Original Article

Use of Non-ophthalmic Ultrasound for Evaluation of Retinal Detachment in Patients with Opaque Media

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Aim: To examine the accuracy of non-ophthalmic ultrasonography for detecting retinal detachment in eyes with opaque media

Methods: This was a prospective observational study conducted over a 1-year period. Eyes with opaque media in the form of a mature cataract, occluded pupils, or vitreous haemorrhage that precluded visualisation of the fundus were examined using non-ophthalmic ultrasound to detect retinal detachment. The clinical findings reported by the ophthalmologist were compared with the radiologist’s assessment.

Results: Of the 95 eyes of 94 patients enrolled in the study, 86 had mature cataract, 7 had vitreous opacity, and 2 had eye trauma. Fifteen eyes (15.8%) showed evidence of posterior segment pathology on ultrasonography, with underlying conditions of retinal detachment (n = 7; 7.4%), posterior vitreous detachment (n = 5; 5.3%), asteroid hyalosis (n = 1; 1.1%), a vitreous traction membrane attached to the optic disc (n = 1; 1.1%), and intraocular foreign body (n = 1; 1.1%). Using non-ophthalmic ultrasonography, retinal detachment was detected in all 7 eyes, to achieve a sensitivity of 100% (95% confidence interval, 56-100%) and a specificity of 99% (95% confidence interval, 92-99%).

Conclusions: Non-ophthalmic ultrasound is highly accurate for excluding retinal detachment, and may have a role in diagnosing retinal detachment in patients presenting with opaque media.

Key words: Eye, Retinal detachment, Ultrasonography


Introduction

Ophthalmologists commonly use ultrasonography for evaluation of eyes, particularly when slit-lamp examination and fundoscopy are expected to provide insufficient data.1,2 The role of ultrasound in the detection of retinal detachment in eyes with opaque media has already been established.3,4 Generally, ophthalmologists use a 10-MHz B-mode probe and an 8- to 10-MHz A-mode probe to detect intraocular pathology. A detached retina appears as a thin continuous acoustically opaque line of echoes, separate from and anterior to the echoes from the wall of the globe but connected to those from the optic nerve (Figures 1 and 2). However, this ophthalmic ultrasound equipment may not be available in the ophthalmology departments of some general hospitals that possess only conventional grey scale ultrasound equipment in the radiology departments.

Radiologists use a 7.5- to 15-MHz probe to detect systemic pathologies in the abdomen, chest, head, and neck. Although modern non-ophthalmic ultrasound equipment capable of producing better quality images has been developed, the sensitivity and specificity of modern radiological ultrasound equipment used for detection of ocular pathology have not been reported to date. The aim of this study was to evaluate whether the use of non-ophthalmic ultrasound can accurately evaluate retinal detachment in eyes with opaque media.

Methods

A prospective observational study was performed on a convenience sample of patients, who presented between August 2009 and September 2010 to Prapokklao Hospital, Chanthaburi, Thailand. The inclusion criteria were presence of a mature cataract, vitreous haemorrhage, and/or corneal scar that obscured the visualisation of the retina by fundoscopy. The study was approved by the hospital institutional review board. Written informed consent was obtained from each patient.
Ocular ultrasonographic examinations were performed by a radiologist using an ACUSON Sequoia 512 ultrasound system (Siemens, Munich, Germany) equipped with a 4- to 10-MHz linear probe (10V4 transducer) with the contact method. The probe was placed over the closed eyelid after applying a coupling gel. A radiologist who had a special interest in ocular ultrasonography was instructed to submit a data collection sheet that included printed results of the ultrasound examination and assessment of cases of retinal detachment prior to evaluation by an ophthalmologist. The clinical findings reported by the ophthalmologist were compared with the radiologist’s assessment.

The ophthalmology assessment included visual acuity measurement and indirect fundoscopy examination with dilated pupils after cataract surgery, vitrectomy, or spontaneous resorption of vitreous haemorrhage. Only patients who were available for ophthalmological follow-up were included in the study. The sensitivity and specificity of non-ophthalmic ultrasonography was estimated by using 95% exact confidence intervals (CI). A false-positive result was defined as a positive ultrasound scan in the absence of clinical findings. A false-negative result was defined as a negative ultrasound scan in the presence of clinical findings.

Results
Ultrasonography was performed for 95 eyes of 94 patients over 14 months. Among these patients, 86 had mature cataract, 7 had vitreous opacity, and 2 had eye trauma. Follow-up records were maintained for all 94 patients. Bilateral mature cataract in 1 patient necessitated the examination of both eyes. The patients' demographic data are shown in Table 1.

Fifteen eyes (15.8%) showed evidence of some ultrasonographic posterior segment pathology. Retinal detachment (7 eyes; 7.4%) was the most frequent abnormality detected; other abnormal findings were posterior vitreous detachment (n = 5; 5.2%), asteroid hyalosis (n = 1; 1.1%), a vitreous traction membrane attached to the optic disc, which mimicked retinal detachment on ultrasound (n = 1; 1.1%), and intraocular foreign body (n = 1; 1.1%).

The fundoscopy findings were in agreement with the confirmatory studies in all 7 eyes with ultrasonographic findings of retinal detachment. Thus, non-ophthalmic ultrasound had a sensitivity of 100% (95% CI, 56-100%). Of the 88 eyes that were judged to be free from retinal detachment by the ophthalmologist, 87 were judged identically by the radiologist for a specificity of 99% (95% CI, 92-99%) [Table 2]. The positive predictive value was 88% (95% CI, 47-99%) and the negative predictive value was 100% (95% CI, 95-100%).

The only patient for whom there was disagreement about the diagnosis had diabetic vitreous haemorrhage with a vitreous traction membrane attached to the optic disc.

Discussion
Ophthalmic ultrasound can be potentially useful for diagnosing or excluding ocular pathologies such as globe rupture, lens dislocation, retrobulbar haemorrhage, intraocular foreign bodies,
Table 2. Ultrasound and clinical findings for retinal detachment (n = 95).

<table>
<thead>
<tr>
<th>Ultrasound findings</th>
<th>Clinical findings</th>
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<tbody>
<tr>
<td></td>
<td>RD-positive</td>
</tr>
<tr>
<td>RD-positive</td>
<td>7</td>
</tr>
<tr>
<td>RD-negative</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>7</td>
</tr>
<tr>
<td>Number (%)</td>
<td>7/7 (100)</td>
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<tr>
<td>Sensitivity</td>
<td>56-100</td>
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<tr>
<td>Specificity</td>
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<td>Positive predictive value</td>
<td>47-99</td>
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<tr>
<td>Negative predictive value</td>
<td>95-100</td>
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Abbreviation: RD = retinal detachment.

non-ophthalmic ultrasound, like ophthalmic ultrasound, can detect posterior vitreous detachment, asteroid hyalosis, and intraocular foreign bodies.\(^6\)

Only 1 false-positive case was found — diabetic vitreous haemorrhage with a vitreous traction membrane attached to the optic disc. This condition mimics retinal detachment because the membrane attached to the optic disc can be mistaken for the retina. Subhyaloid heme and optic disc oedema can also be interpreted as retinal detachment.\(^7\) No false-negative results were observed in this study, although macula-on retinal detachment can be interpreted as a false-negative result.\(^7\)

This observational study had several limitations, including small sample size, few cases of retinal detachment, and wide confidence intervals. A study with a large sample size will decrease the confidence intervals, thereby consolidating these results.

The findings indicate that non-ophthalmic ultrasound is a highly reliable diagnostic method for excluding retinal detachment and may have a role in diagnosing retinal detachment in eyes with opaque media.

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References