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The Female Patient: Pregnancy and Gynecologic Issues in the Bariatric Surgery Patient

Karina A. McArthur, Giselle G. Hamad, and George M. Eid

Polycystic Ovary Syndrome and Morbid Obesity

Polycystic ovary syndrome (PCOS) was initially named Stein-Leventhal syndrome for the physicians who recognized in 1935 a clinical triad of hirsutism, amenorrhea, and obesity. Since then, the National Institutes of Health (NIH) has updated this definition to the Rotterdam consensus criteria requiring two of the three following clinical manifestations: menstrual irregularity, hyperandrogenism (clinical or biochemical), and polycystic ovaries on ultrasound [1]. Estimates of the prevalence of polycystic ovary syndrome (PCOS) have ranged between 4 and 18 % [2].

The etiology of PCOS remains largely unclear. It is currently thought to represent a complex interaction of genetics and environmental factors, including intrauterine factors that predispose an individual to having endocrine abnormalities including insulin resistance, hyperandrogenemia, and infertility. Recently several studies have been published implicating candidate genes from genome-wide association studies [3, 4]. This represents an exciting avenue for further elucidation of the etiology of PCOS. Obesity is also thought to influence the phenotype of PCOS strongly [5], potentially forming a part of a "vicious" cycle further contributing to androgen excess [6].

PCOS is primarily a disorder of ovary function, resulting in menstrual irregularities, infertility, and hyperandrogenism. Hyperandrogenism is manifested in a number of ways, including hirsutism and acne. There is also a strong prevalence of insulin resistance in the PCOS population, in both obese and lean women [7]. The relationship between hyperandrogenism and insulin resistance is not clearly defined. However, hyperandrogenism predisposes to central obesity, which itself correlates with insulin resistance [8]. As a result of these endocrinopathies, women with PCOS may be at risk for cardiovascular events and other end organ complications [9].

The prevalence of obesity in women with PCOS ranges from 30 to 80 % [6, 9]. The role that obesity plays in the pathophysiology of PCOS is controversial. Nevertheless, obesity undoubtedly exacerbates some of the features of PCOS, including insulin resistance [9]. The prevalence of obesity in US women aged 20 and older is 35.8 % in 2009–2010 [10]. Obesity is clearly associated with a number of comorbidities including cardiovascular disease, hypertension, diabetes mellitus, sleep apnea, osteoarthritis, dysfunctional uterine bleeding, and endometrial carcinoma. When compared to their nonobese PCOS counterparts or to obese women without PCOS, women with PCOS and obesity have an even higher risk of developing the comorbidities that overlap between the two conditions. In other words, the risks are additive [11].

PCOS treatment focuses on the clinical manifestation of the syndrome such as hyperandrogenemia and insulin resistance. Insulin-sensitizing agents are one of the mainstays of treatment of PCOS. Advocates of their use believe that high insulin levels trigger the cascade of endocrinopathies that lead to anovulation and hyperandrogenism. While some studies have shown an improvement in ovulation and pregnancy rates with the use of insulin-sensitizing agents, a recent meta-analysis did not show any improvement in live birth rates with the use of insulin-sensitizing agents in PCOS [12]. A potential explanation for the heterogeneity of the results of insulin-sensitizing agents in studies looking at PCOS and improvement of metabolic dysfunction is the broader Rotterdam consensus criteria, including many patients without metabolic dysfunction in the definition of PCOS [13]. Treatment with antiandrogens is generally effective for the amelioration of hirsutism and acne but does not produce an insulin-sensitizing effect. Similarly, oral contraceptives may improve menstrual cycle regularity and acne [14].

Currently, there is no ideal treatment for PCOS, as none of the treatments described can remedy all of the biochemical aberrations, signs, and symptoms of the disease. Instead,

S.A. Brethauer et al. (eds.), *Minimally Invasive Bariatric Surgery*,
DOI 10.1007/978-1-4939-1637-5_54, © Springer Science+Business Media New York 2015

most treatments tend to target only one or a few components of PCOS. Weight loss is the only treatment that improves many of the endocrine aspects of the disease in the obese PCOS patient. A recent Cochrane review [15] showed that lifestyle intervention reduces adiposity and improves hyperandrogenism and insulin resistance in women with PCOS. However, weight loss achieved by lifestyle intervention is generally modest (5–10 %) and is followed by a regain in weight in the majority of cases [16].

Surgical management of weight is, therefore, an attractive option for improving the symptomatology of PCOS. Although studies on this subject are limited, they appear to show a significant benefit of bariatric surgery in treating PCOS [6]. One retrospective study evaluated 24 patients with an established diagnosis of PCOS [17]. All patients were oligomenorrheic, 96 % had hirsutism, 20 % had acne, and 50 % had ovary cysts on ultrasound. All of the patients had resolution of their menstrual abnormalities and the five patients who wished to conceive postoperatively were able to do so without clomiphene.

