Injury to the Superior Laryngeal Branch of the Vagus During Thyroidectomy: Lesson or Myth?

Peter F. Crookes, MD, FACS, and James A. Recabaren, MD, FACS

From the Department of Surgery, University of Southern California Keck School of Medicine, Los Angeles, California

Objective
To examine the historical evidence that the thyroidectomy performed on operatic soprano Amelita Galli-Curci was responsible for the abrupt termination of her career.

Summary Background Data
The superior laryngeal branch of the vagus nerve may be injured during thyroidectomy, producing vocal defects more subtle than those found after recurrent nerve injury. It is widely believed that Galli-Curci suffered superior laryngeal nerve injury during her thyroidectomy by Arnold Kegel, MD, in 1935, resulting in the termination of her career.

Methods
The authors examined contemporary press reviews after surgery, conducted interviews with colleagues and relatives of the surgeon, and compared the career of Galli-Curci with that of other singers.

Results
Evidence against the prevailing view is to be found in the fact that she continued to perform acceptably after surgery, her continued friendly relationship with the surgeon for years afterward, the absence of the typical effects of superior laryngeal nerve injury, and the presence of other explanations for the gradual decline in her vocal abilities (documentation of deterioration before surgery, physiologic changes in the larynx comparable to those found in most other famous sopranos who retire at about the same age or earlier, and the possible development of myxedema).

Conclusions
The story should no longer be perpetuated in surgical textbooks and papers.

Recurrent nerve injury during thyroidectomy is the best-known and best-studied complication of this surgical procedure. The external branches of the superior laryngeal nerve may also be injured as the superior thyroid pedicles are ligated: they are smaller, they are encountered at the extremity of the field of dissection, and their anatomical course is not as familiar to surgeons. Techniques for routinely protecting the superior laryngeal nerves are not commonly found in textbooks of surgery. Consequently, there is widespread lack of awareness of their anatomical proximity and the effects of injury. It is believed that superior laryngeal nerve injury alters the speaking voice relatively little, but that its effects are more obvious when singing, especially high notes, and the singer can no longer generate the required tension in the cricothyroid muscle. To illustrate these effects, many textbooks and articles quote the case of the famous operatic soprano Amelita Galli-Curci (1882–1963) as an example of the disastrous effects of superior laryngeal nerve injury on vocal performance.1–3 The purpose of this article is to examine the evidence that superior laryngeal nerve damage during thyroidectomy was the cause of Galli-Curci’s vocal decline in the years after she underwent surgery.

THE PATIENT
Amelita Galli was born in Milan in 1882, although as an adult she always gave her birth year as 1889. She came of a musical family and studied piano at the conservatory of music in Milan, where she graduated with a gold medal in piano in 1905. She received almost no formal vocal training, but she was encouraged to seek a career as a singer by the composer Pietro Mascagni (1863–1945), who heard her sing during a visit to her family home. She made her operatic debut in Trenta, Italy, in 1906, and during the next
Figure 1. Galli-Curci (A) in 1919, before any trace of the goiter is visible, (B) showing clear signs of thyroid enlargement, and (C) a few days after surgery. (Courtesy of the New York Public Library for the Performing Arts.)
few years she toured extensively in Italy, Spain, Egypt, and South America to great acclaim. In November 1916, as a relatively unknown singer in the United States, she was given the lead role of Gilda in the Chicago Opera’s production of Verdi’s Rigoletto, creating a spectacular sensation that launched her American career as a coloratura soprano. She was a star attraction every season in Chicago and New York for the next 14 years. In the late 1920s, critics began to notice a decline in her vocal powers, commenting on her tendency to sing flat, and the loss of the sense of effortless ease that previously characterized her execution of high and difficult passages. She retired from opera singing in 1930. Thereafter, she went on several long tours as a recital singer, always singing to packed houses in Britain, continental Europe, Australia, India, and the Far East. In the early months of 1935, while on tour in India, she noticed more obvious vocal difficulty, attributing it to the dry and dusty air. A chance meeting in the hotel in Rawalpindi, when Galli-Curci’s second husband Homer Samuels met a patient of his twin brother’s, brought to light the fact that an American surgeon with a special interest in goiter was staying in Shrinagar, studying the effects of dietary deficiency of iodine. This surgeon was Arnold Kegel, MD. Galli-Curci had known him in Chicago and immediately telegraphed him. He traveled more than 200 miles by car to Rawalpindi to see her and examine her next day. She was found to have a goiter and, when examined by indirect laryngoscopy, substantial tracheal compression. It emerged that Galli-Curci had been aware of the goiter for several years and had increasingly noticed a sense of constriction as it enlarged. Early photographs show no trace of it, but it is clearly visible in later photographs (Fig. 1). Dr. Kegel recommended further study, and he subsequently met her again in Calcutta and traveled with her to Rangoon, Singapore, and Java, finally ending up at the University Hospital, Tokyo. There he enlisted the help of Dr. M. Nakaldzumi, professor of radiology, to make a more exact study. These studies revealed that the larynx was displaced 1.5 inches to the left side by the goiter and the tracheal diameter was reduced by 50%. At this point, he recommended thyroidectomy. He arranged to reexamine her when she returned to the United States.

