

# The role of virtual reality on pain during intravenous cannulation and preoperative separation anxiety in paediatric patients: A prospective randomised study

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## Abstract

**Background:** Pain and anxiety in paediatric patients creates significant problems for the patients and the treating physicians. Virtual reality is a relatively new intervention that can be used to provide distraction. **Aim:** The aim of the proposed study is to evaluate virtual reality (VR) as a non-pharmacological intervention tool to reduce pain and anxiety in patients of paediatric age group undergoing intravenous cannulation. **Methods:** This was a prospective randomised trial that enrolled paediatric patients of age group 7-11 years. Patients were randomly allocated to virtual reality group where they were made to wear VR headgear and videos were played and standard Emla cream group where cream was applied at the intended site of intravenous cannulation. **Results:** Patients using VR exhibited lower pain and anxiety score during intravenous cannulation. **Conclusions:** This current study found that application of immersive VR had better pain alleviation and parent separation anxiety score when compared with non-VR group patient.

**Key Word:** intravenous cannulation, preoperative separation anxiety.

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## INTRODUCTION

Pain and anxiety have a direct correlation, patients who experience anxiety are more susceptible to feel the pain. This is significantly more specific in pediatric patients and is known to cause short and long term consequences.

Preoperative anxiety can also cause emergence delirium and studies have shown significant psychological changes in two weeks after the surgery and the post trauma stress symptoms persisting upto 6 months in the age group of 6-18 year old<sup>1,2</sup> Pharmacological interventions to treat preoperative anxiety in children has its own side effects. Hence, Non-pharmacological interventions could help avoid these complications.<sup>3</sup> With advent of VR, its application in medical field is growing immensely, its inherent distraction from the outer world has allowed doctors to evaluate its potential applications. One such application is distracting a child to help to reduce the separation anxiety and pain. Virtual reality is a technology that allows individuals to experience a virtual world. VR allows the patients to be immersed in an interactive world stimulating sights, sounds and its been hypothesized that more immersion is related to more pain reduction

ultimately reducing the anxiety.<sup>2,4</sup> Considering the paediatric case load and the existent practices in our BGS GIMS hospital and also the noninvasive non-pharmacological nature of VR, we propose to study the role and feasibility of using VR during IV cannulation. Our objective is to determine the role and feasibility of using VRH to reduce pain during IV cannulation and anxiety during parent separation

**MATERIALS AND METHODS**

the proposed study is a prospective randomized control study. After institutional ethical committee approval and written informed consent from parents and the guardians study was conducted in our institution. Study population - ASA physical status I,II posted for elective surgeries study was conducted between April 2009-february 2020

Sixty patients were randomized into two groups and patients were randomly allocated to either of the group based on the computer generated tables:

Group A-VR group

Group B-EMLA patch

**Inclusion criteria:** ages of 7-11 of either sex undergoing elective surgery

Exclusion criteria: cognitive impairment, history of epilepsy, iv cannula in place or previous attempt of iv cannulation done, History of previous surgery, Allergic to EMLA cream, ASA physical status>II Group A-On the previous day of the surgery to get the patient acquainted to the VR gadget a standardized trial video was played and the child is sensitized to the gadget .VR effectively immerses a child in a virtual environment where the child can swim with dolphins or play cricket game etc On the day of surgery ,before shifting the patient, to the preoperative room , the children were made to wear the gadget with the head gear powered by smartphone playing the videos and were allowed to watch the videos and transferred to the operation theatre, preoperative room from the ward Group B – emla cream is applied at the site where iv cannulation is intended to perform 1 hour prior And in both the groups, an observer who is blinded to either group is asked to assess the pain during IV cannulation using faces pain scale and parent separation anxiety. Heart rate and oxygen saturation were measured using pulseoximeter ten minutes preprocedure ,during and ten minutes post procedure

**RESULTS**

Children had moderate anxiety and had severe anxiety children had anxiety with regard to separation anxiety and about the unfamiliar people and environment statistical analysis of the heart rate and saturation done using paired t test

