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Main Article

Evaluating resident involvement and the 'July effect' in parotidectomy

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Abstract

Objective. This study aimed to evaluate the effect of resident involvement and the 'July effect' on peri-operative complications after parotidectomy.

Method. The American College of Surgeons National Surgical Quality Improvement Program database was queried for parotidectomy procedures with resident involvement between 2005 and 2014.

Results. There were 11 733 cases were identified, of which 932 involved resident participation (7.9 per cent). Resident involvement resulted in a significantly lower reoperation rate (adjusted odds ratio, 0.18; 95 per cent confidence interval, 0.05–0.73; $p = 0.02$) and readmission rate (adjusted odds ratios 0.30; 95 per cent confidence interval, 0.11–0.80; $p = 0.02$). However, resident involvement was associated with a mean 24 minutes longer adjusted operative time and 23.5 per cent longer adjusted total hospital length of stay (respective $p < 0.01$). No significant difference in surgical or medical complication rates or mortality was found when comparing cases among academic quarters.

Conclusion. Resident participation is associated with significantly decreased reoperation and readmission rates as well as longer mean operative times and total length of stay. Resident transitions during July are not associated with increased risk of adverse peri-operative outcomes after parotidectomy.

Introduction

Within otolaryngology education, parotidectomy is a highly technical key-indicator case, and competence in parotidectomy is required for graduation from residency.[1–3] The procedure is considered technically challenging, often requiring identification and careful dissection of the facial nerve. Several studies have reported complication rates ranging from 7–22 per cent.[4–5] Despite the broad complication rate reported in the literature, there are limited data evaluating the implications of resident involvement on parotidectomy procedures.

The current model for surgical residency training involves a stepwise model of graduated surgical autonomy as residents progress through their training.[6–7] Across surgical specialties, varied results have been found when evaluating the impact of resident involvement, occasionally demonstrating worse patient outcomes.[8–9] A recent study utilising the American College of Surgeons National Surgical Quality Improvement Program broadly examined all head and neck surgical procedures recorded in its database, and after adjusting for comorbidities found no association between resident participation and 30-day morbidity or mortality.[10] Moreover, the yearly turnover in residents and role transitions for existing house staff, which has been referred to as the 'July effect', is another factor that may impact surgical outcomes.[11–15]

Within otolaryngology specifically, this phenomenon has been studied in microvascular surgery, pituitary skull base surgery and for procedures involving head and neck cancer. For the aforementioned procedures, there has been no evidence of an increase in morbidity and mortality during the resident transition period.[16–18] However, no studies have examined outcomes of patients undergoing parotidectomy during this transition period either. The purpose of this study was to investigate the morbidity of parotidectomy procedures with resident involvement compared with cases performed without residents. Our secondary aim was to investigate the impact of performing this procedure during the first academic quarter (July, August and September) relative to the months where residents would be expected to have more cumulative experience (all other quarters).

Materials and methods

This was a retrospective study utilising the American College of Surgeons National Surgical Quality Improvement Program database. The American College of Surgeons National Surgical Quality Improvement Program is a multicentre, nationally validated, risk-adjusted and outcomes-based database created for the purpose of measuring and improving surgical quality care.[19] Each case contains up to 274 Health Insurance Portability and Accountability Act compliant variables regarding patient demographics, comorbidities, pre-operative laboratory values and operative variables, along with post-operative complications, mortality, readmission and reoperation within 30-days of the index procedure.[19] Data are collected by centrally trained and certified clinical reviewers. Currently, this database contains information on more than 6.6 million cases, from over 700 hospitals across the USA and internationally in 9 different countries.[19]

The American College of Surgeons National Surgical Quality Improvement Program is a de-identified data set that meets exemption criteria established by The George Washington University School of Medicine and Health Sciences institutional review board. The American College of Surgeons National Surgical Quality Improvement Program database was queried for patients who had undergone parotidectomy procedures from 2005 to 2014.

