Despite many advances in surgical techniques during the last several decades, the risk for recurrent laryngeal nerve (RLN) injury during thyroid and parathyroid surgery has only declined, not disappeared. In the first half of the twentieth century, Lahey and subsequently Riddell independently described a technique for thyroidectomy, in which an attempt was made to find the RLN in every case rather than taking the traditional approach of avoiding even seeing the nerve. The superiority of this approach has been documented by Hermann and colleagues who reviewed thyroidectomies for benign diseases from 1979 to 1990 when nerves were not visualized (n = 15,865) and from 1991 to 1998 when visualization of the RLN was standard practice (n = 10,548). These authors showed that the risk for permanent RLN injury in the former group was 1.1%, but in the latter group, in which visualization of the nerve became standard practice, the risk of permanent RLN injury decreased to 0.4%.

Most surgeons attempt to identify the RLN, thereby minimizing the risk of injuring it. Despite adopting this technique, there are several well-described circumstances that increase the likelihood of RLN injury. Thomusch and colleagues conducted a multivariate analysis that analyzed risk factors for patients undergoing thyroidectomy for benign disease. These investigators found that larger extent of resection and recurrent goiter were independent variables that contribute to the probability of RLN injury. In addition, Dralle and colleagues have identified abnormal anatomy, bulky disease, and surgeon inexperience as additional risk factors for RLN injury. The approach of routinely identifying the RLN has been adopted by most surgeons and has at least partially been credited with the low risk for permanent RLN injury of less than 2%.

Despite this low rate of permanent RLN injury, this complication continues to be problematic for patients and surgeons. The morbidity of permanent hoarseness is
readily apparent and has been documented.\textsuperscript{8,9} Not surprisingly, RLN injuries continue to be frequent sources of medical malpractice claims against surgeons.\textsuperscript{10} Surgeons have therefore sought methods to try to reduce injuries to the RLN. RLN monitoring is an attempt to reduce the risk of nerve injury during thyroid and parathyroid surgery.

**OPTIONS FOR RLN MONITORING**

Although RLN monitoring has garnered significantly more interest in recent years, there were attempts in prior decades to use technology to minimize the risk of injury to the RLN. As early as the 1960s, some clinicians were exploring the use of electrical stimulation of the RLN as a means of identification and preservation.\textsuperscript{11,12} However, only in recent years has the technology become sufficiently user-friendly and commercially available that widespread use of RLN monitoring during thyroid surgery has been undertaken. These changes have led to many studies in the last decade, describing intraoperative nerve monitoring during thyroid surgery.

The basics of RLN monitoring technology involve 2 components: a method of stimulating the RLN intraoperatively and a method of assessing vocal fold response to the stimulation. The stimulation of the RLN is by low-voltage stimulation of tissues on or near the RLN or indirectly by stimulating the vagus nerve. The monitoring of the response to stimulation of the RLN has included several different techniques. Several groups have described finger palpation of the cricoarytenoid muscle during nerve stimulation as a method of demonstrating that the RLN is intact.\textsuperscript{13–16} Riddell\textsuperscript{17} and later Eltzschig and colleagues\textsuperscript{18} described monitoring of RLN function using vocal cord observation by direct or fiberoptic laryngoscopy. Several investigators have described the use of intramuscular vocal cord electrodes, the so-called hook electrodes.\textsuperscript{19–26} This technique of RLN monitoring is effective, but does require skill and experience to appropriately place the hook electrodes. Although less common than the use of hook electrodes, the use of postcricoid surface electrodes has also been described and appears to be effective.\textsuperscript{27} The most widely used method of RLN monitoring in recent years has been the use of endotracheal tube surface electrodes.\textsuperscript{28–40}

The use of endotracheal tube surface electrodes as the sensor for RLN monitoring has become the most popular method worldwide because of the ease of use and commercial availability. No particular skill or experience is required of the surgeon to place the electrode in the correct location. Instead, the electrode is on the endotracheal tube itself. As long as the anesthesiologist accurately places the electrode in contact with the vocal cords, the electrode is in the correct location for neuromonitoring.\textsuperscript{41} Usually, getting the correct location for the electrode is not difficult as long as the vocal cords can be seen at the time of intubation. If fiberoptic intubation is required, the positioning of the electrode in contact with the vocal cords is made more difficult because the cords cannot be readily seen from the lumen of the endotracheal tube. In this circumstance, it is necessary to take another look from outside the endotracheal tube with the fiberoptic scope after the patient is intubated to ensure that the electrode is in contact with the cords. With just a little practice, accurately positioning the electrode during intubation rarely adds time to the procedure.

