EAS Journal of Radiology and Imaging Technology
Abbreviated Key Title: EAS J Radiol Imaging Technol
ISSN: 2663-1008 (Print) & ISSN: 2663-7340 (Online)
Published By East African Scholars Publisher, Kenya

OPEN ACCESS

Volume-1 | Issue-1 | Jan-Feb-2019 |

Research Article

Diagnostic Accuracy Of Ultrasound B Scan In Detection Of Retinal Detachment Following Trauma Taking Surgical Findings As Gold Standard: Experience At Tertiary Care Hospital Of Balochistan, Pakistan

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Abstract: One of the most important diagnostic modalities in ophthalmology is ultrasound. It uses high frequency sound waves as its basic principle. It helps us in obtaining the critical information and making the final diagnosis of different traumatic and non-traumatic ocular diseases and guides us in deciding the final line of treatment. **Methods:** A total of 278 ocular injuries were evaluated between January 2018 and December 2018. All patients of ocular injuries were referred to the radiological department since fundoscopy is not always possible as the opaque density of lens prevents direct visualization of posterior segment of the eye. So we found ultrasound as an important alternate in making the final treatment decision (surgical or medical). The ultrasound results were later confirmed during surgeries. **Result:** Among the 278 patients enrolled we found that out of 32 patients with retinal detachment, 28 were correctly identified with ultrasonography as having retinal detachment (true positive). Of the remaining 246 patients not having retinal detachment, 214 were correctly identified with ultrasonography (the true negatives). The sensitivity and specificity of ocular ultrasonography for retinal detachment came out to be 88% and (95% confidence interval = 60 to 98) and 87% (95% confidence interval = 79 to 92), respectively. **Conclusion:** Our study suggests that ultrasound B - scan is a noninvasive method that can help in the diagnosis of retinal detachment.

Keywords: Diagnostic accuracy, Ultrasound B Scan, Retinal Detachment, Trauma, Surgical Findings.

INTRODUCTION:

One of the most common vision threatening ocular emergencies encountered is retinal detachment. It was not until 1920s when Jules Gonin, MD, pioneered the repair of retinal detachment and saved many from permanent blindness. With approach of new methods these days, prompt diagnosis of retinal detachment can be vision saving. When retina detaches, it is lifted or pulled away from its normal position i.e. from the back of the eye ball. In the most common type of detachment it is the breaks in the membrane that causes fluid to enter beneath it. If not promptly treated, the retina partially deprived of nutrition and blood will cause function impairment. If further left untreated permanent blindness will ensue. That is the reason why rapid diagnosis and treatment is important in patients with retinal detachment.

Pain is not a feature of retinal detachment. So, recalling other symptoms is important in order to prompt the diagnosis making. The symptoms include sudden increase in floaters which are little specks that float about in the vision, light flashes in the eye and blurred vision. As separation of retina advances, patients frequently complain of a drapery or cloak in the visual field. With the involvement of macula, the central vision gets worse.

The primary way to diagnose retinal detachment is by fundoscopy; however it may only be able to detect large posterior pole detachments. Nonoptimal visualization of peripheral retina, low magnification and illumination properties and lack of stereopsis by fundoscopy, makes indirect ophthalmoscopy the definite means to detect retinal detachment. But to perform indirect ophthalmoscopy, the ophthalmologist may not always be present.

Quick Response Code

Journal homepage:
http://www.easpublisher.com/easjrit/

Article History
Received: 10.01.2019
Accepted: 15.02.2019
Published: 25.02.2019

DOI: 10.36349/easjrit.2019.v01i01.003

Alternatively, in recent years (Yoonessi, R. *et al.,* 2010) Emergency ocular ultrasonography (EOUS) has been identified as a valuable and standard diagnostic modality for retinal detachment in emergency department (ED). It was 1960s and 1970s (Kerman, B. M. *et al.,* 1978; Blumenkranz, M. S., & Byrne, S. F. 1982) when EOUS was advocated. Since then it has been gaining popularity in the ED. Number of studies have been published favoring the use of EOUS in ED for correct diagnosis of wide range of ocular pathologies including retinal detachment (Blaivas, M. *et al.,* 2002; Elia, J., & Borger, R.2009; and Winter, K ., & Baker, T. 2007) The main advantages being rapid, safe and noninvasive.

The main purpose of our study was to determine the accuracy of ultrasound B-Scan in retinal detachment by taking surgical findings as goal standards.