**Table 1**

Descriptive Statistics					
Groups		Age	Weight kg	Parental separation anxiety scale	Facespain scale
Group A	Mean	8.200	29.567	2.533	5.300
	SD	.9613	5.1774	.9732	1.3170
Group 2	Mean	8.243	29.033	3.533	6.533
	SD	1.4325	3.7184	.5074	1.1666
Total	Mean	8.222	29.300	3.033	5.917
	SD	1.2097	4.4771	.9200	1.3814

**Table 2**

Paired Samples Statistics							
	Group A	Mean	SD	SEM	paired t test	P value	Significance
Pair 1	@10minspreHR	86.00	7.58	1.38	1.789	.084	Not Significant
	DuringprocedureHR	83.77	6.72	1.23			
Pair 2	@10minspreHR	86.00	7.58	1.38	.754	.457	Not Significant
	@10minspostprocedureHR	84.83	6.57	1.20			
Pair 3	DuringprocedureHR	83.77	6.72	1.23	-.747	.461	Not Significant
	@10minspostprocedureHR	84.83	6.57	1.20			
Pair 4	@10minspreprocedureSPO2	99.40	0.81	0.15	-.895	.378	Not Significant
	DuringprocedureSPO2	99.57	0.68	0.12			
Pair 5	@10minspreprocedureSPO2	99.40	0.81	0.15	-1.943	.062	Not Significant
	@10minspostprocedureSPO2	99.77	0.43	0.08			
Pair 6	DuringprocedureSPO2	99.57	0.68	0.12	-1.649	.110	Not Significant
	@10minspostprocedureSPO2	99.77	0.43	0.08			

Table 3

Paired Samples Statistics								
	Group B	Mean	N	SD	SEM	paired t test	P value	Significance
Pair 1	@10minspreHR	88.333	30	8.3018	1.5157	7.603	<0.0001	Highly
	DuringprocedureHR	82.267	30	7.2964	1.3321			Significant
Pair 2	@10minspreHR	88.333	30	8.3018	1.5157	10.792	<0.0001	Highly
	@10minspostprocedureHR	76.700	30	7.3866	1.3486			Significant
Pair 3	DuringprocedureHR	82.267	30	7.2964	1.3321	6.290	<0.0001	Highly
	@10minspostprocedureHR	76.700	30	7.3866	1.3486			Significant
Pair 4	@10minspreprocedureSPO2	99.967	30	.1826	.0333	2.340	<0.05	Significant
	DuringprocedureSPO2	99.667	30	.6609	.1207			
Pair 5	@10minspreprocedureSPO2	99.967	30	.1826	.0333	2.249	<0.05	Significant
	@10minspostprocedureSPO2	99.733	30	.5208	.0951			
Pair 6	DuringprocedureSPO2	99.667	30	.6609	.1207	-.626	.536	Not Significant
	@10minspostprocedureSPO2	99.733	30	.5208	.0951			

## DISCUSSION

patient pain and anxiety are undesirable side effects which causes heightened discomfort to the treating physician. The confines of a hospital environment can be stressful experience for a child and its worth noting here that stress and anxiety heighten ones perception of pain so measures like use of VR helps to scale down anxiety which will in turn alleviate pain.

VR is one such advanced technology where in patients are immersed in a simulated environment with sounds and motion to enhance the experience and aims to introduce VR as a non pharmacological pain reduction tool. Adeel Faruki *et al.* have concluded that with introduction of non pharmacological interventions potentially reduces the use of sedation and still providing a satisfactory perioperative experience.<sup>3</sup> Hoff man hg *et al.*<sup>4</sup> in their study using functional MRI of patients using VR while being exposed to painful stimulus showed a greater 50% reduction in brain related activity and they have also found that VR and opioid analgesia combination resulted in significant reduction in pain perception –child health<sup>5,6</sup>