The 2 most commonly used RLN monitoring systems in the United States are the nerve integrity monitor (NIM) system manufactured by Medtronic Xomed (Minneapolis, Minnesota) and the Nervea¨na system manufactured by Neurovision Medical (Ventura, California). The NIM system uses a special endotracheal tube with the vocal cord electrodes embedded into the wall of the tube. This system is convenient in that the endotracheal tube is already prepared and simply needs to be placed appropriately in contact with the vocal cords. These special Medtronic endotracheal tubes are
reinforced so that they do not often kink at the teeth even when taped in the midline. However, only certain common adult size endotracheal tubes are manufactured, and the use of these tubes in the pediatric population is problematic. The endotracheal tube and the stimulator probe are single-use items, adding to the convenience. The NIM unit that is available in many hospitals is the same unit used for RLN monitoring and also for facial nerve monitoring in parotid surgery.

The Nerveânea system is specifically designed for RLN monitoring and therefore is much less ubiquitous in hospitals than the NIM system at present. However, the Nerveânea system uses an electrode that can be attached to any endotracheal tube. This approach results in a lower cost per case. In addition, the stimulator used by the Nerveânea system is a small dissecting clamp that has been modified to carry the stimulating electric current. The stimulator is therefore a multiuse item. Because any size endotracheal tube can be used (with the appropriately sized electrode), the Nerveânea system can be readily used in pediatric patients. Because it is advantageous to tape the endotracheal tube in the midline to center the electrode in the vocal cords, the tubes often kink at the teeth when directed straight back over the patient’s face and away from the operative field. If a nasal Ring, Adair, Elwin (RAE) tube (Mallinckrodt, Inc., St. Louis, Missouri) is used in a trans-oral fashion rather than a trans-nasal fashion, then the permanent curve of the tube can be used so that the end of the endotracheal tube is positioned away from the operative field, and there is much less risk of kinking of the tube.

When RLN monitoring is to be undertaken using any of the electromyography type of sensors or when using laryngeal palpation, neuromuscular blockade is avoided during the induction of general endotracheal anesthesia. If neuromuscular blockade is required during induction, a short-acting agent is generally recommended. Marusch and colleagues have reported that RLN monitoring can be undertaken even in the presence of neuromuscular blockade, at least when using needle electrodes in the vocalis muscle to monitor summed action potentials. However, despite this report, the use of neuromuscular blockade when using endotracheal tube surface electrodes should still be avoided.

Almost all the reports examining the use of intraoperative RLN monitoring have described various types of intermittent nerve stimulation. The NIM system uses a fine probe that can be used to precisely stimulate different anatomic structures. The Nerveânea system uses a fine dissecting instrument as the stimulator. A continuous stimulation system has been described whereby a flexible cuff electrode is atraumatically placed around the vagus nerve so that continuous stimulation can be used. Thus far, there have not been clear benefits shown with this new technique of continuous rather than intermittent nerve stimulation.

