

Perceptual Disturbances (Illusions) Due To Low Dose Ketamine In Emergency Department

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ABSTRACT

Background: In emergency rooms, ketamine is commonly used as a low dose analgesic because it has a fast onset, is hemodynamically stable, and opioid sparing. Nevertheless, at sub-dissociative dosage, ketamine is capable of causing perceptual disturbance and dissociative experiences that can impact patient comfort, communication and overall care experience. Very little research has been done on varying regimens of low dose ketamine in relation to the level of these perceptual disturbances. This research was intended to assess the frequency and degree of occurrence of perceptual disturbances and to identify the relationship between the dose of ketamine and the incidence of dissociative symptoms in emergency patients. **Methods:** The study was a cross-sectional observational study on 108 patients (adults) undergoing low doses of ketamine (0.1 mg/kg or 0.3 mg/kg) as an anaesthetic's agent

in the emergency room. The perceptual disturbances such as sensory illusions, body perception, cognitive disconnection, and memory effects were measured with the help of an organized questionnaire. The overall disturbance patterns were summarized with the help of descriptive statistics, whereas the correlation between the dose of ketamine and the severity of perceptual effects were analyzed with the crosstabulation and chi-square tests. Results: The level of perceptual disturbance was widespread in the sample as the majority of the patients reported at least one type of dissociative or sensory alteration. The most pronounced dose-related differences were in 10 out of 11 disturbances that had been measured. The moderate to severe symptoms that were more prevalent among patients who were treated with 0.3 mg/kg included feeling of unreality, being disconnected, floating, disorienting, uncontrollable, and memory lapses ($p < 0.05$). There was no significant correlation between dose and only misinterpreted sounds ($p = 0.576$). On the whole, the results showed that there was a definite dose-response correlation, and the high low-dose regimen produced stronger perceptual effects. Conclusion: Ketamine low dose is a good analgesic, which is linked to dose-related perceptual disturbances in emergency department patients. Most of the symptoms were mild and non-hazardous; however, the 0.3mg/kg dose always had more severe dissociative effects compared to the 0.1mg/kg dose. These findings should be used by clinicians in choosing doses, preparing patients to expect perceptual experiences, and watching out the symptoms of dissociation in the course of care. The findings also emphasize the need to balance between analgesic effect and patient comfort, and safety in the case of low-dose of ketamine.

Keywords: Low Dose Ketamine, Perceptual Disturbance, Emergency Department Analgesia, Illusions

INTRODUCTION:

Pain management in emergency departments (EDs) remains a critical yet challenging aspect of healthcare worldwide, with undertreatment of pain being a well-documented issue despite its prevalence as the most common presenting symptom. EDs are characterized by unpredictable patient flows, overcrowding, limited resources, and the need for rapid assessment and treatment of diverse medical conditions (1). Healthcare providers must balance urgent pain relief with concerns over adverse effects, drug interactions, and the risk of masking diagnostic findings. Traditional analgesics, such as opioids and nonsteroidal anti-inflammatory drugs (NSAIDs), have significant limitations: opioids carry risks of respiratory depression, dependency, and misuse amid the opioid crisis, while NSAIDs may be inadequate for severe pain and contraindicated in patients with renal, gastrointestinal, or cardiovascular issues. This backdrop has spurred the exploration of alternative analgesics that offer rapid onset, safety across patient populations, and minimal interference with clinical examinations (2,3).

Ketamine, first synthesized in 1962 by Calvin Stevens and developed as an anesthetic, has emerged as a promising alternative for pain management in ED settings. Initially approved by the FDA in 1970 and used extensively during the Vietnam War, ketamine's unique properties including dissociative anesthesia, preservation of airway reflexes, and hemodynamic stability make it suitable for short procedures without

muscle relaxation (4). Its fast-acting analgesic effects, typically within minutes, provide relief for severe acute pain from trauma, fractures, or burns, while stabilizing cardiovascular status and offering sympathomimetic benefits in hemodynamically unstable patients. Unlike opioids, low-dose ketamine (0.1-0.5 mg/kg) avoids respiratory depression and is effective in patients with comorbidities, making it a valuable non-opioid option during the ongoing opioid crisis. However, ketamine is not without drawbacks, particularly its association with perceptual disturbances such as illusions, hallucinations, and dissociative reactions, which can range from mild sensations to intense dysphoria and may complicate patient care in busy ED environments (5,6).

Despite the growing integration of ketamine into ED protocols for analgesia, procedural sedation, and agitated patient management, its psych perceptual side effects pose significant barriers to widespread adoption. These disturbances, linked to NMDA receptor antagonism and altered thalamocortical connectivity, occur in 5-30% of patients depending on dose, administration route, and individual factors like age. While ketamine's benefits include efficacy in neuropathic pain, lack of organ toxicity, and predictable dosing, the potential for adverse psychological reactions necessitates a deeper understanding of risk factors. This systematic review and meta-analysis aim to address this gap by examining perceptual disturbances (illusions) in patients receiving low-dose ketamine in EDs, focusing on incidence, severity, and associated risk factors to enhance safe and evidence-based use (7,8).

Sampson et al. (2023) conducted a systematic mixed-studies review to explore staff perspectives on barriers and facilitators to pain management in EDs, highlighting the global undertreatment of pain despite its prevalence. The study synthesized qualitative and quantitative data from 24 articles, using the Mixed Methods Appraisal Tool for quality assessment and thematic synthesis to identify interpretive themes. Key findings emphasized environmental challenges such as high workloads and bureaucratic restrictions, alongside staff attitudes prioritizing experience over patient self-assessment of pain. The review underscored that ED environments are inherently difficult to optimize for pain treatment, with qualitative insights revealing attitudinal barriers and quantitative data focusing on systemic issues, ultimately advocating for interventions that address both to improve care (9).

Alahmari et al. (2024) reviewed effective pain management strategies in EDs, emphasizing its impact on patient satisfaction and outcomes. The study identified persistent challenges, including demographic disparities in treatment, inconsistent pain assessment practices, and underutilization of protocols. Successful interventions highlighted included multimodal analgesia, standardized pain scales, and staff education programs, alongside a patient-centered approach to account for subjective pain and cultural factors. The review provided practical recommendations for enhancing ED pain management, stressing the need for equitable, evidence-based practices to address inequalities and improve overall patient care quality (10).

