Diagnostic and Treatment Considerations for Thyroid Cancer in Women of Reproductive Age and the Perinatal Period

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KEYWORDS

• Thyroid cancer • Pregnancy • Fertility • Preconception • Radioactive iodine
• Thyroid hormone

KEY POINTS

- Any woman of reproductive age diagnosed with thyroid cancer should be offered preconception advice on the risks of thyroid cancer progression or recurrence, or adverse obstetric and/or childhood outcomes, and contraception in cases where thyroid cancer treatment contraindicates pregnancy.
- For most cases of differentiated thyroid cancer (DTC) in the perinatal period, treatment can be delayed until after delivery. If surgery is recommended during pregnancy, it should be performed in the second trimester.
- Pregnancy is not associated with clinically meaningful disease progression of previously treated DTC or micropapillary thyroid carcinoma under active surveillance.
- It is recommended to avoid pregnancy for 6 to 12 months after radioactive iodine treatment.
- The need for thyroid hormone therapy to achieve a suppressed serum thyrotropin level during pregnancy is based on the DTC's dynamic risk response, but the harms and benefits of this should be weighed against the risks of adverse pregnancy outcomes.

INTRODUCTION

The worldwide incidence of thyroid cancer has been steadily increasing over the last 2 decades in line with the increased use of imaging modalities.[1,2] Papillary thyroid

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carcinomas (PTC) and follicular thyroid carcinomas (FTC) are referred to as differentiated thyroid cancer (DTC) and comprise 80% to 85% of all thyroid carcinomas, whereas the remaining minority is made up of medullary (MTC) and anaplastic thyroid cancer (ATC).

Thyroid cancer occurs more frequently in women than in men and is one of the most common cancers diagnosed in women of reproductive age.[2–4] It is estimated to make up 20% of all diagnosed cancers in the perinatal period, ranking thyroid cancer the second most common cancer after breast cancer.[5,6] About two-thirds of thyroid cancer diagnoses in the perinatal period are made in the first 12 months postpartum.[5] This is most likely due to reluctance to perform radiographic or invasive procedures during pregnancy and the predominantly absent, mild, or nonacute symptoms of DTCs especially. Importantly, regardless of the type of thyroid cancer that complicates the perinatal period, specific attention should be paid to psychosocial distress, anticonception strategies, and wish to breastfeed in order to provide optimal care for women with thyroid cancer. The current review focuses on preconception and perinatal-specific clinical considerations predominantly related to the care of patients with thyroid cancer, focusing particularly on DTC.

PREGNANCY AND THYROID CANCER DIAGNOSIS

In the general population, up to 68% of adults have a thyroid nodule detectable by imaging, and approximately 5% have a palpable thyroid nodule, with the prevalence of both increasing throughout a lifetime.[7,8] During pregnancy, only about 29% of women have a thyroid nodule detectable with imaging, whereas about 5% have a potentially palpable nodule of greater than 1 cm.[9] Although thyroid nodules are more frequent with advancing age, it is not uncommon for thyroid nodules to be first detected in young women during the perinatal period. The goal of thyroid nodule evaluation is the detection of thyroid cancer, which occurs in 7% to 15% of cases. The initial evaluation of thyroid nodules discovered during pregnancy or postpartum is the same as in the nonpregnant, nonlactating population and includes measuring serum thyroid function and performing an ultrasound.[10] Subsequent fine needle aspiration should be performed, if applicable, based on the sonographic pattern and patient preference, but pregnancy is a contraindication for nuclear imaging; during lactation, iodine-123 and technetium pertechnetate can be used if breastmilk for the few days following their administration is discarded.[10]

Several studies have shown decreased quality-of-life (QoL) measures in patients diagnosed with thyroid cancer compared with the general population, with the decrease more pronounced in young women.[11–13] In particular, the lower QoL in young women could be mediated by increased psychosocial distress related to pregnancy planning and/or (future) parenthood.[14–16] A recent study showed that a diagnosis of DTC and its subsequent treatment negatively influenced the desire to have a child in almost 40% of women.[17] The main reasons for these women were that they did not want a child anymore (40%), and fear of medicalization of the upcoming pregnancy (33%), although the outcomes related to family planning were not assessed. As such, the treating physician should have an active role in providing information and support, as is emphasized by the fact that psychological distress is related to suboptimal fertility and pregnancy outcomes.[18,19] Important uncertainties that need to be actively addressed relate to pregnancy-specific thyroid cancer progression or recurrence, the potential risks of serum thyrotropin (TSH) suppressive therapy, and risks of adverse obstetric and/or childhood outcomes.