Patients were isolated based on Current Procedural Terminology codes, selecting patients with Current Procedural Terminology codes corresponding to superficial parotidectomy with facial nerve dissection (Current Procedural Terminology code 42415), superficial parotid without facial nerve dissection (Current Procedural Terminology code 42410), total parotidectomy with facial nerve dissection (Current Procedural Terminology code 42420) and total parotidectomy with facial nerve sacrifice (Current Procedural Terminology code 42425).

In order to isolate solely parotidectomy cases, Current Procedural Terminology codes corresponding to neck dissections (Current Procedural Terminology codes: 38700, 38720 and 38724), as well as those associated with cancer resections (Current Procedural Terminology codes: 21016, 61605, 61590, 69120, 11644, 11646, 69970, 31225 and 69535) or reconstruction (Current Procedural Terminology codes: 14040, 14041, 14301 and 15120) as a separate or concurrent procedure were excluded. Additionally, patients with missing information with regards to demographic data or comorbidity information were excluded to ensure inclusion of patients with the most complete history as possible.

Within the American College of Surgeons National Surgical Quality Improvement Program database are two variables that allow for identification of resident involvement. The first variable is 'attend', which is coded as attending and resident when both are present in the operating room. The second variable is 'postgraduate year (PGY)' which refers to the highest-level training of the resident surgeon participating in the surgery. Resident involvement was therefore captured when both the 'attend' and 'PGY' variables were coded for a particular case. Cases that did not specify involvement by either an attending or resident were excluded.

Demographic data, pre-operative comorbidity information and 30-day patient morbidity and mortality outcomes were collected. Composite binary outcome variables were created to improve the ability to determine an association between resident participation and early patient morbidity and mortality after parotidectomy. These outcomes included cardiac events (myocardial infarction or cardiac arrest requiring cardiopulmonary resuscitation), pulmonary events (prolonged intubation, reintubation or pneumonia), septic events (sepsis or septic shock) and clotting events (deep venous thrombosis or pulmonary embolism). The association of resident involvement with organ-space infection, the occurrence of bleeding events requiring transfusion, prolonged length of hospital stay (defined as greater than 3 days), unplanned return to the operating room and 30-day mortality was also investigated. Next, the effect of resident transitions in July was examined by comparing parotidectomy procedures performed in the first academic quarter (quarter three) versus those in all other quarters (quarters one, two and four).

Statistical analysis

Demographics, pre-operative comorbidities and 30-day outcomes were compared separately between resident involvement cohorts (resident involvement *vs* attending only) and 'July Effect' cohorts (quarter three *vs* quarter one, quarter 2 and quarter 4) separately. Univariate comparisons were analysed using independent sample *t*-test and Mann–Whitney U test for parametric and non-parametric continuous variables, respectively, as well as the chi-square and Fisher's exact test for adequate and low cell-count (more than or equal to 25 per cent of expected cell counts less than or equal to 5) categorical variables, respectively. Continuous outcomes were analysed for normality by measuring the variable distribution's skew and kurtosis coupled with the Kolmogorov–Smirnov test for normality. Continuous outcome 'total hospital length of stay' was severely positively skewed and was therefore natural logarithm transformed to meet the assumptions of normality.

Demographic data and pre-operative comorbidities with resulting univariate-test of *p*-values less than 0.2 were considered potential confounding covariates and were entered into multivariable models following a backward stepwise selection procedure with stay criteria $\alpha = 0.1$ in order to elucidate the independent effect between cohort of interest and outcome.

Multivariable logistic regression models were used for categorical outcomes, whereas general linear models were used for natural logarithm transformed continuous outcomes that were later reverse transformed for interpretation. No transform was performed for linear regression on outcomes that met the assumptions of normality, specifically for 'total operative time'. Multicollinearity of covariates in all models was assessed by way of variance inflation factor analysis where variance inflation factor less than 2 was considered acceptable. Resulting adjusted odds ratios, 95 per cent confidence intervals (CIs) and *p*-values were reported from multivariable logistic regression models, whereas adjusted parameter estimates (β) with corresponding standard errors and *p*-values were reported for normally distributed or reverse transformed continuous outcomes.

All statistical analysis was performed using SAS statistical software (version 9.4; SAS Institute, Cary, USA), and a two-sided *p*-value less than 0.05 was considered statistically significant.

