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Parathyroidectomy outcomes for Asians in the United States: Implications for resident surgical education

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ABSTRACT

Introduction: Outcomes for Asian patients in the United States are often overlooked in the surgical literature. Surgical education includes little emphasis on reporting outcomes for Asian patients in the United States. Our null hypothesis (H_0) is that there is no difference in surgical complications following parathyroid surgery between Asians and all other ethnicities in the United States. Our alternate hypothesis (H_1) is that Asians have more incidences of certain complications (possibly due to culture and language barriers).
Methods: Data from the American College of Surgeons National Surgical Quality Improvement Program (ACS-NSQIP) was queried for parathyroidectomy and patient race. Complications within 30 days of surgery were extracted.
Results: Among, White, Black, Asian, Pacific Islanders, Native Americans, and Hispanic patients of the United States the Asians ($p = 0.018$) and Blacks ($p = 0.003$) had increased operative time for parathyroid surgery compared to other groups. Hispanics had the most surgical complications ($p = 0.025$). Blacks had statistically significant longer hospital stay ($p < 0.0001$).
Discussion/conclusion: United States Asian patient data is not typically analyzed separately for complications. We found that in the United States Asians have increased operative time for parathyroidectomy. Future studies of healthcare inequities should include analysis of data for Asian surgical data in the United States as this may help prevent future surgical complications.

Introduction

In the movie, The Farewell, the grandmother in an Asian family is never told that she has cancer [1]. Many surgeons have experienced taking care of a patient from cultures where like in the movie, full disclosure to the patient is not accomplished due to deeply held cultural taboos [2]. This outcome often clashes with the requisite concept of consent. Given increased incidences of violence directed at Asian communities in the United States since the onset of the COVID-19 pandemic, we became further interested in the absence of in-depth analyses on surgical outcomes for Asian patients, specifically in 2020 when anti-Asian sentiment was highest. We sought to see whether Asian patients have more complications after parathyroid surgery within the first 30 days after surgery. No studies have examined healthcare disparities with parathyroid surgery with regards to Asian patients specifically. Most studies on surgical outcomes have largely ignored the Asian data and have only concentrated on African American and Hispanic populations.

For example, most studies on healthcare disparities with regards to thyroid surgery have concentrated on thyroid cancer-adult and pediatric-with better survival as a proxy for better surgical outcomes [3–10]. Although most studies have shown worse outcomes overall for African Americans and Hispanics, Crepau et al. observed no differences across race/ethnicity in surgical thoroughness or rate of recurrence in thyroid cancer patients. [7] Sosa et al. studied racial disparities with thyroidectomy and concentrated on African American and Hispanic outcomes [11]. Previous studies of ACS-NSQIP data have shown disparities in complications for hematoma with thyroidectomy [12]. Many studies on disparities with thyroid surgery have only concentrated on African Americans and Hispanics and did no specific analysis with regards to Asians [3–11,13].

A previous study showed that Asians with primary hyperparathyroidism were less likely to be evaluated for parathyroidectomy [14]. Another analysis of parathyroidectomy rates by race did not include separate analysis of outcomes for Asians [15] –with only Whites, Blacks,

Hispanic and other reported. A study of emergency department visits and readmission after parathyroidectomy surgery showed no significant differences between Whites, Blacks, and Asians in 191 patients [16]. In a study by Radowsky et al. voice outcomes after thyroid and parathyroid surgery were analyzed for Blacks only–Hispanic and Asian patients were not separately analyzed. With analysis of data with regards to Asians, the question remains: Is it appropriate to not analyze data for Asians? In many studies Asians are classified as "non-white" [3] or "other" [11] with the latter often including Native Americans, Pacific Islanders and Asians. Given increased incidences of violence directed at Asian communities in the United States since the outset of the COVID-19 pandemic [17], we became further interested in the absence of in-depth analyses on surgical outcomes for Asian patients. We sought to examine whether Asians have more complications after parathyroid surgery. Our null hypothesis (H_0) is that there is no difference in surgical complications following parathyroid surgery between Asians and all other ethnicities in the United States. Our hypothesis (H_1) is that Asians have more incidences of certain complications (possibly due to culture and language barriers).

