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Medication Administration Error in Anaesthetic Practice: AReview of the African Experience

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***Abstract*:** *Medication error is a significant issue of concern in medical practice because it can lead to severe and deleterious reaction. The issue is of more concern in anaesthetic practice in which medications are administered to interfere with the normal activity of the central nervous system so as to prevent pain associated with medical procedures. This papers reviews record of anaesthetic medication administration error in the African setting drawing from records of contemporary databases. Also the likely causes were enumerated and recommendations to ensure best practices. Overall 9 publications comprising 7 studies and 5 case reports were accessed from 3 countries (i.e. Nigeria, South Africa and Morocco). These error can be adequately checked by double checking of all medication label by a minimum of two Anaesthetist prior to administration, reducing Anaesthetics work load and introducing colour coding of syringes into national guidelines.*
Keywords:*medication error, anaesthetic, colour coding, iatrogenic*

I. Introduction

The crucial roles of medicines in the prevention and treatment of diseases are well appreciated; they are life-saving and can greatly improve the quality of life when used appropriately. However, the administration of medicinal products may be accompanied by avoidable undesirable effects which sometimes arelife-threatening,especially when administered in error. Medication errorsare preventable events that may lead to inappropriate medication use causing varying degrees of harm to patients [1]. These undesirable effectsarecommon in healthcare system andcan occur across the spectrum of activitiesrelating to prescribing, dispensing, transcribing and administration of medicines, with prescribing errors highlighted as the most frequent in medical practice.[2] Medication errors are said to be a known concern in the hospital setting leading to various degree of harm in patient. [3]The magnitude of harm caused to patients due to medication errors is significant and it is considered to be the most prevalent of all medical errors[2] with an estimated 7000 deaths per year in the US alone[4] Other studies have recorded that 1–2% of patients in UK and US hospitals have been expose to iatrogenic harm leading to increase in mortality as a result of medication errors.[5, 6, 7]Medication error do not only lead to increased morbidity and mortality but also contribute to longer hospital stay, additional healthcare cost. Additional healthcare cost as a result of medication related event has been estimated to be up to $1.5million in a single facility comprising of both medication error and adverse drug reaction. [8]Medication errormay also serve as a potential cause for litigation and erosion of public confidence in healthcare delivery systemas such it is a serious concern that needs to be addressed at every level of care. [9, 10, 11]

Medication error occurs in every field of medical practice and may actually be particularly more serious and sometimes irreversible in anaesthetic practice. With the advent of safer anaesthetic agents and overall improvement in the quality of anaesthetic practice, the management ofanaesthesia in general has improved in the last few decades. However, the complex working environment involving different medical and paramedical personnel and the need to use several drugs in combination in the practice may directly or indirectly drive the occurrence of medication errors in anaesthetic practice settings.

In most parts of Africa, theseimprovements have not been replicated as access to modernequipment, safer drugs and quality monitoring are severely limited. The cascade of these factors makes it more likely for medication errors to occur in the African anaesthetics practice settings.

Medication error reporting should be a common practice among health workers, however this is not the casein many settings as many errors go unreported due to number of factors including practice settings limitations, lack of reporting and data collection format, population variation, lack of a consensus definition of what constitute an error and the avoidance of defamation of colleagues and practices.[12]

Surveys of the occurrence of medication errors inanaesthetic practice in anumber of countries showsignificant variations. While only 30% of the members of the Canadian Society of Anaesthesiologists admitted experiencing errors in their lifetime career [13], 89% anaesthesiologists in New Zealand admitted

making an error in practice [14] and these figure still varies when compared with data from other advance countries.

Record keeping in African anaesthetic practices is quite poor as highlighted in an audit[15]hence medication errors data in this region is reasonable poor.[9, 16]

Several methods have been employed forcollecting data on medication errors and these methods with their associated advantages and caveats have been reviewed.[5,17] In general two approaches are popular in the study of this subject: retrospective review of critical incident reports and a prospective study. Though the prospective study of medication errors may give more accurate error rates, it is limited to a smaller population as such serious incidents may not be captured and these areadequately addressed in retrospective reviews.

In the methodology for this systematic review, case report, retrospective and prospective studies and all studies relating to medication administration error in anaesthetic practice in the Africa clinical setting were accessed and discussed. Also factors contributing to errors were highlighted and general recommendations to prevent errors wereproposed.

