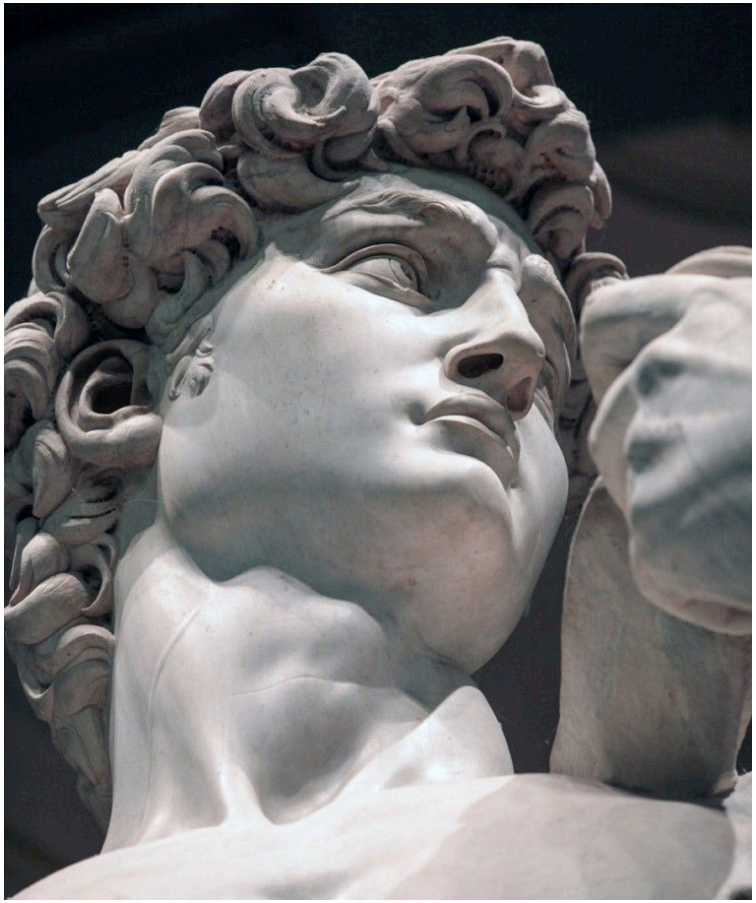
BC CANCER | SURGERY Surgeon Network



Thyroidectomy & Thyroid Cancer Surgical Quality Indicators: What Should The Surgeon Know

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British Columbia Cancer Agency Surgeon Network
Fall Update 2018: Head & Neck Endocrine Tumors
October 13, 2018, Vancouver, BC

Objectives

1. Review the **importance of QI** in thyroid & thyroid cancer surgery

2. Be aware of contemporary **complication rates** for thyroid/thyroid cancer operations

3. Appreciate **postop RAI uptake, Tg level, and LN yield** as thyroid cancer surgery QIs

4. Understand the importance of **surgeon volume** in thyroid surgery & thyroid cancer surgery outcomes

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What Is Healthcare Quality?

The degree to which health services for individuals and populations **increase the likelihood of desired health outcomes** and are consistent with current professional knowledge.

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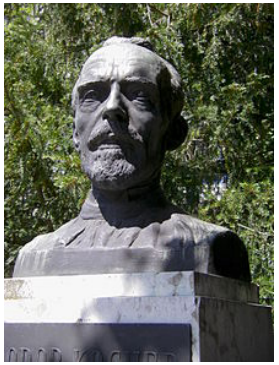
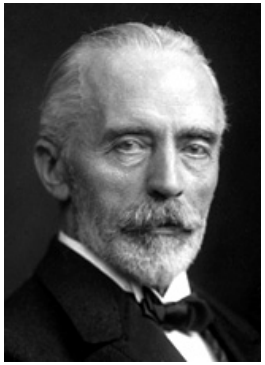
(Lohr et al N Eng J Med 1990;322;707-712)



Revolutionary Thyroid Surgical Quality Improvement: Kocher's Thyroidectomy Technique



Current thyroid surgical technique was pioneered by Emil Theodor Kocher that led to a **reduction in mortality from** **12.8% in 1883 to less than 0.5% 15 years later**

EMIL THEODOR KOCHER

Concerning pathological manifestations in low-grade thyroid diseases

Nobel Lecture, December 11, 1909*

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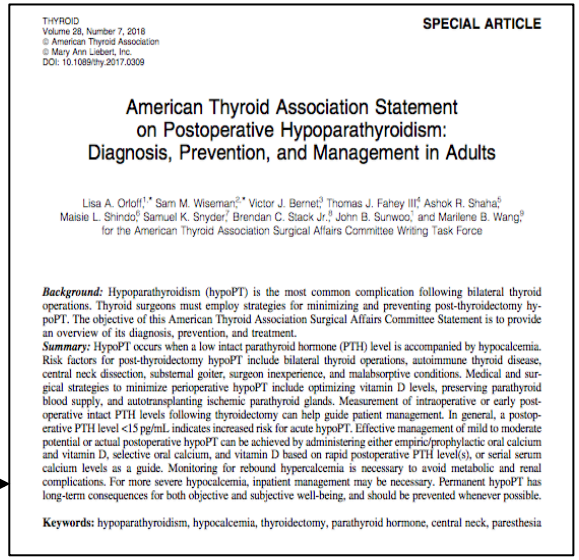
Thyroidectomy Surgical QIs: Complications

- Are important thyroid **surgical quality outcomes** and thyroid **surgeons should be aware of their own complication rates and how they compare to current reported outcomes**

- **Thyroidectomy Specific Complications**
  - Recurrent Laryngeal Nerve Injury (**Scope**)
  - Hypoparathyroidism (**Measurement**)

- **Nonspecific Surgical Complications**
  - Pneumonia
  - Myocardial Infarction
  - Renal Failure
  - Wound Infection
  - Blood Loss/Transfusion Requirement
  - Urinary Tract Infection
  - Postoperative Hemorrhage/Return to OR



THYROID
Volume 28, Number 7, 2018
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DOI: 10.1089/thy.2017.0309

SPECIAL ARTICLE

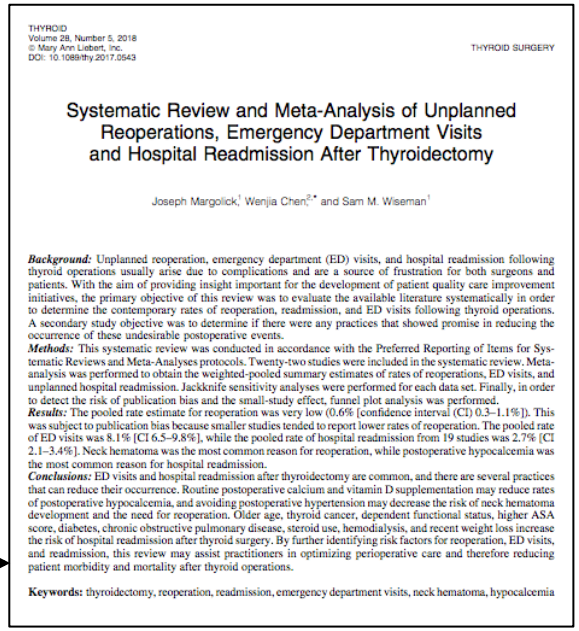
American Thyroid Association Statement on Postoperative Hypoparathyroidism: Diagnosis, Prevention, and Management in Adults

Lisa A. Orloff,[1,*] Sam M. Wiseman,[2,*] Victor J. Bernet,[3] Thomas J. Fahey III,[4] Ashok R. Shaha,[5] Maisie L. Shindo,[6] Samuel K. Snyder,[7] Brendan C. Stack Jr.,[8] John B. Sunwoo,[1] and Marilene B. Wang,[9] for the American Thyroid Association Surgical Affairs Committee Writing Task Force

Background: Hypoparathyroidism (hypoPT) is the most common complication following bilateral thyroid operations. Thyroid surgeons must employ strategies for minimizing and preventing post-thyroidectomy hypoPT. The objective of this American Thyroid Association Surgical Affairs Committee Statement is to provide an overview of its diagnosis, prevention, and treatment.

Summary: HypoPT occurs when a low intact parathyroid hormone (PTH) level is accompanied by hypocalcemia. Risk factors for post-thyroidectomy hypoPT include bilateral thyroid operations, autoimmune thyroid disease, central neck dissection, substernal goiter, surgeon inexperience, and malabsorptive conditions. Medical and surgical strategies to minimize perioperative hypoPT include optimizing vitamin D levels, preserving parathyroid blood supply, and autotransplanting ischemic parathyroid glands. Measurement of intraoperative or early postoperative intact PTH levels following thyroidectomy can help guide patient management. In general, a postoperative PTH level <15 pg/mL indicates increased risk for acute hypoPT. Effective management of mild to moderate potential or actual postoperative hypoPT can be achieved by administering either empiric/prophylactic oral calcium and vitamin D, selective oral calcium, and vitamin D based on rapid postoperative PTH level(s), or serial serum calcium levels as a guide. Monitoring for rebound hypercalcemia is necessary to avoid metabolic and renal complications. For more severe hypocalcemia, inpatient management may be necessary. Permanent hypoPT has long-term consequences for both objective and subjective well-being, and should be prevented whenever possible.

Keywords: hypoparathyroidism, hypocalcemia, thyroidectomy, parathyroid hormone, central neck, paresthesia



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Volume 28, Number 5, 2018
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DOI: 10.1089/thy.2017.0543

THYROID SURGERY

Systematic Review and Meta-Analysis of Unplanned Reoperations, Emergency Department Visits and Hospital Readmission After Thyroidectomy

Joseph Margolick,[1] Wenjia Chen,[2,*] and Sam M. Wiseman[1]

Background: Unplanned reoperation, emergency department (ED) visits, and hospital readmission following thyroid operations usually arise due to complications and are a source of frustration for both surgeons and patients. With the aim of providing insight important for the development of patient quality care improvement initiatives, the primary objective of this review was to evaluate the available literature systematically in order to determine the contemporary rates of reoperation, readmission, and ED visits following thyroid operations. A secondary study objective was to determine if there were any practices that showed promise in reducing the occurrence of these undesirable postoperative events.