EFFECTIVENESS OF RLN MONITORING

A review of the relevant medical literature on RLN monitoring in the last 10 years shows many articles that explore aspects of RLN monitoring in different settings. Some of the earlier studies were small series designed to show that RLN monitoring was feasible. In 1999, Timon and Rafferty showed in 21 consecutive patients that a nerve monitor could be helpful in RLN localization. Also in 1999, Horn and Rotzscher reported on a series of 96 patients with 167 nerves at risk, in which the endotracheal surface electrode was used for RLN monitoring. These investigators found a rate of RLN palsy of 0.60% of nerves at risk at 3 days postoperatively. They compared this rate with the rates seen in a previous unpublished series of 300 patients with 558 nerves at risk, in which no nerve monitor was used. In this earlier series, the postoperative RLN palsy...
rate was 4.3% of nerves at risk in cases with visualization of the RLN and 2.87% of nerves at risk in cases of nonvisualization of the RLN. There is no mention of whether these differences are statistically significant, but it is surprising that visualization of the RLN in the earlier series (that is not fully reported) resulted in higher rates of vocal cord dysfunction than did nonvisualization of the nerve.

In subsequent years, several groups reported their single-center experience of series of patients (number of patients ranging from 19 to 97) in which RLN monitoring was used. None of these studies were large enough to draw any statistically significant conclusions about whether RLN monitoring decreased the rates of nerve injury. Yet the authors generally agreed that RLN monitoring was “safe, simple, and effective for intraoperative monitoring.” Several groups noted that the monitor sometimes malfunctioned, and just because there was no signal, one could not be certain that there would be no cord movement postoperatively. This type of technical issue is a problem that is revisited later in the article. One group reported a single patient with “rapidly resolving hoarseness due to extensive electrical stimulation of the nerve.”

Since 2002, several groups have reported series of more than 100 patients in which RLN monitoring was used. These studies helped to point out how RLN monitoring could be used, but they did not compare a monitored group of patients with an unmonitored group. Hamelman and colleagues reported a series of 238 patients with 431 nerves at risk, which used needle electrodes through the cricothyroid membrane. Dackiw and colleagues reported on 117 patients with 176 nerves at risk who underwent thyroidectomy and parathyroidectomy in which RLN monitoring was done by use of endotracheal tube surface electrodes. Eltzschig and colleagues used a laryngeal mask airway (LMA), with fiberoptic visualization of the cords through the LMA to monitor RLN function during the procedure. Only 90% of the 363 consecutive patients studied could actually have a thyroidectomy successfully performed with LMA anesthesia. Jonas reported on 417 patients with 784 nerves at risk in 2002 in whom the RLN was identified intraoperatively 98.9% of the time. Although there was no comparison group in which neuromonitoring was not used in this study, the investigators clearly recommend stimulating the vagus nerve to increase accuracy of the determination that a nerve injury has occurred. Several additional large series of patients undergoing thyroidectomy with RLN monitoring have been reported. Although these studies have resulted in varying degrees of endorsements to use the neuromonitoring in thyroid surgery, none of the studies provides statistically significant data to support the use of neuromonitoring.

Five large studies have been published in the last 7 years that compare a monitored group of patients with a nonmonitored group to determine if there is a difference in RLN injuries. Friedrich and colleagues reported in 2002, a prospective study of 116 patients with 223 nerves at risk who underwent thyroid surgery. They compared RLN palsy rates in the group with RLN monitoring with rates in the group without RLN monitoring. The transient RLN palsy rate was 10.7% in the group with RLN monitoring compared with a rate of 9.6% in the group without nerve monitoring. When permanent vocal cord paralysis was compared, a reduction was seen in the monitored group (1.8%) compared with the unmonitored group (3.0%), but this difference did not reach significance.

In 2004, Dralle and colleagues reported a multi-institutional prospective non-randomized study of 16,448 patients with 29,998 nerves at risk who underwent thyroidectomy. The patients were divided into 3 groups: no RLN identification, visual RLN identification, and visual identification combined with neuromonitoring. This
study showed that only in cases of surgeons who treated a lesser number of patients (ie, <45 nerves at risk per year) did RLN monitoring decrease the risk of RLN paralysis from 1.4% to 0.9%. However, when specifically examining the impact of RLN monitoring on nerve injury rates, the authors found no statistically significant difference between visual identification alone and combined visualization with RLN monitoring.5

