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Myringoplasty

Short and long-term results in a training program

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MYRINGOPLASTY is today an established procedure, yet several questions regarding its results have not so far been fully documented. In this study we have tried to find out what are the factors influencing the short-term and the long-term results in myringoplasty—as related to the type of pathology encountered, and correlated as well to the experience of the surgeon performing the operation. We were particularly interested as to how residents did in comparison with experienced surgeons.

Methods

1. This study concerns myringoplasties performed at the ENT Department, Meir Hospital, during the years 1971–1979, by staff members and residents.
2. Fifty-six questions (Fig. 1) were tabulated on a sheet suitable for computer analysis, fifty-five of which were answered for each patient. This was accomplished with the help of the patient's hospital chart, his out-patient follow-up chart and a final check-up. One question, i.e. type of pneumatization (marked X), was finally excluded.
3. While the study was done retrospectively, all the patients included came regularly to our follow-up clinic at least twice a year post-operatively.
4. The data were summarized as frequency tables using SPSS (Nie, 1975). Chi-square tests of significance were computed where appropriate.

Material

Our study concerns only myringoplasties done with the 'underlay' technique, using fascia or tragal perichondrium. Only patients who were operated upon for the first time, and who had no other lesions besides a perforation of the pars tensa, were included. Patients who had an ossicular chain lesion, retraction pockets, cholesteatoma, or who were operated

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MYRINGOPLASTY

Name: .....

1 0 __ __ __ __ I.D. No.

6 1 1

8 __ Sex: male—1; female—2

9 __ __/__ __ Date of birth (month/year)

13 __ No. of op.: first—1; second—2; third—3

14 __ __/__ __ Date of operation (month/year)

18 __ Surgeon: 1, 2, 3, 4, 5, 6, 7, 8

19 __ Perf. on arrival: dry—1; wet—2;

20 __ Size of initial perf.: 1, 2, 3, 4, 5

21 __ Place of initial perf.: post. sup.—1; central—2; anterior—3; other—4

22 __ Mucosa: thin—1; thick—2; polypoid—3

*23 __ Pneumatization: 1, 2, 3, 4, 5, 6, 7, 8, 9,

24 __ Graft: fascia—1; perichondrium—2; other—3

25 __ Rotating flap: no—1; yes—2

26 __ Ant. underlay: no—1; yes—2

27 __ Tufts: no—1; yes—2

28 __ Ant. overhang: not removed—1; removed—2

29 __ Prim. take: yes—1; pin-point—2; partial—3; dropped—4; no-take—5

30 __ Place of no-take: post. sup.—1; central—2; anterior—3; other—4

31 __ Epithelialization: total—1; partial—2; grossly defective—3; granulations—4

32 __ Post. op. infection: no—1; yes—2

33 __ Size of perf. (if breakdown): 1–5

34 __ Further surgery recom.: no—1; yes—2

35 __ Re-operation: no—1; yes—2

RE-OPERATION

38 __ __/__ __ Date of second operation (month/year)

42 __ Surgeon: 1, 2, 3, 4, 5, 6, 7, 8

43 __ Perforation: dry—1; wet—2

44 __ Size of perforation: 1, 2, 3, 4, 5

45 __ Place of perf.: post. sup.—1; central—2; anterior—3; other—4

46 __ Mucosa: thin—1; thick—2; polypoid—3

47 __ Graft: fascia—1; perichondrium—2; other—3

48 __ Rotating flap: no—1; yes—2

49 __ Ant. underlay: no—1; yes—2

50 __ Tufts: no—1; yes—2

51 __ Ant. overhang: not removed—1; removed—2

52 __ Prim. take: yes—1; pin-point—2; partial—3; dropped—4; no-take—5

53 __ Place of no-take: post. sup.—1; central—2; anterior—3; other—4

54 __ Epithelialization: total—1; partial—2; grossly defective—3; granulations—4

55 __ Size of perf. (if breakdown): 1, 2, 3, 4, 5

56 __ Post-op. infection: no—1; yes—2

57 __ Further surgery recom.: no—1; yes—2

58 __ Re-op. (3rd time): no—1; yes—2

59 __ Patient: happy—1; indifferent—2; unhappy—3

LONG-TERM FOLLOW-UP, FIRST GRAFT STATUS (if no re-operation)

