EFFICACY OF SUBANESTHETIC DOSE OF KETAMINE IN PREVENTING EMERGENCE AGITATION IN ADULT PATIENTS UNDERGOING ELECTIVE LAPAROSCOPIC APPENDICECTOMY UNDER GENERAL ANAESTHESIA: A RANDOMIZED CONTROL TRIAL

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ABSTRACT

BACKGROUND: We wanted to conduct a study to check the efficacy of a sub-anesthetic dose of Ketamine in preventing emergence agitation in adult patients posted for Laparoscopic Appendicectomy under General Anaesthesia.

METHODOLOGY: It was a prospective, randomized, double-blinded controlled trial conducted on 100 patients of either sex in the age group of 25-45 years of ASA -PS I and II in the Department of Anaesthesiology and Critical Care, at Government Medical College, Kadapa through the study period from March 2021 – October 2022

RESULTS: The study included 100 patients randomly divided into two groups, group 50 patients received 5ml of normal saline 20 min before the end of the surgery, and group B 50 patients received 0.2 mg/kg inj. Ketamine 20 min before the end of surgery. Parameters such as emergence agitation assessed by RSAS, pain by NRS, and adverse effects. In this study, none of the patients in Group B develop EA as compared to Group A, postoperative pain was significantly lower in Group B as compared to Group A. There were no adverse effects in the Groups.

CONCLUSION: We concluded that the dose of 0.2 mg/kg ketamine given 20 mins before the end of the surgery is effective in preventing ED in adult patients after general anaesthesia.

KEYWORDS: Emergence Agitation(ED), Ketamine, Laparoscopic Appendicectomy.

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INTRODUCTION: The issue of emergence agitation (EA) has been identified as one that may occur because of general anaesthesia recovery. Emergence Agitation (EA) is characterised by agitation, confusion, and excitation and/or uncontrollable sobbing are frequent occurrences during early general anaesthesia recovery[1] This syndrome could result in nausea, vomiting, and respiratory depression and may also result in an increase in myocardial oxygenation consumption, heart rate, and blood pressure. It may cause operational disruption in adults. It raises the possibility of harm to oneself or to their medical team, falling out of bed, a delayed discharge, more severe internal bleeding, accidentally removing an intravenous (IV) cannula, from the surgical site drain removal and rising medical expenses among those who are admitted to the post-anaesthesia care unit (PACU)[2] Pharmacological intervention may be necessary, which could lead to a lengthy stay in the post-anaesthesia care unit (PACU). Clinical outcomes are improved when emerging agitation is prevented

effectively. Even though the precise reasons for postoperative anxiety after general anaesthesia have not yet been fully explained, several risk factors for EA mentioned things like postoperative discomfort, nervousness before surgery, and individual symptoms of the patient including nausea, vomiting, and too quickly awakening.

Sevoflurane is an inhalation anaesthetic that poses a risk factor. [4,5,6] Even though it was contented that children experienced EA more frequently, its prevalence among adults has been estimated at up to 21.4%.[3] This can be prevented by administering ketamine at sub-anaesthetic dose. Hence, I want to study the efficacy of ketamine at sub-anaesthetic doses in preventing emergence agitation.

AIMS&OBJECTIVES-

Aim of the study -This study is designed to determine the efficacy of ketamine at sub-anaesthetic doses in preventing emergence agitation in adult patients undergoing laparoscopic appendicectomy under general anaesthesia.

Objectives of the study-

1. The primary objective is to compare the emergence of agitation levels after extubation and in post anaesthesia care unit utilising the Ricker sedation- agitation scale in both groups.

2. The secondary objectives are to compare the postoperative pain using the Numerical rating scale and adverse effects in both the groups

METHODOLOGY:

Study Design: Prospective, randomized, double-blinded study. The study was started after receiving Institutional Ethical Committee approval and written informed consent from all the patients.

Randomization: Simple randomized sampling was done by computer-generated random numbers

Group allocation: Patients were allocated into two groups.

