<School of Communication, Northwestern University, The Roxelyn and Richard Pepper Department of Communication Sciences and Disorders>

# Northwestern University

# Systematic Review of Surgical or Non- Surgical Intervention: Comparing and Contrasting Effects of Laryngectomy vs. Chemoradiation /Radiation in Laryngeal Cancer Patients

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# Background

Laryngeal cancer is the most frequently occurring malignant tumor of the head and neck. Over the last twenty years, science has debated whether surgical intervention or non-surgical intervention is more advantageous for individuals deciding best fit treatment options.

- Pursuing a surgical intervention, such as a laryngectomy, drastically impacts a patient's physiology. However, voice rehabilitation through the use of TEP, Electrolarynx and other alternatives, have resulted in beneficial outcomes for speech.
- Non- surgical interventions such as chemoradiation and radiation therapy gives individuals the ability to avoid drastic and invasive surgeries, however, is costly and may allow for a recurrence of the cancer.

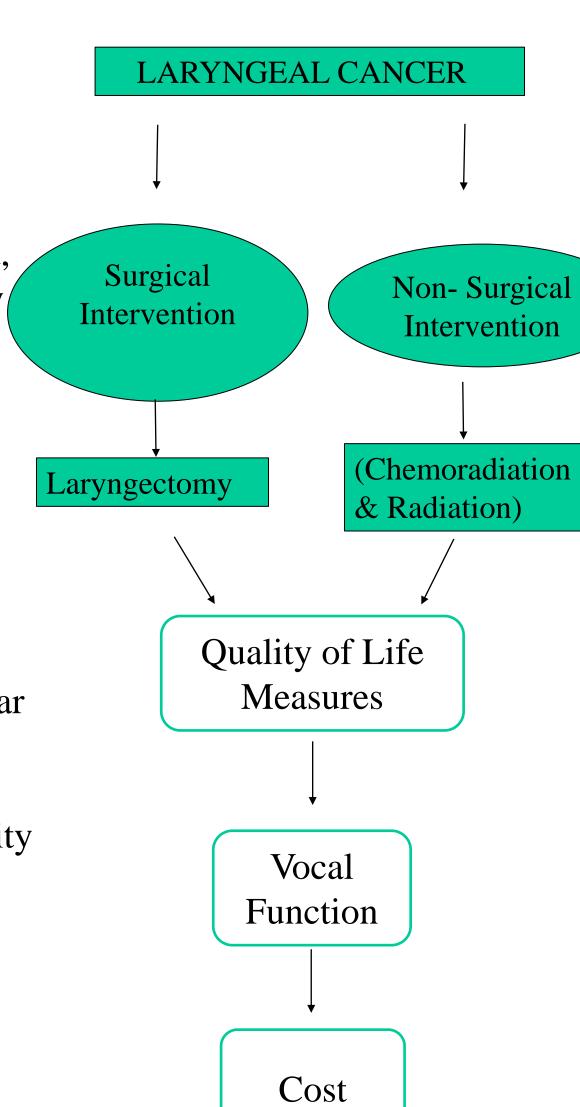
The lack of consensus on both sides emphasizes the greater need for further research. Additional investigations will allow speech-language pathologists to gain deeper insight into the most beneficial treatment options to help better educate patients and families when managing an individual's head and neck cancer.

# Research Objectives

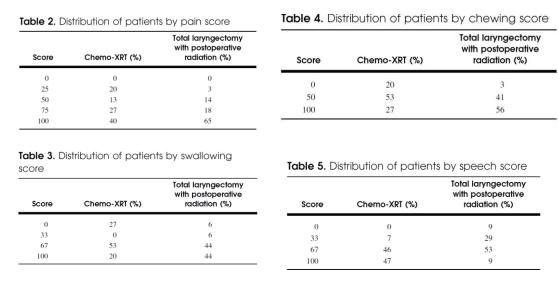
- Highlight the effects of radiation and/or chemoradiation compared to laryngectomy as it relates to quality of life, impact on vocal functions and overall cost
- Provide holistic information to help inform and guide clinicians when assisting patients in making decisions regarding treatment options

