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Same-day discharge is not associated with increased readmissions or complications after thyroid operations

Q. Lina Hu, MD, MS[a,b,*], Masha J. Livhits, MD[a,c], Clifford Y. Ko, MD, MS, MSHS[a,b], Michael W. Yeh, MD[a,c]

[a] Department of Surgery, David Geffen School of Medicine at University of California, Los Angeles, CA
[b] Division of Research and Optimal Patient Care, American College of Surgeons, Chicago, IL
[c] Section of Endocrine Surgery, David Geffen School of Medicine at University of California, Los Angeles, CA

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ABSTRACT

Background: Overnight hospitalization after thyroid surgery has been a widely adopted practice because of the concern for complications such as hypocalcemia and hematoma. Same-day discharge, however, has become popular in recent years.

Methods: The American College of Surgeons National Surgical Quality Improvement Program Targeted Thyroidectomy database (2016–2017) was used to identify patients who underwent thyroid resections. A 1:1 propensity score matching was used to match patients who were discharged on postoperative day 0 and those discharged on postoperative days 1 or 2. Multivariable logistic regression models were constructed to assess the association between discharge timing and postoperative outcomes.

Results: Of the 10,502 patients, 2,776 (26.4%) were discharged on postoperative day 0, and 7,726 (73.6%) were discharged on postoperative days 1 or 2. After propensity score matching, 1,977 matched pairs were created. In this matched cohort, the rates of readmission were similar when comparing patients discharged on postoperative day 0 with those discharged on postoperative days 1 or 2 (odds ratio 1.26, 95% confidence interval 0.78–2.05). Likewise, no differences were observed in the rates of surgical site infection, clinically severe hypocalcemia, neck hematoma, or recurrent laryngeal nerve injury.

Conclusion: In a national cohort of patients undergoing thyroid surgery, same-day discharge was not associated with greater rates of readmission or complications when compared with discharge 1 or 2 days after thyroid surgery.

Introduction

Overnight hospitalization after thyroid surgery has been a widely adopted practice because of the concern for potentially serious postoperative complications, such as severe hypocalcemia and neck hematoma. Despite these potential concerns, same-day discharge after thyroid resections has gained popularity in recent years.[1–3] Numerous case series and cohort studies have shown that in appropriately selected patients, same-day discharge can be achieved safely without increased risk for complications.[3–7] The practice further offers the benefits of improved patient comfort and decreased costs of health care.[8,9] In a study of almost 50,000 thyroidectomies using the University HealthSystem Consortium Database, Marino et al[9] found that same-day surgery was associated with significantly lesser costs compared with overnight observation.

Nevertheless, concerns remain among many surgeons regarding the safety of same-day discharge after thyroid resection.[10–13] Postoperative neck hematoma is a potentially serious complication that may lead to airway compromise and death without rapid intervention. Furthermore, a fraction of neck hematomas (19%–57%) may develop in a delayed manner more than 6 hours postoperatively.[10–12] Studies investigating the safety of outpatient thyroid resection have been limited by a single-institution design, restriction to specific types of thyroid operations (eg, partial thyroidectomy), or lack of examination of thyroid-specific complications. In addition, the definition of outpatient surgery in the literature is highly variable, ranging from true same-day discharges (ie, zero days from operation to discharge) to operations performed in an outpatient surgery center, to 23-hour observations in the

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* Reprint requests: Q. Lina Hu, MD, MS, American College of Surgeons, 633 N. St. Clair Street, 22nd Floor, Chicago, IL 60611.
E-mail address: lhu@facs.org (Q.L. Hu).

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hospital. This ambiguity in terminology has been an obstacle to drawing clinically applicable conclusions from published studies. The objective of this study was to examine the safety of same-day discharge after all thyroid operations, using a national, clinically validated registry with standardized definitions and thyroid-specific outcomes.

Methods

Data source

Patients who underwent elective thyroid resection from January 1, 2016, to December 31, 2017, were identified from the American College of Surgeons National Surgical Quality Improvement Program (ACS NSQIP) Targeted Thyroidectomy database. The ACS NSQIP database includes more than 200 validated data points on patient characteristics, operative details, and 30-day postoperative events on a large number of cases across a variety of practice settings across the United States.[14,15] The targeted data set additionally captures 26 thyroid-specific variables, including operative indication, intraoperative techniques, and thyroid-specific postoperative outcomes, such as hypocalcemia, injury to the recurrent laryngeal nerves (RLNs), and neck hematoma. Reliability of the data is ensured through centrally defined variable definitions, data collection by trained clinical abstractors, and program audits.[16] Because this study used pre-existing, deidentified data, the Advarra Institutional Review Board (Columbia, MD) deemed it exempt from oversight.

