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The marsupialized (radical) mastoid

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The controversy of open-versus-closed techniques in cholesteatoma surgery is mostly related to the bad reputation open mastoids have as wet cavities. This study is an attempt to analyse the frequency of such a complication (wet cavity), and the factors related to self-cleansing of marsupialized mastoids.

Material and Methods

119 marsupialized mastoid cavities, of which 58 were radical cavities and 61 conservative (modified) radical cavities, were analysed. The study was undertaken at the out-patient clinic of the Meir Hospital, Kfar-Saba.

The patients were examined post-operatively and the data were arranged on a computer sheet, with 44 questions. The data were summarized in a series of two-way and three-way frequency tables, using the SPSS computer program. Where appropriate a Chi-square statistic was computed, to test whether the two incides of frequency were independent.

Results

Four main points were found to be related to the state of dryness of mastoid cavities:

A. Size of mastoid cavity (Table I)

We have divided the mastoids into small (17 ears), medium (31 ears) and large cavities (70 ears).

1. *Small cavities* (17 ears) presented at operation a very small antrum: of these 15 ears (88 per cent) were dry.
2. *Medium sized cavities* (31 ears), 27 ears (87 per cent) were dry.
3. *Large cavities* (70 ears), with the cavity reaching the hypotympanic level or passing it. Of these, 43 ears (61 per cent) were dry.

It is obvious that there is no difference between the small- and the medium-size groups. When combined, the difference between them and the large cavity group was significant, at the level of $p < 0.0019$.

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TABLE I
DRYNESS AND SIZE OF MASTOID CAVITY
118 Mastoid Cavities

Size of cavity	Dry cavity	Wet cavity
Small (48)	42 (87.5%)	6 (12.5%)
Large (70)	43 (61%)	27 (39%)
Total (118)	85 (72%)	33 (28%)

$P < 0.0019$

B. Height of the facial ridge (Table II)

1. *Low or no ridge:* 74 (84 per cent) out of 88 presented a dry ear.
2. *Ridge of medium height:* 10 (48 per cent) out of the 21 ears were dry.
3. *High ridge:* 2 (20 per cent) out of the 10 ears presented dry cavities.

The difference between the groups was highly significant ($p < 0.001$).

TABLE II
DRYNESS AND HEIGHT OF FACIAL RIDGE
119 Mastoid Cavities

Facial ridge	Dry cavity	Wet cavity
None or low (88)	74 (84%)	14 (16%)
Medium (21)	10 (48%)	11 (52%)
High (10)	2 (20%)	8 (80%)
TOTAL (119)	86 (72%)	33 (28%)

$P < 0.0001$

C. External ear meatus (Table III)

1. 44 (85 per cent) of 52 ears with an *adequate* external meatus were dry,
2. 39 (68 per cent) out of 57 with *large* meatus were dry.
3. Only 3 (30 per cent) out of 10 ears with a *stenotic* meatus presented a dry mastoid.

The difference between stenotic and adequate meatus was highly significant ($p < 0.0013$), and between adequate and large $p < 0.05$.

D. The presence of air in the tympanic cavity

(1). Whereas 82 per cent of the radical conservative (modified) ears were dry, only 62 per cent of all the radical ears were dry. However, the radical cavities were broken down into two groups: (1). Group A: those which *spontaneously* formed a neotympanic membrane, creating a shallow 'air-protected' middle ear; (2). Group B: those whose eustachian tube and promontory remained exposed. Group A presented a dry ear in 81 per cent of the cases and group B in only 50 per cent, the difference being significant

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TABLE III
DRYNESS AND SIZE OF EXTERNAL MEATUS
119 Mastoid Cavities

External meatus	Dry cavity	Wet cavity
Adequate (52)	44 (85%)	8 (15%)
Large (57)	39 (68%)	18 (32%)
Stenotic (10)	3 (30%)	7 (70%)
Total (119)	86 (72%)	33 (28%)

$P < 0.0013$ $P < 0.05$

at the level of $p < 0.0006$. The spontaneous development of a tympanic membrane occurred in 30 (51 per cent) of the 58 radical cavities: some of these had a shallow tympanic cavity formed; others presented an almost entire 'neotympanum'.

(2). 6 drums out of the 61 conservative (modified) radicals broke down. Of these six, only four (66 per cent) were dry. 84 per cent of the remaining 55 ears, which had an 'intact' tympanic membrane, were dry.

Discussion

Our study confirms previous studies by Baron (1977), Gristwood (1976), Cody *et al.* (1980), Abramson *et al.* (1977), and Sadé *et al.* (1981), that most radical cavities stay dry* (Table IV).