## Methods

- Surgical intervention, and non-surgical interventions were compared based on quality of life measures, vocal function outcomes, and cost comparisons.
- Results of findings were extracted from PubMed, Science Direct databases, Journal of Voice, Wiley Online Journals, SAGE Journals, and JAMA Network of Medicine Journals published by the American Medical Association.
- Inclusion criteria:
  - I. Each study needed at least one participant who had been diagnosed currently or had a history of laryngeal cancer.
  - II. Each study had to be published after the year 2000
  - III. Employ an experimental design
  - IV. Investigate the cost, vocal functions or quality of life measures in regards to surgical intervention through laryngectomy or non surgical intervention and laryngeal preservation as it pertains to radiation or chemoradiation.

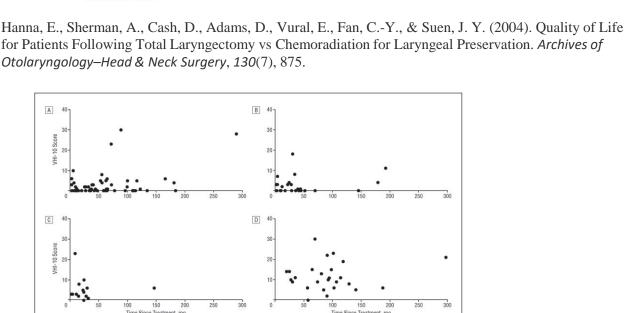


### Quality of Life Measures



Maria M. LoTempio et al., "Comparison of Quality of Life Outcomes in Laryngeal Cancer Patients
Following Chemoradiation vs. Total Laryngectomy," *Otolaryngology-Head and Neck Surgery:*Official Journal of American Academy of Otolaryngology-Head and Neck Surgery 132, no. 6 (June 2005): 948–53

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Nobuhiko Oridate et al., "Voice-Related Quality of Life after Treatment of Laryngeal Cancer," Archives of Otolaryngology--Head & Neck Surgery 135, no. 4 (April 2009):

### **Vocal Function**

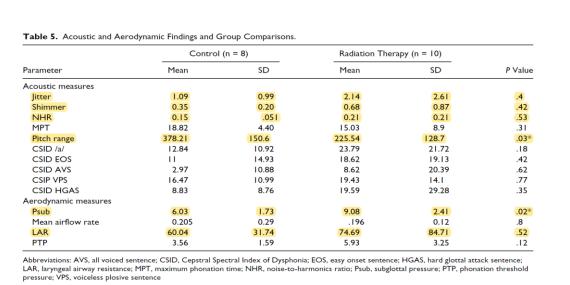


Figure 1. Percentage of abnormal findings on high-speed laryngeal imaging measures.

Elevated mean peak air pressure, laryngeal airway resistance and phonation threshold pressure were seen in the XRT group. The increase in Psub and laryngeal airway resistance (LAR) values are indicative of increased stiffness of the vocal folds.

Vrushali Angadi, Emily Dressler, and Joseph Stemple, "A Multidimensional Study of Vocal Function Following Radiation Therapy for Laryngeal Cancers," *Annals of Otology, Rhinologyology & Laryngology* 126, no. 6 (June 1, 2017): 483–92

Comparison of voice outcomes at 12 months for chemoradiotherapy patients revealed superiority over the TL group in all parameters except MPT (18.2 s vs. 10.4 s, p = 0.06). Analysis of the recovery of the voice up to 12 months after treatment revealed progressive improvement in most electroglottographic measures.