In 2005, Witt52 reported a retrospective review of 136 consecutive patients who underwent thyroidectomy at a single institution. Of the 190 nerves at risk, 107 were unmonitored and 83 were monitored using an endotracheal surface electrode. There was no reduction in transient or permanent vocal cord dysfunction when comparing the monitored and unmonitored patients. The author concluded that although RLN integrity as determined by an electrophysiologic signal does not always translate into clinical postoperative vocal cord mobility, a signal does provide evidence that the RLN was not severed.52

In 2006, Chan and colleagues37 studied 1000 RLNs at risk in 639 consecutive patients who underwent thyroidectomy. Of this group, 501 nerves were dissected with use of neuromonitoring and 499 were operated with the use of routine RLN identification alone without neuromonitoring. These were not randomized groups. The authors found no significant difference in postoperative, transient, and permanent paralysis rates between neuromonitored and control groups. However, in subgroup analysis, the authors found that the postoperative RLN palsy rate was higher for reoperative thyroidectomy patients in the control group but not in the neuromonitoring group.37 Based on these findings, the authors concluded that RLN monitoring during thyroid surgery cannot be demonstrated to significantly reduce RLN injury compared with routine RLN identification without neuromonitoring. However, for select high-risk operations, the use of neuromonitoring “may be associated with an improved outcome.”37

The largest retrospective study was performed by Shindo and Chheda39 in 2007. These authors retrospectively reviewed charts of 684 patients (1043 nerves at risk) who underwent thyroidectomy by a single surgeon. Of this group, 427 patients had the operation performed with neuromonitoring using endotracheal tube surface electrodes, and 257 patients did not have neuromonitoring during their surgery. Although there was a modest reduction in postoperative RLN paresis in the monitored group, this was not a statistically significant difference.39

A few additional studies from the literature require separate attention. Several authors have looked at RLN neuromonitoring in pediatric patients who underwent thyroidectomy.24,53–55 All of these studies are small, single-institution series with no control group. The findings are reminiscent of those in the adult population; RLN neuromonitoring seems to be effective in illustrating nerve integrity, but not in preventing RLN injury. One group studied the use of RLN monitoring to aid in the identification of 14 nonrecurrent laryngeal nerves.56 Another group explored specifically the benefits of RLN monitoring as an aid in finding the external branch of the superior laryngeal nerve (EBSLN).16 They concluded that out of 100 nerves at risk, the use of a nerve stimulator was useful in identifying only 1 EBSLN. It should be noted, however, that this group of investigators assessed function by palpation of the posterior cricoarytenoid muscle contraction for RLN stimulation and observation of cricothyroid muscle twitch with EBSLN stimulation.

One of the most important studies of RLN monitoring was by Thomusch and colleagues26 in 2004. This group prospectively studied 8534 patients from multiple institutions with 15,403 nerves at risk. They compared neuromonitoring results depending on where the nerve was stimulated. Indirect stimulation of the vagus nerve was compared with direct stimulation of the RLN. The results show that indirect (vagal)
stimulation excluded postoperative, permanent vocal cord palsy with a specificity of 97.6% and a negative predictive value of 99.6%. In comparison, direct (RLN) stimulation was insufficient to predict permanent RLN palsy with a sensitivity of 45.9% and a positive predictive value of 11.6%. These data emphasize the importance of doing more with the RLN monitor than just stimulating the RLN after it has been clearly identified.

Based on the literature, RLN monitoring can be effective in assisting the surgeon in identifying the RLN, predicting that the nerve is intact, and perhaps even more importantly, predicting when the nerve is not intact. Use of an RLN monitor does not prevent nerve injuries. Nor does it turn an unsafe surgeon into a safe surgeon. The RLN monitor is simply an adjunct that may be helpful, but based on the current data, it should never replace the meticulous technique of the surgeon.

HOW TO USE THE RLN MONITOR FOR INTRAOPERATIVE DECISION MAKING

It is essential for any surgeon contemplating use of the RLN monitor to fully understand how to use the technology to optimize patient care. Many authors have pointed out that there are technology-related issues that can make the use of the RLN monitor problematic. Specifically, when one begins an operation, one does not know that the system is connected correctly or that the electrode is in the correct location in the vocal cords (if the endotracheal surface electrode is being used). It is for these reasons that a systematic approach to RLN monitoring is critical.

