

Compromised Outcome of Papillary Thyroid Cancer at Low-Volume Treatment Centers: Practice Makes Perfect?

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The intimate relationship between volume and outcome for nearly every major type of surgery is ubiquitous. High-volume hospital care is associated with significantly lower mortality rates compared to low-volume hospitals.^{1,2} The effect of high surgeon volume accounts for the majority of the effect of high hospital volume in complex procedures.³ Nobel laureate and masterful Swiss surgeon Emil Theodor Kocher recognized the importance of surgical volume in improving outcomes in thyroid surgery. Kocher reported an operative mortality rate of 13 % for his first 100 thyroid procedures. By 1912, Kocher was able to reduce his mortality rate of thyroidectomy to less than 0.5 % after performing over 5000 thyroid excisions. He demonstrated a significant reduction in operative mortality with increasing experience.⁴

In the modern era, the association recognized by Kocher between provider volume and improved patient outcome has persisted. Reames et al. demonstrated that higher-volume hospitals had significantly lower mortality rates compared to lower-volume hospitals for eight different complex procedures in over 3 million patients.² Data also show a significant relationship between surgeon volume and surgical morbidity in thyroid operations. Although the majority of thyroid operations are still performed by low-volume surgeons, national trends in thyroid surgery over the last two decades exhibit an increase in thyroid surgical procedures performed by high-volume surgeons with a decrease in the incidence of complications, specifically recurrent laryngeal nerve injury and hypocalcemia.^{5,6} In addition, high-volume surgeons were more likely to

perform total thyroidectomy and neck dissection as compared to low-volume surgeons. Hauch et al. evaluated the Nationwide Inpatient Sample (2003–2009) of all adult patients who underwent total thyroidectomy and unilateral thyroidectomy.⁷ They found that total thyroidectomy was associated with a significantly higher risk of complications compared to unilateral thyroidectomy in both low- and high-volume surgeons; however, higher surgeon volume was associated with improved patient outcome. Mitchell et al. demonstrated that operations for thyroid cancer led to avoidable reoperations more frequently if performed at low-volume centers.⁸ The initial operations requiring avoidable reoperations included errors in judgment concerning lymph node dissection or technical errors in incomplete thyroid resection. Furthermore, Schneider and colleagues found that higher-volume surgeons had better oncologic outcomes for thyroid cancer.⁹

In this issue, Youngwirth et al. report the first study examining margin status after total thyroidectomy for papillary thyroid cancer in the National Cancer Data Base (1998–2006).¹⁰ A total of 31,129 adult patients with thyroid cancer met the inclusion criterion of patients who underwent total thyroidectomy. By multivariable analysis, the authors identified specific factors for patients with papillary thyroid cancer undergoing total thyroidectomy that led to a poor outcome in survival. These factors included patient factors (male gender, advanced age, African American race), socioeconomic factors (low income, government insurance), cancer stage (large tumor size, positive lymph nodes, distant metastases), absence of radioactive iodine treatment, and microscopically and macroscopically positive surgical margin status. Of these independent factors, which compromised patient survival, the authors recognized that only surgical margin status could be potentially controlled. They evaluated the factors associated with positive margin status in patients undergoing surgical resection for thyroid cancer. Their study

identified many vulnerable patient populations at risk for positive surgical margin after total thyroidectomy for papillary thyroid cancer, including the elderly, uninsured, and patients with government insurance. After adjusting for patient demographic, clinical, and pathologic factors, the authors found an association between high surgical volume (>12 thyroidectomies per year per institution) and surgical resection success as defined by negative margin status (odds ratio 0.72; $p < 0.01$). High surgical case volume was protective against incomplete resections. Patients with negative margins were more likely to be younger, female, and white, have private insurance, and receive treatment at an academic and/or high-volume facility compared to patients with microscopically or macroscopically positive margins. Patients with negative margins were also more likely to have smaller tumors and stage I disease. They hypothesize that the elderly, the uninsured, and patients with government insurance may present to a physician later in their disease process with more advanced disease and may not have access to high-volume surgeons, putting them at risk for positive-margin resections. The authors conclude that patients with larger or more locally advanced thyroid cancers should be referred to high-volume centers to optimize patient outcomes.

The data presented by Youngwirth et al. demonstrate the influence of margin status on survival in patients undergoing total thyroidectomy for papillary thyroid cancer. With the exception of distant metastases, a macroscopic positive margin at the time of total thyroidectomy was the most important determinant in poor outcome with a hazard ratio of 2:38. Therefore, one cannot diminish the importance of meticulous surgical resection in optimizing patient outcome. Although academic and/or high-volume centers may provide the foundation for best surgical treatment practices, this study did not demonstrate that patients undergoing total thyroidectomy at an academic and/or high surgical case volume center had improved survival outcomes. Institutions with high surgical volumes were associated with negative margin resections but not with improved overall survival in multivariable analysis. It is likely that high surgical volume did not contribute to a survival advantage because of the overall favorable survival of this disease and the small absolute difference of having a negative margin resection at a high-volume center versus a low-volume center. However, it does beg the question as to whether the absence of effect on survival may be because, after adjusting for differences in tumor factors seen in high-volume centers (smaller tumors, stage I disease) versus low-volume centers (larger tumors, advanced-stage disease), surgical case volume was no longer a contributing factor in survival. In other words, patient selection at high-volume centers was more important than surgical volume in determining patient survival. It would be interesting to see a comparison of clinical

and pathologic differences in high-volume versus low-volume centers.

As confirmed by this study and many others, the association between experience and outcome is indisputable. However, initiatives to improve thyroid surgical care by referring more patients to high-volume centers are unlikely to be feasible or practical because of patient preferences and provider incentives. Instead, national database studies direct our attention to the need for exposing surgical residents and low-volume providers to the same measures used by high-volume surgeons. Increased educational efforts are necessary to more effectively train surgeons to adopt best-practice strategies in order to improve outcomes by low-volume providers.

In 1919, William Stewart Halsted reasoned that Kocher's exceptional outcomes were a product of Kocher's immense technical skills. Halsted eloquently compared Kocher's surgical acumen to that of one of his contemporary surgeons, Theodor Billroth:

I have pondered the question for many years and conclude that the explanation probably lies in the operative methods of the two illustrious surgeons. Kocher, neat and precise, operating in a relatively bloodless manner, scrupulously removed the entire thyroid gland doing little damage outside its capsule. Billroth, operating more rapidly and, as I recall, with less regard for the tissues and less concern for hemorrhage, might easily have removed the parathyroids or at least have interfered with their blood supply, and have left fragments of the thyroid.⁴

Both Kocher and Halsted recognized the importance of practice in acquiring precision, the hallmark of a great surgeon. One hundred years later, we continue to acknowledge the importance of surgical volume in developing improvements in surgical outcome.

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