

# Relationship between surgeon experience and adverse events in thyroid surgery

*Tommaso Loderer, Davide Beretta, Federico Cozzani, Elena Bonati, Matteo Rossini, Paolo Del Rio*

Department of Medicine and Surgery, General Surgery Unit, Parma University Hospital, Parma, Italy.

**Abstract.** In scientific literature there are numerous authors that have highlighted how the outcome of patients undergoing surgical treatment, such as intraoperative or postoperative complications, surgical time, mean hospital stay, is related to the surgeon's experience based on the number of cases treated per year for a specific disease. In our study we decided to verify if, in our clinical practice, there are significant differences in postoperative outcomes between procedures performed by a senior surgeon, a young specialist or a surgical resident, evaluating if surgical experience affects positively either on intraoperative complications such as bleeding, hypocalcemia, dysphonia, or on surgical time, mean hospital stay and postoperative complications. In this retrospective study we examined all cases of patients that underwent surgery for thyroid disease at our Operative Unit, from January 1, 2015 to December 31, 2019. The analysis of our data highlights how the surgeon's experience affects the surgical outcome of patients undergoing lobectomy or total thyroidectomy. Our conclusion was that a high volume center, like the one we are working in, with a correct selection of the patients, allows to train a surgical resident guaranteeing both the surgical training of the doctor and the patients safety. ([www.actabiomedica.it](http://www.actabiomedica.it))

**Keywords:** thyroidectomy, surgical resident, learning curve, postoperative complications

## Introduction

In scientific literature there are numerous authors that have highlighted how the outcome of patients undergoing surgical treatment, such as intraoperative or postoperative complications, surgical time, mean hospital stay, is related to the surgeon's experience based on the number of cases treated per year for a specific disease (1-13).

In our experience at the Hospital-University of Parma we started a reorganization of the Surgical Department (14), organizing surgical activity into different disease management pathways related to the high volume surgical clinical practice.

Endocrine surgery is one of the disease surgical

management pathways involved in this reorganization at our clinic. We have a high volume per year of surgical procedures for thyroid pathology and this elevated number of procedures favors surgeons experience and allows young residents who approach this type of surgery to get trained and to make a learning curve.

In our study we decided to verify if, in our clinical practice, there are significant differences in postoperative outcomes between procedures performed by a senior surgeon, a young specialist or a surgical resident, evaluating if surgical experience affects positively either on intraoperative complications, such as bleeding, hypocalcemia, dysphonia, or on surgical time, mean hospital stay and postoperative complications.

## Materials and Methods

In this retrospective study we examined all cases of patients that underwent surgery for thyroid disease at our Operative Unit, from January 1, 2015 to December 31, 2019, after authorization by ethical committee.

Cases were collected and authorized by an institutional review board database of thyroid surgical operations, carried out by General Surgery Unit, Department of Surgery, University Hospital of Parma, Parma, Italy.

We collected data regarding patient's gender, age, type of surgical procedure (total thyroidectomy and hemithyroidectomy), surgical time (in minutes), length of hospital stay, occurrence of postoperative bleeding, presence of postoperative dysphonia and pre-and post-operative (24 h after surgery) serum calcium levels, defining as hypocalcemia the presence of serum calcium values below 8 mg/dL. Those data were compared with the experience of the lead surgeon considering three categories based on the expertise in thyroid surgery:

- senior surgeon (over 1000 thyroid surgical procedures),
- young specialist surgeon (at least 50 surgical procedures per year),
- surgical resident under tutoring.

Collected data were analyzed using Pearson's chi-square test for parametric variables while nonparametric variables were considered using student's T test.

Values of  $p < 0.05$  were considered statistically significant.

## Results

Data were collected on 1216 patients that underwent surgical treatment for thyroid disease, including 917 females and 295 males, on 4 patient data about gender were missing.

Out of all surgical procedures we found 941 cases of total thyroidectomy (77.4%) and 275 cases of hemithyroidectomy (22.6%). In table 1 we report the type of surgical procedure performed based on surgeon's experience.