Methods: This systematic review was conducted in accordance with the Preferred Reporting of Items for Systematic Reviews and Meta-Analyses protocols. Twenty-two studies were included in the systematic review. Meta-analysis was performed to obtain the weighted-pooled summary estimates of rates of reoperations, ED visits, and unplanned hospital readmission. Jackknife sensitivity analyses were performed for each data set. Finally, in order to detect the risk of publication bias and the small-study effect, funnel plot analysis was performed.

Results: The pooled rate estimate for reoperation was very low (0.6% [confidence interval (CI) 0.3–1.1%]). This was subject to publication bias because smaller studies tended to report lower rates of reoperation. The pooled rate of ED visits was 8.1% [CI 6.5–9.8%], while the pooled rate of hospital readmission from 19 studies was 2.7% [CI 2.1–3.4%]. Neck hematoma was the most common reason for reoperation, while postoperative hypocalcemia was the most common reason for hospital readmission.

Conclusions: ED visits and hospital readmission after thyroidectomy are common, and there are several practices that can reduce their occurrence. Routine postoperative calcium and vitamin D supplementation may reduce rates of postoperative hypocalcemia, and avoiding postoperative hypertension may decrease the risk of neck hematoma development and the need for reoperation. Older age, thyroid cancer, dependent functional status, higher ASA score, diabetes, chronic obstructive pulmonary disease, steroid use, hemodialysis, and recent weight loss increase the risk of hospital readmission after thyroid surgery. By further identifying risk factors for reoperation, ED visits, and readmission, this review may assist practitioners in optimizing perioperative care and therefore reducing patient morbidity and mortality after thyroid operations.

Keywords: thyroidectomy, reoperation, readmission, emergency department visits, neck hematoma, hypocalcemia

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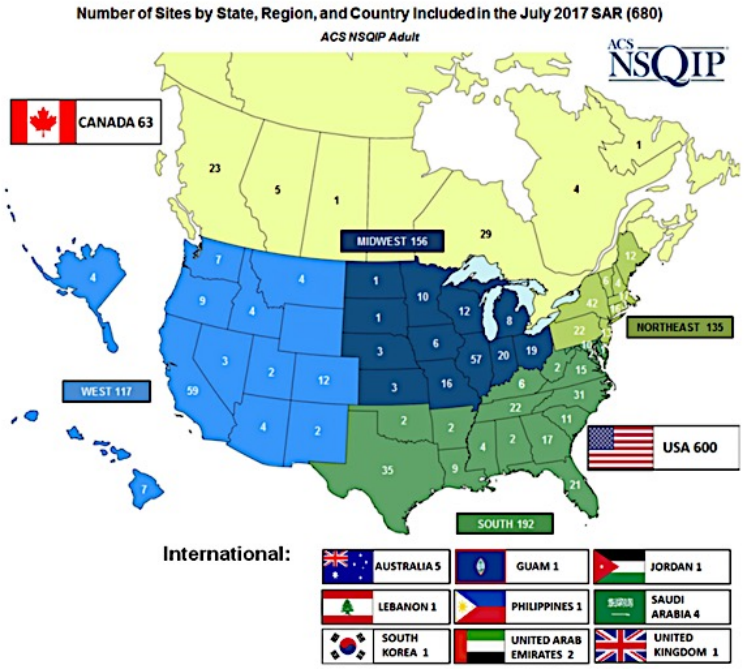
Thyroidectomy QIs:
What Are Contemporary Complication Rates?

- Objective: **Identify operations needing more QI**
- 10 procedures evaluated in ACS NSQIP database between 2008-20015 (**1.2 million** operations)



(Liu et al JACS 2018;226;1:30-36)

Thyroidectomy Current Complication Rates:
Benchmarks For Thyroid Surgery QI

Operation	Year	Cases, n	Mortality		Pneumonia		Renal failure		Surgical site infection		Unplanned intubation		Urinary tract infection	
			Events, n	Rate, %	Events, n	Rate, %	Events, n	Rate, %	Events, n	Rate, %	Events, n	Rate, %	Events, n	Rate, %
Thyroidectomy	2008	7,915	7	0.09	17	0.21	2	0.03	29	0.37	40	0.51	31	0.39
	2009	9,339	8	0.09	13	0.14	0	0.00	26	0.28	45	0.48	28	0.30
	2010	9,774	4	0.04	23	0.24	4	0.04	28	0.29	34	0.35	30	0.31
	2011	11,088	15	0.14	35	0.32	5	0.05	53	0.48	46	0.41	42	0.38
	2012	13,212	7	0.05	16	0.12	1	0.01	38	0.29	38	0.29	41	0.31
	2013	14,614	14	0.10	31	0.21	8	0.05	80	0.55	63	0.43	36	0.25
	2014	16,043	9	0.06	38	0.24	8	0.05	68	0.42	65	0.41	41	0.26
	2015	17,687	19	0.11	52	0.29	10	0.06	72	0.41	60	0.34	43	0.24
Subtotal	—	99,672	83	0.08	225	0.23	38	0.04	394	0.40	391	0.39	292	0.29

Table 2. Estimated Number of Adverse Events Avoided per 10,000 Operations

Operation	Mortality	Pneumonia	Renal failure	Surgical site infection	Unplanned intubation	Urinary tract infection
Colectomy	—	—	—	124	82	128
Esophagectomy	—	—	—	—	—	95
Hepatectomy	76	—	24	—	98	164
Hysterectomy	5	—	—	—	9	—
Pancreatectomy	26	—	—	—	51	265
Proctectomy	16	—	—	49	—	186
Total hip arthroplasty	—	—	—	—	10	78
Total knee arthroplasty	—	24	—	13	—	68
Thyroidectomy	—	—	—	—	—	5
Ventral hernia repair	—	—	—	44	—	—

Adverse events avoided = slope from Table 2 × 8 years × 10,000 operations. Events avoided are not estimated for those without significant improvements. Values presented are interpreted as number of cases avoided per 10,000 procedures in the final year, resulting from cumulative quality effects during the 8-year period.

(Liu et al JACS 2018;226;1:30-36)

Thyroidectomy For Cancer QIs:
What Are Contemporary Complication Rates?

- Objective:
  - To determine **thyroid cancer surgical complication rates and identify at risk populations**

- SEER database (1998-2011)
  - **22,867** patients 30 day and 1 year complication rates in DTC (97.2%) & MTC (2.8%) cases

- Complications Separated into:
  - » **General** (Fever/Infection/Hematoma/Pneumonia/ Intubation/Trach/MI/PE/DVT)
  - » **Thyroidectomy Specific** (Hypoparathyroidism/VC paralysis) (Starting at 31 days postop)

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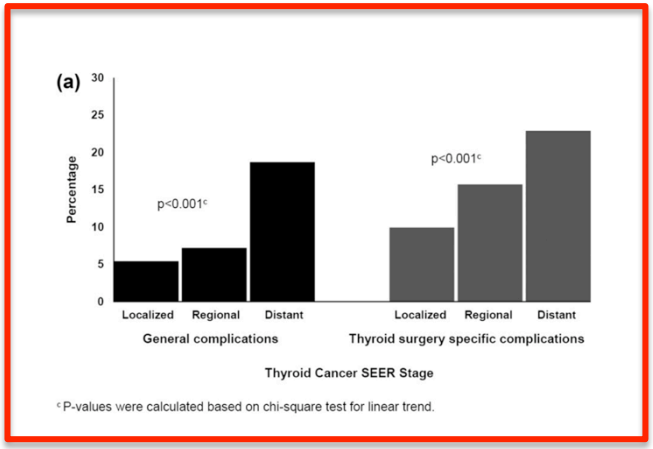
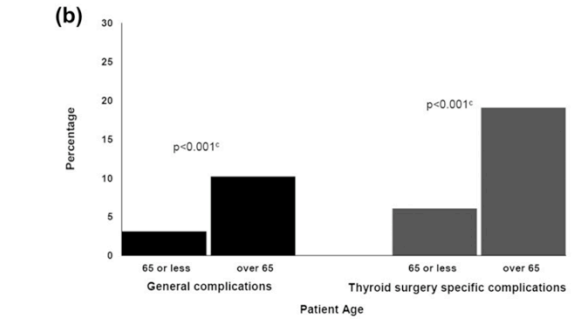
(Papaleontiou et al JCEM; 2017;102:2543-2551)

Thyroidectomy For Cancer QI: Complications





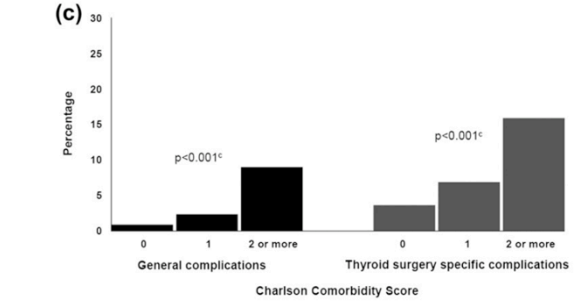


Figure 1. (a) Postoperative complications according to SEER thyroid cancer stage. (b) Postoperative complications according to patient age (years). (c) Postoperative complications according to the Charlson/Deyo comorbidity score.