Results

Resident involvement

After applying inclusion and exclusion criteria for resident involvement cohort comparisons, 11 731 patients were included. Of the included cases, 932 (7.4 per cent) were resident involved. Resident involvement was significantly associated with a higher proportion of patients aged 41–60 years and more than 80 years, fewer white race patients and in turn more black and 'other' race patients, lower proportion of obese, diabetic and chronic obstructive pulmonary disease patients, as well as a higher proportion of anaemic patients

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Table 1. Patient demographics and pre-operative comorbidities

Parameter	Attending only* (*n* (%))	Resident† (*n* (%))	*P*-value
Age			<0.001‡
– <40	1689 (15.6)	144 (15.4)	
– 41–60	4225 (39.1)	403 (43.2)	
– 61–80	4420 (40.9)	324 (34.7)	
– >80	467 (4.3)	61 (6.5)	
Sex			0.558
– Female	5594 (51.8)	492 (52.8)	
– Male	5207 (48.2)	440 (47.2)	
Race			0.023‡
– Black	772 (7.1)	73 (7.8)	
– White	7415 (68.6)	624 (66.9)	
– Other	884 (8.2)	101 (10.8)	
– Unknown	1730 (16)	134 (14.4)	
– Hispanic ethnicity	595 (5.5)	40 (4.3)	0.115
BMI			
– Obese	4486 (41.5)	351 (37.6)	0.021‡
Comorbidity			
– Smoking	2834 (26.2)	236 (25.3)	0.541
– Dyspnoea	550 (5.1)	52 (5.6)	0.517
– Diabetes	1630 (15.1)	114 (12.2)	0.018‡
– COPD	504 (4.7)	30 (3.2)	0.042‡
– CHF	28 (0.3)	1 (0.1)	0.725
– Hypertension	4655 (43.1)	419 (44.9)	0.271
– Dialysis	32 (0.3)	5 (0.5)	0.213
– Steroid use	261 (2.4)	26 (2.8)	0.479
– Weight loss	38 (0.3)	10 (1.1)	0.004‡
– Bleeding disorder	171 (1.6)	12 (1.3)	0.484
– Anaemia	1053 (9.7)	125 (13.4)	<0.001‡
– Systemic sepsis	26 (0.2)	2 (0.2)	0.999

**n* = 10 801 (92.1 per cent); †*n* = 932 (7.9 per cent); ‡two-sided *p*-value < 0.05 considered statistically significant. BMI = body mass index; COPD = chronic obstructive pulmonary disease; CHF = congestive heart failure

Table 2. Peri-operative variables categorised by resident involvement

Operative variables	Attending	Resident	*P*-value*
Total operating time (mean ± SD; minutes)	142 ± 81	167 ± 93	<0.001*
Total hospital stay length (median (IQR); days)	1 (0, 1)	1 (1, 1)	<0.001*
ASA classification			0.951
– Class I, II (*n* (%))	6860 (63.5)	591 (63.4)	
– Class >II (*n* (%))	3941(36.5)	341 (36.6)	

*Two-sided *p*-value < 0.05 considered statistically significant. SD = standard deviation; IQR = interquartile range; ASA = American Society of Anesthesiology

Table 3. Univariate analyses assessing post-operative parotidectomy complications categorised by resident involvement

Parameter	Attending (*n* (%))	Resident (*n* (%))	*P*-value*
Reoperation	129 (1.2)	2 (0.2)	0.003*
Haematoma	39 (0.4)	2 (0.2)	0.770
Readmission	155 (1.4)	4 (0.4)	0.007*
Extended length of stay (≥ 3 days)	233 (2.2)	30 (3.2)	0.036*
Extended length of stay (≥ 30 days)	13 (0.12)	0	0.617
Blood transfusion	12 (0.1)	3 (0.3)	0.111
Mortality	17 (0.2)	0	0.392
Cardiac events	13 (0.1)	1 (0.1)	0.999
Pulmonary events	38 (0.3)	1 (0.1)	0.367
Sepsis	13 (0.2)	1 (0.1)	0.999
Urinary tract infection	33 (0.3)	3 (0.3)	0.761
DVT and/or PE	16 (0.1)	1 (0.1)	0.999
Stroke	11 (0.1)	1 (0.1)	0.999
Clostridium difficile infection	4 (0.04)	0	0.999
Superficial incisional SSI	155 (1.4)	16 (1.7)	0.491
Deep incisional SSI	30 (0.3)	2 (0.21)	0.392
Organ/space SSI	18 (0.2)	0	0.999
Wound disruption	18 (0.2)	3 (0.3)	0.230
Wound complication	228 (2.1)	22 (2.4)	0.613

