

**MINIMALLY INVASIVE THYROID SURGERY
MEDICAL COLLEGE OF GEORGIA
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During then next hour in this live interactive webcast from the Medical College of Georgia, in Augusta, Drs. David J. Terris and Paulo Miccoli will demonstrate the new techniques that enable a thyroidectomy through an incision less than an inch at the base of the neck. The program will highlight the use of an endoscope and harmonic device in performing the minimally invasive procedure. During the webcast, viewers may ask the physicians questions by clicking the MDirect Access button on the webcast screen. Dr. Terrace is Chairperson and Professor of Otolaryngology at the Medical College of Georgia. Dr. Miccoli is Professor and Chief, Department of Surgery, University of Pisa, Pisa, Italy. This webcast is made possible by an educational grant from Ethicon Endosurgery, and originates from the Medical College of Georgia in Augusta, Georgia.

00:01:08

DAVID J. TERRIS, MD, FACS: Good afternoon. Thank you for joining us for a special discussion of thyroid surgery, in particular, minimally invasive techniques. I'm David Terris. I have as my special guest today Dr. Paulo Miccoli who is from the University of Pisa and is the pioneer of the minimally invasive video-assisted thyroidectomy. In order to optimize the educational experience today, we're going to start with a brief introduction which will discuss the patient characteristics which would be appropriate for this technique, as well as the sequence in steps involved with the surgery. We'll then share with you a brief video of a procedure that was done last month. We will then have an opportunity for Dr. Miccoli to share comments and some data from his wealth of experience. Finally, we will have ample opportunity for questions and answers. And I think that is really the advantage of this format, is being able to directly query Dr. Miccoli. There are a number of thyroid diseases that justify surgical intervention. Those that lend themselves most to this technique include the solitary thyroid nodule, small well-differentiated cancers, and small multi-nodular goiters. Before we discuss the minimally invasive technique, it's worthwhile spending a minute discussing the conventional thyroid approach. With the conventional approach, an 8-10 sonimeter incision is made low in the neck. Subplatismal flaps are elevated up to the top of the thyroid cartilage or even the hyoid bone and down to the clavicles. The midline in the neck is identified. The strap muscles are then mobilized away from the thyroid glands, exposing the thyroid compartments. Following this, the blood vessels to the thyroid gland can be ligated, and then the important recurrent laryngeal nerve identified, traced, and preserved during the removal of the glands. Typically, after a conventional surgery, a drain is placed, the patient is hospitalized for a minimum of one day after surgery, the calcium levels are monitored if a total thyroidectomy is accomplished, and the thyroid hormone is replaced. The minimally invasive video-assisted thyroidectomy was first performed in the late 1990s in Europe, and currently only a few centers in the U.S. are performing this procedure. It involves a minimal incision, usually about $\frac{3}{4}$ of an inch. It's endoscopic assisted. No drains are required, no skin sutures are