- Overall Complication Rates:
  - **General (6.5%)**
  - **Thyroidectomy Specific (12.3%)**
    - 1152 cases of vocal cord paralysis
    - 2553 cases of hypoparathyroidism

Table 2. Patient Characteristics Associated With Postoperative Complications

Clinical Factors	Cardiopulmonary/Thromboembolic Complications n (%)	*P* Value[a]	Postoperative Fever/Local Complications n (%)	*P* Value[a]
General postoperative complications				
Age (y)				
≤65	332 (2.3)		192 (1.3)	
>65	1119 (8.4)	<0.001	444 (3.3)	<0.001
Charlson/Deyo comorbidity score				
0	33 (0.6)		25 (0.4)	
1	67 (1.9)		25 (0.7)	
≥2	1351(7.2)	<0.001	586 (3.1)	<0.001
Stage				
Localized	737 (4.1)		373 (2.1)	
Regional	513 (5.9)		195 (2.2)	
Distant	193 (16.5)	<0.001	63 (5.4)	<0.001
	Hypoparathyroidism/Hypocalcemia		**Vocal Cord/Fold Paralysis**	
	n (%)	***P* Value[a]**	**n (%)**	***P* Value[a]**
Thyroid surgery–specific complications				
Age (y)				
≤65	743 (5.1)		204 (1.4)	
>65	1810 (13.6)	<0.001	948 (7.1)	<0.001
Charlson/Deyo comorbidity score				
0	164 (2.9)		55 (1.0)	
1	202 (5.8)		51 (1.5)	
≥2	2187 (11.7)	<0.001	1046 (5.6)	<0.001
Stage				
Localized	1448 (8.1)		420 (2.4)	
Regional	932 (10.7)		568 (6.5)	
Distant	158 (13.5)	<0.001	150 (12.8)	<0.001

[a] *P* values were calculated based on χ^2 test for linear trend.

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(Papaleontiou et al JCEM; 2017;102:2543-2551)

Thyroidectomy QIs:
What Is The Influence of Surgeon Volume On Complications?

- Retrospective review of Nationwide Inpatient Sample (2003-2009) to evaluate thyroidectomy complications and the effect of surgeon experience/volume

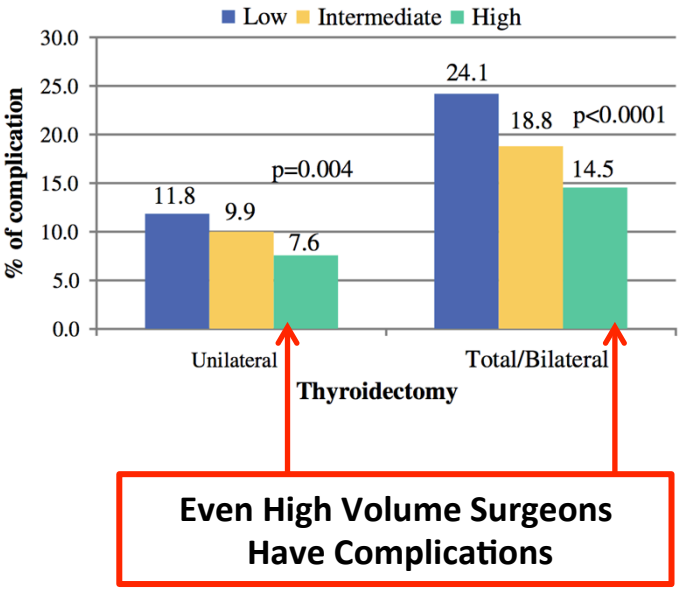
- **62,722** thyroidectomies evaluated
  - 57.9% Total Thyroidectomy / 42.1% Lobectomy
  - 3.3% Graves, 60.8% Benign Disease, 35.9% Cancer
  - 0.4% Neck Dissection

- **Surgeon Volume Classification**
  - **Low (<10)** - 50.2%
  - **Intermediate (10-99)** – 44.8%
  - **High (>99)** – 5.0%

(Hauch et al; Ann Surg Onc 2014;21:3844-3852)

Thyroidectomy QIs: Influence of Surgeon Volume On Complications

- **Higher complication risk after Total Thyroidectomy (20.8%) compared to Lobectomy (10.8%)** (p<0.0001):
  - **Hypocalcemia** (7.1% vs 16.1%, p<0.0001)
  - Respiratory Complications (0.84% vs 1.34%, p<0.0001)
  - Bleeding (0.15% vs 0.23%, p=0.0403)
  - Hematoma (1.24 vs 1.54%, p=0.0027)
  - **Tracheostomy** (0.004% vs 0.024%,p=0.0493)
  - **Vocal Cord Paralysis** (0.59 vs 1.33%, p<0.001)



- **Even high volume surgeons have a higher complication risk for Total Thyroidectomy compared to Lobectomy**

- **Low volume surgeons were more likely to have complications then high volume surgeons** (OR 1.53, 95% CI 1.12,2.11,p=0.0083)
  - **True for both Lobectomy and Total Thyroidectomy**

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(Hauch et al; Ann Surg Onc 2014;21:3844-3852)

Total Thyroidectomy Surgical QIs: Complications & Influence of Surgeon Volume

- Retrospective review of Nationwide Inpatient Sample (1998-2009) to evaluate **total thyroidectomy** complications and the effect of surgeon experience/volume

- **16,954** Total Thyroidectomies evaluated
  - 47% Thyroid Cancer, 53% Benign Disease
  - Median annual surgeon volume was 7 cases
  - 51% of surgeons performed 1 case/year

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H·CUP HEALTHCARE COST AND UTILIZATION PROJECT

(Abdelgadir et al; Ann Surg 2017;265:402-407)

Total Thyroidectomy Surgical QIs: Influence of Surgeon Volume On Complications

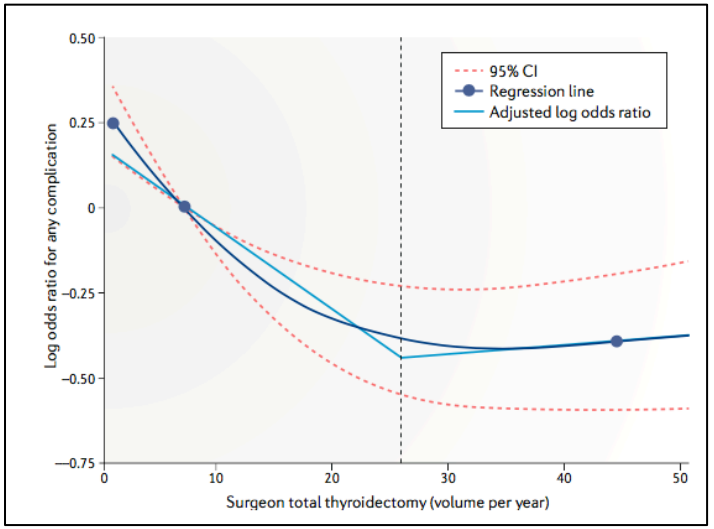
- Likelihood of experiencing a complication decreased with increasing surgeon volume up to **26 cases/year** ($p<0.01$)

- Patients undergoing thyroidectomy by low compared to high volume surgeons were:
  - **More likely to experience complications** (OR 1.51, p=0.002)
  - Have **longer hospital admissions** (+12%, P=0.006)

TABLE 2. Clinical Outcomes, Hospital Length of Stay, and Inflation-adjusted Hospital Costs by Surgeon Volume Status

Complication	High-volume (>25 Cases/y)	Low-volume (≤25 Cases/y)	*P*
Endocrine-related	50 (1.6%)	316 (2.3%)	0.01
Bleeding	31 (1.0%)	223 (1.6%)	0.006
Wound	21 (0.7%)	146 (1.1%)	0.05
Respiratory	18 (0.6%)	183 (1.3%)	0.0002
Cardiac	9 (0.3%)	58 (0.4%)	0.35
Urologic	15 (0.5%)	66 (0.5%)	1
Overall	130 (4.1%)	876 (6.4%)	<0.0001
In-hospital mortality	0	*	0.59
Length of stay, d (median, IQR)			<0.0001
Mean, SD	1.5 (1.3)	2.0 (1.9)	
Median, IQR	1 (1–2)	2 (1–2)	
Inflated-adjusted costs†			<0.0001
Mean, SD	$7166 (5052)	$7550 (5683)	
Median, IQR	$5826 (4325, 8578)	$6385 (4800, 8674)	

*Suppressed due small cell size, per HCUP-NIS policy.
†Cost data are reported in 2014 US dollars.
IQR indicates interquartile range; SD, standard deviation.



(Abdelgadir et al; Ann Surg 2017;265:402-407)

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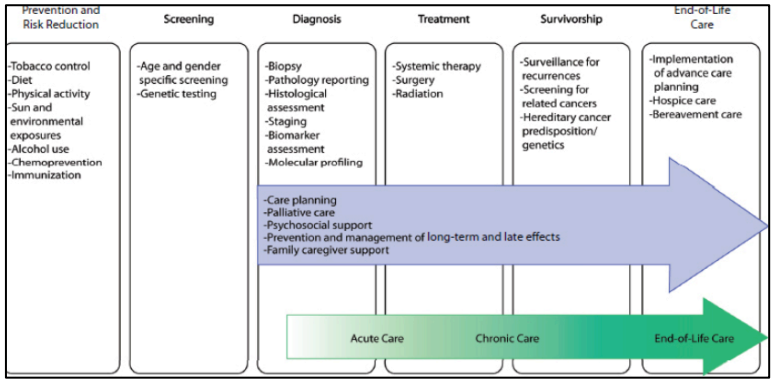
What is Quality Cancer Care?

"The provision of evidence-based, patient-centered services throughout the continuum of care in a **timely** and **technically competent** manner, with good communication, shared decision making, and cultural sensitivity, with the aim of **improving clinical outcomes**, including **patient survival** and health-related **quality of life**"

(NIH Publication No. 03e4373. Bethesda: U.S. Department of Health and Human Services, National Institutes of Health; 2002)

Quality Improvement For Cancer Patients Is Challenging

- Ongoing and continuous **modification** of cancer treatment plan



- **Multidisciplinary** treatment paradigm

- **Lengthy time intervals** for outcomes

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(Albert et et al; I J Rad Onc 2012;83:773-780)

What Are Cancer Care Quality Indicators?

