

Approach to the Patient With Thyrotoxicosis Using Telemedicine

Michelle L. Griffith,¹ Lindsay A. Bischoff,¹ and Howard B.A. Baum¹

¹Division of Diabetes, Endocrinology, and Metabolism, Vanderbilt University Medical Center, Nashville, Tennessee 37232

ORCID number: [0000-0001-7511-8001](https://orcid.org/0000-0001-7511-8001) (H. B.A. Baum).

Context: The potential for endocrine care via telemedicine has been recognized since the early 2000s when clinical outcome data demonstrated improvements in glycemic control with telemedicine. The widespread use of telemedicine during the COVID-19 pandemic has pushed telemedicine beyond diabetes care and into clinical areas with a paucity of published data. The evaluation and treatment of thyrotoxicosis heavily relies on laboratory assessment and imaging with physical exam playing a role to help differentiate the etiology and assess the severity of thyrotoxicosis.

Case Description: We describe a patient presenting for evaluation of new thyrotoxicosis via telemedicine, and describe modifications to consider for thorough, safe evaluation via telemedicine.

Conclusion: Telemedicine may be an ideal way to assess and treat patients with thyrotoxicosis who are not able to physically attend a visit with an endocrinologist but still have access to a laboratory for blood draws. Potential challenges include access to imaging and high-volume surgeons if needed. Clinical and economic outcomes of telemedicine care of thyrotoxicosis should be studied so that standards of care for endocrine telemedicine can be established. (*J Clin Endocrinol Metab* XX: 0–0, 2020)

Freeform/Key Words: hyperthyroidism, thyrotoxicosis, telemedicine, telehealth

Case Presentation

A 30-year-old woman was referred to the endocrinology clinic for evaluation of thyrotoxicosis. Because of the COVID-19 pandemic, she was offered a telemedicine visit and accepted. The consultation was provided using real-time, interactive telecommunication technology including audio and video. At a 6-month postpartum visit 6 weeks prior, the patient had complained of anxiety. Thyroid function tests revealed a suppressed thyrotropin (TSH) of 0.005 mIU/L (0.45–4.54 mIU/L) and elevated direct free thyroxine (T4) of 44.6 pmol/L (10.6–22.8 pmol/L). She reported that symptoms began about a month postpartum and had

worsened in recent weeks. She noted heat intolerance, insomnia, tremor, palpitations, and brisk loss of her pregnancy weight. She was not taking oral contraceptives or biotin. At a subsequent visit 2 days before the endocrine consultation, pulse was noted to be 115 beats per minute with a blood pressure of 131/67 mm Hg. On telemedicine exam, the patient appeared comfortable. There was no conjunctival injection, periorbital edema, or proptosis. Extraocular movements appeared normal. The thyroid was visible on swallowing, approximately 2 to 3 times enlarged, with the right lobe more prominent than the left. No tremor was evident with arms outstretched on camera.

ISSN Print 0021-972X ISSN Online 1945-7197

Printed in USA

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Received 10 May 2020. Accepted 8 June 2020.

First Published Online 11 June 2020.

Corrected and Typeset 6 July 2020.

Abbreviations: ATDs, antithyroid drugs; CMS, Centers for Medicare and Medicaid Services; RAI, radioactive iodine; T4, thyroxine; TSH, thyrotropin; TSI, thyroid-stimulating immunoglobulin.

Background

Telemedicine and endocrinology: history and current state

The potential of endocrine care via telemedicine has been recognized since the early days of the field. Telemedicine, defined here as real-time audiovisual patient care encounters delivered remotely using a teleconferencing technology, is one form of telehealth (1). *Telehealth* is a broad term encompassing many models of clinical and nonclinical health promotion activities delivered over a distance using communication technologies (1). Telemedicine services can be structured to provide care to a patient at a remote clinical site, such as a hospital or clinic, or to the patient at home. Although earlier examples of remote care programs exist, proliferation of widespread internet service in the 1990s made telehealth programs more feasible.

In that historical context, telemedicine entered diabetes care on a large scale with the Informatics for Diabetes Education and Telemedicine (IDEATel) Project, a foundational RCT funded by the Centers for Medicare and Medicaid Services (CMS). This demonstration project was born of the Balanced Budget Care Act of 1997 (2). The study combined nurse video visits and remote patient monitoring to provide proof of concept of telemedicine to CMS (2). Patients showed improvement in glycemic control and other clinical outcomes (3), though the intervention was costly, primarily because of the cost of technology including all patient equipment (4). In the years since, a robust literature around diabetes telemedicine has developed. Multiple groups have shown positive results for diabetes care via telemedicine. Diabetes consults, provided by endocrine specialists, lead to similar hemoglobin A_{1c} improvement when delivered via telemedicine or traditional office visits (5). Endocrine consultation via telemedicine improves diabetes care in special populations, such as residents of correctional facilities, while helping to control costs of care related to transport (6).