Several surgeons have recommended routine stimulation of the vagus nerve as the first step to ensure that the RLN neuromonitoring system is functioning correctly and as the last step to ensure that, at the completion of the operation, the entire RLN is intact. By systematically ensuring that there is a signal when the vagus nerve is stimulated, the surgeon can start the operation knowing that the entire RLN is intact and that the neuromonitor is positioned and connected correctly. If the vagal stimulation step is skipped and the surgeon moves directly into dissection of the RLN adjacent to the thyroid gland, the surgeon does not know if the neuromonitoring system is working correctly. In addition, stimulation of the RLN proves only that there is no injury of the nerve between the point of stimulation and the neuromuscular endplate. For example, if the RLN were injured low in the tracheoesophageal groove but was exposed and stimulated higher in the groove, one would see a positive signal. This would suggest that the RLN is intact, but in fact, it would only be intact from the point of stimulation to the neuromuscular endplate.

If a signal is present with vagal stimulation at the beginning of the operation and it remains present when initially stimulating the RLN, the subsequent loss of signal should not be ignored. Initially, stimulation of the nerve with finger palpation of the posterior cricoarytenoid muscle can help ensure that the patient is not paralyzed. A careful examination of the course of the nerve should be undertaken to look for any potential cause of injury. Sometimes excessive traction can result in loss of signal. If this is the case, releasing the traction will often result in return of signal. Sometimes stimulation along different points of the RLN can help to pinpoint the site of injury. Once potential sources of false loss of signal are ruled out, the surgeon should go back and stimulate the vagus again. If there remains no signal with stimulation of the vagus nerve when there had initially been a good signal, the surgeon should assume that the nerve has been injured. Based on the very high specificity and negative predictive value of signal loss from the vagus, careful consideration should be given to converting a bilateral operation into a staged operation or to performing a near-total or subtotal thyroidectomy on the contralateral side. Above all, it is
important to minimize the chances of bilateral vocal cord palsy, which can be life threatening.

**CONTEMPORARY USE OF RLN MONITORING**

One of the central questions that a practicing surgeon often faces is whether what he or she is doing in the operating room is similar to or different from what other surgeons are doing. A major source of discussion when surgeons who perform significant volumes of thyroid and parathyroid surgery meet relates to neuromonitoring. All surgeons who do these operations know the risks of RLN injury, and most can remember patients who have been affected by a nerve injury either transiently or permanently. Despite this interest, it has been difficult for most surgeons to understand the rates at which RLN monitoring is done nationwide and whether the rates are increasing or decreasing. Until recently, there were few data to address these questions. However, in the last 2 years, 2 studies have explored issues in the use of RLN monitoring.

In 2007, Horne and colleagues\(^60\) mailed a questionnaire to 1685 randomly selected otolaryngologists representing approximately half of the practicing otolaryngologists in the United States. A total of 685 (40.7%) of those surveyed completed the questionnaires, of which 81% (555) reported performing thyroidectomy in their practices. Most respondents who performed thyroidectomy in their practices reported performing less than 25 thyroidectomies per year. The respondents not performing thyroidectomy were excluded from the analysis. About 44.9% of respondents reported using RLN monitoring during thyroidectomy in their current practice. A smaller group, 23% of respondents, reported using neuromonitoring for all cases of thyroidectomy. The investigators solicited responses in the questionnaires as to why the surgeon did or did not use RLN monitoring. The top 6 responses for each group are noted in Table 1. These reasons provide important insights into why these surgeons made the choice to either use or not use the RLN monitor.

