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Research Article

Reusing Single Use Phacoemulsification Cassette During Cataract Surgery, is it a Safe Approach?

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Abstract

Introduction: Reuse of medical equipment intended for single-use is quite common. We conducted this study to assess if this practice has an impact on patients safety.

Materials and Methods: Its a double microscopic and macroscopic study, involving 5 phacoemulsification procedures performed on artificial eyes, using one phaco cassette pack, and changing other medical devices, irrigation solutions were titrated with biochemical markers and finally assessing the risk of contamination by biochemical measurements on a total of 22 samples, and by using an artificial color for each procedure, and then study their presence at the end of all procedures.

Results: For artificial eyes: Out of the 10 possibilities of probability of cross-contamination, 7 cases were noted in our experimental study, whereas for collector bags: Out of the 10 possibilities of probability of cross-contamination, 10 cases were noted, i.e. 100% contamination. with regard to macroscopic study, the different colors appear progressively on the operating table bag and on the microscope shells testifying to the potential risk of contamination.

Conclusion: Microbiological contamination, whether bacterial or viral, at the surgical site is real and obvious. Our study has confirmed this hypothesis.

Keywords: Single Use; Reused Instruments; Cassette; Phaco; Contamination; Cataract Surgery

Introduction

Advances in phacoemulsification and the development of surgical techniques have improved the results of cataract surgery. The incidence of bacterial endophthalmitis has decreased significantly since the introduction of intracameral antibiotic therapy. However, viral contamination remains invisible to the surgeon, visible to the patient if he is contaminated. Covid has taught us that viral contamination is mainly caused by contact with surfaces, In addition to the microbacterial flora, Invisible and undetectable communicable agents by the ophthalmologist are: HIV, HBV, HCV, herpes simplex, rabies, hepatitis B, Creutzfeldt-Jakob disease (CJD), cytomegalovirus, Ebstein-Barr virus, adenovirus and rubella virus, Gerstmann-Straussler-Scheinker's syndrome is also transmissible.

Aim of the Study

For most countries of the third world, especially in Africa and Asia, reuse of medical equipment intended for single-use is quite common. In our structure, Nour Clinic Of ophthalmology of Casablanca, single use for us is the rule, we conducted this study to demonstrate the absurd, and to assess whether this practice has an impact on patients safety or not.

Materials and Methods

In order to make the invisible visible, we conducted a double microscopic and macroscopic study.

Microscopic study: Involving 5 phacoemulsification procedures performed on artificial eyes, using as support: one phaco cassette system was kept with the same tubing, while the hand piece and the irrigation/aspiration systems, surgical gloves and gowns were changed after each procedure, by both, the surgeon and his operating assistant, irrigation solutions were provided by bottles of distilled water titrated with biochemical markers from N1 to N5: N1: Potassium, N2: Calcium, N3: Sodium, N4: Glucose, N5: Mag-

nesium (Figure 1 and 2). On the artificial eyes, phacoemulsification procedures were performed on 10 minutes each for the two phases: Then we carried out an ultrasensitive biochemical analysis by a laboratory in Double-blind, with a total of 22 samples: 5 eye samples Versus 5 control samples, 5 bag samples Vs 5 control samples, phaco cassette system, and finally the collector bag of the cassette (Figure 3 and 4). All this was carried out in the presence of a judicial bailiff who ensured the smooth running and safety of our experiment.

Figure 1: Technical set-up for microscopic study: artificial eyes, operating table, operating microscope, phacoemulsification machine, irrigation bottles and tubes for sampling.

Figure 2: Distilled water irrigation solutions titrated with biochemical markers, from N1 to N5: N1: Potassium, N2: Calcium, N3: Sodium, N4: Glucose, N5: Magnesium.

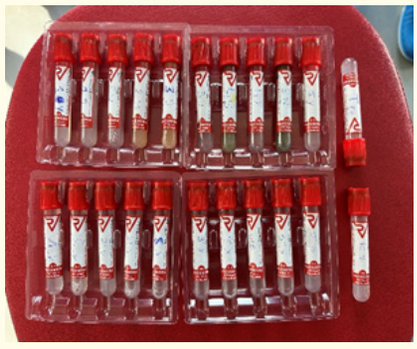

Figure 3: Ultrasensitive biochemical analysis, using a total of 22 samples.

Figure 4: Ultrasensitive biochemical analysis, using a total of 22 samples.

The macroscopic study consisted of using an artificial color for each procedure, for the surgeons' and assistants' gloves, then study of the presence of each color at the end of the procedures (Figures 5).

Results

Biochemical analysis

At the end of each procedure, samples were sterilely collected for biochemical studies on artificial eyes, drainage liquids of collector bags, and from the cassette of the phacoemulsification system by the same medical operator and analysis is carried out at the CBH laboratory (Casablanca hospital biology center); In general : The different concentrations (mEq/l) of solutes in artificial eyes and in collection bags are shown in the underlying table (1).