MATERIAL AND METHOD

This single-center cross-sectional study was conducted during January 2018 to December 2018. The study was approved by Research Ethics Committee of our hospital. All adult patients (>18 years) presented with acute onset (defined as less than 48 h in duration) visual changes (decreased visual acuity, floaters or flashes, or visual field loss) were referred to the department of Radiology from Emergency Room and Ophthalmology Clinics since adequate clinical assessment of the fundus was impossible because of the presence of opaque ocular media. Those patients were excluded from the study who have already diagnosed with retinal detachment; those who are under treatment of pre-existing retinal detachment and unable to give consent. Ultrasounds were performed with 10 MHz transducer (Toshiba Diagnostic ultrasound equipment with probe selector unit). Informed consent was taken prior to examination. Patients, who were in a supine position on the examining couch, underwent Ultrasound with the transducer placed gentle on the closed eyelid. Through-the- lid contact imaging was employed with a standard water-soluble coupling gel, using a very gentle technique to cause minimal discomfort to the injured eye. The scan was done in both transverse and longitudinal planes. Patients tolerated the examination well. The scan was conducted by single senior radiologist with more than five-year experience in field of radiology for all the cases. The primary outcome measure was RD as defined by an abnormal lifting of the retina or the presence of a retinal flap (Figure 1; shows case of normal right eye and partial retinal detachment in left eye on lateral aspect along with vitreous hemorrhage; and figure 2; shows case of complete retinal detachment). The ophthalmologists were blinded to Radiological findings. Radiological findings were confirmed during surgical procedures.

The data was entered and analyzed using Statistical Package for Social Sciences (IBM SPSS v20 for Windows, Chicago Illinois). The sensitivity, specificity, and likelihood ratios and their 95% confidence intervals (CIs) were calculated.

RESULT

A total of 278 patients were evaluated between January 2018 and December 2018. In these 184 were females (66%) and 94 were males (34%) and the median age was 58 years (range: 18–92 years). The final diagnoses by ophthalmologists are listed in Table 1. Among the 278 patients enrolled we found out that of 32 patients (12%) with retinal detachment, 28 were correctly identified by ultrasonography as having retinal detachment (true positive). Of the remaining 246 patients (88%) not having retinal detachment, 214 were correctly identified with ultrasonography (the true negatives). The sensitivity and specificity of ocular ultrasonography for retinal detachment came out to be 88% (95% confidence interval = 60 to 98) and 87% (95% confidence interval = 79 to 92), respectively. The positive predictive value of Ultrasound B Scan was 0.47 (95% CI = 0.29 to 0.65) and the negative predictive value was 0.98 (95% CI = 0.93 to 1.0), with a positive likelihood ratio of 6.7 (95% CI = 4.1 to 11.0) and a negative likelihood ratio of 0.14 (95% CI = 0.04 to 0.55).

Table 1: Final diagnoses by ophthalmologists

Diagnosis	Total number
Posterior vitreous detachment	140
Retinal detachment	32
Vitreous hemorrhage	24
Retinal hemorrhage	4
Retinal break/tear	14
Floaters	14
Cataract	12
Epiretinal membrane	8
Uveitis	4
Macular hemorrhage	2
Normal	10
Others	12