IMPACT OF PREGNANCY ON THYROID CANCER

The overall prognosis of most thyroid cancers is excellent, but the remaining reproductive window for many patients, even among younger individuals, is often limited. Therefore, it is important to understand the effects of pregnancy on treated and/or persistent DTC to be able to determine the need for and optimal timing of specific treatments, as well as supporting plans for pregnancy, if desired, in those who received initial treatment or during active surveillance of newly diagnosed DTC.[20]

It should also be considered that normal thyroid physiology during pregnancy complicates the interpretation of serum thyroid test results. During pregnancy, the size of the thyroid gland increases by 10% in iodine-replete areas, but by 20% to 40% in areas of iodine deficiency. Furthermore, serum thyroglobulin (Tg) concentrations, as a marker of thyroid volume and/or remnant DTC, increase during pregnancy, especially in states of insufficient iodine,[21,22] and then normalize postpartum, which may complicate follow-up in women after hemithyroidectomy or with remnant disease following initial therapy for DTC.

Clinical data have refuted the theoretic concept that various pregnancy-specific physiologic changes could promote thyroid cancer (remnant) growth to a clinically meaningful extent (eg, increase in estrogen, placental growth hormone, and human chorionic gonadotropin). Several studies have demonstrated no significant disease recurrence or worsening of structural disease during pregnancy.[23–30] In a study including women with known structural disease, growth was seen in 30% to 50% during pregnancy,[24–26] with 8% requiring additional therapy (neck dissection and tyrosine kinase inhibitor [TKI] treatment) in the first year following pregnancy.[26] However, the interpretation of these studies is limited by the lack of a control group, and therefore, it is unknown what the disease courses would have been in a nonpregnant setting. However, these studies indicate that the American Thyroid Association (ATA) thyroid cancer dynamic risk stratification (DRS) system[8] can also help predict disease progression in pregnant women previously treated for DTC. In women with an excellent response, no additional monitoring is needed during pregnancy, whereas in those with biochemically or structurally incomplete responses, additional monitoring is needed with both serum Tg levels and surveillance neck ultrasounds.[10]

Previous studies have shown that pregnancy does not seem to impact the overall and disease-free survival of newly diagnosed DTC.[10] It must be noted that in most studies, the majority of the patients had stage I disease, which means that there were very few young patients with distant metastasis. For the 2 studies that did show a higher rate of persistent disease and recurrences in women diagnosed with DTC during pregnancy or in the first year thereafter,[28,29] the interpretation of results is limited by the fact that most recurrences (60%) were biochemical,[28] or biochemical and structural disease were shown together.[29] Larger and more detailed studies are needed to better verify the lack of an increased risk of persistent disease (whether biochemical, structural, or both) in patients with DTC that is newly diagnosed during pregnancy. In addition, there would be benefit in studying specific high-risk subgroups, such as women with new lymph node metastases discovered during pregnancy, or persistent disease during pregnancy following history of initial therapy.

Over the past several years, active surveillance for low-risk thyroid papillary carcinomas (mostly <1-cm tumors) has emerged as an acceptable alternative approach to surgery, if no suspicious cervical lymph nodes and no extrathyroidal extension are present.[31] A recent study by Ito and colleagues[32] showed that women with a desire to become pregnant are good candidates for active surveillance. Out of the total of 50 patients, biopsy-proven DTCs grew ≥3 mm in only 4 patients (8%) during the

perinatal period. Of these four, 2 patients underwent surgery after delivery and had no recurrence afterward. The others underwent continuous active surveillance because of lack of enlargement after delivery. The current ATA thyroid and pregnancy guidelines advise to monitor these microcarcinomas with a neck ultrasound in each trimester of pregnancy.[10] However, based on the study of Ito and colleagues, as well as an expected physiologic increase in thyroid volume overall during pregnancy, it could be argued that neck ultrasounds may be reasonably performed less frequently in this group (for example, only once in the second trimester).