Similarly, in another retrospective study of 20 patients with PCOS who underwent Roux-en-Y gastric bypass, 82 % of patients had improvement in menstrual cycle irregularity, and all six patients who desired pregnancy were able to achieve it, five without any additional intervention [18]. In regard to the effect of restrictive bariatric procedures on PCOS, a study of the Swedish adjustable gastric band showed improvement of symptoms in 48 % of the patients with PCOS [19]. While several small studies have shown promising results in PCOS treatment with bariatric surgery, further research is necessary to establish bariatric surgery as a standard therapy for PCOS.

Pregnancy After Bariatric Surgery

Because preoperative menstrual irregularities and infertility frequently improve following bariatric surgery, female patients of reproductive age may become more fertile [17, 20]. Patients should be advised that they are at increased risk of becoming pregnant following bariatric surgery. Given that micronutrient deficiencies can result in deleterious effects on the fetus, it is critical to discuss the importance of compliance with micronutrient supplementation.

Bariatric surgery is associated with improved perinatal outcomes. Obese pregnant women are at higher risk of a number of perinatal complications, including preeclampsia, gestational diabetes, hypertension, post-datism, meconium staining, and prolongation of labor [21–23]. In a review of 75 published articles, post-bariatric surgery mothers had lower rates of pregnancy-related complications than obese women without bariatric surgery [24]. A population-based study demonstrated a lower risk of macrosomia following bariatric surgery, but these patients were more likely to be anemic, hypertensive, and deliver small for gestational age infants [25]. Another population-based study over a 20-year period compared pregnancy outcomes after different types of bariatric surgeries, including laparoscopic adjustable gastric band (LAGB), vertical banded gastroplasty, silastic ring gastroplasty, and Roux-en-y gastric bypass (RYGB). Among the groups, there was no significant difference in low birth weight, macrosomia, low Apgar scores, or perinatal mortality [26].

Gestational diabetes confers an increased risk of cesarean delivery and macrosomia [27]. Following bariatric surgery, the rate of gestational diabetes decreases [28]. In a retrospective study of a private insurance claims database, women who underwent bariatric surgery were less likely to have gestational diabetes and cesarean section compared to those who delivered before having bariatric surgery [29].

Pregnancy Following Gastric Bypass

A common question among women of reproductive age who are potential candidates for bariatric surgery concerns the safety and optimal timing of subsequent childbearing. The period of rapid weight loss following RYGB was initially thought to be a vulnerable time period for a pregnancy. Traditionally, bariatric surgeons have counseled patients to avoid pregnancy for up to 24 months following RYGB because of the concern that rapid weight loss leads to adverse fetal outcomes. However, recent studies have challenged the notion that pregnancy should be avoided in the first 2 years after bariatric surgery. In a retrospective review comparing RYGB patients who became pregnant within 1 year of surgery with those who became pregnant after 1 year, there was no increase in malnutrition, adverse fetal outcomes, or complications in pregnancy in the women who became pregnant within 1 year after surgery [31]. These data suggest that recommending a delay in conceiving beyond 1 year after bariatric surgery is unnecessary.

One theoretical challenge in the management of this population is the possibility that the anatomy of the RYGB impairs absorption of oral contraceptives, which might lead to unintended pregnancy [31]. There are few pharmacokinetic studies in the literature to guide clinical practice and more clinical trials are needed.

Gastric bypass has been shown to reduce the rate of pregnancy-related complications. In an analysis of insurance claims data from bariatric surgery patients who had at least one pregnancy [32], mothers having prior bariatric surgery had lower rates of preeclampsia, eclampsia, and gestational hypertension compared to deliveries prior to bariatric surgery. The majority (81.5 %) had undergone RYGB surgery.

A small bowel obstruction is a potentially catastrophic complication following RYGB that may result in major morbidity and mortality for both mother and fetus [33–35]. The gravid uterus displaces the intestines cephalad and a closed-loop obstruction through an internal hernia defect may occur.

This may progress to infarction or perforation if not recognized promptly. A small bowel intussusception is another possible etiology of small bowel obstruction that can lead to bowel necrosis [35]. A pregnant post-RYGB patient who complains of abdominal pain may present with vague clinical complaints which make diagnosis difficult. Clinicians may be reluctant to submit pregnant patients for CT scanning because of the radiation exposure. In addition, imaging studies may fail to diagnose an internal hernia or even intestinal volvulus [36]. Therefore, in a pregnant post-GBP patient with unexplained abdominal pain, serious consideration should be given to exploratory laparotomy or diagnostic laparoscopy, as early surgical intervention is needed to avoid a delay in diagnosis [37].