*Two-sided *p*-value < 0.05 considered statistically significant. DVT = deep vein thrombosis; PE = pulmonary embolism; SSI = surgical site infection

and patients with more than 10 per cent weight loss 6 months prior to surgery (all respective $p < 0.05$). All other demographic data and comorbidities did not differ between resident involved and attending only cohorts (Table 1).

Univariate analysis also showed that resident involved cases were significantly associated with longer operative times, longer total hospital length of stay, a higher proportion of extended length of stay more than or equal to 3 days, and lower proportions of reoperations and readmissions (Tables 2 and 3).

After adjusting for confounding covariates, multivariable analysis elucidated decreased odds of reoperation and readmission to be independently significant in association with resident involvement (Table 4). Relative to attending only cases, resident involved cases had 82 per cent lower adjusted odds of reoperation (95 per cent CI: 0.05–0.73; $p = 0.017$) and 71 per cent lower adjusted odds of readmission (95 per cent CI: 0.11–0.79; $p = 0.016$). Additionally, resident involvement was associated with 24 ± 3 minutes longer adjusted operative times and 23.5 ± 2.3 per cent longer adjusted total hospital length of stay when analysed continuously (mean ± standard error; respective $p < 0.001$).

'July effect'

After applying inclusion and exclusion criteria for 'July effect' cohorts, 11 931 patients were included. Of the included cases, 2983 (25 per cent) took place in first academic quarter. Demographic and pre-operative comorbidities did not significantly differ by cohort, implying that the patient populations were similar in quarter three relative to all other yearly quarters (Table 5). Additionally, all operative variables and outcomes of interest were not detected to be significantly different between cohorts (Tables 6 and 7).

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Table 4. Multivariate analyses assessing complications categorised by resident involvement

Complication	Odds ratio (95% CI)	P-value*
Reoperation	0.18 (0.05–0.73)	0.017*
Haematoma	0.64 (0.15–2.66)	0.538
Readmission	0.29 (0.11–0.79)	0.016*
Extended length of stay (≥ 3 days)	1.29 (0.87–1.92)	0.219
Extended length of stay (≥ 30 days)	NE	–
Blood transfusions	2.4 (0.66–9.10)	0.179
Mortality	NE	–
Cardiac events	0.89 (0.11–7.01)	0.916
Pulmonary events	0.26 (0.04–1.93)	0.188
Sepsis	0.89 (0.12–6.85)	0.910
Urinary tract infection	1.12 (0.03–3.69)	0.848
DVT or PE	0.76 (0.10–5.81)	0.794
Stroke	1.06 (0.13–8.30)	0.955
Clostridium difficile infection	NE	–
Superficial incisional SSI	1.23 (0.73–2.07)	0.433
Organ/space SSI	NE	–
Deep SSI	0.71 (0.17–3.00)	0.644
Wound disruption	1.81 (0.53–6.20)	0.343
Wound complication	1.12 (0.72–1.74)	0.616

*Two-sided p-value < 0.05 considered statistically significant. CI = confidence interval; NE = not estimable due to too few events; DVT = deep vein thrombosis; PE = pulmonary embolism; SSI = surgical site infection

Table 5. Patient demographics and pre-operative comorbidities categorised by academic quarter