II. Method

Search strategy

A systematic review of literature relating to Medication administration error in anaesthetic practice across Africa was conducted between November 2013 to April 2014. The following electronic databases were searched: Embase (1974– April 2014), Pubmed (1950 – April 2014), Scopus(1966 – April 2014) and the Cumulative Index to Nursing & Allied Health Literature (CINAHL) (1982 – October 2011). The search protocol included all ages, all languages, and all types of studies. References of eligible articles were further hand search so as to uncover other relevant articles.

Search terms

The following keywords were used as search terms: medication error(s), administration error(s),anaesthetic error(s) and anaesthesia error with "Africa" and list of Africa countries.

Inclusion/exclusion criteria

Articles were included if the aim of the study was to report drug administration error in anaesthetic practice or to report adverse effect as a result of medication use in anaesthesia practice. Articles were excluded if it did not focus on drug administration error in anaesthetic practice and if study or case report was conducted outside of Africa. All letters, conference papers, opinions, reports or editorial papers were also excluded.

III. Result

The result summary is shown in figure 1 below . The majority of Africa countries have no documented report of drug administration error in anaesthetic practice with the exception of Nigeria, South Africa and Morocco. More than 450 articles were excluded, as the papers were either not related to Africa countries or not relevant to anaesthetic error. 112 articles were then left for full-text review. Furthermore 103articles were excluded because they were not relevant to the topic, not related to Africa countries or were opinion articles, letters or editorials.9 articles were identified which comprises of 7studies and 5 case report .