Beyond its analgesic properties, ketamine offers additional benefits that position it as a versatile tool in ED settings, particularly in addressing the opioid crisis and improving patient throughput. Its bronchodilator effects make it ideal for patients with asthma or reactive airway conditions, while its safety in children and those with cyanotic heart disease expands its utility for minor procedures. As a non-opioid

alternative, ketamine reduces risks of dependency and addiction, benefiting vulnerable populations such as the elderly, opioid-tolerant individuals, and those with substance use disorders. Furthermore, understanding perceptual disturbances through this review could lead to standardized dosing guidelines, preempting adverse reactions and enhancing patient comfort, thereby supporting faster ED throughput and reducing the need for additional interventions like benzodiazepines (11,12).

In conclusion, while ketamine represents a significant advancement in ED pain management due to its rapid, safe, and opioid-sparing profile, the occurrence of perceptual disturbances necessitates targeted research to mitigate risks. By identifying risk factors such as dose, age, and administration methods, this systematic review aims to inform clinical practices, promote patient safety, and foster interdisciplinary discussions among healthcare providers. Ultimately, optimizing ketamine's use could transform acute pain treatment in EDs, aligning with global efforts to combat undertreatment and improve outcomes in high-stakes environments.

MATERIALS AND METHODOLOGY

This study employed a cross-sectional investigation and prospective observational cohort design to evaluate the incidence, severity, and risk factors of perceptual disturbances (illusions) in patients receiving low-dose ketamine (LDK) for analgesia or procedural sedation in the Emergency Department of Allama Iqbal Memorial Hospital, Sialkot, a tertiary care facility. Conducted over five months in 2025, it included 108 adult patients aged 18-65 years presenting with acute pain or injury, using convenient non-probability sampling and excluding those with cardiovascular/respiratory comorbidities or sensory impairments. Informed consent was obtained, and data were collected via a structured form capturing demographics, medical history, and ketamine dosing (0.1-0.3 mg/kg IV). Primary outcomes assessed perceptual disturbances at 30 minutes using the Clinician-Administered Dissociative States Scale (CADSS) and Perceptual Disturbance Scale (PDS), while secondary outcomes explored risk factors (e.g., age, dosing parameters), scale correlations, and analgesic effectiveness. Ethical approval was secured, and data were analyzed using SPSS with descriptive statistics, bivariate tests (t-test, chi-square), correlations, and binary logistic regression, considering $p < 0.05$ as significant to ensure confidentiality and minimize bias (13).

RESULTS:

Frequency Analysis

Frequency analysis with respect to each variable

A total of 108 patients were included in the final analysis. Demographic characteristics including age, gender, and weight were recorded for all participants. Various types of perceptual disturbances were assessed, including movement illusions, color changes, disorientation, hearing misinterpretation, altered sound intensity, floating sensations. Frequency analysis and crosstabulation with chi-square tests were conducted to examine the relationship between ketamine dose and the occurrence and severity of each perceptual disturbance. Results are presented in the following tables.

Online ISSN

3007-3197

Print ISSN

3007-3189

<http://amresearchreview.com/index.php/Journal/about>

Table 1. Descriptive Statistics of Perceptual Disturbances in Patients Receiving Low-Dose Ketamine

	Gender	Medical history	distorted size	movement illusions	color changes
N	Valid	108	108	108	108
	Missing	0	0	0	0
Mean	0.3519	0.2778	1.2407	1.0741	1.0463
Median	0.0000	0.0000	1.0000	1.0000	1.0000
Mode	0.00	0.00	1.00	0.00	0.00
Std. Deviation	0.47977	0.44999	0.91580	1.07394	1.17914
Variance	0.230	0.202	0.839	1.153	1.390

	misinterpreted sounds	distorted hearing	sound intensity	floating feeling	body distortion
N	Valid	108	108	108	108
	Missing	0	0	0	0
Mean	1.1389	1.3426	1.2500	1.1389	1.3611
Median	1.0000	1.0000	1.0000	1.0000	1.0000
Mode	0.00	0.00	0.00	0.00	0.00
Std. Deviation	1.21869	1.12043	1.13669	1.12290	1.23393
Variance	1.485	1.255	1.292	1.261	1.523

	body boundary	unreal	disconnection	uncontrolled actions	blank memory
N	Valid	108	108	108	108
	Missing	0	0	0	0
Mean	1.3611	1.2963	1.1389	1.8426	1.6296
Median	2.0000	1.0000	1.0000	2.0000	2.0000
Mode	0.00	0.00	0.00	1.00	0.00
Std. Deviation	1.15571	1.13779	1.19546	1.09512	1.41152
Variance	1.336	1.295	1.429	1.199	1.992

	sense of time	sunrounding unclear	observing outside	concentration	blank stare
N	Valid	108	108	108	108
	Missing	0	0	0	0

Annual Methodological Archive Research Review

<http://amresearchreview.com/index.php/Journal/about>

Volume 4, Issue 1 (2026)

Online ISSN

3007-3197

Print ISSN

3007-3189

<http://amresearchreview.com/index.php/Journal/about>

Mean	1.9722	1.8981	1.3796	1.3148	1.6296
Median	2.0000	2.0000	1.0000	1.0000	1.0000
Mode	1.00	1.00	1.00	1.00	1.00
Std. Deviation	1.11455	1.11858	1.07406	1.30884	1.36438
Variance	1.242	1.251	1.154	1.713	1.862

		conversationdifficulty	disorientation	motorincordination	group
N	Valid	108	108	108	108
	Missing	0	0	0	0
Mean		1.9167	1.7407	1.1204	0.5000
Median		1.0000	1.0000	1.0000	0.5000
Mode		1.00	3.00	0.00	.00 ^a
Std. Deviation		1.55957	1.44927	1.35148	0.50233
Variance		2.432	2.100	1.826	0.252

