Original Research Article

Sonographic assessment of mac- off and mac- on rhegmatogenous retinal detachment: A potential critical emergency

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Abstract

Background: Mac- Off and Mac- On retinal detachments (RD) are less known and very rarely reported by the radiologists, and yet are findings which hold urgent importance in the final outcome of the patients' vision being restored. The study aimed to identify retinal detachments, differentiate Mac- Off from Mac- On retinal detachments and emphasize on the importance and urgency of surgical management for better prognosis. **Materials and method:** Fifty cases of retinal detachment were retrospectively analyzed at the Department of Radiodiagnosis. The patients were of age group ranging from 10 years to 60 years. Traumatic and non-traumatic cases, with and without any underlying infection of the affected eye were included in the study. Information of time period of the first clinical symptoms of the affected eye and promptness to contact the ophthalmologist was also retrieved and determined. Descriptive analysis of the included retinal detachment cases with differentiation into Mac- On and Mac- Off RD was done. **Results:** Out of the 50 cases studied, 41 were diagnosed as Mac- Off retinal and 9 were diagnosed as Mac- On retinal detachment. 9 cases of Mac-On RD, had reported within a few hours of their eye being affected and immediately contacted the ophthalmologist. On the other hand patients who had been diagnosed with Mac- Off RD had contacted 2 to 10 days after the eye had been clinically affected. **Conclusion:** Mac- On RD warrants immediate surgical intervention (within 24 hours) to preserve the maintained central vision Any further delay would mean the progression of Mac- On RD to Mac- Off RD , and lesser chances of preserving normal vision in spite of treatment.

Key Words: Retinal detachment, Mac- On retinal detachment, Mac- Off retinal detachment, Ultrasonography, Posterior vitreous detachment, Macula, Retina.

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INTRODUCTION

The retina, as we know, is a layer of organized neurons which line the posterior portion of the posterior chamber of the eye. The retina consisting of photoreceptors, neurons and support cells, is lined anteriorly by the vitreous and posteriorly by the choroid, and has a central portion called the macula. The macula has a high concentration of photoreceptors and is responsible for capturing central vision. More precisely there is a 1.5 mm central portion in it with the highest concentration of photoreceptors called the fovea, which forms the basis of classification of Mac- On and Mac- Off retinal detachment. Normal anatomical

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landmarks of the eye as visualized on ultrasonographic imaging are depicted in Figure 1.

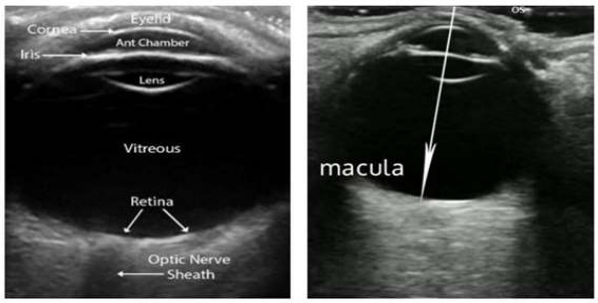

Figure 1: Normal anatomical landmarks of the eye on ultrasonographic imaging

RD (Retinal Detachment) occurs when this layer separates from the underlying epithelium, resulting in ischemia and leading to progressive photoreceptor degeneration which might result in complete blindness of the affected eye if not properly treated or even with delayed treatment and surgeries performed beyond the stipulated time period[1, 2] Depending on the type of retinal detachment, the time interval of the surgical treatment is the key to preservation of vision.[3] Retinal detachments as described are of three types[4]: Rhegmatogenous RD (RRD), Tractional RD (TRD) and Exudative and Serous RD. RRD is the most common, and is caused by a tear in the retina ('Rhegma' meaning 'tear') with consequent extension of vitreous into the potential space below the retina and separation of retina from choroid, requiring surgery. TRD is caused due to pre-retinal membrane formation and scarring which pulls away the retina from its attachment. It is seen in diabetes, trauma, Eales disease and sickle cell retinopathy also indicating surgery. Exudative and Serous RD is less common and along with TRD will not be referred in this study. Rhegmatogenous Retinal Detachment (RRD) can be of two types: Mac- Off and Mac- On RRD. Mac- Off (Macular- Off) rhegmatogenous retinal detachments occur when the retinal detachment also involves the macula and extends to the fovea. Mac- On (Macular- On) retinal detachments on the other hand spare the macula and do not extend to the fovea.[4] (Figure 2)

a b

Figure 2: Ultra-sonographic images of a) Mac- On and b) Mac- Off Retinal Detachments