necessary. It can frequently be done on an outpatient basis, and can even be done under local anesthesia quite readily. In terms of choosing correct patients, it's important that these be non-obese individuals with the nodule size no bigger than about 25-30 mm. Also, the thyroid should be of relatively normal size, no larger than about 20 cc's in volume. There should not be any thyroiditis, as this makes dissection quite challenging. So those conditions that lend themselves to this technique include follicular neoplasms, low risk papillary carcinomas, and small multi-nodular goiters. By way of introduction, Dr. Miccoli and his partner, Pierre Oberti at the University of Pisa, have a very robust thyroid surgical practice that has allowed them to develop this new technique. For example, they do on average about 75-80 thyroidectomies per week, about 8-10 parathyroidectomies per week, and this translates into 2,500 thyroidectomies per year. The reason they have such a busy surgical practice is due in part to a very busy endocrine practice in which his endocrine partners perform approximately 250 ultrasound examinations per day. Now the MIVAP technique involves three distinct segments. It starts with an open approach, and then it becomes an endoscopic component, and then it moves back to being an open procedure. The procedure starts with a skin incision of approximately $\frac{3}{4}$ of an inch. Interestingly, with an incision that short, that low in the neck, typically the platysma muscle is not even encountered because the incision is between the medial heads of that muscle. The strap muscles are identified and vertically separated, and then the plain between these strap muscles and the thyroid gland is identified, and then blunt dissection is accomplished around the gland quite liberally in order to mobilize the gland and in order to create a space through which the endoscopic technique can be accomplished. At this point the procedure becomes endoscopic. The room lights are darkened, and the first part of the procedure is ligation of the superior pole vessels. This is made quite easy with the magnification provided by the telescope. The middle thyroid vein is ligated, and then one moves inferiorly to identify the recurrent laryngeal nerve. The parathyroid glands are identified and mobilized. At this point, the procedure turns back to an open procedure. The superior pole of the gland is grasped and delivered through the incision. The isthmus is divided, and the entire gland is exteriorized, remaining attached simply by the ligament of Barry. The recurrent laryngeal nerve which has been previously identified, is now traced up into its entrance in the larynx, and the lobectomy is completed. With this new technique, the instrumentation becomes critical. There is a Miccoli thyroidectomy instrument set that is available that includes a 5 mm 30 degree telescope. In addition, there are various spatulas which allow for blunt dissection of the thyroid glands. If one does not have that specific instrument set, there are other instruments that can substitute, including a Freer elevator or a suction Freer elevator. Equally important is the harmonic instrumentation. This device is a new form of energy distinct from laser and electrocautery that actually provides hemostasis by vibrational energy or frictional energy. The active blade seen on the right vibrates or moves 55,500 times per second. That frictional energy causes the hydrogen bonds to break, the protein to denature, a sticky coagulant forms within the vessel, and then the vessel is sealed and divided. And you will also notice the size of the instrument shaft is quite narrow, allowing one to operate through a very small and narrow space. As an example, we operated on a 56-year-old woman who had a follicular neoplasm identified by fine needle aspiration. You can see the incision has been marked out, which is about 20 mm. We marked beyond where we expect to make our incision, in case we need to extend it during surgery for any reason. It's important to mark this incision with the patient awake sitting up in a holding area, as the location will vary once the patient is lying supine. We've also marked out here the extent of her disease. This slide demonstrates the retrieval of the gland through the incision after the nerve and

parathyroid glands have been identified and the blood vessels ligated. This is what the specimen looks like once it's been removed, and you can see a very large dominant nodule as part of her total thyroidectomy specimen. The incision is closed and sealed simply with Dermabond, which is medical-grade glue. This is a patient who's, several months after surgery, and you can see that the incision heals quite nicely down low in the neck. It's about $\frac{3}{4}$ of an inch. By contrast, this is a patient who had surgery in this community about two years ago for a small follicular neoplasm through a conventional approach. And you can see the difference in the size and extent of the incision that was utilized for that approach. So this new technique really is a different type of surgery. We have documented our experience with this technique, starting in February of 2005 and extending to March 2006. During this period of time, we did 125 thyroidectomies, 36 of which were accomplished through the minimally invasive video-assisted approach. This represents 29% of our patient population. Three of these patients were male and 33 were female. Five patients had a total thyroidectomy, 31 a hemi-thyroidectomy, and our mean incision length was 24 mm, just under an inch, with a range from 15 mm to 33 mm. None of the patients required a drain. None of the patients required skin sutures, and all but one patient was operated on on an outpatient basis, meaning that they went home just a few hours after surgery. We're now going to provide you with video of a patient that was operated on last month. This is a 52-year-old woman who had a follicular neoplasm measuring 2.5 centimeters. And let's roll that video. As you can see, a scalpel is used to make a skin incision, and then electrocautery is used to divide the subcutaneous tissues. At this point, one identifies the midline, and during this process an anterior jugular vein is identified. This can be easily managed with a harmonic ace device. As you can see, the vessel is grasped with the device and activated, and after about six to eight seconds, the vessel is ligated and then cut. Here we show elevation of the strap muscle off of the thyroid glands. With specialized retractors in place, blunt elevation with this Miccoli elevator allows us to mobilize the thyroid gland safely. Now we can see the use of the harmonic ace through the endoscopic appearance, and tissues that may contain blood vessels can be easily and safely divided. Here we're mobilizing the medial aspect of the glands in that area referred to as the triangle Oberti. The superior pole is dissected away from the laryngeal cartilage. A small segment of the sternothyroid muscle is likewise divided with the harmonic ace to expose the upper pedicle and a superior thyroid artery and vein. First the artery and then the vein are dissected free. This is the superior thyroid artery and the long pedicle right angle can be utilized to safely isolate this vessel. Once it has been isolated, the harmonic ace shears can be introduced and used to grasp that vessel prior to ligating it. The harmonic is typically used at a power setting of 3. As you see, it generates steam, it's not really smoke, it's steam as it ligates that vessel. The superior thyroid artery has now been safely divided, and you can see it pulsating in the top of the wound. With this technique, no sutures or clips are left inside the patient. Now we're ligating the superior thyroid vein, and just above this you can see the external branch of the superior laryngeal nerve. Another small vessel is identified and carefully ligated with the harmonic ace shears. Remaining attachments of the glands can be lysed with electrocautery now that we are safely away from the superior laryngeal nerve. This demonstrates the positioning of the assistants during the surgery, one at the head of the bed holding retractors, one opposite the surgeon holding the endoscope, and then the operative surgeon using instruments through the same incision through which the endoscope is providing visualization. We have now directed our attention inferiorly to identify first the inferior thyroid artery, and then a search is undertaken for the recurrent laryngeal nerve. One dissection is utilized for this purpose. Unlike conventional surgery in which a clamp is spread along the direction of the nerve,