- **Disease specific, reliable,** scientifically **validated**/ evidence or consensus based measures that **reflect quality of care and can be utilized to guide cancer patient & caregiver**:

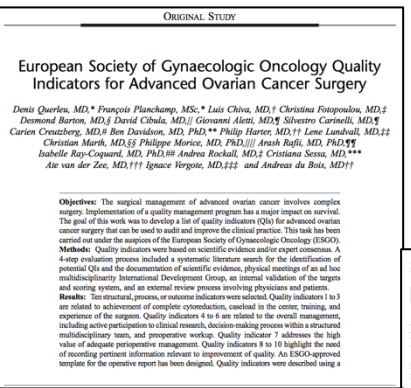
  - **Assessment**
  - **Benchmarking**
  - **Accreditation**
  - **Credentialing**
  - **Reimbursement**
  - **Quality Improvement**

(Albert et et al; I J Rad Onc 2012;83:773-780)

Surgical Quality Indicators In Cancer Patients

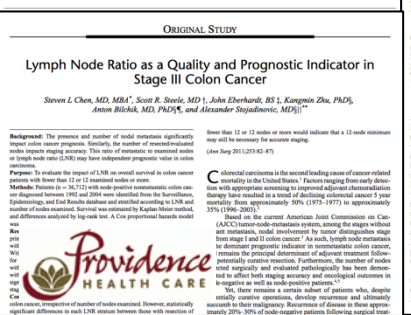
- Diversity in pathophysiology/prognosticators/ treatments for different cancer types and so **QIs must be tailored to the cancer type**

- QI development has focused on cancer types:
  - » **High Mortality/Recurrence Risk**
  - » **High Risk Operations**
  - » **Most Common Operations**



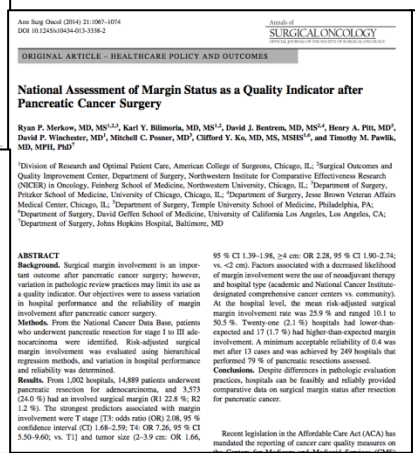
ORIGINAL STUDY

European Society of Gynaecologic Oncology Quality Indicators for Advanced Ovarian Cancer Surgery



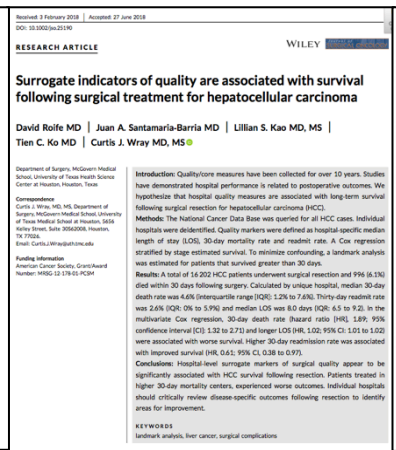
ORIGINAL STUDY

Lymph Node Ratio as a Quality and Prognostic Indicator in Stage III Colon Cancer



ORIGINAL ARTICLE – HEALTHCARE POLICY AND OUTCOMES

National Assessment of Margin Status as a Quality Indicator after Pancreatic Cancer Surgery

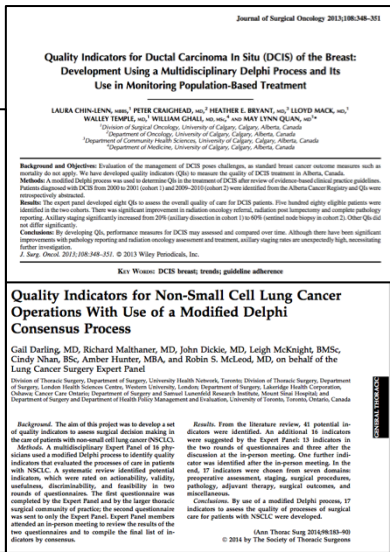


RESEARCH ARTICLE

Surrogate indicators of quality are associated with survival following surgical treatment for hepatocellular carcinoma

ORIGINAL ARTICLE

Validity and significance of 30-day mortality rate as a quality indicator for gastrointestinal cancer surgeries



Quality Indicators for Ductal Carcinoma In Situ (DCIS) of the Breast: Development Using a Multidisciplinary Delphi Process and Its Use in Monitoring Population-Based Treatment

Quality Indicators for Non-Small Cell Lung Cancer Operations With Use of a Modified Delphi Consensus Process

Thyroid Cancer Surgical QI: Challenges

- Thyroid Cancer tends to:
  - Have an **excellent prognosis**
    - Mortality is uncommon
      - » Poor QI Outcome Measure
  - May recur over **decades**
    - Recurrence may be hard to track
      - » QI Outcome Measure of interest
  - Most considered '**low risk**'
    - May NOT require:
      - » Total Thyroidectomy
      - » Central Neck Neck Dissection
      - » RAI treatment

	Projected incidence			Projected mortality			5-year net survival
Both sexes combined	Rank	Cases	ASIR*	Rank	Deaths	ASMR*	%
All cancers	—	206,200	515.9	—	80,800	198.1	60
Lung and bronchus	1	28,600	69.9	1	21,100	51.4	17
Colorectal	2	26,800	66.3	2	9,400	23.1	64
Breast	3	26,500	68.1	3	5,000	12.6	87
Prostate	4	21,300	110.4	5	4,100	23.8	95
Bladder	5	8,900	21.8	8	2,400	5.7	73
Non-Hodgkin lymphoma	6	8,300	20.8	7	2,700	6.7	66
Uterus (body, NOS)	7	7,300	35.7	18	1,150	5.3	84
Melanoma	8	7,200	18.5	15	1,250	3.1	88
Thyroid	9	7,100	19.0	21	220	0.5	98
Kidney and renal pelvis	10	6,600	16.5	12	1,900	4.6	67
Leukemia	11	6,200	15.5	6	2,900	7.2	58
Pancreas	12	5,500	13.5	4	4,800	11.9	8
Oral	13	4,700	11.9	16	1,250	3.1	63
Stomach	14	3,500	8.6	11	2,100	5.1	25
Brain/CNS	15	3,000	7.8	9	2,400	6.0	24
Multiple myeloma	16	2,900	7.1	14	1,450	3.5	42
Ovary	17	2,800	13.7	13	1,800	8.2	44
Liver	18	2,500	6.1	17	1,200	3.0	19
Esophagus	19	2,300	5.7	10	2,200	5.3	14
Cervix	20	1,550	8.3	20	400	2.0	73
Larynx	21	1,150	2.8	19	440	1.1	63
Testis	22	1,100	6.1	23	45	0.2	96
Hodgkin lymphoma	23	990	2.7	7	140	0.4	85
All other cancers	—	19,500	48.5	—	10,400	25.5	—

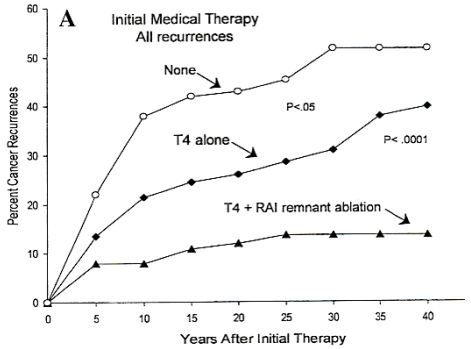
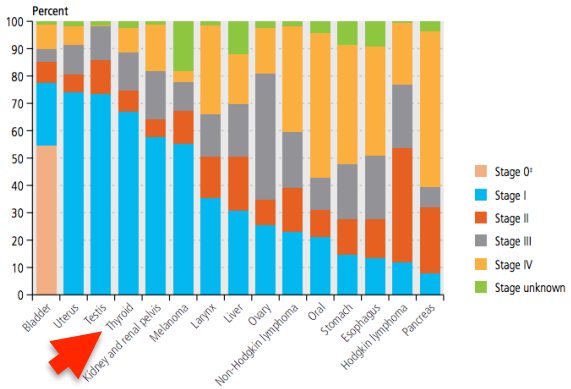


FIGURE 11 Percent distribution of cancer stage at diagnosis, selected cancers, Canada,* 2011–2015†



(Mazzaferri at al. Journal Clin Endocin and Metab 2001)

Thyroid Cancer Surgical QIs

- Goal of the surgeon when performing a thyroidectomy for cancer is to **safely remove all thyroid cancer/tissue** **(including primary tumor and nodal disease)** on the side that is being operated upon

- Thyroid cancer surgical QIs are based on **completeness of thyroid/thyroid cancer resection**

- **None of these oncological QIs are considered standard of care** currently

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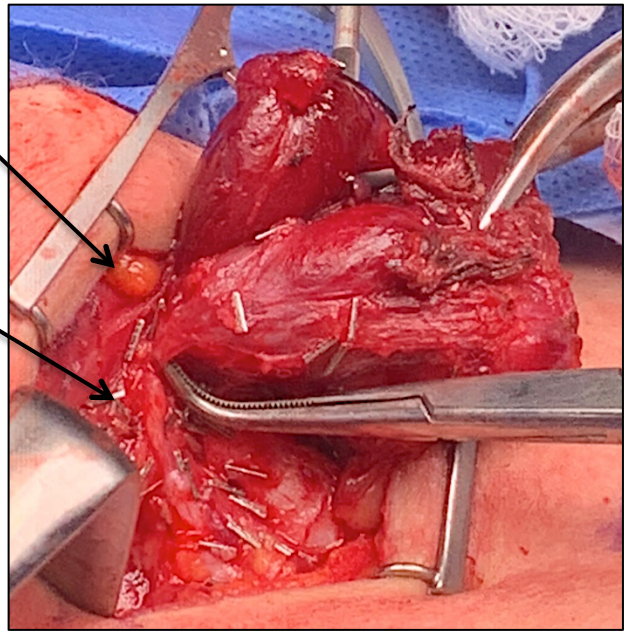
Not All Thyroidectomies Are Total

