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Journal of Current Ophthalmology 30 (2018) 202–210

http://www.journals.elsevier.com/journal-of-current-ophthalmology

Review

Ocular changes during pregnancy

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Received 13 January 2017; revised 20 October 2017; accepted 29 November 2017
Available online 3 January 2018

Abstract

Purpose: To summarize available literature on physiologic and pathologic ocular changes during pregnancy.
Methods: Narrative review of literature.
Results: Ocular changes occur commonly during pregnancy. Although most of these are benign physiologic responses to the metabolic, hormonal, and immunologic modifications to adopt the gestational product, there is some serious pathology that may develop, exacerbate, or even resolve over the course of pregnancy which requires prompt diagnosis and management. The pathological eye conditions can be classified into preexisting pathologies and emerging ocular diseases. Regardless of the different mechanisms by which these ocular changes occur, the key point is the establishment of an effective perinatal screening program to monitor the new development or successive progression of these ocular abnormalities. Irrespective of the visual health status of the pregnant women, regular perinatal eye examination should be scheduled in order to assure continuous surveillance of healthy eyes. Treatment of pathologic ocular conditions or functionally disturbing benign changes relies on an appropriate patient selection.
Conclusions: Discriminating pathological eye disease from physiologic ocular changes is important in order to establish an individualized treatment or preventive plan and constitutes the mainstay of obstetric ophthalmology. This individualized approach should always weigh the ocular benefits of treatment to the mother against the potential harms to the fetus.

Keywords: Eye; Gestation; Ophthalmic change; Pregnancy; Visual change; Visual system

Introduction

Impairment of visual acuity during pregnancy is supposed to be a rare occurrence; however, ocular changes include a wider spectrum of physiologic and pathologic conditions which might present different symptoms and require different treatments. Ocular changes during pregnancy occur due to physiological responses to cope with the gestational product. While up to 15% of these pregnancy-induced changes are benign, a few pathological conditions might affect the eyes. On the other hand, the severity of these ocular changes is largely affected by the health status of the pregnant women, e.g. in a diabetic or hypertensive pregnancy.[1]

Affected ocular structures during pregnancy include eyelid, conjunctiva, cornea, lens, retina, optic nerve/tract, and orbit.[2] Retinal changes in diabetic and hypertensive women can worsen with pregnancy and may correlate with the severity of gestational diabetes mellitus (GDM) or eclampsia. Additionally, hormonal changes in pregnancy may lead to increased corneal thickness and curvature which can lead to or worsen keratoconus,[3,4] decreased intraocular pressure (IOP), and improve glaucoma slightly.[4,5] Other ocular changes include chloasma, subconjunctival hemorrhage, increased thickness of lens and subsequent refractive errors, enlargement of the pituitary gland

Conflicts of Interest and Source of Funding: There were no conflicts of interest. This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.
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Peer review under responsibility of the Iranian Society of Ophthalmology.

https://doi.org/10.1016/j.joco.2017.11.012

and optic nerve compression, and increased volume of intra-orbital contents by growing hemangioma.[2]

The aim of this review article is to summarize available data in the literature on the pregnancy-induced ocular changes to discriminate between benign and pathological conditions.

Methods

A comprehensive literature review was conducted in PubMed/Medline from January 1975 to July 2017 to identify original studies in English language regarding ocular changes during pregnancy. The following MeSH terms were used: ("ocular" OR "vision" OR "ophthalmologic" OR "ophthalmic" OR "eye" OR "visual acuity" OR "refractive error" OR "astigmatism" OR "anterior segment" OR "intra-ocular") AND ("pregnancy" OR "gestational" OR "pregnant women" OR "obstetrics" OR "maternal"). Moreover, the following text words were used as well: "pregnancy and the eye", "ocular complications in pregnancy", "ocular changes in pregnancy", "ocular disease in pregnancy", "refractive changes in pregnancy", "anterior segment changes in pregnancy", "eyelid in pregnancy", "retina and pregnancy", "treatment of the eye during pregnancy", and "treatment of the ocular disease during pregnancy" In each text words, the words "eye", "ocular," and "ophthalmic" were used instead of each other. In addition, the citations from the above searches were also included. The title and abstract of the identified articles were screened for relevancy. Of these, full-texts of the relevant articles were retrieved for eligibility, and relevant studies reporting data on any ocular changes in pregnant women were included in this review. The primary endpoint of this review was the classification of ocular changes during pregnancy.