typically a spatula is held in each hand and the tissues are spread perpendicular to the direction of the nerve. The nerve is gently identified. The nerve can now be seen coming into view. These instruments are blunt so one can safely elevate the tissues surrounding the nerve. Once that nerve is identified, one can exteriorize the glands. As you can see, a clamp is placed on the superior pole. Several clamps are typically utilized to distribute the tension along the glands, and care is taken not to grasp the nodule. Patients must be exercised at this point to gently deliver the gland through the incision. At this point, the gland is gently withdrawn through the incision. Once the gland is exteriorized, one identifies the recurrent laryngeal nerve once again and traces that up, as with open surgery, to its entrance in the cricoid thyroid joint. The harmonic shears can be utilized to ligate the tissues overlying the nerve, with care being taken to place the active blades superficially and the inactive blade deep to minimize the chance of injuring the nerve. The superior parathyroid gland can be seen just to the right of the nerve, and that is gently dissected laterally with attachments ligated with the harmonic shears. With the nerve under direct vision at all times, the remaining attachments to the gland can be ligated and divided using the harmonic shears. When possible, individual blood vessels are identified and separately ligated. The nodule can be seen within the wound at this point. The isthmus is divided, and the lobe is therefore delivered. A total thyroidectomy is therefore accomplished. Inspection of the wound reveals the superior parathyroid glands, the recurrent laryngeal nerve, and the inferior parathyroid glands safely preserved. Surgicel is placed within the thyroid bed, and the wound is closed with interrupted sutures of Vicryl. Now we're going to give Dr. Miccoli an opportunity to discuss his wealth of experience with this particular surgical technique. Dr. Miccoli.

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PROFESSOR PAOLO MICCOLI: Yes, we started in July 1998, and until January 2006 we operated on 958 patients: 132 males and 826 females with a mean age of 39.7 years. And mainly the thyroidectomies have been performed since 609. And this is the pattern of our preoperative diagnosis. As you can see, the main indication is now, as Dr. Terris already said, low risk papillary carcinomas. Follicular tumor and small goiters are also very good indication. So as you can see, this is a surgery which can be performed also for malignancies. The conversion rate is quite low, and it should be low. Because if you stick quite strictly to the inclusion criteria already indicated by Dr. Terris, you shouldn't have a high rate of conversion. Conversion was due, in our experience, mainly to few cases of extracapsular invasion and in some cases, due to the difficult dissection mainly for an under-diagnosed thyroiditis. Next. The complication rate seems to be more or less the same as in open surgery, as you can see. We have a 1.2% of permanent laryngeal nerve palsies, and a quite low rate, less than 1%, of permanent hypothyroidism. Based on several studies performed in different centers, we realized that we had the same rate in the different centers, and they are all, this data comparable to standard surgery. So we repeat again the inclusion criteria, which are more or less the ones indicated by Dr. Terris, and although should not exceed 3.5 cm, with a thyroid volume which must be less than 20 ml. Which must be measured by means of a preoperative ultrasonography. It is important not to have to deal with an enlarged and pathologic lymph nodes, and also very important is to avoid any form of thyroiditis. So the selection of the patients are really pivoted on a good echography to perform preoperatively. So the procedure is characterized, as you have seen in this gorgeous video, by five different steps: the incision and the access to the operative space; the section of the operpedical ; the identification of laryngeal nerve and parathyroids; then the extraction and resection of the lobe; and finally by the closure. We performed also a center compartment clearance in patients carriers of gene mutation, and this