- The remnant of thyroid tissue that is **intentionally left by the surgeon in the thyroid bed in order to reduce the risk of RLN and Parathyroid injury** is influenced by multiple factors:

  - **Surgical Indication**
  - **Clinical Setting**
  - **Surgical Anatomy**
  - **Surgeon**
    - Training
    - Comfort
    - Experience
    - Judgment



- **Near-total** thyroidectomy (<1g)

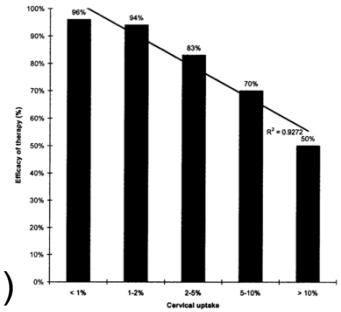
The Reality Regarding Thyroid Remnants

- **Incomplete thyroid/cancer resection predicts a worse outcome** (reduced survival and increased recurrence risk)

Score = 3.1 (age <40) or 0.8 × age (age >40) + 0.3 × tumour size (cm) + 1 if incompletely resected + 1 if locally invasive + 3 if distant spread
20-year survival by MACIS score
• <6 = 99% • 6–6.99 = 89% • 7–7.99 = 56% • ≥8.00 = 24%

MACIS SCORE

- Larger thyroid remnants **may not adequately be ablated by postop RAI**
  - Stimulated WBS (5 mCi iodine-131) 6-12 months postop predicted success of remnant ablation by 100 mCi iodine-131



(Rosario et al Clin Nuc Med;2004;6;358-361)

(Hay et al. Surgery 1998)

Proposed Thyroid Cancer Surgical QIs

1. Remnant Thyroid Uptake of RAI
2. Postoperative Thyroglobulin Level
3. Metastatic Lymph Node Ratio

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Remnant Thyroid RAI Uptake

- Post-radioactive iodine ablation treatment a whole body scan is carried out 3-7 days later to evaluate for **remnant thyroid tissue & the presence of regional/distant metastases**

- Remnant thyroid radioiodine uptake (RTRU) is calculated as a **% of the total radioisotope given that is detected in the thyroid bed after adjusting for decay**

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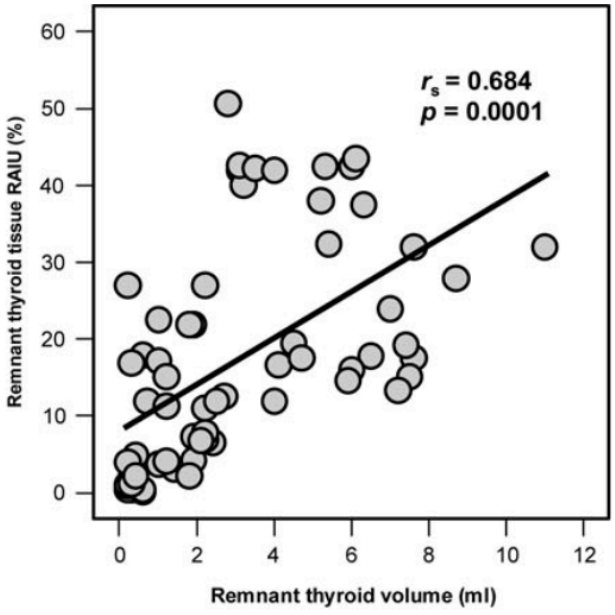
Remnant Thyroid RAI Uptake

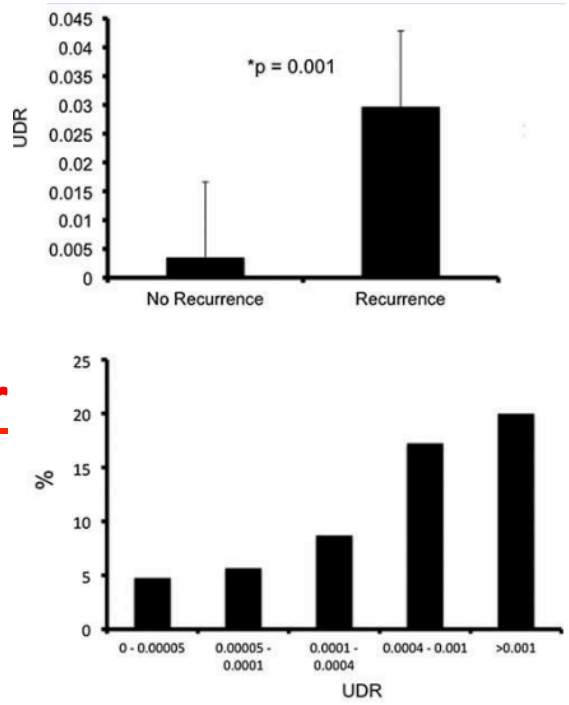
- **RTRU correlates with volume of residual thyroid tissue present** when evaluated by neck US
  - 66 thyroidectomy patients (benign) had remnant volume and uptake evaluated by US, TSH, and RAI scan 1 month postop



(Erbil et al JLO;2008;122;615-622)

Remnant Thyroid Tissue RAI Uptake

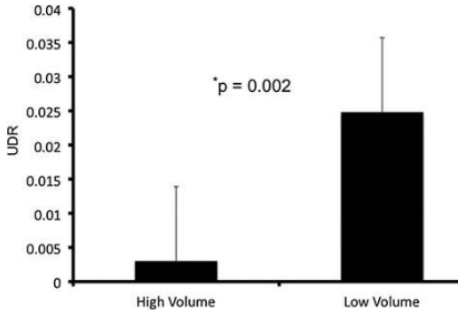
- Retrospective review of cases undergoing TT and postop RAI for thyroid cancer treatment
- Remnant uptake analyzed as ratio of the % uptake of dose received (**UDR**) and evaluated for association with recurrence
- 21/223 patients recurred (FU 25 mo)
- **Patients with recurrence had a 10x higher UDR then those that didn't recur**
- **The higher UDR, the higher the recurrence risk**

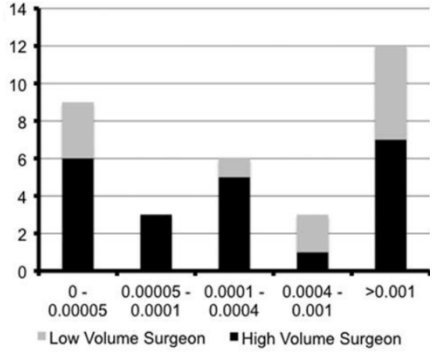


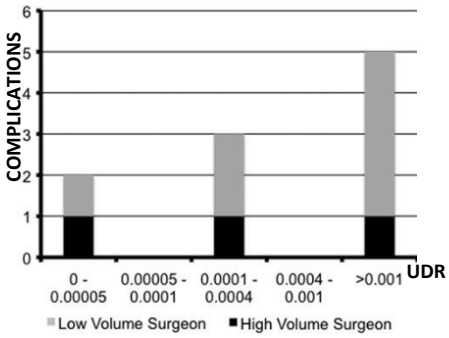
(Schneider et al Thyroid;2013;23;1269-76)

Is There An Influence Of Surgeon Volume On RTRU?

- Surgeons classified as **high** (3) or **low** (5) volume (defined by **20** thyroid operations/year)
- **UDRs of high volume surgeons were significantly lower then low volume surgeons**
- Overall **33 complications** (24 temporary/9 permanent)
- **High volume surgeons had significantly lower permanent complications, even at high UDR**
- Low volume surgeons, had a **stepwise increase** in complications as UDR rises







(Schneider et al Thyroid;2013;23;1269-76)

Growing Literature Evaluating Remnant Thyroid Tissue RAI Uptake As A Thyroidectomy QI

Study (year)	N	Variables Studied	Outcome
Rosario *et al.* (2004)	142	RAI uptake post TT	- Inverse correlation between RAI uptake and ablation efficiency ($r^2 = 0.92$, $p < 0.05$)
Lim *et al.* (2012)	173	Quantified postoperative cervical uptake	- Quantified cervical uptake >10% after thyroidectomy is a significant predictor for ablation failure (OR = 4.95 [1.07 – 22.88]; p = 0.041) and disease-free status (OR = 0.87 [0.76 – 0.98]; p = 0.024)
Schneider *et al.* (2013)	223	Post-TT RAI UDR Surgeon volume	- Odds ratio for UDR independently predicting disease recurrence is 3.71 [1.5-13.10] - The post-TT UDRs of high-volume surgeons were significantly smaller than low-volume surgeons (0.003 vs 0.025; p = 0.002)
Holsinger *et al.* (2014)	245	RAI uptake post TT	- 65% of patients with RAI uptake >0.2% had measurable stimulated Tg levels compared with 25% of patients with RAI uptake ≤0.2% (p < 0.001) - Rates of local and/or regional recurrence were low regardless of RAI uptake
Oltmann *et al.* (2014)	45	CT vs TT Surgeon volume	- CT patients had higher UDR than those undergoing TT (0.0008 vs 0.0004; p = 0.04) - CT patients managed by high-volume surgeons had lower UDR than those managed by low-volume surgeons (0.005 vs 0.006; p = 0.03)

RAI: Radioactive iodine; TT: Total thyroidectomy; US: Ultrasound; TSH: Thyroid stimulating hormone; rhTSH: Recombinant human TSH; L-T4: L-thyroxine; UDR: Uptake dose ratio; Tg: Thyroglobulin; CT: Completion thyroidectomy

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(Liu & Wiseman; Exp Rev Anticancer Ther; 2016;16;919-928)

Remnant Thyroid RAI Uptake As A QI

- **RTRU may serve as a QI for thyroid cancer surgery because it correlates with 'completeness of thyroidectomy' and recurrence risk**

- Thoughts & Limitations
  - **Cannot be utilized in lobectomy (Low Risk) patients**
  - **Utility limited in RAI non-avid recurrence**
  - **Not appropriate for locally advanced/completely resectable cases**
  - **Not accurate in the presence of significant metastatic disease**
  - Influence of other concurrent thyroid disease (ie. Graves)
  - What is an "acceptable" RTRU?
  - Should RTRU influence postoperative surveillance and follow up?
  - Is there a RTRU that mandates reoperation or repeat RAI treatment?