Results

In the initial search, 2857 articles were found. After evaluating the title and abstract of those articles, 2653 articles that did not meet the inclusion criteria were excluded. The full-text of the remaining 204 articles were studied and included in this review. In the current study, the ocular effects of pregnancy were divided into physiologic changes, pathologic changes, and changes in preexisting ocular diseases.

Physiologic changes during pregnancy

All of the ocular structures are affected during pregnancy. The most important changes are summarized in Table 1.

Eyelid changes during pregnancy

Chloasma or melasma, which is a hypermelanosis of sun-exposed areas, commonly occurs during pregnancy with a possibility of solo involvement of eyelids and often resolves postpartum.[6] Eyelid retraction as a result of underlying sinus disease[7] and ptosis due to the presence of blepharophimosis, ptosis, and epicanthus inversus syndrome[8] have also been reported. However, the latter is a coincidence with pregnancy rather than a consequence of the gestational changes. Unilateral ptosis has been reported during pregnancy and after normal delivery due to fluid and hormonal effects on levator aponeurosis which resolves postpartum.[9] Interestingly, enlargement of the pituitary gland during pregnancy might result in the over-expansion of a preexisting undiagnosed prolactinoma leading to ocular symptoms such as ptosis.[2,10]

Corneal changes during pregnancy

Keratometry studies have shown increased values in central and thin corneal thicknesses in the second and third trimesters of pregnancy which are most likely due to water retention, and usually returns to the normal value with delivery.[11] These changes produce temporary refractive changes during pregnancy and need special attention for refractive eye surgery. The surgery may be postponed to ensure refractive stability. On the contrary, some studies have demonstrated progression of keratoconus during pregnancy which persists even after delivery.[4,12] Different timing during pregnancy for keratometry and measurements of corneal values may be a reason for these conflicting findings in the literature. Nevertheless, refractive change is a transient finding during pregnancy, which might resolve after delivery.[13–15]

Moreover, contact lens intolerance has been reported during pregnancy, so contact lens prescription should delay until several weeks postpartum. Dry eye is also reported during pregnancy. This condition is caused by disruption of lacrimal

Table 1
Physiologic changes during pregnancy.

Condition	Effect
Chloasma	May worsen during pregnancy but resolves spontaneously postpartum.
Contact lens intolerance	May presents during pregnancy and resolves postpartum.
Dry eye	May presents during pregnancy and resolves postpartum.
Intraocular pressure (IOP)	Decreased in IOP toward the end of pregnancy which returns to baseline values postpartum.
Krukenberg spindles	Develop early in pregnancy and usually tend to decrease in size during the third trimester and postpartum.
Lens changes	A decrease in lens autofluorescence is reported. Increased liquid volume during pregnancy might result in development or exacerbation of cataracts.
Ptosis	Unilateral ptosis during pregnancy and after normal delivery which resolves postpartum.
Refractive changes	Increasing in central and thinnest corneal thicknesses in the second and third trimesters of pregnancy which returns to the normal value with delivery.

acinar cells. In addition, Krukenberg spindles have been observed on the cornea early in pregnancy, which usually tend to decrease in size during the third trimester and postpartum. These spindles are not accompanied by other findings of pigment dispersion such as increased angle pigmentation and iris transillumination defects.[16] The mechanism presumably is related to hormonal changes such as low progesterone levels; however, by the third trimester, an increase in progesterone and aqueous outflow often result in decreased or absence of Krukenberg spindles.[17]

Crystalline lens changes during pregnancy

Water retention is a well-described phenomenon in pregnancy.[18] At the ocular level, the increased aqueous component can result in corneal edema and contact lens intolerance.[3] On the other hand, as the crystalline lens constitutes of water in 65% of its normal volumes,[19] increased liquid volume might result in development or exacerbation of cataracts during pregnancy. A recent study showed a significant decrease in lens autofluorescence in pregnant women compared with the normal population.[20] This physiological change in lens fluorescence with pregnancy might be explained by an increase in the lens aqueous component.