The preoperative diagnosis of the patients that underwent surgery were also divided according to the

**Table 1:** Surgical procedure

Lead Surgeon	Surgical procedure		
	Lobectomy	Total thyroidectomy	Tot.
Resident	12 (11,5%)	92 (88,5%)	104
Young specialist	39 (18,9%)	167 (81,1%)	206
Senior surgeon	224 (24,8%)	682 (75,2%)	906

experience of the lead surgeon that performed the procedure:

- a) senior surgeon (906 cases):
  - indeterminate nodule: 236 cases
  - malignant nodule: 284 cases
  - Plummer adenoma: 10 cases
  - Basedow disease: 71 cases
  - goiter: 300 cases
  - medullary carcinoma: 5 cases
- b) young specialist surgeon (206 cases):
  - indeterminate nodule: 64 cases
  - malignant nodule: 42 cases
  - Plummer adenoma: 13 cases
  - Basedow: disease 13 cases
  - thyroid goiter: 74 cases
- c) surgical resident surgeon (104 cases):
  - indeterminate nodule: 50 cases
  - malignant nodule: 16 cases
  - Plummer adenoma: 8 cases
  - thyroid goiter: 30 cases

We analyzed the surgical procedure time and it emerged that the mean operating time was 53,6 +/- 18,6 minutes for the senior surgeon, 69,8 +/- 21,5 minutes for the young specialist surgeon and 61,4 +/- 19,1 minutes for the resident. The surgical time of the senior surgeon resulted to be inferior to both the young specialist surgeon and the resident. (Table 2)

The mean operating time was also analyzed considering the different surgical procedures, total thy-

**Table 2:** Mean surgical time related to the lead surgeon

Surgical time (min)	Surgical time (min)	P
Resident 61,4+/- 19,1min	Young specialist 69,8+/-21,5	<0,001
Resident 61,4+/- 19,1min	Senior surgeon 53,6+/-18,6	<0,001
Young specialist 69,8+/-21,5	Senior surgeon 53,6+/-18,6	<0,001

roidectomy and hemithyroidectomy. The average surgical time for total thyroidectomy was 57,8 minutes for the senior surgeon, 73,9 minutes for the young specialist surgeon and 63,6 minutes for the resident.

The average surgical time for hemithyroidectomy was 41 minutes for the senior surgeon, 53,8 minutes for the young specialist surgeon and 45,8 minutes for the resident. (Table 3)

If we analyze the data about the length of hospital stay for surgery, we can highlight that the mean hospital stay was 2,03 +/- 0,7 days for the senior surgeon, 1,90 +/- 0,3 days for the young specialist and 1,82 +/- 0,5 days for the resident.

In our results about the length of hospital stay we found a statistically significant positivity by comparing the data between the cases operated as lead surgeon by a resident and the senior surgeon ( $p < 0.007$ ) and between the young specialist and the senior surgeon ( $p < 0.024$ ); no statistically significant correlation was found in the mean length of hospital stay between the patients treated by the resident and the young specialist.

From data analysis of postoperative calcium serum levels, dosed 24 hours after surgery, the mean calcium value resulted to be 8,65 mg/dl and, as predictable, we recorded a higher incidence of hypocalcemia in the cases of total thyroidectomy then in the cases of hemithyroidectomy, 22,5 % VS 4,4%. In 79 cases, out of the 1216 analyzed, data about calcium serum levels were missing. (Table 4)

Analyzing the data divided into three categories according to the lead surgeon it emerged that in the total thyroidectomy procedures performed by a resi-

**Table 3:** mean surgical time: lobectomy VS total thyroidectomy

	Lobectomy	Total thyroidectomy
Resident	45,8 min	63,6 min
Young specialist	53,8 min	73,9 min
Senior surgeon	41 min	57,8 min

**Table 4:** Postoperative hypocalcemia from the analysis of 1137 cases out of 1216

	Postoperative hypocalcemia	
	No	Yes
Lobectomy	237 (95,6%)	11 (4,4%)
Total thyroidectomy	689 (77,5%)	200 (22,5%)

dent there was a lower incidence of early postoperative hypocalcemia cases compared to the ones performed by the young specialist and the senior surgeon, resulting respectively 16,9%, 18,1% and 24,3%.