62 __ __/__ __ Last date seen (month/year)

66 __ Take: no—1; yes—2

67 __.__ Total take (years) of 1st graft: 1–9

69 __.__ Breakdown after (years): 1–9

71 __ Size of breakdown: 1, 2, 3, 4, 5

72 __ Place of breakdown: post. sup.—1; central—2; anterior—3; other—4

73 __ Atelectasis appeared: no—1; yes—2

74 __.__ Atelectasis appeared after (years): 1–7

76 __ Grade of atelectasis: 1, 2, 3, 4, 5

77 __ Epithelialization: total—1; partial—2; grossly defective—3; granulations—4

78 __ Patient: happy—1; indifferent—2; unhappy—3

FIG. 1

Complete sheet with 56 questions. Note question No. 23 (marked *) has not been entered in this study.

upon before (in our department or elsewhere), were excluded. During the years 1971–1979, 855 myringoplasties were performed in our department. 167 myringoplasties, which were either re-operations or were grafted with other material than fascia or tragal perichondrium (such as periosteum)—or which could not be strictly termed as 'underlay' technique—were excluded from this study. To this group belonged also myringoplasties operated by two younger residents, who had operated upon less than 12 ears each. Out of the remaining 688 ears, 35 (5·1 per cent) ears were lost to our final follow-up, which left us for this study with 653 (94·9 per cent) ears.

The study was done in two stages:

1. Group A—myringoplasties performed during the years 1971–1978 were analysed in 1979 for short- and long-term results.
2. Group B—in 1980, the ears operated upon during 1979 were analysed for short-term results. This second stage was not planned *a priori,* but was conceived at the end of the first stage, when it was felt that awareness by the surgeons of such a study may influence their short-term results; this, as we may see, turned out to yield rather interesting results.

Group A: During the years 1971–1978, 731 myringoplasties were performed. 136 were not considered to comply with the strict criteria required, leaving 595 ears, of which 30 (5 per cent) were lost to our final follow-up; leaving us with 565 (or 95 per cent) of the ears.

1. Sex: 52·7 per cent of the patients were male and 47·3 per cent were female, the difference being insignificant.
2. Age: the mean age of our patients was 33 years (ranging from 5 to 74 years).
3. Side: 47 per cent of the cases had their perforations on the right side, 53 per cent on the left, the difference being insignificant.
4. Size of perforation: perforations were designated as: Grade I—pin-point—no such ears were operated upon; Grade II—small, i.e. smaller than one quarter of the drum—these numbered 225 (40 per cent) of the total; Grade III—medium—up to half the drum's size—these numbered 166 (29 per cent); Grade IV—large—up to three-quarters of the drum—these numbered 126 (22 per cent); Grade V—total perforations, where only the annulus or part of it were left—these numbered 48 (9 per cent).
5. Place of perforation: the place was defined as: (a) posterior-superior (behind and above the umbo)—53 (9·5 per cent); (b) central—430 (76 per cent); (c) anterior (anterior to the umbo)—82 (14·5 per cent).
6. The mucosa: the middle-ear mucosa was designated as thin in 397 (70·3 per cent) ears; thick or polypoid in 168 (29·7 per cent) ears;

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dry in 398 (70·4 per cent) and wet* on arrival in 167 (29·6 per cent) ears. The ears with thin mucosa turned out to be usually those designated as dry.

7. The study concerned six surgeons—three staff and three senior residents; the number of myringoplasties per surgeon ranged between 46 and 130.

Group B: During 1979—114 myringoplasties were performed—31 being revisions or having other 'disqualifying' features—leaving 83 ears, of which 5 (6 per cent) were lost to follow-up. The remaining 78 ears were operated upon by 5 of the 6 surgeons which constituted Group A—the sixth surgeon left for a year of Basic Sciences training.

Short-term Results

A. *Group A*

Any graft which was seen to be intact two months after the operation, was considered to have taken. These were qualified as 'take' or 'no take'. 'No take' was divided into 'total no take' and 'partial take'. Altogether, 460 ears (81 per cent) were found to have a total primary take, 11 per cent had a partial take, and 8 per cent failed to take altogether.

