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Intravitreal Injection Endophthalmitis Results: Two Different Rooms

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Abstract

Purpose: To compare postoperative complication rates of intravitreal injections (IVIs) when performed in dedicated rooms versus performed in standard surgical rooms.

Material and methods: Group 1 underwent IVIs in the operating room, Group 2 underwent IVIs in a dedicated room with high-efficiency particulate air filtering device (PFD) on mode (0.02 %). Postoperative complications, room particle counts were evaluated.

Results: A total of 13354 injections consisting of 652 females (48 %) and 680 males (52 %) who had undergone intravitreal injection were reviewed. Endophthalmitis was observed in a total of 3 injections (0,022%), 2 patients in the operating room (0.02%), and 1 patient in the dedicated room.

Conclusion: We found no difference between performing IVIs in a theatre versus in a dedicated room.

Keywords: hospital productivity, endophthalmitis, dedicated room, intravitreal injections, postoperative antibiotics

Introduction

Intravitreal drug injections (IVIs) have long been used for the treatment of retinal diseases. Although performed ambulatory and extensively, the optimum place to perform this surgical intervention is a subject of debate. British Royal Society of Ophthalmologists recommends

an operating room or dedicated rooms for IVIs. On the other hand, American Academy of Ophthalmology (AAO) does not have a recommendation for a dedicated room for IVIs (1,2). As a principle, hospital infection control committees suggest all operations to be performed in an operating room environment; however, not all ophthalmology procedures require a sterile room (3). Performing IVIs in a standard surgical operating room (theatre) may block other surgical schedules unnecessarily in hospitals. Furthermore, if an IVI treatment procedure involves an increasing number of injections, these together may lead to a noticeable decrease in productivity in hospital management. Nevertheless, the IVIs have a rare risk of infections related to the treatment environment: Bacterial endophthalmitis. The endophthalmitis is the most feared complication because it has poor visual prognosis. In order to avoid this problem, the operational conditions, organization and preparations become important (4).

In this study, we aimed to compare the endophthalmitis in intravitreal injections when performed in dedicated rooms versus performed in standard surgical operating rooms (theatres)

Material and Methods

This study was conducted per the Declaration of Helsinki Guidelines, and local ethics committee approval was

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obtained accordingly.

In this study, patients who had anti-VEGF injections (Bevacizumab, Ranibizumab, Aflibercept) were retrospectively reviewed for January 2014 and October 2018. The please intravitreal injections were used for exudative age-related macular degeneration, clinically significant diabetic macular edema, macular edema associated with branch and central retinal vein occlusion.

All of the procedures were carried out by the same surgeon (Dr. SGC). Patients were divided into two groups, in the first group intravitreal injections performed in surgical operating rooms (theatre) and the second group intravitreal injections performed in the dedicated room with high-efficiency particulate air filtering device (PFD) on mode (% 0.02). Patients were randomly selected and distributed and after the procedure, endophthalmitis and secondary cataract rates were reviewed. Also, air-borne particles during the procedures were measured for both rooms.

The theatre is a standard/classical surgical operating room without laminar flow, and the dedicated room is a specially designed, three sections unit composed of the locker room, semi-restricted area and restricted area for the intervention. Automatic doors separated the intervention section and the semi-restricted area. Intervention section included antibacterial vinyl surface from floor to a height of 2 meters, an air conditioning for clean air (Daikin, Japan), a high-efficiency particulate air filtering device (Daikin- mc70lvm, Osaka-Japan, PFD), an ultraviolet lamp and a clinical pathway designed to reproduce theatre check protocols. Maximum of four people can operate in the room at any time (including the patient). Injections were performed with the same standard surgical procedure in both rooms. Topical anesthesia was used, following surgical area cleaning with 10% povidone-iodine, and 5% topical povidone-iodine in the eye. Sterile lid speculum, mask, sterile gloves, and drape were used. Injections were performed 3,5 mm inferior to the limbus with 30 G needle. The physician and nurse wore operating rooms clothing, a disposable surgical cap, and surgical masks in both theatre and dedicated room.

After the procedures, a drop of povidone-iodine 5 % was applied into the eye immediately marking the entry point with the end of a sterile syringe, and the eye surface was rinsed with 0.5% saline and the ocular surface toxicity was minimized. The patients were examined for endophthalmitis on the day following the operation, and also one week later. All cases of suspected endophthalmitis underwent vitreous tap (or culture) and intravitreal antibiotics (vancomycin and ceftazidime) were de-

livered. Pars plana vitrectomy also considered according to clinical progression.