Ultrasound has been evolving in the background of vast advancements in MRI and CT scans in the field of Radiodiagnosis and has proved to be an effective, safe and cost effective radiological investigation giving enormous information in minimum time. However radiologists mostly tend to limit themselves to abdominal or f*et al.* ultrasound leaving small part ultrasounds mostly to the experts. An area not so commonly explored is ultrasounds or B scans of the eye. It has been found that visualization of the eye is equally possible with a routine ultrasound machine even without the availability of a B scan. Orbital ultrasounds are regularly referred to the Department of Radiology for various pathologies including screening to rule out retinal detachment, particularly prior to cataract surgeries or following trauma or infections of the eye. Radiologists predominantly suffice themselves by reporting the absence or presence of retinal detachment. No classification of the type of retinal detachment is investigated beyond this finding, in majority of the cases. Mac- Off and Mac- On, as described above are classifications of retinal detachment which are less known and very rarely reported by the radiologists, and yet are findings which hold urgent importance in the final outcome of the patients' vision being restored. Differentiating these two types of retinal detachment give crucial evidence for the outcome of the treatment planned by the ophthalmologist besides giving critical time frame for performing any surgery planned on the affected eye. Overlooking this simple data and a lack of reporting and understanding of the value of this finding may lead to an erroneous miscalculation of the time of surgery and a delay in the surgery, based on this data provided by the radiologist, leading to total permanent blindness. Not only does this radiological finding gives crucial data allowing prompt surgery and saving of the vision, but also provides any unnecessary medico legal repercussions. Retinal detachment on ultrasounds appears as an echogenic linear floating membrane which is attached to the optic disc, differentiating it from PVD (posterior vitreous detachment) where the optic disc is free of the attachment of the membrane.[4, 5] (Figure 3) Mac- Off RD can be visualized on ultrasounds as retinal detachment with retina lifted away from the fovea, whereas in Mac- On RD, the retina is attached at the fovea sparing the macula. Mac– Off and Mac– On classification of RD are relatively less known entities and rarely reported or evaluated. Findings of Mac- On RD on urgent sonographic evaluation become critical, requiring urgent surgical repair to prevent total blindness.

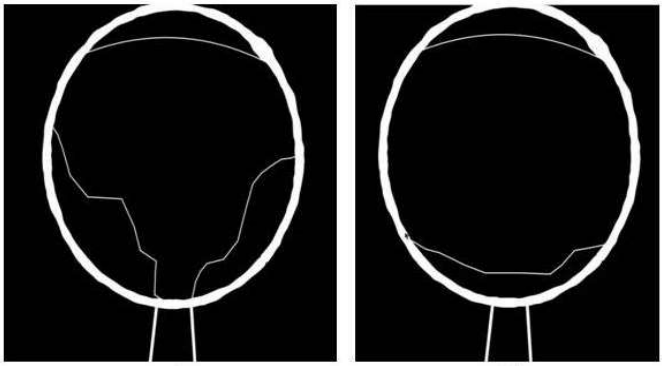

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Figure 3: a) Retinal detachment with optic nerve connection b) Vitreous detachment without optic nerve connection

The study aimed to identify retinal detachments, differentiate Mac- Off from Mac- On retinal detachments and emphasize on the importance and urgency of surgical management for better prognosis.

MATERIALS AND METHOD

Study design, setting and duration: A retrospective study was conducted at the Department of Radiodiagnosis at Jaipur National University Institute for Medical Science and Research Centre (JNUMISRC), Jaipur, Rajasthan, India over a duration of 2 years from January' 2018 to January' 2020.

Sample size and sample population: Fifty cases of retinal detachment were retrospectively analyzed. The patients were of age group ranging from 10 years to 60 years. Traumatic and non-traumatic cases, with and without any underlying infection of the affected eye were included in the study.

Methodology:

Fifty cases of Sonography of the eye/ B scans were studied at the Department of Radiodiagnosis for retinal detachments. Ultrasounds were performed with the help of linear 5 Megahertz (MHz) probes of Siemens ACUSON X300 Ultrasound system (Siemens, Germany). Once RD was established on ultrasound and dynamic ultrasounds, the next step was to differentiate Mac- On from Mac – Off retinal detachment. In some cases where differentiating retinal detachments into Mac- On and Mac- Off RD was difficult, dynamic ultrasound of the eye was performed with scanning during lateral movements of the eyeballs with closed eyelids. Information of time period of the first clinical symptoms of the affected eye and promptness to contact the ophthalmologist was also retrieved and determined.

Analysis: Descriptive analysis of the included retinal detachment cases with differentiation into Mac- On and Mac- Off RD was done.

Ethical approval and consent: Approval was sought and obtained by the Institutional Ethics Committee and informed consent was taken from the included sample of patients, prior to conducting this study.

RESULTS

A total of 50 ultrasounds of the eyes were studied for retinal detachments. Out of the 50 cases studied, 41 were identified or diagnosed as Mac- Off retinal detachment and 9 were diagnosed as Mac- On retinal detachment. The findings on ultrasound revealed a linear echogenic membrane floating in the vitreous which was attached posteriorly at the disc producing a V shaped structure unlike the finding in PVD (Posterior Vitreous Detachment) where the membrane was not attached along the posterior margin. (Figure 4) The initial differentiation on ultrasound was between RD and PVD where posterior attachment and a V shaped detachment indicated RD and a floating membrane with no posterior attachment denoted PVD. RD produced lesser movements compared to PVD. PVD also revealed after movements of the membrane after stopping of the dynamic scans.