Rehan Kazi et al., "Electroglottographic Comparison of Voice Outcomes in Patients With Advanced Laryngopharyngeal Cancer Treated by Chemoradiotherapy or Total Laryngectomy," International Journal of Radiation Oncology\*Biology\*Physics 70, no. 2 (February 1, 2008): 344–52

#### Cost Comparison

	Year 1 <sup>†</sup>	Year 2	Year 3	Year 4	Year 5	Total <sup>‡</sup>
Overall costs						
Surgery only	41,507 (4,8619)	20,134 (36,066)	17,762 (24,742)	13,224 (29,898)	18,518 (18,143)	71,346 (70,943
Radiation only	44,183 (49,798)	21,966 (35,348)	19,015 (31,615)	14,448 (25,576)	14,623 (24,632)	77,715 (69,520
Surgery + radiation	45,821 (48,639)	21,210 (37,283)	17,163 (30,942)	18,419 (34,003)	20,104 (36,481)	83,595 (81,986
Chemoradiation	85,331 (56,460)	30,626 (37,556)	22,900 (36,616)	23,222 (46,291)	21,768 (25,043)	11,8921 (83,279
Inpatient						
Surgery only	26,364 (39,570)	11,258 (29,726)	9,164 (17,541)	6,580 (22,108)	11,007 (14,185)	43,060 (54,337
Radiation only	19,907 (39,801)	12,308 (27,383)	9,924 (24,076)	7,640 (20,265)	7,642 (19,967)	39,218 (52,993
Surgery + radiation	19,094 (37,031)	11,103 (28,703)	8,859 (23,977)	9,358 (24,501)	12,287 (29,083)	39,731 (59,154
Chemoradiation	34,195 (45,613)	15,403 (26,993)	10,635 (24,914)	12,870 (37,022)	11,453 (17,594)	51,511 (58,438
Outpatient						
Surgery only	13,306 (11,766)	7,712 (10,164)	7,674 (11,126)	5,865 (9,613)	6,212 (7,373)	24,822 (22,566
Radiation only	22,113 (13,105)	7,818 (10,442)	7,385 (10,013)	5,554 (6,874)	6,226 (8,512)	33,642 (22,053
Surgery + radiation	24,600 (15,394)	8,423 (10,981)	6,879 (10,343)	7,849 (14,136)	6,323 (8,455)	38,933 (28,326
Chemoradiation	45,694 (20,895)	12,261 (13,765)	10,295 (16,403)	8,543 (10,377)	7,119 (6,974)	58,977 (34,081
Other						
Surgery only	1,836 (3,483)	1,163 (2,720)	922 (1,945)	778 (1,983)	1,299 (2,510)	3,463 (6,133)
Radiation only	2,163 (4,446)	1,839 (4,281)	1,705 (4,667)	1,253 (3,818)	754 (1,395)	4,855 (9,302)
Surgery + radiation	2,126 (4,681)	1,683 (4,485)	1,424 (3,772)	1,211 (2,971)	1,492 (3,318)	4,930 (9,706)
Chemoradiation	5,552 (6,776)	2,960 (4,374)	1,968 (3,698)	1,807 (3,325)	3,195 (4,711)	8,432 (10,593)

TABLE IV.  Costs of Larynx Cancer for Initial Treatment and Subsequent Additional Cancer-Directed Treatment.							
	Inpatient Costs	Outpatient Costs	Other Costs	Total C			
Initial treatment costs							
Surgery only	13,329 (29,918)	4,486 (3,174)	106 (560)	17,922 (			
Radiation only	8,648 (23,385)	15,248 (9,447)	618 (2,020)	24,515 (			
Surgery + radiation	8,257 (21,627)	17,701 (11,725)	787 (2,260)	26,746 (2			
Chemoradiation	15,700 (23,140)	32,783 (17,936)	2,094 (3,130)	50,578 (			
Additional cancer-directed treatment costs							
No subsequent cancer-directed treatment	31,994 (50,094)	28,686 (18,773)	3,823 (7,566)	64,504 (			
Any subsequent cancer-directed treatment	50,677 (61,036)	47,417(32,431)	6,521 (10,806)	104,616			
Hospice care	34,006 (44,641)	8,234 (8,113)	2,208 (3,569)	44,449 (4			
Salvage surgery	62,328 (65,550)	33,548 (27,624)	8,114 (12,056)	103,991			
Salvage neck dissection	50,204 (57,171)	38,882 (29,980)	7,391 (12,922)	96,477 (			
Salvage radiation	34,654 (49,684)	29,183 (30,086)	4,964 (9,307)	68,801 (			
Salvage chemotherapy	49,236 (56,462)	44,524 (35,996)	6,693 (10,613)	100,453			

