

# USE OF A NEURAL NETWORK TO EVALUATE POSTOPERATIVE COMPLICATIONS IN THYROID SURGERY.

Hugo Fontan Kohler, José Guilherme Vartanian, Genival Barbosa de Carvalho, Luiz Paulo Kowalski.

Department of Head and Neck Surgery and Otolaryngology - A C Camargo Cancer Center



**A.C. Camargo  
Cancer Center**  
Centro Integrado de Diagnóstico,  
Tratamento, Ensino e Pesquisa

## 1. INTRODUCTION

Complications are inherent to any surgical procedure and have a significant impact on patient's quality of life and treatment costs.

We propose a model to evaluate quality of care for patients submitted to thyroid surgery.

## 2. MATERIALS AND METHODS

We analyzed all patients submitted to thyroidectomy at a single institution from January 2004 to December 2019. The following variables were included in the database: age, sex, body mass index (BMI), comorbidities, type of surgery (partial vs total), neck dissection, diagnosis and acting surgeon. The outcomes were dysphonia, hypocalcemia, local, length of stay and overall complications. Systemic complication was not analyzed by itself due to the low number of events. Logistic regression models and neural networks were developed for each outcome and compared to each other.

## 3. RESULTS AND DISCUSSION

We included 5,877 patients in this analysis. There were 4,603 females (78.31 %) and 1,275 males (21.69 %). Age ranged from 6 to 94 years (mean, 45.2 years; SD, 6.13 years) and BMI ranged from 13.8 to 42.90 (mean, 27.4; SD, 6.13). Total thyroidectomy was performed in 4,882 patients (83.05 %) and partial thyroidectomy, in 996 patients (16.94 %). Neck dissection was performed in 704 patients (11.98 %). Dysphonia was diagnosed in 377 patients (7.01 %), hypocalcemia in 931 patients (15.84 %), other local complications in 272 patients (4.63 %) and systemic complications in 77 patients (1.31 %). The incidence of postoperative complications varied from surgeon to surgeon as did the patient profile. In the logistic regression models, we identified type of surgery, BMI and neck dissection as significant for postoperative complications with an area under the ROC curve of 0.617. We trained neural networks using the multilayer perceptron, convolutional neural network (CNN) and recurrent neural network algorithms. To augment the number of adverse events the synthetic minority oversampling technique was used. We partitioned the data using a 0.65 fraction for training and a 0.35 fraction for testing. The best performance was the CNN with an AUC of 0.84 and a tendency for overfitting. Afterwards, we compared the estimated number of complications adjusted for the model error and the real number of observed complications. Although discrepancies among different team members persisted, the differences in patient profiles accounted for several of them.

## 4. CONCLUSION

A CNN has a good performance although with a significant tendency for overfitting. It may help to evaluate outcomes and evaluate, in the preoperative setting, the risk of complications, allowing for preventive measures to be undertaken in apt time.