Figure 1

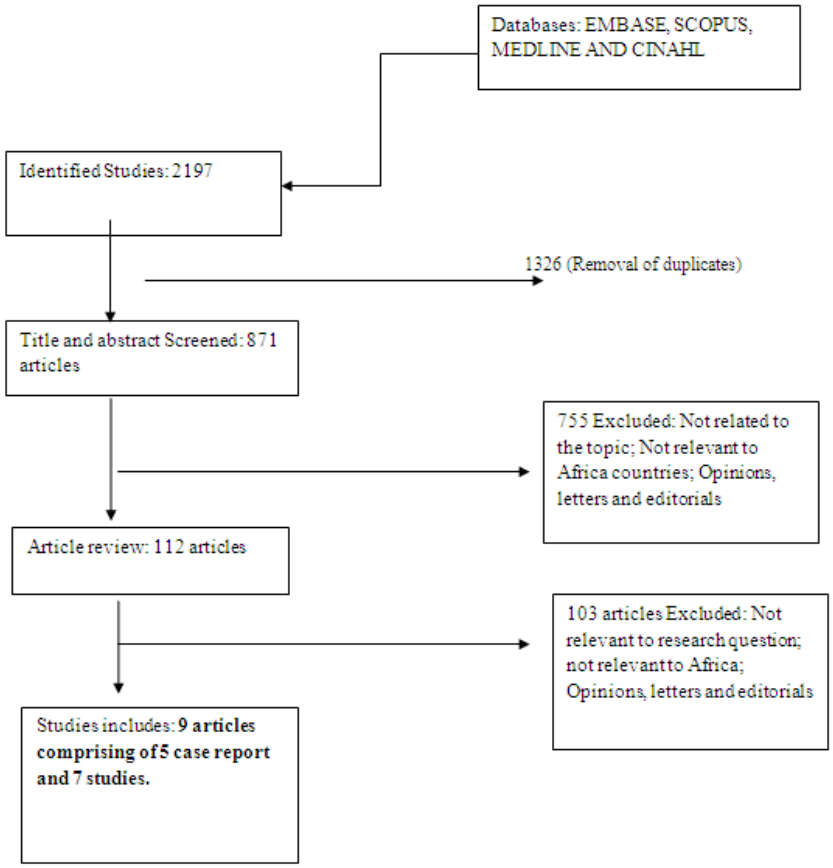

Table 1: Case report on Medication Error

No	Country Setting	Method	Medication involved	Management	Type of error	Reference
1	Nigeria	Case report	Pancuronium bromide injection 4mg being administered intravenously, instead of suxamethonium chloride injection in a 50 year old male farmer.	At the end of the procedure , residual paralysis was managed with neostigmine and atropine . He recovered fully with no adverse consequence.	Substitution	Ogboli[18]
2	Nigeria	Case report	In a 2 year old girl with Retinoblastoma booked for enucleation, 100mg of thiopentone sodium was administered in place of 25mg of the same drug because Thiopentone 1gm vial was mistaken for Thiopentone 500mg vial.	Ventilation had to be assisted for over 10 minutes until spontaneous respiration resume.	Dose	Ogboli [18]
3	Nigeria	Case report	Intravenous injection of ketamine hydrochloride instead of suxamethonium hydrochloride during a ceaserean operation after the effect of bupivacaine wore off in a 33 year Old woman	Quick ventilation with 100% oxygen after patient became unresponsive and stopped breathing. Ventilation was continued till she recovered consciousness and started spontaneous breathing.There after surgery was concluded without further complications.	Substitution	Mato &Fyneface-Ogan [19]
4	Nigeria	Case report	Injection of suxamethonium chloride instead of ketamine hydrochloride as analgesic supplement after administering intravenous propofol infusion in a 15 year old girl with left breast	Immediate cessation of respiration was observed. 100% oxygen via facemask was administered, after which she was intubated . Manual ventilation with oxygen was continued until	Substitution	Mato &Fyneface-Ogan [19]

			lump excisional biopsy.	spontaneous respiration begun, and she patient was allowed to continue breathing 100% oxygen spontaneously through the endotracheal tube. The procedure was completed successfully with out further issues.		
5	Nigeria	Case report	Inadvertent intravenous injection of 100mg ketamine hydrochloride for muscle relaxation instead of suxamethonium hydrochloride.	Not reported as there was no adverse consequence	Substitution	Mato &Fyneface-Ogan[19]

Table 2: Studies on Medication Administration Error in Anaesthetic Practice

	Country	Nature of study	Sample	Outcome	Reference
1	Nigeria	Multicentrecross-sectional survey conducted among physician anesthetists and nurse anesthetists practicing in the major secondary and tertiary hospitals in North Western Nigeria City.	43 (physician anaesthetists and nurse anaesthetists). Response rate was 86%.	Twenty four of the respondent admit to have made medication error, and 34 of them remarked that the medication error was due to look alike drug labels from manufacturers. According to the study, untoward sequelae resulted in 44% of the patients that were affected by these medication errors ranging from cardiac arrest to delayed recovery from anaesthesia. Continuous vigilance, double checking of drug labels, and colour coding of syringes was recommended as measures of minimizing medication errors in their practice.	Nwasor et al[20]
2	South Africa	Confidential self-reporting survey was posted and sent electronically to all 720 anaesthetists registered with the South African Society of Anaesthesiologists (SASA) 2004.	A total of 133 questionnaires were returned for analysis (18.5% response rate).	Of the respondents, 125 (94%) admitted to having inadvertently administered a wrong drug. Thirty respondents (22.6%) said they had made errors on at least four occasions. A total of 303 specific wrong drug administrations were described. Nearly 50% involved muscle relaxants. A further 43 incidents (14%) involved the erroneous administration of vasoactive drugs. Five deaths and 3 nonfatal cardiac arrests were reported. In 9.9% of incidents the anaesthetic time was prolonged by more than 30 minutes. Contributory causes identified included syringe swaps (40%), misidentification of drugs (27.1%), fatigue (14.1%), distractions (4.7%), and mislabelling of syringes (4.7%). Only 19% of respondents regularly use colour-coded syringe labels complying with the national standard.	Gordon et al[21]
3	South Africa	A confidential self-reporting survey was sent out to all members in the department in which details were sought of incidents of wrong drug administrations	65 anaesthetists (25 specialists and 40 registrars) in the Department of Anaesthesia at the University of Cape Town with 95.4 response rate	93.5 % of respondents admitted to having administered the wrong drug at some stage of their anaesthetic career. 19/62 (30.6%) have injected the wrong drug or the correct drug into the wrong site on at least three occasions. 56.9 % of incidents involved muscle relaxants with suxamethonium chloride administered instead of fentanyl accounting for nearly a third of cases. 17.6 % of reported incidents were classified as being dangerous, with the potential to cause either severe haemodynamic instability and / or	Gordon et al[22]