particular class of patients is characterized by the fact that they will develop medolory carcinoma and they must be operated before they develop this terrible malignancy. And these patients can undergo this surgery quite safely. The demonstration is that we operated on 16 cases, and after a mean follow-up of 22 months, calcitonin, which is a very good marker for this kind of tumor, was undetectable six months after surgery in eight patients, thus demonstrating that this is a surgery which can be performed safely even in patients carrying a malignancy.
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DAVID J. TERRIS, MD, FACS: Thank you very much, Dr. Miccoli. I see that we already have several questions that have been sent in to us. So I'm going to share with you the very first question, which is how close to the recurrent laryngeal nerve can you get with the harmonic device?
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PROFESSOR PAOLO MICCOLI: Well I think that you can go safely as close as 3 mm. In case you are doubtful, you can stay at 5 mm, at a 5 mm distance. But I think that 3, and even 2 mm is a distance of safety to stay to the nerve.
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DAVID J. TERRIS, MD, FACS: Very good. The second question is, what's your opinion about dividing the sternocleidomastoid muscle to have a better exposure like Professor Gemzin Jagger from Switzerland recommend?
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PROFESSOR PAOLO MICCOLI: Well, we don't think that this is of paramount importance. As you have seen, we favor very, very small access to the thyroid gland, and this, I think, is meeting the favor of our patients.
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DAVID J. TERRIS, MD, FACS: One question is, how high does the temperature get with the harmonic device?
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PROFESSOR PAOLO MICCOLI: Well, uh, it's important to say that a harmonic scalpel is not a cold instrument. It's a hot instrument. But just consider that the maximum temperature is around 70 Celsius degrees, which is not a terrible temperature. But it's enough to damage the nerve if you touch the nerve with this instrument.
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DAVID J. TERRIS, MD, FACS: And just for reference sake, with electrocautery, typically those temperatures reach as high as 400 degrees Celsius, so it's really a significant difference. Where would you re-implant an injured parathyroid gland if one was injured during a minimally invasive approach?
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PROFESSOR PAOLO MICCOLI: Well, in this case, you can re-implant the parathyroid gland in the strap muscles, because as you have seen in the video, the strap muscles are divided in the midline so you can dissect a little bit of strap muscles, divide the gland, and put the fragments or the entire gland inside of the strap muscles, and there are great possibilities that the parathyroid gland will work again.
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DAVID J. TERRIS, MD, FACS: Does the endoscopic approach lend any difficulty to that particular procedure?
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PROFESSOR PAOLO MICCOLI: No, I don't think so. I don't think so.
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DAVID J. TERRIS, MD, FACS: Another question was how do you identify the superior laryngeal nerve, the external branch? Is there a greater risk of injury to this structure with minimally invasive approaches?
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PROFESSOR PAOLO MICCOLI: I don't think that this surgery put this nerve in more jeopardy. I think it's by opposite, that thanks to the optical magnification, this structure can be more easily seen. How to visualize the nerve, you have to put the camera quite close to the upper pedicle to dissect the different parts of the upper pedicle, and then, only in case this structure is very close to the companion of the upper pedicle you will see it. Otherwise, you have not to consider that the nerve is in connection with the upper pedicle and you can grab the companion of the pedicle and divide with that moniker.

