

Echographic evaluation of optic disc excavation

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Purpose: To evaluate the role of high resolution B-scan echography in differentiating the causes of optic disc excavation.

Methods: A prospective study was conducted on 30 subjects presenting to Al-Zahraa University Hospital (2009 – 2011) with optic nerve excavation. Of these patients 10 with coloboma, 10 with cup-shaped posterior staphyloma and 10 with glaucomatous optic nerve cupping were identified. Horizontal and vertical approaches for optic disc excavations were evaluated using B-scan echography. Specific echographic criteria for excavation configurations were successfully estimated.

Results & conclusion: High-resolution contact B-scan echography may provide useful differentiation for optic disc excavations in eyes with opaque media.

Key words: Echographic, optic disc excavation

Introduction:

The eyeball's fluid content and its superficial position make it ideally suited for examination with ultrasonography (U/S). U/S is the only practical method for obtaining images of the posterior segment of the eye when the media are opaque; it is a simple, noninvasive tool for diagnosing lesions of the posterior segment of the eyeball. Due to its noninvasiveness, ease of access, quick and reliable information and real-time character, U/S is quite often the first imaging modality used in eye and orbit assessment (**Aironi & Gandage, 2009& Dudea, 2011**).

Echography is a useful method in the investigation of optic nerve diseases. The optic nerve is well suited to echographic imaging because of its regular tubular structure consisting of "low reflective" nerve proper and "highly reflective" peri-neural sheaths, surrounded by the heterogeneous

orbital fat. Echography may be a method of choice in detecting subtle changes in the nerve and in providing tissue differentiation of its lesions (**Atta, 1988**).

The current study focused on the echographic shape of posterior ocular contour as considering the optic disc in eyes with coloboma, high myopia with cup-shaped posterior staphyloma or advanced glaucoma, determine the ultrasonic criteria that differentiate between them in patients with clear media, to help later in differentiating these with opaque media.

Patients & Methods;

This prospective, case series study included 30 subjects (12 males and 18 females; with different ages at presentation). The patients were selected from the outpatient clinic at Al-Zahraa university hospital (2009-2011), according to fundus examination. They were

classified into three subgroups: patients with optic disc coloboma, patients with cup-shaped posterior staphyloma and patients with advanced glaucoma, each group comprised 10 subjects. All patients had clear media, so ophthalmoscopic evidence of each optic nerve lesion is confirmed via visualization of the fundus using +90D slit lamp biomicroscope and indirect ophthalmoscope prior to U/S examinations

Exclusion criteria for this study included any evidence of retinal pathology (other than the selected 3 lesions) or opaque media.

All images presented in this article were obtained using a High-resolution Mentor-Advent™ A/B system equipped with 7.5-15 MHz real-time high-frequency probe with the contact method. The patient lying supine and the probe was placed over the closed eyelid at the temporal equator, aiming nasally and posteriorly after application of a coupling gel (Hydroxy- propyl methyl cellulose). Fine adjustment of the probe was made while the patient fixated gaze at the primary position or slightly infero- temporally. Transverse (cross-section) and longitudinal (long-section) scans were performed on optic nerve head giving vertical and horizontal sections of the disc cup. Both sections have the advantage of avoiding the lens and allowing better resolution of images. B-scan examination was performed with medium gain setting; initially, we displayed the nerve at a high gain level then decreased the gain setting, the grey scale was also reduced to improve contrast and produce

well defined margins of the disc cup whenever possible.

Results:

Of the 30 patients included in the study; 12 males and 18 females, they were categorized according to the clinical diagnosis into 3 groups of 10 patients in each group.

U/S examination of the patients with optic disc coloboma revealed: excavation of the ocular wall, disc of variable depth, and the contour is smooth or out-pouching. The edges are typically overhanging, sharp or shelved. There were two cases with unilateral morning glory syndrome (**Fig.1: a, b**) and two cases had associated microphthalmia, with cystic orbital component (**Fig.1: c, d**).

