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RESEARCH ARTICLE

ADMINISTRATION OF LOCAL ANAESTHETIC BEFORE INTRAVENOUS CANNULATION REDUCES CANNULATION PAIN IN THE EMERGENCY DEPARTMENT.

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Abstract

Introduction: Local anaesthetic to relieve the pain of intravenous cannulation is widely used in paediatric and some anaesthetic practice. The application and the usage in patients presenting to emergency department is scarce. **Aim:** To study the applicability of local anaesthetic before inserting intravenous cannula in patients presenting to the emergency department. **Methodology:** This is a double blinded placebo controlled randomized study conducted on patients presenting to the emergency department. Total sample size was 450 and was divided into three equal groups' viz. Group A / study group (infiltration with local anaesthetic, Lignocaine 1% 0.5 ml using 27 gauge needle and insulin syringe.), Group B/ control I Group (infiltration with normal saline 0.5 ml using 27 gauge needle and insulin syringe.) and Group C/ control II Group (no infiltration). The hemodynamic changes pre and post cannulation and verbal pain rating scores were recorded by blind observers in all groups. **Results:** The post cannulation heart rates of the study group (91.77 ± 24.66) control II (98.03 ± 23.18) and control I (96.81 ± 21.87) groups differed significantly with P value 0.0485 (< 0.05). Pain scores in control-I and control-II groups do not vary significantly with P value 0.111. Post cannulation pain is having significant positive correlation with Increase in Heart rate (r = 0.671, P value < 2.2e-16) and also Increase in Diastolic Blood Pressure (r = 0.476, P value < 2.2e-16). Post cannulation pain was having significant positive correlation with increase in Heart rate (r = 0.671, P value < 2.2e-16) and also increased diastolic blood pressure (r = 0.476, P value < 2.2e-16). **Conclusion:** Intravenous cannulation can be made pain free with patient satisfaction and hemodynamic stability if carried out with prior local anaesthetic infiltration.

Introduction:-

Intravenous (IV) cannulation is one of the most common invasive procedures done in hospitals. About half of these patients receive intravenous therapy during their stay.[1] Local anaesthetic to relieve the pain of intravenous cannulation is widely used in paediatric and some anaesthetic practice.[1-7] The procedure is associated with pain, anxiety and frustration in patients and changes in hemodynamic parameters. Studies have shown that the use of local anesthesia decreases the pain of I /V cannulation.[2] The procedure is a skilled technique, best performed as a staged

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process.[6] Various methods are used including topical ethyl chloride, eutectic mixture of local anaesthetic (EMLA), intradermal or subcutaneous (SC) Lignocaine (lidocaine).[8] All have been shown to significantly reduce cannulation pain.[4,5,8] SC Lignocaine injection has been shown to be less painful than insertion of 18, 20 and 22 gauge cannula. Post-cannulation insertion site pain may be abolished by the use of local anaesthetic (LA).[5] In spite of the evidence favouring the use of LA; many clinicians do not use it, believing that the pain inflicted is minimal or not worth the time and expense of LA application [7].

A further reason for emergency clinicians not using LA is that most studies have been performed on non-emergency patients. The majority of studies have been performed on children and preoperative adults cannulated in the operating room awaiting routine surgery, who are likely to be anxious about the surgery and related procedures. It is postulated that the anxiety of emergency department (ED) patients is different, in that it is often related to the presenting complaint compared with the imminent procedure. More patients in the ED will be in pain on attendance. These factors may change the perception of pain. EMLA cream has been used extensively in pediatrics, but needs 30–60 minutes to create effective analgesia[8, 11] and thus is not suitable for many emergency conditions. SC Lignocaine 1% is effective quickly and is widely available in nearly all Emergency Departments.

Materials and Methods:-

The study was conducted in patients attending Emergency Department of Peerless Hospital and requiring insertion of I.V. cannula. The duration of the study was approximately 1 ½ year between December 2015 to August 2017 after getting ethical approval from the ethical committee and proper consent from the patients who wanted to be a part of this study. viz. Group A / study group (infiltration with local anaesthetic, Lignocaine 1% 0.5 ml using 27 gauge needle and insulin syringe 30 seconds before cannulation.), Group B/ control I Group (infiltration with normal saline 0.5 ml using 27 gauge needle and insulin syringe 30 seconds before cannulation.) and Group C/ control II Group (no infiltration).