Materials and methods

Data

Data from the 2020 American College of Surgeons National Surgical Quality Improvement Program (ACS-NSQIP) was queried. The 2020 Participant Use Files (PUFs) dataset is comprised of 902,968 cases and contains >275 variables regarding patient demographics, indications, preoperative comorbidities, laboratory values, and 30-day outcomes on a procedure-level basis. The scope of this research activity falls under exempt status of the institutional review board of the University of California, San Diego due to anonymous nature of the data and the minimal likelihood of risk and patient harm.

Study population

The study population was limited to adults who were 18 years or older who had undergone a parathyroidectomy in 2020 by a general surgeon or otolaryngologist. The 4889 parathyroidectomies performed that were analyzed, identified by Current Procedural Terminology (CPT) codes (60500, 60502, 60505, 60512), were included with baseline characteristics of the population included in Table 1. Patient demographics include age, sex, and race (white, black, Hispanic, Asian/Pacific Islander), while clinical characteristics include body mass index (BMI) (underweight, normal weight, overweight, class I, class II, class III), preoperative comorbidities such as diabetes (Type 1 or Type 2), hypertension requiring medication, history of chronic obstructive pulmonary disease (COPD), >10 % weight loss in the last 6 months, smoking status, and American Society of Anesthesiology (ASA) classification of patient physical condition. Variables were recoded (e.g. from string to numeric or dummy variables) and calculated (e.g. BMI) as needed to fit the statistical modeling process.

Surgical outcomes

One of the surgical outcomes that was examined (that acts as a stand-in for overall morbidity) is the sum total of postoperative complications (COMPLICATIONS) including surgical site infection (SSI) (superficial incisional, deep incisional, organ/space), wound disruption, pneumonia, unplanned intubation, pulmonary embolism, ventilator dependence for over 48 h, progressive renal insufficiency, renal failure, urinary tract infection (UTI), stroke/cerebral vascular accident (CVA), cardiac arrest, myocardial infarction (MI), bleeding requiring transfusion, deep vein thrombosis (DVT)/thrombophlebitis, sepsis, and septic shock.

Taking the total number of postoperative complications, we were

Table 1
Comparison of patient preoperative characteristics by racial demographics.

Variable	White (n = 3036)	Black (n = 710)	Hispanic (n = 368)	Asians (n = 142)
Age (years)	61.81 (13.08)	58.10 (12.70)	54.03 (13.74)	56.63 (16.24)
Female	2281 (75 %)	515 (73 %)	271 (74 %)	100 (70 %)
Underweight	33 (1 %)	7 (0.98 %)	1 (0.27 %)	6 (4.2 %)
Normal weight	632 (21 %)	98 (13.8 %)	64 (17 %)	51 (35.9 %)
Overweight	890 (29 %)	184 (26 %)	122 (33.2 %)	47 (33 %)
Class I	731 (24 %)	173 (24.4 %)	101 (27.4 %)	26 (18.3 %)
Class II	360 (12 %)	111 (15.6 %)	39 (10.6 %)	5 (3.5 %)
Class III	303 (10 %)	125 (17.6 %)	28 (7.6 %)	3 (2.1 %)
Diabetes	423 (13.9 %)	184 (26 %)	65 (17.8 %)	29 (20.4 %)
Hypertension	1655 (54.5 %)	531 (74.8 %)	184 (50 %)	80 (56.3 %)
COPD	86 (2.8 %)	15 (2.11 %)	1 (0.27 %)	0
>10 % weight loss in last 6 months	15 (0.5 %)	8 (1.1 %)	1 (0.27 %)	0
Current smoker (within 1 year)	258 (8.5 %)	76 (10.7 %)	22 (6 %)	11 (7.7 %)
ASA classification				
1	50 (1.6 %)	7 (0.98 %)	8 (2.17 %)	7 (5 %)
2	1665 (54.8 %)	251 (35 %)	207 (56 %)	74 (52.1 %)
3	1259 (41.4 %)	390 (55 %)	142 (38.6 %)	59 (41.2 %)
4	61 (2 %)	62 (8.7 %)	11 (3 %)	2 (1.4 %)
5	0	0	0	0