Patient selection

Thyroid operations were identified using Current Procedural Terminology codes and included partial thyroid lobectomy (60210 and 60212), thyroid lobectomy (60220 and 60225), total thyroidectomy (60240, 60252, 60270, and 60271), and completion thyroidectomy (60260). Emergency cases and operations involving lateral neck dissections (60254 or 38724) were excluded.

Same-day discharge

Same-day discharge was defined as discharge on postoperative day (POD) 0 (ie, 0 days between the date of procedure and the date of discharge). These patients were compared with patients who were discharged on PODs 1 or 2. Patients who were discharged on or after POD 3 were excluded, because many of these patients represented a heterogenous population with potentially other causes of extended duration of stay unrelated to their thyroid operations.

Risk-adjustment variables

Patient demographics (eg, age, race/ethnicity), preoperative comorbidities (eg, hypertension, diabetes mellitus), American Society of Anesthesiologists (ASA) class, functional status, laboratory values (eg, serum albumin level), and operative details (eg, wound classification) were considered for risk adjustment. Additional thyroid-specific details (eg, operative indication, intraoperative RLN monitoring) were also included as candidate variables for adjustment.

30-day postoperative outcomes

The primary outcome was 30-day readmission, which was defined as readmission to a hospital—which may or may not be the same hospital at which the initial operation was performed—within 30 days of the operation. Secondary outcomes evaluated included death or serious morbidity, overall surgical site infection, reoperation, and 3 thyroid-specific complications—clinically severe hypocalcemic event, RLN injury, and neck hematoma. A serious morbidity event included 1 or more the following complications: cardiac arrest, myocardial infarction, pneumonia, renal insufficiency, acute renal failure, reoperation, deep or organ-space surgical site infection, systemic sepsis, unplanned intubation, urinary tract infection, or wound disruption. A clinically important hypocalcemic event was defined as (1) requiring intravenous calcium supplementation, (2) emergent evaluation in the clinic or emergency department for signs and symptoms related to abnormally low serum calcium levels, or (3) readmission for signs and symptoms related to low serum calcium. RLN injury was defined as (1) symptoms of hoarseness or vocal cord dysfunction beyond POD 1, (2) laryngoscopy confirming vocal cord paresis or paralysis, or (3) tracheostomy requirement for airway obstruction. Finally, neck hematoma was defined as documentation of a hematoma and any additional interventions required, such as (1) additional observation, (2) intervention including drainage of blood or reoperation, or (3) tracheostomy. Specifically, documentation of only ecchymosis or "bruising" at the surgical site did not qualify as a hematoma.

Statistical analysis

Overall, missing or unknown rates were low (<1% for most variables and <5% for all variables). Standard ACS NSQIP variables with missing data were imputed using maximum likelihood estimation using the entire ACS NSQIP data set.[17] Thyroid-specific variables were not imputed, and missing or unknown variables were considered as negative responses in the analysis, because all thyroid-specific variables required specific documentation in the clinical chart for non-negative coding (eg, documentation of intraoperative RLN monitoring in the operative report). Continuous variables were compared using the Student's t tests, and categorical variables were compared using the Pearson's χ^2 tests for association. A multivariable logistic regression with stepwise backward selection from all measured patient and perioperative characteristics was used to determine factors associated with same-day discharge and to calculate the propensity score or the estimated probability of being discharged on POD 0. Propensity score–matched cohorts on the basis of discharge timing were then generated using a "greedy" 1:1 algorithm with a 0.2 caliper width based on the logit of the propensity score. The match balance was assessed graphically comparing standardized differences in the means of matched variables before and after the match. A threshold of 0.1 was used to define adequate balance.

