Maternal gastrointestinal tract adaptation to pregnancy

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INTRODUCTION — Pregnancy has little, if any, effect on gastrointestinal secretion or absorption, but it has a major effect on gastrointestinal motility. Pregnancy-related changes in motility are present throughout the gastrointestinal tract and are related to increased levels of female sex hormones. In addition, the enlarging uterus displaces bowel, which can affect the presentation of disorders such as appendicitis. Knowledge of the gastrointestinal adaptation to pregnancy is necessary for accurate interpretation of laboratory tests, as well as imaging studies in the gravid patient.

Maternal gastrointestinal tract changes during pregnancy and common gastrointestinal disorders related to pregnancy will be reviewed here.

OROPHARYNX — The mucous membrane lining the oropharynx is responsive to the hormonal changes related to pregnancy. The gingiva is primarily affected, while the teeth, tongue, and salivary glands are spared, although excessive salivation during pregnancy has been described [1]. The effect of pregnancy on the initiation or progression of caries is not clear; pregnancy-related changes in the oral environment (salivary pH, oral flora) or in maternal diet and oral hygiene may increase the risk of caries [2]. (See "The skin, hair, nails, and mucous membranes during pregnancy", section on 'Mucous membranes'.)

Taste — Most studies suggest that taste perception changes during pregnancy [3-6]. The etiology is unknown and the direction of taste change varies among studies.

Gingiva

   Gingivitis — Enlargement and blunting of the interdental papillae of the gingiva may result in gingival bleeding, ulceration, and pain. Gingival inflammatory symptoms are frequently aggravated during pregnancy; prevalence rates of 40 to 100 percent have been reported [7]. The cause of pregnancy-induced gingivitis (picture 1) is likely multifactorial and includes pregnancy hormone-related vascular and inflammatory changes [8-12].

Optimal oral hygiene can reduce gingival swelling, erythema, and bleeding tendencies; therefore, frequent brushing and flossing are important. Women with moderate to severe symptoms should consult with a dental professional. (See "Gingivitis and periodontitis in adults: Classification and dental treatment".)

   Pregnancy epulis — Pregnancy epulis (also called granuloma gravidarum, pregnancy granuloma) is a benign lesion of the gingiva, particularly the interdental papillae, that also occurs on the oral mucosa, lips, and tongue. The same lesion may occur on the skin of nonpregnant individuals, where it is termed a pyogenic granuloma. (See "Pyogenic granuloma (Lobular capillary hemangioma)".) It is a small, soft, pink or red, smooth or lobulated, exophytic growth on a pedunculated or sessile base that develops over a few days to weeks and bleeds easily due to its vascularity. It is thought to arise in response to local irritation/trauma and/or hormonal factors [13]. Spontaneous resolution usually occurs postpartum so no intervention is necessary. (See "The skin, hair, nails, and mucous membranes during pregnancy", section on 'Vascular changes'.)

Ptyalism or sialorrhea gravidarum — Ptyalism or sialorrhea of pregnancy is an oral pathological condition consisting of excessive salivation that typically begins in the first trimester [14,15]. Symptoms generally abate in the second trimester, although they can continue to term. Salivary volumes range from 1.5 L to 2 L per day [16]. Reported incidences range widely from 0.08 percent to 35 percent and depend upon the definition used [16,17]. The mechanism in pregnancy is not known and ptyalism is commonly associated with nausea and vomiting as well as hyperemesis gravidarum [15]. (See "Treatment and outcome of nausea and vomiting of pregnancy".)

Causes of ptyalism unrelated to pregnancy include gastroesophageal reflux, medications (eg, clozapine), or irritants (eg, smoking). For women with a potential identified cause, treatment or removal of the underlying cause reduces excessive salivation [14,16,18]. For women with symptoms resulting only from pregnancy, treatment is mainly aimed at lessening symptoms. Women have reported relief with frequent expectoration, chewing gum or using lozenges, frequent drinks of water, and antiemetics [15].