Group A (n= 50): Patients receiving Normal saline

Group B (n= 50): Patients receiving Ketamine

Blinding: Anesthesiologists who are not involved in the study prepare the study's medications. Until the trial's conclusion, the anesthesiologist observing the patient is uninformed of the study group

Inclusion criteria:

1. Age between 25 to 45 years.

2. ASA PS 1 and 11

Exclusion criteria:

1. Patients having a severe systemic illness (cardiac, hepatic, renal pulmonary, endocrinal, neurological, or psychiatric disease),

2. Patients with substance abuse disorder,

3. Patients have a body mass index of >35 kg/m2,

4. Patients with known allergic reactions to study drug

5. Mentally retarded patients 6. Pregnant and lactating mothers

Preoperative evaluation: During the preoperative visit, the patient's detailed history, general physical examination, and systemic examination were evaluated. Routine investigations like haemoglobin, blood grouping and typing, bleeding time and clotting time, blood sugar, blood urea, serum creatinine, chest X-ray PA view, and ECG were done in all patients. Demographic characters like age, sex, height, and weight were recorded and written informed consent was obtained.

Premedication: All the patients received oral Ranitidine 150mg and Alprazolam 0.25 / 0.5mg on the night before surgery.

General Anaesthesia procedure: After shifting the patients to the operative room, ASA standard monitors such as Non-invasive blood pressure (NIBP), ECG, and Pulse Oximeter (SpO2) were connected, and an 18 Gauge Intravenous line was secured. Baseline vital parameters -BP, HR, and SpO2 were noted. Patients were allocated randomly to each group by computer-generated randomization so that each group consisted of 50 patients. Patients were preoxygenated with 100% Oxygen for 3 minutes, premedicated with Inj.Glycopyrrolate4µ/kg, Inj Fentanyl 2µ/kg, Inj. Midazolam 0.02mg/kg , ondansetron 0.1mg/kg. The patient was induced with intravenous Propofol 2mg/kg. After ensuring adequate mask ventilation, patients were paralyzed with intravenous Vecuronium 0.1mg/kg. Heart rate (HR), systolic blood pressure(SBP), diastolic blood pressure(DBP), mean arterial pressure(MAP), and SpO2 were recorded before intubation. After securing the endotracheal tube, anaesthesia was maintained with Nitrous oxide, oxygen (60:40), and sevoflurane (2%) The study drug is prepared and diluted to 5ml by an anaesthesiologist not participating in the study In GROUP A, patients received normal saline 20 min before the end of surgery, (n=50). In GROUP B, patients received 0.2mg/kg of ketamine 20 min before the end of the surgery, (n=50) Intra operatively hemodynamic variables like heart rate, blood pressure, oxygen saturation, and EtCO2.The study drug is given by the anaesthesiologist not participating in the study 20 minutes before the end of the surgery. After the onset of spontaneous respiration, the neuromuscular blockade is reversed with Inj. Neostigmine 0.05mg/kg and Inj. Glycopyrrolate 8µg/kg.

The patients were assessed for emergence agitation at extubation and PACU by using the Ricker sedation agitation scale and pain was assessed by Numerical Rating Scale. If any patients developed emergence agitation in the control group which was treated by an intravenous bolus dose of in.Ketamine 0.2mg/kg.

OBSERVATIONS AND RESULTS-

Table 1: COMPARISON OF AGE DISTRIBUTION

	GroupA(n=50) Mean±SD	GroupB(n=50) Mean±SD	Mean age Difference	Student's independent t-test
Age(in years)	30.26 ± 5.4	31.52 ± 5.47	1.26	t=1.15 p=0.25 not signific

Table 2: COMPARISON OF GENDER DISTRIBUTION

Gender	Group A		Group B		Chi-square test
	n	%	n	%	
Male	30	60.00%	30	60.00%	χ2=0.00 P=1.00(N
Female	20	40.00%	20	40.00%	
Total	50	100.0%	50	100.00%	

Table 3: COMPARISON OF HEIGHT DISTRIBUTION

	GroupA(n=50) Mean±SD	GroupB(n=50) Mean±SD	Mean height Difference	Student's independent t-test
Height (in cm)	165.24 ± 6.1	165.06 ± 5.0	0.18	± 5.05 0.18 t=0.16 p=0.87 not significa

Table 4: COMPARISON OF WEIGHT DISTRIBUTION

	GroupA(n=50) Mean±SD	GroupB(n=50) Mean±SD	Mean weight Difference	Student's independent t-test
weight (in kg)	71.96 ± 9	70.02 ± 8.9	1.94	t=1.03 p=0.30 not significant

Table 5: COMPARISON OF LEVEL OF ASA

ASA	Group A		Group B		Chi-square test
	n	%	n	%	
Grade1	41	82.00%	44	88.00%	χ2=0.00 P=1.00(N
Grade2	9	18.00%	6	12.00%	
Total	50	100.0%	50	100.00%	