IMPACT OF THYROID CANCER ON PREGNANCY

It has been shown that general cancer survivors often have a higher risk of adverse obstetric outcomes, such as preterm birth, which is mostly attributed to the long-term effects of cancer treatments like chemotherapy.[3,33–35] The rare occurrence of thyroid cancer in women of reproductive age limits the abilities to perform high-quality prospective studies. Subanalyses of large studies in survivors of any cancer indicate that the risk of adverse obstetric outcomes is not higher in thyroid cancer survivors than controls without a previous diagnosis of any cancer.[3,33–35] In line with such subanalyses, a study of 7734 women showed that those with a history of DTC have similar risks of adverse pregnancy outcomes, such as preeclampsia, preterm birth, or abnormal birth weight, as women without DTC.[36] Furthermore, the available data also do not indicate a higher risk of adverse obstetric outcomes in women diagnosed with DTC during pregnancy.[37] In general, a malignancy is not an absolute risk for preterm birth or indication for cesarean section. Clear communication and reassurance regarding similar risks of adverse pregnancy outcomes are important in this population, as young women in particular exhibit more distress and anxiety related to a thyroid cancer diagnosis,[14,15] which are independent risk factors for adverse pregnancy outcomes.[19,38,39]

DIFFERENTIATED THYROID CANCER TREATMENT-SPECIFIC CONSIDERATIONS IN PREGNANCY

For women with more concerning acute symptoms owing to DTC, or signs of MTC or ATC, pregnancy should not dissuade from recommendations to perform any necessary diagnostics or treatment interventions. The health risks related to these more aggressive types of thyroid cancers in the mother (and thus also risks to the offspring) typically outweigh these necessary procedures. Clinical data on perinatal MTC or ATC are limited to case reports, in comparison to that of DTCs showing that women of reproductive age with DTC have extremely good outcomes (ie, disease-specific survival rates >99%).[40–43] As such, a careful approach to clinical decision making that takes into account the harms and benefits of the timing of diagnostics or treatment interventions, as well as the risks and benefits for future reproductive function and pregnancy, is warranted.

Treatment of DTC is historically based on thyroid surgery followed by radioactive iodine (RAI) ablation. However, in many cases, a less-aggressive therapy seems more appropriate, as DTC-specific mortality has remained very low over the past several decades despite a concurrent increase in its incidence.[1,2,8] For this reason, current ATA guidelines recommend less-extensive surgery and more restricted use of RAI therapy in low-risk tumors,[8] but controversies remain.[44] Nevertheless, postoperative RAI ablation is still one of the cornerstones of the treatment of patients with DTC, particularly in more advanced disease.[8,45] After initial therapy (surgery, plus RAI if needed), patient follow-up strategies can be based on the ATA guidelines, which

include regular DRS assessments to determine no evidence of disease, persistent structural and/or biochemical disease, or a recurrence.[8] The need for additional therapy, for example, additional surgery and/or RAI therapy, TKIs, is based on these findings. Reoperative surgery, RAI therapy, and TKI use have different influences on pregnancy planning, reproductive function, and pregnancy course.

Thyroid Surgery

Thyroid surgery for DTC consists of either a hemithyroidectomy or a total thyroidectomy. Thyroid hormone replacement is always necessary following a total thyroidectomy. After hemithyroidectomy for DTC, up to 80% of nonpregnant patients require levothyroxine replacement therapy,[46–48] but this is likely higher during pregnancy because of increased thyroid hormone demands. When taking thyroid hormone replacement therapy, women should be counseled to increase their dose by 25% to 30% upon a positive pregnancy test.[49] After either hemithyroidectomy or total thyroidectomy, serum TSH level should be checked every 3 to 5 weeks during the first and second trimester, and at least once during the third trimester of pregnancy. The indication for TSH suppression is based on the ATA DRS status but should also consider pregnancy-specific risks (see section on Thyrotropin Suppressive Therapy).[10]

After thyroid surgery, permanent hypoparathyroidism may occur in up to 10% of patients.[8,50] Replacement therapy with calcium and/or active vitamin D is then needed, but even when calcium concentrations are normal and stable, episodes of hypocalcemia or hypercalcemia may occur, as pregnancy and lactation affect calcium and vitamin D metabolism. Undertreatment or overtreatment of hypoparathyroidism during pregnancy has been associated with abortion, stillbirth, and perinatal/fetal death.[51] Furthermore, maternal hypocalcemia can cause fetal parathyroid hyperplasia and associated skeletal changes, whereas maternal hypercalcemia can suppress fetal parathyroid hormone production, leading to neonatal hypocalcemia. Therefore, serum calcium levels should be monitored closely during pregnancy (eg, every 3–4 weeks) and during lactation (eg, monthly) with maintaining normocalcemia as the primary goal.[51]