"Pseudo"-sialorrhea is caused by failure to swallow saliva that is being secreted at a normal rate. It may be due to dysphagia, neurologic disease, cultural customs, or psychologic disorders.

ESOPHAGUS AND STOMACH — It is not clear whether gastric acid secretion is altered in pregnant women. Gastric emptying is not affected by pregnancy [19-21]. During labor, however, gastric emptying is prolonged if sedative or opiate drugs are administered. A combination of factors related to pregnancy, supine position, and analgesia and anesthesia put pregnant women at high risk of aspiration during labor and delivery.

In contrast to the stomach, transit time is prolonged in the small and large intestine (see 'Bloating and constipation' below).

Women with diabetes may have gastroparesis. (See "Diabetic autonomic neuropathy of the gastrointestinal tract".)

Gastroesophageal reflux — Gastroesophageal reflux (heartburn) is common during pregnancy. Most studies report an increasing prevalence of symptoms from the first to the third trimester, with relief postpartum [22]. Gastroesophageal reflux tends to recur in subsequent pregnancies, and similarly affects multiparous and nulliparous women [23].

The pathogenesis of gastroesophageal reflux during pregnancy involves both mechanical and intrinsic factors that adversely affect lower esophageal sphincter tone. Lower esophageal sphincter pressure is below the lower limits of normal in all trimesters, returning to normal in the postpartum period [24-26]. A study of women during early pregnancy and six weeks after pregnancy termination also demonstrated an inappropriate response of the sphincter to injections with pentagastrin, edrophonium, and methacholine, or a protein meal [26]. Thus, it appears that pregnancy is associated with both decreased lower esophageal sphincter pressure and inhibition of the adaptive responses of the sphincter.

Animal and human experiments have helped elucidate the effects of female sex hormones on the lower esophageal sphincter. In vivo models (using the opossum) showed a substantial reduction of lower esophageal tone with the administration of both estradiol and progesterone [27]. Whether the decrease in tone was due to estrogen, progesterone, or both, is unclear. Some studies suggest that progesterone is the mediator of lower esophageal sphincter muscle relaxation; however, estrogen may be needed as a primer for this action to occur [28].

The clinical features, diagnosis, and management of gastroesophageal reflux in pregnant women and the general population are reviewed separately. (See "Clinical manifestations and diagnosis of gastroesophageal reflux in adults" and "Medical management of gastroesophageal reflux disease in adults", section on 'Pregnancy and lactation'.)

Aspiration of gastric contents — Pregnant women are predisposed to gastric aspiration due to increased intraabdominal pressure and relaxation of the lower esophageal sphincter associated with pregnancy. They

are at highest risk of occurrence during labor or soon after delivery, presumably as a consequence of sedation and assumption of a recumbent position. Aspiration may also occur as a complication of general anesthesia and intubation for an emergent cesarean delivery. Aspiration pneumonia, acute bronchospasm, or the acute respiratory distress syndrome may ensue. Ideally pregnant women should be fasting for up to eight hours prior to a scheduled and/or elective surgical procedure. (See "Aspiration pneumonia in adults" and "Acute respiratory distress syndrome: Clinical features and diagnosis in adults".)

LIVER — In late pregnancy, physical examination of the liver is difficult because of the expanding uterus. The enlarging uterus causes a progressive upward displacement of the diaphragm, to a maximum of 4 cm, and the liver is forced up further into the chest, as well. A palpable liver is an abnormal finding. On ultrasound examination, the biliary tract is usually normal. Because of hemodilution, serum albumin levels decrease during the first trimester, and this decrement becomes more accentuated with advancing gestation.

Serum total cholesterol and triglyceride concentrations increase markedly during pregnancy [29-31]. Reported ranges vary among studies. In one large series, the 95th percentile of the distributions in the second and the third trimesters were: total triglyceride 254 and 415 mg/dL (2.87 and 4.68 mmol/L), respectively; total cholesterol 319 and 380 mg/dL (8.24 and 9.83 mmol/L), respectively; LDL-cholesterol 217 and 251 mg/dL (5.61 and 6.48 mmol/L), respectively; and the fifth percentile of HDL-cholesterol distribution was 42 and 40 mg/dL (1.09 and 1.04 mmol/L), respectively [31].