Figure 4: Mac- Off retinal detachment with V shaped configuration.

An attachment of the detached membrane eccentrically and temporally at the fovea indicated Mac- On RD, indicating preservation of the macula. On the other hand no attachment of the membrane at the fovea, but only attachment centrally at the optic disc indicated a Mac- Off RD, with no preservation of the macula. In both cases the results were immediately conveyed to the concerned ophthalmologists for immediate follow up. It was conveyed that cases of Mac- On RD were to be immediately treated within 24 hours to preserve the central vision. And in cases of Mac-off RD a period within 7 to 10 days were indicated for treatment and surgery. All 9 cases of Mac- On RD were immediately referred for corrective surgeries and showed preservation of eyesight in affected eyes subsequently. The results stressed the need for

immediate and correct diagnosis by the radiologist performing the ultrasound of the eye, followed by prompt surgeries within 24 hours. In regards to the time period since first clinical symptoms of the affected eyes, it was found that all 9 cases of Mac-On RD, had reported within a few hours of their eye being affected and immediately contacted the ophthalmologist. On the other hand patients, who had been diagnosed with Mac- Off RD, had contacted 2 to 10 days after the eye had been clinically affected.

DISCUSSION

The field of Radiology has encountered tremendous technological advancement since the past few decades and is still progressing and evolving. It is up to the modern radiologists to further the knowledge acquired by their peers. One such area which is less explored and requires attention is in cases of ultrasounds of the eye or B scans. Even without a dedicated B scan, excellent ultrasounds are possible with routine ultrasound machines. Moreover, ultrasounds that are generally performed by the radiologists are simply reported to identify and diagnose retinal detachment, with no further differentiation between Mac- Off and Mac- On RD thereby excluding critical data from contacting the ophthalmologist. Such incomplete ultrasound reports might be detrimental in the final outcome of the preservation of vision in the affected eye of patients with retinal detachments.[3] Accurate sonography assessment and understanding of retinal detachment and its variations is crucial in the ultimate efforts to maintain vision in the affected eye.[2, 6] In the preliminary ultrasound assessment it is necessary to establish the efficacy of the vitreous chamber and whether there are any echogenic areas or membranes within it. In the presence of membranes, the next step would be to establish retinal detachment.[4] The primary differentiation is from PVD (Primary Vitreous Detachment). Posterior attachment centrally or eccentrically, reduced after movement on dynamic ocular ultrasound and visualization of membranes on normal gain settings of ultrasound confirm diagnosis of retinal detachment. On the other hand PVD is without any posterior attachment, significant after movements on dynamic ocular ultrasound with visualization mostly on high gain settings on ultrasound. Once ultrasound establishes existence of retinal detachment, the next step is to differentiate Mac-On RD from Mac- Off RD.[7] Mac- On RD would be sparing the macula and in this case the membrane of detached retina is attached eccentrically at the fovea [5] advocating prompt surgical intervention within 24 hours to preserve central vision.[1, 2, 8] In Mac- Off RD, macula is not spared, there is no preservation of central vision and the detached retinal membrane displays the characteristic central attachment at the optic disc and V shaped configuration. This is more commonly seen possibly due to a delay in the time of performing the ultrasound and progression of Mac- On RD to Mac- Off RD. The Mac-off RD is retinal detachment where central vision has already been compromised due to involvement of the macula and hence does not warrant immediate surgery, and could be performed within 7 – 10 days. In the current study, 9 cases of Mac-On RD, had reported within a few hours of their eye being affected and had contacted the ophthalmologist who had immediately recommended an ultrasound of the eye. This promptness by the patient and treating doctors were key factors in success of the treatment. On the other hand patients with Mac- Off RD had appeared 2 to 10 days after the eye had been clinically affected possibly indicating a progression of an initial (undiagnosed) Mac- On RD progressing to Mac- Off RD due to lack of medical attention in the appropriate time frame. Hence it is important for the patient, ophthalmologist and particularly the radiologist to understand that prompt and early consultation and correct data acquisition and reporting by the radiologist is essential in such cases to preserve vision in cases of retinal detachment. It is to be stressed that simply diagnosing RD from other pathologies, particularly PVD is not enough. Further differentiation of RD into Mac- Off and Mac- On RD needs to be an essential modality in reporting of RD. Early identification and knowledge of the differentiation of the two types of retinal detachment could initiate the patients and doctors to go in for an early ultrasound within the first few hours of the eye being affected, to allow the surgeon to intervene and preserve crucial vision.[3]

CONCLUSION

The study concludes that ultrasonic evaluation of retinal detachment and further differentiation into Mac- On and Mac- Off retinal detachments is crucial for prompt treatment planning, successful surgical outcomes and enhanced possibility of preservation of vision. Mac- On RD warrants immediate surgical intervention (within 24 hours) to preserve the maintained central vision Any further delay would mean the progression of Mac- On RD to Mac- Off RD, and lesser chances of preserving normal vision in spite of treatment. [1, 3, 9]

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