THE SURGEON

Arnold Henry Kegel was born in Lansing, Iowa, in 1894, and studied medicine at the University of Illinois, from which he graduated with a medical degree in 1916. He did surgical training at the Mayo Clinic between 1917 and 1921. He subsequently returned to Chicago, where he established a busy practice, frequently performing thyroidectomy using a method requiring only local anesthesia so that he could make the patient vocalize during surgery to ensure that he was not endangering the laryngeal nerves. The years around 1930 were notable for the frequency of thyroidectomy, and it is estimated that at the Mayo Clinic alone 3,000 thyroidectomies were carried out annually. In 1927 he was asked by the Mayor of Chicago to become the Commissioner of Health, apparently as a result of his ability to sort out a hospital plumbing problem that had led to an outbreak of cholera. Between 1928 to 1932, he apparently did little or no surgery but devoted himself to public health issues such as the risks of domestic refrigerators and the merits of compulsory vaccination of schoolchildren. He played a prominent role in the famous “baby-switching” case in Chicago in 1930: he used the relatively new techniques of blood typing to establish the claim by one set of parents that their baby had been given to another in error. He left Chicago shortly after returning to practice and moved to Los Angeles in 1935, and before he was eligible for a California license he took a trip to North India, where he came into contact with Galli-Curci.

In later years Dr. Kegel continued to perform thyroidectomy under local anesthesia, certainly up until the 1950s (Kenneth Morgan, MD, personal communication), but progressively concentrated on nonsurgical approaches to gynecologic problems, namely urinary incontinence and sexual dysfunction. He invented what may have been the first example of biofeedback, which he used clinically to develop improved tone and awareness in the pelvic musculature in women. His name is associated with exercises designed to improve urinary incontinence and sexual dysfunction by developing the pubococcygeus muscle. He died of an aortic aneurysm in 1981.

THE SURGICAL PROCEDURE AND ITS SEQUELAE

When Galli-Curci returned to the United States, Dr. Kegel arranged to perform a thyroidectomy but had to admit the patient to Henroten Hospital in Chicago because he still did not have a California license. Thyroidectomy was performed on August 11, 1935. The assistant was G. Raphael Dunleavy, MD, a Los Angeles surgeon who had graduated from Northwestern University School of Medicine and had trained in surgery at Los Angeles County Hospital; we believe he was married to Dr. Kegel’s sister. The surgical procedure was performed under local anesthesia, and at several points the surgeons asked the patient to sing scales to ensure that the laryngeal nerves were not traumatized. At the end, she sang part of a duet from The Barber of Seville. An artist, Ms. Lucy Bassoe, was present in the operating room, but the sketches and the surgical record have been lost. Her first vocal exercises were performed in the ward, and her voice was initially harsh. When one of the nurses commented, “Wonderful, Madame,” she replied acerbically, “Wonderful! It sounds like a buzz saw hitting a rusty nail!” There were no postoperative complications. She was discharged from hospital on August 18 and returned to Los Angeles, accompanied by Dr. Kegel.

Even before discharge, she was euphoric about the change in her voice. She attributed the improvement to the
facilitation of airflow that followed the removal of what she described as her “little potato in the throat.” She undertook more formal retraining from her former brother-in-law Gennari Curci. The director of the Chicago City Opera Company was contacted and informed about her “new voice.” The opera company was at that time in some difficulty and jumped at the chance to regain its audiences by announcing the return of Galli-Curci to the opera stage, although she had not appeared in an opera for 6 years and was now in her mid-50s. News that she was to sing again was a great stimulus for the opera company, and the subscription seats were rapidly sold. On November 16, 1936, 20 years to the day since her spectacular debut as an opera singer in the United States, she appeared in Chicago as Mimi in La Bohème, being greeted with prolonged and tumultuous applause at her first entrance. However, her performance was harshly reviewed by many critics. Some critics withheld judgment, but others dubbed the performance “pathetic.”