However, other areas of endocrinology are minimally represented in the telemedicine literature. Various telehealth modalities have been explored to enhance specific aspects of thyroid care. These include remote doctor-to-doctor consultation for thyroid nodule and cancer evaluation (7), allowing experts in one geographic region to reach another in need. Similarly, methods to conduct both remote cytopathology (8) and operative pathology (9) consults have been examined. Remote monitoring of hospitalized, isolated patients after high-dose radioiodine therapy has been tested to help reduce personnel exposure to these patients (10). A Dutch study (11) examined the feasibility of web-based consultation

for thyroid conditions as well as 2 unrelated complaints. This led to a 46% absolute reduction in in-person referrals with high satisfaction among general practitioners and with average savings of €286 per consultation. The long-term nature of thyroid cancer follow-up suggests a role for telemedicine when expertise is not available locally. Relatively indolent disease may cause patients to lose motivation for repeated visits to a specialty center. However, there are nuances of management such as TSH targets specific to disease risk and interpretation of ultrasound findings that favor continued follow-up by an endocrine specialist. Thus, telemedicine is a potential solution (12), though it is important that high-quality, consistent imaging can be obtained when indicated.

One plausible explanation for the limited data on management of thyroid conditions via telemedicine is a lack of easily measured short-term outcomes analogous to the hemoglobin A_{1c} for diabetes, which may make objective comparisons between telemedicine and usual care more difficult. Despite this, aspects of endocrinology make the specialty well suited to telemedicine. These include the scarcity of endocrinologists relative to the population, particularly outside urban areas (13), and the data-driven nature of endocrine decision making.

Despite this long history, until very recently the adoption rate of telemedicine among clinicians remained relatively low, and many telemedicine services were not integrated into the patient's ongoing care or own medical record (14, 15). Barriers to more widespread use of telemedicine in chronic care have included a number of legal and regulatory policies as well as limited private-payer reimbursement (16). CMS limits on telehealth included requirements for specific health care settings and geographic restrictions emphasizing very rural locations (16). Medicaid policies, and state requirements around private insurer coverage, vary widely from state to state (17).

Changes with COVID-19 pandemic

This landscape changed dramatically in early 2020 as a response to the COVID-19 pandemic. As the virus reached the United States, the federal government responded with important waivers to increase access to medical care during a need for physical distancing. Critical changes allowed during this time via the CARES Act and 1135 waiver included removing the restriction for patients to be at a particular geographic location and removing limitations that prevented the home from being a site of service (18). Additionally, the Office of Civil Rights took action to temporarily expand the allowable videoconferencing modalities and reduce technical barriers by announcing a plan to exercise

enforcement discretion over certain aspects of HIPAA (the Health Insurance Portability and Accountability Act) when clinicians act in good faith (19).

With these changes and the pressures of the pandemic, many clinicians rapidly shifted to seeing patients with telemedicine. Our own division had an existing telemedicine program seeing approximately 15 patients per month in the setting of payer restrictions. We served more than 2300 patients via telemedicine to their homes in the first 2 months following the first case of COVID-19 in our state (unpublished data.)

Telemedicine evaluation and management of the thyrotoxic patient

The hyperthyroid patient seen via telemedicine can largely be managed according to accepted practice guidelines, though some aspects of the evaluation and management require modification to the usual approach. It is outside the scope of this article to discuss at length the principles of thyroid disease management, as these are published extensively elsewhere. This discussion focuses on telemedicine visits with the patient at home; some of the limitations discussed, such as vital sign concerns, will not be applicable to the patient seen in a distant health care facility.

The initial telemedicine visit

A patient referred to an endocrinologist for thyrotoxicosis will have been seen by another clinician and generally will have at least a TSH value available. It is important, particularly for a telemedicine visit, that the specialist have available the outside office notes, the record of any physical examination performed, and the initial laboratory results.

A comprehensive history is essential and is as readily achievable via telemedicine as with a traditional office visit. Some aspects of the physical examination of the hyperthyroid patient using telemedicine are unchanged, but there are limitations (Table 1). General hyperkinesia can be assessed. A visible, uniformly enlarged thyroid suggests Graves disease, whereas asymmetry or a focal prominence might indicate nodular goiter. The patient can assist in some elements of the exam; thyroid tenderness can be grossly determined by guiding the patient to gently palpate in the correct area of the anterior neck. Other findings, such as a thyroid bruit, mild diffuse thyroid enlargement, or more subtle nodularity, cannot be determined from video as they can with a hands-on examination. Basic neurologic assessment, including presence or absence of tremor, is readily obtained.