Air-borne particle measurements were performed in different locations of both operating rooms and the injection rooms. Measurements were explicitly performed in the injection area (around the head of the patient) and around the surgical tool table; particles with a size of 0,3-0,5-0,7-1.0-2.0-5.0 micron were especially measured. The measurement was performed with Aerotrak 9306 (Minnesota- USA) portable particle measurement device. In the dedicated rooms, two type of measurements and injections were performed. In PFD switched off mode, patients were taken to room and surgeon performed injection, air-bone particular measurements were done, and patients were taken out. The same procedure was performed with PFD switched on a mode in alternating days with the same number of patients for each day. The main purpose of this change, to determine the effect of PFD device on particle number and the relationship between particle number and endophthalmitis. Average of measurements were recorded as data. In theatre room, all measurements were done all filter systems on mode.

Confidence intervals were calculated using the Newcombe-Wilson (22) method without continuity adjustment in Microsoft Excel 2008 (Microsoft Corporation, Redmond, WA). Statistical analysis was performed using Pearson chi-square test for two proportions in SAS 9.3 (SAS Institute Inc., Cary, NC).

Results

A total of 13354 injections consisting of 652 females (48 %) and 680 males (52 %) who had undergone intravitreal injection were reviewed. IVIs were performed in 8602 (64%) of these injections in the theatre, and the average age of the patients was 68.1 ± 12.3 (38-99) years.

4752 (36%) injections underwent the procedure in the dedicated room, and the average age of the patients was 68.6 ± 11.2 (25-90) years. In a dedicated room, 2370 injections performed PFD off mode, 2382 injections performed PFD on mode. Endophthalmitis was observed in a total of 3 injections (0,022%) (95 % confidence interval 0,01-0,07 %) while endophthalmitis was seen in 2 patients who had undergone injection in the operating room (0.02%) (95 % confidence interval 0,01-0,08 %), it was seen in 1 patient who had undergone injection in the injection room PFD on mode. (% 0.02) (95 % confidence interval 0,00-0,12 %) . This was not statistically significant ($p > 0,05$, $p = 1$). Staphylococcus epidermidis proliferated in the culture of all endophthalmitis cases. Secondary cataract, retinal detachments were not seen.

Table 1: Patients features, Complications and Particle Counts

	Participant Classification					
	Theatre	Dedicated Room				
Number Of Injection	8602 (64%)	4752 (36%)				
Average Age	68.1 ± 12.3	68.6 ± 11.2				
Endophthalmitis	2 (0,023%)	1 (0,021%)				
Culture Result	2 (Staphylococcus epidermidis)	1 (Staphylococcus epidermidis)				
		<table border="1"> <thead> <tr> <th>PFD ON</th> <th>PFD OFF</th> </tr> </thead> <tbody> <tr> <td>29869/ m3 ± 4188 (22300-37000)</td> <td>7849169/ m3 ± 944044 (6539000-9520000)</td> </tr> </tbody> </table>	PFD ON	PFD OFF	29869/ m3 ± 4188 (22300-37000)	7849169/ m3 ± 944044 (6539000-9520000)
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PFD: Particulate air filtering device

We observed no difference regarding post-operational complications between the rooms whether being a theatre or the dedicated room.

When we checked the particle counts of both rooms, the theatre was 29869/ m3 ± 4188 (22300-37000) (Iso 6, 0.5-micron particle size). An average of 7849169/ m3 ± 944044 (6539000-9520000) (Iso 9) with the air conditioning for clean air with PFD off mode ; the particle count was 281.516 / m3 ± 11819 (262200-295300) when the device (PFD on mode) was placed near the patient’s injection chair (17) (Table-1). Particle counts were primarily performed in the injection field and around the area which had been used as the sterile table. Thus, the particle count in the operating environment did not contribute to post-operational complications. Endophthalmitis was seen in theatre (lower particle count) and dedicated room with PFD on mode (lower particle count).

Discussion

Intravitreal injections have become an irreplaceable part of ophthalmology and their indication spectrum is continuously expanding. Anti-vascular endothelial growth factor (Anti-VEGF) and sustained release of steroid implants are among the most administered intravitreal drugs (5-7).

The primary focus is on patient safety, concerning prevention of complications since IVI procedures may lead to severe infections. The most feared complication of the injections is endophthalmitis, which has an incidence of 0.2 to 0.00%, and this incidence increases cumulatively with sequential independent injections (1,2,8,21).

In order to avoid the risk for endophthalmitis, povidone iodine is topically administered as the first choice for protection. The burden of other methods such as using sterile surgical gloves, masks, drapes, or using a sterile operating are all hypothetical (18-20). The treatment environment is also crucial. We compare the place of the procedure regarding complications and found no statistical difference between the incidence of endophthalmitis after being operated in a dedicated room with specialized instruments or the surgical room (theatre).