				neurological damage or seizures.	
4	Nigeria	Retrospective study involving all patients who had undergone surgery as elective procedures using a general or regional anaesthetic technique within a twelve month period	Retrospective study of eight hundred and ninety-five elective surgical procedures (12 month study)	Five patients were reported as being involved in errors of drug administration. Drugs involve are pancuronium, o xytocin, neostigmine, metoclopramide and lignocaine/bupivacaine. 4 Junior registrars and 1 senior registrar were involved in the respective cases. Poor theatre light, syringe swap and ampoules swap were recorded as cause of error. Timely intervention by senior anaesthetist ensured success in all of the procedures.	Amucheazi& Ajuzieogu [23]
5	South Africa	Anonymous questionnaires were distributed to doctors performing anaesthesia in public hospitals in the Free State	188 doctors at 22 public sector hospitals	48.8% were medical officers, and 39.3% of participants have being involved in at least one event of wrong drug administration. Registrars and specialists reported the most errors. Most events were of no clinical significance and did not cause any permanent harm to patients. The drugs mostly involved are fentanyl and suxamethonium.	Lambuschagn e et al[24]
6	South Africa	Prospective study to determine the incidence of drug administration errors by anaesthetists at three tertiary South African hospitals. Hospitals. Hospital A & C predominatly manage adult patient while Hospital B is a peadiatric hospital.	A total of 30,412 anaesthetics were administered during the 6 month study period.	The response rate and combined incidence of errors and near-misses was as follows: Hospital A 48.8% (1:320), B 81.3% (1:252) and C 48.1% (1:250). Total response rate was 53% and the combined incidence of drug administration error was 1:274. The most common errors were as a result of substituting one drug for another. At the paediatric hospital, incorrect dose was as common as substitution. According to the study, 36.9% of errors were due to drug ampoule misidentification and 21.3% were due to syringe identification errors.	Llewellyn et al[25]
7	Morroco	Prospective study was carried out in nine hospitals affiliated to four university hospitals.	9199 anesthetic procedures were reported (mean response of 36%). General anesthesia was performed in 75% of patients. (9 month study)	Sixteen cases of drug errors were reported. The drugs involved were dominated by hypnotics. Medication errors were mainly due to labeling mistakes and attention deficit due to fatigue and stress. Majority of the errors were substitution error and errors were mainly made by the less experienced practitioners.	Amor et al[26]

IV. Discussion

Our results highlightpoor reporting of medication error in African anaesthetics practice. We carried out thorough searches of published reports across different databases but found only 9 publications comprising 7 studies and 5 case reports. This finding is in tandem with previously filed reports pinpointing under-reporting of medication errors. [27,28,29] This under reporting of medication error can negatively impart on rational use of anaesthetic medication and increase medication related iatrogenic harm. Medication error reporting in anaesthetic practice can be encouraged by providing incentive per report and by encouraging reporting on an anonymous basis as knowledge gained will be beneficial in the management of future patient.

In all of the cases highlighted above, all the patient recovered fully and no significant harm or death occurred. This is in contrast to reports from other part of the world that has recorded death in anaesthetic practice. [13, 21] This implies that there is need to begin to carry out research on anaesthetic as a likely cause of death in hospitalized patient.

From the result above, medication administration error in anaesthetic practice is said to be frequently caused by lookalike drug label. [20,22,23] The onus lies on Pharmaceutical companies to ensure that medication use in anaesthetic practice especially those for intravenous administration comes in defined and easily differentiated vials of various shapes, cap colour and sizes so as to assist the practicing anaesthetics to easily differentiate vials even in the case of an emergency.

The second major cause of medication error is wrong labelling of syringes. The practice of using colour coded syringe needs to be employed across practice setting in Africa so as to minimize this type of error. From the review conducted, South Africa is the only country that use this principle to differentiate anaesthetic medication. Specific coloursare being use to differentiate anaesthetic medication according to an agreed national standard. [22, 24]

Other factors that have been highlighted as possible causes of medication error in anaesthetic practice include fatigue and distraction. Effort should be made by all stakeholders to ensure that the anaesthetic practice setting across Africa be made as convenient and comfortable as possible with adequate power, ventilation and

lightening. Also anaesthetist should not be overworked in their respective practice so as to minimize the risk of error. [26]

V. Conclusion

From this review, 9 publications comprising 7 studies and 5 case reports were accessed. This shows that there is need for improvement in medication reporting in Africa especially as regards anaesthetic practice. Secondly reports exist for only three Africa countries as regards medication administration error in anaesthetic practice and there is need for other Africa countries to report and publish their own unique practice experience so that best practices can be shared.

The types of error were found to be either as a result of substitution or the dose of the medication. Causes of error have been reported to include look alike medication vial , fatigue and lack of colour coding for syringes. This can be adequately checked by double checking of all medication label by a minimum of two anaesthetist prior to administration, reducing Anaesthetics work load and introducing colour coding of syringes into national guidelines.

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