TITLE: CONTAMINATION OF DRUGS IN AMPULES - THE CONTAINER AS CULPRIT!

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INTRODUCTION:Glass particle contamination of drugs marketed in glass ampules is ubiquitous during ampule opening and has been previously described, as well as consequences, hazards and possible methods of prevention[1-4]. Previous studies have concentrated only on the glass itself as a contaminant. This is the first clinical study which examines the incidence of drug contamination with particles from the external ampule surface liberated upon opening.
METHODS: The external 5-6 mm wide ampule neck surface of 15 10ml ampules (Astra Xylocaine 2%) were painted with 3 coats of a saturated methylene blue (MB) solution and allowed to dry. This resulted in a dense, adhesive coat of MB. Fifteen untreated ampules of the same type served as controls. Nurse anesthetists and Anesthesia residents were asked to first open an untreated and then a MB treated ampule and draw the content through a 21G needle into a 10cc syringe. This occurred under typical clinical conditions as per the individual's routine. We recorded during opening the use of protective (against laceration), desinfecting or contaminating measures, breakage characteristics of ampules (regular=no free fragments noted and < 2 mm variation of jagged edge height on ampule neck) and noticeable MB contamination of needle and hub. Spectrophotometric measurement of absorption at 660 nm of all samples occurred serially while alternating control vs MB samples, to exclude systematic errors. The absorption and rates of contamination in the two groups were compared using Chi^2- with Yate's correction and 1-tailed t-test. We considered contamination to be significant when P<0.05 and to be evident when absorption values exceeded mean + 3 standard deviation (SD) of control values.
RESULTS: Mean absorption X 10^{-3} (± SD X 10^{-3}) of untreated, MB treated and contaminated ampules was found to be 0.3±0.5, 5.3±6.7 and 9.6±6.6 respectively. The difference in absorption in untreated vs MB treated groups was highly significant (P=0.006, t-test). Absorption values >1.8 X 10^{-3} indicated contamination from the external ampule surface. Eight ampules in the MB-treated group met this criteria and the contamination was significant (P=0.039, Chi^2-test). In 2 cases, no contamination was apparent via photometer analysis despite the fact that clinically, MB contamination of the needle exterior surface, hub and interior surface of the needle cap was clearly evident as blue coloured drops. Clearly 66% of the syringes were clinically contaminated (P=0.0005, Chi^2-test). Five MB-treated ampules broke in a highly irregular fashion and in 4 of these, the extent of surface glass fragmentation exceeded the width of the MB coated area. In 2 of these 4 cases, no photometric contamination was evident, although one of the 2 had MB contamination of the needle and cap, as stated above. Large, full-thickness or superficial fragments (as large as 2.5 mm diameter) were noted to be liberated from the ampule necks outside of the MB treated area. Only 27% of our personnel used alcohol desinfection prior to snapping open the ampule, while non-sterile procedures, including gauze or coattails to protect against laceration (20%) or no protection (53%) at all, were most common used.
DISCUSSION: Identifiable contamination of the ampule content with the external ampule surface material was demonstrated in 66% of all samples. We expected to detect an even higher incidence, as glass fragment contamination of 10ml ampules has been shown to approach 100%[2]. Our methods may not have been sufficiently sensitive to detect all contamination from the external surface, as fragments were liberated from MB-unpainted surfaces and contaminated drug was immediately drawn up through small bore needles. The large volume (10 cc) of solution may, by dilution, have limited detection to only substantially contaminated ampules. Often ampules are carried in pockets (narcotics in anesthetic practice), intimately handled, stored on dusty shelves and not generally desinfected before opening, so that any contamination of the drug with particles originating form the ampule surface will be associated with microbial contamination. The high contamination rate found here with ampule use is significant statistically and clinically. Routine external desinfection of ampules before opening is recommended, particularly when treating immunosuppressed patients or when administering drugs via central intravenous lines. Improved drug container designs (i.e. Luer-lock openings) appear desirable to minimize nosocomial infections of patients, to eliminate sharp edges and needle use during drug administration into IV lines and to minimize injuries to personnel.
REFERENCES: 1) Sabon RL et al:Anesthesiol 70:859-862, 1989. 2) Turco S et al:N Engl J Med 287:1204-5, 1972. 3) Shaw NJ et al:Br Med J 291:1390, 1985. 4) Waller DG et al:Br Med J 292:714-5, 1986.