A Comparison of the Success Rates of Resident and Attending Strabismus Surgery

H. Jay Wisnicki, MD, Michael X. Repka, MD, Edward Raab, MD, Giselle G. Hamad, MD, David Kirsch, MD, Ajay Nath, MD, and Donna N. Loupe, CO, COMT

ABSTRACT
Residency training involves surgery by resident surgeons at various levels of experience and proficiency, supervised by an experienced attending physician. We reviewed the results of strabismus surgery performed at four institutions with two residency training programs. Five hundred twenty-two cases with follow up greater than 6 weeks were evaluated. These cases included 315 attending procedures and 207 resident procedures under direct attending supervision. Success was defined as a strabismic deviation of 8 prism diopters or less. Average postoperative follow-up was 57 weeks and did not differ between groups. There was no statistical difference between the resident success rate of 58% (121/207) and the attending success rate of 69% (217/315) after adjusting for population differences. The average final deviation of the patients postoperatively was 7 Δ for the attending group and 10 Δ for the resident group. Amblyopia was significantly more frequent in the resident cases ($P < .001$). Adjustable sutures were used significantly more often in attending cases ($P < .0001$). This study supports the premise that resident strabismus surgery is as successful as attending surgery.

INTRODUCTION
Residency training involves surgery by resident physicians at various levels of experience and proficiency, supervised by experienced attending physicians. Many strabismus surgeons involved in residency training feel that the outcome of resident surgery they supervise is no different than had they been the primary surgeon. Hospitals and residency training programs are under increasing scrutiny of the quality of care delivered to their patients. This study was undertaken to compare the success rate of strabismus surgery performed by residents to that performed by experienced strabismus surgeons.

METHODS
Records of patients who underwent horizontal strabismus surgery at two residency training programs (Johns Hopkins University School of Medicine and Mount Sinai School of Medicine) including four institutions (Beth Israel Medical Center, Elmhurst General Hospital, Mount Sinai Medical Center, and Wilmer Ophthalmological Institute) were retrospectively reviewed. All resident cases were performed by residents during their pediatric ophthalmology rotations and who were assisted in the operating room by a faculty member. In virtually all cases, the faculty member was a strabismus specialist. Attending surgery was performed by a pediatric ophthalmologist with the assistance of an ophthalmology resident or fellow in pediatric ophthalmology and strabismus.

The following data were collected: patient name, date of birth, date of surgery, date of last follow-up examination, preoperative deviation in primary gaze, postoperative deviation, presence of amblyopia, use of an adjustable suture, history of prior strabismus surgery, resident or attending case, and institution at which performed. All data were entered into a computer data base for analysis. For each procedure, the patient's age, follow-up interval in weeks, and absolute value of preoperative and postoperative deviations were calculated. Surgical success was defined as a postoperative deviation of 8 prism diopters or less at least 6 weeks after surgery.

STATISTICAL ANALYSIS
The proportions of each demographic variable were compared using chi-square tests without continuity correction. Differences in means between the two groups were
TABLE 1
Overall Success of Strabismus Surgery

<table>
<thead>
<tr>
<th></th>
<th>No. of Patients</th>
<th>Successful Alignment(%)*</th>
<th>Mean Age (Years)*</th>
<th>Mean Follow Up (Weeks)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resident</td>
<td>207</td>
<td>121 (58%)</td>
<td>12.7</td>
<td>52</td>
</tr>
<tr>
<td>Attending</td>
<td>315</td>
<td>217 (69%)</td>
<td>18.7</td>
<td>60</td>
</tr>
<tr>
<td>Total</td>
<td>522</td>
<td>338 (65%)</td>
<td>16.3</td>
<td>57</td>
</tr>
</tbody>
</table>

*Statistically significant difference (see text).

TABLE 2
Distribution of Risk Factors Possibly Affecting Outcome

<table>
<thead>
<tr>
<th></th>
<th>No.</th>
<th>Ambylopia*</th>
<th>Adjustable†</th>
<th>Reoperation‡</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resident</td>
<td>207</td>
<td>43%</td>
<td>15%</td>
<td>22%</td>
</tr>
<tr>
<td>Attending</td>
<td>315</td>
<td>29%</td>
<td>38%</td>
<td>26%</td>
</tr>
<tr>
<td>Total</td>
<td>522</td>
<td>34%</td>
<td>29%</td>
<td>24%</td>
</tr>
</tbody>
</table>

*Statistically significant difference (P < .001).
†Statistically significant difference (P < .0001).
‡Not statistically significant.

tested for significance using a t-test. All reported P-values are two-tailed. Linear and logistic regression analyses were performed to adjust for demographic differences between the two groups and determine statistically significant predictors of outcome.

RESULTS
The records of 522 procedures were found to meet the inclusion criteria for this study. Each of these patients underwent horizontal strabismus surgery. There were 207 resident cases and 315 attending cases. Before adjusting for population differences, the overall success rates differed significantly (Table 1). Resident surgery patients were less likely to have successful motor alignment (58%) compared to attending patients (69%) (chi-square = 5.9, df = 1, P < .02). The average final deviation was 10Δ for the resident group and 7Δ for the attending group (t = 3.63, P < .0001). These patients did not differ significantly in length of follow up.