This study indicates that several factors which *are to some extent in the surgeon's hands* can significantly influence the end-results. Thus, if we endeavour to reach a small mastoid with a low facial ridge, an adequate meatoplastry, and a covered, air-containing tympanic cavity, we may obtain a dry cavity in about 90 per cent of the cases. Should these criteria not be met, then the end-result is worse. In fact, large cavities with a high facial ridge, inadequate or stenotic meatus, and exposed promontory and eustachian tube opening have hardly any chance to become dry. These four factors often depend on the operative technique. The facial ridge is often

TABLE IV
OPEN MASTOID OPERATIONS

	No. of ears	F.U. %	Residual disease	Recurrent disease	Total failure
Abramson *et al.* (1977)	155	—	—	—	9%
Baron (1977)	132	—	15%	—	15%
Gristwood (1976)	141	91–78%	17%	—	17%
Cody *et al.* (1980)	172	89%	6%	+ 8%	18%
Sadé *et al.* (1981)	65	94%	13%	—	20% (10%–30%)

*These authors refer mostly to such events as recurrent disease and residual disease in open mastoid cavities yet, from the figure of total failure, one may deduce how many of their mastoids stayed dry.

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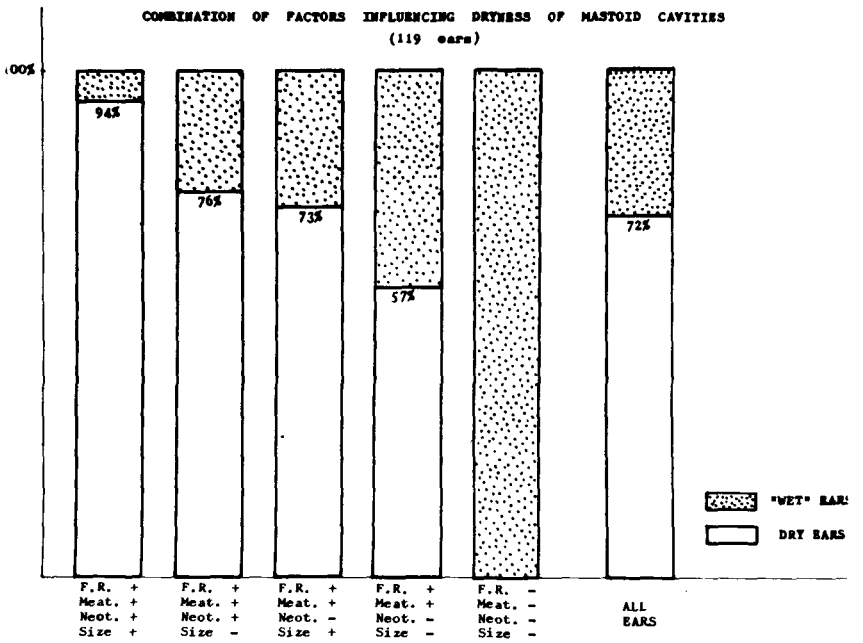


FIG. 1

(+) favourable conditions: (–) unfavourable conditions F.R. = facial ridge; Meat. = external ear meatus; Neot. = spontaneous neotympanic development or a middle-ear buffle of some sort; size = size of mastoid cavity; All ears = the average of all the ears examined in our study.

kept high because of fear of change of the facial nerve but this can be reduced to a minimum by a skilled surgeon. An adequate meatoplasty also depends on the surgeon. We have found that 50 per cent of radical cavities spontaneously form a neotympanic membrane.* However, we should try whenever possible to assist nature and perform some sort of a 'myringoplasty', even if there are no prospects of improving the hearing. Last but not least, the size of the mastoid cavity is often also in the surgeon's hand. The classical method of creating a mastoidectomy through the mastoid cortex leaving a bridge and finally removing it (Shambaugh, 1967) is best avoided. One should attempt to avoid enlarging the antrum or mastoid cavity beyond what nature and disease have created. The best way to achieve this is by exposing the antrum mastoid through the middle ear performing first an atticotomy and thereafter proceeding backwards.

The results reported here by us may be compared with those achieved after a C.A.T. operation, as well as after obliterative procedures. After C.A.T. operations failure reports vary, yet most probably they are not less than 50 per cent (Palva *et al.*, 1977; Cody, 1980; Sadé *et al.*, 1981).

*When we make a radical cavity we do not insist on 'digging out' the annulus; neither do we remove every small remnant of tympanic membrane which looks healthy. These small details may help in *spontaneous* growth of part or the whole of the tympanic membrane. Whether air will fill such a spontaneous cleft or tympanic cavity depends on the 'eustachian tube function'.

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TABLE V
MASTOID OBLITERATION

Author	No. of ears	% follow-up	Mean follow-up	Residual disease	Recurrent disease (retraction pocket)	Infection and cleansing problems	Total failures
Cody (1980)	90	89%	8 years	16%	3%	4%	23%
Palva *et al.* (1977)	100	100%	6 years	2%	10%	10%	Unknown
Ojala (1979)	922	76.1%	8.8 years	4.6%	1.7%	12.1%	Unknown*

* in 31.5% of the patients, a cavity (or part of it) developed once again.