Patients were **included** were if: (1).Age should be over 8 year's (2).ED presentation requiring cannulation.(3).Non-critical condition (4).GCS 15 (5).Conscious and oriented

Exclusion criteria were if: (1.) Allergy to lignocaine (2) Dementia, acute brain syndrome (3)Drugs ingested that may change pain perception (including opioids and alcohol) (4) Refusal to participate (5)Potentially difficult cannulation

Patients were randomly selected by Nursing and medical staff (interns, medical officers, residents, registrars and specialists) working within the ED and have performed intravenous cannulation according to the following protocol. The operator performing the cannulation had to choose a sealed envelope containing a plain language statement explaining the trial to the patient, a consent form, data collection form and a visual analogue/numerical pain scale. One third of envelopes contained a 27 gauge insulin syringe and a masked vial of Lignocaine, one third contained the syringe and a masked vial of saline and the remainder contained neither syringe nor vial. Masked syringes were prepared and numbered by two Emergency Department Consultants and both the researcher and the participants (doctors, nurses and patients) remained blinded during the study. The decoding was done by the medical statistician during data analysis.

The patient was fully explained about the study and written consent was obtained. Proper aseptic measures were taken. The skin was prepared with chlorhexidine/ alcohol. In group C, a cannula was chosen by the staff member according to the patient's need and inserted, in groups A and B 0.5 ml of Lignocaine 1% and saline was injected respectively by slow SC injection with 27 gauge needle.. The cannula was inserted after 30 seconds.

In all groups the patients pre and post cannulation Heart rate, Blood Pressure and Respiratory rate noted was then asked to mark the pain on a visual analogue scale (VAS) and numerical scale as recommended by Ho et al.[15]

Results:-

Patients in Study group, Control-I and Control-II groups do not vary significantly with respect to age, sex, employment category, years of experience and no. of iv cannula of participating cannulators with P value > 0.05. Test statistic used chi-square test. Patients in Case/Study, Control-II and Control-I groups do not vary significantly with respect to site of insertion, no. of attempts and size of cannula with P value > 0.05.

Pre cannulation heart rates of study group, control II and control I groups, respiratory rates of case control II and control I groups, systolic blood pressure (SBP) of study group control II and control I groups and diastolic blood pressure (DBP) of case control II and control I groups do not differ significantly with P value > 0.05 (refer to Table 1).

Table I:- Clinical Outcomes (mean ± sd) of Patients of all three groups.

Clinical Outcomes	**Study (n=150)**	**Control-II (n=150)**	**Control-I (n=150)**	**P value**
Heart Rate (Pre)	90.93 ± 23.98	90.19 ± 23.18	88.05 ± 21.65	0.5273
Heart Rate (Post)	91.77 ± 24.66	98.03 ± 23.18	96.81 ± 21.87	0.0485 **
Heart Rate (Post – Pre)	0.75 ± 1.92	7.84 ± 4.04	8.76 ± 4.52	< 2.2e-16 **
Respiratory Rate (Pre)	18.12 ± 2.99	18.41 ± 3.17	18.43 ± 3.22	0.6222
Respiratory Rate (Post)	18.17 ± 3.09	18.31 ± 3.11	18.34 ± 3.13	0.8761
Respiratory Rate (Post – Pre)	0.05 ± 0.50	-0.11 ± 1.16	-0.09 ± 1.21	0.3451
SBP (Pre)	119.93 ± 1.42	120 ± 0	120 ± 0	0.7178
SBP (Post)	127.6 ± 25.38	133.68 ± 24.21	133.68 ± 24.10	0.0468**
SBP (Post – Pre)	7.67 ± 25.32	13.68 ± 24.21	13.68 ± 24.10	0.0498 **
DBP (Pre)	78.57 ± 11.48	78.7 ± 11.56	78.47 ± 11.61	0.9846
DBP (Post)	78.57 ± 11.72	81.87 ± 11.13	81.77 ± 11.21	0.0165 **
DBP (Post – Pre)	0.0 ± 1.16	3.17 ± 3.31	3.31 ± 3.76	< 2.2e-16 **