Chemoradiation in elderly patients with laryngeal cancer was associated with increased costs, additional cancer-directed treatment, and a reduced likelihood of surgical salvage. Surgery with postoperative radiation was associated with improved survival.

Christine G. Gourin, Robert J. Herbert, Harry Quon, Carole Fakhry, Ana P. Kiess, David W. Eisele and Kevin D. Frick, Quality of care and short and long-term outcomes of oropharyngeal cancer care in the elderly, *Head & Neck*, 41, 10, (3542-3550), (2019).

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### Results and Conclusions

#### **QUALITY OF LIFE:**

- Individuals who pursued **radiation or chemoradiation** showed worse quality of life measures in the domains of pain, swallowing, chewing, difficulty speaking, anxiety, and managing moods. Patients experienced increased dry mouth and sticky saliva.
- Individuals who pursued **surgical intervention** experienced greater difficulties with managing cough, social functioning, sensory disturbances with smell and taste, decreased social contact and increased use of pain killers with lower V-RQOL scores in their ability to communicate.
- Patients who utilized voice restoration options such as Tracheoesophageal Prosthesis at the time of laryngectomy followed by voice and speech rehabilitation, showed a lack of significant difference in speech and VHI scores when compared to the scores of individuals who pursued radiation.

#### **VOCAL FUNCTION:**

- Radiation and Chemoradiation showed increased fibrosis and hyperemia due to the dryness of laryngeal mucosa
- Abnormal values of jitter, shimmer, noise to harmonic ratio, decreased vocal pitch range, roughness of voice when speaking at low volume, reduced mean peak air pressure, and decreased mucosal wave, amplitude of vibration, and phase symmetry were observed.
- Laryngeal appearance was deemed abnormal, showing signs of dehydration and erythema.

#### **COST:**

- Non-surgical interventions were associated with higher overall treatment costs and increased occurrence of additional cancer treatment
- Patients who received radiotherapy had worse survival rates than patients who underwent surgery
- Surgical interventions were associated with lower overall treatment costs and in various circumstances, higher survival rates.

# Limitations

- Articles used individuals with varying degrees in severity of cancer and age
- Differing levels of chemoradiation/radiation were given to participants
- Many patients had a combination of surgery with post- operative radiation
- Quality of life measurements were taken at various points of treatment