Parameter	Quarters 1, 2, 4 (n (%))*	Quarter 3 (n (%))†	P-value*
Age			0.840
– <40	107 (15.5)	37 (15.3)	
– 41–60	295 (42.7)	108 (44.6)	
– 61–80	240 (34.8)	84 (34.7)	
– >80	48 (6.9)	13 (5.4)	
Sex			0.793
– Female	366 (53)	126 (52)	
Race			0.630
– Black	51 (7.4)	22 (9.1)	
– White	467 (67.7)	157 (64.9)	
– Other	71 (10.3)	30 (12.4)	
– Unknown	101 (14.6)	33 (13.6)	
– Hispanic ethnicity	32 (4.6)	8 (3.3)	0.379
BMI			0.366
– Obese (>30)	254 (36.8)	97 (40.1)	
Comorbidity			
– Smoking	180 (26.1)	56 (23.1)	0.364
– Dyspnoea	37 (5.3)	15 (6.2)	0.626
– Diabetes	79 (11.4)	35 (14.4)	0.218
– COPD	23 (3.3)	7 (2.9)	0.738
– CHF	1 (0.1)	0 (0)	0.999
– Hypertension	311 (45.1)	108 (44.6)	0.905
– Dialysis	2 (0.3)	3 (1.2)	0.113
– Steroid use	22 (3.2)	4 (1.6)	0.212
– Weight loss	7 (1.0)	3 (1.2)	0.725
– Bleeding disorder	6 (0.8)	6 (2.48)	0.090
– Anaemia	84 (12.2)	41 (16.9)	0.061
– Systemic sepsis	1 (0.1)	1 (0.4)	0.452
– Disseminated cancer	8 (1.1)	2 (2.1)	0.340

*n = 690 (74 per cent); †n = 242 (726); ‡two-sided p-value < 0.05 considered statistically significant. BMI = body mass index; COPD = chronic obstructive pulmonary disease; CHF = congestive heart failure

Discussion

Parotidectomy is a relatively common procedure performed by otolaryngologists, and technical mastery of this procedure is required by residents prior to graduation. To our knowledge, this study represents the first analysis of both resident involvement and the 'July effect' on 30-day morbidity and mortality after parotidectomy.

Within otolaryngology, a handful of studies have described the relationship between resident involvement and patient outcome. Two large retrospective national database studies by Vieira *et al.* and Abt *et al.* showed no association between resident involvement and adverse outcomes in peri-operative patient care.[10,20] Studies examining other key-indicator cases such as tympanoplasty, tympanomastoidectomy, transsphenoidal surgery and thyroid surgery have also failed to find an association between increased peri-operative complications and resident involvement.[21–23] However, similar to those studies examining otological surgery and thyroidectomy, we found significantly increased mean operative times in our resident cohort. This is not surprising considering the mission of academic programs is to graduate surgeons who can independently perform these technically demanding surgical procedures, a process that takes years of training to achieve.

When examining the effect of resident transitions in the first academic quarter on peri-operative care, we found no significant difference in peri-operative complication rates, readmissions or operative times. Other studies examining the 'July effect' across otolaryngology, as well as in other surgical disciplines have also found no evidence to support an increase in morbidity, mortality or length of stay during this time period.[17, 24–29] Past reports of increased morbidity and mortality in July have likely fuelled the emphasis and implementation of formal patient handoffs throughout medicine, with which modern trainees are well acquainted. While these protocols may not affect intra-operative outcomes, peri-operative patient care is almost certainly improved by them.[30,31]

We also found lower 30-day reoperation and readmission rates in resident-involved cases than those performed by the senior attending alone. No significant difference in readmission rate was associated with cases performed in the first academic quarter. Lower 30-day reoperation rates in resident-involved cases may reflect subtle differences in care not accounted for in the National Surgical Quality Improvement Program database. The American College of Surgeons National Surgical Quality Improvement Program database consists of multiple institutions throughout the

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Table 6. Peri-operative variables categorised by academic quarter

Operative variables	Quarters 1, 2, 4	Quarter 3	*P*-value*
Total operating time (mean ± SD; minutes)	161 ± 92	185 ± 94	<0.001*
Total hospital stay length (median (IQR); days)	1 (1, 1)	1 (1, 1)	0.154
ASA Classification			0.933
– Class I, II	437 (63.3)	154 (63.6)	
– Class >2	253 (36.7)	88 (36.4)	

*Two-sided *p*-value < 0.05 considered statistically significant. SD = standard deviation; ASA = American Society of Anesthesiology

