± diclofenac IV in the first 4 h followed by oral diclofenac subsequently. Total analgesic consumption in the first 24 h was the primary objective, intraoperative haemodynamics, number of attempts and time required for performing the block as well as the postoperative pain scores were also evaluated.They found that time to first analgesic request was 319.8 ± 115.2 min in Group I and 408 ± 116.4 min in Group II [P = 0.005]. Seven patients [23.33%] in Group I and two [6.67%] in Group II required tramadol in first four hours. No patient in either groups received diclofenac IV. The average dose of tablet diclofenac was 200 ± 35.96 mg in Group I and 172.5 ± 34.96 mg in Group II [P = 0. 004].They found that USG guided IIN/IHN block reduces the postoperative analgesic requirement compared to USG guided TAP block , this may most probably due to higher concentration of the local anaesthetic.

The current study goes with Levent Sahin et al.[14] they compared the analgesic efficiencies of caudal blocks, ultrasound [US]-guided transverses abdominis plane [TAP] blocks, and ilio-inguinal/ilio-hypogastric [II/IH] blocks performed to provide postoperative analgesia in pediatric patients undergoing unilateral lower abdominal surgery. The doses used were as follows: 0.5 ml/kg [group T], 0.3 ml/kg [group I], and 0.7 ml/kg [group C] of a 0.25% levobupivacaine solution with 1/200,000 adrenalin for the TAP block, II/IH block, and caudal block. The primary aim was to compare postoperative analgesic consumption within the first 24 hours after surgery. The secondary aim were to compare the mCHEOPS score, first analgesic requirement time, vital signs, and undesirable effects such as nausea and vomiting, which were recorded in the surgical ward at 1, 4, 8, 16, and 24 hours after surgery.they found that ninety patients with American Society of Anesthesiology physical status class I-II were randomized into 3 groups [group I, group T, and group C]. The total amount of analgesic consumption was significantly higher in Group I compared with Groups T and C [p=0.003]. Pain scores at 1, 4, and 8 hours were significantly higher in Group I compared with the other 2 groups; however, pain scores in Group I at 16 hours were significantly higher only compared with Group C [p<0.05].their Conclusion was caudal and TAP blocks are more effective than II/IH nerve blocks in the early postoperative period.

5. Conclusion

The results of the study showed that ultra-sound guided transverses abdominus plane block is more effective in postoperative analgesia when compared to local anaesthetic wound infiltration and ultra-sound guided ilioinguinal /iliohypogastric nerve block. Using dexmedetomidine as an additive to bupivacaine provides prolonged duration of postoperative analgesia, and lowered FLACC pain scores.

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