TABLE 6: COMPARISON OF EXT, RASS,NRS IN TWO GROUPS OF PATIENTS

	Group				Mean difference	Student independent Group A Group B t-test
	Group A		Group B			
	Mean	SD	Mean	SD		
TIME TO EXTUBATE	5.06	.47	4.04	.28	1.02	t=13.15 p=0.001***(S)
RASS	5.04	.45	4.08	.34	0.96	t=12.03 p=0.001***(S)
NRS	5.16	.65	4.14	.70	1.02	t=7.55 p=0.001***(S)

TABLE 7: COMPARISON OF HEART RATE (bpm) IN TWO GROUPS OF PATIENTS

Heart Rate (bpm)	Group				Mean difference	Student t-test
	Group A		Group B			
	Mean	SD	Mean	SD		

BL	87.54	13.14	85.46	12.90	2.08	t=0.80 p=0.43(NS)
SI	89.94	10.94	89.52	10.13	0.42	t=0.20 p=0.84(NS)
15 min	93.66	14.51	93.76	14.66	-0.1	t=0.03 p=0.97(NS)
30min	89.48	11.51	89.60	11.38	-0.12	t=0.05 p=0.95(NS)
45min	88.26	9.65	88.84	10.15	-0.58	t=0.29 p=0.77(NS)
60min	88.36	8.22	87.90	9.11	0.46	t=0.27 p=0.79(NS)
Ext	109.68	11.01	91.26	12.15	18.42	t=7.94 p=0.001***(S)
10min	108.16	10.44	87.18	10.54	20.98	t=9.99 p=0.001***(S)
20min	105.26	6.33	86.22	9.11	19.04	t=12.13 p=0.001***(S)
30min	105.78	8.54	87.02	7.199	18.76	t=11.88 p=0.001***(S)

TABLE 8: COMPARISON OF SBP (mmHg) IN TWO GROUPS OF PATIENTS

SBP (mmHg)	Group				Mean difference	Student t-test
	Group A		Group B			
	Mean	SD	Mean	SD		
BL	114.04	9.45	114.24	9.21	-0.20	t=0.11 p=0.91(NS)
SI	113.32	8.79	113.52	8.50	-0.20	t=0.12 p=0.91(NS
15 min	112.32	9.35	112.54	9.04	-0.22	t=0.13 p=0.90(NS)
30min	112.48	9.69	112.76	9.39	-0.28	t=0.15 p=0.88(NS)
45min	112.40	8.83	112.68	8.57	-0.28	t=0.16 p=0.87(NS)
60min	112.64	8.60	112.84	8.32	-0.20	t=0.12 p=0.90(NS)
Ext	130.80	9.21	121.40	6.22	9.40	t=5.98 p=0.001***(S)
10min	123.32	9.49	116.84	7.34	6.48	t=3.82 p=0.001***(S)
20min	128.12	6.37	112.52	8.96	15.60	t=10.03 p=0.001***(S)
30min	128.96	6.64	113.20	8.54	15.76	t=10.30 p=0.001***(S)

TABLE 9: COMPARISON OF DBP (mmHg) IN TWO GROUPS OF PATIENTS

DBP (mmHg)	Group				Mean difference	Student t-test
	Group A		Group B			
	Mean	SD	Mean	SD		
BL	76.24	6.37	76.46	6.48	-0.22	t=0.17 p=0.86(NS)
SI	71.44	6.71	71.54	6.94	-0.10	t=0.07 p=0.94(NS)
15 min	69.52	6.61	69.66	6.94	-0.14	t=0.10 p=0.91(NS)
30min	69.00	6.30	69.14	6.62	-0.14	t=0.11 p=0.90(NS)
45min	68.64	5.76	68.78	6.12	-0.14	t=0.12 p=0.90(NS)
60min	69.04	5.73	69.28	5.71	-0.24	t=0.21 p=0.83(NS)
Ext	78.48	8.83	70.88	6.25	7.60	t=4.96 p=0.001***(S)
10min	83.00	4.82	80.76	5.79	5.78	t=2.10 p=0.03*(S)
20min	79.48	6.07	75.32	5.74	4.16	t=3.52 p=0.001***(S)
30min	92.84	7.59	85.00	7.73	7.84	t=5.12 p=0.001***(S)