# References

André Luís Quarteiro, Rogério Aparecido Dedivitis, and Elio Gilberto Pfuetzenreiter, "Videolaryngostroboscopic Analysis of Patients Submitted to Radiation Therapy for the Treatment of Glottic Cancer," Brazilian Journal of Otorhinolaryngology 76, no. 1 Caterina Finizia et al., "Quality of Life and Voice in Patients with Laryngeal Carcinoma: A Posttreatment Comparison of Laryngectomy (Salvage Surgery) versus Radiotherapy," The Laryngescope 108, no. 10 (1998): 1566–73, https://doi.org/10.1097/0000553 Cathy L. Lazarus, "Effects of Chemoradiotherapy on Voice and Swallowing," Current Opinion in Otolaryngology & Head and Neck Surgery 17, no. 3 (June 2009): 172–78, https:// Cheng Zhan et al., "Radiotherapy vs Surgery for T1-2N0M0 Laryngeal Squamous Cell Carcinoma: A Population-based and Propensity Score Matching Study," Cancer Medicine 7, no. 7 (May 7, 2018): 2837–47, https://doi.org/10.1002/cam4.1525. Christine G. Gourin, MD, MPH; Sydney M. Dy, MD, MSc; Robert J. Herbert, BS; Amanda L. Blackford, ScM; Harry Quon, MD; Arlene A. Forastiere, MD; David W. Eisele, MD; Kevin D. Frick, PhD Christine G. Gourin, Robert J. Herbert, Harry Quon, Carole Fakhry, Ana P. Kiess, David W. Eisele and Kevin D. Frick, Quality of care and short and long-term outcomes of oropharyngeal cancer care in the elderly, Head & Neck, 41, 10, (3542-3550), (2019). Diane L. Kendall et al., "The Influence of Phonomotor Treatment on Word Retrieval Abilities in 26 Individuals With Chronic Aphasia: An Open Trial," Journal of Speech, Language, and Hearing Research: JSLHR 58, no. 3 (June 2015): 798–812, Greg E. Davis et al., "Cost Comparison of Surgery vs Organ Preservation for Laryngeal Cancer," Archives of Otolaryngology-Head & Neck Surgery 131, no. 1 (January 1, 2005): 21–26, https://doi.org/10.1007/january-11.0007/jan GALLI et al., "Voice Prosthesis Rehabilitation after Total Laryngectomy: Are Satisfaction and Quality of Life Maintained over Time?," Acta Otorhinolaryngologica Italica 39, no. 3 (June 2019): 162–68, https://doi.org/10.14639 Hanna, E., Sherman, A., Cash, D., Adams, D., Vural, E., Fan, C.-Y., & Suen, J. Y. (2004). Quality of Life for Patients Following Total Laryngectomy vs Chemoradiation for Laryngeal Preservation. Archives of Otolaryngology-Head & Neck Surgery, 130(7), 875. Irena Honocodeevar-Boltežar and Miha Žargi, "Voice Quality After Radiation Therapy for Early Glottic Cancer," Archives of Otolaryngology—Head & Neck Surgery 126, no. 9 (September 1, 2000): 1097–1100, http Isabel Vilaseca, Amy Y. Chen, and Andrea G. Backscheider, "Long-Term Quality of Life after Total Laryngectomy," Head & Neck 28, no. 4 (2006): 313–20, in K. Fung et al., "Vocal Function Following Radiation for Non-Laryngeal Versus Laryngeal Tumors of the Head and Neck," The Laryngoscope 111, no. 11 (2001): 1920–24, he Jai Prakash Agarwal et al., "Factors Affecting the Quality of Voice in the Early Glottic Cancer Treated with Radiotherapy," Radiotherapy and Oncology: Journal of the European Society for Therapeutic Radiology and Oncology 90, no. 2 (February 2009): 177– Jeffrey E. Terrell, Susan G. Fisher, and Gregory T. Wolf, "Long-Term Quality of Life After Treatment of Laryngeal Cancer," Archives of Otolaryngology-Head & Neck Surgery 124, no. 9 (September 1, 1998): 964-71, Lisa Tuomi et al., "Voice Range Profile and Health-Related Quality of Life Measurements Following Voice Rehabilitation After Radiotherapy; a Randomized Controlled Study," Journal of Voice 31, no. 1 (January 1, 2017): 115.e9-115.e16, Maria M. LoTempio et al., "Comparison of Quality of Life Outcomes in Laryngeal Cancer Patients Following Chemoradiation vs. Total Laryngeotomy," Otolaryngology-Head and Neck Surgery: Official Journal of American Academy of Otolaryngology-Head and Neck Surgery 132, no. 6 (June 2005): 948–53, h Matthew R. Naunheim et al., "Voice Outcomes After Radiation for Early-Stage Laryngeal Cancer," Journal of Voice, January 2, 2019, https://doi.org/10.1016/j.january.2019. Megan Watson et al., "Voice Outcomes after Radiotherapy Treatment for Early Glottic Cancer: Long-Term Follow-Up," Journal of Voice 32, no. 5 (September 1, 2018): 636–42, htt Michael G. Stewart, Amy Y. Chen, and Carol B. Stach, "Outcomes Analysis of Voice and Quality of Life in Patients With Laryngeal Cancer," Archives of Otolaryngology-Head Neck Surgery 124, no. 2 (February 1, 1998): 143-48, Mieke Moerman, Jean-Pierre Martens, and Philippe Dejonckere, "Application of the Voice Handicap Index in 45 Patients with Substitution Voicing after Total Laryngectomy," European Archives of Oto-Rhino-Laryngelogy and Head & Neck 261, no. 8