The adjusted difference in success rates after multiple linear regression analysis was 6%. This difference was no longer statistically significant (P = .19). Similarly, logistic regression analysis did not demonstrate a significant difference in the chance of a successful outcome. Absence of ambylopia, use of adjustable sutures, and reoperative deviation less than 25Δ were significant predictors of surgical success.

A number of factors may contribute to the difference in outcome. These factors include age, ambylopia, use of adjustable sutures, and reoperation surgery (Tables 1-2). The resident surgical patients were significantly younger (t = 4.89, P < .0001). Amblyopia was significantly more common in the resident surgical patients (chi-square = 11.5, df = 1, P < .001). Adjustable sutures were employed significantly more often in the attending cases (chi-square = 32.5, df = 1, P < .0001). There was only a slight difference in the frequency of reoperation surgery being performed.

In Table 3, the success rates are compared for exotropic and esotropic deviations. Overall, there was no significant difference in outcome. However, there was a significant difference with a poorer surgical outcome for resident exotropia surgery compared to attending exotropia surgery (49% vs 70%; chi-square = 7.2, df = 1, P < .01).

Table 4 illustrates the effect of the size of deviation on outcome. Our data support the observation that surgery for small-angle strabismus surgery is more successful than surgery for large-angle strabismus (75% vs 58%; chi-square = 16.3, df = 1, P < .0005). There is a substantial trend toward a better outcome for attending
surgery compared to resident surgery for large-angle strabismus (chi-square = 3.07, df = 1, P < .08).

An analysis of outcome for reoperation surgery was performed. There was no difference in the success rates between resident (67%) and attending (64%) surgery for reoperation surgery. Unexpectedly, there was no difference in the success rates between reoperation (65%) and initial surgery (65%) for all cases.

We also stratified the data on the basis of adjustable vs nonadjustable (Table 5) and amblyopic vs nonamblyopic patients (Table 6). There were no statistical differences in this data by chi-square analysis. We also eliminated patients who had amblyopia or who underwent adjustable surgery (Table 7). There was no statistical difference between resident and attending success for nonadjustable, nonamblyopic surgeries.

DISCUSSION AND CONCLUSIONS

A number of studies in various surgical specialties have compared resident and attending surgery. These studies have evaluated surgical success, complication rate, and other measures of morbidity and mortality. Surgical outcome for appendectomy\(^1\) and cholecystitis\(^2,3\) were similar for resident and attending cases. Resident carotid endarterectomy\(^4\) and abdominal aortic procedures\(^5\) have results comparable to reports in the literature for attending surgery. Operative mortality in patients undergoing cardiac surgery involving single valve replacement in teaching institutions was no different for resident vs staff surgeon groups.\(^6\) In a report from Finland, a difference in outcome was detected for complex ear surgery, with poorer results for the resident surgeons.\(^7\) This was true despite extensive cadaver training. The authors did not speculate on a cause for this divergent outcome.

There are only a few reports evaluating outcomes for eye surgery. In a prospective study of cataract surgery with intraocular lens implantation at a major residency training program, there was no significant difference between the results of resident and faculty surgery.\(^8\) Another report of resident cataract surgery\(^9\) showed complication rates and visual acuity outcome comparable to other reports in the literature. There have been no reports evaluating the outcome of resident strabismus surgery.

In our retrospective study of strabismus surgery for horizontal deviations, the overall success rate of resident surgery was lower than that of attending surgery. Once population differences and the use of adjustable sutures were adjusted, the adjusted difference of 6% was no longer statistically significant. The resident group was significantly younger and more often amblyopic than the attending group. These factors may have contributed to the poorer success rate in the resident group.\(^10\) They may also explain the better success rate of attendings for exotropia surgery. Poor compliance with amblyopia therapy in resident service populations is a likely explanation of increased amblyopia rate. The success rate of attending surgery might be higher due to better surgical technique. Such a relationship has been often implied, but never proven. In the Prism Adaptation Study, technique has been shown not to affect surgical outcome in the management of acquired esotropia.\(^11\) Adjust-
able surgery has often been cited as a method to improve success. 12 This technique was utilized significantly more often in the attending group.

A history of prior strabismus surgery was perceived in the planning of this study to adversely affect outcome. We also expected that there would be more reoperations in the attending group and that this might reduce the attending success rate. The rate of reoperations did not differ substantially between the two groups. Surprisingly, the chance of a successful alignment was the same for a reoperation as for initial surgery.

It is important to mention that although the differences in patient characteristics explain the relative success of strabismus surgery, this does not prove these factors govern outcome. Numerous factors affecting outcome were not evaluated in this project. A prospective study of strabismus surgery could indicate the variables which directly determine whether a surgical procedure will be successful. This study has shown that the success rate for strabismus surgery performed by residents does not differ from that for attending physicians. The factors which are important predictors of success are absence of amblyopia, smaller preoperative deviation, and the use of an adjustable suture.

REFERENCES

Erratum

Regarding the article, “Superior Oblique Tuck Surgery in the Management of Superior Oblique Palsies,” by Drs Morris, Scott, and Keech, which appeared in the November/December 1992 issue of The Journal of Pediatric Ophthalmology and Strabismus, the following statement appeared on page 343:

“In patients with larger vertical deviations in primary position, we have also found a superior oblique tendon tuck combined with an ipsilateral inferior rectus recession to be highly effective.”

This statement should read:

“In patients with larger vertical deviations in primary position, we have also found a superior oblique tendon tuck combined with a contralateral inferior rectus recession to be highly effective.”

The authors regret the error.