Return to December 2002 Table of Contents

Canadian Association of General Surgeons Evidence Based Reviews in Surgery. 4. Decision analysis of total thyroidectomy versus thyroid lobectomy in low-risk, differentiated thyroid cancer

Carole S. Richard, MD; Richard W. Nason, MD; Robin S. McLeod, MD; for Members of the CAGS Evidence Based Reviews in Surgery Group*

CAGS Evidence Based Reviews in Surgery

In September 2000, the Canadian Association of General Surgeons (CAGS) initiated a program entitled "CAGS Evidence Based Reviews in Surgery" (CAGS-EBRS) to help practising clinicians improve their critical appraisal skills. During the academic year, 8 clinical articles are chosen for review and discussion. Both methodologic and clinical reviews of the article are performed by experts in the relevant areas. The *Canadian Journal of Surgery* will publish 4 of these reviews each year. Each review will consist of an abstract of the selected article and a summary of the methodologic and clinical reviews. We hope that readers will find these useful and learn skills that can be used to evaluate other articles. For more information about the CAGS-EBRS or information about participating in the program, send an email to mmckenzie@mtsinai.on.ca.

Selected article

Kebew E, Duh QY, Clark OH. Total thyroidectomy or thyroid lobectomy in patients with low-risk differentiated thyroid cancer: surgical decision analysis of a controversy using a mathematical model. *World J Surg* 2000;24: 1295-302.

Abstract

Question: What is the best surgical approach for low-risk, differentiated thyroid cancer? **Design:** Decision analysis using a simple decision tree. **Base case:** A patient with a localized, well-differentiated thyroid cancer. **Treatment alternatives:** Total or near-total thyroidectomy or thyroid lobectomy. **Outcomes considered:** Risk of surgical complications, recurrence and death after 10 years' follow-up. **Sources of estimates for probabilities and utilities:** Baseline probabilities were "weighted averages" generated from a review of mainly retrospective reviews plus the authors' experience with 156 patients. Utilities (quantitative measures of the value that a person places on a certain health state) were derived from a survey of their own patients. **Results:** Total or near-total thyroidectomy is favoured with a utility of 0.876 compared with a utility of 0.741 for lobectomy. **Sensitivity analyses:** Total or near-total thyroidectomy remains the preferred strategy unless the risk of recurrence is the same after both procedures or the risk of a complication is 33 times greater for total or near-total thyroidectomy. Also, the patient's utilities for risk of recurrence and surgical complications affect the model. **Conclusion:** Total or near-total thyroidectomy is the preferred treatment for localized, well-differentiated thyroid cancer.

Commentary

Clinicians are often faced with difficult decisions, especially as new treatments and technology become available. In the early part of the last century, it was often possible to be certain that a treatment did more

*The CAGS Evidence Based Reviews in Surgery Group comprises Drs. J.S.T. Barkun, C. Cina, G.W.N. Fitzgerald, H.J.A. Henteleff, H.M. MacRae, R.S. McLeod, C.S. Richard, M.C. Taylor, E.M. Webber and Ms. M.E. McKenzie.

Correspondence to: Ms. Marg McKenzie, RN, Administrative Assistant, CAGS-EBRS, Mount Sinai Hospital, 1560–600 University Ave., Toronto ON M5G 1X5; fax 416 586-5932

good than harm. For instance, McBurney had no doubts, just from observation, that appendectomy was the best treatment for acute appendicitis. Today, it is more likely that there are trade-offs, and even if there are differences in outcome, they may be small. Thus, McBurney would be hard pressed to be certain whether laparoscopic or open appendectomy is the preferred procedure. Laparoscopy is useful in evaluating other abdominal disorders and perhaps the scar is more cosmetically acceptable, but in reality patients do not get out of hospital or return to work earlier. At 0300 in the night, it may be easier to do an open appendectomy. A difference in mortality is not even a consideration as it was in McBurney's day.

Decision-making can be even more difficult if the treatments have not been subjected to rigorous evaluation in a randomized controlled trial, and one is left making a complex decision using clinical judgement based on the relative pros and cons of a treatment. Such an example is whether to perform a local excision or an abdominoperineal resection for an early, low-lying rectal cancer. The advantage of local excision is that patients have less morbidity and do not have a permanent colostomy. The advantage of an abdominoperineal resection is that the risk of local recurrence may be lower. However, if lymph nodes are not involved, either procedure should have an equal success rate locally, providing the tissue at the resection margin is clear of disease. If the nodes are positive or there is hematogenous spread, abdominoperineal resection may not improve survival anyway. Furthermore, although others say that abdominoperineal resection is associated with higher morbidity and mortality, in the hands of a good surgeon the likelihood of a young patient dying after this procedure is remote.

Decision analysis is the application of explicit, quantitative methods to analyze decisions under conditions of uncertainty. It allows clinicians to compare the expected consequences of pursuing different strategies. The process of decision analysis makes fully explicit all of the elements of the decision so that they are open for debate and modification. Although a decision analysis will not solve the clinical problem, it can assist in exploring the decision. Optimally, one would like to use data from randomized controlled trials (RCTs) in the decision analysis, but more often, decision analyses are performed when there are no data from RCTs.