We further looked at possible causative factors of complications since operating rooms or dedicated rooms were not among the factors. Airborne particles are considered to be the causative agents of infections not only in ophthalmologic procedures but also in many other fields of medicine. These particles are considered to be transfer-attachments for microorganisms and decreasing the particle count assumed to decrease the rate of infection, as well 9. According to the intravitreal injection simulation study performed by Lapid-Gortzak et al., in which mobile ultra-clean unidirectional airflow (UDF) device has been used, this device was reported to decrease the particle count over the size of 0.3 microns significantly and therefore recommended in intravitreal injections to decrease the incidence of infection. In our study, using a mobile cleaning device decreased the particle count to 95% (7.390.571/ m3 to 282.566 / m3). Neither a global number of particle standard for intravitreal injections nor a standard for the places where these injections are being performed does exist 10. In a study performed by Arbell et al., 12249 patients who had received intravitreal

injection were reviewed; 8873 of these injections were performed in a theatre, and the remaining 3376 were performed in an office environment. A high-efficiency particle filtering system, mask, bonnet, vinyl floor covering were used in the office environment. While no endophthalmitis was seen in the theatre conditions, 4 cases of endophthalmitis were seen in the office environment, and therefore it was concluded that the risk for endophthalmitis would be lower in the theatre environment (3).

In our study, we did not see a difference between the dedicated room and the operating room for endophthalmitis. We calculated the overall endophthalmitis ratio as 0,022% (3/13354). In the meta-analysis by Band et al., in which the ratio of endophthalmitis was reviewed following intravitreal anti-VEGF injections, endophthalmitis ratio was calculated as 0.035% (0.012% to 0.100%) and a statistically significant difference was not found between the injections performed in the theatre and the in the office environment with respect to endophthalmitis ($p=0,243$) (12). In Brynskov et al. study, the authors have performed a total of 20,293 injections in theatre and no cases of proven or suspected endophthalmitis were identified. In Freiburg et al study, total of 134,701 intravitreal injections were performed and ten cases (0,007 %) of presumed endophthalmitis were documented in between 2003 and 2016 (23) . In the same study, they performed IVIs in operating rooms under laminar flow and very low incidence may be related to laminar flow. In our study, our theatres did not have laminar flow. Laminar flow and particle count may be important in other surgeries like orthopedic and cardiac surgery, such that operative areas are many times larger than that of an intravitreal injection site and these large surgeries takes much more time.

In the study by Tabandeh et al., 5 endophthalmitis cases were reported in 11710 intravitreal injections (0.043%), 3 of these cases occurred in the office environment (0.035%, 3/8647), and 2 cases occurred (0.065%, 2/3063) in the theatre, no statistically significant difference was seen between the ratios of endophthalmitis ($p=0,611$). Besides, sterile gloves, mask, sterile drape were not used in the office environment in this study, only a sterile lid speculum, topical 5% povidone iodide and postoperative antibiotics were used (13).

In our study, we used sterile gloves, drapes and masked in both groups since otherwise would be unsanitary.

In a meta-analysis performed by Mccanel, Streptococcus species are especially reported to be present in endophthalmitis cases following intravitreal injections. Since this bacterium is usually found in the oropharyngeal line of the patients or the staff, usually appear to

be less common on the conjunctiva than staphylococci, seminate in the air with the help of droplets/particles, wearing a mask and/or filtering the air might be useful in decreasing the risk for endophthalmitis (14). In Freiburg et al study, they found that positive culture results could only be seen in 4 out of 10 endophthalmitis cases and rate was 75% *Staphylococcus epidermidis* (3/4) and 25% *Proteus* species (1/4). Similar this study, we found *Staphylococcus epidermidis* (3/3) species in our endophthalmitis cultures. This could be explained by the standard use of surgical masks, a sterile drape may be effective even if laminar flow or other PFD devices not. Though the influence of preoperative and postoperative antibiotic usage in the prophylaxis for endophthalmitis has not been determined yet, it may alter the ocular surface flora and result in colonization of more virulent and pathogenic microorganism. This might increase the incidence of endophthalmitis (15,16) . In our study, we didn't use topical antibiotics in the postoperative period.

Conclusion

We found no statistical difference between performing IVIs in a theatre versus in a dedicated room or, decreasing air particle count.

Therefore, regarding hospital productivity, performing IVIs in dedicated rooms may be a valid choice, also considering the cost and availability of using an operating room.

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