Baseline patient characteristics, operative details, and postoperative outcomes were compared between the matched cohorts using the Student's t test or the Pearson's χ^2 test for association where appropriate. Multivariable logistic regression models were created to evaluate the association of same-day discharge with postoperative outcomes and adjusting for patient and case mix. All candidate, risk-adjustment variables were entered into the regression models, and relevant variables were selected using a stepwise backward selection process. Postoperative outcomes were evaluated for the overall population of patients undergoing all thyroid resections and for a subgroup of patients undergoing total thyroidectomy only. Adjusted associations were presented as odds ratios (ORs) with 95% confidence intervals (CIs) comparing patients discharged on POD 0 with patients discharged on PODs 1 and 2. That is, ORs greater than 1.0 represented greater odds of adverse outcome associated with same-day discharge. All tests of statistical significance were 2-sided with $\alpha = 0.05$. All statistical analyses were performed in SAS, v 9.4 (SAS Institute, Cary, NC).

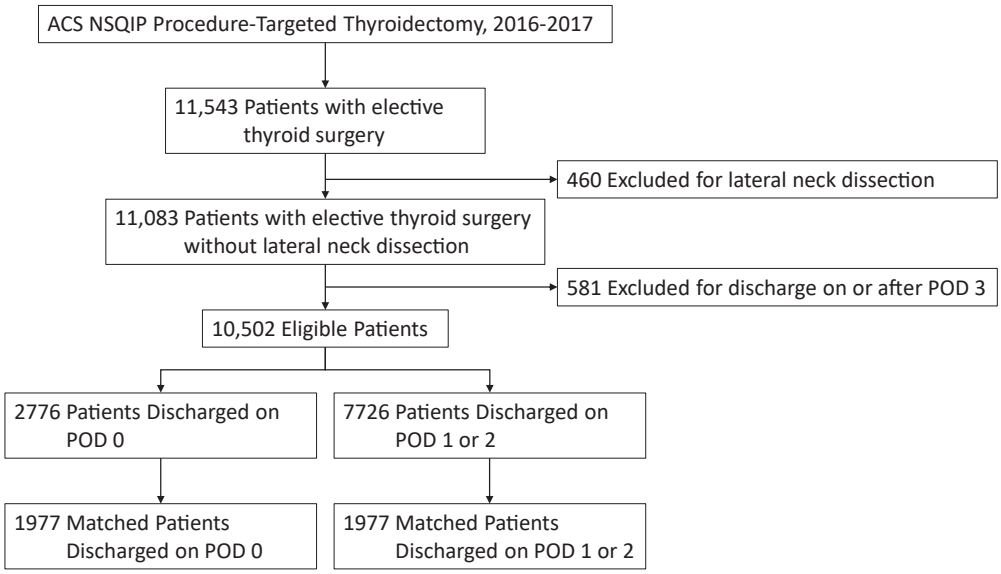

Fig. Patient selection.

Results

Patient characteristics

A total of 11,543 patients underwent elective thyroid resection from January 1, 2016 to December 31, 2017. Of these, 460 patients underwent lateral neck dissections, and 581 were discharged on or after POD 3. After excluding these patients, there were 10,502 patients, of whom 2,776 (26.4%) were discharged on POD 0,and 7,726 (73.6%) were discharged on POD 1 or 2 (Fig). In the unmatched cohort, same-day discharge occurred more frequently in patients who underwent partial thyroid lobectomy (10.2% vs 5.0%), thyroid lobectomy (59.0% vs 25.1%), or completion thyroidectomy (5.0% vs 4.7%; $P < 0.01$). Patients who were discharged on POD 0 were also generally younger, more functionally fit (ie, ASA class I or II), and had fewer comorbidities (ie, obesity, hypertension, chronic obstructive pulmonary disease; Table I). Those discharged on POD 0 were also more likely to be undergoing a thyroid operation for single nodules (51.2% vs 32.1%, $P < .01$).

Propensity score matching

A multivariable logistic regression model was constructed to estimate the predicted probability of being discharged on POD 0. All measured baseline characteristics were entered into the model with stepwise backward selection, and 16 variables were identified as independently associated with discharge status (Table II). Patient characteristics predictive of same-day discharge included younger age, white race, ASA class I or II, independent functional status, and lack of comorbidities such as diabetes mellitus and dyspnea. Operative characteristics predictive of same-day discharge included lobectomy, single nodule, central neck dissection, use of a vessel sealant device, intraoperative RLN monitoring, and no use of a postoperative drain. Postoperatively, laboratory testing of serum parathyroid hormone (PTH) levels was predictive of same-day discharge, and laboratory testing of serum calcium levels and replacement of calcium were predictive of inpatient stay. Accounting for differences in these characteristics, propensity score matching yielded 1,977 matched pairs, among whom no differences in baseline characteristics were found (Table I).