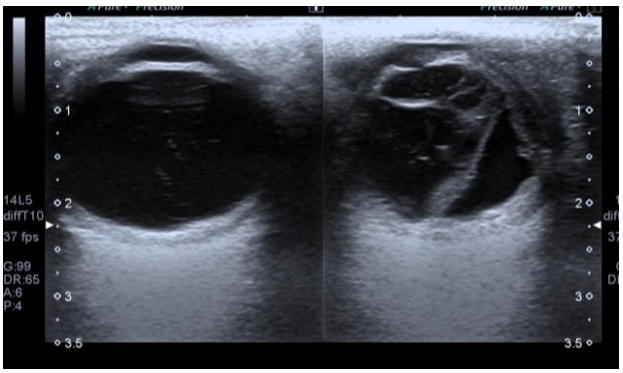

Fig 1: Normal Right Eye and Partial Retinal Detachment in left eyes

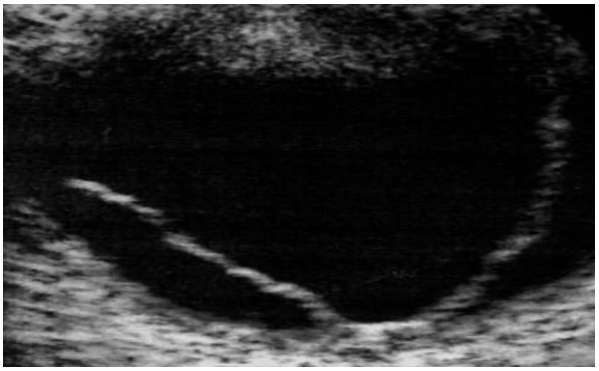

Fig 2: Complete Retinal Detachment Detachment in Left Eye

DISCUSSION

According to Siegel, B.S. *et al.*, (1990) the missed rates of retinal pathologies requiring intervention was 38%, when only fundoscopy was used. Thus ultrasound B-Scan makes an important adjunct to diagnose retinal detachment, as we found that it has high sensitivity (88%) and negative predictive value (98%) in this study.

Even studies done previously showed comparable negative predictive values. However our result for sensitivity and specificity was less than studies done previously. According to a study by Shinar *et al.*, (2011) published in 2011 the sensitivity of 97% ((95% CI = 82 to 100)) and specificity of 92% (95% CI = 82 to 97) has also been observed with the positive predictive value being 85% (95% CI = 68 to 95) and negative predictive value being 98% (95% CI = 91 to 100). In another study Yoonessi *et al.*, (2010) also stated sensitivity of 100% (95% CI = 78 to 100) and specificity of 83% (95% CI = 65 to 94). the positive predictive value being 78% (95% CI = 56 to 92) and negative predictive value being 100% (95% CI = 83 to 100).

In our study 4 cases were false negatives. Among these patients 2 had one day history of floaters, however no retinal flap was found by attending physician in these patients. So they were referred to the ophthalmology department. Ultimately these patients were found to have macular hole retinal detachment. Ultrasound B-Scan is not considered sensitive for macular holes, rather the best diagnostic test for macular disease including macular holes (Hee, M. R. *et al.*, 1995; Puliafito, C. A.*et al.*, 1995) is optical coherence tomography. The other 2 patients gave history of flashes in the eye for 1 day. Again ultrasound showed no retinal flap. They were later found to have left inferior retinal detachment. It has been stated that this may be likely due to the probing technique used as fanning the probe from caudal to cephalad may not be thorough enough to pick the peripheral detachments. Furthermore, it is known that peripheral retina is difficult to see on axial section. This can be overcome by revising the scanning protocol. For e.g. A transverse section with the probe moving from limbus to fornix will better examine the peripheral retina and posterior pole. 22 out of 32 false positives were misidentified as having posterior vitreous detachment. This is because the common mimicker of retinal detachment on ocular ultrasonography is posterior vitreous detachment (Byrne, S., & Green, R.L. 1992). On ocular ultrasound retinal detachment appears as a linear density arising from fundus. However these findings may change with the change in time and severity. These findings may range from a small peripheral convexity to a complex bright intersecting line. This is because of the adherence of retina to the ora serrata anteriorly and the optic disc posteriorly giving the detached membrane a funnel shaped sign. On the other hand, a hyperechoic linear density is seen in posterior vitreous detachment that has been lifted of the posterior glove, however as compared to retinal detachment it is thinner and smoother structure. Moreover, PVD takes on a "swaying seaweed" appearance on dynamic scanning (Siegel, B. S. *et al.*, 1990; Aironi, V. D., & Gandage, S. G. 2009). On ocular movement the flap of posterior vitreous detachment floats to and fro, cross the optic nerve and is not attach to the back wall (Sharma, S. *et al.*, 2008). On reducing the ultrasound gain posterior vitreous detachment fades as the posterior hyaloid surface is less dense than the retina (Siegel, B. S. *et al.*, 1990). This is useful in differentiating posterior vitreous detachment from retinal flap as retinal flap is highly reflective (Larkin, G. 2015, 22 April). Thus, misdiagnosing a posterior vitreous detachment as retinal detachment can be reduced if dynamic scanning and ultrasonography with lower gain is added to the probing protocol. Vitreous hemorrhage was another mimicker of retinal detachment found in two of our false positive patients. To differentiate these two, dynamic ocular sonography should be used. Vitreous hemorrhage will swirl around without any posterior attachment whereas retinal detachment will show undulating flap like movement (Yanoff, M., & Duker, J. S. 2008) with attachment to the posterior globe. Moreover, different gains are needed to identify these two. Vitreous hemorrhage requires higher gain while retinal detachment requires lower gain to be identified. Vitreous hemorrhage will fade when gain is reduced.

CONCLUSION

Ultrasound B - scan is a noninvasive method and useful adjunt that can help in the diagnosis of retinal detachment.

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