

## Research Article

### INTRAVENOUS KETAMINE ANAESTHESIA: A 20- YEAR EXPERIENCE IN A SUB-URBAN HOSPITAL IN NIGERIA

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#### Abstract :

Although the role of intravenous ketamine anaesthesia in the operating theatre setting is not well defined, it is still widely used as a general anaesthetic agent in most parts of Nigeria where the services of anaesthesiologists are scarce. This retrospective study was aimed to highlight the experience of intravenous ketamine use in a general practice hospital in Auchi, Nigeria. Case records of all patients who were operated using intravenous ketamine from January 1994 to January 2014 were retrieved and the relevant data extracted for the study. One thousand three hundred and seventy patients were operated, 463(33.8%) being major and 907(66.2%) being intermediate/minor operations. More females (725 [53.0%]) than males (645 [47.0%]) were operated. Transient elevation of blood pressure with mild tachycardia, postoperative disorientation and confusion, emergent delirium and priapism were the adverse effects observed in 31 patients. It is concluded that intravenous ketamine anaesthesia has high clinical efficacy and safety in these patients.

**KEYWORDS:** Intravenous Ketamine, Anaesthesia, Adverse effects of ketamine, Suburban hospital, Nigeria.

#### INTRODUCTION

There is a general dearth of anaesthesiologists in Nigeria, hence intravenous (IV) ketamine has continued to be widely used in the country as a general anaesthetic to perform many major and intermediate/minor operations with little anaesthesia-related complications.<sup>[1-2]</sup> Having been in use for more than 50 years, ketamine has proven to be a safe dissociative anaesthetic drug with potent analgesic properties. It has been widely used to induce narcosis because it preserves respiratory and cardiovascular functions, and in the context of emergency, it allows the preservation of pharyngeal and laryngeal reflexes.<sup>[3]</sup>

The psychodysleptic (psychotomimetic) effects associated with ketamine use, affected its popularity in the 1980s but during the 1990s till date, its peculiar antihyperalgesic properties renewed the interest for it because these properties are appealing in many awkward clinical scenarios<sup>[3]</sup>. Also more recently, an antidepressive activity of ketamine has been demonstrated that may participate in the recovery from the disability resulting from chronic pain syndromes.<sup>[4]</sup>

The antagonism of N-methyl-D-aspartate (NMDA) receptor is responsible for ketamine's more specific properties. Ketamine may promote neuronal apoptotic lesions in experimental animals but in clinical doses, it does not induce neurotoxicity. The consequences of high doses, repeatedly administered, are not known, although cognitive disturbances are frequent

with chronic use, as well as frontal white matter abnormalities. Hence safety concerns have been advocated especially in the case of administration during pregnancy and in paediatric setting.<sup>[3-6]</sup>

This paper aims to highlight a 20-year experience of the safe and efficacious use of ketamine anaesthesia in a suburban hospital in Edo State in the South-South Region of Nigeria with emphasis on what to do where similar situations exist in developing countries.

### **PATIENTS AND METHODS**

This is a retrospective study of the operated patients in Osigbemhe Hospital Auchi, a 25-bed privately owned general practice centre in Edo State, in the South-South Region of Nigeria from January 1994 to January 2014. Data were collected from the theatre register and patients' case notes. These data included age, sex, educational background, occupation, diagnosis, type of operation done and the mode of anaesthesia, duration of the operation, as well as the adverse effects recorded intra-operatively and during the immediate post-operative period when the patient recovered from anaesthesia.

Of note, all the operations were done by the Medical Director who is a senior experienced general practitioner as well as a Consultant Clinical Pharmacologist/Associate Professor, except in the case of bilateral truncal vagotomy and drainage, prostatectomy, thyroidectomy and hysterectomy when a Consultant Surgeon/Professor was invited. The surgeon doubled as the anaesthesiologist while the nurse monitored the patient.<sup>[7]</sup> Intravenous ketamine was administered at the induction dose of 2mg/kg in adults and 1mg/kg in children. This was followed by increment of 1-1.5mg/kg for maintenance of the anaesthesia. Premedication given was atropine 0.6mg in adults and 0.3mg in children as well as diazepam 10-20mg in adults and 0.45mg/kg in children. Those with mildly elevated blood pressures were given chlorpromazine 50-100mg prior to induction; so also were those undergoing intra-abdominal operations where muscle relaxation was required. In the case of caesarean section and thyroidectomy, local anaesthesia was done with 1% lidocaine infiltration before the delivery of the baby and at the stage of mobilizing the superior poles of the thyroid gland, respectively.<sup>[8]</sup>

All patients breathed room air freely. Patients were monitored by the nurse who regularly recorded the vital signs as well as the doctor who still kept an eye on the patients to detect adverse effect. Two hundred and thirty six operations were emergency while 1134 were elective.

### **Statistical analysis**

The data were analyzed using SPSS software to generate percentages, proportions, means and standard deviations. Where necessary, the student-t test was used to make comparison at 95% confidence interval while  $P < 0.05$  was considered to be statistically significant.

