Abstract

Objective. The objective of this clinical review is to highlight the otolaryngological symptoms that occur in pregnancy. Where available, the authors discuss the current evidence of the etiology and management of the various presentations. While it is appreciated that many of these complaints are transient, their impact on the maternal quality of life can be significant, and therefore, medical practitioners should be aware of what to expect in order to provide reassurance to patients and also to safely manage such symptoms.

Data Sources. MEDLINE and EMBASE databases were searched for publications related to otolaryngology and pregnancy.

Review Methods. All literature was searched for and reviewed by 2 authors independently. Search results were then cross-examined, and any differences were settled by consensus.

Results. Pregnancy leads to circulatory changes and increased susceptibility to viral reactivation, and along with the exercise of parturition, it can lead to tinnitus, facial palsies, and deafness. Rising levels of sex hormones and heightened sensitivity to allergens may influence the nasal mucosa, precipitating epistaxis and rhinitis. Increased progesterone and the increased intra-abdominal pressure of the growing fetus can lead to symptoms and sequelae of laryngopharyngeal reflux. Evidence for the treatment of pregnancy-induced symptoms is principally restricted to case reports and retrospective studies.

Conclusion. Recognition and understanding of pregnancy-related ear, nose, and throat complaints will allow otolaryngologists to reassure and manage these patients, improving their experience of the gestational period. High-quality evidence for their management is limited, with further research required.

Keywords

pregnancy, ENT, otolaryngology, rhinology, otology

A considerable number of changes occur throughout the body in the pregnant female. Whilst most of these produce no harm to the expectant mother or fetus, some can become pathological. Any organ of the body can become affected by the hormonal and physiological adjustments that take place during this period, and the ear, nose, and throat (ENT) region is no exception. This unique cohort of patients faces a challenging period, which may be made more stressful by developing ENT-related symptoms. Although most symptoms are minor and transient, it is important that otolaryngologists recognize the potential influences that pregnancy can exhibit in order to manage and reassure the patient. An understanding of the treatment options and their risks will facilitate an informed consultation with the mother, allowing safe and acceptable management.

We present a review of the current literature on the manifestations of pregnancy related to ENT. We aim to explore the physiological processes responsible for the occurrence of such symptoms along with discussions on their management through analysis of current evidence. Consultation with local obstetricians and guidelines is advised before commencement of pharmacological and surgical intervention.

Materials and Methods

Search Objectives

The primary goal of this review was to explore the literature regarding the relationship between pregnancy and ENT symptoms. We aimed to determine the current understanding of the pathophysiological processes that lead to these manifestations, attempting to separate fact from fiction. The secondary goal was to collate the evidence for the management of ENT symptoms in pregnancy.

Search Strategy

The MEDLINE (1948 to November 2010) and EMBASE (1966 to November 2010) databases were searched using the
key terms pregnancy and a variety of otolaryngology-related keywords along with the relevant synonyms (see each section for detailed search strategy). All articles were limited to those based on humans and published in English. The titles and abstracts of the search yield were independently examined by 2 authors for relevant articles pertaining to otolaryngological manifestations in pregnancy.

**Ear**

Key terms used were pregnancy AND hearing loss OR dizziness OR vestibular disorders OR facial palsy OR tinnitus OR auditory perception disorders, along with their respective synonyms, as outlined in Figure 1.

**Nose**

Key terms used were pregnancy AND rhinitis OR epistaxis OR hyposmia, along with their respective synonyms, as outlined in Figure 2.

**Throat**

Key terms used were pregnancy AND hoarseness OR dysphonia OR voice disorder OR laryngeal disease OR pharyngeal disease OR laryngopharyngeal reflux OR gastroesophageal reflux, along with their respective synonyms, as outlined in Figure 3.

**Quality Assessment and Data Abstraction**

Two authors individually selected and evaluated the articles and compared findings prior to data abstraction. Any discrepancies were resolved via a re-review of the data. With regard to management of symptoms, we aimed to include only prospective randomized controlled trials. However, because of the paucity of data, we also included retrospective studies and systematic reviews to provide a more comprehensive overview of the treatment options, highlighting the deficiencies of knowledge where applicable. Case reports related to less common conditions have been included for interest, but those related to management options have been excluded.
Statistical Methods
Because of the scarcity and heterogeneity of the data, pooling and statistical analysis was not appropriate.