TABLE 10: COMPARISON OF MAP (mmHg) IN TWO GROUPS OF PATIENTS

MAP (mmHg)	Group				Mean difference	Student t-test
	Group A		Group B			
	Mean	SD	Mean	SD		
BL	92.84	7.59	92.76	6.92	0.08	t=0.06 p=0.95(NS)
SI	87.52	6.68	87.54	6.11	-0.02	t=0.02 p=0.99(NS)
15 min	86.96	6.48	87.16	6.29	-0.20	t=0.16 p=0.87(NS)
30min	83.16	6.63	83.36	6.50	-0.20	t=0.15 p=0.88(NS
45min	82.00	5.98	82.20	5.73	-0.20	t=0.17 p=0.86(NS)
60min	81.48	6.11	81.68	5.95	-0.20	t=0.17 p=0.86(NS)
Ext	86.28	9.53	81.68	6.49	4.60	t=2.82 p=0.01***(
10min	97.76	7.31	87.72	9.36	10.04	t=5.98 p=0.001***(S)
20min	92.40	6.11	84.74	5.15	7.66	t=6.78 p=0.001***(S)
30min	86.12	8.16	80.44	8.50	5.68	t=3.41 p=0.001***(S)

TABLE 11: COMPARISON OF SPO2 IN TWO GROUPS OF PATIENTS

SPO2	Group				Mean difference	Student t-test
	Group A		Group B			
	Mean	SD	Mean	SD		
BL	99.92	.27	99.96	.20	-0.04	t=0.83 p=0.41(NS)
SI	99.94	.24	99.98	.14	-0.04	t=1.01 p=0.31(NS
15 min	99.94	.24	99.98	.14	-0.04	t=1.02 p=0.31(NS
30min	99.90	.30	99.96	.20	-0.06	t=1.17 p=0.24(NS)
45min	99.92	.27	99.96	.20	-0.04	t=0.83 p=0.40(NS
60min	99.84	.37	99.88	.33	-0.04	t=0.57 p=0.57(NS)
Ext	99.86	.35	99.96	.20	-0.10	t=1.75 p=0.08(NS)
10min	99.90	.30	99.96	.20	-0.06	t=1.17 p=0.24(NS)
20min	99.90	.30	99.98	.14	-0.08	t=1.69 p=0.09(NS)
30min	99.90	.30	99.98	.25	-0.08	t=1.44 p=0.08(NS)

DISCUSSION: Emergence agitation (EA) is a common condition that can impact postoperative outcomes during recovery from general anaesthesia. Although EA incidence was considered more common in children, its incidence in adults has been estimated to be as high as 21.4%[3]. The effectiveness of ketamine in treating postoperative emergence agitation in adult patients undergoing laparoscopic appendicectomy was assessed in the current study, together with the postoperative use of analgesics. The frequency of EA during extubation and in the PACU was statistically considerably lower in the ketamine group, as were the numbers of patients who needed to be physically restrained or given agitation medicines. Ketamine is a potent antagonist of the NMDA receptor used primarily for inducing and maintaining anaesthesia. Ketamine has hypnotic effects at sub-anaesthetic dosages but analgesic effects at large ones. It separates the brain from the limbic system and works wonders as an amnestic [5,6]**.** Ketamine has been shown in prior research to have a considerably lower risk of EA than a placebo.[7,8,9]. Lin et al 2016 [10] conducted a study to assess the effect of ketamine and butorphanol on emergence agitation in gastric cancer patients. They divided 150 stomach cancer patients into three groups: group B (1 mg butorphanol, n=50), group K (1 mg/kg ketamine, n=50),

and Group C (1 mg butorphanol plus 1 mg/kg ketamine, n=50) received before induction of anaesthesia. At the conclusion of the procedure, the MAP and HR were compared. Butorphanol mixed with ketamine injection before induction of anaesthesia was more successful than an injection of ketamine or butorphanol separately in the prevention of EA, according to statistical analysis of recovery time, extubation time, in PACU, and side effects. 100 patients, ranging in age from 25 to 45 years, were included in our study, and the present study compared the mean ages of the two groups using matched data. There is no notable variation in the age distribution. The mean age of adult patients in Group A and Group B was 30.26± 5.45 and 31.52± 5.47, respectively, with a p>0.05 Not Significant value. Radtke et al [11] divided patients into three age groups—18 to 39, 40 to 64, and 65 years—and revealed that younger and older patients had a higher probability of developing EA than middle-aged patients. In contrast, several research showed that younger individuals experienced EA more frequently. Kim et al. [12] reported that young age was a risk factor for EA . Rim et a l.[13] and Rose [14]. reported that old age was a risk factor for EA.