Association between discharge timing and postoperative outcomes

In the matched cohort, the crude rates of readmission were similar when comparing patients discharged on POD 0 with those discharged on PODs 1–2 (2.0% vs 1.6%, $P = .33$). This lack of any difference remained true after multivariable adjustment (OR 1.26, 95% CI 0.78–2.05). Only 1 patient in the inpatient group died, and the cause of death was not related to a thyroid-specific complication. We observed no differences in the crude rates of serious morbidity between the 2 groups (1.1% vs 1.3%, $P = .66$) or adjusted death or serious morbidity (OR 0.85, 95% CI 0.48–1.50). Similarly, no differences were found in any other adverse postoperative outcomes, including clinically severe hypocalcemia (OR 1.02, 95% CI 0.57–1.81), RLN injury (OR 0.81, 95% CI 0.59–1.10), and neck hematoma (OR 1.24, 95% CI 0.67–2.32; Table III).

Moreover, when focusing only on patients who suffered an RLN injury either confirmed by laryngoscopy or which required tracheostomy, there were no differences observed in the POD 0 discharge group versus the PODs 1–2 discharge group in both crude rates (1.2% vs 1.0%, $P = .26$) and adjusted odds (OR 0.74, 95% CI 0.42–1.28). Similar findings were observed for patients who suffered a hematoma requiring further intervention, such as drainage, operation, or tracheostomy, in both crude rates (0.8% vs 0.5%, $P = .16$) and adjusted odds (OR 1.81, 95% CI 0.81–4.31).

Total thyroidectomy subgroup analysis

Finally, the analysis was limited to the subgroup of patients who underwent total thyroidectomy, of whom 653 (52.8%) were discharged on POD 0 and 583 (47.2%) were discharged on PODs 1–2. Patients who were discharged on POD 0 were not at increased odds for readmission (OR 1.73, 95% CI 0.79–4.00) or any other postoperative complications, including clinically severe hypocalcemia (OR 0.92, 95% CI 0.45–1.89), RLN injury (OR 0.85, 95% CI 0.49–1.45), and neck hematoma (OR 2.00, 95% CI 0.50–9.86).

Discussion

As utilization of health care resources has come under greater scrutiny, same-day discharge has gained popularity as part of a broader trend in shifting surgical care from the traditionally