Results

Ear
The search yielded 68 results pertaining to otological manifestations of pregnancy. No randomized controlled trials were available, with most of the articles consisting of case reports on facial palsies (n = 32). The studies are summarized in Table 1.

Nose
The search yielded 77 articles pertaining to pregnancy and nasal symptoms. The articles included 2 randomized controlled trials for management of rhinitis. The remainder consisted of observational studies and systematic reviews alongside numerous case reports regarding epistaxis. Table 2 summarizes the articles found.

Throat
The search yielded 56 articles pertaining to pregnancy and laryngopharyngeal-related symptoms. Dysphonia in pregnancy is rarely described. However, reflux is frequently reported, and 3 randomized controlled trials were identified. Table 3 summarizes the articles found.

Discussion

Hormonal Changes in Pregnancy
From when the sperm fertilizes the ovum, the female hormonal cycle begins to change. Human chorionic gonadotrophin (hCG), produced from the embryo, stimulates the continual rise in progesterone levels that usual fall midway through the luteal phase following ovulation. While hCG
levels usually begin to decline following their peak at the end of the first trimester, progesterone levels, alongside estrogen and human placental lactogen, continue to rise throughout gestation. The actions of these hormones are vital to the continued growth of the fetus, but their effects extend beyond the uterus and can alter the physiological activity of the entire body.

**Pregnancy and the Nose**

*Rhinitis.* Pregnancy rhinitis occurs in about 22% of pregnancies and can begin during any trimester. Ellegard defined this as nasal congestion in the last 6 or more weeks of pregnancy, without other signs of respiratory tract infection, with no known allergic cause, and with complete resolution of symptoms within 2 weeks after delivery. Female sex hormones, which continue to rise throughout the antenatal period, have

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**Table 1. Studies Obtained regarding Pregnancy and Otological Symptoms**

<table>
<thead>
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<th>Study Type</th>
<th>Hearing Loss</th>
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be implicated as an etiological factor, although they remain debated among authors in the literature. A proposed theory is an increase in sensitization to allergens in women who may have a preexisting subclinical allergy. Ellegard and Karlsson have demonstrated an increase in IgE levels against house dust mites in women with pregnancy rhinitis but no increase in allergic symptoms. Sequelae of pregnancy rhinitis include an exacerbation of concomitant asthma and an effect on quality of life.

Management of rhinitis of pregnancy should begin conservatively, with allergen avoidance when possible. A lack of high-quality studies on the efficacy of treatment and fetal outcomes with various pharmacological interventions makes medical treatment difficult to advise. We identified 2 prospective randomized controlled trials that looked at nasal lavage and fluticasone propionate for treatment of allergic rhinitis in pregnancy. Garavello et al failed to demonstrate any additional benefit of fluticasone compared with placebo for symptom control. Intranasal sodium cromoglycate has been shown to have no association with congenital abnormalities and may therefore be used, although its efficacy in pregnancy rhinitis has not been tested. First-generation oral antihistamines such as chlorphenamine are considered to have no increased teratogenic effect. However, second-generation products such as loratadine have been linked with hypospadias.

**Smell disturbance.** Olfactory perception is frequently reported as being disturbed during pregnancy, which is supported by anecdotal evidence but variably in the literature. It has been described as either an increase or a reduction in sensitivity. However, scientific evidence is inconclusive at best. Gilbert and Wysocki analyzed the data compiled by the National Geographic Smell Survey in 1986, which consisted of 13,610 pregnant women. The data suggested that smell intensity was increased in pregnancy, although there was no hyperacuity. A recent prospective study by Cameron compared 100 non-smoking women who were either pregnant, postpartum, or had never been pregnant. By comparing the University of Pennsylvania Smell Identification Test, they were able to demonstrate that the pregnant cohort had a higher self-rated olfactory sensitivity, although objective assessment was no different from nonpregnant patients.

The incidence of epistaxis in pregnancy has been linked to other complications. Dugan-Kim et al conducted a large prospective cohort study on 1475 pregnant women, demonstrating a link between women who experience epistaxis during the antenatal period and postpartum hemorrhage. The data showed a 10.7% relative risk compared with 6.2% in those with no nose bleeds.