Pregnancy Following Restrictive Procedures

A low rate of pregnancy-related complications has been noted among patients having restrictive procedures. Following LAGB, there is a lower risk of gestational diabetes, pregnancy-induced hypertension, preeclampsia, cesarean section, macrosomia, and low birth weight babies compared to pregnancies in obese mothers who did not undergo bariatric surgery [38].

An advantage of LAGB is that the restriction may be adjusted during pregnancy to decelerate weight loss or to relieve hyperemesis. Dixon and colleagues cite the adjustability of the gastric restriction of the LAGB as an ideal method to control the weight of pregnant bariatric patients [39]. Of 1,382 gastric band patients, 79 pregnancies were compared with the patients' previous pregnancies and with matched obese subjects and community outcomes data. Birth weights were comparable to the community birth weights. Gestational diabetes and pregnancy-induced hypertension were comparable to the community incidence and were less frequent compared to the obese cohort. Stillbirths, preterm deliveries, and abnormal birth weights were concordant with the community data.

Conceiving within a year after LAGB appears to be safe according to a retrospective study which demonstrated that bariatric surgery patients who became pregnant during the first postoperative year did not have a higher rate of perinatal complications compared to those who became pregnant more than 12 months postoperatively [26]. In this study, the majority of patients had undergone LAGB (61.5 %). These data suggest that it is safe to conceive within 1 year of bariatric surgery.

The timing of pregnancy after LAGB is related to the rate of revisional surgery [40]. Among LAGB patients who became pregnant following LAGB, excess weight loss was equivalent at 3 years compared to nonpregnant controls. The rates of revisions of the band, port, and tubing were equivalent between the two groups. However, the women who became pregnant sooner after LAGB and pregnancy had a higher rate of band revisions.

Pregnancy Following Biliopancreatic Diversion

There are few studies in the literature evaluating pregnancy outcomes in BPD patients. One study with 18-year follow-up has addressed pregnancy following biliopancreatic diversion (BPD) [41]; 239 pregnancies occurred in 1,136 women who had previously undergone BPD. Thirty-five women experienced improvement in fertility following BPD. Eighty-five percent delivered at term and 28 % were small for gestational age. Total parenteral nutrition was required in 21 %. Two birth malformations were observed and three fetal deaths occurred.

In another study of pregnancy in BPD patients, a survey of 783 women showed an improvement in fertility in 47 % of patients who were unable to conceive preoperatively [28]. Although fetal macrosomia improved after the BPD, the miscarriage rate remained elevated at 26 %. The authors supported delaying pregnancy until weight stabilization.

The most recent study of pregnancy outcomes after BPD retrospectively evaluated ten BPD patients who previously had type 2 diabetes mellitus which resolved after BPD [42]. None of the mothers developed gestational diabetes and none of the infants had macrosomia.

Nutritional Issues

Several essential micronutrients are malabsorbed in GBP patients [43]. Therefore, compliance with vitamin and mineral supplementation is of utmost importance in pregnant patients following gastric bypass surgery. Deficiencies in vitamin A, iron, calcium, vitamin D, vitamin B12, thiamine, and folate have all been described. Thiamine deficiency may lead to Wernicke's encephalopathy, which may have devastating neurologic consequences.

The post-GBP reduction in calcium absorption may lead to a decrease in bone density which potentially places a female patient at risk for osteoporotic fractures [44]. Longer-term follow-up of 3 years reveals that the reduction in bone density continues [45].

Premenopausal women are at risk of iron deficiency anemia because of menstrual losses. Following GBP, these women are even more predisposed to iron deficiency. Gastric acid is required for release of iron and cobalamin from food. Iron is maximally absorbed in the duodenum, while cobalamin is absorbed in the terminal ileum. Following gastric bypass, the parietal cells in the distal stomach are bypassed, thereby reducing gastric acidity and subsequent absorption of iron and cobalamin. Therefore, daily iron supplementation is mandatory in GBP patients. Prenatal vitamins or multivitamin supplements containing iron are generally inadequate to meet the needs of the GBP patient; a separate iron supplement is required.

In the setting of folate deficiency, neural tube defects may occur after GBP and may result in devastating fetal

abnormalities [46]. Therefore, patients must be counseled about the importance of folic acid supplementation, especially as an increasing number of adolescent and childbearing-aged females undergo bariatric surgery.