Online ISSN

3007-3197

Print ISSN

3007-3189

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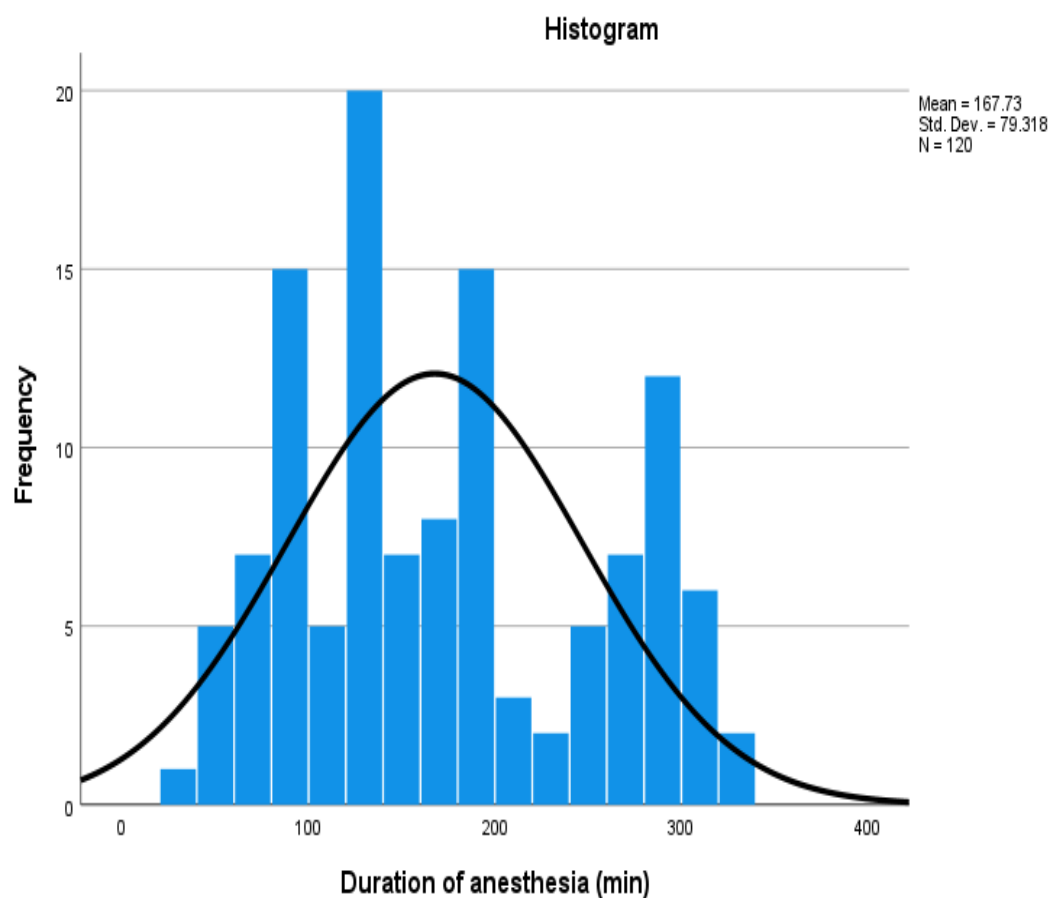


Figure 1. Histogram for Frequency of duration of anesthesia

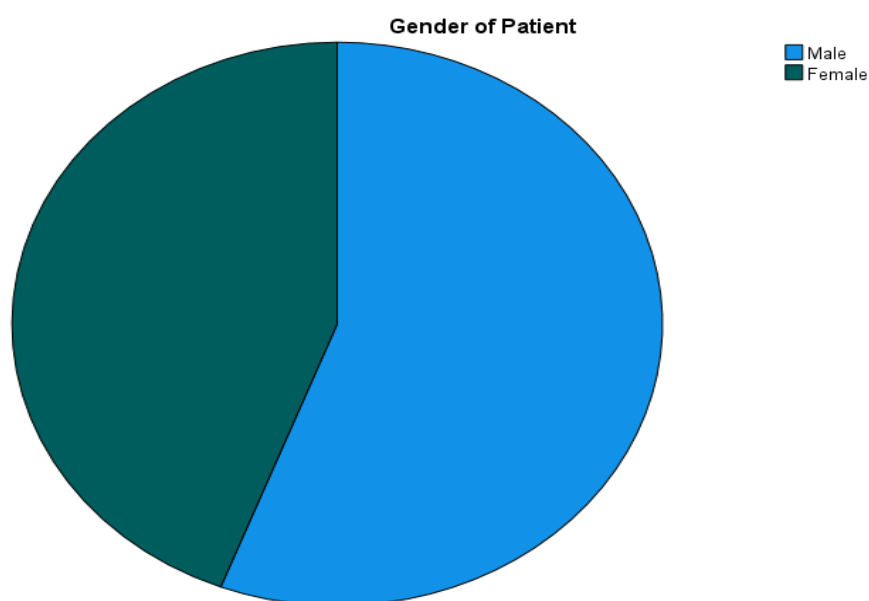


Figure 2. Pie Chart for the Gender of Patient

Online ISSN

3007-3197

Print ISSN

3007-3189

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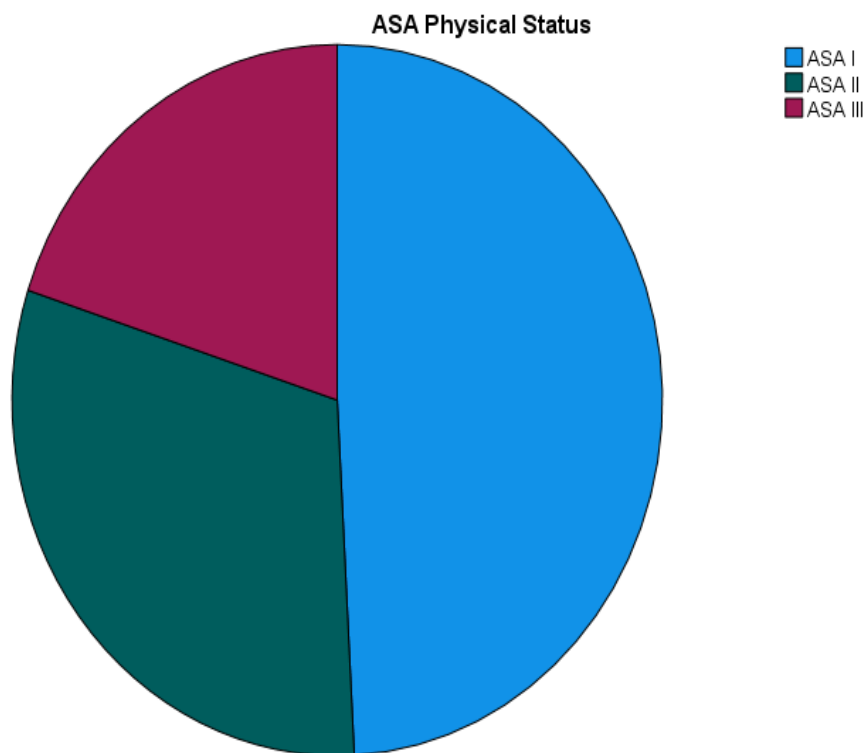