Demographics of patient population studied.

able to recode a binary variable for the occurrence of any of the aforementioned surgical complications (YESCOMP). Other surgical outcomes examined include unplanned hospital readmission related to surgery (READMISSION), total length of hospital stay (TOTHLOS), and total length of operation time (OPTIME).

Statistical analysis

IBM SPSS version 20 was used to create logistic regression models of binary dependent variables for odds-ratio/likelihoods of hospital readmission and surgical complication (READMISSION, YESCOMP), while a multiple linear regression model was used to analyze scalar dependent variables for impact of independent variable unit change on total number of complications, total operation time, and total length of hospital stay (COMPLICATIONS, OPTIME, TOTHLOS). Independent and dependent variables were included in regression modeling on the basis of either clinical importance (regardless of significance), or significant associations ($p < 0.05$) found during exploratory correlation analysis or stepwise selection regression method. As a result, the final model for both logistic and multiple linear regression analysis of parathyroidectomy outcomes account for sex, age, BMI, diabetes, smoking, hypertension, being black or African American, being Hispanic, being Asian or Pacific Islander, and ASA classification.

Results

Study population

A total of 4889 patients who had undergone a parathyroidectomy in 2020 were identified. Of those patients, 3036 (62.1 %) were white, 710 (14.5 %) were black, 368 (7.5 %) were Hispanic, and 142 (2.9 %) were Asian (Table 1). On average, patients undergoing parathyroidectomies

were more often older, female, over normal weight, and being treated for hypertension.

Surgical outcomes

Comparing descriptive statistics of surgical outcomes, black patients had a higher rate of postsurgical hospital readmittance as well as stayed approximately a day longer than other races (Table 2). Hispanics had over 4 times as many surgical complications compared to whites and Asians, while Asians had longer average operation times.

Statistical analysis

Unplanned Hospital Readmission (READMISSION) – In building out our statistical model, we needed to be aware of possible confounding variables that may not have been obvious in exploratory correlation analysis. To that end, we initially tested a model for hospital readmission, only accounting for race, and found that being black was statistically significant ($p = 0.036$) for hospital readmission (Table 3), which appears to corroborate existing literature [18]. However, upon controlling for other covariates we found that being black was no longer statistically significant, but rather, was being confounded by hypertension (odds ratio (OR) 1.646; 95 % confidence interval (CI); 1.046–2.590; $p = 0.031$) and ASA classification (3.878 OR, 2.838–5.301, $p < 0.0001$).

Surgical Complication Likelihood (YESCOMP) – Knowing that this model was better at controlling for confounding variables, we applied it to a logit model of surgical complication likelihood (Table 4), where we found that controlling for our selected covariates, age, hypertension, and ASA were significant (0.979 OR, 0.963–0.996, $p = 0.016$; 1.834 OR, 1.037–3.243, $p = 0.037$; 3.490 OR, 2.369–5.142, $p < 0.0001$ respectively), but more importantly, within our racial variables, we found that being Hispanic leads to a 235 % increase in likelihood of having surgical complications compared to other races during a parathyroidectomy (2.351 OR, 1.253–4.413, $p = 0.008$).

Total Number of Surgical Complications (COMPLICATIONS) – Looking at the total number of surgical complications as an indicator of overall postsurgical morbidity (Table 5), we applied a multiple linear regression model and found that the only non-racial factor positively affecting surgical complications was ASA classification (0.029 b, 0.104 Beta, 95 % CI, 0.020–0.037, $p < 0.0001$) while being Hispanic was statistically significant for increased surgical complications (0.021 b, 0.033 Beta, 0.003–0.039, $p = 0.025$).