Table 7. Univariate analyses for post-operative complications categorised by academic quarter

Parameter	Quarters 1, 2, 4 (*n* (%))	Quarter 3 (*n* (%))	*P*-value*
Reoperation	1 (0.1)	1 (0.4)	0.452
Haematoma	1 (0.1)	1 (0.4)	0.452
Readmission	4 (0.6)	–	0.578
Extended length of stay (≥ 3 days)	22 (3.2)	8 (3.3)	0.929
Blood transfusions	2 (0.3)	1 (0.4)	0.771
Mortality	–	–	–
Cardiac events	–	1 (0.4)	0.260
Unplanned reintubation	1 (0.1)	–	0.999
Sepsis	–	1 (0.4)	0.260
Urinary tract infection	3 (0.4)	–	0.572
DVT and/or PE	1 (0.1)	–	0.999
Stroke	1 (0.1)	–	0.999
Clostridium difficile infection	–	–	–
Superficial incisional SSI	9 (1.3)	7 (2.9)	0.145
Deep incisional SSI	–	2 (0.8)	0.067
Organ/space SSI	–	–	–
Wound disruption	2 (0.3)	1 (0.4)	0.771
Wound complications	13 (1.9)	9 (3.7)	0.106

*Two-sided *p*-value < 0.05 considered statistically significant. ELOS =; DVT = deep vein thrombosis; PE = pulmonary embolism; SSI = surgical site infection

country. Interestingly, the readmission rates gathered from National Surgical Quality Improvement Program appear to be lower than the 4 per cent readmission rate calculated from the nationwide readmission database.[32] This discordance of values may be attributed to the fact that the National Surgical Quality Improvement Program only considers readmissions within 30 days post-operatively whereas the nationwide readmission database accounts for 30 days after discharge. Thus, if a patient had a prolonged hospital stay, American College of Surgeons National Surgical Quality Improvement Program may have underestimated the readmission rate. Moreover, parotidectomy procedures performed at academic centres may be more likely to be staffed by fellowship-trained head and neck attendings than those performed in community hospitals.

Within otolaryngology, surgical procedures performed at high-volume centres have been shown to be associated with decreased mortality and fewer post-operative complications.[33, 34] Although collinearity between high parotidectomy case volume and teaching hospital status has not been directly studied, nor is that data available in the National Surgical Quality Improvement Program database, collinearity between these variables has been demonstrated in head and neck cancer surgery.[35] Further study is required to assess if parotidectomy case volume at institutions with resident involvement might explain the lower readmission, and reoperation rates associated with resident involvement.

- Resident involvement during parotidectomy is associated with significantly lower reoperation rates and readmission rates
- Resident involvement during parotidectomy is associated with significantly increased mean operative time and total length of stay
- No significant differences in medical or surgical complication rates were observed when comparing resident performed cases during the first academic quarter during new resident transitions compared to all other academic quarters

Although the National Surgical Quality Improvement Program database provides a wide range of variables and complications to address the impact of resident involvement, it has several limitations. Although certain surgical complications such as haematoma, surgical site infection and wound dehiscence are available, the lack of broader procedure-specific complications of interest is a limitation. Many of the potential surgical complications following a parotidectomy, such as incidence of seroma, sialocele formation or facial nerve paralysis are not recorded in the National Surgical Quality Improvement Program. Many pre-operative variables were controlled using multivariable analysis and while the National Surgical Quality Improvement Program database provides high-quality comorbidity data for risk-adjusted analyses of outcomes, there is a possibility of confounding by variables not captured in this database, such as socioeconomic status, histopathology, tumour size and drain placement. Underreporting of resident involvement is a possible source of bias that may influence complication rates. Although our study focused on parotid surgery, the proportion of resident involvement in all otolaryngology surgical cases has been cited as 38.4 per cent.[36] The necessary exclusion of cases that do not specify resident-involved or attending-only cases could bias the results.