U/S examination of the patients with cup-shaped posterior staphyloma with axial myopia revealed: In addition to high axial length (28-32mm axial length), there is cup-shaped posterior staphyloma with typically smooth edges and shallow depth rather than coloboma (**Fig. 2**).

U/S examination of the patients with glaucomatous optic nerve cupping with variable degrees of affection between both eyes revealed:

- 5 cases had unilateral cup/disc ratio less than 0.6 disc diameters; the cup/disc ratio could not be estimated echographically.
- 5 cases had bilateral asymmetrical advanced cupping; a characteristic bean-pot configuration detected by U/S examination.

We evaluated the symmetry between both eyes with glaucoma to exclude congenital large

cups which are characteristically symmetrical (Fig. 3).

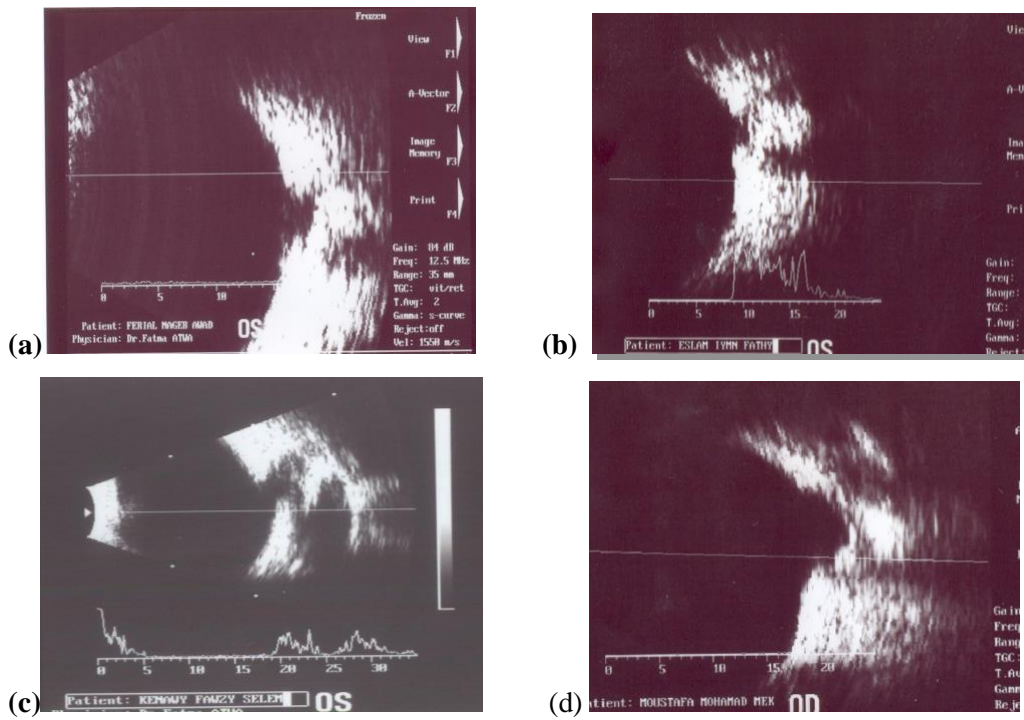


Fig. 1. Coloboma of the optic nerve head.