Several factors were found *not* to influence primary take (Table I)—these were: (1) sex; (2) *age* of the patient; (3) the state of the mucosa prior to the operation (i.e. dry, wet, thin, thick or polypoid); (4) post-operative infections; (5) neither did the type of graft, i.e. perichondrium or fascia, alter the results significantly.

TABLE I

SUCCESS RATE NON-INFLUENCING FACTORS (565 MYRINGOPLASTIES)

Factor		% of ears	Average rate	p
Age	0– 9	38 (6·7%)	84%	0·5796
	10–19	141 (24·9%)	81%	
	20–39	193 (34·2%)	82%	
	40+	193 (34·2%)	80%	
Sex	Males	298 (52·7%)	82%	0·5401
	Females	267 (47·3%)	81%	
Dryness	Dry	398 (70·4%)	80%	0·8986
	Wet	167 (29·6%)	81%	
Mucosa	Thin	397 (70·3%)	81%	0·1046
	Thick	135 (23·9%)	83%	
	Polypoid	33 (5·8%)	79%	

$p<0·001$

* Our policy was to treat discharging ears pre-operatively (with or without a thick or polypoid mucosa) conservatively. This treatment amounted to suctioning the discharge under the operating microscope and treating the ear with boric acid powder or a 3 per cent boric acid solution; in the latter case wicks were used. We tried to have the ears treated in this fashion thrice a day. All ears were cultured. *Antibiotics (systemically or locally) were, however, not used.* With such a treatment, ears usually dried within an *average* of 5·3 days to a reasonable degree and turned bacteriologically sterile.

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Percentage-wise the distribution between the surgeons concerning the above factors was essentially equal and accordingly these factors may be considered not to influence the results of any individual surgeon.

Other factors, however, did influence the primary take considerably and significantly: these were the surgeon, the size of the perforation, and its position.

(1) *Primary take—overall results* (Table II)

Out of 565 ears, 460 (81 per cent) were found to have total primary take; 43 (8 per cent) were total failures; and 62 (11 per cent) were found to have a partial graft take, i.e. the perforation decreased in size. However, without being first broken down, these overall numbers do not give us a realistic picture of what can be expected from a particular surgeon or a particular ear.

TABLE II

SHORT-TERM RESULTS

	No. of ears	Range	Average	PT	NT
Group A	565	63·5– 93·5%	81%	11%	8%
Group B	78	86 –100%	91%	9%	0%

PT = Partial take; NT = No take; $p<0{\cdot}001$

(a) *The surgeon*

The highest overall take for a single surgeon was 93·5 per cent, with 6·5 per cent partial take, and no 'no take'. The lowest overall take rate of a single surgeon was 63·5 per cent with 7·5 per cent partial take, and 19 per cent no take. The rest of the surgeons fell between these two extremes.

While the best results were obtained by an experienced staff member and the poorest results by a resident, when the results were compared for each surgeon, there was no direct or absolute correlation between success and seniority; some senior residents had shown better results than a staff member. Neither was there a direct linear relationship between the number of myringoplasties operated upon and the success rate.

(b) *Size of perforation* (Table III)

There was a linear relationship between the size of perforation and success of operation, smaller perforations having better success rates than the larger ones. The different success rates between surgeons again became apparent; it was found that bigger perforations did better in the hands of more experienced surgeons. This factor was all the more important as the distribution of the various types of perforations was not equal among the group; the more senior the surgeon, the bigger were the perforations he dealt with.

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TABLE III

PRIMARY TAKE AND SIZE OF PERFORATION

Size	Take	PT	NT	Range
2(225)	87%	1%	12%	72 %—100%
3(166)	81%	13%	6%	71 %— 89%
4(126)	76%	21%	3%	26·5%—100%
5 (48)	73%	25%	2%	50 %—100%
Total (565)	81%	11%	8%	26·5%—100%

PT = Partial take; NT = No take; $p<0·001$
Range—the lowest and highest success rate obtained.

(c) *Place of perforation* (Table IV)

Postero-superior perforations showed better rates of take than central or anterior perforations, the range between the various surgeons being again considerable (Table IV).