Figure 3. Pie Chart for ASA Physical Status

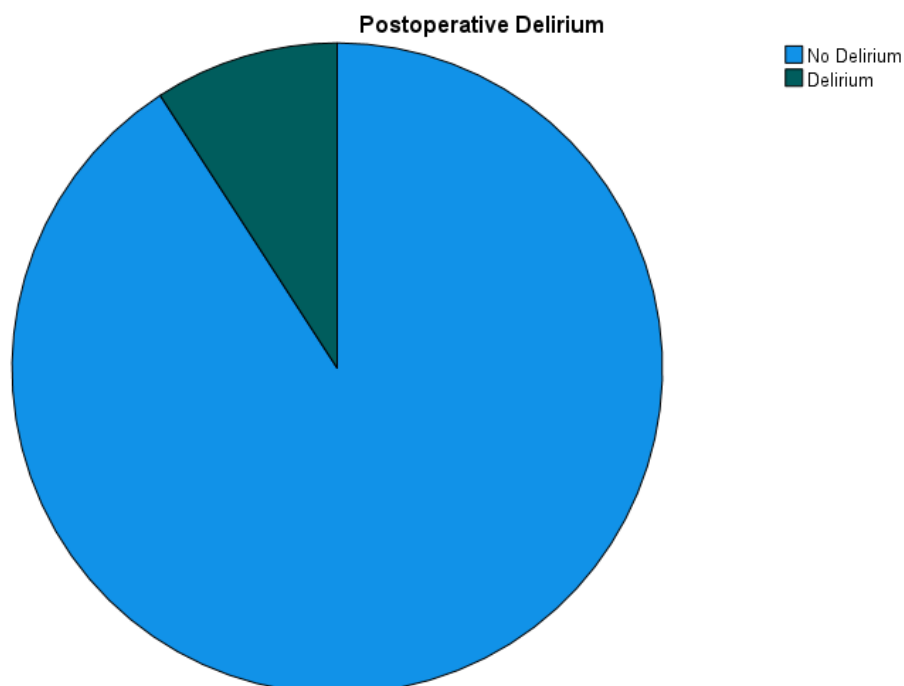


Figure 4. Pie Chart for Postoperative Delirium

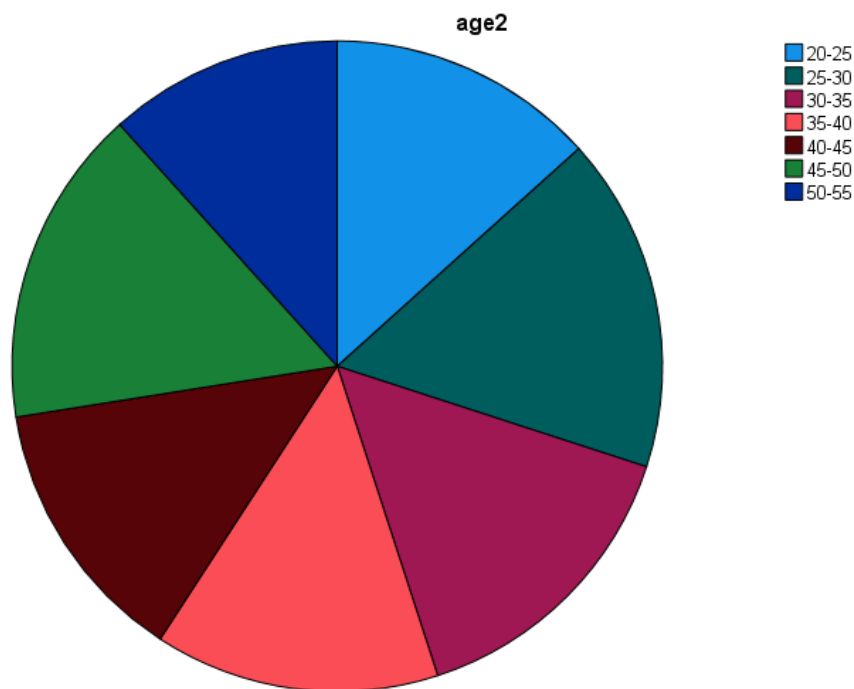


Figure 5. Pie Chart for Age

Table 2. Distribution of Age across Ketamine Dose Groups and Independent t Test Results

Group Statistics

	group	N	Mean	Std. Deviation	Std. Error Mean
Age	0.1	54	43.9815	6.94042	.94447
	0.3	54	43.9815	7.28527	.99140

Independent Samples Test

Levene's Test for Equality of Variances		t-test for Equality of Means						
F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	

Online ISSN

3007-3197

Print ISSN

3007-3189

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							ce		Lower	Upper
Age	Equal variances assumed	.191	.663	.000	106	1.000	.000	1.36927	-2.71471	2.71471
	Equal variances not assumed			.000	105.752	1.000	.000	1.36927	-2.71478	2.71478

Independent Samples Effect Sizes

		Standardizer ^a	Point Estimate	95% Interval	Confidence
				Lower	Upper
Age	Cohen's d	7.11493	.000	-.377	.377
	Hedges' correction	7.16578	.000	-.375	.375
	Glass's delta	7.28527	.000	-.377	.377

a. The denominator used in estimating the effect sizes.

Cohen's d uses the pooled standard deviation.

Hedges' correction uses the pooled standard deviation, plus a correction factor.

Glass's delta uses the sample standard deviation of the control group.