Management of acute epistaxis must always prioritize the safety of the mother. Control of the bleeding via conservative measures would be first line, escalating treatment as appropriate. Chronic or recurrent epistaxis may be managed with silver nitrate cautery or Naseptin (chlorhexidine, neomycin) cream. No studies have been conducted on either treatment modality in pregnancy.

Despite several published case reports and anecdotal evidence, pyogenic granuloma (PG) of the nasal cavity is uncommon. It is thought to arise due to the sensitivity of the nasal mucosa to sex hormones, for which studies have shown glandular hyperplasia even in asymptomatic pregnant women. In most women, PG tends to resolve postpartum; however, intervention via surgical excision may be required in the symptomatic patient. Although the oral cavity appears to be the most published site of occurrence, otolaryngologists are more likely to encounter nasal granulomas due to the presentation of nosebleeds.
Pregnancy and the Ear

Hearing loss. Hearing loss manifesting in pregnancy does not appear to be a commonly reported problem, which is reflected in the paucity of available literature.

Sudden onset of sensorineural hearing loss (SNHL) during pregnancy has been described in case reports, with one report concerning a patient who experienced the hearing loss with each serial pregnancy, with all episodes resolving postpartum. A perilymph fistula secondary to a fracture of the stapes footplate occurring at the time of exertion of parturition, leading to a sudden onset of high-frequency SNHL, has also been described in a case report.

Otosclerosis is one of the most common causes of acquired hearing loss and is widely accepted as being related to pregnancy. The primary etiological factor is thought to be genetic autosomal dominant inheritance with incomplete penetrance and variable expressivity. Since the 1930s, the onset of otosclerosis was linked with pregnancy, with advice to patients ranging from termination of pregnancy and sterilization to delaying surgical treatment until their families are complete. However, since 1974, an increasing number of studies are dismissing the relationship between pregnancy and otosclerosis as being coincidental. Lippy et al retrospectively studied 94 women with otosclerosis and were unable to identify any significant difference between those with children and those without. An early study of 479 women by Gristwood and Venables also failed to demonstrate any link between pregnancy and symptoms. It is now considered that otosclerosis is simply more prevalent in women of childbearing ages and that there is no deleterious effect of pregnancy on hearing. Current management is entirely conservative and supportive, with any surgery delayed until after pregnancy andbreast-feeding.

The changes in estrogen and progesterone levels have been postulated as an influence on the hearing mechanism due to alterations in the sensory nervous system; however, the exact mode of influence during pregnancy is still under question. Sennaroglu and Belgin studied the relationship between hormonal changes in pregnancy and cochlear function. With a series of 20 pregnant women, they demonstrated a decrease in hearing levels during the first trimester for 125 Hz to 500 Hz, with the frequencies above this unaffected. Alongside this being part of a small study, this degree of hearing loss is not clinically significant as, according to the British Society of Audiology, it is the frequencies greater than 500 Hz that are important, and therefore this cannot be regarded as a true hearing loss.

The hypercoagulable state, which can occur as part of a normal pregnancy, has been thought to lead to vascular occlusion of the microcirculation of the inner ear, leading to sudden onset of deafness. Another process that may lead to a transient SNHL is preeclampsia. Preeclampsia, or pregnancy toxemia, is a syndrome in which hypertension occurs from 20 weeks’ gestation in the presence of proteinuria and endothelial dysfunction. It has the potential to cause damage to the maternal end organs through vasoconstriction and immunological reactions. It has been suggested that the cochlea as an end organ may be affected during the episode of resultant vasoconstriction, resulting in ischemia, ultimately producing a hearing deficit. The case-control study by Bakhshaee et al revealed a transient hearing loss by means of transient otoacoustic emissions in 5 of 37 preeclamptic patients compared with none of the healthy pregnancy group. This preliminary study requires further research before a final conclusion is reached, and so, at present, the relevance is undetermined.