Nirav Pravin Trivedi, "Comparison of Quality of Life in Advanced Laryngeal Cancer Patients after Concurrent Chemoradiotherapy vs Total Laryngectomy," *Head and Neck Surgery* 139, no. 5 (2008): 6.

Nobuhiko Oridate et al., "Voice-Related Quality of Life after Treatment of Laryngeal Cancer," *Archives of Otolaryngology--Head & Neck Surgery* 135, no. 4 (April 2009): 363–68, <a href="https://doi.org/10.1001/archoto.2009.8">https://doi.org/10.1001/archoto.2009.8</a>.

Paolo Boscolo–Rizzo et al., "Long-Term Quality of Life After Total Laryngectomy and Postoperative Radiotherapy Versus Concurrent Chemoradiotherapy for Laryngeal Preservation," *The Laryngoscope* 118, no. 2 (2008): 300–306, <a href="https://doi.org/10.1097/MLG.0b013e31815a9ed3">https://doi.org/10.1097/MLG.0b013e31815a9ed3</a>.

Raj C. Dedhia et al., "Cost-Identification Analysis of Total Laryngectomy: An Itemized Approach to Hospital Costs," *Otolaryngology--Head and Neck Surgery: Official Journal of American Academy of Otolaryngology-Head and Neck Surgery* 144, no. 2 (February 2011): 220–24, <a href="https://doi.org/10.1177/0194599810393117">https://doi.org/10.1177/0194599810393117</a>.

Rehan Kazi et al., "Electroglottographic Comparison of Voice Outcomes in Patients With Advanced Laryngopharyngeal Cancer Treated by Chemoradiotherapy or Total Laryngectomy," *International Journal of Radiation Oncology\*Biology\*Physics* 70, no. 2 (February 1, 2008): 344–52, <a href="https://doi.org/10.1016/j.ijrobp.2007.06.040">https://doi.org/10.1016/j.ijrobp.2007.06.040</a>.

Ryan Pollard et al., "Effects of the SpeechEasy on Objective and Perceived Aspects of Stuttering: A 6-Month, Phase I Clinical Trial in Naturalistic Environments," *Journal of Speech, Language, and Hearing Research: JSLHR* 52 (2008): 516–33, <a href="https://doi.org/10.1044/1092-4388(2008/07-0204">https://doi.org/10.1044/1092-4388(2008/07-0204</a>).

Susanne Wiegand, "Evidence and Evidence Gaps of Laryngeal Cancer Surgery," *GMS Current Topics in Otorhinolaryngology, Head and Neck Surgery* 15 (December 15, 2016), <a href="https://doi.org/10.3205/cto000130">https://doi.org/10.3205/cto000130</a>.

Therese Karlsson et al., "A Prospective Longitudinal Study of Voice Characteristics and Health-Related Quality of Life Outcomes Following Laryngeal Cancer Treatment with Radiotherapy," *Acta Oncologica* 55, no. 6 (June 2, 2016): 693–99,

https://doi.org/10.3109/0284186X.2016.1150604.

Vrushali Angadi, Emily Dressler, and Joseph Stemple, "A Multidimensional Study of Vocal Function Following Radiation Therapy for Laryngeal Cancers," Annals of Otology, Rhinology & Laryngology 126, no. 6 (June 1, 2017): 483–92,