Intraocular pressure changes during pregnancy

IOP has been proclaimed to drop 2–3 mmHg during pregnancy mainly under the influence of progesterone hormone.[21] This drop reaches to a 10% value, notably in the third trimester.[22] Although the underlying mechanism in pregnancy that decreases the IOP is still a myth, several proposed factors to explain reduction in IOP during pregnancy are increased aqueous outflow, lower scleral rigidity as a result of increased tissue elasticity, lower episcleral venous pressure due to decreased systemic vascular resistance, and general acidosis during pregnancy.[23,24] One study has described a relationship between the number of fetus and the amount of decrease in IOP.[25] It may be hypothesized that the increased level of female sex hormones such as estrogen, progesterone, and relaxin increase the outflow rate of intraocular fluid leading to such a hypotensive effect.[25] Changes in IOP usually return to pre-pregnancy levels several months after delivery.[26]

Pathologic changes during pregnancy

Pathologic changes during pregnancy include systemic diseases with ocular complications occurring during pregnancy and ocular disease that are seen in increased frequency during pregnancy. The most important findings are summarized in Table 2 and Table 3.

Systemic diseases with ocular manifestations

Preeclampsia and eclampsia

As a constrictive vasculopathy, preeclampsia is considered to be a major cause of maternal and neonatal morbidity and mortality. It has been estimated that the visual system is affected

Table 2
Systemic pathologic changes during pregnancy with possible ocular effect.

Condition	Effect
Antiphospholipid syndrome (APS)	Major complications in the anterior segment include episcleritis, iritis, conjunctival telangiectasia or conjunctival microaneurysms, and in the posterior segment include vitritis, retinal detachment, retinal hemorrhages, cottonwool spots, central serous type chorioretinopathy.
Disseminated intravascular coagulation (DIC)	Occlusion of the choriocapillaris by a thrombus leads to disruption of the overlying retinal pigment epithelium causing serous retinal detachment that resolves with resolution of DIC.
Graves' disease	It tends to exacerbate in the first trimester, remit in the second and third trimesters, and relapse postpartum. Eye stare, eyelid lag, proptosis, and extraocular muscle palsy are common findings. Mild cases may be monitored, but moderate to severe cases must be treated with antithyroid medications (drug of choice is propylthiouracil).
Idiopathic intracranial hypertension (IIH)	It occurs frequently in pregnancy with the greatest propensity in the first trimester. Ocular manifestations include visual obscuration, diplopia, scotomata, photopsias, pulsatile tinnitus, and retrobulbar pain. Medical treatment of IIH includes symptoms alleviation and preservation of visual function. Weight loss is recommended after pregnancy.
Pituitary tumors	Accelerated growth of a preexisting pituitary gland tumor is reported during pregnancy and may result in compressive optic tract/chiasma neuropathy. A magnetic resonance imaging will be diagnostic. Monthly ophthalmologic examination and visual field monitoring are necessary to monitor for tumor growth.
Preeclampsia and eclampsia	Ocular manifestations include blurred vision, photopsia, scotoma, and diplopia. Hypertensive retinopathy and optic neuropathy are also presented. Most of these findings return to normal following the resolution of preeclampsia.
Purtscher-like retinopathy	It has been reported in the immediate postpartum period with manifestation of severe bilateral vision loss with widespread cotton-wool spots with or without intraretinal hemorrhage. Visual symptoms and retinal changes may resolve spontaneously.
Sheehan's syndrome	This vision-threatening condition is accompanying with sudden headache, vision loss, visual field loss (typically present in bitemporal superior quadrant), and/or ophthalmoplegia. Following pituitary apoplexy, resolution of ophthalmoplegia is more likely to occur than recovery of vision.
Toxoplasmosis	Reactivated latent ocular toxoplasmosis during pregnancy may result in decreased vision and floaters. Toxoplasmic retinochoroiditis is the most common cause of posterior uveitis in immunocompetent patients. Women with active infection during pregnancy should be monitored every three months. Spiramycin is the drug of choice during pregnancy.