Hearing disturbance. Tinnitus is the more common auditory complaint during pregnancy, with proposed theories of pathogenesis including hyperdynamic circulation, increase in perilymphatic fluid pressure, and hormonal changes. Results from a prospective cohort study of 82 women suggest that up to 33% of pregnant women report tinnitus, compared with 11% in a control group of nonpregnant women, with resolution of symptoms after delivery. Severe tinnitus has even led to an emergency cesarean delivery at 34 weeks, with total resolution postoperatively. More significantly, tinnitus has been speculated as an early warning sign of gestational hypertension or preeclampsia, and it would be prudent for such patients to be carefully monitored, although the positive predictive value of tinnitus is unknown, and beyond case reports, no definitive scientific link has been identified.

Autophony is a classic complaint of those suffering from a patulous Eustachian tube (PET). The symptom of hearing a hollow-sounding resonance was first described by Jago in 1867, who himself was a sufferer. The typical patient with PET has lost a drastic amount of weight, resulting in shrinkage of the peritubal mucous membranes. An early study by Plate et al demonstrated a link between PET, weight gain during pregnancy, and elevated serum estriol levels, but only 5 patients were symptomatic and so the validity of the study is questionable. A larger study by Weissman et al looked at the Eustachian tube function of 53 women but failed to correlate any changes with estrogen levels during the antenatal period despite reports that up to one-third of patients with PET are either pregnant or taking estrogen replacement therapy. In view of the resolution of the symptoms postpartum, management should consist of informative reassurance alone.

Neurological. Unilateral facial nerve paralysis in the general population is most commonly due to Bell’s palsy (BP), with studies showing that men and women are equally affected. Several reports have suggested an increase in incidence during pregnancy, although only 1 of these studies collected the
plex virus reactivation in early pregnancy and an increased incidence in late pregnancy, which may be due to the suppression of herpes simplex virus reactivation in early pregnancy and an increased susceptibility to infection and reactivation in late pregnancy.42 The third trimester is also the time when the extracellular volume is at its maximum, supporting the theory that fluid retention leads to perineural edema followed by a facial palsy in a similar manner to carpal tunnel syndrome.43 Prognosis for a full recovery in more severe palsies is poorer in pregnant women than in nonpregnant women,44 although the data supporting this theory may be biased as pregnant patients are less likely to receive treatment.42

Management of BP in pregnancy requires careful consideration of both the mother and fetus. Management in the general population has long consisted of oral prednisolone, antiviral agents, and supportive eye care, mostly based on little substantial evidence. Sullivan et al45 published a large randomized controlled trial with 496 nonpregnant patients, which demonstrated that an increased chance of recovery is achieved via prednisolone alone, provided it has been initiated within 72 hours of onset of facial weakness, and supplementing treatment with acyclovir provides no additional benefit. Oral corticosteroids are used in pregnancy to treat a number of preexisting maternal conditions, including asthma and inflammatory bowel disease, along with treating pregnancy-induced conditions such as gestational thrombocytopenia.46 Their antenatal use, however, has been associated to varying degrees with a risk of developing fetal cleft lip and palate, especially when used in the first trimester.47-49 Following a review by the Committee on Safety of Medicines in May 1998, it is now the general consensus that there is no convincing evidence that corticosteroids increase the incidence of congenital abnormalities, and doses of prednisolone up to 40 mg are unlikely to cause systemic effects in the infant.50

Ramsey Hunt Syndrome does not appear to have an increased incidence in pregnancy; only 1 published case report has been identified in the literature.51 The use of antenatal acyclovir has not been linked with an increased rate of birth defects.

**Balance.** Vertigo and dizziness are frequently experienced during pregnancy and are among the most common complaints from pregnant women to primary care,52 yet surprisingly, the amount of published literature in this area is low. In the prospective study by Schmidt et al,32 the authors discovered that 52% of their pregnant cohort complained of dizziness. These patients are rarely referred to ENT departments, as most cases are secondary to nonvestibular causes. The nausea and vomiting associated with pregnancy may be precipitated or influenced by the hormonal or fluid-volume changes occurring in the vestibular system32,53; however, evidence for this is currently observational.

The course of Ménière’s disease during pregnancy is poorly reported in the literature, but it has been shown to be exacerbated during the late luteal phase of the menstrual cycle,54 and therefore by inference, it may have some association with hormonal changes (which cause fluid retention). A physiological reduction in serum osmolality may affect the vestibular system via changes in the perilymph and therefore lead to an exacerbation of symptoms during pregnancy,55 although the evidence supporting this is limited.