Total Length of Hospital Stay (TOTHLOS) – Applying multiple linear regression modeling to length of patient hospital stay (Table 6), we find that age and BMI to be associated with *shorter* hospital stays (−0.015 b, −0.061 Beta, −0.023 to −0.008, $p < 0.0001$; −0.036 b, −0.078 Beta, −0.049 to −0.022, $p < 0.0001$ respectively) while ASA classification and being black were associated with *longer* hospital stays (1.110 b, 0.198 Beta, 0.937–1.282, $p < 0.0001$; 0.547 b, 0.057 Beta, 0.273–0.821, $p < 0.0001$ respectively).

Total Operation Time (OPTIME) – A multiple linear regression model of operation time (Table 7) finds a similar phenomenon to the previous model for hospital stay length in that increased age has a negative relationship on operation time (−0.251 b, −0.067 Beta, −0.367 to

−0.136, $p < 0.0001$), however increased BMI now has a positive relationship with operation time (0.231 b, 0.033 Beta, 0.026–0.436, $p = 0.027$). Among the controlling covariates, being male and ASA classification are positively related to total operation time (9.916 b, 0.086 Beta, 6.648–13.184, $p < 0.0001$; 7.667 b, 0.091 Beta, 5.051–10.284, $p < 0.0001$). As for racial factors, being black is significant for increased operation time (6.247 b, 0.044 Beta, 2.091–10.404, $p = 0.003$), as is being Asian (10.247 b, 0.034 Beta, 1.764–18.729, $p = 0.018$).

Discussion

Our analysis revealed significantly increased operative time in Asians and Blacks. No previous study has analyzed parathyroidectomy complications with Asians analyzed separately. Our study also revealed more total complications for parathyroid surgery in Hispanics. A previous study of combined complications for thyroid and parathyroid surgery showed that African Americans had higher overall complications (16.8 %) compared with Caucasians (11 %), Hispanics (13.5 %), Asians (12 %), and others (11.5 %) ($p < 0.001$) [19]. Unlike our study where Asian outcomes for parathyroidectomy was queried, the study by Noureldine et al. analyzed data for thyroidectomy and parathyroidectomy combined.

In an analysis of 10-year data at Kaiser Permanente, Dehal et al. reported on the significance of neck hematoma after thyroid and parathyroid surgery. In their conclusions, attention was drawn to the increased risk for African Americans for hematoma ($p < 0.001$). However careful review of the data shows that Asians also had significant hematoma ($p = 0.04$) [20].

Controlling for clinical covariates such as ASA classification or BMI, our results have shown that surgical outcomes for parathyroidectomies are affected by social determinants of health such as race. Initial exploratory longitudinal regression analysis of surgical outcomes suggested that some omitted, yet statistically significant, surgical outcomes in parathyroidectomies, such as bleeding needing a transfusion, differed from 2019 data. While these outcomes were not included due to their low statistical power, the fact that these changes in postoperative morbidity were primarily in Asian populations and show up in the 2020 NSQIP PUF and not the 2019 dataset, potentially suggest the COVID-19 pandemic's role on surgical outcomes via implicit bias or surgical team fatigue. This warrants further study.

The Accreditation Council on Graduate Medical Education (ACGME) in the United States has six core competencies one of which is (Communication/Interpersonal Skills and Professionalism). Included in this core competency is cultural competency training. Changoor et al. described how a cultural training program that would provide surgeons with specific knowledge and skills to care for patients from diverse sociocultural backgrounds [21]. In 2003, the Institute of Medicine (IOM) recommended incorporating cultural competency education into the training of healthcare professionals as a method for reducing healthcare disparities [22]. Cultural competency is defined as the ability of healthcare professionals to communicate with and provide high-quality care to patients from diverse socio-cultural backgrounds [23]. Future training should include modules and competency in caring for Asian patients specifically, especially given the historical "othering" of Asians and the xenophobia that they face, made further manifest by the COVID-19 pandemic [17].

