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Microbiological quality of remnants of some injections used in paediatric ward of a tertiary hospital in Nigeria

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Abstract

Microbiological quality of remnants of Sodium bicarbonate, potassium chloride and gentamicin single dose ampoules used in emergency paediatric unit of University of Maiduguri Teaching Hospital was investigated. Nutrient agar, MacConkey agar, Saboraud dextrose agar, Mannitol salt agar, tryptone soya broth and thioglycollate medium were used for isolation and differentiation of microorganisms. Three methods (uncovered, covered with cotton wool and covered with plaster) of storage of the remnants were evaluated. After 8 hours of storage, contamination began to manifest starting with the uncovered, cotton wool covered then plaster covered. The vulnerability to microbial contamination was found to be Sodium bicarbonate> potassium chloride> gentamicin. The contaminating organisms include yeast and Staphylococcus aureus. Single dose ampoules should be used only once.

Key words: microbiological, remnants, contamination, sodium bicarbonate, potassium chloride, gentamicin.

INTRODUCTION

Administration of intravenous fluids, drugs and nutrition parenterally is very common in hospitals [1]. Studies have shown that about 80% of hospitalized patients received one form of intravenous therapy at some point during their admission [2].

Parenteral medications are usually manufactured in single dose ampoules or multidose vials (MDV). The single dose ampoules are intended for a single use and the content discarded after

use while MDV can be used severally for a patient or more. Some ampoules are manufactured with contents upto 10ml and the paediatric dose usually smaller than 10ml (1 – 3 ml) eg sodium bicarbonate while some are manufactured with 2ml content and the paediatric dose less than 2ml (0.2 -0.4ml) eg gentamicin. Such preparations are suppose to be discarded after single withdrawal of a dose, in resource limited areas, the remnants are stored for the next dose sometimes until completely exhausted. The method of storage is either by covering the open ampoule with cotton wool, covered with a plaster or left opened.

Studies have shown that contamination of parenterals lead to an outbreak or further infection that may lead to more hospital stay. Seven month outbreak of nosocomial *Burkholderia cepacia* bacterimia involving 8 children in a paeditric hospital was reported [3] it was revealed that *B. cepacia* was recovered from the upper surface of capped rubber stoppers of a commercial emulsion used as parenteral nutrition. A wide epidemic of *Pseudomonas picetti* bacteremia was reorted in Australia due to contaminated water for injection [4]. Franke and colleagues [5] reported that 2 patients died of meningitis caused by *Pseudomonas aeruginosa* in a hospital in Germany and the infection was traced to be caused by contaminated contrast media used as MDV for over 8 days.

MDV contains preservatives that maintain the product sterile during usage but ampoules are manufactured without preservatives, hence to be used once.

The aim of the study is to examine the microbiological quality of the the remnants of the content of ampoules of potassium chloride (KCl), sodium bicarbonate ($NaHCO_3$) and gentamicin after exposure to the three methods of storage in Emergency Paeditric Unit (ward) of University of Maiduguri Teaching Hospital, Nigeria.

MATERIALS AND METHODS

The media used for microbial analysis include nutrient agar, MacConkey agar, Saboraud dextrose agar, Mannitol salt agar, tryptone soya broth and thioglycollate medium. The media were prepared according to the manufacturer's instructions.

Procedure

Three ampoules of $NaHCO_3$ were opened and 1ml was removed from each ampoule. The first ampoule was covered with cotton wool, the second ampoule was covered with plaster while the third ampoule was left uncovered. The sample was collected and transferred to sterile nutrient agar and saboraud dextrose agar and incubated. The remnant contents of the ampoules were kept were patients use for keeping medications in the ward. At 8 hrs, 16, 24 and 48 hrs 1ml was withdrawn from each sample and incubated as above.

All the samples were withdrawn by a nurse to simulate the actual process of giving injection at usual time of medication. Same procedure was done for KCl and gentamicin. But a total of 9 ampoules were used for gentamicin (i.e. 3 ampoules each covered with cotton wool, plaster and uncovered) because it comes as 2ml.

The incubated media were observed for growth of micro-organisms. Anyone with visible growth was removed and sub-cultured for differentiation and characterization. All isolates were fully characterized biochemically.