Conclusion

By utilising a multi-institutional database, we were able to use regression analysis to independently identify the impact of resident involvement on 30-day peri-operative complications, readmissions, reoperation and operative length. Resident participation is associated with significantly lower reoperation and readmission rates while demonstrating increased mean operative time and total hospital length of stay. Parotidectomy procedures performed in the first academic quarter during resident transitions had no significant impact on overall patient outcomes.

Competing interests. None declared

References

1 Franzen A, Buchali A, Lieder A. The rising incidence of parotid metastases: our experience from four decades of parotid gland surgery. *Acta Otorhinolaryngol Ital* 2017;**37**:264–9

2 Iyer NG, Clark JR, Murali R, Gao K, O'Brien CJ. Outcomes following parotidectomy for metastatic squamous cell carcinoma with microscopic residual disease: implications for facial nerve preservation. *Head Neck* 2009;**31**:21–7
3 Malata CM, Camilleri IG, McLean NR, Piggot TA, Chippindale AJ, Kelly GC, Soames JV. Malignant tumours of the parotid gland: a 12-year review. *Br J Plast Surg* 1997;**50**:600–8
4 Sethi RKV, Deschler DG. National trends in inpatient parotidectomy: A fourteen-year retrospective analysis. *Am J Otolaryngol* 2018;**39**:553–7
5 Kim BD, Lim S, Wood J, Samant S, Ver Halen JP, Kim JY. Predictors of adverse events after parotidectomy: a review of 2919 cases. *Ann Otol Rhinol Laryngol* 2015;**124**:35–44
6 O'Brien DC, Kellermeyer B, Chung J, Carr MM. Experience with key indicator cases among otolaryngology residents. *Laryngoscope Investigative Otolaryngology* 2019;**4**:387–92
7 Cameron JL. William Stewart Halsted. Our surgical heritage. *Ann Surg* 1997;**225**:445–58
8 Iannuzzi JC, Rickles AS, Deeb AP, Sharma A, Fleming FJ, Monson JR. Outcomes associated with resident involvement in partial colectomy. *Dis Colon Rectum* 2013;**56**:212–18
9 Iannuzzi JC, Chandra A, Rickles AS, Kumar NG, Kelly KN, Gillespie DL *et al.* Resident involvement is associated with worse outcomes after major lower extremity amputation. *J Vasc Surg* 2013;**58**:827–31
10 Abt NB, Reh DD, Eisele DW, Francis HW, Gourin CG. Does resident participation influence otolaryngology-head and neck surgery morbidity and mortality? *Laryngoscope* 2016;**126**:2263–9
11 Bohl DD, Fu MC, Golinvaux NS, Basques BA, Gruskay JA, Grauer JN. The "July Effect" in Primary Total Hip and Knee Arthroplasty: Analysis of 21,434 Cases From the ACS-NSQIP Database. *J Arthroplasty* 2014; **29**:1332–8
12 Hoashi JS, Samdani AF, Betz RR, Bastrom TP, Harms Study Group, Cahill PJ. Is there a "July Effect" in surgery for adolescent idiopathic scoliosis? *J Bone Joint Surg Am* 2014; **96**:e55
13 Nandyala SV, Marquez-Lara A, Fineberg SJ, Singh K. Perioperative characteristics and outcomes of patients undergoing anterior cervical fusion in July: analysis of the "July effect." *Spine* 2014; **39**:612–17
14 Karipineni F, Panchal H, Khanmoradi K, Parsikhia A, Ortiz J. The "July effect" does not have clinical relevance in liver transplantation. *J Surg Educ* 2013;**70**:669–79
15 Young JQ, Ranji SR, Wachter RM, Lee CM, Niehaus B, Auerbach AD. "July effect": impact of the academic year-end changeover on patient outcomes: a systematic review. *Ann Intern Med* 2011;**155**:309–15
16 Hennessey PT, Francis HW, Gourin CG. Is there a "July effect" for head and neck cancer surgery? *Laryngoscope* 2013;**123**:1889–95