TABLE IV

PRIMARY TAKE AND PLACE OF PERFORATION (565 MYRINGOPLASTIES)

Place of perforation		Complete take	(Range)	Partial take	(Range)	No take	(Range)
Postero-superior	(53)	90%	(66·5–100%)	—	—	10%	(0–33·5%)
Central	(430)	81%	(65 – 93%)	13%	(7–22%)	6%	(0–15·5%)
Anterior	(82)	78%	(50 – 93·5%)	7%	(0–16·5%)	15%	(0–41·5%)
Total	(565)	81%	(50 –100%)	11%	(0–22%)	8%	(0–41·5%)

$p<0·001$

B. *Group B*

Out of the eighty-three operated ears seventy-one i.e. 91 per cent, were found to have a primary take; 7 (9 per cent) partial take; none failed to take. The overall range of success between surgeons was 86 per cent and 100 per cent (Table II).

Long-term Results

460 ears out of Group A, designated as 'take' in the short-term inspection, were followed up to seven years (the mean being 2·6 years). The results were accepted as long-term after a 'take' of one year or longer. Only 387 (84·2 per cent) were included in the long-term follow-up. The remaining 73 ears were not included for two reasons: 45 ears (9·8 per cent) had a follow-up of less than one year; and 28 ears (6 per cent) did not appear for the last long-term follow-up. The following features were looked for: (1) intactness of drum; when the drum was found to have re-perforated, this was regarded as a *breakdown*; (2) atelectasis of the

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pars tensa; (3) degree of epithelization; (4) appearance of granulation tissue.

(1) *Intactness of the drum*

Twenty-four ears (6·2 per cent) out of the 387 drums which initially showed complete takes, presented themselves again with perforations of grade 2 and 3. In addition to this, 7 ears (1·8 per cent) showed pinpoint (grade 1) perforations. Pinpoint perforations were those perforations which were detected with the aid of the surgical microscope only. *None* of these patients were aware of the perforation nor of the event which provoked it; no episodes of acute otitis media or trauma were reported. The average post-operative time for the appearance of re-perforation was 1·9 years; thereafter there was a decline in the occurrence of re-perforations (Fig. 2). Altogether 92 per cent of the ears followed for long-term results were found, therefore, to have a completely intact drum.

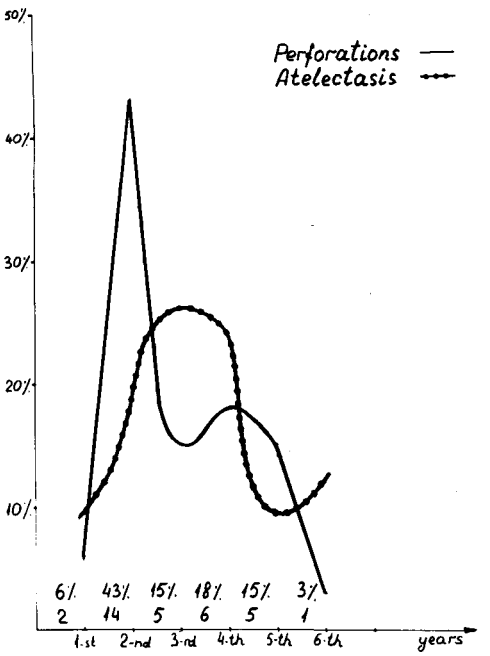


FIG. 2

Rate of re-perforations and atelectasis appearance (ordinate), as reflected in years after the operation (abscissa).

(2) *Atelectatic phenomenon* (Table V)

Some sinking of the *pars tensa* was found to occur in 41 (10·6 per cent) of the ears. The time-peak at which atelectasis appeared was 2·3 years

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TABLE V

DEVELOPMENT OF ATELECTASIS
(387 PRIMARY TAKES)

Grade of atelectasis	Number and % of ears	
I	18	(4·7%)
II	16	(4·1%)
III	3	(0·8%)
IV	4	(1·0%)
Total	41	(10.6%)

$p<0.001$

after the operation; thereafter there was a sharp decline in the frequency of atelectatic appearance (Fig. 2). Eighteen ears (4·7 per cent) showed a slight retraction—grade I; 16 (4·1 per cent) showed the drum touching the ossicular chain, i.e. grade II; and 7 ears (1·8 per cent) showed the drum to recline severely, all the way towards the promontory—grades III and IV. Shrapnel's membrane retraction was not observed.