Figure 5: Macroscopic study: artificial color (yellow, red, green, black, white) assigned to each procedure, for surgeons' and assistants' gloves.

Concentrations (mEq/l)	Artificial eyes					collection bags				
	1st	2nd	3th	4th	5th	1st	2nd	3th	4th	5th
N1: Potassium	5.37	0.15	0.27	0.19	0.14	0.14	0.2	0.2	0.19	0.17
N2: Calcium	0	1.35	0.25	0	0	0.2	0.35	0.53	0.29	0.44
N3: Sodium	1	2	26	12	5	2	3	11	10	7
N4: Glucose	0	0	0	77.98	0,31	0	0	0	0.22	0.39
N5:Magnesium	0.03	0.03	0.09	0	0.65	0.02	0.03	0.01	0.11	0.28

Table 1: Different concentrations of solutes in artificial eyes and in collection bags.

Samples from the artificial eyes

The solutes were detected as follows: N1: was found in the 3rd and 4th artificial eyes, and respectively: N2: in the 3rd and 5th, N3: in the 4th and 5th, N4 and N5: in the 5th artificial eyes.

Samples from the collector bag

N1: was found in all collection bags, and respectively: N2: in the 3rd, 4th and 5th, N3: in the 4th and 5th, N4 and N5: in the 5th collection bags.

In summary, for artificial eyes: Out of the 10 possibilities of probability of cross-contamination, 7 cases were noted in our experimental study, whereas for collector bags: Out of the 10 possibilities of probability of cross-contamination, 10 cases were noted, i.e. 100% contamination (Figure 6,7).

Cassette sampling

All 5 solutes were found in the cassette collection bag (with respectively these concentrations in:N1=1.84/ N2=0.62/ N3=18/ N4=39.9/ N5=0.44) (Figure 8).

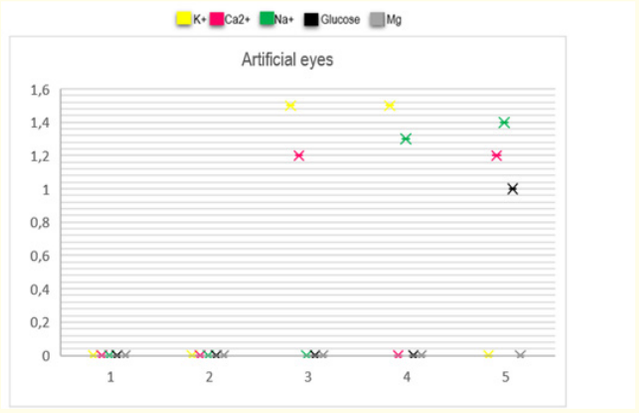

Figure 6: Summury of concentrations of solutes in artificial eyes.

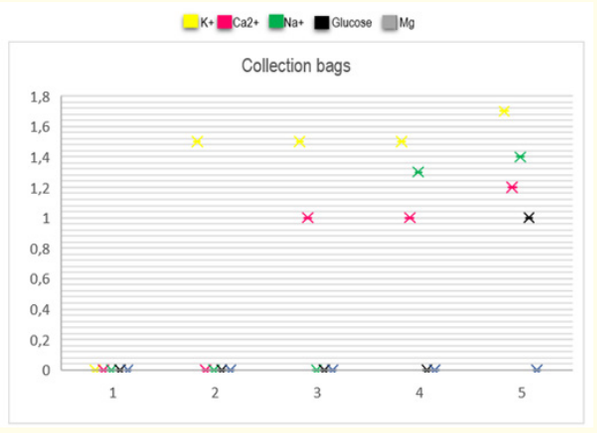

Figure 7: Summury of concentrations of solutes in collection bags.

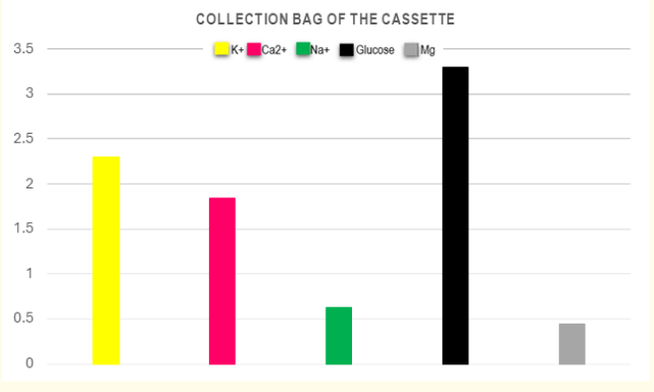

Figure 8: Concentrations of solutes in the collection bag of the cassette.

Macroscopic appearance

The different colors appear progressively on the operating table bag and on the microscope shells (Figure 9,10), secondary to the different maneuvers performed by the surgeon and his assistant. In the last procedure, all colors were present. This may correspond to the presence of liquid or solution, a source of potential cross-contamination.