Gross findings of orbitopathy could be noted on video, whereas subtle eye findings such as chemosis,

Table 1. Physical examination for thyrotoxicosis via telemedicine (patient at home)

Readily obtained	Limited or not possible via telemedicine
Pulse	Cardiac exam
Hyperkinesia	Mild diffuse goiter
Visibly enlarged goiter—smooth or irregular	Subtle nodularity
Thyroid tenderness (guide patient to self-palpate)	Thyroid bruit
Tremor	Subtle orbitopathy findings
Stare	
Extraocular movements	
Proptosis	
Pitting edema (guide patient to palpate and demonstrate)	
Prominent pretibial or preradial myxedema	
Psychiatric exam including affect, mood, judgment	

mild conjunctival injection, or mild proptosis may be less evident. Pretibial myxedema, preradial myxedema, and acropachy are also potentially diagnosable via telemedicine based on appearance, though the inability to assess texture is a limitation.

One potential challenge in assessing a new thyrotoxic patient via telemedicine is determining the presence of hemodynamic instability, as with severe sinus tachycardia, atrial fibrillation, or congestive heart failure. Thyroid hormone levels do not provide an adequate assessment because the correlation between the degree of thyroid hormone elevation and clinical signs and symptoms is only moderate (20). Remote evaluation of vital signs has been used in previous telemedicine studies, but the patients enrolled are typically being followed for chronic conditions such as heart failure, and are given validated instruments that can be uploaded electronically to a central monitoring system (21, 22). Although patients may have personal devices capable of measuring pulse and blood pressure, their use for a formal medical evaluation has not been validated. However, any home data available should be collected, and taking history about changes in the patient's own observed baseline, for example on a smartwatch, can provide useful information. The lack of exam for hemodynamics makes the history about these symptoms even more critical. The patient should be asked about dyspnea, exercise tolerance, palpitations, and edema. Documentation from the referring clinician should also be carefully reviewed for vital signs and any noted findings of arrhythmia or heart failure.

The previously mentioned steps are important in the evaluation, but the majority of patients with

subtle thyrotoxic symptoms will not have significant underlying cardiac problems. Nonetheless, if reliable recent vital signs are unavailable, and the endocrinologist is concerned that the patient is unstable, a different approach to the patient is required. This could entail referral to a local emergency department, coordinating a recheck with the local referring provider, or bringing the patient to the endocrinologist's office or an affiliate office closer to the patient, if available. Given the concern for the rare patient who may present to the endocrinologist with hemodynamic instability, some specialists may choose that new thyrotoxic patients be evaluated at an office visit only, with the option for subsequent follow-up to be conducted via telemedicine.

Diagnostic evaluation

As with the typical new patient visit, the initial laboratory evaluation of the telemedicine patient should include TSH, T4, 3,5,3'-triiodothyronine (T3), complete blood count, and comprehensive metabolic panel if not previously available (23). The endocrinologist can order any required laboratory testing through a local lab convenient to the patient, with the results transmitted by electronic means, if available, or by facsimile. The next recommended step is to determine the etiology of thyrotoxicosis. This can be accomplished with the measurement of thyroid receptor antibodies, radioactive iodine (RAI) uptake (possibly accompanied by iodine-123 or technetium 99-metastable pertechnetate scanning) or assessment of thyroid morphology and blood flow on ultrasonography based on availability of expertise and resources (23).

If the patient is located in a remote area where radiology facilities and expertise are scarce, the endocrinologist may opt to order thyroid receptor antibodies or thyroid-stimulating immunoglobulin (TSI) to diagnose Graves disease. This approach may be more easily accessible for patients without close access to radiology facilities with nuclear medicine, but it will not differentiate hyperfunctioning nodular disease and subacute thyroiditis. For a patient whose thyroid receptor antibodies measurement does not indicate Graves disease, or whose history or physical suggests another etiology, imaging to evaluate for thyroiditis or nodular disease may be required. In this instance, the endocrinologist will need to determine the best site for this to occur and the urgency of the testing so that these concerns may be balanced against the issues of geographic convenience. There is variability in ultrasound technique and interpretation between radiologists (24, 25), so becoming familiar with available locations and/or obtaining images

for personal review may be helpful. It is also crucial that established criteria (American Thyroid Association or American College of Radiology Thyroid Imaging Reporting and Data Systems) be used by radiologists to communicate findings (24, 25).

