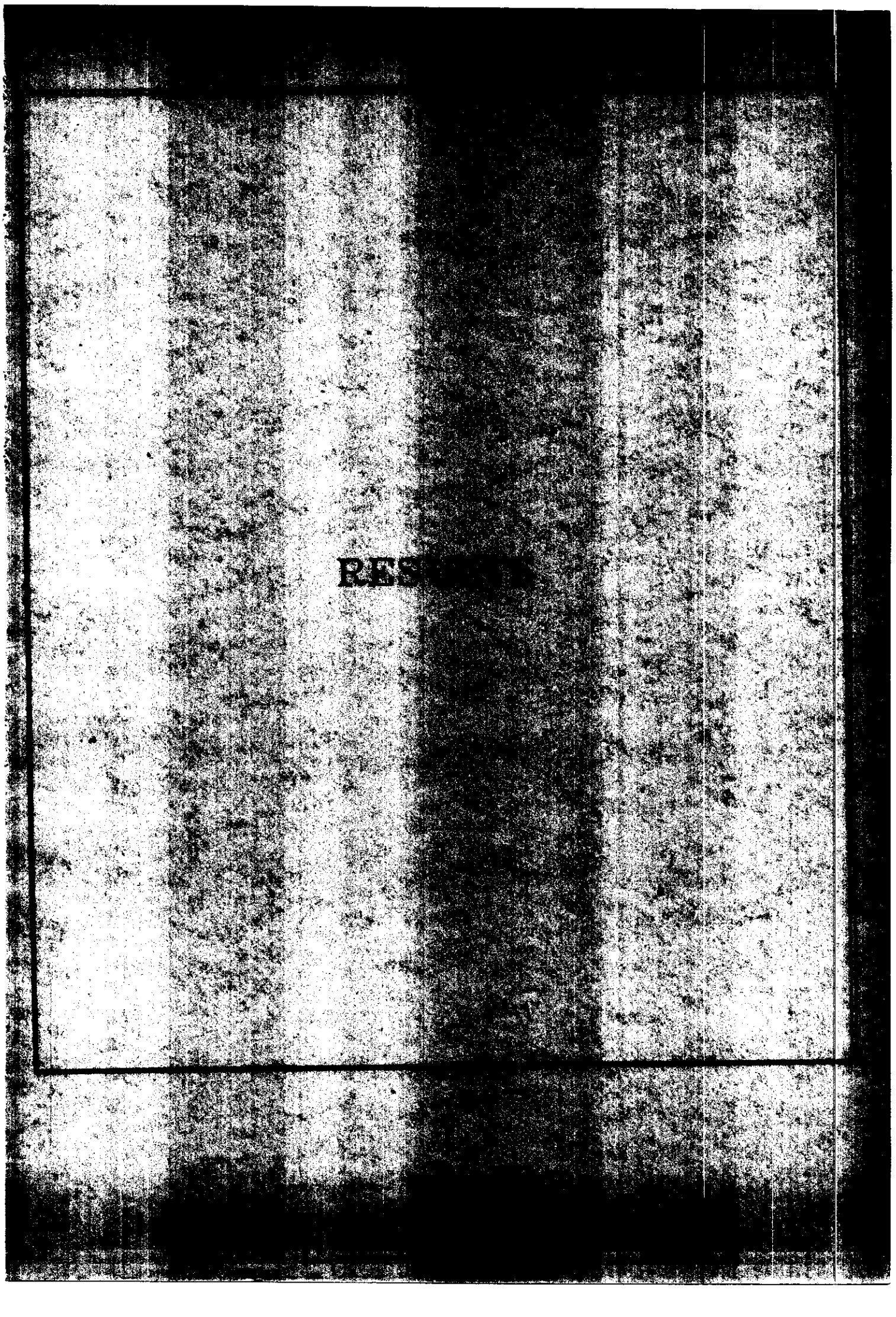

RESULTS

This study included 120 patients with dry central perforation who were subjected to myringoplesty. Testing of ETF pre and postoperative was done.

Females included in the study were 54 patients and males were 66 cases.

The age of patients ranged between 15 years and 46 years old with the mean age of 23.7 Years.

Postoperative follow up ranged between 6 months and 18 months, with the mean of 10 months as shown in Table (1)

The follow up was done for cases in which the graft took with no residual perforation.

Preoperative Eustachian tube function test:

I Inflation. Deflation test:

a- Negative pressure testing :

It has been found that 34 patients (28.33%), tested had residual negative pressure between 0 and -50 mm H_2O.