17. Bresler AY, Bavier R, Kalyoussef E, Baredes S, Park RCW. The "July effect": Outcomes in microvascular reconstruction during resident transitions. *Laryngoscope* 2020; **130**:893–8
18 Bashjawish B, Patel S, Kılıç S, Hsueh WD, Liu JK, Baredes S *et al.* Examining the "July effect" on patients undergoing pituitary surgery. *Int Forum Allergy Rhinol* 2018;**8**:1157–61
19 American College of Surgeons. ACS NSQIP participant use data file. In: https://www.facs.org/quality-programs/acs-nsqip/about/participants [25 March 2020]
20 Vieira BL, Hernandez DJ, Qin C, Smith SS, Kim JYS, Dutra JC. The impact of resident involvement on otolaryngology surgical outcomes. *Laryngoscope* 2016;**126**:602–7
21 Wong A, Filimonov A, Lee YJ, Hsueh WD, Baredes S, Liu JK *et al.* The impact of resident and fellow Participation in Transsphenoidal Pituitary Surgery. *Laryngoscope* 2018;**128**:2707–13
22 Muelleman T, Shew M, Muelleman RJ, Villwock M, Sykes KJ, Staecker H *et al.* Impact of resident participation on operative time and outcomes in otologic surgery. *Otolaryngol Head Neck Surg* 2018; **158**:151–4
23 Kshirsagar RS, Chandy Z, Mahboubi H, Verma SP. Does resident involvement in thyroid surgery lead to increased postoperative complications? *Laryngoscope* 2017;**127**:1242–6
24 Hennessey PT, Francis HW, Gourin CG. Is there a "July effect" for head and neck cancer surgery? *Laryngoscope* 2013;**123**:1889–95
25 Ehlert BA, Nelson JT, Goettler CE, Parker FM, Bogey WM, Powell CS *et al.* Examining the myth of the "July Phenomenon" in surgical patients. *Surgery* 2011;**150**:332–8
26 Ford AA, Bateman BT, Simpson LL, Ratan RB. Nationwide data confirms absence of 'July phenomenon' in obstetrics: it's safe to deliver in July. *J Perinatol* 2007;**27**:73–6
27 Watkins AA, Bliss LA, Cameron DB, Eskander MF, Tseng JF, Kent TS. Deconstructing the "July effect" in operative outcomes: a national study. *J Gastrointest Surg* 2016;**20**:1012–19
28 Highstead RG, Johnson LS, Street JH 3rd, Trankiem CT, Kennedy SO, Sava JA. July—as good a time as any to be injured. *J Trauma* 2009;**67**:1087–90
29 Lieber BA, Appelboom G, Taylor BES, Malone H, Agarwal N, Connolly ES. Assessment of the "July Effect": outcomes after early resident transition in adult neurosurgery. *J Neurosurg* 2016;**125**:213–21
30 Gagnier JJ, Derosier JM, Maratt JD, Hake ME, Bagian JP. Development, implementation and evaluation of a patient handoff tool to improve safety in orthopaedic surgery. *Int J Qual Health Care* 2016;**28**:363–70
31 Murray N, Valdez TA, Hughes AL, Kavanagh KR. Teaching a tracheotomy handoff tool to pediatric first responders. *Int J Pediatr Otorhinolaryngol* 2018;**114**:120–3
32 Mukdad L, Goel AN, Nasser HB, St John MA. Understanding nationwide readmissions after parotidectomy. *Laryngoscope* 2020;**130**:1212–17
33 Hatch JL, Bauschard MJ, Nguyen SA, Lambert PR, Meyer TA, McRackan TR. Does hospital volume affect outcomes in patients undergoing vestibular schwannoma surgery? *Otol Neurotol* 2018;**39**:481–7
34 Rubin SJ, Wu KY, Kirke DN, Ezzat WH, Truong MT, Salama AR *et al.* Head and neck cancer complications in the geriatric population based on hospital case volume. *Ear Nose Throat J* 2021;**100**:62–8
35 Cheung MC, Koniaris LG, Perez EA, Molina MA, Goodwin JW, Salloum RM. Impact of hospital volume on surgical outcome for head and neck cancer. *Ann Surg Oncol* 2009;**16**:1001–9
36 Vieira BL, Hernandez DJ, Qin C, Smith SS, Kim JYS, Dutra JC. The impact of resident involvement on otolaryngology surgical outcomes. *Laryngoscope* 2016;**126**:602–7