Orbitopathy and a diffusely enlarged thyroid, particularly with bruit, are indicative of Graves disease and would ordinarily obviate further evaluation (23). It is possible that subtle orbitopathy findings would be missed in a telemedicine visit, meaning that laboratory or radiologic evaluation might be ordered that would have otherwise been omitted. The potential added testing and cost burden to the patient and to the health care system must be balanced against the benefits of telemedicine such as convenience and potential patient savings from reduced travel.

Treatment and follow-up

β -Blockade is recommended for all patients with symptomatic hyperthyroidism, particularly the elderly, and for those patients with a resting heart rate greater than 90 beats per minute or those with underlying heart disease (23). Reactive airway disease is a potential contraindication. As previously mentioned, reliable current measurement of vital signs may be difficult using telemedicine, and the endocrinologist could consider routinely treating, in addition to the symptomatic and high-risk patients, young asymptomatic patients displaying overt biochemical thyrotoxicosis, given the low risk of β -blockade in this population.

If the patient is found to have Graves disease as the etiology of hyperthyroidism, treatment options include RAI therapy, antithyroid drugs (ATDs), or thyroidectomy (23). Typically, the choice of treatment is made based on factors such as patient and physician preference, plans for pregnancy, and comorbidities including the presence of orbitopathy. There are additional considerations with the telemedicine patient that may influence the decision. The patient living in a remote area may have limited access to nuclear medicine treatment or high-volume surgeons. RAI will require radioactive iodine uptake, and if this cannot be accomplished close to home, logistics of treatment may be challenging. These factors might influence the treatment in the direction of ATDs, which can be implemented with appropriate discussion, risk-benefit counseling, and a plan for follow-up to watch for normalization of thyroid levels and remission.

For the patient with nodular disease, RAI, thyroidectomy, or long-term treatment with low-dose ATDs may also be appropriate (23). Although

pregnancy, comorbidities increasing surgical risk, and lack of access to a high-volume surgeon are the usual considerations leading to ATDs for nodular disease, reluctance to travel to a major health center might prompt the choice of ATDs, even if on a temporary basis. If surgery is felt to be the best choice for a given patient, ATDs can be used as bridge therapy while awaiting surgical consultation. Many surgeons have also begun offering initial consultations via telemedicine; patients living far from a high-volume center may be able to significantly reduce their travel burden if endocrine and surgical consultations are performed remotely.

As with an office patient, telemedicine patients found on evaluation to have thyroiditis would not need specific treatment for hyperthyroidism and could be treated symptomatically in the usual fashion.

For patients who have received RAI or ATDs, the guidelines recommend biochemical evaluation at intervals of 2 to 6 weeks. Guidelines do not expressly mention a need for examination (23). Such follow-up can be conducted quite readily without a traditional office visit, with laboratory orders and results being transmitted electronically or by facsimile. Communication with the patient can be conducted by encrypted email, electronic health record message, or telephone. In the setting of RAI, thyroidectomy, or thyroiditis, thyroid hormone replacement can be initiated remotely when indicated with appropriate laboratory follow-up. The frequency of subsequent telemedicine visits can be arranged at the discretion of the endocrinologist, in a similar frequency as they would typically see a patient back in the office for follow-up care. The patient should be counseled regarding symptoms requiring more urgent communication, such as ATD side effects, the development of or increase in eye symptoms, or hyperthyroid or hypothyroid symptoms.

Optimizing the telemedicine experience for patient and clinician

Providing safe, effective care with the patient's best interest in mind must remain the first goal of telemedicine. Patients report a preference for care from their own established providers (26) and high satisfaction and confidence in telemedicine provided by their own providers (14). Patient preferences regarding follow-up of well-differentiated thyroid cancer have been explored (27). Although this study found that patients preferred specialist or specialist-primary provider shared care models for their follow-up, 32% indicated they would be satisfied if specialist follow-up were provided by video visits.

When initiating telemedicine visits, several factors can foster a good experience for the patient and the clinician (28) (Table 2). When scheduling a telemedicine visit, we recommend explaining in plain language what will occur during the visit, including that the clinician and patient will be able to see and hear each other. Depending on the platform used, patient education materials may need to be provided ahead of time, and the patient should be encouraged to set up and test his or her device before the visit. If the visit is scheduled, as opposed to an on-demand encounter, it can be useful to explain that this time is reserved for the patient and takes the place of an office visit. Specific consent for telemedicine may be required by some states or institutions.

During the visit, patients and providers should both ensure a private space to conduct the visit. HIPAA laws apply to telemedicine, and technology used must be compliant. Any parties present with the clinician, such as a trainee or scribe, should be introduced to the patient. Similarly, parties present with the patient should be greeted and identified. Patient consent to discussion with all parties present should be confirmed.