30 patients (25%) had residual negative pressure between -50 and -100 mm H_2O.

18 patients (15%) of the tested cases had residual negative pressure between -100 and -150 mm H_2O.

10 patients (8.3%) of the tested group had residual negative pressure between -150 and -200 mm H2O.

Table (1): Periods of postoperative follow up of successful cases.

Period of follow up in months.	Number of cases	%
6: 10 months	60	60
10: 14 months	30	30
14: 18 months	10	10
Total	100	100

28 patients (23.3%) of the group had residual negative pressure of -200 to -250 mm H_2O.These results are shown in Table (2).

b- Positive pressure testing:

Positive pressure was applied to the test ear then the patient was asked to swallow helped by sips of water and the residual positive pressure was measured.

On application of positive pressure, the eustachian tube of all patients opened spontaneously before the pressure of + 200 mm H_2O was reached with no residual pressure after swallowing. From the results of negative pressure and positive pressure testing and according to Siedentop et al. (1972) classification, the function of the ET in our patients could be differentiated into the following :

10 patients (8.33%) had ETF type I.

24 patients (20%) had ETF type II,

64 patients (53.33%) had ETF type III.

22 patients (18.33%) had ETF type IV.

As regards ETF type V mentioned by Siedentop et al. (1972) non of our cases was included; this distribution is shown in table (3).

From table (3) It can be noticed that most of our cases (53.33%) got ETF type III which is rather poor function. Together with those who had type IV ETF they represent 71.66% which is significantly high. So we can conclude that inspite of the fact that the ears were dry, still the ETF is affected.

Table (2): Distribution of patients according to the residual negative pressure.

Residual negative pressure	Number of patients	%
0: -50	34	28.33
- 50: -100	30	25
-100: -150	18	15
-150: -200	10	8.33
-200: -250	28	23.33
Total	120	100

Table (3): Distribution of patients according to their ETF type

ETF type	Number of patients	%
I	10	8.33
II	24	20
III	64	53.33
IV	22	18.33
V	0	0
Total	120	100

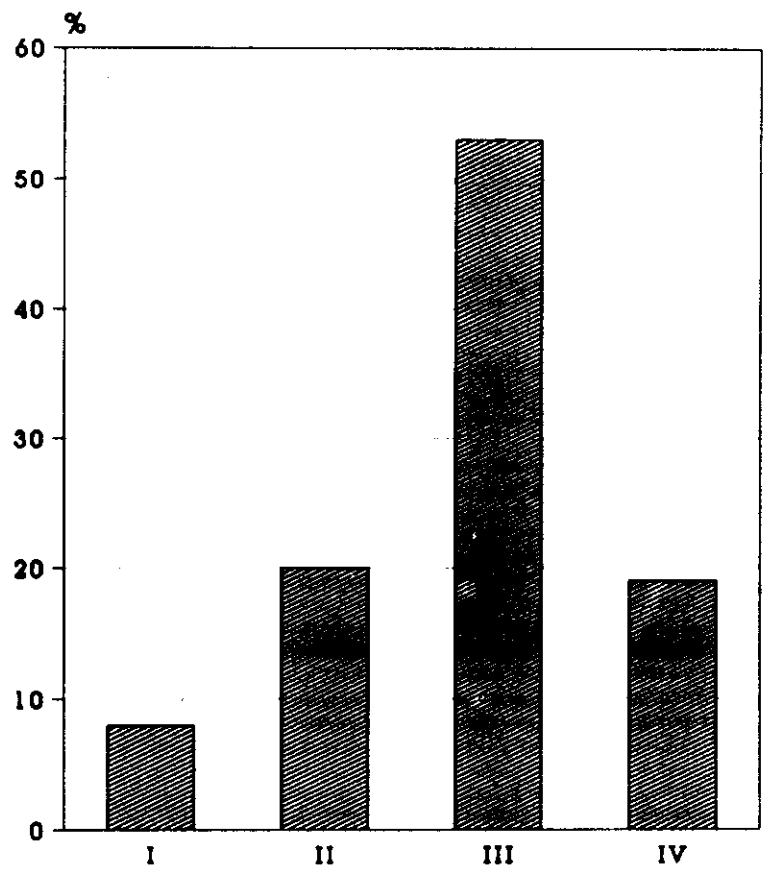

Chart (1): ETF Types

II- Valsalva test:

Preoperative results :

Valsalva test was performed preoperatively.It was found be positive in 72 patients out of 120 tested patients (60%) and 48 patients (40%) had negative Valsalva.