Do you know your patient's RTRU?

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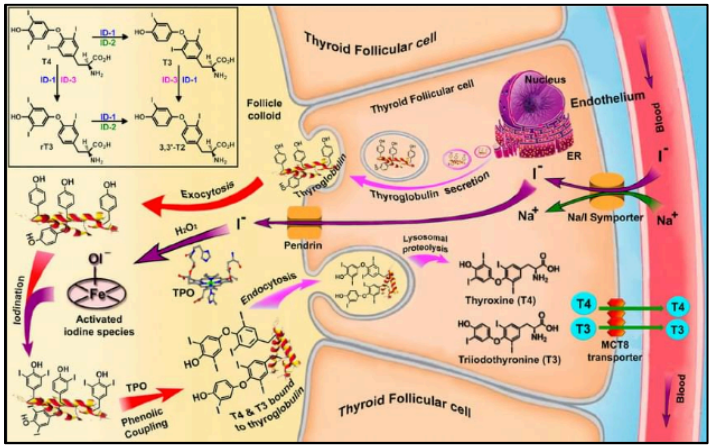
Postoperative Thyroglobulin Level

- Tg is a glycoprotein, a prohormone, only synthesized by thyrocytes stored in colloid, that's production is stimulated by TSH

- Stimulated and unstimulated Tg measurement is used for postop surveillance of all thyroid cancer patients

- **Tg measurement after Total Thyroidectomy correlates with volume of remnant thyroid tissue &/ or cancer** and may serve as a thyroid cancer surgical QI



Postoperative Thyroglobulin Level

No mention of early postoperative serum Tg measurement

[C5] What is the role of serum Tg measurement in the follow-up of DTC?

■ **RECOMMENDATION 62**

(A) Serum Tg should be measured by an assay that is calibrated against the CRM457 standard. Thyroglobulin antibodies should be quantitatively assessed with every measurement of serum Tg. Ideally, serum Tg and anti-Tg antibodies should be assessed longitudinally in the same laboratory and using the same assay for a given patient.

(Strong recommendation, High-quality evidence)

(B) During initial follow-up, serum Tg on thyroxine therapy should be measured every 6–12 months. More frequent Tg measurements may be appropriate for ATA high-risk patients.

(Strong recommendation, Moderate-quality evidence)

(C) In ATA low- and intermediate-risk patients that achieve an excellent response to therapy, the utility of subsequent Tg testing is not established. The time interval between serum Tg measurements can be lengthened to at least 12–24 months.

(Weak recommendation, Low-quality evidence)

(D) Serum TSH should be measured at least every 12 months in all patients on thyroid hormone therapy.

(Strong recommendation, Low-quality evidence)

(E) ATA high-risk patients (regardless of response to therapy) and all patients with biochemical incomplete, structural incomplete, or indeterminate response should continue to have Tg measured at least every 6–12 months for several years.

(Weak recommendation, Low-quality evidence)

■ **RECOMMENDATION 63**

(A) In ATA low-risk and intermediate-risk patients who have had remnant ablation or adjuvant therapy and negative cervical US, serum Tg should be measured at 6–18 months on thyroxine therapy with a sensitive Tg assay (<0.2 ng/mL) or after TSH stimulation to verify absence of disease (excellent response).

(Strong recommendation, Moderate-quality evidence)

(B) Repeat TSH-stimulated Tg testing is not recommended for low- and intermediate-risk patients with an excellent response to therapy.

(Weak recommendation, Low-quality evidence)

(C) Subsequent TSH-stimulated Tg testing may be considered in patients with an indeterminate, biochemical incomplete, or structural incomplete response following either additional therapies or a spontaneous decline in Tg values on thyroid hormone therapy over time in order to reassess response to therapy.

(Weak recommendation, Low-quality evidence)

(ATA Guidelines 2015)

Is There An Influence Of Surgeon Volume On Postoperative Thyroglobulin Level?

- Retrospective review of all thyroid operations (DTC≥1cm) during 2011 in a regional health system (U Pitt)

- 42 surgeons/volume evaluated for:
  - **Extent of initial operation**
  - **% uptake on I^{123} pre-RAI TSH stimulated uptake scan**
  - **Pre-ablation TSH-stimulated Tg level**
  - **Dose of I^{131} administered**

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(Adkisson et al; Surgery; 2014;156;1453-60)

Surgeon Volume & Thyroid Cancer Surgical QIs

Higher Surgeon Volume

>30 Thyroid ORs/Year

- **Total Thyroidectomy**
- **More 'complete'**
  - **% uptake on I^{123}**
  - **Stimulated Tg**
  - **Administered I^{131} dose**
- **Fewer complications**

Table II. Analysis of surgeon volume and quantitative measures of adequate initial surgery

Thyroid cases per year	*No. surgeons (DTC patients)*	*I^{123} prescan uptake, % HVS (LVS)*	P *value*	*Serum Tg, ng/mL HVS (LVS)*	P *value*	*Mean dose I^{131} given, mCi HVS (LVS)*	P *value*
≥10	16 (331)	3.1 (6.0)	.135	3.9 (7.4)	.115	94.9 (92.5)	.85
≥20	13 (326)	2.5 (2.5)	.9	3.7 (6.1)	.16	95.0 (96.7)	.85
≥25	11 (302)	2.3 (3.1)	.2	3.8 (5.0)	.36	**91 (108)**	**.03**
≥30	8 (275)	**2.2 (4.4)**	**.01**	**3.8 (8.4)**	**.02**	**90 (107)**	**.03**
≥50	6 (239)	**2.2 (4.2)**	**.005**	**3.5 (8.8)**	**.007**	**88 (108)**	**.002**
≥100	5 (224)	**2.0 (3.9)**	**.001**	**3.7 (6.6)**	**.04**	**92 (105)**	**.02**

Bold type represents $P < .05$.
DTC, Differentiated thyroid cancer; *HVS*, high-volume surgeons; *LVS*, low-volume surgeons.

>50 Thyroid ORs/Year

For Stage 3 & 4 Disease

- **More 'complete'**
  - **% uptake on I^{123}**

Table IV. Analysis of surgeon volume and quantitative measures of adequate initial surgery for patients with AJCC TNM stage III/IV disease

*No. of Tx/y**	*I^{123} prescan uptake, % HVS (LVS)*	P *value*	*Serum Tg, ng/mL HVS (LVS)*	P *value*	*Mean dose I^{131} given, mCi, HVS (LVS)*	P *value*
25	2.4 (3.0)	.7	5.5 (6.5)	.8	104 (132)	.3
30	2.8 (4.8)	.2	5.3 (7.7)	.5	105 (117)	.5
50	**2.2 (5.2)**	**.004**	5.0 (8.2)	.3	105 (121)	.2
100	**1.9 (3.9)**	**.001**	**3.5 (6.8)**	**.03**	**93.5 (115)**	**.05**

*At thresholds of 10 and 20 cases per year, the number of patients with stage III/IV disease was too small for analysis.
Bold type represents $P < .05$.
AJCC, American Joint Committee on Cancer; *HVS*, high-volume surgeon; *LVS*, low-volume surgeon; *Tx*, thyroidectomy.

(Adkisson et al; Surgery; 2014;156;1453-60)

Growing Literature Evaluating Postoperative Thyroglobulin Level As A QI

Study (year)	N	Variables	Outcome
Ruiz-Garcia *et al.* (1991)	98	Type of surgery unspecified	- 10-year disease free survival was 100% in patients with Tg ≤23 ng/mL and 68.4% in patients with Tg >23 ng/mL
Lin *et al.* (2002)	847	1 month after TT	- 1-month post-operative Tg level >10ug/L is a significant prognostic factor for patients with DTC
Bernier *et al.* (2005)	407	TT	- Tg during T4 withdrawal of ≥5ng/mL is predictive of unsuccessful ablation (RR = 1.02 [1.00 – 1.03]; p < 0.05)
Makarewicz *et al.* (2006)	178	TT	- Tg during T4 withdrawal was significantly higher in patients who later developed recurrence compared to those who did not (97.4 ng/mL vs. 4.3 ng/mL; p = 0.000001)
Heemstra *et al.* (2007)	366	Near TT	- Tg during T4 withdrawal of <27.5ug/L had a positive predictive value of 97.8% for disease-free remission and is an independent prognostic marker for disease-free remission (likelihood ratio = 43.2; p < 0.001)
Hall *et al.* (2003)	213	3 months after TT	- Patients with Tg during T3 withdrawal of >20pmol/L had a significantly increased risk of disease recurrence (p = 0.001) - Tg during T3 withdrawal of >20pmol/L is a significant predictor of recurrence (RR = 5.1 [2.0 – 13.1]; p = 0.001)
Alagic-Smailbegovic *et al.* (2012)	116	1 month after TT	- Mean Tg was 190.8 ng/mL in patients who later developed recurrent disease and 9.3 ng/mL in those who had no evidence of recurrence (p = 0.023)
Kendler *et al.* (2012)	96	1 month after TT	- Tg ≥18 ng/mL in thyroid hormone withdrawal is an independent predictor of unsuccessful ablation (RR = 5.89, p < 0.0001)
Lee *et al.* (2013)	218	3 months after TT	- Tg <2ng/mL in thyroid hormone withdrawal had a negative predictive value of 94.9% for disease free status
Moon *et al.* (2016)	253	TT with CND	- rhTSH-stimulated Tg of < 1.79 ng/mL has a negative predictive value of 99.5% for persistent or recurrent disease at 1 year post-ablation

RAI: Radioactive Iodine; Tg: Thyroglobulin; TT: Total thyroidectomy; RR: Relative risk; T4: Thyroxine; T3: OR: Odds ratio; rhTSH: Recombinant human thyroid stimulating hormine; Anti-Tg Ab: Anti-thyroglobulin antibody. * Prospective study.