Table I
Baseline characteristics before and after propensity score match

	Pre match				Post match			
	Discharge on POD 0 $N = 2,776$	Discharge on POD 1–2 $N = 7,726$	*P* value	SMD	Discharge on POD 0 $N = 1,977$	Discharge on POD 1–2 N = 1,977	*P* value	SMD
Age, y (mean ± standard deviation)	50.45 ± 14.54	52.88 ± 14.88	<.01*	0.197	51.01 ± 14.86	51.63 ± 14.53	.18	0
Female sex	2,226 (80.19)	6,073 (78.60)	.08	0.039	1,586 (80.22)	1,544 (78.10)	.10	0.052
Race class			<.01*	0.188			.01*	0.118
Asian	91 (3.28)	297 (3.84)			73 (3.69)	73 (3.69)		
Black or African American	337 (12.14)	1,250 (16.18)			243 (12.29)	232 (11.74)		
Other/unknown	560 (20.17)	1,823 (23.60)			471 (23.83)	566 (28.63)		
White	1,788 (64.41)	4,356 (56.38)			1,190 (60.19)	1,106 (55.94)		
Hispanic	170 (6.12)	348 (4.50)	<.01*	0.072	111 (5.61)	105 (5.31)	< .01*	0.013
ASA class			<.01*	0.220			.65	0
I or II	2,034 (73.27)	4,898 (63.40)			1,378 (69.70)	1,385 (70.06)		
III	716 (25.79)	2,687 (34.77)			575 (29.09)	574 (29.03)		
IV	26 (0.94)	141 (1.83)			24 (1.21)	18 (0.91)		
Dependent functional status	3 (0.11)	28 (0.36)	.03*	−0.053	3 (0.15)	2 (0.10)	.65	0.014
Admitted not from home	8 (0.29)	34 (0.44)	.28	−0.025	6 (0.30)	7 (0.35)	.78	−0.009
Weight loss	11 (0.40)	43 (0.56)	.31	−0.023	8 (0.40)	8 (0.40)	1.00	0
Smoking	389 (14.01)	1,185 (15.34)	.09	−0.037	285 (14.42)	283 (14.31)	.93	0.003
Hypoalbuminemia	37 (1.33)	176 (2.28)	<.01*	−0.071	27 (1.37)	22 (1.11)	.47	0.023
Body mass index			<.01*	0.195			.18	0.161
Underweight	22 (0.79)	71 (0.92)			19 (0.96)	18 (0.91)		
Normal	752 (27.09)	1,730 (22.39)			511 (25.85)	486 (24.58)		
Overweight	870 (31.34)	2,277 (29.47)			617 (31.21)	629 (31.82)		
Class 1 obesity	605 (21.80)	1,724 (22.32)			435 (22.00)	433 (21.90)		
Class 2 obesity	294 (10.59)	989 (12.80)			221 (11.18)	193 (9.76)		
Class 3 obesity	233 (8.39)	935 (12.10)			174 (8.80)	218 (11.03)		
Hypertension	896 (32.28)	3129 (40.50)	<.01*	−0.172	684 (34.60)	668 (33.79)	.59	0.017
Congestive heart failure	7 (0.25)	27 (0.35)	.44	−0.018	7 (0.35)	3 (0.15)	.21	0.040
Preoperative dyspnea			<.01*	−0.130			.04*	−0.011
At rest	17 (0.61)	32 (0.41)			14 (0.71)	4 (0.20)		
Moderate exertion	108 (3.89)	555 (7.18)			97 (4.91)	112 (5.67)		
Chronic obstructive pulmonary disease	57 (2.05)	241 (3.12)	<.01*	−0.067	48 (2.43)	49 (2.48)	.92	−0.003
Renal insufficiency	1 (0.04)	1 (0.01)	.45	0.015	1 (0.05)	0 (0.00)	.32	0.032
Dialysis requirement	2 (0.07)	19 (0.25)	.08	−0.044	2 (0.10)	2 (0.10)	1.00	0
Preoperative SIRS/sepsis	4 (0.14)	23 (0.30)	.17	−0.033	3 (0.15)	7 (0.35)	.21	−0.040
Diabetes mellitus			<.01*	0.161			.79	0.038
Oral medication	175 (6.30)	782 (10.12)			148 (7.49)	138 (6.98)		
Insulin	83 (2.99)	318 (4.12)			67 (3.39)	64 (3.24)		
Ascites	0 (0.00)	1 (0.01)	.55	−0.016	0 (0)	0 (0)	1.00	0
Chronic steroid use	60 (2.16)	219 (2.83)	.06	−0.043	49 (2.48)	51 (2.58)	.84	−0.006
Bleeding disorder	20 (0.72)	88 (1.14)	.06	−0.044	19 (0.96)	23 (1.16)	.53	−0.020
Wound class			.17	−0.032			.11	−0.051
Clean or clean contaminated	2,769 (99.75)	7,692 (99.56)			1,973 (99.80)	1,967 (99.49)		
Contaminated or dirty	7 (0.25)	34 (0.44)			4 (0.20)	10 (0.51)		
Disseminated cancer	8 (0.29)	51 (0.66)	.02*	−0.054	4 (0.20)	10 (0.51)	.11	−0.051
Operation			<.01*	0.875			.07	0.077
Partial thyroid lobectomy	282 (10.16)	389 (5.04)			185 (9.36)	197 (9.96)		
Thyroid lobectomy	1,638 (59.01)	1,941 (25.12)			1,038 (52.50)	1,075 (54.38)		
Total thyroidectomy	716 (25.79)	5,033 (65.14)			653 (33.03)	583 (29.49)		
Completion thyroidectomy	140 (5.04)	363 (4.70)			101 (5.11)	122 (6.17)		
Indication			<.01*	0.431			.10	0.087
Single nodule	1,422 (51.22)	2,476 (32.05)			925 (46.79)	995 (50.33)		
Multinodular goiter	946 (34.08)	3,341 (43.24)			710 (35.91)	628 (31.77)		
Graves' disease	83 (2.99)	594 (7.69)			76 (3.84)	70 (3.54)		
Differentiated malignancy	230 (8.28)	1,038 (13.43)			190 (9.61)	212 (10.72)		
Poorly differentiated malignancy	16 (0.58)	61 (0.79)			14 (0.71)	13 (0.66)		
Other	79 (2.85)	216 (2.80)			62 (3.14)	59 (2.98)		
Clinical toxicity	173 (6.23)	596 (7.71)	.01*	−0.058	139 (7.03)	102 (5.16)	.01*	0.078
Prior neck operation	241 (8.68)	760 (9.84)	.08	−0.040	180 (9.10)	188 (9.51)	.66	0.014
Minimally invasive approach	20 (0.72)	27 (0.35)	.01*	0.053	12 (0.61)	7 (0.35)	.25	0.037
Central neck dissection	538 (19.38)	1,757 (22.74)	<.01*	−0.083	411 (20.79)	444 (22.46)	.20	−0.040
Vessel sealant device use	2,009 (72.37)	4873 (63.07)	<.01*	0.200	1,323 (66.92)	1,270 (64.24)	.08	0.056
RLN monitoring	1,792 (64.55)	4,753 (61.52)	<.01*	0.063	1,229 (62.16)	1,264 (63.94)	.25	−0.037
Postoperative drain placement	194 (6.99)	2,463 (31.88)	<.01*	−0.663	194 (9.81)	215 (10.88)	.27	−0.035
Postoperative serum calcium checked	623 (22.44)	5,806 (75.15)	<.01*	−1.241	623 (31.51)	639 (32.32)	.59	−0.017
Postop serum PTH checked	562 (20.24)	3,390 (43.88)	<.01*	−0.523	511 (25.85)	552 (27.92)	.14	−0.047
Postop serum calcium/vitamin D replacement			<.01*	0.583			.20	0.065
Oral calcium	261 (9.40)	1,749 (22.64)			224 (11.33)	204 (10.32)		
Oral vitamin D	236 (8.50)	439 (5.68)			151 (7.64)	154 (7.79)		
Both oral calcium and vitamin D	559 (20.14)	2,516 (32.57)			452 (22.86)	409 (20.69)		
No	1,720 (61.96)	3,022 (39.11)			1,150 (58.17)	1,210 (61.20)		