** P Value < 0.05 implying significant difference

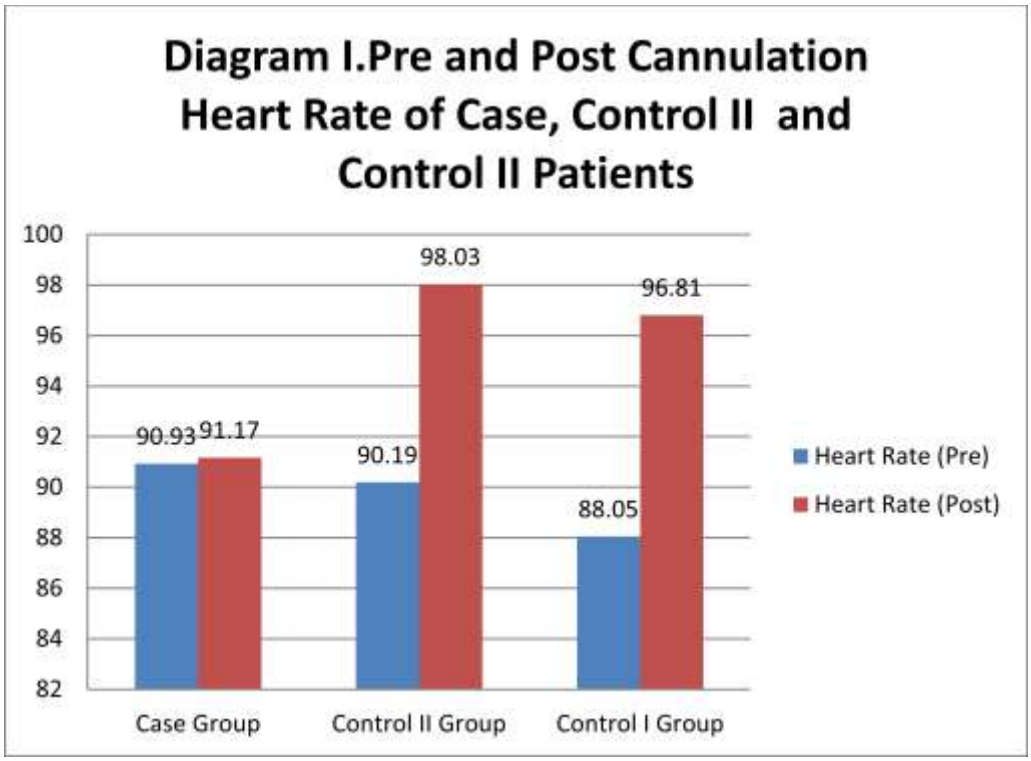
Table II:- Post Cannulation Increase in Heart rate, Systolic and Diastolic Blood Pressure

Clinical Outcomes (Post – Pre)	**P - value**		
	Case/Study vs Control II	**Case/Study vs Control I**	**Control - I vs Control - II**
Increase in Heart Rate	< 2.2e-16**	< 2.2e-16**	0.06324
Increase in SBP	0.0357**	0.03537**	1
Increase in DBP	< 2.2e-16**	< 2.2e-16**	0.7441

**P Value < 0.05 implying significant increase

Post cannulation heart rates of case control II and control I groups differ significantly with P value 0.0485 (< 0.05). Post and pre cannulation differences in study group, control II and control I groups vary significantly. Post and pre cannulation differences in control II group is significantly greater than the study group patients also the difference in control I group is significantly greater than study group with P value < 2.2e-16 (<0.05) but the post and pre cannulation differences in control I and control II groups do not vary significantly with P value 0.06324 (> 0.05). (Refer to TABLE 2).

Post cannulation Pain scores in study group, control-II and control-I groups differ significantly. Post cannulation pain scores in control II groups is significantly greater than study group and pain scores in control-I group is significantly greater than study group with Pain scores in control-I and control-II groups do not vary significantly (Table 3 ,Table 4 and chart 1)



Besides aim of study and while analyzing the data Simple linear regression (table 6) shows age of patient and size of cannula are significant factors for post cannulation pain and age of patient and size of cannula are significant factors for post cannulation increase in Heart rate. Age of patient, site of insertion and size of cannula are significant factors for post cannulation increase in Respiratory rate .Age of patient and size of cannula are significant factors for post cannulation increase in Systolic Blood Pressure. Age of patient is significant factors for post cannulation increase in Diastolic Blood Pressure.