(3) *Epithelialization of drum and presence of granulation tissue*

Out of 387 ears, 42 (11 per cent) showed an incomplete epithelialization of the drum, 9·5 per cent as a spot; and 1·5 per cent showed more extended denuded areas of the drum. *These 11 per cent included the 7 pinpoint perforations mentioned above, which appeared in the center of the disepithelialized regions.*

The frequency distribution of the long-term complications, i.e. re-perforation, atelectasis and deficiency in epithelialization, between any of the surgeons or residents who participated in this study, *was statistically not significant*; nor did these secondary deficiencies appear more often in ears which had initially larger perforations than in those which were operated upon for small ones.

Discussion

Results of myringoplasty operations, presenting various techniques, have already been reported by numerous surgeons (Austin and Shea, 1961; Guilford, 1962; Jansen, 1964; Sheehy, 1964; Austin, 1965; Robinson, 1966; Smyth and Kerr, 1969; Plester, 1970; Cody and Taylor, 1973; Glasscock, 1973; Booth, 1973; Puhakka *et al.*, 1979). The number of operations reported per study varied from 53 to 878, being usually around 100–200. The satisfactory results claimed were usually between 90 per cent and 98 per cent; only few (Cody and Taylor, 1973; Sheehy, 1964; Puhakka *et al.*, 1979) presented long-term results.

The quantitative information obtained by us, when all the details from this study were fed into the computer, was too large to describe *in toto.* However, only part of it seemed to be relevant, and we have chosen to

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report those items which seemed to us to be most relevant and from which we could learn pertinent points.

A. *Short-term or immediate results*

From our study we learn that the 'take' of a myringoplasty flap was irrelevant in respect to several factors; sex, side and type of graft used (fascia or perichondrium). To our great surprise, age or type of mucosa (thick or thin), as well as immediate pre-operative infection, also had no significant bearing on the success rate.

What did affect initial success was the actual technical problem of fitting the graft snugly in place—and being successful in keeping it there! That we see from the lower success rate in anteriorly placed perforations, or in large perforations. This technical aspect mirrored itself especially well when the analysis of the results of each individual surgeon was compared. This also revealed the almost obvious conclusion that, while an extensive experience is of course extremely valuable, an able and meticulous resident in his senior years could nevertheless obtain very acceptable results.

When comparing results obtained by various surgeons, however, one should remember that the samples were not completely unbiased, as the more difficult perforations obviously became the lot of the more experienced surgeons.

A more detailed analysis of the results obtained by each of the residents—taking into account the *time* factor in their residency—brought in the following interesting information:

A. As in most training departments, residents in their senior years are tutored by a staff man until they are found to be able to perform their surgery independently, at which time they are permitted to do their surgery on their own, unsupervized. *It was soon after this stage that their success rate dropped*—only to pick up again when the results surfaced. I attribute this phenomenon to over-confidence of young and eager (though able) residents.

B. It is also very interesting to note that results improved considerably, once it became known that this study was underway and that the cases of each surgeon were being scrutinized and put on a computer sheet; this surfaced when the results of 1979 (Group B) were compared with the previous results, although added experience cannot of course be discounted.

While all this sounds optimistic, *some residents are not cut out to be surgeons—or microsurgeons—and should be advised accordingly.*

There is the question of partial take, which could be due to two factors:

A. Technical—and all that was said in regard to 'no take' would apply here as well. Indeed, partial takes happened less frequently in the hands of more experienced surgeons. Also, the more experienced

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the surgeon, the greater was the 'gap' closure between the initial perforation and the final result, i.e. the 'partial take'. The pre-operative mean size of perforation which took only partially was 3·3, the range being 3·1–3·8, according to the surgeon. The mean size of these perforations (which took only partially) was post-operatively 2·3, ranging from 2·0–2·7 according to the different surgeons.

B. Even when technically well performed, a graft may undergo partial necrosis. I suppose that this would be inevitable in a certain number of cases, no matter how skilled and meticulous the surgeon is. I have watched such necrosis developing. At times, a necrotic patch will serve as a scaffold over which epithelialization will grow and close the perforation. At other times, the necrotic place may break down and actually grow, suggesting an inadequate blood supply. This is borne out by the greater prevalence of partial takes in the larger perforations. When one thinks of our tympanic membrane grafts, which are *unsupported* grafts—i.e. they are actually hanging in mid-air—it is amazing that partial takes does not occur more often.