Urinary Stress Incontinence and Obesity

Obesity is a risk factor for urinary stress incontinence [47]. It has been postulated that the increased intra-abdominal pressure due to obesity increases the intravesical pressure until it overcomes the maximal urethral closing pressure [48]. Neurogenic mechanisms for urinary stress incontinence in the obese have also been proposed [49].

Weight loss appears to be an essential element in sustained improvement in stress incontinence. The effect of nonsurgical weight reduction resulting in weight loss of ≥5 % had a ≥50 % reduction in incontinence frequency compared to only 25 % of women with <5 % weight loss ($p < .03$) [50]. Similarly, a recent randomized controlled trial demonstrated that a weight loss of 8.0 % resulted in a self-reported decrease in incontinence episodes in 47 % of patients in the intervention group, compared to 28 % in the control group that had 1.6 % of weight loss ($p = 0.01$) [51].

There has been increasing support in the literature citing the improvement of stress incontinence after bariatric surgery. One prospective study demonstrated that urinary incontinence resolved in 64 % and improved in 92 % at 1 year after gastric bypass [52]. Whitcomb et al. found that the overall prevalence of stress urinary incontinence decreased from 32 % at baseline to 15 % at 6 months ($p = 0.006$) [53].

The impact of obesity on the surgical treatment of urinary stress incontinence has been investigated in a modest number of studies. The literature looking at results of traditional surgical treatment such a Burch colposuspension in obese patients is mixed. However, there is an increasing consensus that cure rates and complication rates after tension-free vaginal tape repair are similar between obese and nonobese patients [49].

Conclusion

Obesity and PCOS are closely related; surgically-induced weight loss improves menstrual irregularities, hirsutism, and infertility. Postoperative bariatric patients are at increased risk of becoming pregnant. During pregnancy, compliance with vitamin supplementation is of utmost importance. Pregnancy outcomes are improved following bariatric surgery. If possible, close prenatal surveillance should be established with an obstetrician with experience in high-risk pregnancies. Elevated BMI is a risk factor for urinary stress incontinence, which improves with surgically-induced weight loss.

Review Questions and Answers

Question 1

What combination of characteristics does not meet the requirement for the diagnosis of PCOS according to the Rotterdam criteria?

(a) Obesity and polycystic ovaries on ultrasound
(b) Hyperandrogenism and menstrual irregularity
(c) Menstrual irregularity and polycystic ovaries on ultrasound
(d) Hyperandrogenism and polycystic ovaries on ultrasound

Answer: A

The Rotterdam consensus criteria requires two of the three following clinical manifestations: menstrual irregularity, hyperandrogenism (clinical or biochemical), and polycystic ovaries on ultrasound. Although obesity exacerbates many of the clinical abnormalities of PCOS, it is not a required component of the diagnosis.

Question 2

A 24-year-old G2P1 woman is 32 weeks pregnant and presents with dehydration, nausea, vomiting, and left upper quadrant abdominal pain. She underwent a gastric bypass 2 years ago and has lost 150 lb. Physical exam reveals tachycardia of 110, blood pressure of 90/50, and a gravid abdomen with left upper quadrant tenderness without peritonitis. White blood cell count is 11.0. CT scan reveals distended bowel loops and swirling of the small bowel mesentery. What is the next step in diagnosis and treatment?

(a) Insertion of nasogastric tube
(b) Upper endoscopy
(c) Serial abdominal exams
(d) Surgical exploration

Answer: D

Internal hernia is a devastating complication in a gastric bypass patient, possibly resulting in necrosis of the bowel, perforation, peritonitis, and short gut. Pregnancy complicates the diagnosis of internal hernia due to a gravid uterus displacing intra-abdominal contents. Clinicians may be reluctant to subject the fetus to ionizing radiation, making diagnosis challenging. In a patient with high suspicion of internal hernia, there should be no delay in intervening surgically.

Question 3

A 35-year-old female presents to a general obstetrician at 20 weeks of pregnancy for a first prenatal visit. She has had a gastric bypass 10 years ago and has not followed up for the last 5 years with the bariatric surgeon. She has not taken any nutritional supplements during this pregnancy. A routine CBC reveals anemia. The deficiency of what nutrient early in pregnancy could have predisposed this woman to deliver an infant with severe spinal cord abnormality?

(a) Cobalamin
(b) Iron
(c) Folate
(d) Calcium

Answer: C

This patient's anemia could potentially be multifactorial, with causes that include iron, folate, and cobalamin deficiency. However, folate deficiency can lead to neural tube defects. Many of these abnormalities occur early in pregnancy. Female bariatric patients of childbearing age should be counseled on the need for close monitoring of micronutrients starting early in their pregnancy.

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