Despite this isolated failure, she subsequently made several broadcasts later in the year and sang in several recitals throughout 1937. In contrast with the years 1920 to 1930, few reviews of her public performances after her surgery survive. She gave an acclaimed recital in Albany on April 10, 1937, and did a Pacific Coast tour from Los Angeles to Victoria, British Columbia, in the fall. Press reviews from Los Angeles, Seattle, Victoria, and Winnipeg were collected and included in her biography, but for the year 1937, the only review preserved in the archives of the New York Library for Performing Arts records a performance in Wadena, Minnesota, a town of less than 5,000 people, and it is unlikely that such a town possessed an opera critic of sufficient discriminatory ability to assess her vocal capacities. Similarly, the conductor of the Detroit Symphony Orchestra, who accompanied her in a live broadcast in December 1936, said “She sang beautifully tonight,” but he had never heard her in her prime.

In 1938, she abruptly cancelled her engagements and retired from singing. She continued to live in Westwood, California, until 1945. During this time she maintained frequent social contact with Dr. Kegel. Thereafter, she retired to Rancho Santa Fe, California, and lived a relatively secluded life, devoting herself to painting and piano playing. She was friendly with Paramahansa Yogananda, head of the Self-Realization Fellowship in Encinitas, California, but had few close companions, especially after her husband died in 1954. In her 80s she built a smaller house in nearby La Jolla, where she moved in 1962. She died on November 24, 1963, apparently of emphysema.

**DISCUSSION**

The anatomy and physiology of the superior laryngeal nerves are now quite well understood, and several workers have systematically dissected the nerves in an attempt to define how vulnerable they are during thyroidectomy. It is estimated that the course of the external branch of the superior laryngeal nerve lies immediately adjacent to the superior thyroid artery in 21% of patients and is thus at high risk of being injured during mobilization of the superior pole of the thyroid. Although these details are of fairly recent description, injury to the superior laryngeal nerve was known in the 1920s, and the relevant literature is likely to have been known to Dr. Kegel. The surgical notes relating to Galli-Curci’s thyroidectomy have been lost and the hospital has been demolished. There is consequently no direct evidence as to whether Dr. Kegel was aware of the nerves or made any attempt to protect them. However, there are several reasons why it seems unlikely that the thyroidectomy performed by Dr. Kegel caused injury to the superior laryngeal nerve.

First, subtle vocal changes in timbre and agility are usually noticed by the singer in private, even when they are not obvious to listeners. A noted laryngologist with extensive experience in vocal cord injuries in singers has observed that the singer is always the first person to notice the problem, often long before it is detectable to listeners (Herbert Dedo, MD, personal communication). It seems unlikely that Galli-Curci, conscious of her declining vocal powers in the years before her surgery, could have suffered an injury to her laryngeal nerves of which she herself was unaware. She was sufficiently self-critical for the initial postoperative difficulty to be obvious to her. It is undeniable that in the year before she died, she gave an interview in which she attributed the end of her singing career to her thyroidectomy, but this is at variance with her enthusiastic comments in the early postoperative period and throughout 1937. Further, the soprano Joan Sutherland spent an engaging day with her in 1961, and although they discussed all sorts of matters relating to singing technique and artistry, she told me that Galli-Curci made no mention of the effect of the thyroidectomy on her career. Rather, it is likely that the improved airflow that followed the removal of the goiter imparted a sense of freedom that allowed her for a time to avoid confronting the fact that her voice had been declining steadily for several years. Evidence of this deterioration is now readily available because her later recordings have been recently compiled in CD form. A comparison of her 1917 and 1930 recordings of Caro Nome is instructive. Despite the superior technical quality of the later recording, the vocal performance shows unmistakable signs of deterioration, especially in the inability to negotiate the rapid decorative passages toward the end, and the sustained penultimate note (high B) is almost a semitone flat.

Second, Galli-Curci remained on friendly social terms with Dr. Kegel for several years afterward. Dr. Kegel’s son told me that he and his father frequently visited the home of Galli-Curci and her husband until the 1940s. This behavior seems out of keeping if she believed that the thyroidectomy had prematurely aborted her career. Filing a lawsuit would be a much more typical response, and Galli-Curci was no stranger to the law courts in this country, having sued her
first husband over a dispute about his right to a share in her vast earnings.