B. *Long-term results*

The long-term follow-up was also very revealing, as it showed that whoever the surgeon was, and not withstanding the size and place of the perforation, some myringoplasties which were initially successful, had late complications: 11 per cent lost their epithelium; 10·6 per cent became atelectatic and retracted to one degree or another; and 8 per cent re-perforated. There was, however, some overlap between the ears with late complications, e.g. in 4·4 per cent all the three complications were seen in the same ear. *All these late complications came about insidiously, without any insult, such as trauma or acute infection.* Our late results showing 8 per cent perforations are, *grosso modo,* similar to those reported by Sheehy (1964), Cody (1973) and Puhakka *et al.* (1979).

The pinpoint perforations, which were usually seen only with the operating microscope, might be a blessing in disguise, because some of these ears might need some extra aeration, and therefore may be viewed as the late Sven Ingelstedt (1978) used to point out, 'as a God sent ventilating tube'.

The pathogenesis of these late perforations, atelectasis and granulations, could be related in a way which we do not understand to deficiency of aeration capability, i.e. 'Eustachian tube insufficiency', which indeed might well have been the original cause of the perforation. It would seem to me that herein lies also the secret of the appearance of some of the primary silent perforations, which indeed make about 40 per cent of all central perforations, a problem discussed previously by us (Sadé and Halevy, 1976).

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Clearance deficiency of the external ear followed by granulation tissue, i.e. granular myringitis (Sadé, 1962), which perforates thereafter—unrelated to Eustachian tube insufficiency—should also be taken as a possibility.

Of great importance is the conclusion that, as most ears did not show deterioration with time, *one may consequently be justified in viewing Eustachian tube insufficiency as potentially a transitory condition* (Sadé, 1979). I am also rather sceptical of the use or meaning of pre-operative Eustachian tube function tests to determine which ear should or should not be operated upon, at least those tests which are available today. In this I am in agreement with Palva and Karja (1970), as well as with Ekvall's communication (1970).

Other complications, such as anterior blunting and stenosis of the external ear canal, were not observed by us. Small superficial epidermoid pearls were encountered by us, but they were either easy to remove or showed a tendency to be cleared out by themselves. One case did, however, show the development of an intratympanic cholesteatoma, which may be a serious complication.

Conclusions

A. While the optimism regarding the results of myringoplasty operations is generally justified, there is obviously no way to know the actual results without a long-term follow-up.
B. Results of myringoplasty are not significantly determined by side, age, sex, state of the middle-ear mucosa, post-operative infections, or the type of graft used.
C. Primary graft-take is significantly influenced by technical problems and difficulties; therefore smaller and posterior-superior perforations have a better chance than anterior perforations, or very large ones.
D. It is practical to aspire to obtain initial graft-take in over 90 per cent of operated cases.
E. Residents may obtain very acceptable results.
F. Supervision in a training programme and awareness that results and failures are being computed increased the rate of good results, while over-confidence of young surgeons—even able ones—may be counter-productive.
G. Long-term follow-up shows that even very successful initial results sometimes deteriorate: about 8 per cent of the ears will show small re-perforations, years after surgery, without being preceded by either traumatic events or overt inflammation. This suggests the possibility that such a 'silent' event was also responsible for some of the original perforations; and that the notion of regarding central tympanic perforations as usually secondary to acute otitis media might be wrong. 8·7 per cent of these ears will eventually show slight tympanic retraction, and 1·5 per cent severe retraction

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(grades III and IV). 11 per cent will show some defect of the epithelial covering, associated at times with granulation tissue. Most long-term complications (perforations and atelectasis) occur within the first two years after the operation.

Summary

Out of 855 myringoplasties performed during the years 1971–1979, 741 ears were analysed for early results, and 387 for late results. The operations were performed by experienced surgeons and by senior residents. Only the ears with an underlaid fascia or perichondrium, operated upon for the first time, were included in this study. The analysis was performed with the help of a computer, using SPSS and Chi-square tests.