The distribution of patients with negative and positive Valsalva test in relation to their ETF types is shown in Table (4):

Of type I ETF 8 patients (80%) were Valsalva positive and 2 patients (20%) had negative Valsalva.

Of type II ETF 16 patient (66.67%) had positive Valsalva and 8 patients (33.33%) had negative Valsalva.

Of type III ETF 41 patients (64.06%) had positive Valsalva and 23 patients (35.94%) had negative Valsalva.

Of type IV ETF 7 patients (31.82%) had +ve Valsalva and 15 patients (68.18%) had negative Valsalva.

The difference in the results of Valsalva test of patients with ETF type I and patients with type IV ETF were statistically calculated and found to be significant (X^2=9.83 and $P < 0.05$).

Table (4): The results of preoperative Valsalva test in relation to ETF types.

ETF type	Valsalva				Total	
	+ ve		-ve			
	No.	%	No.	%	No.	%
I	8	80	2	20	10	100
II	16	66.67	8	33.33	24	100
III	41	64.06	23	35.94	64	100
IV	7	31.82	15	68.18	22	100
Total	72	60	48	40	120	100

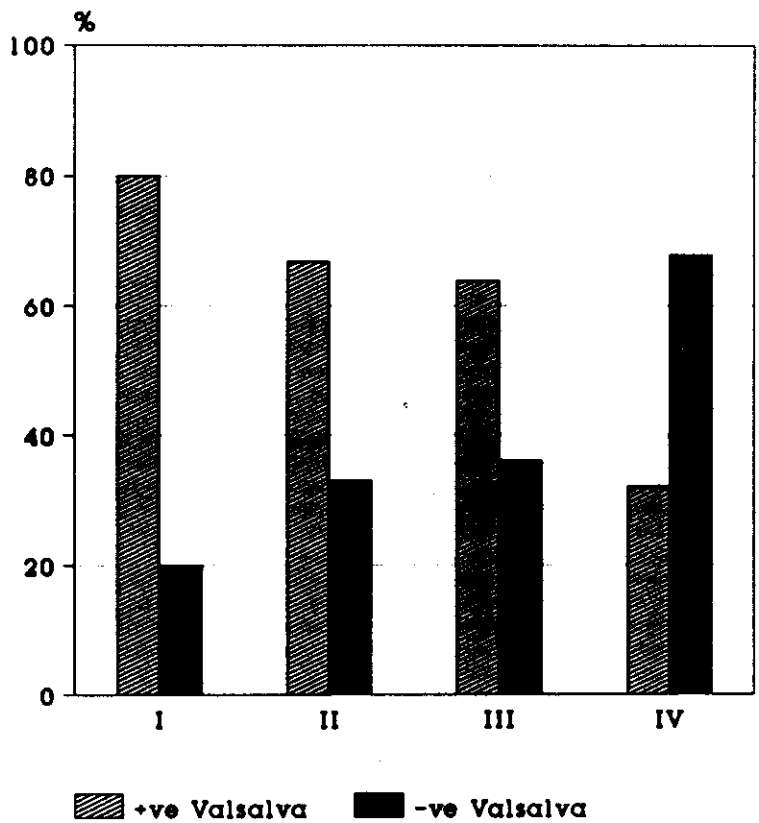

Chart (2): Preoperative results of valsalva test.

Toynbee's test:

Preoperative results :

Preoperative performance of Toynbee's test:

78 patients (65%) had Toynbee positive and 42 patients (35%) had Toynbee negative.

Relating the results of Toynbee's test to inflation defletion ETF types. It was found that:

Of type I ETF 9 patients (90%) had +ve Toynbee and 1 patient (10%) had negative Toynbee.

Of type II ETF 18 patients (75%) had positive Toynbee and 6 patients (25%) had negative Toynbee test.

Of type III ETF 44 patients had positive Toynbee test (68.75%) and 20 patients (31.25%) had negative Toynbee test.

Of type IV ETF 7 patients (31.82%) had positive Toynbee's test and 15 patients (68.18%) had negative Toynbee's test. From this it can be noticed that the maximum positive Toynbee is at type I ETF which is 90% while it represented only 31.82% of type IV ETF. This difference is statistically singnificant (X^2 = 14.85 and $P < 0.01$). The same is applicable for Toynbee negative cases.

The results of Toynbee testing in correlation with ETF typing of patients are shown in Table (5)

Table (5): The preoperative results of Toynbee testing in relation to ETF types.