Table 3
Selected ocular diseases in pregnancy.

Condition	Effect
Diabetic retinopathy	It can progress quickly during pregnancy and is associated with hyperglycemia, duration of diabetes before pregnancy, degree of retinopathy in the beginning of pregnancy, glycemic control, and comorbid hypertension. The standard treatment is panretinal photocoagulation, but regression after delivery may occur with uncertain rate and timing.
Central serous chorioretinopathy (CSCR)	It is characterized by neuroepithelium detachment with subretinal fluid accumulation at the posterior part of the fundus and mostly observed in the third trimester of pregnancy. Ocular manifestations include visual loss, blurred vision, or dark spot in the central visual field. Patients recover spontaneously within 3 months after delivery.
Glaucoma	Glaucoma improves during pregnancy due to a decrease in intraocular pressure (IOP). Glaucoma medications should be put on hold because of their potential teratogenic effect. The standard treatment is laser trabeculoplasty.
Uveitis	Pregnancy causes improvement in autoimmune diseases such as non-infectious uveitis, especially from the second trimester onwards, with the third trimester being associated with the lowest activity of the disease. However, it can be treated by using local eye drops, parabulbar or intraocular injections, or with systemic immunosuppression medications.

in 30%–100% of pregnant women with an established diagnosis of preeclampsia.[27] Preeclampsia occurs in about 5% of pregnant women and ocular complications have been reported in one-third of these patients.[28] Blurred vision is the most frequent complaint in these patients, however, photopsia, scotoma, and diplopia is not uncommon.[29,30] This effect may lead to hyperperfusion and subsequent hyperemia of the ocular system, leading to the hypertensive retinopathy and optic neuropathy. Retinopathy of preeclampsia is similar to those in hypertension associated retinopathy. Focal narrowing of the retinal arterioles which may be generalized as well is the most common finding in preeclampsia-related retinopathy. Retinal edema, hemorrhage, and exudate, infarcts of the nerve fiber layer and vitreous hemorrhage secondary to neovascularization are other changes observed in preeclampsia-related retinopathy.[17] Most of these findings return to normal following the resolution of preeclampsia.[31] The degree of retinopathy is positively correlated with the severity of preeclampsia. Pregnant women with the coincidence of preeclampsia-related retinopathy and diabetes, kidney disease, and chronic hypertension may have more severe disease. The only definitive treatment for preeclampsia and eclampsia is delivery. However, anticonvulsant medications such as magnesium sulfate and antihypertensive therapy like administration of nifedipine or labetolol may be useful in treatment of these patients.[32]

Occlusive vascular disorders

Purtscher-like retinopathy has been reported in the immediate postpartum period. It is associated with preeclampsia, pancreatitis, hypercoagulability state, and amniotic fluid emboli and most likely occurs from arteriolar obstruction by complement-induced leukocyte aggregation. Patients with Purtscher-like retinopathy experience severe bilateral vision loss with widespread cotton-wool spots with or without intraretinal hemorrhage shortly after delivery. Visual symptoms and retinal changes may resolve spontaneously. Less common findings such as branch and central retinal artery occlusions and retinal vein occlusions have been reported in pregnancy, probably secondary to or a hypercoagulable state or amniotic fluid emboli.