Table 3. Distribution of Gender across Ketamine Dose Groups and Chi-Square Test Results

Case Processing Summary

	Cases	Missing	Total
	Valid		
Gender	Frequency	Percent	Valid Percent
			Cumulative Percent

Online ISSN

3007-3197

Print ISSN

3007-3189

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Valid	male	70	64.8	64.8	64.8
	female	38	35.2	35.2	100.0
	Total	108	100.0	100.0	

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	.000 ^a	1	1.000		
Continuity Correction ^b	.000	1	1.000		
Likelihood Ratio	.000	1	1.000		
Fisher's Exact Test				1.000	.580
Linear-by-Linear Association	.000	1	1.000		
N of Valid Cases	108				

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 19.00.

b. Computed only for a 2x2 table

Table 4. Distribution of Weight across Ketamine Dose Groups and Independent t Test Results

Group Statistics

	group	N	Mean	Std. Deviation	Std. Error Mean
Weight	0.1	54	58.4630	12.69781	1.72795
	0.3	54	58.1481	11.99750	1.63265

Independent Samples Test

Levene's
Test for
Equality
of
Variance
s

t-test for Equality of Means

F	Sig.	t	df	Sig. (2- tailed)	Mean Differe nce	Std. Error Differe nce	95% Confidence Interval of the Difference	
							Lower	Upper

Online ISSN

3007-3197

Print ISSN

3007-3189

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Weight	Equal variances assumed	.435	.511	.132	106	.895	.31481	2.37726	-4.39834	5.02797
	Equal variances not assumed			.132	105.661	.895	.31481	2.37726	-4.39851	5.02814

Table 5. Distribution of Hearing distortion Severity across Ketamine Dose Groups and Chi-Square Test Results

distorted hearing

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	not present	33	30.6	30.6	30.6
	mild	27	25.0	25.0	55.6
	moderate	26	24.1	24.1	79.6
	severe	22	20.4	20.4	100.0
	Total	108	100.0	100.0	

Case Processing Summary

	Cases		Missing		Total	
	Valid N	Percent	N	Percent	N	Percent
distorted hearing * group	108	99.1%	1	0.9%	109	100.0%

distorted hearing * group Crosstabulation

Count

		group		Total
		0.1	0.3	
distorted hearing	not present	20	13	33
	Mild	17	10	27
	Moderate	12	14	26
	Severe	5	17	22
Total		54	54	108

Chi-Square Tests

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3007-3197

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3007-3189

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	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	9.999 ^a	3	.019
Likelihood Ratio	10.402	3	.015
Linear-by-Linear Association	8.032	1	.005
N of Valid Cases	108		

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 11.00.

Interpretation: The mean number of 33 patients did not show any hearing distortion with 75 having mild and severe distortion. Chi-square analysis indicates that there is a significant difference between doses ($\chi^2 = 9.999$, $p = 0.019$) and that the severity of cases is greater in the group receiving a higher dose (0.3 mg/kg)

Table 6. Distribution of Floating Feeling Severity across Ketamine Dose Groups and Chi-Square Test Results

Floating feeling

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	not present	42	38.9	38.9	38.9
	mild	28	25.9	25.9	64.8
	moderate	19	17.6	17.6	82.4
	severe	19	17.6	17.6	100.0
	Total	108	100.0	100.0	

Case Processing Summary

		Cases					
		Valid		Missing		Total	
		N	Percent	N	Percent	N	Percent
floating group	feeling *	108	99.1%	1	0.9%	109	100.0%

floating feeling * group Crosstabulation

Count

		group		
		0.1	0.3	Total
floating feeling	not present	29	13	42
	mild	15	13	28

Online ISSN

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	moderate	5	14	19
	severe	5	14	19
Total		54	54	108

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	14.764 ^a	3	.002
Likelihood Ratio	15.273	3	.002
Linear-by-Linear Association	13.578	1	.000
N of Valid Cases	108		

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 10.00.

Interpretation: The mean number of 42 patients did not show any floating sensations, with 66 having mild and severe floating sensations. Chi-square analysis indicates that there is a significant difference between doses ($x^2 = 14.764$, $p = 0.002$) and that the severity of cases is greater in the group receiving a higher dose (0.3 mg/kg)

Table 7. Distribution of Body Distortion Severity across Ketamine Dose Groups and Chi-Square Test Results

body distortion

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	not present	41	38.0	38.0	38.0
	mild	15	13.9	13.9	51.9
	moderate	24	22.2	22.2	74.1
	severe	28	25.9	25.9	100.0
	Total	108	100.0	100.0	

Case Processing Summary

		Cases					
		Valid		Missing		Total	
	*	N	Percent	N	Percent	N	Percent
bodydistortion group	*	108	99.1%	1	0.9%	109	100.0%

body distortion * group Crosstabulation

Online ISSN

3007-3197

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Count

		group		
		0.1	0.3	Total
bodydistortion	not present	24	17	41
	mild	9	6	15
	moderate	5	19	24

Chi-Square Tests

	Value	df	Asymptotic Significance (2- sided)
Pearson Chi-Square	10.533 ^a	3	.015
Likelihood Ratio	11.086	3	.011
Linear-by-Linear Association	1.028	1	.311
N of Valid Cases	108		

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 7.50.

		severe	16	12	28
Total			54	54	108

Interpretation: The mean number of 41 patients did not show any body distortion with 67 having mild and severe body distortion. Chi-square analysis indicates that there is a significant difference between doses ($\chi^2 = 10.533$, $p = 0.015$) and that the severity of cases is greater in the group receiving a higher dose (0.3 mg/kg)

Table 8. Distribution of Body Boundary Severity across Ketamine Dose Groups and Chi-Square Test Results

Body boundary

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	not present	38	35.2	35.2	35.2
	mild	14	13.0	13.0	48.1
	moderate	35	32.4	32.4	80.6
	severe	21	19.4	19.4	100.0
	Total	108	100.0	100.0	

Case Processing Summary

Cases

Valid

Missing

Total

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3007-3197

Print ISSN

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	N	Percent	N	Percent	N	Percent
body boundary *	108	99.1%	1	0.9%	109	100.0%
group						

body boundary * group Crosstabulation

Count

		group		
		0.1	0.3	Total
bodyboundary	not present	27	11	38
	mild	4	10	14
	moderate	11	24	35
	severe	12	9	21
Total		54	54	108

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	14.565 ^a	3	.002
Likelihood Ratio	14.984	3	.002
Linear-by-Linear Association	3.667	1	.055
N of Valid Cases	108		

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 7.00.

