

**Figure 1** Magnetic Resonance Cisternography demonstrating a right-sided CSF leak

## Background

Diagnostic and localizing strategies for cases of cerebrospinal fluid (CSF) rhinorrhea vary widely. Recent reviews have established sensitivities and specificities for diagnostic modalities. To date, no study has investigated the cost implication of using a certain order of tests to arrive at a diagnosis and ultimately treatment.

## Methods

A decision tree analysis of diagnostic algorithms for CSF rhinorrhea localization was performed. The primary outcome measured was cost, with estimated study costs from the Centers for Medicare and Medicaid. The model was parameterized using the best available current literature; a systematic review was performed of studies published from 1990 to 2017 to estimate the sensitivity, specificity, and accuracy of four localization modalities for CSF rhinorrhea. One-way sensitivity analyses were performed via TreeAge Pro software.

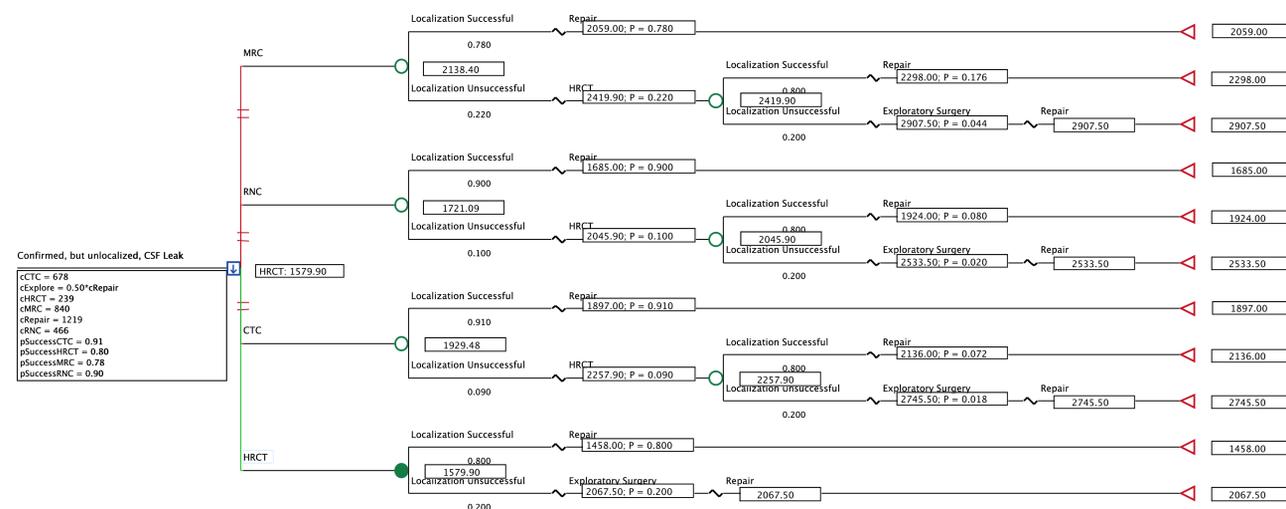
## Results

The use of High-Resolution Computed Tomography (HRCT) followed by exploration in the operating room if preliminary HRCT was negative was found to be the least costly means of diagnosing and localizing a patient with a high index of suspicion for CSF leak (expected cost \$1579). The next least costly algorithm was CT-Cisternogram (CTC) followed by visualization in the operating room (expected cost \$1897). Sensitivity analyses generally supported HRCT to be the optimal strategy over a wide range of parameter values.

## Conclusion

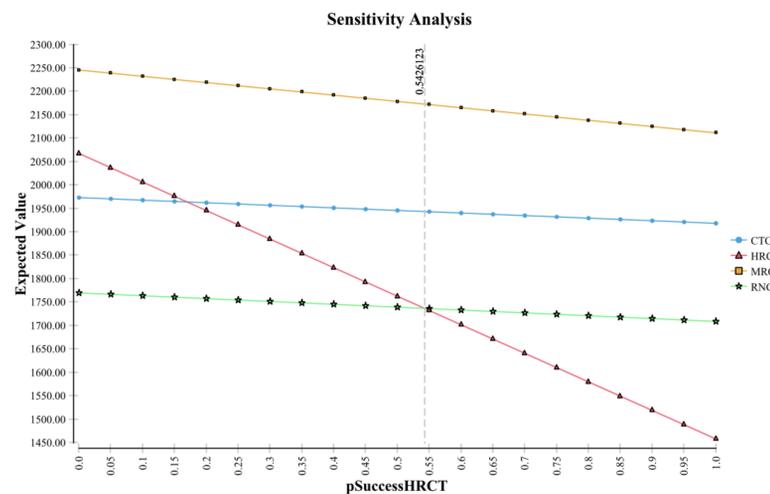
Our model suggests primary use of HRCT for localization is the lowest cost approach to localize CSF leaks in patients with confirmed CSF rhinorrhea. These results differ from previously published algorithms with respect to CTC. Considering the additional risks and discomfort associated with intrathecal contrast and lumbar puncture, we recommend HRCT as the first line to localize an assist in treating CSF rhinorrhea.

## Decision Tree Model for Cost of Localizing Clinically Suspicious CSF Leaks



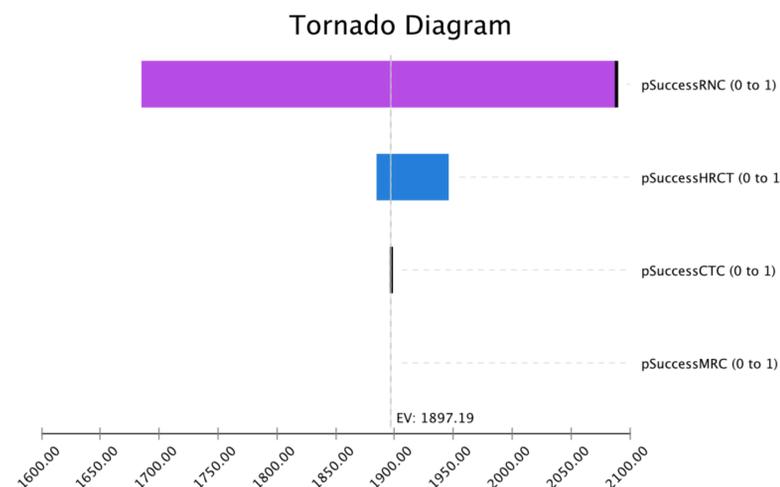
**Figure 2** Decision tree for diagnosis of CSF leaks with sensitivities and pricing

## Cost Based on Localization Success of High-Resolution Computed Tomography



**Figure 3** Sensitivity Analysis for Probability of HRCT Success  
Cost of CSF localization (Y-axis) as a function of probability of localization success for HRCT (X-axis). As probability of success of HRCT increases above 54%, the expected cost of localizing a CSF leak using HRCT becomes the least costly method relative to all other methods. Notice that even at extremely low success probabilities for HRCT, HRCT is less costly than MR-Cisternography.

## Sensitivity of Each Model Parameters to Cost of Localization



**Figure 4** Tornado Diagram for Probability of Successful Localization for Each Modality  
Cost of CSF leak localization with relation to the success of detection modalities. The wider the bar, the greater the change in the cost workup algorithm as the success of each test changes. As shown, the model is most sensitive to changes in the success rate of RNC.

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## References

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