The multifactorial pathology leading to Ménière’s disease can pose difficulties in management in all patients, with pregnancy adding in additional considerations. If the diagnosis is uncertain and imaging is required, it is recommended to wait until the postpartum period before undertaking a magnetic resonance imaging (MRI) scan due to a lack of conclusive studies on the safety of MRI in pregnancy. Contrast medium used may also interfere with breast-feeding, and it is currently advised to suspend nursing for 24 hours postimaging, although this recommendation is being reviewed.56

Conservative methods of management of Ménière’s disease, with respect to dietary changes of salt and caffeine reduction, pose no risk to the mother or fetus and could therefore be used as first line of management. Although there are no adverse event data published to preclude the use of betahistine in these patients, its should be used with caution. Prochlorperazine for acute episodes of vertigo should also be used with caution as antipsychotics have been linked to extrapyramidal effects in the neonate when used in the third trimester57; however, most evidence indicates no increased risk.58

Postpartum vertigo is associated with a multitude of causes. Although most are nonotological, some case reports suggest the abrupt changes in middle ear and intracranial pressure, secondary to Valsalva maneuver during labor, can lead to trauma to the vestibular system, including perilymph fistula formation (PLF)59 and superior semicircular canal dehiscence (SSCD).50 The resulting symptoms of both conditions can include vertigo, disequilibrium, aural fullness, autophony, tinnitus, and conductive hearing loss with enhanced bone conduction.60,61 Differentiating the 2 conditions from each other along with Ménière’s disease can pose a diagnostic challenge. Audiometric assessment must be undertaken at the time of presentation and serially afterward. Although only 50% of patients with PLF may experience hearing loss, a low-frequency SNHL may be suggestive of Ménière’s disease as an alternative diagnosis.62 The fistula test, observing for a positive Hennebert sign (pressure-induced nystagmus) may be demonstrable, but it is absent in a significant number of patients and can be present in up to 30% of patients with Ménière’s disease, so it is therefore unreliable. A high-resolution computed tomography scan of the temporal bones may help diagnose SSCD; however, the sensitivity for the diagnosis of PLF is limited. Treatment can begin with bed rest, stool softeners, and avoidance of Valsalva maneuver; however, delayed treatment may result in permanent auditory loss,63 and therefore, exploratory tympanotomy and repair should be undertaken as soon as possible.

**External canal.** Granuloma gravidarum, or pregnancy tumor, describes pyogenic granulomas occurring in the prenatal period. These benign lesions can occur in up to 5% of pregnancies64 and occur more frequently in the second and third
Pregnancy and the Throat

Dysphonia. Disturbance in the quality of the voice is an uncommon complaint among pregnant females. In fact, due to perfect lubrication of the vocal cords, a better quality of voice can occur in the first and second trimesters, with professional singers being able to sing well up until 7 months. Dysphonia does occur, a number of etiological factors are thought to influence the voice during pregnancy, including altered breathing support, nasal obstruction, and laryngopharyngeal reflex (LPR).

Only one study was identified examining how the voice alters during pregnancy. Hamdan et al demonstrated, through the acoustic analysis of 25 pregnant women compared with 21 nonpregnant women, that vocal fatigue has a greater prevalence during pregnancy with a reduction in the maximum phonation time, which significantly improves immediately postpartum. The breathing support mechanism changes toward later pregnancy with alterations in the volume of the thoracic cage due to an enlarging uterus. In addition, pregnancy rhinitis may lead to persistent mouth breathing due to marked nasal obstruction. This would bypass the humidifying function of the nasal mucosa, leading to both oral and laryngeal dryness. It is thought that the respiratory tract is lined with secretions in 2 layers, an aqueous sol layer and a more superficial gel layer. Depletion of the sol layer can occur after 15 minutes of mouth breathing, leading to an increase of the phonation threshold along with vocal effort and consequently dysphonia.

Few case reports have been published regarding laryngopathia gravidarum, which relates to transient changes within the laryngeal mucosa and is considered a hormonal response of the larynx resulting in edema. In some cases, it may be associated with preeclampsia, although the literature in this area does not extend beyond a single case series. Other etiological factors of laryngeal edema include raised venous hypertension, fluid overload, weight gain, and pregnancy-aggravated hypertension.