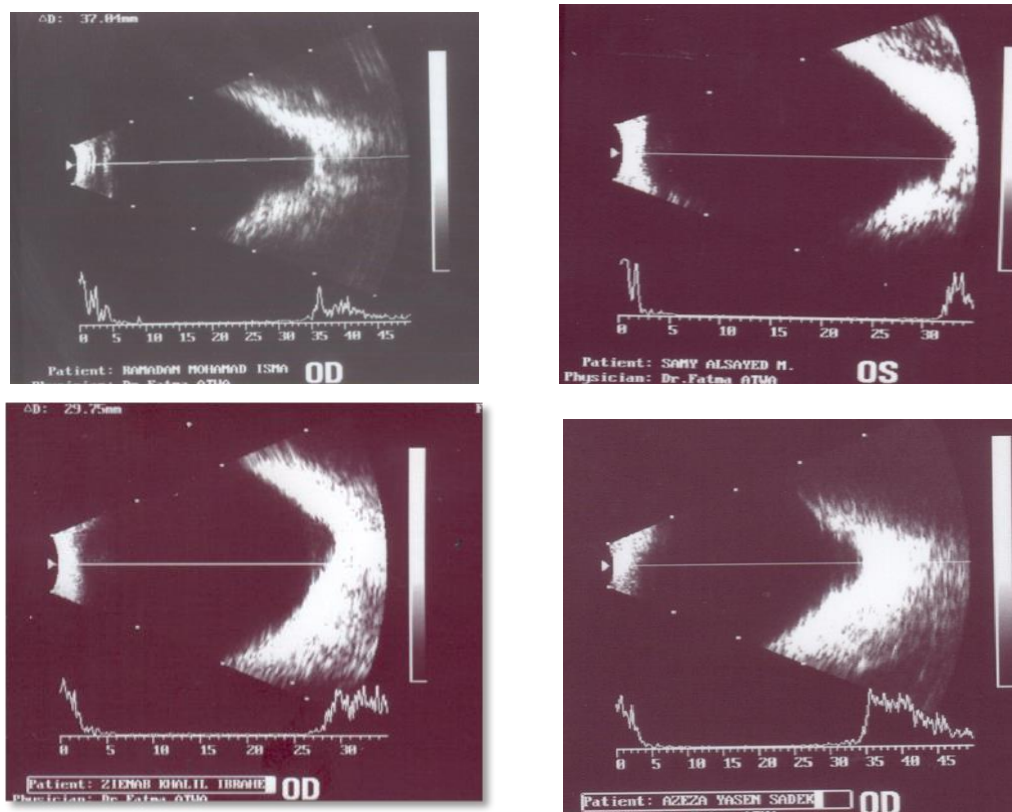


Fig. 2. Cup-shaped posterior staphyloma.

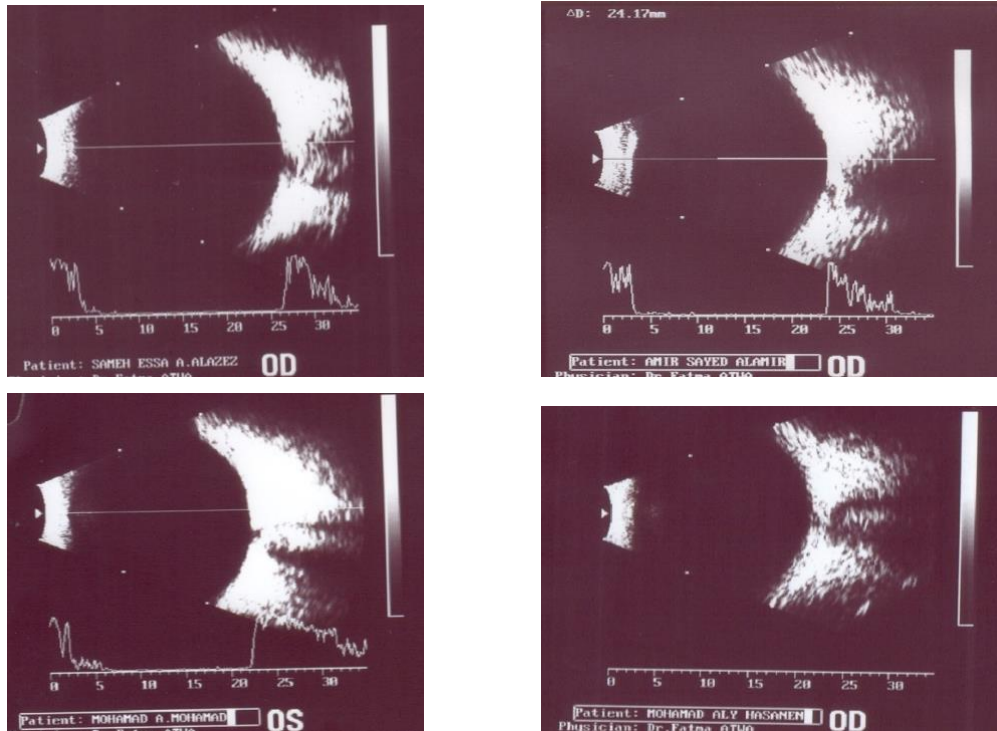


Fig.3. Advanced glaucomatous cupping.