ETF type	Toynbee +ve		Toynbee -ve		Total	
	No.	%	No.	%	No.	%
I	9	90	1	10	10	100
II	18	75	6	25	24	100
III	44	68.75	20	31.25	64	100
IV	7	31.82	15	68.18	22	100
Total	78	65	42	35	120	100

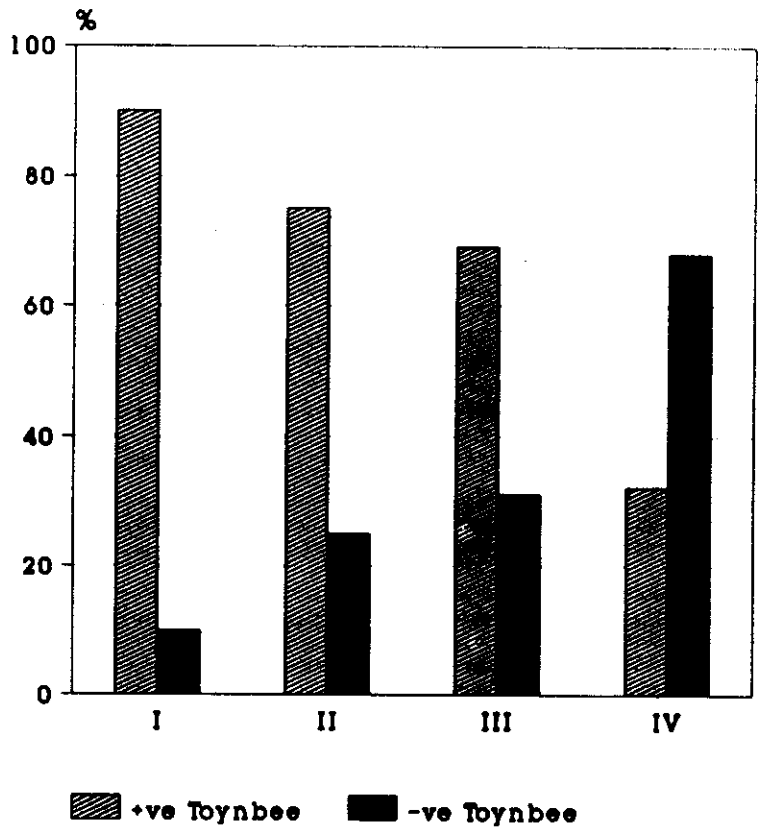

Chart (3): Preoperative results of Toynbee test.

Myringoplasty:

Myringoplasty was performed in all patients, using the underlay technique with temporalis fascia autograft.

The graft took in 100 patients with success rate of 83.33%. The operation failed in 20 patients with failure rate of 16.67%.

Out of 10 patients with type I ETF 9 patients (90%) had successful operation and only one operation failed (10%). In type II ETF the success rate was 87.5% i.e out of 24 patients 21 patients had successful operation and 3 failed (12.5%). Type III ETF 55 patients (85.94%) had successful operation and 9 operations (14.6%) failed and of type IV ETF 15 patients (68.18%) out of 22 had successful myringoplasty and 7 patients (31.82%) their operation failed.

It can be noticed that the highest success rate was in patient with type I ETF (90%) and the lowest success rate was in patients with ETF type IV (68.18%). While the difference in the results of the 2 groups appears to be remarkable, yet, it was found to be statistically in significant ($P>0.05$ and ($X^2=4.57$) The results of myringpplasty are shown in Table (6).

The operation failed in 20 patients out of 120 operated cases. It was noticed that the graft did not take in 14 patients, a condition which was discovered in the early postoperative period, i.e. within 2 months after the operation. Out of these 14 patients, one patient had ETF type

Table (6): Success and failure rates of myringoplasty operation.

ETF type	Success		Failure		Total	
	No.	%	No.	%	No.	%
I	9	90	1	10	10	100
II	21	87.5	3	12.5	24	100
III	55	85.94	9	14.06	64	100
IV	15	68.18	7	31.82	22	100
Total	100	83.33	20	16.67	120	100