Demir ey, yozkay et al.[4] (2018) did a recent study on 140 persons who were under the age of 18 and had elective rhinoplasty surgery. The 70 patients in the saline group (control group) and the 70 patients in the ketamine group were randomly allocated into two groups. Twenty minutes before the surgery was finished, the saline group received 1 ml of saline intravenously (i.v.) while the ketamine group received 0.5 mg/kg of ketamine. They found that a sub-anaesthetic dose of ketamine is highly efficient in reducing emergence agitation when they compared the efficacy of ketamine with a placebo for the avoidance of emergence agitation in patients scheduled for rhinoplasty. The study by Chai et al [3]**.** (2010), titled "Emergence Agitation in Adults: Risk Factors in 2,000 Patients," revealed that males were more likely to experience EA (28.1%) than females (16.1%) (P = 0.017) [13,15].The higher rate of EA in men is explained by lower pain tolerance and a significant correlation between postoperative pain and the male sex. The patients in our study were gender-matched across both groups. Both group A and group B patients were 60% male and 40% female in our study. The incidence of EA in females is anticipated to be higher than in males when taking into consideration the association between postoperative pain and EA as described above. Contrarily, in the current investigation, the incidence of EA was considerably higher in men than in women. Lower pain tolerance in males may contribute to this result [3,4,13,16,17]**.** Previous studies have also mentioned that men complain of more pain and consume more patient-controlled analgesia than women. Similarly, they found a significant relationship between male gender and postoperative pain (NRS ≥ 6) in this study. The distribution of weight was also comparable between the two groups. The mean weight distribution of adult patients was 71.96 ± 9.69 in group A and 70.02 ± 8.99 in group-p B and the value of p>0.05 is not significant. The distribution of height was also comparable between the two groups. The mean height distribution of an adult patient is 165.24 ± 6.12 in group A and 165.06 ± 5.05 in group B and the value of p>0.05 is not significant. The distribution of ASA levels was also comparable between the two groups. The mean ASA level distribution of adult patients was 82 % in ASA 1 and 18 % in ASA 2 in group A and 88% in ASA 1 and 12 % in ASA 2 in group B and the value of p>0.05 is not significant. The effects of supplemental intravenous ketamine were assessed in 93 children, who belonged to ASA I-II, in the age group of 2-14 years undergoing an adenotonsillectomy. Choi et al [18]]conducted a study on the effect of ketamine on the incidence of emergence agitation in children undergoing tonsillectomy and adenoidectomy under sevoflurane general anaesthesia. The patients were divided into three groups randomly and given either saline (group C), 0.25 mg/kg of ketamine (group K0.25), or 0.5 mg/kg of ketamine (group K0.5). Ten minutes prior to the conclusion of the operation, the children in each group received the study medications. There were no evident changes in the extubation time, delivery time, postoperative nausea and vomiting, agitation, or other

recovery characteristics, including the time to extubation, delivery time from the PACU, and pain between the three groups.Modified CHEOPS (Children's Hospital of Eastern Ontario Pain Scale) scores showed a significant difference between the three groups. Compared to the control group, the incidence of emerging agitation was low in the K0.25 and K0.5 groups. The K0.25 and K0.5 groups did not significantly differ from each other. They concluded that Ketamine (0.25 mg/kg and 0.5 mg/kg) given 10 minutes prior to the conclusion of surgery helped to avoid EA in children after sevoflurane anaesthesia without delaying recovery. They concluded that 0.5 mg/kg of ketamine is helped to avoid EA after general anaesthesia with sevoflurane, but it also increased the anaesthetic time due to a slower recovery. In our research, the lowest subanaesthetic dose of ketamine to prevent emergence agitation was used—0.2 mg/kg. Emergence agitation was measured using the ricker sedation-agitation score scale. In our study, we found that Group B's hemodynamics were more stable than Group A's during extubation, and this difference was statistically significant. In this study, none of the patients developed EA in group B which was assessed by RSAS in comparison to group A.Additionally, there was no or much less pain, as measured by the NRS scale, in group B patients during the postoperative period compared to group A patients. This difference is statistically significant. Although EA has been reported despite pain-free procedures and may occur regardless of pain intensity, pain is a major risk factor for both children and adults [3,4,18,22,23,24,25] These findings suggest that EA and postoperative pain are separate clinical phenomena; however, it is difficult to distinguish between EA and behavioral changes brought on by postoperative pain.[34,35] [34,35]. A score of more than five points on a numerical rating scale which was used to quantify postoperative pain in adults was found to increase the incidence of EA [4,26,27].