Serum alkaline phosphatase concentrations are significantly higher (up to two to four times normal) in the third trimester, primarily due to placental synthesis of alkaline phosphatase. Serum gammaglutamyl transpeptidase is significantly reduced and 5'-nucleotidase is slightly increased. The other liver biochemical tests are either normal or slightly increased or decreased, but remain within the normal range [32]. Thus, an increase in serum aminotransferase, bilirubin, or fasting total bile acid concentrations during pregnancy may be pathologic and should prompt further evaluation. The prothrombin time is unchanged during pregnancy, and serum fibrinogen increases in late pregnancy.

Additional issues regarding the effect of pregnancy on the liver are discussed separately.

- (See "Approach to liver disease occurring during pregnancy".)
- (See "Intercurrent hepatobiliary disease during pregnancy".)
- (See "Intrahepatic cholestasis of pregnancy".)
- (See "Pregnancy in women with pre-existing chronic liver disease".)
- (See "Acute fatty liver of pregnancy".)

GALLBLADDER — Pregnancy decreases gallbladder motility and increases the lithogenicity of bile. On ultrasound examination, fasting gallbladder volume and residual volume after contraction may be increased, with no change in the size of the common hepatic duct [33]. Epidemiologic studies have shown that pregnancy is associated with an increased risk for gallstones. (See "Intercurrent hepatobiliary disease during pregnancy", section on 'Gallstones'.)

PANCREAS — There is a paucity of information on the effect of pregnancy and sex steroid hormones on pancreatic secretion. Amylase levels have been reported to remain in the normal range or be slightly elevated [32,34-36].

Acute pancreatitis during pregnancy is rare. Most cases are associated with gallstones and, like acute cholecystitis, the incidence increases with advancing gestational age [37]. (See "Etiology of acute pancreatitis".)

BOWEL, RECTUM, ANUS — Bowel and anorectal symptoms, such as constipation, incontinence, and hemorrhoids, are common during pregnancy and postpartum [38].

Bloating and constipation — Pregnant women frequently complain of abdominal bloating and constipation. Prospective longitudinal studies of pregnant women using Rome II criteria to define constipation found the

prevalence of constipation ranged from 16 to 39 percent in each trimester of pregnancy and 6 to 12 weeks postpartum [39,40]. This is higher than the baseline rate of constipation (7 percent [39]) in nonpregnant women of similar age. Pregnant women become constipated for the same reasons as the general population; in addition, pregnancy-related factors can promote constipation. (See "Etiology and evaluation of chronic constipation in adults", section on 'Definition of constipation'.)

Abdominal bloating and constipation during pregnancy are probably caused by hormonal changes that affect small bowel and colonic motility. Increased progesterone concentration probably plays the major role in decreasing the activity of colonic smooth muscle, but other hormones may be involved. Animal and human studies evaluating gastrointestinal transit during pregnancy and in relation to hormonal changes during the estrus cycle support this concept [41-44].

For example, a study that measured gastrointestinal transit time and sex hormone concentrations in 15 women during their third trimester of pregnancy and four to six weeks postpartum found that small bowel transit time was significantly longer during pregnancy when progesterone and estradiol levels were increased compared to the postpartum period when the hormonal levels had fallen [41]. Another study noted that intestinal transit times were prolonged in both the second and third trimesters of pregnancy compared to the first trimester or the postpartum period [42]. A third study showed that progesterone inhibited both the amplitude and frequency of spontaneous colon muscle activity, while estrogen and hydrocortisone had no effect [44].