The antiphospholipid syndrome (APS) is autoimmune disorder characterized by either a history of vascular thrombosis or pregnancy morbidity in association with the presence of antiphospholipid antibodies.[33] Both anterior and posterior segments of the eye are involved in APS. These complications in the anterior segment include episcleritis, iritis, conjunctival telangiectasia or conjunctival microaneurysms, and limbal or filamentary keratitis, and in the posterior segment include vitritis, retinal detachment, retinal hemorrhages, cottonwool spots, central serous type chorioretinopathy, posterior scleritis, branch or central retinal vein occlusion, bilateral choroidal infarction, cilioretinal artery occlusion, and venous tortuosity.[33] Other less common ocular manifestations include transient monocular or bilateral visual loss, transient visual field loss, ischemic optic neuropathy, and progressive optic nerve atrophy.[33]

Disseminated intravascular coagulation (DIC) is an acquired syndrome characterized by the systemic intravascular activation of coagulation. Amniotic fluid embolism, preeclampsia/eclampsia, placental abruption and placenta praevia, intrauterine fetal demise, intrauterine infection, septic abortion, and acute fatty liver of pregnancy are associated with develop in DIC during pregnancy.[34,35] The most common intraocular structure involved in DIC is choroid. Occlusion of the choriocapillaris by a thrombus leads to disruption of the overlying retinal pigment epithelium, causing serous retinal detachment.[36] Although the serous detachment resolves with resolution of DIC, residual retinal pigment epithelial changes may be present.

Sheehan's syndrome or pituitary apoplexy

Pituitary apoplexy, or Sheehan's syndrome, is an enlargement of pituitary gland due to infarct and severe postpartum hemorrhage in pituitary adenoma. Pregnancy is a risk factor associated with this condition. This vision-threatening condition is accompanying with sudden headache, vision and visual field loss, and/or ophthalmoplegia. Visual field defects are typically present in bitemporal superior quadrant. Compression on cavernous sinus affects the third, fourth, and sixth cranial nerves and causes ptosis, diplopia, mydriasis, and lateral-inferior deviation of the globe, while involvement of sympathetic nerve fibers cause Horner's syndrome.[37,38] Following pituitary apoplexy, resolution of ophthalmoplegia is more likely to occur than recovery of vision.[38]

Idiopathic intracranial hypertension

Idiopathic intracranial hypertension (IIH) also known as benign intracranial hypertension (BIH) or pseudotumor cerebri is a disease of unknown etiology associated with increased intracranial pressure. Obese females of childbearing age are at increased risk of developing IIH; therefore, this condition occurring frequently in pregnancy with greatest propensity in the first trimester.[39] Ocular manifestations of IIH include visual obscuration, diplopia, scotomata, photopsias, pulsatile tinnitus, and retrobulbar pain.[39,40] Papilledema is typically bilateral but may be unilateral or even absent in some cases.[39,41] The most common symptoms of papilledema are transient visual obscuration, loss of peripheral vision, and a decrease in visual acuity.[39] Medical treatment of IIH includes symptoms alleviation and preservation of visual function.[39,40] Moreover, weight loss is recommended after pregnancy.

Graves' disease

Graves' disease is the most common cause of hyperthyroidism in pregnancy. It is an important cause of unilateral and bilateral proptosis. Graves' disease tends to exacerbate in the first trimester, remit in the second and third trimesters, and relapse postpartum.[17] Eye stare, eyelid lag, proptosis, and extraocular muscle palsy are common abnormal eye findings in Graves' diseases.[42] Mild cases may be monitored, but moderate to severe cases must be treated with antithyroid medications. Propylthiouracil is the preferred drug in pregnant women.[43]

Pituitary tumors

Accelerated growth of a preexisting pituitary gland tumor is a reported phenomenon during pregnancy.[10,44] The angiogenetic effect of estrogen may also play a role in the acceleration of tumor growth during pregnancy. Meningioma,[45] and uveal melanoma[46] are the other most common tumors. However, most cases of pituitary adenoma appear with amenorrhea and infertility in women of childbearing age. In rare cases that overt growth occurs intrapartum, the patient may show symptoms of intracranial space occupying lesion as well as compressive optic tract/chiasma neuropathy. Decrease in visual acuity, visual field changes mostly bitemporal defects, and diplopia are the most common symptoms in pituitary growth of adenomas. In these patients, a magnetic resonance imaging will be diagnostically beneficial. In patients with known adenoma, monthly ophthalmologic examination and visual field monitoring are necessary to monitor for tumor growth.[47]