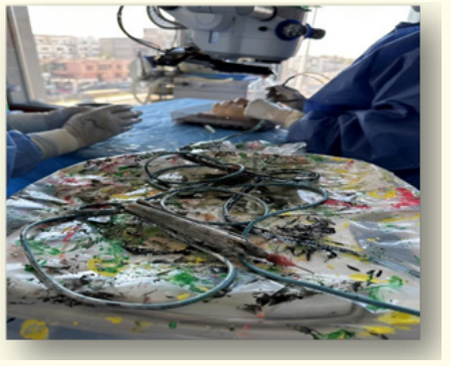

Figure 9: During the last procedure, all colors were found on the operating table bag and on the microscope shells.

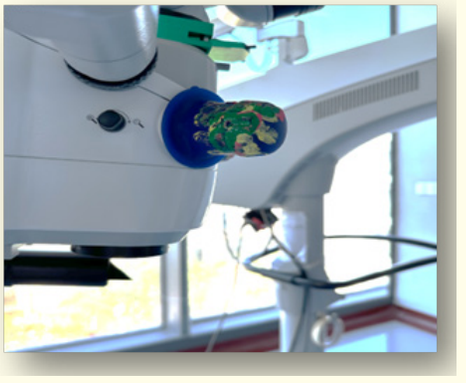

Figure 10: During the last procedure, all colors were found on the operating table bag and on the microscope shells.

Discussion

Cataract surgery is the most frequently performed surgical procedure worldwide. Phacoemulsification is currently the reference technique. This is due to its minimally invasive nature and rapidity, which make it suitable for outpatient surgery, avoiding hospitalization and reducing costs. As a means of reducing costs, in some third-world country like ours, this reuse of medical equipment is quite common. it is considered that only the handpiece comes into contact with the patient's eye, so the cassette and tubing can re-

main sterile after several procedures if it's handled with care. However, the risk of contamination is real. In fact, Malandrini., *et al*. in their study published in the European Journal of Ophthalmology in 2012, showed that there was microbial contamination of irrigation fluids during phacoemulsification, indeed, contamination does not necessarily lead to endophthalmitis, which is in fact rare, and preoperative use of antibiotics reduced its the rate [2], in particular, the use of vancomycin intracamerularly or in irrigation fluids [3-5]. For the latter, a study was carried out in Brazil by Coelho R., *et al*. similar to ours, on viral contamination during phacoemulsification on an experimental model of pig eyes. The aim was to determine the incidence of Piry virus contamination among reused surgical instruments, and this study concluded that there was a transfer of viral genetic material during the procedure where the handpiece, irrigation and aspiration systems were reused [6]. Indeed, viral contamination during ophthalmic surgery has been proven by several studies, particularly for CVH and HIV [7,8]. These results underline the importance of observing universal precautions and implementing effective methods for the maintenance and sterilization of medical instruments. In addition to the risk of infection, according to Demircan., *et al*. reuse also compromises the efficacy and prognosis of phacoemulsification, by reducing the sharpness of the bevelled edge of the handpiece. It is also responsible for the dissemination and possible retention of metallic foreign bodies. These retained fragments can cause postoperative inflammation, anterior segment toxic syndrome, siderosis or chalcosis, and even endopthalmitis [9-11]. With regard to the economic aspect, few studies have looked at the monetary value attributed to this common but controversial practice. Indeed, the conviction of the majority of surgeons in favor of reuse is economic gain, yet according to Panagiota., *et al*. the reuse of medical devices in cataract surgery is not cost-effective. According to the panel's estimates, the likelihood of complications is higher with reuse compared to single use, resulting in higher complication management costs. Consequently, the additional cost of managing them outweighs the initial benefit of not purchasing new devices [12]. In our structure, In the case of single use, especially of the cassette, we could save 80 euros per cataract surgery, the equivalent of 210 000 euros per year, but, in our facility, we are convinced that this is an inappropriate practice, and the safety of patients and staff is our absolute priority. Indeed, to save money during cataract surgery and at the same time reduce the environmentally harmful waste associated with single-use, a good alternative would be to manufacture reusable devices with well-coded standards for their re-sterilization and cleaning. This could make cataract surgery more accessible, especially in developing countries [13], lastly, from an ethical point of view, the reuse of medical equipment without the patient's informed consent is totally inappropriate, and from a legal point of view, it is also a practice that engages the surgeon's responsibility [14-16].

Conclusion

Microbiological contamination, whether bacterial or viral, at the surgical site is real and obvious. This and other studies have confirmed this hypothesis. Fortunately, bacterial contamination has been significantly reduced by intraoperative intra-cameral antibiotics, but viral contamination remains underestimated due to its long incubation period and silent evolution. We insist that cost savings must not be at the expense of patient safety. We can come up with ideas to save money during cataract surgery, but without harming the patient or exposing him to complications, either in the short or long term. As surgeons, we must always think in the following order: Quality, safety and finally cost.

Conflict of Interest

The authors declare no conflict of interest.

Contribution of the Authors

All the authors participated in the care of the patient and the writing of the manuscript. All authors have read and approved the final version of the manuscript.

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