However, other factors may also contribute to the prolongation in transit time. The plasma concentration of motilin (a stimulatory gastrointestinal hormone) is reduced during pregnancy, possibly because progesterone may inhibit motilin release [45]. In addition, the gravid uterus can cause mechanical impedance to small bowel transit, particularly late in gestation.

Incontinence of feces and flatus — Pregnancy appears to be a risk factor for fecal incontinence and increased flatus [46]. (See "Effect of pregnancy and childbirth on anal sphincter function and fecal incontinence".)

Hemorrhoids — Hemorrhoids are varicosities in the anal canal caused by local pressure. Hemorrhoidal disease is particularly frequent in the last trimester of pregnancy and immediately postpartum: approximately 30 to 40 percent of pregnant women are affected by hemorrhoidal discomfort. Symptoms include pruritus, discomfort, and/or bleeding. (See "Hemorrhoids: Clinical manifestations and diagnosis".)

Constipation exacerbates these symptoms; therefore, adequate hydration and a diet replete with fiber are advisable. Treatment for relief of symptoms consists of conservative medical management using local application of antiinflammatory, antipruritic, and local anesthetic preparations. Recurrent and severe hemorrhoids usually require surgical treatment, typically hemorrhoidectomy, which can be performed safely during pregnancy if necessary [47]. (See "Treatment of hemorrhoids".)

INFORMATION FOR PATIENTS — UpToDate offers two types of patient education materials, "The Basics" and "Beyond the Basics." The Basics patient education pieces are written in plain language, at the 5th to 6th grade reading level, and they answer the four or five key questions a patient might have about a given condition. These articles are best for patients who want a general overview and who prefer short, easy-to-read materials. Beyond the Basics patient education pieces are longer, more sophisticated, and more detailed. These articles are written at the 10th to 12th grade reading level and are best for patients who want in-depth information and are comfortable with some medical jargon.

Here are the patient education articles that are relevant to this topic. We encourage you to print or e-mail these topics to your patients. (You can also locate patient education articles on a variety of subjects by searching on "patient info" and the keyword(s) of interest.)

- Basics topic (see "Patient education: Acid reflux (gastroesophageal reflux disease) during pregnancy (The Basics)" and "Patient education: Pregnancy symptoms (The Basics)")

SUMMARY AND RECOMMENDATIONS

- Oropharyngeal changes in pregnancy include pregnancy epulis, gingivitis, increased salivation, and changes in taste. (See 'Oropharynx' above.)

- Gastrointestinal reflux is common in pregnancy because of decreased lower esophageal sphincter pressure and inhibition of the adaptive responses of the sphincter. (See 'Gastroesophageal reflux' above.)

- Pregnant women are predisposed to gastric aspiration due to increased intraabdominal pressure and relaxation of the lower esophageal sphincter. (See 'Aspiration of gastric contents' above.)

- Serum aminotransferase, bilirubin, and fasting total bile acid concentrations remain within the normal range during pregnancy. Serum albumin and gammaglutamyl transpeptidase levels are significantly reduced, whereas lipids and alkaline phosphatase levels are significantly increased. (See 'Liver' above.)

- Gallbladder volume and the lithogenicity of bile are increased. (See 'Gallbladder' above.)

- Amylase levels appear to remain in the normal range or be slightly elevated. (See 'Pancreas' above.)

- Abdominal bloating and constipation during pregnancy are probably caused by hormonal changes (increased progesterone concentration) that reduce small bowel and colonic motility. (See 'Bloating and constipation' above.)

- Fecal incontinence and flatus are more common during pregnancy. (See 'Incontinence of feces and flatus' above.)

- Hemorrhoids are common in pregnancy, due to increased local venous pressure and an increased prevalence of constipation. (See 'Hemorrhoids' above.)

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GRAPHICS

Gingivitis during pregnancy

Hormonal changes that occur with pregnancy significantly influence the bacterial flora, causing significant gingival inflammation and hypertrophy.

Courtesy of Mark S Obernesser, DDS, MMSc.

Graphic 82278 Version 1.0

Contributor Disclosures

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