### **RESULTS**

There was a total of 1370 cases comprising 645(47.0%) males and 725 (53.0%) females ( $P < 0.05$ ). The age range was between 3 months to 86 years with the mean age being  $28 \pm 12$  years. Table 1 shows the age and sex distribution of patients who underwent operations.

There were 463(33.8%) major operations and 907(66.2%) intermediate/minor operations,  $P < 0.01$ , (Table 2). From Table 3, more major operations were done in females (282 [60.1%]) than in males (181 [39.1%]). Conversely, from Table 4, more intermediate/minor operations were done in males (464 [51.2%]) than in females (443 [48.8%]),  $P < 0.05$ . The adverse effects observed are as listed in Table 5. The important adverse effects observed in 31 patients were post operative disorientation and confusion, emergent delirium and priapism that were observed in 17, 14 and 1 cases, respectively. Some patients experienced more than one adverse effects.

**Table1: Age and gender distribution of 1370 operation cases**

Age range (yr)	Sex		Total (%)
	Male (%)	Female (%)	
0 – 10	21 (1.5)	18 (1.3)	39 (2.8)
11 – 20	42 (3.1)	94 (6.9)	136 (9.9)*
21 – 20	148 (10.8)*	213 (15.5)	361 (26.4)*
31 – 40	102 (7.4)*	159 (11.6)	261 (19.1)*
41 – 50	132 (9.6)*	104 (7.6)	236 (17.2)*
51 – 60	156 (11.4)*	112 (8.2)	268 (19.6)*
61 – 70	29 (2.1)	13 (0.9)	42 (3.1)
71 – 80	13 (0.9)	8 (0.6)	21 (1.5)
81 – 90	2 (0.1)	4 (0.3)	6 (0.4)
<b>Total</b>	<b>645 (47.1)</b>	<b>725 (52.9)</b>	<b>1370 (100.0)</b>

\*Higher % in these age ranges

**Table2: Types of operations done with intravenous ketamine anaesthesia**

Major Operations	No (%)	Intermediate/Minor Operations	No (%)
Bilateral truncal vagotomy & drainage	6 (0.4)	Herniorrhaphy	373 (27.2)*
Prostatectomy	14 (1.0)	Herniotomy	12 (0.9)
Exploratory laparotomy	10 (0.7)	Hydrocoelectomy	50 (3.6)
Thyroidectomy	4 (0.3)	Haemorrhoidectomy	11 (0.8)
Drainage of liver abscess	2 (0.1)	Sphincterotomy	7 (0.5)
Appendicectomy	341 (24.9)*	Suprapubic cystostomy	8 (0.6)
Bladder repair	3 (0.2)	Bouginae	15 (1.1)
Caesarian section	48 (3.5)	Catheterization	20 (1.5)
Repair of rupture uterus	4 (0.3)	Evacuation for incomplete abortion	34 (2.5)
Hysterectomy	5 (0.4)	Cervical laceration	2 (0.1)
Myomectomy	12 (0.9)	Manual placental removal	4 (0.3)
Salpingectomy	7 (0.5)	Lumpectomy	142 (10.4)*
Ovarian cystectomy	7 (0.5)	Major debridement	36 (2.6)
		Major laceration	168 (12.3)*
		Reduction of fracture/dislocation	9 (0.7)
		Sequestrectomy	4 (0.3)
		Foreign body removal from the ear	12 (0.9)
<b>Subtotal</b>	<b>463 (33.8)</b>		<b>907 (66.2)</b>
<b>Total</b>		<b>1370 (100.0)</b>	

\*Higher % in these operations

**Table3: Gender distribution of 463 major operation cases**

Major Operations	Gender		Total (%)
	Male No (%)	Female No (%)	
Bilateral truncal vagotomy & drainage	5 (1.1)	1 (0.2)	6 (1.3)
Prostatectomy	14 (3.0)	0 (0)	14 (3.0)
Exploratory laparotomy	4 (0.9)	6 (1.3)	10 (2.2)
Thyroidectomy	0 (0.0)	4 (0.9)	4 (0.9)
Drainage of live abscess	2 (0.4)	0 (0)	2 (0.4)
Appendicectomy	155 (33.5)*	186 (40.2)*	341 (73.7)*
Bladder repair	1 (0.2)	2 (0.4)	3 (0.6)
Caesariansection	0 (0)	48 (10.4)	48 (10.4)
Repair of rupture uterus	0 (0)	4 (0.9)	4 (0.9)
Hysterectomy	0 (0)	5 (1.1)	5 (1.1)
Myomectomy	0 (0)	12 (2.6)	12 (2.6)
Salpingectomy	0 (0)	7 (1.5)	7 (1.5)
Ovarian cystectomy	0 (0)	7 (1.5)	7 (1.5)
<b>Total</b>	<b>181 (39.1)</b>	<b>282 (60.9)</b>	<b>463 (100.0)</b>