Discussion

In the present study, the U/S morphologic features of the optic nerve head were evaluated for each lesion (optic disc coloboma, cup shaped posterior staphyloma & glaucomatous cupping) in 30 patients.

A coloboma is a defect that results from an abnormality of the closure of the foetal fissure in the inferonasal quadrant of the developing optic cup. Isolated optic disc colobomata present as enlarged, white, sharply delineated, bowl-shaped excavations of the disc, 2–8 diopters in depth. Usually, a rim of neural tissue is preserved superiorly (Onwochei *et al.*, 2000&Taylor, 2007).

Coloboma of the optic nerve may be visually insignificant, with benign enlargement of the optic disc and cup, or may involve the inferior disc with

pigmentary disruption and visual loss (Guercio & Martyn, 2007). Microphthalmos and coloboma resulting from associations represent only a minority of cases (Warburg, 1993).

The main feature of degenerative myopia is congenital scleral weakness, leading to progressive globe enlargement, axial lengthening, and finally the formation of posterior staphyloma (Forte *et al.*, 2008).

A posterior staphyloma is a protrusion of the posterior shell of the eye globe. The scleral shell of highly myopic eyes has increased elasticity and a tendency to expand gradually and to thin (Hsiang *et al.*, 2008).

Staphyloma locations are various, including nasal, macula-centered, disc-centered, and tiered staphylomas. Myopic

posterior staphylomas can be diagnosed with stereoscopic binocular indirect ophthalmoscopy and B-scan ultrasonography (Chae *et al.*, 2011).

The optic-disc appearance of glaucoma is characterized by loss of the neuro-retinal rim area, an increase in the absolute size of the optic cup and in the cup-to-disc ratio, vertical elongation of the optic cup, backward bowing or excavation of the lamina cribrosa, enlarged chorioretinal atrophy, and asymmetry of these features between the two eyes (Piettea & Sergott, 2006). A congenital large optic cup with an intact neuro-retinal rim could be accurately identified if the fellow disc was examined ophthalmoscopically and photo-echographic excavations were symmetrical (Darnley-Fisch *et al.*, 1990).

In the current study, the ultrasonographic configurations of the 3 selected lesions were evaluated to detect the characteristic appearance for each. These eyes were examined in a state of clear media with known diagnosis prior to U/S examination to collect the U/S data concerning each diagnosis. Eyes with other posterior segment pathologies could interfere with proper evaluation and hinder detailed description of the optic nerve head echographic appearance, so they were excluded.

This study suggests that, U/S alone is an accurate method in establishing optic disc configuration, still a valuable tool in the preoperative evaluation of eyes with opaque media in conjunction with clinical

assessment. High-resolution contact B-scan with a vertical and transverse approach may properly defined the degree and nature of optic disc excavation in conditions that create a dilemma in patients with opaque media where funduscopy could not be performed and surgery is indicated.

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المخلص العربي

تقييم دور الموجات فوق الصوتية فى تكهف العصب البصرى

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الهدف من البحث: تقييم دور الموجات فوق الصوتية فى التفرقة بين أسباب تكهف العصب البصرى.

الأساليب: تم فحص 30 حالة من مرضى مستشفى الزهراء الجامعى (2009 - 2011) مع تكهف بالعصب البصرى و تم تقسيمهم الى: 10 حالات بها نقص خلقي فى نسيج العين و 10 حالات بها بروز خلفى فى الصلبة يحتوي على نسيج من الطبقة المشيمية 10 حالات مصابة بالمياه الزرقاء . و تم تحديد المواصفات الخاصة بالتكهف فى كل مجموعة.

النتائج و الاستنتاج: يوفر الفحص باستخدام الموجات فوق الصوتية تفرقة بين أسباب تكهف العصب البصرى .