Interpretation: The mean number of 38 patients did not show any body boundary disturbances with 70 having mild and severe disruptions. Chi-square analysis indicates that there is a significant difference between doses ($\chi^2 = 14.565$, $p = 0.002$) and that the severity of cases is greater in the group receiving a higher dose (0.3 mg/kg)

Table 9. Distribution of Unreal Severity across Ketamine Dose Groups and Chi-Square Test Results

unreal

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	not present	38	35.2	35.2	35.2
	mild	20	18.5	18.5	53.7

Online ISSN

3007-3197

Print ISSN

3007-3189

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	moderate	30	27.8	27.8	81.5
	severe	20	18.5	18.5	100.0
	Total	108	100.0	100.0	

Case Processing Summary

		Cases		Missing		Total	
		Valid	Percent	N	Percent	N	Percent
unreal	*	108	99.1%	1	0.9%	109	100.0%
group							

unreal * group Crosstabulation

Count

		Group		Total
		0.1	0.3	
unreal	not present	31	7	38
	mild	10	10	20
	moderate	4	26	30
	severe	9	11	20
Total		54	54	108

Chi-Square Tests

	Value	df	Asymptotic Significance (2- sided)
Pearson Chi-Square	31.491 ^a	3	.000
Likelihood Ratio	34.601	3	.000
Linear-by-Linear Association	17.881	1	.000
N of Valid Cases	108		

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 10.00.

Interpretation: The mean number of 38 patients did not show any feeling of unreality with 70 having mild and severe episodes. Chi-square analysis indicates that there is a significant difference between doses ($\chi^2 = 31.491$, $p < 0.001$) and that the severity of cases is greater in the group receiving a higher dose (0.3 mg/kg)

Table 10. Distribution of Disconnection Severity across Ketamine Dose Groups and Chi-Square Test Results

disconnection

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	not present	50	46.3	46.3	46.3

Online ISSN

3007-3197

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mild	13	12.0	12.0	58.3
moderate	25	23.1	23.1	81.5
severe	20	18.5	18.5	100.0
Total	108	100.0	100.0	

Case Processing Summary

		Cases Valid		Missing		Total	
		N	Percent	N	Percent	N	Percent
disconnection group	*	108	99.1%	1	0.9%	109	100.0%

disconnection * group Crosstabulation

Count

		Group		Total
		0.1	0.3	
disconnection	not present	34	16	50
	mild	5	8	13
	moderate	6	19	25
	severe	9	11	20
Total		54	54	108

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	14.132 ^a	3	.003
Likelihood Ratio	14.630	3	.002
Linear-by-Linear Association	7.937	1	.005
N of Valid Cases	108		

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 6.50.

Interpretation: The mean number of 50 patients did not show any disconnection with 58 having mild and severe episodes. Chi-square analysis indicates that there is a significant difference between doses ($\chi^2 = 14.132$, $p = 0.003$) and that the severity of cases is greater in the group receiving a higher dose (0.3 mg/kg)

Table 11. Distribution of Uncontrolled Actions Severity across Ketamine Dose Groups and Chi-Square Test Results

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3007-3197

Print ISSN

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Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	17.005 ^a	4	.002
Likelihood Ratio	17.753	4	.001

uncontrolled actions

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	not at all	10	9.3	9.3	9.3
	mild	38	35.2	35.2	44.4
	moderate	25	23.1	23.1	67.6
	quite a bit	29	26.9	26.9	94.4
	extremely	6	5.6	5.6	100.0
	Total	108	100.0	100.0	

Case Processing Summary

		Cases				
		Valid		Missing		Total
		N	Percent	N	Percent	N
uncontrolled actions	*	108	99.1%	1	0.9%	109
group						100.0%

uncontrolled actions * group Crosstabulation

Count

		group		
		0.1	0.3	Total
uncontrolled actions	not at all	3	7	10
	mild	28	10	38
	moderate	13	12	25
	quite a bit	9	20	29
	extremely	1	5	6
Total		54	54	108

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Linear-by-Linear Association	6.493	1	.011
N of Valid Cases	108		

a. 2 cells (20.0%) have expected count less than 5. The minimum expected count is 3.00.

Interpretation: The mean number of 38 patients reported mild uncontrolled actions, while severe effects were rare. Chi-square analysis indicates that there is a significant difference between doses ($\chi^2 = 17.005$, $p = 0.002$) and that the severity of cases is greater in the group receiving a higher dose (0.3 mg/kg)

Table 12. Distribution of Blank memory Severity across Ketamine Dose Groups and Chi-Square Test Results

blank memory

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	not at all	38	35.2	35.2	35.2
	mild	12	11.1	11.1	46.3
	moderate	18	16.7	16.7	63.0
	quite a bit	32	29.6	29.6	92.6
	extremely	8	7.4	7.4	100.0
	Total	108	100.0	100.0	

Case Processing Summary

		Cases Valid N	Percent	Missing N	Percent	Total N	Percent
blankmemory group	*	108	99.1%	1	0.9%	109	100.0%

blank memory * group Crosstabulation

Count

		group		
		0.1	0.3	Total
blankmemory	not at all	26	12	38
	mild	4	8	12
	moderate	11	7	18
	quite a bit	13	19	32
	extremely	0	8	8

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Total	54	54	108
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Chi-Square Tests

	Value	df	Asymptotic Significance (2- sided)
Pearson Chi-Square	16.505 ^a	4	.002
Likelihood Ratio	19.759	4	.001
Linear-by-Linear Association	9.834	1	.002
N of Valid Cases	108		

a. 2 cells (20.0%) have expected count less than 5. The minimum expected count is 4.00.

Interpretation: The mean number of 38 patients had no memory lapses, 70 having mild to severe lapses. Chi-square analysis indicates ($\chi^2=16.505$, $p=0.002$) and that the severity of cases is greater in the group receiving a higher dose (0.3 mg/kg)

Table 13. Distribution of Difficulty Conversation Severity across Ketamine Dose Groups and Chi-Square Test Results

conversation difficulty

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	not at all	26	24.1	24.1	24.1
	mild	29	26.9	26.9	50.9
	moderate	9	8.3	8.3	59.3
	quite a bit	16	14.8	14.8	74.1
	extremely	28	25.9	25.9	100.0
	Total	108	100.0	100.0	

Case Processing Summary

	Cases Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
conversation difficulty * group	108	99.1%	1	0.9%	109	100.0%

conversation difficulty * group Crosstabulation

Count

		group		Total
		0.1	0.3	
conversation difficulty	not at all	19	7	26
	mild	18	11	29

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	moderate	9	0	9
	quite a bit	4	12	16
	extremely	4	24	28
Total		54	54	108

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	34.514 ^a	4	.000
Likelihood Ratio	39.973	4	.000
Linear-by-Linear Association	23.759	1	.000
N of Valid Cases	108		

a. 2 cells (20.0%) have expected count less than 5. The minimum expected count is 4.50.