TABLE III:- Post Cannulation Pain Scores (mean ± sd)

Study Gr (n=150)	**Control-II (n=150)**	**Control-I (n=150)**	**P value**
0.69 ± 1.06	6.69 ± 2.49	6.24 ± 2.44	< 2.2e-16 **

**P Value < 0.05 implying significant differenc

Table IV:- Post Cannulation Pain

P Value	
Study group vs Control-II	< 2.2e-16**
Study group vs Control-I	< 2.2e-16**
Control-I vs Control-II	0.111

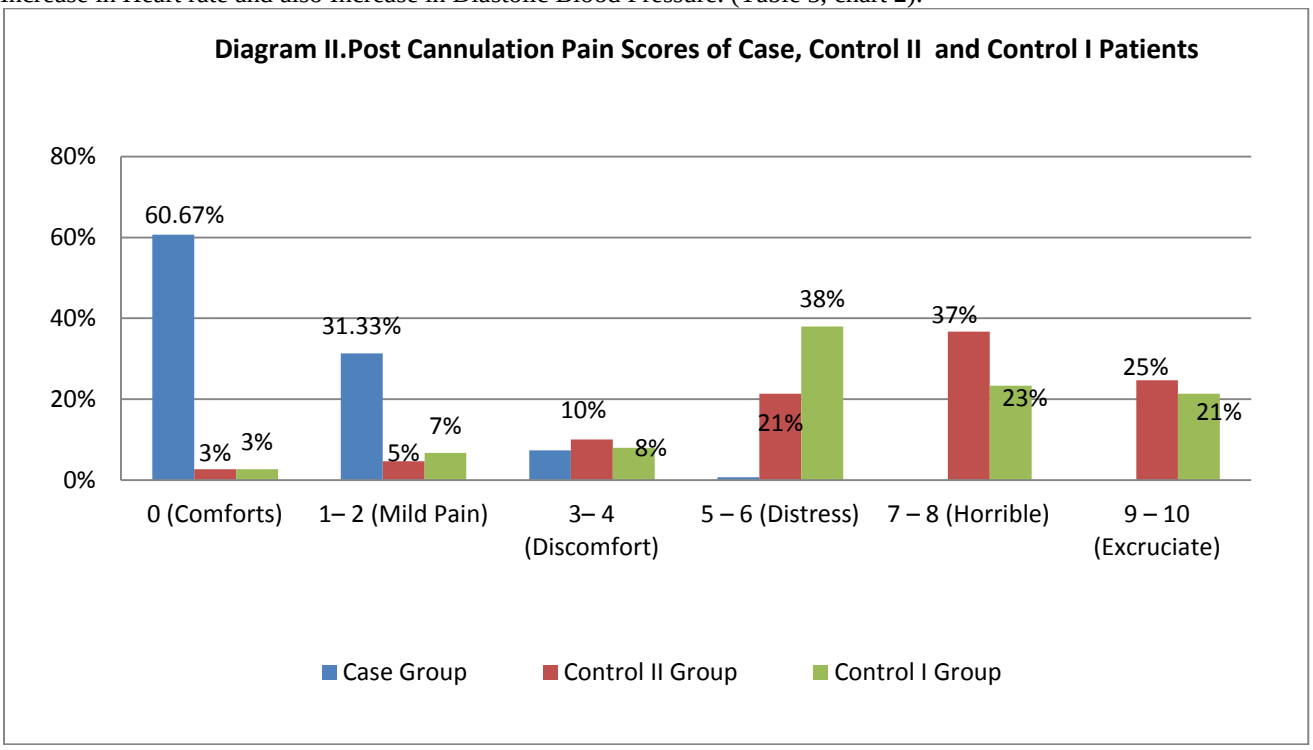
**P Value < 0.05 implying significant difference

Table V:- Correlation coefficient of Pain Scores with different clinical parameters (n=450)

Clinical Parameters (Post – Pre)	**Pearson's Correlation Coefficient (r)**	**P value (greater than) for positive correlation**
Increase in Heart Rate	0.671	< 2.2e-16**
Increase in Respiratory Rate	-0.0003	0.5022
Increase in Systolic Blood Pressure	0.066	0.08
Increase in Diastolic Blood Pressure	0.476	< 2.2e-16**

***P Value < 0.05 implying significant positive correlation coefficient*

During the data analysis it was observed Post cannulation pain is having significant positive correlation with Increase in Heart rate and also Increase in Diastolic Blood Pressure. (Table 5, chart 2).