Toxoplasmosis

Latent ocular toxoplasmosis may reactivate during pregnancy and result in congenital infection. The most common ocular complications are decreased vision and floaters. Toxoplasmic retinochoroiditis is the most common cause of posterior uveitis in immunocompetent patients. Its active form typically presents as grey-white retinal necrosis with choroiditis, vasculitis, and vitritis, while atypical presentations include neuroretinitis, scleritis, papillitis, Fuchs-like anterior uveitis, and acute retinal necrosis.[48] Women with active infection during pregnancy should be monitored every three months by screening and their offspring followed up systematically.[48] Spiramycin is a safe and effective drug for treatment of toxoplasmosis during pregnancy. Although sulfadiazine and pyrimethamine are potentially teratogenic, they are used by many clinicians in combination with spiramycin and oral steroids from the second trimester onward for treatment of toxoplasmosis. Moreover, intravitreal injection of clindamycin and dexamethasone are recommended to avoid systemic toxicity.[49]

Preexisting ocular diseases

Diabetic retinopathy

Diabetic retinopathy can progress quickly during pregnancy. Hyperglycemia, duration of diabetes before pregnancy, degree of retinopathy in the beginning of pregnancy, glycemic control, and comorbid hypertension are several factors associated with progression of retinopathy during pregnancy.[50–52] The degree of retinopathy is associated with duration of disease rather than the pregnancy. It is suggested that activation of the immune system has a role in progression of retinopathy during pregnancy. It is found that some immune system components that have a known association with pathogenesis of diabetic retinopathy are activated during pregnancy.[53,54]

For women with preexisting diabetic retinopathy or at risk of developing a hypertensive crisis, the frequency of this screening approach should be increased to a level to assure prompt detection of minimal retinal changes in order to prevent further damage or decelerate its progression.[55] Nevertheless, there is a lack of evidence regarding the appropriate timing for conduction of peripartum eye examination. American Academy of Ophthalmology's Preferred Practice Pattern suggests that diabetic women have an eye examination before conception and then during first trimester of pregnancy, and the follow-up examinations depend on the initial degree of retinopathy.[56] Results have shown that 10% of patients without diabetic retinopathy at the beginning of pregnancy developed non-proliferative change, while only less than 0.2% developed proliferation. Therefore, in the absence of visual symptoms, a baseline examination during first trimester is sufficient. Retinopathy findings during pregnancy in patients with non-proliferative diabetic retinopathy, showed 50% progression during pregnancy that regressed in the third trimester and postpartum period.[57] About 5–20% of patients with severe non-proliferative diabetic retinopathy had developed to proliferative diabetic retinopathy of which up to 45% of their disease can progress during pregnancy.[58] The standard treatment for diabetic retinopathy is panretinal photocoagulation that may be safely administered during pregnancy.[59] However, regression of diabetic retinopathy after delivery may occur with uncertain rate and timing.

Laser treatment before pregnancy in patients with proliferative and severe non-proliferative diabetic retinopathy could reduce the risk of progression by 50% with no recurrence of proliferation after regression.[57,60] Monthly examination is

recommended for pregnant patients with proliferative diabetic retinopathy whose disease has regressed in the third trimester and postpartum period. Patients with no retinopathy to moderate non-proliferative diabetic retinopathy should be reexamined every three to 12 months, and those with severe non-proliferative diabetic retinopathy or worse should be reexamined every one to three months.[60]