Interpretation: The mean number of 26 patients did not show any difficulty and 82 having mild and severe difficulty. Chi-square analysis indicates that there is a significant difference between doses ($\chi^2 = 34.514$, $p < 0.001$) and that the severity of cases is greater in the group receiving a higher dose (0.3 mg/kg)

Table 14. Distribution of Disorientation Severity across Ketamine Dose Groups and Chi-Square Test Results

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	not at all	29	26.9	26.9	26.9
	mild	29	26.9	26.9	53.7
	moderate	5	4.6	4.6	58.3
	quite a bit	31	28.7	28.7	87.0
	extremely	14	13.0	13.0	100.0
	Total	108	100.0	100.0	

Case Processing Summary

	Cases		Missing		Total	
	Valid					
	N	Percent	N	Percent	N	Percent
disorientation group	* 108	99.1%	1	0.9%	109	100.0%

disorientation * group Crosstabulation

Count

Group		
0.1	0.3	Total

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disorientation	not at all	22	7	29
	mild	15	14	29
	moderate	4	1	5
	quite a bit	9	22	31
	extremely	4	10	14
Total		54	54	108

Interpretation: 29 patients reported no disorientation, 79 experienced milds to extreme disorientation. Significant dose association ($\chi^2 = 17.616$, $p = 0.001$), with **higher doses producing more severe disorientation.**

Table 15. Distribution of Misinterpretedsounds Severity across Ketamine Dose Groups and Chi-Square Test Results
misinterpretedsounds

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	not present	47	43.5	43.5	43.5
	mild	25	23.1	23.1	66.7
	moderate	10	9.3	9.3	75.9
	severe	26	24.1	24.1	100.0
	Total	108	100.0	100.0	

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
misinterpretedsounds * group	108	99.1%	1	0.9%	109	100.0%

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	17.616 ^a	4	.001
Likelihood Ratio	18.390	4	.001
Linear-by-Linear Association	13.825	1	.000
N of Valid Cases	108		

a. 2 cells (20.0%) have expected count less than 5. The minimum expected count is 2.50.

misinterpretedsounds * group Crosstabulation

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Count

		group		
		0.1	0.3	Total
misinterpreted sounds	not present	23	24	47
	mild	11	14	25
	moderate	7	3	10
	severe	13	13	26
Total		54	54	108

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	1.981 ^a	3	.576
Likelihood Ratio	2.028	3	.567
Linear-by-Linear Association	.156	1	.693
N of Valid Cases	108		

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 5.00.

Interpretation: 47 patients had no misinterpretation of sounds, 61 had mild to severe episodes. No significant dose association ($\chi^2 = 1.981$, $p = 0.576$), indicating **misinterpreted sounds occurred irrespective of dose.**

Analytical Calculations

To analyze the association of ketamine dose with the severity of perceptual disturbances (illusions) in patients receiving low-dose ketamine in the emergency department.

Hypotheses

H₀: The dose of ketamine is **not strongly correlated with the prevalence/intensity of perceptual illusions.**

H₁: The dose of ketamine is strongly correlated with the prevalence/intensity of perceptual illusions.

Level of Significance

0.05

Test Statistics

Chi-square is appropriate here because:

Categorical Data: Both variables (ketamine dose and severity) are categorical.

Testing Association: It is used to test whether the extent of illusions is relative to the dose of ketamine.

Non-Parametric Nature: Chi-square is the most suitable as we are working with counts of frequencies and not numerical means.

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Results

Table 16. Distribution of Perceptual Disturbances Among Emergency Patients Receiving Low-Dose Ketamine

Perceptual Disturbance	Not Present	Mild	Moderate	Severe/Quite bit/Extremely	Total (N)
Distorted hearing	33	27	26	22	108
Floating feeling	42	28	19	19	108
Body boundary	38	14	35	21	108
Unreal	38	20	30	20	108
Disconnection	50	13	25	20	108
Uncontrolled actions	10	38	25	35	108
Blank memory	38	12	18	40	108
Conversation difficulty	26	29	9	44	108
Disorientation	29	29	5	45	108
Body distortion	41	15	24	28	108
Misinterpreted sounds	47	25	10	26	108

Table 17. Analysis Results for Chi-Square Tests

Perceptual Disturbance	Dose 0.1					Dose 0.3					Total	χ^2	df	p-value
	Not present	Mild	Moderate	Quite a bit	Extreme	Not Present	Mild	Moderate	Quite a bit	Extreme				
Distorted hearing	20	17	12	5		13	10	14	17	17	108	9.999	3	0.019
Floating feeling	29	15	5	5		13	13	14	14		108	14.764	3	0.002
Body boundary	27	4	11	12		11	10	24	9		108	14.565	3	0.002
Unreal	31	10	4	9		7	10	26	11		108	31.491	3	0.000
Disconnection	34	5	5	6	9	16	8	19	11		108	14.132	3	0.003
Uncontrolled actions	3	28	13	9	1	7	10	12	20	5	108	17.005	4	0.002
Blank memory	26	4	11	13	0	12	8	7	19	8	108	16.505	4	0.002
Conversation difficulty	19	18	9	4	4	7	11	0	12	24	108	34.514	4	0.000
Disorientation	22	15	4	9	4	7	14	1	22	10	108	17.764	4	0.001

Perceptual	Dose 0.1					Dose 0.3					Total	χ^2	df	p-value
Body distortion	24	9	5	16		17	6	19	12		108	10.533	3	0.015
Misinterpreted sounds	23	11	7	13		24	14	3	13		108	1.981	3	0.576

Conclusion

The crosstabulation analysis has shown that the amount of ketamine given in the emergency environment directly influences the severity and occurrence of the perceptual disturbances of the patients. The 108 cases analyzed revealed that increased doses of ketamine (0.3mg/kg) tended to induce more perceptual phenomena such as distorted hearing, floating feelings, body-boundary distortions, feelings of unreality, uncontrollable actions, blank memory, difficulty in conversation, disorientation, and body distortion.