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(Liu & Wiseman; Exp Rev Anticancer Ther; 2016;16;919-928)

Postoperative Thyroglobulin Level As A QI

- **Postop Tg may serve as a QI for thyroid cancer surgery because it correlates with 'completeness of thyroidectomy' and recurrence risk**

- Thoughts & Limitations
  - **Utility in lobectomy (Low Risk) patients unknown**
  - **Not useful for tumors that don't synthesize Tg**
  - **Not appropriate in locally advanced/not completely resectable cancers**
  - **Not accurate in the presence of bulky metastatic disease**
  - Influence of other concurrent thyroid disease (ie. Hashimoto's)?
  - What is the optimal timing of Tg measurement relative to surgery and RAI?
  - What is an acceptable postoperative Tg level?
  - Should Tg influence postoperative surveillance and follow up?
  - Is there a Tg level that mandates reoperation or repeat RAI treatment?

Do you know your patient's postoperative Tg level?

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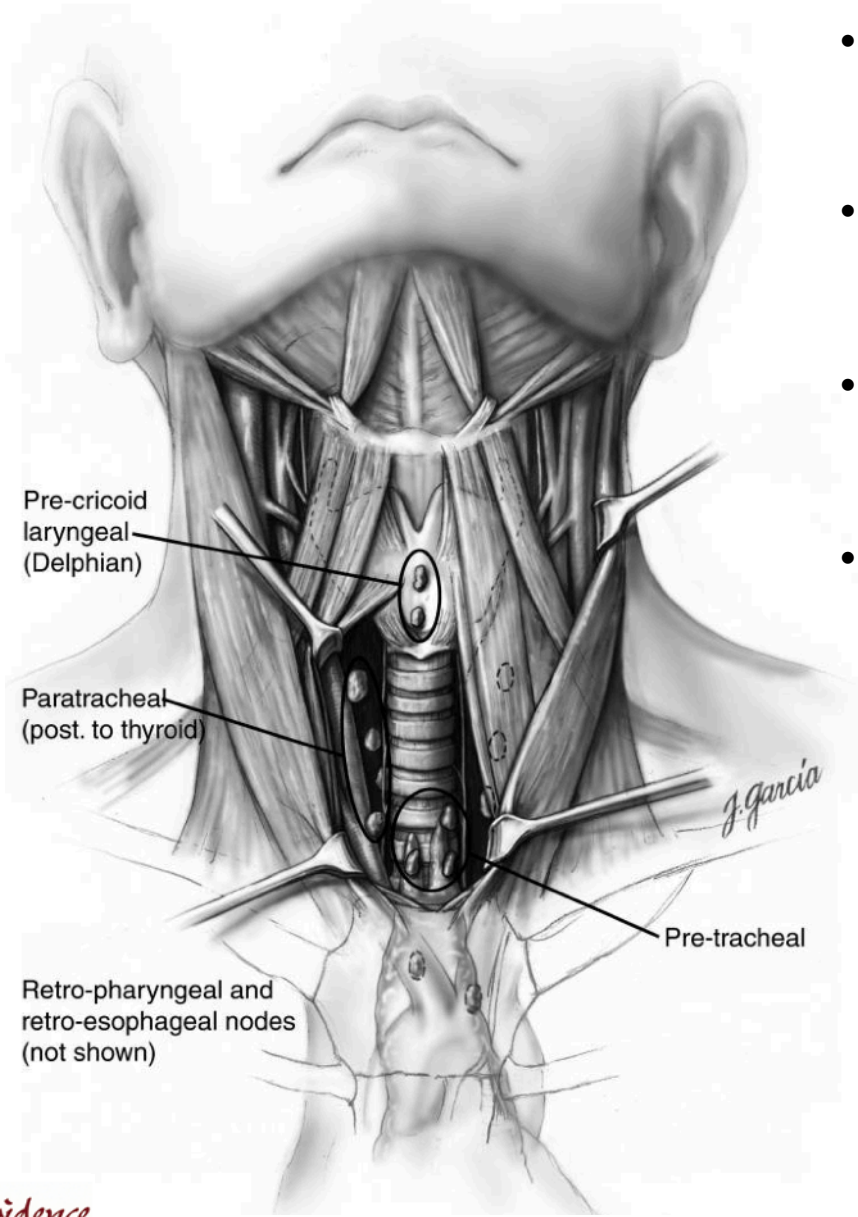
Central Neck Dissection For Thyroid Cancer



- **Variation in surgical practice** regarding CND for thyroid cancer treatment
- Central neck lymph node metastases can be detected **in 20-50%** of cases
- Lymph node metastases **increase risk of cancer recurrence**
- The AHNS defines a central neck dissection a comprehensive removal of :

NECK NODE LEVEL VI

- **Prelaryngeal** (Delphian) Lymph Nodes
- **Pretracheal** Lymph Node

and

- Left +/or Right **Paratracheal** Lymph Nodes

+/-

NECK NODE LEVEL VII

(Agrawal et al; Head Neck;2017;39;1269-1279)

Central Neck Dissection: ATA Guidelines

Therapeutic CND

Prophylactic CND

No CND

RECOMMENDATION 36

(A) Therapeutic central-compartment (level VI) neck dissection for patients with clinically involved central nodes should accompany total thyroidectomy to provide clearance of disease from the central neck.

(Strong recommendation, Moderate-quality evidence)

(B) Prophylactic central-compartment neck dissection (ipsilateral or bilateral) should be considered in patients with papillary thyroid carcinoma with clinically uninvolved central neck lymph nodes (cN0) who have advanced primary tumors (T3 or T4) or clinically involved lateral neck nodes (cN1b), or if the information will be used to plan further steps in therapy.

(Weak recommendation, Low-quality evidence)

(C) Thyroidectomy without prophylactic central neck dissection is appropriate for small (T1 or T2), noninvasive, clinically node-negative PTC (cN0) and for most follicular cancers.

(Strong recommendation, Moderate-quality evidence)

(ATA Guidelines 2015)

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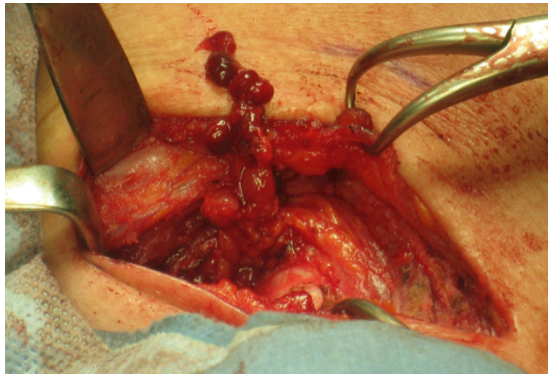
ATA

What Is Metastatic Lymph Node Ratio?

- Proposed as a QI for thyroid cancer surgery
- **Reflects the success of the surgeon in central neck compartment lymphadenectomy**

$$\frac{\text{\# Metastatic Lymph Nodes}}{\text{Total \# of Lymph Nodes (Lymph Node Yield)}}$$



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Metastatic Lymph Node Ratio

- Evaluation of MLNR in **10,955** DTC patients with >3 LN removed in the SEER database (1988-2007) (median follow up 25 month

- **MLNR was strongly associated with DSM**

  (HR 4.33, 95%CI 1.68-11.18, p<0.01)

- MLNR ≥ **0.42** separated cases based on disease specific mortality

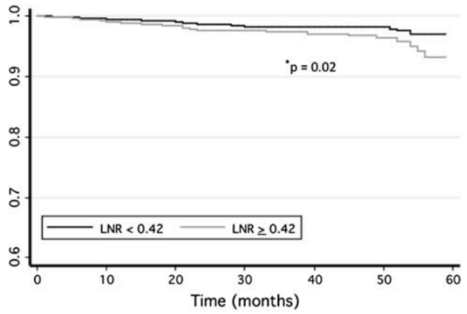

FIG. 2 Kaplan–Meier estimates of disease-free survival according to the threshold lymph node ratio

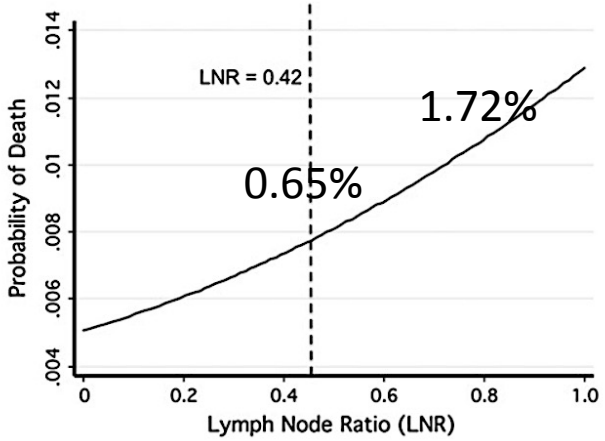

FIG. 3 Probability of thyroid cancer-specific death by lymph node ratio. The dashed line indicates the threshold lymph node ratio

(Schneider et al; Ann Sug Onc;2013;20;1906-1911)