On the other hand, the role of GDM in ocular changes has been variably discussed by prospective observational studies. While GDM is a known risk factor for type 2 diabetes mellitus and subsequent diabetic retinopathy,[61] no clinically important association has been found between GDM and visual changes.[62] Women with gestational diabetes are not at increased risk of developing diabetic retinopathy because they are hyperglycemic only for a short period of time, so these women do not require an eye examination during pregnancy.[50,51,56,63] Nevertheless, a recent study with Doppler technique in pregnant women with GDM demonstrated a decreased value for maximum diastolic velocity and resistance index in ophthalmic artery.[64]

Diabetic macular edema is observed with proteinuria or hypertension and may worsen during pregnancy. Macular edema may spontaneously resolve postpartum, but in some cases may remain and cause long-term visual loss.[17] Laser treatment is recommended in patients with clinically significant disease.[57]

The injection of anti-vascular endothelial growth factor (anti-VEGF) agents is accepted as the main method for treatment of retinal vascular disorders and neovascularization in proliferative diabetic retinopathy in patients of childbearing age.[65] The use of anti-VEGF agents during pregnancy is normally safe and only a few studies have been reported miscarriage and complication.[66,67] Bevacizumab and ranibizumab are category C, and pegaptanib is category B. Bevacizumab is preferred over ranibizumab because its high molecular weight prevents it from crossing the placenta. However, theoretically they can affect placental vasculature. Therefore, the decision whether to treat with VEGF inhibitors should be made individually by a well-informed patient and her physician during a carefully monitored pregnancy.

Glaucoma

It was mentioned that as a physiologic ophthalmic change during pregnancy IOP has been proclaimed to drop 2–3 mmHg mainly under the influence of progesterone hormone.[21] The drop in IOP has the potential benefit of avoiding anti-glaucoma medications in pregnancy, as glaucoma management may pose a challenge in pregnant women. Considering the decrease in IOP with an increase in gestational age and the possible birth defects and patient's apprehension, the ophthalmologists may be tempted to put the anti-glaucoma medications on hold in pregnant women.[32] Most of the glaucoma medications are in the B or C pregnancy category and are therefore contraindicated or should be used only on limited indications. However, patients with planning for pregnancy can benefit from laser trabeculoplasty, cyclophotocoagulation, trabeculectomy, or shunt tube surgery.[68,69]

Uveitis

Hormonal changes during pregnancy have been indicated to play a role in maintaining the tolerance of maternal immune system to the semi-allogeneic fetus. These changes may result in amelioration of some autoimmune diseases such as non-infectious uveitis, especially from the second trimester onwards, with the third trimester being associated with the lowest activity of the disease.[70] Although the exact underlying mechanism is not yet well-described, it might result in the ability of the patients to taper the immunosuppressive medications.

Chorioretinal changes during pregnancy

Central serous chorioretinopathy (CSCR) is classified as a type of retinopathy characterized by neuroepithelium detachment with subretinal fluid accumulation at the posterior part of the fundus. Pregnancy has been shown to increase the risk of CSCR up to 9 times.[71] It is mostly observed in the third trimester of pregnancy. The main cause of this condition is attributed to the high concentration of cortisol during pregnancy. The diagnosis of CSCR is made by posterior segment optical coherence tomography. CSCR may occur with visual loss, blurred vision, or dark spot in the central visual field. It was reported that 90% of pregnant patients with CSCR had fibrinous subretinal exudate in comparison with the 20% non-pregnant patients with CSCR.[72] Without treatment, many patients recover spontaneously within 3 months after delivery. However, there might be a recurrence rate up to 50% with no treatments, and 10% of patients with CSCR may experience more recurrences in the long-term, necessitating a more robust follow-up.[73]

Discussion

In the present article, it was attempted to summarize available data in the literature regarding ocular changes during pregnancy in order to enable clinicians and professional nurses to distinguish gestational physiological ocular changes from pathological eye conditions, inform the alteration processes of preexisting visual abnormalities during pregnancy, and establish an appropriately tailored screening, diagnostic, and therapeutic approach to visual health status in pregnant women. However, this paper lacks strong limitations such as absence of second grader and absence of grading the level of evidence; therefore, the recommendations should be used with strong caution.