When DTC is discovered during pregnancy, it can be difficult to determine the optimal timing for thyroid surgery. In patients diagnosed with DTC early in pregnancy who have no lymph node or distant metastases, both the current ATA and the British Thyroid Association (BTA) guidelines recommend monitoring with ultrasound.[8,10,52] In cases of rapid tumor growth or the presence/development of lymph node metastases, surgery should be considered in the second trimester. In 2 studies totaling 53 women diagnosed with DTC during pregnancy who underwent thyroid surgery (the majority during the second trimester), there were no pregnancy losses, and neonatal and maternal outcomes were similar to the general population.[53,54] After surgery, thyroid hormone replacement therapy is needed, and serum TSH level should be checked every 3 to 5 weeks during the second trimester, and at least once during the third trimester. In cases of DTC detected in the second half of the pregnancy, surgery after delivery is preferred[8,10] in order to minimize risks of abortion, altered organogenesis, and preterm labor and delivery.[52]

Postoperative Radioactive Iodine Ablation

Multiple studies have examined the effects of RAI ablation on both gonadal function and various pregnancy outcomes. A transient change of the menstrual cycle has been observed in 12% to 31% of women, in addition to a temporary increase of follicle-stimulating hormone levels during the first year after RAI therapy.[55–58] More recent studies have used serum anti-Müllerian hormone (AMH) concentrations as a

marker of ovarian reserve.[17,59] AMH is relatively insensitive to intercycle and intracycle variability and oral contraceptives use and gradually declines with age until it becomes undetectable during menopause.[60–62] Systematic reviews have shown a significant decline of serum AMH levels 1 year after RAI therapy, compared with baseline levels.[56,63] One study indicated that women older than age 35 years showed a much stronger decrease in AMH levels than those younger than age 35 years (−71% vs −46%; $P<.001$).[17] These data suggest that, if possible, a less-aggressive RAI treatment strategy should be considered in women over 35 years of age who desire pregnancy.

Several studies have reported that there are no increased infertility rates or adverse obstetric outcomes (eg, spontaneous abortions, stillbirths, preterm births, congenital malformations) in patients after RAI therapy.[57,58,63,64] It must be noted that a recent aggregate data meta-analysis identified a higher risk of abortion (odds ratio, 0.60; 95% confidence interval, 0.53–0.68; $P<.0001$) in women who became pregnant within 1 year of RAI therapy, compared with those who became pregnant greater than 1 year after RAI therapy.[64] Although those results may suggest that pregnancy should be avoided within 1 year of RAI therapy, spontaneous and induced abortions were not distinguished in the aforementioned study. Therefore, it is impossible to identify confounding by indication, in which the decision for an induced abortion is made because of recent RAI use, such as in women with an unexpected pregnancy. More data are required to optimize clinical recommendations on the necessary time between RAI ablation and conception, as is reflected by the current ATA guidelines that recommend avoidance of pregnancy for 6 to 12 months after RAI treatment.[8,10]

As mentioned earlier, RAI therapy is still one of the cornerstones in the treatment of patients with DTC, particularly among patients with more advanced disease.[8,45] However, it is well established that iodine-131 crosses the placenta and accumulates in the fetal thyroid, which may cause fetal/neonatal hypothyroidism, if given after 12 to 13 weeks' gestation.[65] Treatment with iodine-131 during pregnancy is therefore contraindicated and should be deferred to after delivery. After pregnancy, as the lactating breast is very efficient in concentrating iodine, breastfeeding must be stopped 6 weeks before until 3 months after RAI therapy.[66] This protects the mother's breast tissue from irradiation, and also the infant's thyroid gland from ingestion of iodine-131 through breastmilk intake.

Tyrosine Kinase Inhibitors

Currently, 4 TKIs (sorafenib, lenvatinib, pralsetinib, selpercatinib) are approved by the Food and Drug Administration in the United States for use with advanced metastatic DTC. To the authors' knowledge, there are currently no human studies evaluating the effects of these medications on reproductive function and pregnancy course, but associated teratogenicity and embryo toxicity have been shown in animal studies.[10] Because these drugs should be avoided during pregnancy and breastfeeding, contraception strategies and plans for breastfeeding should be actively discussed with every woman of childbearing age in need for treatment with a TKI. For rare cases of advanced DTC diagnosed during pregnancy, it should be recognized that such medications should not be started.