Multiple linear regressions shows age of patient is significant factor for post cannulation pain, post cannulation increase in Heart rate, increase in Respiratory rate, increase in Systolic Blood Pressure and also increase in Diastolic Blood Pressure.

Table VI:- Univariate Linear Regression

	P value (for non-zero regression coefficients)				
Factors	**Pain Scores**	**Heart Rate (Post-Pre)**	**Respiratory Rate (Post-Pre)**	**SBP (Post-Pre)**	**DBP (Post-Pre)**
Patients Demography					
Age	0.00188 **	0.0094**	0.0381 *	< 2.2e-16 **	0.0148*
Sex	0.1217	0.0396*	0.4804	0.8131	0.6868
Insertion of Cannula					
Site of Insertion	0.4613	0.74	0.0013**	0.2957	0.9291
No. of attempts for insertion	0.0723	0.1877	0.2277	0.4529	0.6662
Size of Cannula	0.0007 **	0.0164*	0.00015 **	1.845e-11 **	0.3435

Discussion:-

This study was done to see the effectiveness of the 1% Lignocaine S/C before IV cannula insertion. The intervention was carried out with the potential benefits to decrease the intensity of pain during IV cannulation. Significant changes in the vital signs of the subjects were also observed. It showed that the local anaesthetic infiltration prior to Intravenous cannulation was more effective to reduce pain and provide patient satisfaction with almost no change in the hemodynamics of patient and the placebo with Normal saline was done with same way the Lignocaine was given and it was clearly found that patients who received the Lignocaine had no pain during Intravenous cannulation while other two groups had pain during the procedure with significant change in hemodynamics.

The hemodynamic surge noticed immediately after the intravenous cannulation was consistent with the study conducted by Rohm KD et al [3] The pain of IVC is sharp, but remains for a short period of time and this is the reason why immediately after intravenous cannulation vital parameters were checked.

This increases patient's acceptability of our invasive procedure. In this study the both numerical as well as verbal rating of pain[10] was followed for convenience to our general population during post procedural interviewing. We found that following both verbal as well as numerical adopted in this current research was more convenient and comfortable to both patients and clinicians.

Majority of patients in Group A were satisfied and took the procedure very easily as they did not feel any pain due to prior infiltration of the site with local anaesthetic agent. Larger catheter gauge was correlated with greater pain during cannulation.[11;]

The site for IV cannulation in our study was any site with no restriction on the cannula size. The size of veins cannulated might differ from one patient to another. The age, body weight and physique may play a role in this regard. Obese patients may predispose difficulty in IVC.

In a study by Holdgate et al [14,] they found subcutaneous lidocaine did not significantly affect the success rate of IVC on the first attempt and support the use of local anesthetic infiltration for all routine venous cannulation. There is a concern that the local anesthetic infiltration may distort the puncture site and obscure the veins, but this may be prevented by using 0.3-0.5 ml of the agent which quickly dissipates from the site.

There are various methods to reduce pain and anxiety of IVC by applying eutectic mixture of local anaesthetics (EMLA) cream at the puncture site[15] or preoperative use of oral clonidine, an alpha2 agonist, during pre-anaesthetic visit for this purpose.[16] Both these agents have effect after minimum 40 min and waiting so long in the Emergency department is not possible. Lidocaine infiltration is a simple and noble technique to be adopted. Cultivating this habit prior to venous cannulation definitely improves patient satisfaction at no added cost.

Conclusion:-

Local anaesthetic infiltration with lidocaine at the site of venous cannulation significantly reduced pain and gave maximum patient satisfaction without causing hemodynamic stress during the procedure.

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