The majority of alterations in the ocular system arise from metabolic, hormonal, and immunologic changes provoked by pregnancy. While some of these alterations might contribute to the initiation of new ocular conditions, others may result in exaggeration, resolution, or improvement of previously established diseases. That being said, the most crucial step in evaluation of pregnancy-related ocular changes is the establishment of the preexisting eye condition as a part of prenatal visits. Although there is a very narrow line between benign and malignant ocular changes in pregnancy, these conditions are best treated to be discussed separately.

Physiological eye changes during pregnancy

All the components of the visual system can undergo physiologic changes by gestational fluctuations in sex hormones. This effect occurs mostly due to the interaction of estrogen and progesterone with their counterpart receptors in eye tissues.[32,74] The theory of sex hormone-related alteration of the visual system during pregnancy is well-supported by the observed difference between male and female subjects in the prevalence of ocular conditions.[75] Moreover, variations in ocular system function exist according to different phases of the menstrual cycle, taking oral contraceptives, and different gestational trimesters.[74,75] Nevertheless, the ocular literature lacks sufficient attention to the inherent difference between males and females in ocular physiology and usually considers them homogenous subjects; this results in unintentional but consequential heterogeneity of findings in clinical trials. With that being said, future studies on ocular system should appropriately appreciate the existing variation in visual function between different genders, the phase of menstrual cycle, gestational age, and occurrence of menopause.

Pathological eye changes during pregnancy

Hormonal fluctuation during pregnancy may give rise to a couple of pathological conditions. Mostly, these eye pathologies are reflective of the underlying neurovascular complications. Hypertensive crisis and impaired glucose metabolism during pregnancy are associated with vascular spasm and microvascular proliferation, respectively.[2,76] On the other hand, many ocular symptoms are manifestations of an underlying systemic disease which develops or exaggerates with hormonal surges in pregnancy.[77] Overall, these pathologies can be divided into existing and preexisting ocular pathologies.

Emerging eye pathologies during pregnancy

Due to the indolent course of development, these pathologies are usually undiagnosed until the late stages at which the morbidity and irreversibility rate is high. Hence, risk factors for these complications should be promptly identified, and the mother should be followed more closely during pregnancy.

Preexisting eye pathologies affected by pregnancy

Due to the above-mentioned physiological hormonal effect during pregnancy, preexisting eye conditions may undergo derangement. Estrogen has been shown to have an angiopoietic effect in estrogen receptor-positive breast tumors.[78] A similar effect has been found for estrogen as well as progesterone-induced hypersecretion of vascular-endothelial growth factor in proliferative diabetic retinopathy.[57,79] The angiogenetic effect of estrogen may also play a role in the acceleration of tumor growth during pregnancy.[10] On the other hand, estrogen surge has a documented effect on immunological status by which it can influence preexisting autoimmune diseases such as Graves' ophthalmopathy, multiple sclerosis and posterior scleritis, and uveitis.[32,74,77] However, alteration of previously established ocular disease might differ substantially over pregnancy trimesters, probably due to the variation in serum levels of estrogen.

In summary, despite the fact that many ocular changes in pregnant women act as physiologic responses to the homeostatic adaption of the human body to the gestational product, serious eye conditions may develop, exacerbate, or even resolve over the course of pregnancy. The American Academy of Ophthalmology recommends that women with predisposing conditions such as diabetes who plan to become pregnant should have a dilated fundus exam before the pregnancy. During pregnancy, an eye exam should be performed in the first trimester, with follow-ups scheduled according to the amount of ocular changes detected. Those with no symptomatic condition to moderate disease should be reexamined every three to 12 months. Patients with severe findings should be reexamined every one to three months.[56] Regardless of the visual health status of the pregnant women, regular perinatal eye examination should be scheduled in order to assure continuous surveillance of healthy eyes. Treatment of pathologic ocular conditions or functionally disturbing benign changes relies on an appropriate patient selection. This individualized approach should always weigh the ocular benefits of treatment to the mother against the potential harms to the fetus.

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