Our study may potentially have limitations. Parathyroidectomy is a less common surgery and our analysis included one year of data from ACS-NSQIP. The strengths of the current study include analysis of data with regards to complications in Asians specifically. This has not been previously reported for parathyroidectomy. Our study is the first retrospective analysis of American College of Surgeons data with regards to surgical complications in Asians in the United States.

Table 2

Surgical outcomes.

Variable	White	Black	Hispanic	Asians
Length of stay (days)	0.57 (2.15)	1.56 (3.60)	0.87 (2.06)	0.85 (2.20)
Total surgical complications	0.1 (0.36)	0.03 (0.248)	0.04 (0.92)	0.01 (0.17)
Time operation (minutes)	95.67 (48.41)	104.03 (56.16)	97.03 (46.98)	104.37 (49.71)

Length of stay, total surgical complications, and operation time between White, Blacks, Hispanics, and Asians follow parathyroidectomy.

Table 3

Logit regression model of postoperative hospital readmission likelihood.

		B	Std. error	Odds ratio	p-Value	95 % C.I. for EXP(B)		Sig.
						Lower	Upper	
Model 1	Black or African American	0.469	0.223	1.599	0.036	1.032	2.475	*
	Hispanic	−0.109	0.372	0.897	0.770	0.433	1.860	**
	Asian	−0.548	0.720	0.578	0.446	0.141	2.371	
Model 2	Black or African American	−0.024	0.237	0.976	0.919	0.613	1.553	
	Hispanic	−0.189	0.386	0.828	0.625	0.389	1.763	
	Asian	−0.538	0.729	0.584	0.460	0.140	2.437	
	Male	−0.217	0.210	0.805	0.302	0.533	1.215	
	Age	−0.013	0.007	0.987	0.071	0.973	1.001	
	BMI	−0.004	0.011	0.996	0.743	0.974	1.019	
	Diabetes	−0.181	0.237	0.834	0.444	0.524	1.327	
	Smoker	−0.016	0.298	0.984	0.956	0.548	1.765	
	Hypertension	0.498	0.231	1.646	0.031	1.046	2.590	*
	ASA classification	1.355	0.159	3.878	0.000	2.838	5.301	***

* Significant at $p < 0.05$.
** Significant at $p < 0.01$.
*** Significant at $p < 0.001$.

Table 4

Logit regression model of surgical complication likelihood.

	B	Std. error	Odds ratio	p-Value	95 % C.I. for EXP(B)		Sig.
					Lower	Upper	
Male	−0.485	0.275	0.616	0.077	0.359	1.055	
Age	−0.021	0.009	0.979	0.016	0.963	0.996	*
BMI	0.003	0.014	1.003	0.852	0.976	1.030	
Diabetes	0.108	0.273	1.114	0.692	0.652	1.903	
Smoker	−0.643	0.473	0.526	0.174	0.208	1.328	
Hypertension	0.607	0.291	1.834	0.037	1.037	3.243	*
Black or African American	−0.351	0.324	0.704	0.278	0.373	1.328	
Hispanic	0.855	0.321	2.351	0.008	1.253	4.413	**
Asian or Pacific Islander	−0.775	1.021	0.460	0.447	0.062	3.404	
ASA classification	1.250	0.198	3.490	0.000	2.369	5.142	***

* Significant at $p < 0.05$.
** Significant at $p < 0.01$.
*** Significant at $p < 0.001$.

Table 5

Linear regression model of total number of surgical complications.