As a result, effective postoperative pain management may influence the occurrence of EA. The study on intravenous sub-anesthetic ketamine for perioperative analgesia was carried out by David Dety et al in 2016 [28]. The Subanaesthetic Bolus Dose of Intravenous Ketamine for Postoperative Pain Following Caesarean Section study was carried out by Anil Kumar et al [29] It involved 108 parturients divided into three groups, each group had 36 parturients. Group C received 2 ml of 0.9% normal saline; Group Ka received 0.15 mg/kg of ketamine; and Group Kb received 0.3 mg/kg of ketamine after 5 minutes of delivery. Postoperative VAS scores were substantially higher in the control group, but the duration to the first analgesic necessity was significantly longer in the Ka group (5.44 ± 1.48 h) 1.45 h) and Kb group (6.18 ± 1.48 h)1.61 h) compared to the control group (4.97 ± 1.48 h)). Adverse effects were also noted. In comparison to group C (136.11 ± 48.71 mg), the total number of doses and total dose of rescue analgesic (tramadol) required in 24 hours was significantly lower in the Ka group (194.44 ± 53.15 mg) and Kb group (152.78 ± 50.63 mg). They concluded that the administration of sub-anesthetic doses of intravenous ketamine (0.15 mg/kg and 0.3 mg/kg) effectively reduces postoperative analgesia. Additionally, the duration of the first postoperative rescue analgesic request was prolonged by ketamine 0.3 mg/kg. The effectiveness of each drug in preventing emergence agitation in children following ocular surgery was examined in a meta-analysis by Tan et al. in 2019[44]. [44] They concluded that ketamine was an effective way to lower the risk of emergence agitation in children. In a study published in 2019 by Idress Ali et al,[31] 60 children between the ages of 3 and 15 who were having adenotonsillectomy were randomly assigned to receive low-dose ketamine at a dose of 0.15 mg/kg, followed by propofol at a value of 0.45 mg/kg, intravenously. 60 children aged 3 to 15 years received simply normal saline and dextrose 10 minutes before the completion of the procedure as opposed to the ketofol (1:3) group. Additionally, the heart rate was significantly higher in the control group than in the children who had received ketofol at the time of tracheal extubation (P 0.05). They concluded that ketamine and propofol significantly minimize postoperative agitation in children who have had adenotonsillectomy. The study was done

by Achyut Sharma et al.[34] to assess the effects of ketamine and ketamine combined with midazolam on emerging agitation. This prospective randomized controlled experiment included 94 patients between the ages of two and ten who were presenting for ophthalmic procedures. 45 participants were assigned to each group: group K (ketamine) and group KM (Ketamine with Midazolam). Ketamine 0.3 mg/kg IV was given to Group K, and Ketamine 0.3 mg/kg IV with Midazolam 0.03mg/kg was given to Group KM. Heart rate during surgery and post-op emergence agitation, recovering times, and discharge times were noted. The emergence of agitation was found to be greatly reduced in the ketamine group. They concluded that ketamine alone is just as efficient at calming down agitation after sevoflurane as ketamine combined with midazolam in ophthalmic surgery. EA incidence in the control group was 54.3%, while it was only 8.6% in the ketamine group immediately following extubation (significant P value 0.001). While none of the patients in the ketamine group experienced EA in the PACU (p-value 0.001), the control group's EA incidence in the PACU was 28.6%. They concluded that ketamine-administered sub- anaesthetic was successfully preventing emerging agitation in adult patients. In the study by Sayed et al.[32] (2015) Efficacy of ketamine in the prevention of agitation in children having magnetic resonance imaging under face mask sevoflurane, 120 children between the ages of 2 and 7 (ASA I or II) of either sex participated in the study procedure. Patients were divided into 3 groups at random: the saline group, which received normal saline (n = 40), the ketamine 0.25 group, which received 0.25 mg/kg of ketamine intravenously 10 minutes before the procedure ended, and the ketamine 1.0 group, which received 1.0 mg/kg of ketamine intravenously prior to sevoflurane induction, (n = 40). There were no significant differences in the studied groups' age, weight or ASA grade.