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DAVID J. TERRIS, MD, FACS: Okay. Another question just came in. Which harmonic device was used in the video? Ace or CS23C? And any preferences between the use of the two? And so this is obviously somebody that is sophisticated with this instrumentation. And we used the ace for that particular video, and that's our preference now. Is to utilize the ace device because it is able to manage vessels as large as 5 mm in diameter as opposed to the CS23C, which can handle vessels as big as 2-3 mm. Additionally, the harmonic ace device allows one to control the device by a hand activation rather than a foot pedal, which is preferable for some surgeons. It can still be used with a foot pedal, but many surgeons like myself prefer to activate it with a finger switch rather than a foot pedal. The next question that also came in is how do you manage uncontrolled bleeding that may occur?

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PROFESSOR PAOLO MICCOLI: Well, the most hazardous bleeding is, of course, coming from the upper pedicle. And, uh, if you have a failure when dividing by means of a harmonic scalpel, what you can do is to apply a clamp, a vascular clamp, on the artery or on the vein. And the bleeding will be controlled quite quickly and probably easily.

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DAVID J. TERRIS, MD, FACS: Okay. In what circumstances would you convert your incision to a larger, more traditional incision?

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PROFESSOR PAOLO MICCOLI: Well, uh, I would answer that the only case that you have to enlarge an incision to convert is when you probably have underestimated the volume of the goiter you are operating on. So in this case, it's much more reasonable to convert it to open surgery just enlarging the incision. I just want to remind that the incision is in the middle of the neck, so just enlarging it a couple of centimeters on both borders of the incision allows you to have an open procedure completely performed.

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DAVID J. TERRIS, MD, FACS: And that lends itself as an advantage, also, for parathyroid surgery as well, doesn't it?

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PROFESSOR PAOLO MICCOLI: Oh, yes. I think that this is an access which can be used successfully also for parathyroid surgeries, a minimal access. And so the parathyroid glands can be accessed and bilateral neck exploration can be performed, what is also important.

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DAVID J. TERRIS, MD, FACS: Another question came in. It says, how low on the neck is your incision?

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PROFESSOR PAOLO MICCOLI: Well, how low? Generally I assume that the incision should be a couple of centimeters above the sternum notch. And I think that we can assume that this position, of course according to dimensions of the neck, can be easily confirmed.

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DAVID J. TERRIS, MD, FACS: I see. Another question that came in is what's the biggest advantage of this procedure?

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PROFESSOR PAOLO MICCOLI: I think that the cosmetic advantage is the most important advantage to be stressed. But I also have the feeling that these patients have a less painful course, can be discharged more quickly, and so I think that even in terms of economics, this is a procedure which can be really recommended.

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DAVID J. TERRIS, MD, FACS: The next question is sort of a generalized question. What symptoms must one have in order for the thyroid gland to be removed? That's a little bit difficult to answer that.

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PROFESSOR PAOLO MICCOLI: Well, I think that if we are just speaking in terms of symptoms, I think that compression symptoms should be the most important symptoms to, I mean to address a patient to surgery. But, of course, if the patient is carrying a malignancy, the patient should go immediately to the surgeon.

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DAVID J. TERRIS, MD, FACS: Another question that came in. How often do you convert to open surgery? And can you just extend your incision if necessary?

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PROFESSOR PAOLO MICCOLI: Well, the conversion rate, as you have seen, is likely less than 2%. So I can, I would like to confirm this conversion rate. Less than 2% of the cases. In case the goiter is a little bigger than presumed before the operation, you just can divide a little bit of the strap muscles without enlarging the skin incision and the goiter will come out quite easily.

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DAVID J. TERRIS, MD, FACS: And then another specific technical question. The length of the telescope is a laparoscope. That seems quite long. Can one do it with a shorter telescope?

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PROFESSOR PAOLO MICCOLI: Yes, one might do it with a shorter telescope. Personally, I prefer the longer one because so the hands of the cameraman stay back and don't interfere with the hands of the operators.

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DAVID J. TERRIS, MD, FACS: I see. I think that's the sum total of the questions that we've received. I thank you for joining us this afternoon. I hope you've learned something from our discussion, and certainly you can feel free to contact either myself or Professor Miccoli if other questions arise.

00:34:02

NARRATOR: This has been a live internet broadcast presentation of a minimally invasive thyroidectomy procedure from the Medical College of Georgia. For more information about this webcast, just click the "for more information" button on the screen. This webcast is made possible by an educational grant from Ethicon Endosurgery.