After obliteration, failures (i.e., either recurrence, residual disease, or wet ear) have been reported in up to 23 per cent (Table V) (Palva *et al.*, 1977; Ojala, 1979; Cody, 1980).

Finally, a note concerning the size of mastoid cavities: we attempted to measure the size of the post-operative mastoid, filling it with sterile physiological solution. Mastoids measuring up to 2.0 c.c. were designated as small; up to 3.0 c.c. as medium; above 3.0 c.c. as large (the largest in our group containing 4.5 c.c.). When these measurements were compared with the clinical evaluation of mastoid sizes, a 90 per cent correlation was found. However, the measured size of the mastoid is too complicated to use

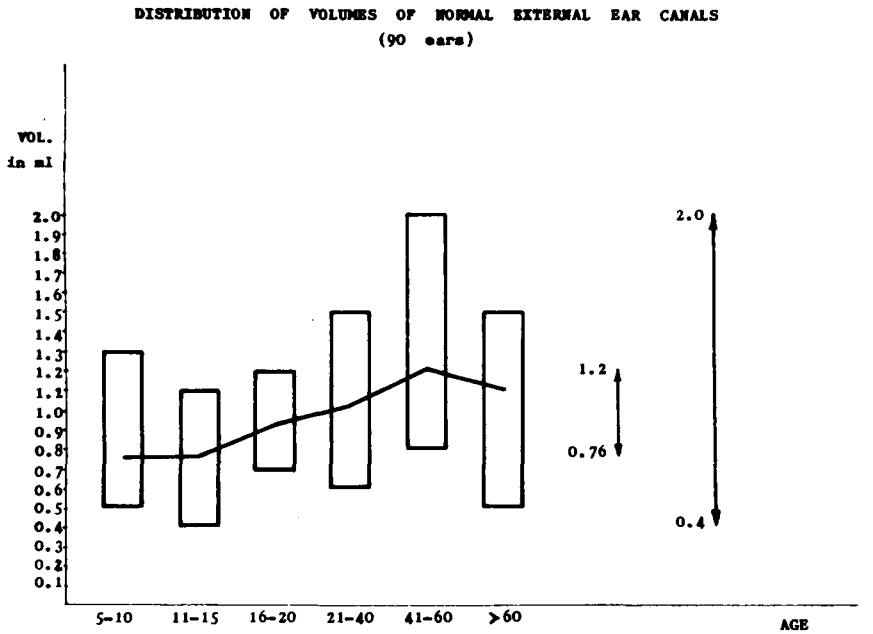


FIG. 2

The mean of the lower measurements and upper measurements were 0.76 cm.^{3} and 1.2 cm.^{3} However, the actual distribution extended from 0.4 cm.^{3} up to 2.0 cm.^{3} respectively.

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as such, owing to the great variance in size of the external ear canal. This was found by us to vary considerably, according to age as well as between individuals, as measured with the same method as that used in ears which had not been operated upon (Table II). Altogether, the external ear canal measured between 0.5 c.c. and 2.0 c.c., averaging 0.75–1.2 c.c. Therefore, the variance in the volume of the external ear canal which at times presented a volume up to 50 per cent of that of the mastoid cavity itself, prevented this type of measurement from being meaningful (Fig. 2). At the same time, if we can deduce from our mastoid measurements the *average* volume of the external ear canal, i.e. 1 c.c., we may view the following mastoid sizes as *roughly* representative: up to 1 c.c. = small mastoid cavity; 1–2 c.c. = medium; above 2 c.c. = large mastoid cavity

Summary

The state of 119 marsupialized mastoids (61 conservative (modified) radicals and 58 radical cavities) was evaluated. Four factors were found to be related to the dryness of a mastoid cavity: A. The small cavities were dry in 87.5 per cent, whereas they were dry in the large ones in only 61 per cent. B. Ears with a low facial ridge were dry in 77 per cent whereas, when the ridge was high, only 20 per cent were dry. C. Ears with an adequate or optimal external meatus were dry in 85 per cent, whereas they were dry in only 30 per cent and 68 per cent respectively when the meatus was stenosed or very large. D. 51 per cent of the radical cavities developed spontaneously a neotympanic membrane of one size or another; these were dry in 82 per cent, a figure similar to the ears with conservative (modified) radical cavities (81 per cent). An exposed promontory reduced the percentage of dry ears to 50 per cent. Whenever all these four factors were present simultaneously, 94 per cent of the ears were found to be dry. Whenever one of the factors was adversely present, inferior results were found. When all four factors were unfavourable, dry ears were found (by extrapolation) to be almost nil. It seems that performing an ideal 'radical cavity' (modified or not) needs more attention than is often realized—as a favourable outcome of each of the four factors depends much upon the surgeon. We are also under the impression that patients who are followed up once or twice a year for cleaning the smallest amount of debris from the mastoid, fare better than patients who are left completely on their own. Our conclusion is that the results of radical and conservative (modified) radical mastoidectomies, if well performed, are better than their reputation suggests.

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