In 2009, Sturgeon and colleagues\(^61\) reported on a different survey of neuromonitoring use among registrants of the 2006 annual meeting of the American Association of Endocrine Surgeons (AAES). Several important similarities and differences are

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<td><strong>Reasons for using or not using RLN monitor</strong></td>
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<td><strong>Reasons for not using RLN monitor</strong></td>
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<tr>
<td>Rely on anatomy</td>
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<tr>
<td>Not needed</td>
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<tr>
<td>Too many false positives/unreliable</td>
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<td>Not available</td>
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<tr>
<td>Cost</td>
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<tr>
<td>Not used in training; never tried</td>
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<tr>
<td><strong>Reasons for using RLN monitor</strong></td>
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<tr>
<td>Improves safety of the procedure</td>
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<td>Helpful in revision surgery/large goiters</td>
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<td>Medical-legal protection</td>
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<tr>
<td>It is available; no reason not to use it</td>
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<tr>
<td>It provides additional help in surgery</td>
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<td>Believe it to be the standard of care</td>
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immediately apparent when this survey is compared with that of Horne and colleagues. First of all, the registrants of the AAES meeting were overwhelmingly general surgeons with a particular clinical interest in endocrine surgery. There were only a few otolaryngologists at the meeting because at the time of the 2006 meeting, otolaryngologists were not eligible for membership, although they were welcome to attend the meeting. (Since that time, the AAES has changed its bylaws so that otolaryngologists may become members.) Second, this is a much smaller study that was Internet based rather than having questionnaires mailed. A total of 117 surveys were completed, giving a response rate of 41%, which is virtually identical to the response rate of the other study. However, the respondents to the AAES survey reported themselves to be 81% in academic practice, 16% in private practice, and only 3% managed care.61 This result is in marked contrast to the otolaryngology group where 15.5% of respondents practiced in an academic setting, and 84.5% were in private practice or a health maintenance organization.60 These differences undoubtedly reflect the differences in surveying registrants to a surgical meeting as compared with surveying members of a specialty society. In addition, the respondents to the survey conducted by Sturgeon and colleagues reported a higher volume of thyroid surgery, with 58% stating that they performed more than 100 thyroidectomies per year.

Sturgeon and colleagues61 found that a total of 37.1% of respondents described themselves as users of neuromonitoring. This percentage is less than that seen among the otolaryngologists. The “user group” could be further broken down to the 13.8% of surgeons who were “routine users” and the 23.3% who were “selective users.” Surgeons who treated a large number of patients were most likely to always use neuromonitoring and, not surprisingly, they were least likely to have never tried neuromonitoring.61

These 2 studies are all of the data that is available to try to understand the current rates of RLN monitoring in the United States. Based on the data from these 2 studies, one of them involving primarily private practice otolaryngologists with low-volume thyroid surgery practices and the other involving primarily academic general surgeons with high-volume endocrine practices, it can be inferred that most of the thyroidectomies performed in the United States seem to be done without RLN monitoring. This issue is certainly a moving target and will inevitably change in the future.

POTENTIAL LEGAL ISSUES IN RLN MONITORING

Kern10 examined jury verdict reports in malpractice cases involving endocrine surgery between 1985 and 1991 and found that surgical injuries, mostly recurrent nerve injuries, accounted for the greatest number of cases and the highest cost of litigation. Therefore, some attention must be given to the legal issues surrounding RLN monitoring. Among respondents to the AAES survey described earlier, 10% of the users of neuromonitoring and 12% of the nonusers had been named in a lawsuit due to RLN injury.61 In the otolaryngology survey, Horne and colleagues60 reported that 22% of the respondents mentioned “medical-legal protection” as a reason for using RLN monitoring during thyroid surgery.60

The central question with respect to the malpractice issues related to RLN monitoring is whether the use of the monitor intraoperatively is considered “standard of care” with respect to thyroid surgery. The legal definition of the “standard of care” is the attention, caution, or prudence that another comparable physician would provide in caring for a patient in a similar circumstance. Failure to meet the standard of care results in negligence. If, therefore, RLN monitoring were the standard of care in thyroid surgery, a surgeon who failed to use neuromonitoring would be negligent. The
determination that something is standard of care should take into account the outcomes as reported in the surgical literature concerning a particular technique and the actual practice of comparable and prudent physicians. At present, because there is no statistically significant evidence that RLN monitoring results in lower rates of RLN injury, even if most surgeons were to use RLN monitoring, it would not constitute the standard of care for thyroid surgery.