SMD, standardized mean difference; *POD*, postoperative day; *ASA*, American Society of Anesthesiologists; *SIRS*, systemic inflammatory response syndrome; *RLN*, recurrent laryngeal nerve; *PTH*, parathyroid hormone; *PO*, per os.

* Statistically significant.

Table II
Patient and operative factors associated with same-day discharge

	OR (95% CI)	*P* value
Age, y (ref: <65)		<.01
65–74	0.73 (0.63–0.86)	
75–84	0.59 (0.45–0.76)	
>85	0.65 (0.30–1.39)	
Race (ref: white)		<.01
Asian	0.62 (0.46–0.83)	
African American	0.84 (0.71–0.99)	
Other or unknown	0.62 (0.53–0.72)	
Hispanic ethnicity	1.48 (1.17–1.89)	<.01
ASA class (ref: I–II)		<.01
III	0.81 (0.71–0.92)	
IV–V	0.75 (0.45–1.26)	
Dependent functional status	0.24 (0.07–0.91)	.04
Dyspnea	0.69 (0.55–0.89)	<.01
Diabetes mellitus (ref: no)		<.01
Oral medication	0.71 (0.57–0.87)	
Insulin	0.78 (0.58–1.05)	
Operation (ref: total thyroidectomy)		<.01
Partial thyroid lobectomy	2.75 (2.21–3.41)	
Thyroid lobectomy	2.23 (1.93–2.57)	
Completion thyroidectomy	3.21 (2.48–4.14)	
Indication (ref: single nodule)		.05
Multinodular goiter	0.91 (0.80–1.04)	
Graves' disease	0.84 (0.63–1.12)	
Differentiated malignancy	0.74 (0.61–0.90)	
Poorly differentiated or other malignancy	0.73 (0.38–1.40)	
Other	0.80 (0.58–1.09)	
Central neck dissection	1.40 (1.22–1.61)	<.01
Vessel sealant device use	1.61 (1.42–1.84)	<.01
RLN monitoring	1.18 (1.05–1.32)	.01
Postop drain placement	0.15 (0.13–0.18)	<.01
Postop serum calcium level checked	0.12 (0.11–0.14)	<.01
Postop serum PTH level checked	1.26 (1.09–1.45)	<.01
Postop serum calcium/vitamin D replacement (ref: no)		<.01
PO calcium	0.70 (0.59–0.83)	
PO vitamin D	1.02 (0.83–1.26)	
Both oral calcium and vitamin D	0.82 (0.71–0.95)	

OR, odds ratio; *CI*, confidence interval.

inpatient setting to one of an outpatient setting.[1–3,9] Outpatient surgery also enables patients to convalesce from surgery in the comfort and familiarity of their home with the support of friends and family. The potential benefits of outpatient surgery, however, must always be weighed against potential risks to patient safety. Using data from a large multi-institutional clinical registry reflecting a variety of practice patterns in the United States, this study sought to evaluate the outcomes of same-day discharge after thyroid surgery. In a propensity score–matched cohort of patients, same-day discharge was not associated with increased readmissions or other thyroid-specific complications.

