

The role of a decision analysis in treatment of T2N0 esophageal cancer

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Provenance: This is an invited article commissioned by the Section Editor Zhicheng He (Department of Thoracic Surgery, Jiangsu Province Hospital, the First Affiliated Hospital of Nanjing Medical University, Nanjing, China).

Response to: Wee JO. cT2N0 esophageal cancer remains a difficult diagnosis. *J Thorac Dis* 2018;10:S2147-8;

Cerfolio RJ. Are predictive models useful in clinical medicine? *J Thorac Dis* 2018;10:S1938-9.

Submitted Jul 27, 2018. Accepted for publication Aug 08, 2018.

doi: 10.21037/jtd.2018.08.47

View this article at: <http://dx.doi.org/10.21037/jtd.2018.08.47>

We would like to thank Dr. Wee (1) and Dr. Cerfolio (2) for their interest in our article (3). Their thoughtful editorials raise several important points about our research, “*Comparative effectiveness of upfront esophagectomy versus induction chemoradiation in clinical stage T2N0 esophageal cancer: A decision analysis*”, that merit in-depth consideration.

First, an understanding of what decision analysis is and how it can be employed to answer clinical questions is essential for appropriately interpreting studies using the technique. Decision analysis is a form of mathematical modeling that provides a “systematic, quantitative approach to decision-making under situations of uncertainty” (4). It is highly useful for studying complex treatment decisions, especially in the setting of multiple types of uncertainty. The problem of T2N0 esophageal cancer is one such example where there is considerable diagnostic inaccuracy, each treatment option carries risk, and thus the benefits of induction chemoradiation versus upfront surgery are uncertain. The ideal way to answer these questions is through a randomized controlled trial, but this is not always feasible. When strong evidence is lacking, providers often rely on clinical experience, but this can have significant limitations for complex decisions. Decision analysis allows for a logical, data-driven analysis of the clinical question. By creating a decision tree, this complex decision can be broken down into components: the treatment choices of interest, the possible consequences of each treatment, and the associated outcomes. Each of

these components can be methodically evaluated: the best estimate for each probability or survival estimate can be derived from published literature or from primary data. These components are then recombined through analysis of the model, which will suggest the best overall decision. Sensitivity analyses can be performed which allow for estimates to be varied over a clinically plausible range. Sensitivity analyses, therefore, are useful for understanding which components are most important to the overall decision and can be used to identify a threshold at which one treatment option should be selected over the other. Understanding the impact of diagnostic uncertainty of endoscopic ultrasound on the treatment decision and identifying the threshold for benefit of induction chemoradiation were primary goals in our study. This is because, as Dr. Wee points out (1), even in the face of diagnostic uncertainty, if we can identify features that place an individual patient above or below the threshold of benefit for induction therapy, we can more appropriately deliver the right treatment to the subpopulation of T2N0 patients most likely to benefit from it.

Armed with this threshold, one can then consider clinical characteristics and their associated oncologic risk in a more informed way to determine if the patient is likely to benefit from induction chemoradiation or upfront surgery. To this point, it is worth clarifying our discussion of risk. Because this study focused on the probability of upstaging, when we discuss high-risk and low-risk patients, we are referencing

their oncologic risk—that is, the likelihood that their cancer was more advanced than T2N0—not their surgical risk. As Dr. Cerfolio notes (2), we did not specifically build various individual factors that can affect the accuracy of endoscopic ultrasound or a patient's risk of pathologic upstaging into to our decision tree itself. As illustrated in his editorial and our discussion, there are numerous factors—both related to the endoscopic ultrasound exam itself and the tumor—that may vary substantially across patients, providers, and institutions. To calculate the impact of all of these factors on probability of upstaging in a clinically usable way, a nomogram or risk calculator might be the most appropriate technique. The output of such a tool, however, would be the probability of upstaging, and a provider would still be left with the question of what to do with that probability. Our study identifies the threshold for predicted benefit of induction chemoradiation, and provides the answer to that question. Our discussion of predictive factors demonstrates how this model can be useful to the provider who sees a spectrum of patients. Knowing this threshold is useful currently for using the discrete clinical factors we identified and explored in our discussion, but also will be helpful if the more complex prediction tools that Dr. Cerfolio (2) alludes to are developed for the T2N0 population, or if, as Dr. Wee suggests (1), additional molecular signatures can be identified that predict more high-risk tumor biology.

Cite this article as: Semenkovich TR, Meyers BF, Kozower BD, Puri V. The role of a decision analysis in treatment of T2N0 esophageal cancer. *J Thorac Dis* 2018;10(Suppl 26):S3309-S3310. doi: 10.21037/jtd.2018.08.47

Acknowledgements

Funding: This work was supported by a Barnes Jewish Hospital Foundation Grant, National Institutes of Health (NIH) Grant Numbers 2T32HL7776-21 and K07CA178120, and the Division of Cardiothoracic Surgery at Washington University in St. Louis.

Footnote

Conflicts of Interest: The authors have no conflicts of interest to declare.

References

1. Wee JO. cT2N0 esophageal cancer remains a difficult diagnosis. *J Thorac Dis* 2018;10:S2147-8.
2. Cerfolio RJ. Are predictive models useful in clinical medicine? *J Thorac Dis* 2018;10:S1938-9.
3. Semenkovich TR, Panni RZ, Hudson JL, et al. Comparative effectiveness of upfront esophagectomy versus induction chemoradiation in clinical stage T2N0 esophageal cancer: A decision analysis. *J Thorac Cardiovasc Surg* 2018;155:2221-30.e1.
4. Hogendoorn W, Moll FL, Sumpio BE, et al. Clinical Decision Analysis and Markov Modeling for Surgeons: An Introductory Overview. *Ann Surg* 2016;264:268-74.