From the analysis of the data collected about early postoperative complications, dysphonia and postoperative bleeding, it came out that there were no statistically significant differences between the three groups of lead surgeons, with no cases of dysphonia and bleeding in the patients operated by a resident, out of 104 patients, 2% cases of dysphonia and 0,5% of bleeding in the patients treated by the young specialist out of 206 patients, and 0,8% of dysphonia and 0,6% of bleeding in the cases of the senior surgeon group, out of 906 patients. (Table 5)

We also evaluated the presence of postoperative complications 90 days after surgery and it emerged that for the resident cases there were 1% of dysphonia and 3,1% of postoperative hypocalcemia out of 98 treated cases, for the young specialist surgeon 2,1% of dysphonia and 3,2% of hypocalcemia out of 187 cases and for the senior surgeon 1,9% of dysphonia and 1,7% of hypocalcemia out of an amount of 853 cases treated. In 78 cases out of our sample follow up data were missing. (Table 6)

## Discussion

The retrospective analysis of our data, collected on a significant sample of surgical procedures, highlights how the surgeon's experience affects the surgical out-

**Table 5:** Early postoperative complications

Lead Surgeon	Early postoperative complications			
	None	Dysphonia	Hypocalcemia	Bleeding
Resident	92,3%	0%	7,7%	0%
Young specialist	92,6%	2%	4,9%	0,5%
Senior surgeon	92,5%	0,8%	6,1%	0,6%

**Table 6:** Postoperative complications 90 days after surgery

Lead Surgeon	Late postoperative complications		
	None	Dysphonia	Hypocalcemia
Resident	95,9%	1%	3,1%
Young specialist	94,7%	2,1%	3,2%
Senior surgeon	96,8%	2%	1,2%

come of patients undergoing lobectomy or total thyroidectomy (15).

In our study, if we analyze the outcome data between the young specialist and the resident surgeon, it emerges that the resident has better results in terms of surgical time, length of hospital stay and postoperative complications, than the young specialist surgeon experienced in thyroid surgery. In fact this figure should be reviewed in light of the fact that the surgical action of a resident as a lead surgeon is always supervised and assisted by an expert endocrine surgeon and that the procedures performed by a resident are usually selected and easier than the ones performed by the other two groups.

From our data it emerges that the senior surgeon performs the highest number of surgical procedures that are usually also of greater complexity and with a potential rate of major intra and perioperative complications compared to the ones performed by the young specialist or the resident.

In our study, all three groups of surgeons resulted to have an outcome comparable with the national average for high volume centers as reported in scientific literature (16,17).

The aim of our study was not to confirm that in a high volume center for the treatment of a specific disease there are less postoperative complications, since this it is a well-known datum in scientific literature, especially in thyroid surgery, but we wanted to find out if a high volume center, like the one we are working in, allows to train a surgical resident guaranteeing both the surgical training of the doctor and the patient safety.

Our conclusion was positive since the outcome of the patients, with a correct selection of the same, was quite similar comparing the senior surgeon and the resident. Our study confirms that in a high-volume center for the surgical treatment of a specific disease a young resident has the possibility to be trained and supervised by an expert surgeon and to be confronted with an elevated number of surgical cases allowing to make a faster and better learning curve.

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**Correspondence:**

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Dott. Loderer Tommaso  
Unit of General Surgery, University Hospital of Parma  
Via Gramsci 14, 43126, Parma, Italy.  
Tel: +39 3204173821  
Fax: +39 0521703568  
E-mail: [tommasoloderer@gmail.com](mailto:tommasoloderer@gmail.com)