\*Higher % in these major operations

**Table4: Gender distribution of 907 intermediate/minor operation cases**

Intermediate/minor operations	Male No (%)	Female No (%)	Total (%)
Herniorrhaphy	204 (22.5)*	169 (18.6)*	373 (41.1)*
Herniotomy	7 (0.8)	5 (0.6)	12 (1.3)
Hydrocoelelectomy	50 (5.5)	0 (0.0)	50 (5.5)
Haemorrhoidectomy	8 (0.9)	3 (0.3)	11 (1.2)
Sphincterotomy	7 (0.8)	0 (0.0)	7 (0.8)
Suprapubic cystostomy	8 (0.9)	0 (0.0)	8 (0.9)
Bouginage	15 (1.7)	0 (0.0)	15 (1.7)
Catheterization	20 (2.2)	0 (0.0)	20 (2.2)
Evacuation for incomplete abortion	0 (0.0)	34 (3.7)	34 (3.7)
Cervical laceration	0 (0.0)	2 (0.2)	2 (0.2)
Manual placental removal	0 (0.0)	4 (0.4)	4 (0.4)
Lumpectomy	40 (4.4)	102 (11.2)*	142 (15.7)*
Major debridement	15 (1.7)	21 (2.3)	36 (4.0)
Major laceration	76 (8.4)	92 (10.1)*	168 (18.5)*
Reduction of fracture/dislocation	7 (0.8)	2 (0.2)	9 (1.0)
Sequestrectomy	3 (0.3)	1 (0.1)	4 (0.4)
Foreign body removal from the ear	4 (0.4)	8 (0.9)	12 (1.3)
	<b>464 (51.2)</b>	<b>443 (48.8)</b>	<b>907 (100.0)</b>

\*Higher % in these intermediate/minor operations

**Table5: Adverse drug reactions\* observed in operation cases**

Adverse drug effect*	Frequency		Total (%)
	Male	Female	
Tachycardia ( 5 beats above baseline)	21	26	47
Blood pressure 5mmHg above baseline	8	17	25
Disorientation and confusion	3	14	17
Emergent delirium	5	9	14
Priapism	1	0	1

No of participants with observed adverse effects = 31. \*Some patients experienced more than one adverse effects

## DISCUSSION

The paucity of anaesthesiologists has continued to plague developing countries nay Nigeria for many years. Hence many surgical procedures are carried out using auxilliary health staff. Thus safe and effective anaesthesia has continued to be administered using IV ketamine. The spectrum of operations done in this study also compares favourably with previous reports<sup>[1-2,7-9]</sup>, demonstrating the unchanging disease profile in the environment.

In this study, all the major and intermediate/minor operations were done using IV ketamine general anaesthesia without any serious complication. This finding is in line with previous reports<sup>[1-2,7-9]</sup> in which IV ketamine was found to be adequate and satisfactory for many surgical operations except in cases of uncontrolled hypertension and known history of psychiatric illness where its use is contraindicated.<sup>[3-4]</sup> This is because ketamine increases blood pressure and exhibits a complex neuropharmacology such as emergent phenomena and hallucinations.<sup>[4]</sup> However, in a prospective trial of patients with head injury and in animal models of stroke and head injury, ketamine has been demonstrated to have neuroprotective effects.<sup>[10]</sup> Also, in a separate report, ketamine was used successfully to control violent schizophrenic patients.<sup>[11]</sup>

In this study, mild tachycardia, transient intraoperative hypertension, postoperative disorientation and confusion as well as emergent delirium and priapism were the only documented adverse effects. This differs from a previous report where convulsion was also an observed complication.<sup>[7]</sup> These cardiovascular and central nervous system adverse effects can be reduced to the barest minimum, as in the present study, by concurrent administration of benzodiazepines such as diazepam or midazolam. One of ketamine's positive features is that it has minimal effects on central respiratory drive if given slowly, hence it can be used safely without oxygen or intubation. Since it neither produces hypotension nor respiratory depression, ketamine has become ideal for use in emergency cases in which patients are in mild-to-moderate shock.<sup>[2-3]</sup> Ketamine has a safety profile that rivals all traditional methods of emergency sedation. However, ketamine has caused hypertension and supraventricular tachycardia in two patients concurrently receiving levothyroxine. This finding has prompted the recommendation to avoid ketamine use in patients who have hyperthyroidism or who are receiving thyroxine.<sup>[12]</sup> Therefore, patients with goitre should be carefully selected before undergoing thyroidectomy in which IV ketamine general anaesthesia is used to augment lidocaine local infiltration.<sup>[8]</sup>

In this study, ketamine use was associated with priapism- the occurrence of a persistent, usually painful, erection of the penis for more than four hours unrelated to sexual stimulation or desire.<sup>[13]</sup> To knowledge, this was the first observation of this adverse effect associated with the use of ketamine. Ketamine-induced cataleptic state is usually accompanied by spontaneous limb movements with increased overall muscle tone and vasodilation, both of which could predispose to priapism<sup>[3-4]</sup>.

Ketamine produces a most useful state of dissociative anaesthesia. It has made many operations possible that would have been otherwise impossible with no anaesthesiologist/anaesthetic. All the same, healthcare professionals need to be cognizant of its adverse effects and limitations.

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