Compared to the ketamine 0.25 and saline groups, children in the ketamine 1.0 group had significantly lower EA scores (P 0.05). In comparison to the saline group, the ketamine 0.25 groups significantly reduced EA scores were found (P 0.05). Ketamine premedication was effective in lowering EA without delaying recovery and significantly decreased the incidence of pausing MRI scans in children in the ketamine 1.0 group compared to ketamine 0.25 and saline groups (P 0.05). Dexmedetomidine vs Ketamine for the Prevention of Emergence Agitation in Paediatrics' was studied by Mohammed et al [33] in 2020. Group C was given normal saline as their treatment. Group K was given a dose of 0.25 mg/kg of ketamine. Dexmedetomidine 0.25 ug/kg was given to Group D prior to the conclusion of the operation, there was a significant difference in the time to discharge between Group C, Group K, and Group D (group C = 39.96 ± 2.84, group K = 37.28 ± 3.80, group D = 35.08 ±3.36, and P value = 0.0002), as well as between group K and group D. After extubation, before leaving the operating room, and when arriving at the PACU, the FLACC scale was low (low FLACC scale in group K, D than group C). They concluded that Ketamine and dexmedetomidine effectively reduced the incidence and severity of emergence delirium when compared to normal saline, with the effects of dexmedetomidine being much superior to Ketamine. Ketamine decreases postoperative pain and emerging agitation following adenotonsillectomy in children, according to randomized clinical research done by Mohammed et al.[35] 66 children between the ages of 5 and 15 who underwent elective adenotonsillectomy were randomly divided into two groups. During the induction of anaesthesia, participants in the control group got 5 ml of normal saline while those in the ketamine group received 0.25 mg/kg of ketamine in a 5 ml volume. The ketamine group's emergence agitation score was considerably lower (P = 0.002). The ketamine group's pain score was lower than the control group's pain score at all hours (P 0.05). The ketamine group had considerably decreased intravenous paracetamol needs (P = 0.0036). They concluded that using low doses of ketamine to induce anaesthesia reduced the agitation and pain that children undergoing tonsillectomy. A study was conducted by Manal et al.[36] in 2014 to compare the effect of the

intravenous administration of a tiny dosage of propofol, fentanyl, or ketamine at the conclusion of surgery, shortly before the withdrawal of sevoflurane on the impact of the incidence and severity of sevoflurane on emergence agitation in children having hypospadias repair surgery. When compared to the ketamine and control groups, they observed that the incidence of emerging agitation was much reduced in the propofol plus fentanyl group. While the PACU stay was significantly lengthened in the fentanyl group, the time for awakening was noticeably prolonged in the propofol, ketamine, and fentanyl groups. Except for a considerably increased incidence of vomiting in the fentanyl group, there were no major side effects. Kim et al. (2016)[37] conducted research on children in age 2–6 years old who received 0.1 mg/kg of midazolam or 1 mg/kg of ketamine as premedication prior to having ocular surgery, and it was found that the incidence of emergence delirium was much lower in the ketamine group than the midazolam group. The total incidence of emerging delirium did not differ significantly. In comparison to the midazolam group, the frequency of midazolam rescue drug use was considerably lower in the ketamine group. A study was conducted by M.S. Kim et al. (2013)[38] to compare the effects of fentanyl and propofol on young patients receiving sevoflurane anaesthesia and found that both ketamine and fentanyl group significantly differed from the control group in terms of the incidence of emergence delirium, but that the incidence of nausea and vomiting was higher in the fentanyl group. When compared to the control group, the group receiving fentanyl and propofol spent more time in the PACU, with no difference between the two groups. In a meta-analysis, Dahmani S et al. (2010)[40] noted that propofol, preoperative analgesia, fentanyl, and ketamine all had a prophylactic effect on emerging delirium. These drugs' analgesic abilities do not appear to contribute to this impact. Children with cerebral palsy were the focus of a study by Dalens BJ et al. (2006)[39] Ketamine or nalbuphine in modest dosages during magnetic resonance imaging given right before the sevoflurane anaesthetic is stopped to prevent emerging delirium. When compared to the control group, noticed that the incidence of emerging delirium is low in the Ketamine and Nalbuphine groups. Compared to the Ketamine group, the Nalbuphine group has a lower incidence of emerging delirium. Woon Young Kim and colleagues (2010)[10] noted the impact of two distinct Ketamine dosages on the incidence of EA in children under sevoflurane general anaesthesia having tonsillectomy and adenoidectomy. Extubation time in the ketamine group receiving 0.5 mg/kg at the end of surgery was significantly longer than in the ketamine group receiving 1mg/kg at the beginning of surgery and the control group. CHEOPS is low in the ketamine group when compared to the control group, with no difference between the groups receiving 0.5 mg/kg of ketamine at the end of surgery and 1mg/kg of ketamine at the beginning of surgery. According to Lepousé et al., [41] abdominal surgery triples the likelihood of developing EA. They linked more intense pain with the extensive operation. According to Tolver et al., visceral discomfort predominates over the shoulder and incisional pain by a wide margin. As a result, there may not be much of a correlation between postoperative pain and incision.Spine surgery was linked to a higher incidence of EA in their study. Standard spinal surgery frequently necessitates substantial dissection of bones, ligaments, and subcutaneous tissues, which causes significant postoperative pain. Their study also found a substantial relationship (NRS 6) between spinal surgery and postoperative discomfort. Additionally, the majority of patients had previously endured chronic pain that was managed with drugs or analgesics. These patients altered pain perception may make pain management more difficult and raise the risk of EA. They recommend using stronger analgesics. They state that after abdominal and spine surgery, stronger analgesics will be needed throughout the perioperative period. It was a randomised clinical trial that Suheyla et al. 2021[45] conducted to determine the impact of ketamine on post-septoplasty emergence agitation.A total of 102 ASA I-II patients who underwent septoplasty were divided into two groups: one received ketamine (Group-K, n=52), and the other received saline (Group-S, n=50). After anaesthetic induction, Group-K was