The key to the decision analysis is that the question and strategies compared are explicitly stated, all possible outcomes are considered and the probability and utility of each outcome is also explicitly stated. The literature is systematically searched to obtain the best estimates for the probabilities and utilities. Then, sensitivity analyses are performed in which one or more of the variables is varied in order to evaluate the robustness of the model (i.e., to determine whether a change in value affects the result).

The decision analysis is started by setting up a decision tree in which 2 treatment alternatives are considered. Thus, in the decision analysis presented by Kebew and associates, the clinical question being addressed is: "What is the best surgical approach for a low-risk, well-differentiated thyroid cancer?" The 2 treatment options are total or near-total thyroidectomy, or thyroid lobectomy. The decision tree (shown in Fig. 2 of the article) is diagrammed by a square, termed a "decision node." The lines emanating from the decision node represent the clinical strategies being compared. Chance events are shown with circles, called "chance nodes," and outcome states are shown at the right of the diagram. The outcomes considered for each strategy are the risk of a surgical complication, risk of recurrence and the risk of death after a follow-up of 10 years. A probability is assigned to each outcome or branch emanating from a chance node, and for each chance node, the sum of probabilities must add up to 1.0. Similarly, a utility is assigned to each branch. Utilities are quantitative measures of the value that a person places on a certain health state; this person estimates the patient's preference for certain disease or health states. Utilities are most valid if they are obtained from patients. They may range from 0 to 1 with 0 usually signifying death and 1 excellent health. Disutilities are temporary health states; they estimate the undesirability of an outcome, in other words, the strength of non-preference for that health state.

In this study, a simple decision tree was constructed. An alternative is the Markov model, in which patients in a decision analysis cycle through the model in defined time intervals. At the end of each cycle, patients either remain in the initial health state or move to another state. As long as the patients are alive, they continue to cycle through at the defined interval. Death is an absorbing state, from which patients cannot leave, and the cycle ends. This model probably covers all of the relevant outcomes. The limitation of the model is in the data used to assign probabilities and utilities. Probabilities were obtained by performing a "focused review of the English literature" and by combining their own data on 156 patients who were followed up for 10 years. The authors acknowledge that most of the data come from small retrospective series, and there is a paucity of high-quality evidence on the subject. Including the data from their own centre may limit the generalizability of the results. Furthermore, they fail to provide the specific search strategy used, so one cannot be certain that all articles were reviewed and that the probabilities were generated without bias. Baseline probability estimates were "weighted averages," but it is not clear how these were generated as well as how the values for the potential ranges were chosen. Given the trend at this institution to perform total or near-total thyroidectomy in this situation, the chosen figures may be biased. Similarly, although the authors obtained the utilities by surveying their patient cohort, details on who was surveyed, how they were surveyed and what proportion of questionnaires were completed are omitted. Thus, one cannot evaluate the validity of the utilities.

From the baseline probabilities and utilities assigned, total or near-total thyroidectomy is favoured, having a utility of 0.876 compared with 0.741 for lobectomy. Thus, the authors conclude that total or near-total thyroidectomy is preferred. Sensitivity analyses were performed, and the authors found that total or near-total thyroidectomy remains the preferred strategy regardless of the complication rate, unless the risk of recurrence is similar after each operation. The risk of a complication after total thyroidectomy would have to be 33 times greater than after lobectomy for lobectomy to become the preferred strategy. In their Fig. 3, the authors show the effect of varying the utilities for cancer recurrence versus a surgical complication. Not unexpectedly, the preferred treatment option varies, depending on the patient's utilities for both of these outcomes.

Because of methodologic concerns related to this decision analysis, and that the present trend in management of well-differentiated thyroid cancer is to total thyroidectomy, this decision analysis may be of limited value. Total thyroidectomy is preferred because of the decreased recurrence rate after bilateral surgery with a minimal increase in risk. Total thyroidectomy is in essence a bilateral lobectomy, and as such should not be associated with a significantly higher complication rate than the lesser procedure. The trade-off for a decrease in tumour recurrence is a small risk of hypoparathyroidism, which is easily treated. Thus, total thyroidectomy is becoming accepted as the preferred treatment for well-differentiated thyroid cancers with the exception of small tumours, generally less than 1.5 to 2.0 cm in dimension in patients who have undergone a thyroid lobectomy for a diagnosis with indeterminate cytologic findings or for another indication with equivocal findings. Thus, the real benefit of a structured decision analysis in this scenario may be as a decision aid. Both patient preferences and surgeon-specific complication rates could be incorporated into the model to assist in decision-making. This assumes that surgeons performing thyroidectomy know their own complication rates, which may not be the case.

Optimally, an RCT is needed to determine which is the best treatment option. However, thyroid cancer is relatively rare, with an estimated incidence of 1900 cases per year in Canada. Not all of these are well-differentiated cancers. Recurrence and death are relatively rare events, so it is unlikely that even a multi-institutional RCT could be performed. Even if data from an RCT were available, a decision analysis might be useful in that individual patient preferences, tumour characteristics and surgeon variables might differ, and these could be incorporated into the model to assist in decision-making.

Acknowledgements: The Canadian Association of General Surgeons Evidence Based Reviews in Surgery is supported by an unrestricted educational grant from Ethicon Inc., Ethicon Endo-Surgery Inc.