Conversely, mild or no symptoms were dominant in the lower dose group (0.1mg/kg) with regard to these variables. The statistical significance of these associations was confirmed by chi-square tests with a p-value of 0.000 to 0.019, which determined that most perceptual disturbances are dose-dependent in development and severity. The misinterpreted sounds only do not represent any statistically significant correlation with ketamine dosage ($\chi^2 = 1.981$, $p = 0.576$), which indicates that auditory misperception might not be dependent on the dose used.

To evaluate the association of ketamine dose with the severity of perceptual disturbances (illusions) in patients receiving low-dose ketamine in the emergency department

The findings show that there is a definite dose response association between the dose of ketamine and other perceptual disturbance. Patients with a dosage of 0.3 mg/kg had significantly greater levels of severity in several disturbances such as unreality, disorientation, floating feelings, memory lapses, and problems communicating. The chi-square tests showed that significant differences in all (10 out of 11) of the measured variables occur, proving that the extent of perceptual disturbance as the dose of ketamine raises also exists. There was no association between the dose and only misinterpreted sounds. These results indicate that dose is a significant determinant of the effect of dissociation when ketamine is used in emergencies.

DISCUSSION:

Our study results are consistent with the available literature besides providing a novel contribution to the current body of knowledge on the effects of low-dose ketamine on perceptual experiences in real-world emergency departments. Even though prior studies have concurred severally that ketamine is capable of producing dissociative and perceptual changes, our study shows that such changes do not subside even in the low dosage analgesic regimen. The similarity in our observations and previous research would indicate that the psych perceptual action of ketamine is patterned and these effects are generally brief, mild to moderate, and dose-dependent but not often leading to complete illusions and potentially hazardous degrees of mental instability (14,15).

Among our patients, the perceptual disturbances were prevalent but were mostly dominated by illusions, dissociative sensory experiences, as well as, phenomena of altered sensory processing which have been adequately recorded through controlled experimental studies (18). This is especially in line with the findings of phenomenology reported by other authors who have found that ketamine is more likely to bring about distortion of perception as opposed to actual psychotic hallucinations even in a higher dose. The agitations witnessed in our research, including a lack of realness, body image, and concentration or communication issues are directly in line with the profile that has been put into place concerning the dissociative effects of ketamine (19,20).

Our results thus serve as a significant literature gap as numerous studies are devoted to the analgesic effect of ketamine, whereas few explored the perceptual side effects of this drug in an emergency population (17). As demonstrated in the current work, although low-dose ketamine is still an effective analgesic, perceptual impairment is not an exceptional case and it must be reported to the patient when making informed consent and performing per-procedure pre-administration guidance. These effects are particularly crucial to be understood in the emergency setting where patients tend to be anxious and are not familiar with the medication, and are more prone to distress due to the unpleasant unexpected sensory changes. A recent systematic review and meta-analysis which has examined adverse neuropsychological events in six clinical trials offers a good example of this trend (21,22).

Although the analysis established that ketamine was related to a relative risk of 2.83 with the psychological effects such as delirium, hallucinations and mood changes, the 95% confidence interval (0.98-8.18) had the value of 1.0 which indicated that the increase was not statistically significant. This is highly similar to the case of our patient population (16). Interestingly, the studies of the psychotomimetic effect of ketamine have revealed that even at higher experimental doses, the substance is more likely to cause perceptual distortions than actual hallucinations. An interesting phenomenological investigation by healthy volunteers was done in 2005 and it found that the participants had mild perceptual effects like sensory heightening and derealization but none had any real hallucinations despite being dosed with dosages sufficient to induce psychotomimetic effects (23,24).

Low dosage of ketamine has also received a lot of concern in emergency medicine as a powerful analgesic agent in the treatment of acute pain. It is proved that ketamine in low doses is effective in analgesia in emergency departments and the studies have shown that ketamine significantly reduces pain when administered in sub-dissociative dosage. A systematic review of the ketamine in the emergency department discovered that ketamine has a rapid analgesia effect with a good safety profile and is especially useful in patients with severe acute pain (25,26).

The action of ketamine acting as an analgesic is very different as it is based on NMDA receptor inhibition unlike conventional opioids which act by activating opioid receptors. It has been demonstrated in clinical trials that ketamine can be used safely over a dose of 0.1 to 0.5 mg/kg with effective analgesia without impairing respiratory and hemodynamic functions which is also very beneficial in a busy emergency department setting. In comparative studies between ketamine and conventional opioid analgesic agents, similar or better pain relief scores have been reported with some

studies suggesting that ketamine is particularly effective in certain types of pain like traumatic injuries and fractures (27,28).

The accumulating evidence on the analgesic efficacy of low-dose ketamine has resulted in its greater use in emergency department pain treatment regimens, although concerns regarding the optimal dosage regimen and patient selection criteria remain open to research. What our research adds to this growing body of knowledge is that instead of focusing on only efficacy, the safety profile in terms of perceptual disturbances that could affect patient acceptability and clinical decision-making are also examined (29,30).

CONCLUSION:

This research examined the relationship between low-dose ketamine (0.1 mg/kg and 0.3 mg/kg) and perceptual disturbances in emergency department patients, revealing that dissociative effects such as floating feelings, unreality, disconnection, communication difficulties, and memory impairment are prevalent even at sub-dissociative analgesic doses, with most patients experiencing at least one sensory, emotional, or cognitive change. A clear dose-response pattern was observed, where 0.3 mg/kg led to significantly higher severity in nearly all disturbances compared to 0.1 mg/kg, supported by statistical tests, emphasizing dose as a key risk factor. Clinically, this highlights the need to balance analgesia with side effects, recommending lower doses when feasible, patient education on potential transient illusions, closer monitoring for higher doses, and consideration of individual factors like anxiety or psychiatric history. However, limitations include the single-center design, lack of control for confounders (e.g., concurrent medications), absence of psychiatric screening, and focus on short-term effects only, suggesting future studies should explore generalizability, causality, and long-term outcomes for safer, patient-centered ketamine use in emergencies.

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