Third, the pattern of vocal change is inconsistent with what is now known of the effects of superior laryngeal nerve injury. These include a shallow voice, fatigue of the voice, and a tendency to aspiration. Spontaneous recovery, either by genuine resolution of nerve pathology or unconscious compensation by other vocal cord elements, may occur within 6 months.13

Fourth, the gradual vocal decline that affects most female singers, especially at the extremity of their range, typically begins in their 40s and may be associated with menopausal changes in vocal cord morphology.14–16 An additional possible factor in Galli-Curci’s case is the well-known effects of thyroid deficiency on the voice, and although it is not possible to know whether she required or took thyroid supplements, it is known that she gained 15 lb in the year after the thyroidectomy. In any case, by age 50 most operatic sopranos give up these coloratura roles, typically depicting young heroines, and assume lyric soprano roles more appropriate to their stage in life. Few sopranos have continued to sing these coloratura roles after the age of 50 (Table 1). Galli-Curci later remarked that the true coloratura’s career begins to decline after age 35. Recent support for this view comes from a notable present-day heir of Galli-Curci, the Korean coloratura soprano Sumi Jo. In a recent broadcast interview on KUSC on December 5, 1999, she said she no longer sings the famous “Queen of the Night” aria from Mozart’s Magic Flute, even though she is still in her 30s.

Galli-Curci’s disappointing performance at her “second debut” has thus more obvious explanations. Although her towering reputation during the 1930s was maintained by her success in the less-demanding role of a recital singer, no severer test could be imagined than for her to appear at age 54, a nervous and corpulent middle-aged woman who had not sung on the opera stage for more than 6 years, to play the part of a young consumptive heroine.

In the light of these considerations, the evidence that Dr. Kegel’s thyroidectomy precipitated the end of Galli-Curci’s career as a soprano evaporates. It has a superficial plausibility and may help emphasize to the surgeon in training how important it is to protect the superior laryngeal nerves and to remind physicians of their importance in vocal function. However, in the interest of historical accuracy and in fairness to the reputation of the surgeon concerned, the story should be relegated to the realm of myth and henceforth expunged from future surgical textbooks and articles.

Acknowledgments

The authors thank, for the help and information given by phone and letter, Robert A. Kegel (Dr. Kegel’s son), Edward Morgan, MD, Gail Anderson, MD, and Frances Wright, RN, all of whom supplied personal reminiscences of Dr. Kegel. Frank Dedo, MD, shared his extensive experience of his close association with the San Francisco Opera and his studies in laryngeal nerve injury. Galli-Curci’s discographer, Bill Park, and the biographical information on the website of John Craton (craton@youpy.fr) were also very helpful. The staff of the New York Public Library for the Performing Arts kindly placed all their archival material at our disposal and provided the hitherto unpublished photographs in Figure 1.

References


Table 1. CAREER SPAN OF FAMOUS COLORATURA SOPRANOS

<table>
<thead>
<tr>
<th>Name</th>
<th>Born</th>
<th>Debut</th>
<th>Retirement</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Caballé, Montserrat</td>
<td>1933</td>
<td>1956</td>
<td>1989</td>
<td>More mature roles after 1989</td>
</tr>
<tr>
<td>Callas, Maria</td>
<td>1923</td>
<td>1950</td>
<td>1965</td>
<td>Recitals in U.S. in 1850s</td>
</tr>
<tr>
<td>Lind, Jenny</td>
<td>1820</td>
<td>1838</td>
<td>1849</td>
<td></td>
</tr>
<tr>
<td>Pagliughi, Lina</td>
<td>1907</td>
<td>1927</td>
<td>1957</td>
<td></td>
</tr>
<tr>
<td>Pasta, Guiditta</td>
<td>1797</td>
<td>1826</td>
<td>1835</td>
<td></td>
</tr>
<tr>
<td>Patti, Adele</td>
<td>1843</td>
<td>1851</td>
<td>1897</td>
<td></td>
</tr>
<tr>
<td>Sills, Beverly</td>
<td>1929</td>
<td>1947</td>
<td>1980</td>
<td></td>
</tr>
<tr>
<td>Sutherland, Joan</td>
<td>1926</td>
<td>1950</td>
<td>1989</td>
<td>More mature roles after 1970</td>
</tr>
<tr>
<td>Tacchianardi-Persani, Fanny</td>
<td>1812</td>
<td>1832</td>
<td>1852</td>
<td></td>
</tr>
<tr>
<td>Tetrazzini, Luisa</td>
<td>1871</td>
<td>1907</td>
<td>1914</td>
<td>Sang in recitals until 1934</td>
</tr>
</tbody>
</table>

Data from individual biographies and operatic encyclopedias.