The study has shown that side, age, sex, and state of the mucosa—as well as the type of graft or post-operative infections—had no significant bearing on the rate of graft take. However, the bigger perforations and the more anteriorly placed ones, had a less favorable prognosis. Rate of graft take also differed from surgeon to surgeon; some senior residents, however, had very favorable results. We analysed graft take for the years 1971–1978 first, when an average initial graft take of 81 per cent was found, the range between surgeons being from 63·5 per cent to 93·5 per cent. As a second group we analysed myringoplasties performed in 1979, when the average graft take rose to 91 per cent and the difference between various surgeons decreased very significantly. It was postulated that the success rate was dependent on experience and meticulousness, the latter being related to awareness that the results were being computed.

Follow-up of one year or more of successful cases showed that, with time, small perforations developed once again in 8 per cent. 8·7 per cent showed the appearance of a slight tympanic membrane retraction, and 1·5 per cent severe retraction. In 11 per cent of the tympanic membranes some defect of the covering epithelium appeared. However, about one-half of these late complications appeared all in one ear. It is concluded that, while there are significant differences in graft take according to the size and place of the perforation, as well as between surgeons, one could and should expect an early average graft take of over 90 per cent. A 10 per cent rate of some deterioration in cases with early satisfactory results will occur mostly within the first two years post-operatively, irrespective of any factors which can be controlled.

REFERENCES

AUSTIN, D. F. (1965) Present status of vein graft tympanoplasty. *Archives of Otolaryngology*, **81**, 20–25.

AUSTIN, D. F., and SHEA, J. J. (1961) A new system of tympanoplasty using vein graft. *Laryngoscope*, **71**, 596–611.

BOOTH, J. B. (1973) Myringoplasty: factors affecting results: final report. *Journal of Laryngology and Otology*, **87**, 1039–1084.

https://doi.org/10.1017/S0022215100091246 Published online by Cambridge University Press

BOOTH, J. B. (1976) Tympanic reconstruction: 15-year report on tympanoplasty. *Journal of Laryngology and Otology,* **90,** 713–741.
CODY, T. R., and TAYLOR, W. F. (1973) Tympanoplasty: long term results. *Annals of Otology, Rhinology and Laryngology,* **82,** 538–546.
EKVALL, L. (1970) *Acta Otolaryngologica,* Supplement 263, 33–42.
GLASSCOCK, M. E. (1973) Tympanic membrane grafting: overlay *vs.* undersurface technique. *Laryngoscope,* **88,** 754–770.
GUILFORD, F. R. (1962) Tympanic grafts: personal experience with surgical repair of tympanic perforations. *Laryngoscope,* **72,** 1028–1052.
INGELSTEDT, S. (1978) Personal communication.
JANSEN, C. (1963) Cartilage tympanoplasty. *Laryngoscope,* **73,** 1288–1302.
NIE, N. H. (1975) *Statistical package for the Social Sciences.* Second Edition, McGraw-Hill, New York.
PALVA, A., and KARJA, J. (1970) *Acta Otolaryngologica,* Supplement 263, 25–28.
PLESTER, D. (1970) Tympanic membrane homografts in ear surgery. *Acta Otolaryngologica* (Belgica), **24,** 34–37.
PUHAKKA, H., VIROLAINEN, E., and RAHKO, T. (1979) Long-term results of myringoplasty with temporalis fascia. *Journal of Laryngology and Otology,* **93,** 1081–1086.
ROBINSON, M. (1966) Tympanoplasty: pedicled canal skin graft with annulus transposition. *Laryngoscope,* September.
SADÉ, J. (1962) Granular external otitis. *Annals of Otology, Rhinology and Laryngology,* **71,** 391–396.
SADÉ, J. (1979) *Secretory Otitis Media and Its Sequelae.* Churchill Livingstone Publishing Company, New York—London.
SADÉ, J., and HALEVY, A. (1976) The natural history of chronic otitis media. *Journal of Laryngology and Otology,* **90,** 743–751.
SHEEHY, J. L. (1964) Tympanic membrane grafts: early and long-term results. *Laryngoscope,* **74,** 985–998.
SMYTH, G. D. L., and KERR, A. G. (1969) Tympanic membrane homografts. *Journal of Laryngology and Otology,* **83,** 1061–1066.

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