To facilitate communication, the clinician should arrange their view of the patient to easily maintain eye contact with the patient. As discussed earlier, it is important to have a plan regarding options for escalation of care if an unexpected urgent clinical need arises. It is also important to establish routines for typical follow-up testing and other related needs. In a study of osteoporosis patients seeing consultants on telemedicine, patients felt the care provided was of high quality but desired improved coordination of their testing and ancillary health services (29).

The roles of all individuals in the telemedicine visit should be documented, and the location of the patient (state) should also be documented. With few exceptions, such as the Veterans Affairs system, clinicians must be licensed where the patient is located. We recommend reviewing documentation requirements, any interstate service plans, and other practice questions with an

Table 2. Steps to optimize patient and clinician experience

Educate patients: what to expect, how to use technology
Obtain consent as needed
Ensure privacy during the visit
Obtain labs/imaging prior to visit when possible; ensure all results are stored in the medical record
Obtain home vital signs if the patient has equipment
Maintain eye contact, explain interruptions
Plan for unexpected findings and follow-up needs
Refer patient to online patient education sites (such as Endocrine Society or American Thyroid Association sites)

experienced health care attorney or other similar resource when establishing telemedicine services.

Return to the patient

The patient was prescribed long-acting propranolol 80 mg daily to mitigate tachycardia. Because 6 weeks had elapsed since the initial laboratory evaluation, repeat thyroid function tests were checked to look for a marked decline in thyroid levels suggesting postpartum thyroiditis. The order was placed in our electronic health record, and the patient was able to go to an affiliated laboratory near her home. β -Human chorionic gonadotropin was negative. TSH was undetectable. Direct free T4 remained elevated at 31.1 pmol/L with total T3 greater than 7.7 nmol/L (0.9–2.5 nmol/L). TSI was also measured and was elevated at 10.40 IU/L (≤ 0.54 IU/L). The duration of symptoms, presence of goiter, persistence of marked biochemical thyrotoxicosis, and TSI were all consistent with a diagnosis of Graves disease. On this basis, the patient was prescribed methimazole 20 mg daily, and instructed to repeat laboratory testing in 4 weeks. She will be seen in follow-up using telemedicine in 3 to 4 months.

Controversies and areas of uncertainty

Although the efficacy of diabetes care via telemedicine is well established in the literature, there are few data for other areas of clinical endocrinology. More information is needed to demonstrate conclusively that a variety of endocrine conditions can be safely cared for via telemedicine, and to establish best practices for addressing specific clinical questions. For example, thyroid cancer care via telehealth may be an area of concern for some providers because of the lack of a physical exam or lack of consistent, reliable ultrasonography. There are also few studies looking comprehensively at the financial value of telemedicine as part of a medical practice. The more permissive reimbursement and regulatory environment that rapidly arose in response to COVID-19 has facilitated increased telemedicine services, including allowing some clinicians to offer it for the first time. However, reimbursement limitations have historically been problematic in many states. A financial analysis of an academic endocrine surgery practice found that collections for telemedicine visits were similar to traditional office visits and that significant capacity could be created in the clinic for the practice to see more patients (30). Differences in reimbursement structures between surgical and medical practices and across states can limit generalizability of some financial analyses. At the same time, many patients may save money from reduced travel (5, 30) and time away from work

when they access specialty care via telemedicine, and health care systems can increase their geographic reach without adding additional costly overhead expenses by using telemedicine. Telemedicine can also create more capacity for in-person visits within a practice (30).

Conclusions

Now that many patients have been exposed to this type of care, it is likely that patient acceptance, interest, and demand will increase. Endocrinologists are well positioned to provide the highest quality of care using telemedicine. Questions of ancillary resource utilization, office visit utilization, and the overall economic impact of telemedicine for specialty care deserve more study. Pragmatic trials could increase understanding of how to make optimal use of this model of care. Additionally, publication of the experiences of centers that have been doing this type of care for years would help peers to learn and build on best practices. We should continue to advocate for patient-centered, endocrinologist-directed care and establish standards of care for endocrine telemedicine practice.

Additional Information

Correspondence and Reprint Requests: Howard B.A. Baum, MD, Division of Diabetes, Endocrinology, and Metabolism, Vanderbilt University Medical Center, MCE 8210, 1215 21st Avenue South, Nashville, TN 37232. E-mail: howard.baum@vumc.org.

Disclosure Summary: The authors have nothing to disclose.

Data Availability: Data sharing is not applicable to this article as no datasets were generated or analyzed during the current study.

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