Some surgeons have the mistaken belief that use of the RLN monitor will somehow be beneficial in a lawsuit if an injury were to occur. However, if an injury to the nerve occurs, whether the RLN monitor is used or not, the surgeon is at risk of being named in a malpractice suit because the use of the RLN monitor would not be considered standard of care. There are scenarios in which a plaintiff’s attorney could argue that using the RLN monitor is worse than not using the monitor. For example, if the surgeon claims that no negligence occurred because RLN monitoring was used, the plaintiff’s attorney might argue that the surgeon was so negligent that even with RLN monitoring he or she injured the RLN. There are also scenarios in which a plaintiff’s attorney could be critical of not using the RLN monitor. For example, if there is a nerve injury and the RLN monitor was not used, the plaintiff’s attorney might claim that an injury would not have occurred, had the RLN monitor been used. Of course, there is no basis to support either of these claims. Therefore, whether RLN monitoring is used or not during thyroidectomy, the determining factor that brings a lawsuit is whether the nerve is injured. Because the literature shows no difference in rates of RLN injury whether neuromonitoring is used or not, the most prudent approach for the surgeon is to use the techniques that have been shown to minimize RLN injury, that is, careful, meticulous dissection with the attempt to visualize the RLN in every case possible.

POTENTIAL ETHICAL ISSUES IN RLN MONITORING

The biggest ethical issues that arise with respect to neuromonitoring in thyroid surgery surround informed consent and advertising by surgeons or medical facilities. Based on the data in the literature, neuromonitoring does not result in lower rates of RLN injury. Despite this, there are many surgeons who will be tempted to tell patients that using the RLN monitor will make the operation safer. Because patients present to surgeons seeking accurate medical information, surgeons have a responsibility to honestly disclose the risks of surgery. In this context, any suggestion that RLN monitoring will reduce the low risk of RLN injury is misleading to patients and is unethical. In addition, any surgeon or medical facility that advertises that neuromonitoring will make thyroid surgery more “safe” is misleading the public. It is all too frequent that claims are made on the Internet that thyroid surgery is made safer by use of the RLN monitor. Although a marketing department cannot be expected to know that such a claim runs counter to the medical literature, it is incumbent on surgeons to ensure that misleading claims are not presented to patients.

SUMMARY

Does the analysis of the literature along with the legal and ethical issues discussed earlier suggest that RLN neuromonitoring should not be used? The answer is unquestionably “No.” Quite the contrary—although there is no increase in documented safety of RLN monitoring during thyroid surgery, there may be other reasons why a surgeon might choose to use monitoring. Some of these issues have been suggested in the questionnaire study by Horne and colleagues. Some surgeons believe that RLN monitoring might help even in less than statistically significant ways. Some investigators have noted that neuromonitoring can aid in dissection in some cases, is easy to
use, aids in anatomic identification of the RLN, and aids in resident training. Some surgeons report that it is reassuring to know that one RLN is intact before embarking on dissection of the other side. As with so much in surgery, decisions must be made without sufficient evidence to give a clear answer. When it comes to RLN monitoring during thyroid surgery, as long as the principles of safe thyroid surgery are not compromised, use of the neuromonitor would seem to provide few negative results. If the device is available and not overly expensive, surgeons should use individual judgment to decide whether to use the device. Much as gastrointestinal surgeons individually decide whether to perform bowel anastomoses in a stapled or hand-sewn fashion, thyroid surgeons must decide whether to use neuromonitoring. Just as cost, time saved, resident education, and other ill-defined issues have an impact on the controversy of stapled versus hand sewn methods, so also numerous individual concerns will have an impact on whether a surgeon decides to use RLN monitoring during thyroid surgery. Regardless of the ultimate decision that each surgeon makes, he or she should fully understand the technology of RLN monitoring and how to best use the technology to gain the greatest amount of useful intraoperative information.

REFERENCES