Robin *et al.*<sup>9</sup> in their study on young adults of 10-25 years of age group found that the use of VR software for children with sickle cell acute pain crisis exhibited reduction in 16% pain intensity- child health. A study by gerheon *et al.* found that use of VR distraction in patients with childhood cancer have decreased level of anxiety and pain during placement of subcutaneous venous port when compared to non VR and standard treatment group. Malamed SF *et al.* in their studies have shown association of anxiety with pain as there is increased sympathetic activity thus producing endogenous adrenaline causing increased pain through the awareness of nociceptors.<sup>8</sup> Wolitzxy *et al.* concluded use of VR during port insertion for chemotherapy found that no differences in self-reported, parent observed or nurse observed pain or anxiety (VAS) during procedure.<sup>9</sup> Andrea Stevenson *et al.* studied the role of immersive VR and concluded that VR is a promising new technology that can

be used for acute and procedural pain and also in chronic pain via neuromodulation as well as physical therapy.<sup>10</sup> Preoperative anxiety strongly differs with age. Older children may have fear of undergoing surgery and pain associate. And younger children may suffer from fear of strangers and separation anxiety.<sup>11</sup> Anna maria Iannicelli *et al.* concluded that VR seems to be effective tool for pain reduction in paediatric patients similar to our study.<sup>12</sup> Biffi *et al.* in their study on 12 children with acquired brain injury used interactive VR system called GRAIL (gait real time analysis interactive lab) found improvement in walking abilities leading way to use VR in rehabilitation.<sup>13</sup> Malloy KM, Milling Ls in their study found VR to be an innovative intervention to improve induction of anaesthesia in children is providing a virtual reality tour of the operative room environment and anaesthesia procedures prior to surgery.<sup>14</sup> Sato *et al.* used VR for treating complex regional pain syndrome in patients and found 50% reduction in the pain intensity which is in sync with present study.<sup>15</sup> Moerman *et al.* in their study noted that the HR and BP are the dependent variables to assess anxiety levels in behavioural studies similar to our study.<sup>16</sup> Several studies have shown that multimodal pain therapy has greater effectiveness and the use of VR in pain therapy has added advantage and has greater effectiveness along with pain therapy. Recent advances in technology has led to reduced cost and ease of access of VR.

## CONCLUSION

The current study concludes that immersive VR is an effective tool to alleviate anxiety of patient and in turn reduces the burden of sedation. While more studies are needed to better understand the effect of VR in a larger study group in perioperative period for both acute and chronic pain.

## REFERENCES

1. Robin Eijlers, Lonneke M Staals, Jeroen Legerstee Journal of Clinical Psychology in Medical Settings (2021)28:313-322
2. Ben Amitay, G Kosov, I Reiss A Toren Kotler M et al. (2006).journal of paediatrics and child health,42(10)618-624
3. Faruki, Thynguyen, Samantha Proeschel, Nadav Levy, Jessica YU Trials(2019)20:782
4. Hoffman HG, HG Sharer Sr et al. Pain 2004;111:162-168
5. Hoffman HG, Richards TL Coda B Bills et al. AR 2004;neuroreport 2004;25(7):2013-4
6. Hoffman HG, Richards T L, Van Oostrom et al. Anesth Analg2007;105(6):1776-83
7. Agaezi Onwuasoanya DCJ Anaesth Pain Med,2016,vol 1,issue2|of 2
8. V R Shweta, RP Abhinav Ann Maxillofac Surg 2019 Jan - Jun ;9(1):110-113
9. Robin Eijlers, Elisabeth M Wjutensanaesth Analgesia, Nov 2019,Vol 129 No5
10. Andrea Stevenson Won, Jakki Bailey, Jeremy Bailenson Children 2017,4,52.
11. J Berghmans, J. M. Poley. M, Weber.F., Minerva Anesthesiologica81,145-146
12. Anna Maria Lannicelli Daniele Vitoitalian Journal of Paediatrics(2019)45:171
13. Biffi E, Bereetta E, Cesareo A Maghini C Methods Inf Med 2017,56,119-126
14. Malloy, KM, milling IS, Clini Psychol Rev2010;30:1011-1018
15. Sato K, Fukumori S, Matsusaki T.Pain Med .2010;11:622-9
16. Moerman N, Van Dam FS, Muller MJ, Anesth Analg.1996;82:445-51

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