Although many surgeons acknowledge that these operations can be performed on an outpatient basis for many patients, concern still remains regarding the potential dangers of rare but serious complications, such as development of a neck hematoma and subsequent airway compromise.[10–13] In 2012 and 2013, the British Association of Endocrine and Thyroid Surgeons and the American Thyroid Association (ATA) both reviewed the best available evidence on outpatient thyroid operations and came to opposing conclusions, with the British Association of Endocrine and Thyroid Surgeons recommending against same-day discharge and the ATA supporting same-day discharge in carefully selected patients.[18,19] Since the publication of these guidelines, the subject of same-day discharge has remained controversial among thyroid surgeons.[3,7,13,20] A recent systematic review and meta-analysis concluded that, although outpatient thyroid operations appeared to be as safe as inpatient operations, the findings were limited by the quality of the studies included, which were primarily single-institution, nonmatched cohort studies.[21] We believe that the present report is the first multi-institutional, matched cohort study to evaluate thyroid-specific outcomes.

The findings of our study should be interpreted in the context of its limitations. First, the database only contained patients who underwent thyroid operations at hospitals choosing to participate in the ACS NSQIP Targeted Thyroidectomy program. Participation in this program may bias the study toward inclusion of greater-volume centers motivated to collect these procedure-specific variables. Second, the probability of same-day discharge was likely dependent on a variety of factors, including surgeon volume and experience as well as characteristics of each patient and the operative procedure. Although these potential confounders were at a minimum partially mitigated by propensity score matching and multivariable adjustment, we acknowledge the presence of additional unmeasured and possibly unappreciated confounders, such as case complexity; surgeon volume and experience; comfort level of both surgeon and patient with same-day discharge; and other geographic, logistic, or social factors that may also influence the probability of same-day discharge. In consideration of these limitations, we conclude cautiously that same-day discharge after thyroid resection is safe for selected patients being treated by surgeons possessing a sufficient level of experience and comfort to warrant this practice. To be clear, we do not believe that our findings can be used to argue that same-day discharge should be the standard of care, especially given that the majority of thyroid operations are performed by low-volume surgeons.[22]

The recent ATA guidelines outlined several criteria for same-day discharge, including lack of major comorbidities, preoperative patient education, postoperative recognition of complications, proximity to a skilled facility, and social support conducive to safe postoperative management.[19] Factors influencing same-day discharge identified in this study correlated well with the ATA guidelines and included lack of comorbidities, independent functional status, lower complexity of procedure, and use of tools that facilitated same-day discharge, such as a vessel sealant device, intraoperative RLN monitoring, and postoperative PTH testing. Of note, only a minority (37.6% overall and 20.2% in same-day discharges) of NSQIP-participating hospitals have incorporated postoperative PTH measurement into their practice, which has been shown to be an effective tool in facilitating same-day discharges, perhaps reflecting a lack of widespread availability at this time.[23] In the absence of readily available PTH measurement, other strategies, such as routine calcium supplementation, may be considered to facilitate same-day discharge.

Despite the limitations discussed here, the present study offers insight into the controversial topic of same-day discharge after thyroid surgery. Our findings are bolstered by the use of a large, clinical database with a sampling of patients from many institutions, using standardized variable definitions across all institutions. Complications after thyroid surgery are infrequent and are, therefore, best studied in large populations.

In conclusion, in a national cohort of patients undergoing thyroid surgery, same-day discharge was not associated with greater rates of readmission or thyroid-specific complications when compared with discharge 1 or 2 days after thyroid operations.