Growing Literature Evaluating Metastatic Lymph Node Ratio As A QI

Study (year)	N	Variables	Outcome
Wada et al. (2007)	134	% of LNM	- % of LNM was significantly higher in patients with local disease recurrence than in those without local disease recurrence (54.8% vs. 23.9%, $p < 0.0005$) - % of LNM was significantly higher in patients with distant metastasis than in those without distant metastasis (49.1% vs. 25.5%, $p < 0.01$) - % of LNM is unrelated to death from disease
Beal et al. (2010)	9926	MLNR	- There is significant decrease in overall survival with increased MLNR (univariate analysis $p < 0.001$; multivariate analysis: $p = 0.01$)
Vas Nunes et al. (2013)	198	LNR LNY	- Patients with LNR ≥ 0.30 had a 3.4 times higher risk of persistent or recurrent disease compared with patients with LNR of 0.00 ($p = 0.031$) - Patients with LNR ≤ 0.11 had an 80% chance of remaining disease free during 5 years of follow-up
Schneider et al. (2013)	6,103	LNR	- Higher rate of DSM experienced by those with a LNR ≥ 0.42 compared to those with LNR <0.42 (1.72% vs. 0.65%; $p < 0.01$) when three or more lymph nodes were harvested
Schneider et al. (2013)	217	LNR cLNR	- Significantly higher rate of recurrence in patients with LNR ≥ 0.7 ($p < 0.01$) or cLNR ≥ 0.86 ($p < 0.01$) - Odds ratio for LNR predicting disease recurrence is 19.5 [4.1 – 22.9]; $p < 0.01$
Ryu et al. (2014)	283	LNR after pCND	- Patients with recurrence had a mean LNR of 0.77 +/- 0.22; patients without recurrence had a mean LNR of 0.39 +/- 0.27, when three or more lymph nodes were dissected ($p < 0.001$) - LNR > 0.65 is significantly associated with recurrence (<0.001)

LNM: Lymph node metastasis; MLNR: Metastatic lymph node ratio; LNR: Lymph node ratio; LNY: Lymph node yield; DSM: Disease-specific mortality; cLNR: Central lymph node ratio; pCND: Prophylactic central neck dissection

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(Liu & Wiseman; Exp Rev Anticancer Ther; 2016;16;919-928)

Metastatic Lymph Node Ratio As A QI

- **MLNR may serve as a QI for thyroid cancer surgery because it correlates with 'completeness of lymphadenectomy' and recurrence risk**

- Thoughts & Limitations
  - Utility in the setting of bulky disease is poor (cannot achieve a low ratio)
  - Surgical intention: Therapeutic vs Prophylactic must be considered
  - Impact of nodal metastases size/extranodal extension unknown
  - Influence of other concurrent thyroid disease (ie. Hashimoto's)
  - What is an "acceptable" MLNR?
  - Should MLNR influence postoperative surveillance and follow up?

Do you know your patient's MLNR?

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Final Thoughts:
Should Guideline Adherence Be Considered A Thyroid Surgical QI?

- Could address difficulty with finding thyroid cancer surgery QIs for Low Risk patients
- **Guidelines are Guidelines** and constantly changing based upon new evidence
- **Should not following guidelines be an indicator of poor oncological surgical quality?**

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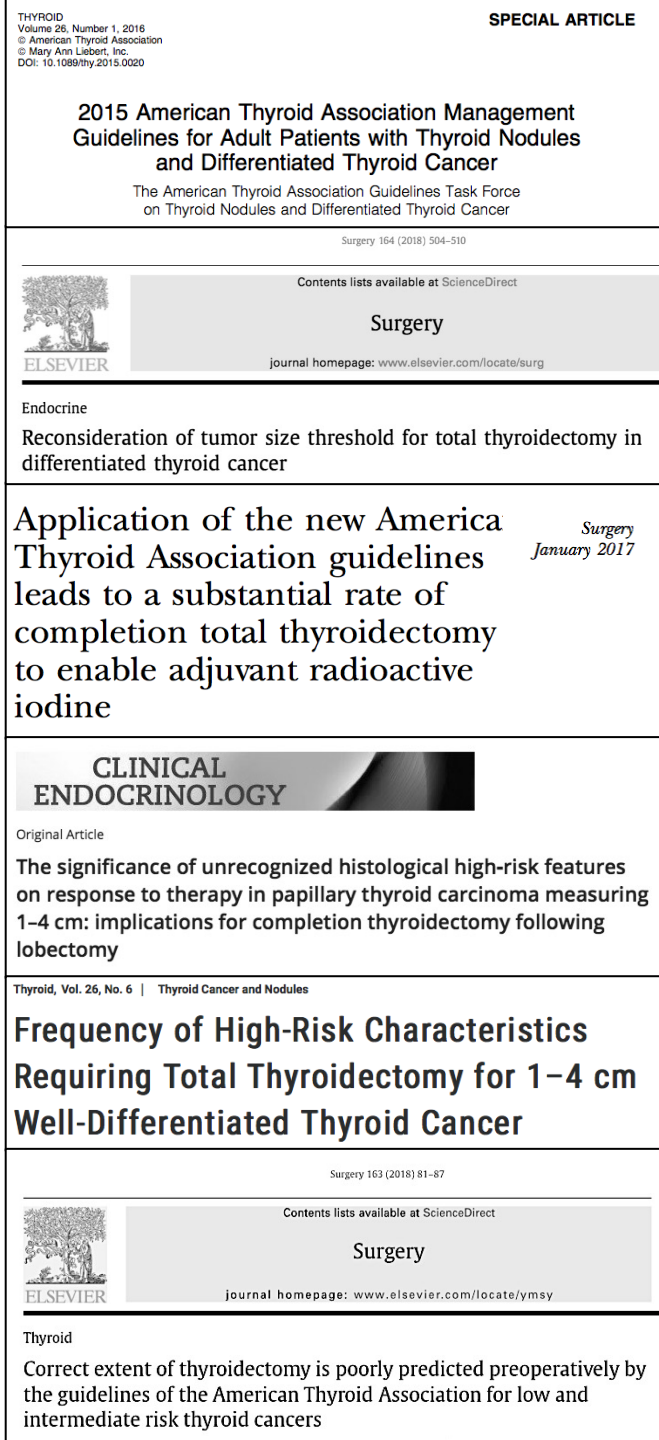

THYROID
Volume 26, Number 1, 2016
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SPECIAL ARTICLE

2015 American Thyroid Association Management Guidelines for Adult Patients with Thyroid Nodules and Differentiated Thyroid Cancer

The American Thyroid Association Guidelines Task Force on Thyroid Nodules and Differentiated Thyroid Cancer

Surgery 164 (2018) 504–510

Contents lists available at ScienceDirect

Surgery

journal homepage: www.elsevier.com/locate/surg

Endocrine

Reconsideration of tumor size threshold for total thyroidectomy in differentiated thyroid cancer

Application of the new America Thyroid Association guidelines leads to a substantial rate of completion total thyroidectomy to enable adjuvant radioactive iodine

Surgery January 2017

CLINICAL ENDOCRINOLOGY

Original Article

The significance of unrecognized histological high-risk features on response to therapy in papillary thyroid carcinoma measuring 1–4 cm: implications for completion thyroidectomy following lobectomy

Thyroid, Vol. 26, No. 6 | Thyroid Cancer and Nodules

Frequency of High-Risk Characteristics Requiring Total Thyroidectomy for 1–4 cm Well-Differentiated Thyroid Cancer

Surgery 163 (2018) 81–87

Contents lists available at ScienceDirect

Surgery

journal homepage: www.elsevier.com/locate/ymsy

Thyroid

Correct extent of thyroidectomy is poorly predicted preoperatively by the guidelines of the American Thyroid Association for low and intermediate risk thyroid cancers

Final Thoughts:

How Many High Volume Surgeons Would It Take To Perform All The Thyroidectomies In The USA Annually? Realistic?

Estimate: Total # Thyroidectomies In US/Year = **150,000**

High Volume Surgeon >99 Thyroidectomies/Year

Total # High Volume Thyroid Surgeons Needed = **1,500**

High Volume Surgeon >24 Thyroidectomies/Year

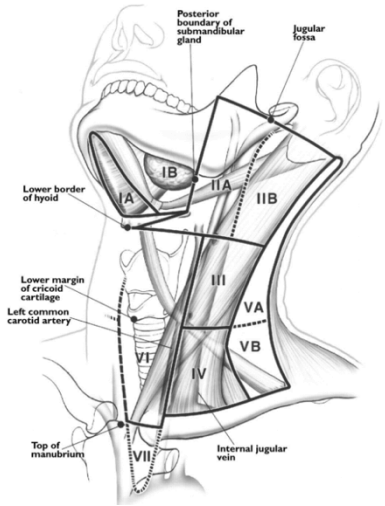
Total # High Volume Thyroid Surgeons Needed = **6,000**

(Al-Qurayashi et al; JAMA Oto HNS 2016;142:32-39)

(Hauch et al; Ann Surg Onc 2014;21:3844-3852)

Conclusions

- Thyroid surgical QIs are focused on **surgical complications**
- Thyroid cancer surgical QIs allow for evaluation of the **completeness of**:
  - **Thyroidectomy**
    - **Remnant Thyroid Uptake of RAI**
    - **Postoperative Thyroglobulin Level**
  - **Central Neck Lymphadenectomy**
    - **Metastatic Lymph Node Ratio**



- Application of these QIs is largely limited to patients who have undergone a **total thyroidectomy +/- RAI**

(primarily High Risk)

Providence HEALTH CARE

Conclusions

- Despite no specific QI currently considered standard, and further study being needed, surgeons who perform thyroid operations should be aware of their:
  - Patient's thyroid surgical QIs
    - **Morbidity & Mortality**
    - **Recurrence Risk**
  - Patient's thyroid cancer surgical QIs
    - **Postop RAI uptake**
    - **Postop TG**
    - **MLNR**
    - **Other?**
  - Own thyroidectomy **surgical volumes**

- This information is **readily available, quantifiable, is associated with surgical and oncological outcomes, and allows for quality improvement (NOW HOW DO WE APPLY THESE QIs IN THE REAL WORLD???)**