	Unstandardized coefficients		Standardized coefficients	p-Value	95.0 % confidence interval for B		Sig.
	B	Std. error	Beta		Lower bound	Upper bound	
Male	−0.008	0.005	−0.022	0.130	−0.019	0.002	**
Age	0.000	0.000	−0.028	0.079	−0.001	0.000	
Patient BMI	0.000	0.000	−0.015	0.336	−0.001	0.000	
Diabetes	0.002	0.007	0.004	0.784	−0.011	0.015	
Smokes	−0.014	0.009	−0.025	0.091	−0.031	0.002	
Hypertension	0.008	0.006	0.024	0.145	−0.003	0.019	
Black or African American	0.002	0.007	0.005	0.734	−0.011	0.016	
Hispanic	0.021	0.009	0.033	0.025	0.003	0.039	*
Asian or Pacific Islander	−0.003	0.014	−0.003	0.811	−0.031	0.025	
ASA classification	0.029	0.004	0.104	0.000	0.020	0.037	***

* Significant at $p < 0.05$.
** Significant at $p < 0.01$.
*** Significant at $p < 0.001$.

Conclusion

We expected Asians to have less complications from parathyroidectomy compared to groups that have previously been shown to suffer from health care disparities, such as Hispanics and African Americans. Yet, analysis of data from the American College of Surgeons showed increased operative time which was significant as was increased operative time for parathyroidectomy for Blacks. The authors wish to encourage analysis of Asian data outcomes for future studies on surgical outcomes.

CRediT authorship contribution statement

Amy Liu, study design, data extraction, data analysis, manuscript drafting, final approval of manuscript for submission: Sapideh Gilani, study design, data analysis, manuscript drafting, final approval of manuscript for submission.

Ethical approval

The scope of this research activity falls under exempt status of the

Table 6
Linear regression model of total length of hospital stay.

	Unstandardized coefficients		Standardized coefficients	p-Value	95.0 % confidence interval for B		Sig.
	B	Std. error	Beta		Lower bound	Upper bound	
Male	0.175	0.110	0.023	0.111	−0.040	0.390	*,**
Age	−0.015	0.004	−0.061	0.000	−0.023	−0.008	***
Patient BMI	−0.036	0.007	−0.078	0.000	−0.049	−0.022	***
Diabetes	−0.105	0.136	−0.011	0.440	−0.371	0.161	
Smokes	0.012	0.170	0.001	0.945	−0.322	0.345	
Hypertension	0.012	0.110	0.002	0.913	−0.204	0.229	
Black or African American	0.547	0.140	0.057	0.000	0.273	0.821	***
Hispanic	0.031	0.184	0.002	0.868	−0.330	0.391	
Asian or Pacific Islander	−0.038	0.285	−0.002	0.894	−0.597	0.521	
ASA classification	1.110	0.088	0.198	0.000	0.937	1.282	***

* Significant at p < 0.05.
** Significant at p < 0.01.
*** Significant at p < 0.001.

Table 7
Linear regression model of total operation time.

	Unstandardized coefficients		Standardized coefficients	p-Value	95.0 % confidence interval for B		Sig.
	B	Std. error	Beta		Lower bound	Upper bound	
Male	9.916	1.667	0.086	0.000	6.648	13.184	***
Age	−0.251	0.059	−0.067	0.000	−0.367	−0.136	***
Patient BMI	0.231	0.105	0.033	0.027	0.026	0.436	*
Diabetes	−0.972	2.060	−0.007	0.637	−5.010	3.066	
Smokes	−2.371	2.582	−0.013	0.359	−7.434	2.691	
Hypertension	1.044	1.675	0.010	0.533	−2.240	4.328	
Black or African American	6.247	2.120	0.044	0.003	2.091	10.404	**
Hispanic	1.393	2.793	0.007	0.618	−4.082	6.868	
Asian or Pacific Islander	10.247	4.327	0.034	0.018	1.764	18.729	*
ASA classification	7.667	1.335	0.091	0.000	5.051	10.284	***

* Significant at p < 0.05.
** Significant at p < 0.01.
*** Significant at p < 0.001.

institutional review board of the University of California, San Diego due to anonymous nature of the data and the minimal likelihood of risk and patient harm.

Declaration of competing interest

None.

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