Finally, for any woman of reproductive age who may undergo a treatment that is contraindicated in pregnancy, it is vital to provide detailed advice on contraceptive use. Specifically, the failure risk of commonly used contraceptive techniques, such as barrier methods (condom [13%], diaphragm/cervical cap [up to 27%]), fertility awareness-based methods (2%–23%), and nonadherence to hormonal methods (7%) compared with intrauterine conception or implants (<1%).[67]

Thyrotropin Suppressive Therapy

A large proportion of women who undergo treatment of thyroid cancer will require postoperative levothyroxine replacement and thus require preconception counseling and gestational monitoring, and likely also a levothyroxine dose increase of 25% to 30%.[8] The gestational dose adjustment should be based on the serum TSH concentrations during pregnancy to prevent overtreatment as (athyreotic) women with preconception TSH suppressive therapy are more likely to be overtreated with a standard-dose increase regimen, and a short period of TSH outside the target range is unlikely to affect the risk of thyroid cancer progression.[68]

Based on the ATA DRS status, the recommendation of whether to initiate TSH suppressive therapy, and its extent if so, should be assessed similarly to that of a nonpregnant, nonlactating patient.[10] However, in (prospective) observational studies, a lower serum TSH and higher free thyroxine (FT4) concentration in pregnancy have been associated with preeclampsia, small-for-gestational-age infant, lower child IQ, and less cerebral gray mass.[69–74] These and other data have raised concern for the possibility of levothyroxine overtreatment,[75,76] for example, when it is started for mild thyroid function test abnormalities, but such concerns can be extended to TSH suppressive therapy for thyroid cancer. Therefore, a similar risk assessment as for nonpregnant patients should be made to weigh the harms and benefits of TSH suppressive therapy, while considering the risks of adverse pregnancy outcomes. If surgery is postponed to after delivery, the possible benefits of TSH suppressive therapy during pregnancy, with respect to the prognosis of DTC, are unknown. Current ATA guidelines advise that thyroid hormone replacement therapy be considered to maintain a serum TSH level between 0.4 and 2.0 mU/L,[10] whereas the current BTA guidelines emphasize that there is no evidence for TSH suppression for such cases, and no advise is given.[52]

For women who are considered to not have any active DTC (ie, DRS showing excellent response), iatrogenic hypothyroidism can be approached in the same way as other forms of pregestational hypothyroidism (such as those with Hashimoto disease or congenital hypothyroidism). In this group, the only exception is that levothyroxine treatment should be targeted to a TSH level less than 2.0 mU/L during pregnancy; this is in contrast to the TSH treatment goal of less than 2.5 mU/L in women with Hashimoto disease and no DTC, and the diagnostic threshold for (subclinical) hypothyroidism that is typically less than 4.0 mU/L in women without known thyroid disease.[10] Women with preexisting hypothyroidism before pregnancy who are well controlled on levothyroxine have similar risks of adverse pregnancy outcomes as women without hypothyroidism.[38,77,78]

MEDULLARY THYROID CANCER

MTC is a relatively rare thyroid cancer entity that occurs sporadically or in a hereditary form (all caused by an *RET* germline mutation and may be a component of type 2 multiple endocrine neoplasia [MEN], MEN2A or MEN2B, and the related syndrome, familial MTC). Testing for germline RET mutations is advised in all patients with newly diagnosed MTC. In the case of an RET mutation, it is important to offer genetic counseling to the parents, including possibilities of testing in utero or after delivery. Furthermore, in the case of an *RET* mutation, a pheochromocytoma should be excluded, preferably before pregnancy.[79] Sporadic MTC occurs mainly in the fourth to sixth decade, but those with hereditary MTC may be much younger. Survival in MTC is based on its initial stage, with a 10-year survival rate varying from 100% in stage I to 21% in stage IV.[79] Thyroid surgery, including possible prophylactic lymph node

dissection of the central compartment, forms the basis of initial treatment.[79] Afterward, patients will require thyroid hormone replacement with the goal of maintaining serum TSH levels in the euthyroid range, and RAI therapy is typically not administered. In cases of recurrent disease or the presence of neck and/or distant metastases, one might consider surgery, local radiotherapy, or systemic treatment with a TKI.[79]

If MTC is diagnosed during pregnancy, both current ATA and BTA guidelines advise surgery during gestation, because of the more aggressive nature of MTC as compared with DTC.[10,52] To the best of the authors' knowledge, no studies evaluating the benefits of this strategy exist. Women undergoing surgery for MTC should be instructed similarly as those treated for DTC, regarding increasing the dose of their thyroid hormone replacement therapy should they become pregnant (see earlier discussion). There are no studies on disease progression/recurrence during pregnancy in women with MTC. In postoperative women who become pregnant, one might consider performing a thyroid ultrasound and obtaining serum calcitonin and carcinoembryonic antigen (CEA) measurements during the second trimester, in order to rule out recurrence or local disease progression. It should be noted, however, that serum calcitonin concentrations can increase up to 2 to 3 times the upper limit of normal during pregnancy and remain high during the postpartum period, especially in breastfeeding women.[80] For serum CEA, there are no clinically meaningful changes as a result of pregnancy.[81]