A positive and negative control was put in place to determine viability and sterility of the media respectively.

RESULTS AND DISCUSSION

The result of incubation of the samples was shown on table 1. At time 0 hour, all the samples contained no microbial growth which showed that all the samples were sterile prior to the test. It also indicated that the first dose would be administered to the patient sterile as intended by the manufacturers.

Table 1: result of contamination of $NaHCO_3$, KCl and Gentamicin injections

Time (hrs)	Sample		Result	Time hrs)	Sample		Result
0	$NaHCO_3$	Cotton wool	-	16	$NaHCO_3$	Cotton wool	+
		plaster	-			plaster	+
		uncovered	-			uncovered	+
	KCl	Cotton wool	-		KCl	Cotton wool	+
		plaster	-			plaster	-
		uncovered	-			uncovered	+
	Genta	Cotton wool	-		Genta	Cotton wool	-
		plaster	-			plaster	-
		uncovered	-			uncovered	+
8	$NaHCO_3$	Cotton wool	+	24	$NaHCO_3$	Cotton wool	+
		plaster	-			plaster	+
		uncovered	+			uncovered	+
	KCl	Cotton wool	-		KCl	Cotton wool	+
		plaster	-			plaster	+
		uncovered	+			uncovered	+
	Genta	Cotton wool	-		Genta	Cotton wool	+
		plaster	-			plaster	+
		uncovered	-			uncovered	+

Key + = growth, - = no growth

At 8 hours, microbial growth was observed in uncovered $NaHCO_3$ and the one covered with cotton wool. There was no growth in sample covered with plaster. Microbial growth was also observed in KCl sample that was kept uncovered while both the ones covered with cotton wool and plaster showed no growth. All gentamicin samples showed no growth irrespective of method of storage. The result showed that at 8 hours contamination has started to manifest especially in

$NaHCO_3$ and KCl. The absence of microbial growth in gentamicin might be as a result of gentamicin being an antimicrobial agent.

At 16 hours, all samples of $NaHCO_3$, uncovered and cotton wool covered KCl as well as uncovered gentamicin have shown microbial growth.

At 24 hours, all the samples of $NaHCO_3$, KCl and gentamicin injections showed growth of microorganism irrespective of the method of storage. The result of 48 hours was not recorded because at 24 hours all the samples were positive of contamination.

It was observed that contamination of sample started with uncovered, then cotton wool and plaster, this might be as result of ease of contamination by the microorganism of uncovered ampoule followed by cotton wool cover and least plaster. The pore size of plaster is probably smaller than cotton wool. Contamination was also observed to be higher with $NaHCO_3$ then KCl and least with gentamicin, this might be due to high concentration of KCl and intrinsic antimicrobial activity of gentamicin. Microbial contamination in parenteral product are not usually seen with naked eyes, it is therefore difficult for the person administering the drug to observe especially if the contamination is new (0 to 24 hours). Hence it is pertinent to use these medications only once and discard the remaining irrespective of the volume of the remnant.

Studies have shown that more than 50% of injections in developing countries are unsafe [6], administration of contaminated remnants may increase the risk of nosocomial infection.

The organisms isolated were yeast and staphylococcus aureus, which have been implicated in hospital acquired (nosocomial) infection all over the world. Nosocomial infections are a significant problem throughout the world and are increasing [7]. For example, nosocomial infection rates range from as low as 1% in a few countries in Europe and the Americas to more than 40% in parts of Asia, Latin America and sub-Saharan Africa [8]. In 1987, a prevalence survey involving 55 hospitals in 14 developing countries in four WHO Regions (Europe, Eastern Mediterranean, South-East Asia and Western Pacific) found an average of 8.7% of all hospital patients had nosocomial infections. Thus at any time, over 1.4 million patients worldwide will have infectious complications acquired in the hospital [9]. The yeast and S. aureus are indication of contamination from the person withdrawing the sample. Withdrawals were not done under aseptic technique like laminar air flow cabinet.

CONCLUSION

Contamination of opened ampoules can occur before the next dose, it is therefore important to use the ampoules once. Aseptic technique should be ensured during withdrawal and administration of parenteral products to prevent further infection of the patient. Manufacturers of such injection should consider paediatric doses when formulating these injections.

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