It is the authors’ opinion that upon exclusion of other pathology, pregnant women presenting with dysphonia should be reassured and reassessed postpartum.

Reflux. Gastroesophageal reflex (GER) is thought to occur in approximately 30% to 50% of pregnancies, with the causative factor predominantly being a decrease in the lower esophageal sphincter pressure secondary to the influence of progesterone. LPR is considered to play an etiopathogenic role in symptoms of dysphonia, dysphagia, throat clearing, and globus and can occur in the absence of symptoms typical of GER.

As reflux-related symptoms are likely to disappear postpartum, treatment of such is not imperative. However, should the patient have symptoms severe enough to warrant referral, it is useful to know which management options are available. Before initiation of treatment for LPR, an accurate clinical assessment must be made, including direct visualization of the larynx.

Conservative management via lifestyle and dietary modifications should be the first step. These include avoidance of eating late at night, elevation of the head of the bed, abstaining from tobacco and alcohol, and avoidance of known dietary triggers such as fatty food, chocolate, and caffeine.

If symptoms are severe enough to warrant pharmacological therapy, a range of options are now available. Treatment may consist of H2-antagonists and/or proton-pump inhibitors (PPIs) and/or a liquid alginic suspension. Prospective studies have shown the use of PPIs (omeprazole, lansoprazole, and pantoprazole), liquid alginic (Gaviscon Advance), and H2-antagonists (ranitidine and cimetidine) to have no adverse teratogenic effects; however, H2-antagonists may be related to higher numbers of premature deliveries. Limitations of these studies include reliance on self-reported drug exposure and maternal interview as a source for outcome data. A recent meta-analysis by Gill et al examined the fetal outcomes of 1530 women exposed to PPIs. They were able to conclude that the use of PPIs inferred no increased risk for major congenital birth defects (odds ratio [OR] = 1.12; 95% confidence interval [CI] = 0.86-1.45), spontaneous abortions (OR = 1.29; 95% CI = 0.84-1.97), or preterm delivery (OR = 1.13; 95% CI = 0.96-1.33). In support of the safety of PPIs, a large cohort study by Pasternak and Hviid examined their effects when taken in the first trimester of pregnancy. There was no increased risk of major birth defects in the 3651 patients exposed to PPIs (adjusted prevalence OR = 1.10; 95% CI = 0.91-1.34). Most of the trial data appear to concentrate on omeprazole over other PPIs, and therefore further studies for the remainder are needed.

In summary, because of the self-limiting nature of GER in pregnancy, a conservative approach to management should be initially adopted; however, pregnancy does not absolutely preclude the use of conventional pharmacological treatment and can be used in more severe cases. Table 4 summarizes the symptoms discussed.

Conclusion

Limitations of the Study

While we aim to provide a comprehensive overview of otolaryngological manifestations in pregnancy, we appreciate the limits of this review. The paucity of data resulted in wide inclusion criteria, and therefore studies have been included in which bias may have been introduced into the data collection. In addition, the deficiency of prospective trials meant the data available were from studies with low levels of evidence, leading to the majority of conclusions being drawn from level 3 evidence such as comparative studies, correlation studies, case-control studies, and case series. The omission of unpublished data must also be highlighted.

Summary

ENT-related symptoms are common during pregnancy, with most resolving spontaneously postpartum. It is important, however, for general practitioners and otolaryngologists to be aware of the conditions and the underlying process in order to
be able to manage them effectively and safely considering the health of both the mother and the unborn child.

With the potential for ENT symptoms to be early warning signs for impending crisis, prompt recognition of these may prevent unnecessary harm and lead to an earlier diagnosis of conditions such as preeclampsia. In contrast, the avoidance of unnecessary treatment can also reduce the risks to the fetus. Sound knowledge of the side effects and safety of use of pharmacological therapy in the prenatal period is mandatory.

**Author Contributions**

Rohit Kumar, corresponding author, literature review, write up of article; Kathryn L. Hayhurst, literature review; Andrew K. Robson, overview of write up, supervisor.

**Disclosures**

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