intravenously supplied 20mL of saline containing 1mgkg-1 ketamine, whereas Group-S was administered 20mL of saline. They concluded that the incidence of EA in patients having septoplasty is unaffected by the injection of 1 mg kg-1 ketamine during anaesthetic induction.

In paediatric patients (2–6 years old) undergoing ophthalmic surgery, Kim et al.[9] compared the effects of preoperative midazolam and ketamine application on EA incidence following sevoflurane anaesthesia. Patients were randomly assigned to receive premedication with either 0.1 mg/kg midazolam or 1 mg/kg ketamine. In the postanaesthetic care unit, incidence of EA and postoperative pain scores were recorded at 10-min intervals. It was found that ketamine was more effective than midazolam at avoiding EA. According to Hadi et al.,[42] an intraoperative bolus of low-dose kETODEX IV significantly lowers the incidence of EA and postoperative pain in children undergoing adenotonsillectomy after sevoflurane-based anaesthesia. A total of 92 children between the ages of 3 and 7 were randomly assigned to receive low-dose ketamine 0.15 mg/kg followed by dexmedetomidine 0.3 g/kg intravenously, in one group (KETODEX, n=45) and volume-matched saline (Control, n=47), in another group about 10 min before the end of the surgery. The incidence and severity of EA were lower in the KETODEX group than in controls (11% vs. 47%) and (2% vs. 13%), respectively (P0.05), but extubation time was reported to be significantly longer compared with the control group. Intranasal ketamine, when compared to alfentanil or saline, significantly enhanced the quality of induction and decreased sevoflurane-induced EA in children undergoing urological surgery, according to Bilgen et al.[43]. In another study, sevoflurane-anesthetized children undergoing tonsillectomy who received intravenous administration of either ketamine 0.5 mg/kg or fentanyl 1 lg/kg[44] prior to the conclusion of surgery experienced a significantly lower incidence of postoperative agitation without any differences between the two drugs. Fewer studies on EA in adults have recently been conducted than on children, according to Jin Lee et al.[46]

SUMMARY AND CONCLUSION- The study included 100 patients randomly divided into two groups, group 50 patients received 5ml of normal saline 20 min before the end of the surgery, and Group B 50 patients received 0.2 mg/kg in. Ketamine 20 min before the end of surgery. Parameters such as emergence agitation assessed by RSAS, pain by NRS and adverse effects. In this study, none of the patients in Group B develop EA as compared to Group A, postoperative pain was significantly lower in Group B as compared to Group A. There were no adverse effects in either group. Therefore concluded that the dose of 0.2 mg/kg ketamine given at 20 mins before the end of the surgery is effective in preventing ED in adult patients after general anaesthesia.

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