Although TKIs should generally be avoided during pregnancy, 1 case report of a woman with metastatic MTC treated with vandetanib until 6 weeks of gestation demonstrated no major pregnancy complications or fetal abnormalities.[82] Although there were no major consequences in this patient, the outcomes of this single case cannot be extracted to other patients, and therefore, pregnancy should be still avoided when on TKI treatment.

ANAPLASTIC THYROID CANCER

ATC is a rare thyroid cancer entity, and in contrast to DTC, is generally extremely aggressive with a disease-specific mortality that approaches 100%. Given its rapid course of disease progression and poor outcome, end-of-life issues and plans for comfort care measure are part of disease management. Recent research from the Netherlands showed a median survival of 2.2 months, and an estimated 1-year survival of 12%.[83] Although the median age in this study was 73 years, the cohort also included patients younger than age 40 years. Immediate therapy is needed, and therefore, in cases of this rare diagnosis made during pregnancy, surgery should not be deferred to after delivery.[10,52] If immediate surgery is not possible, TKI treatment can be considered, but as mentioned earlier, teratogenicity and embryo toxicity have been shown in animals.[10] In general, different treatment options and possibilities impacting both maternal and fetal health should be discussed in a multidisciplinary setting with the patient (and her partner). With respect to the impact of pregnancy on possible recurrence/progression in women successfully treated for ATC, there are no prospective or retrospective studies on this topic to the best of the authors' knowledge.

SUMMARY

Thyroid cancer is one of the most common cancers diagnosed in women of reproductive age and during pregnancy. Studies show that pregnancy is not associated with significant disease progression of previously treated DTC or micro-PTC under active surveillance. Furthermore, there does not seem to be an increased risk of persistent disease in patients with newly diagnosed DTC during pregnancy. Unless DTC has

aggressive features, it is usually advised to defer treatment to after delivery, as this delay will not pose a threat to both the patient and the fetus. However, if surgery is necessary during pregnancy, it should be performed in the second trimester. With respect to RAI treatment, it should be noted that a less-aggressive RAI treatment strategy in women over 35 years of age who have desire for pregnancy should be considered. It is recommended to avoid pregnancy for 6 to 12 months after RAI ablation for DTC, but further research is needed to be better define this period. The need for TSH suppressive therapy during pregnancy is based on the ATA DRS status, but the harms and benefits of TSH suppressive therapy should be weighed against the risks of adverse pregnancy outcomes. Finally, preconception and perinatal management and surveillance should be based on careful discussion of thyroid cancer prognosis and recommended treatment, fertility issues, and the risk for adverse pregnancy or child outcomes within a multidisciplinary team with the woman and her partner.

CLINICS CARE POINTS

- Advice should be given on the risks of progression, adverse pregnancy outcomes, and contraception.
- Women should contact their doctor upon a positive pregnancy test.
- Radioactive iodine treatment should not be given during pregnancy.
- Breastfeeding should be stopped 6 weeks before until 3 months after radioactive iodine treatment.
- In women over 35 years of age with the desire for pregnancy and without high-risk tumor features, a less-aggressive radioactive iodine strategy should be considered.
- Pregnancy should be avoided for 6 to 12 months after radioactive iodine treatment.
- Levothyroxine dose should be increased by 25% to 30% upon a positive pregnancy test.
- The need for thyrotropin suppressive therapy during pregnancy is based on the American Thyroid Association dynamic risk stratification response, but the harms and benefits of this should be weighed against the risks of adverse pregnancy outcomes.
- For DTC, in the case of an excellent response, no additional monitoring is needed during pregnancy.
- For DTC, in those with biochemical or structural incomplete response, monitoring with both serum thyroglobulin levels and surveillance neck ultrasounds is needed.
- In micro-papillary thyroid carcinomas under active surveillance, a neck ultrasounds should be performed in the second trimester.
- For most women, treatment DTC can be delayed until after delivery. If surgery is recommended, it should be performed in the second trimester.

DISCLOSURE

The authors declare no conflicts of interest, and no competing financial interests exist.

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