Table III
Unadjusted and adjusted postoperative outcomes after thyroidectomy

	Unadjusted results			Adjusted results
	Discharge on POD 0 $N = 1,977$	Discharge on POD 1–2 $N = 1,977$	*P* value	OR (95% CI)
Readmission	39 (1.97)	31 (1.57)	.33	1.26 (0.78–2.05)
Death	0 (0)	1 (0.05)	.32	0.85 (0.48–1.50)
Serious morbidity	22 (1.11)	25 (1.26)	.66	
Overall surgical site infection	8 (0.40)	10 (0.51)	.64	0.77 (0.29–1.97)
Reoperation	14 (0.71)	16 (0.81)	.71	0.89 (0.43–1.84)
Clinically severe hypocalcemia event	24 (1.21)	28 (1.42)	.58	1.02 (0.57–1.81)
RLN injury or dysfunction	74 (3.74)	90 (4.55)	.20	0.81 (0.59–1.10)
Neck hematoma	23 (1.16)	19 (0.96)	.53	1.24 (0.67–2.32)

Same-day discharge is safe in appropriately selected patients under the care of surgeons possessing a sufficient level of experience and comfort to warrant this practice.

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Conflict of interest/Disclosure

None of the authors have any conflicts of interest to disclose.

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Discussion

Dr Philip Ituarte (Los Angeles, CA): I think you showed that you included completion thyroidectomies. Since that is a 2-stage process, I was curious if you looked at outcomes associated with the first operation or the second operation in this study.

Dr Q. Lina Hu: The way the data are collected in NSQIP is that the cases are only abstracted separately if they were 30 days apart. So, if they had the first operation and the second operation within 30 days, it would just be one or the other, whichever came up in the sampling process. In that case, it would either be coded as the partial thyroidectomy or the completion thyroidectomy. Looking at the characteristics of the patients, I think those 2 operations are actually relatively similar in risk because they are essentially both partial thyroidectomies.

Dr Samuel Snyder (Harlingen, TX): Thank you for this in-depth analysis. You have to remember these are selected patients, and it's ultimately going to depend on the selection by

the surgeon, and on the institution, and on the support that the patient has.

We all want to avoid readmissions. So, the question I have for you is whether you know exactly why they got readmitted? Because some of those readmissions occur unrelated to the thyroid operation specifically. Sometimes they get readmitted for other reasons. Were you able to pull that out of your data?

Dr Q. Lina Hu: We were able to partially address that because, as you mentioned, the readmission could be for a variety of factors. However, inherent to the thyroid-specific outcomes like the recurrent laryngeal nerve, the hypocalcemia, and the neck hematoma, those variables are built in. For example, in the variable definition for severe hypocalcemia, readmission for hypocalcemia is a condition that would meet criteria for severe hypocalcemia.

So, in that sense, those 3 variables that we looked for for the specific desired operation actually would be a better measure of whether or not these readmissions were related to thyroid-specific complications. And as you can see, even when you look at only those complications, they were not significant.

Dr Quan-Yang Duh (San Francisco, CA): I think it's important to emphasize that it is okay to do this with selected patients in appropriate practice settings. My concern about information like this is it will be used as a way to force the surgeons in the wrong setting to discharge patients the same day. So, I want to hear your comment on how you prevent this type of information from being used to force our clinical practice in a way that probably won't be safe for most patients.

Dr Q. Lina Hu: Thank you for your comment. I think that is really important, and it is something that we really thought about in writing the manuscript and disseminating the information. I definitely agree with the comments that this is a limitation of the data set—that the patients were already selected because they were discharged or not discharged based upon surgeon decisions or institutional decisions.

It is still very important for the surgeon to use clinical judgment as well as define the social support factors that are difficult to study in this way. If the patient lives too far away from the hospital, could not come back for emergency care, or if the patient had social factors that would prevent them having good support after the operation, it is obviously very important to not send that patient home.

Dr Herb Chen (Birmingham, AL): I totally agree with this. I think if you talk to patients and prepare them for going home, most want to go home, but you need to set the expectation of what it will be like.

I think your paper sends a great message, but also, if you look at the denominator, most patients in that whole series are not sent home the same day, right? It looks like only about 20% to 25% are same day. That implies that they are highly selected.

My practice is that over 90% go home the same day. I was wondering, what proportion of your thyroidectomies do you aim to send home same day?

Dr Q. Lina Hu: Thank you for the question. Dr Livhits, would you like to comment on the exact number?

Dr Masha Livhits: I would estimate that maybe 30% to 40% of our patients do go home the same day. There are a variety of factors. Some of it is our referral pattern. We do have patients who come from all over the place, so that may be a reason that they might spend the night in the hospital. We also have a lot of patients who come for reoperations. All those patients we keep overnight. But in patients who are having straightforward, first-time thyroid operations, (lobectomy or total), maybe 30% or 40%.