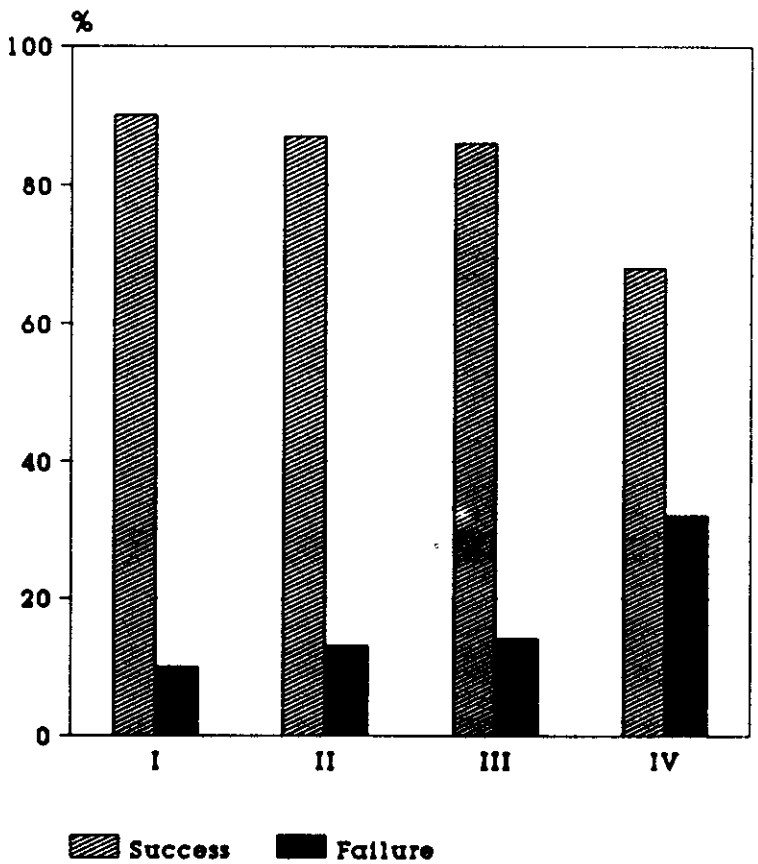

Chart (4): Success Rates

I, 3 patients with ETF type II. 7 patients with ETF type III and 3 patients with ETF type IV.

Late failures were noticed in 6 patients. After early success, reperforation happened in the late postoperative period, i.e. after 3 to 5 months. Most of these failures were in patients with type IV ETF (4 patients) and only 2 patients with type III ETF. These late failures were in the form of antroinferior perforations in 4 cases which followed longstanding retraction of the grafted drum. The other 2 cases had acute otitis media which was accompanied by upper respiratory tract infection. This is shown in (table 7).

It was noted that 4 patients developed secretory otitis media. Three of them had ETF type IV and 1 patient had ETF type III Gromet's tubes were inserted after failure of medical treatment.

Also 5 patients developed retraction pocketes. Four of them had ETF type IV and only I patient had ETF type III.

Table (7) : Types of failures in myringoplasty.

ETF Type	Early failure		Late failure		Total	
	No	%	No	%	No	%
I	1	100	0	0	1	100
II	3	100	0	0	3	100
III	7	77.78	2	22.22	9	100
IV	3	42.86	4	57.14	7	100
Total	14	70	6	30	20	100

POSTOPERATIVE ETF TESTING

1- Postoperative Tympanometric studies:

Tympanometry was done postoperatively. It was found that out of patients with type I ETF 7 patients (77.78%) had type. A curve and 2 patients (22.22%) had type C curve. Of patients with type II ETF 13 patients (61.9%) had type A curve, 3 patients (14.28%) had type B (flat) curve and 5 patients (23.81%) had type C curve. Of patients with type III ETF 25 patients (45.45%) had type A Curve, 6 patients (10.91%) had type B curve (flat), 24 patients (43.63%) had type C curve while out of patients with type 1V ETF 5 patient (33.33%) had type A Curve, 4 patients (26.67%) had type B (flat) curve, 6 patients (40%) had type C curve (Table 8).

It can be noticed that non of the patients with ETF type I had flat curve. While of type IV ETF flat curve was found in 26.67% and type C curve was found in 40%, again type A curve was found in 77.78% of patients with type I ETF while found only in 33.33% of with type IV ETF. From these differences we can deduce that the patients with preoperative bad ETF are more liable to have retracted drum and negative middle ear pressure postoperatively than patients with good ETF.

2- Valsalva'test :

Postoperative Valsalva test was performed on patients with successful operation, i.e. on 100 cases. Results of postoperative Valsalva test are shown in table 9. It was

Table (8) : Postoperative tympanometric results in relation to preoperative ETF type.

ETF type	Type of curve						Total	
	A		B		C			
	No	%	No	%	No	%	No	%
I	7	77.78	0	0	2	22.22	9	100
II	13	61.9	3	14.28	5	23.81	21	100
III	25	45.45	6	10.91	24	43.63	55	100
IV	5	33.33	4	26.67	6	40	15	100
Total	50	50	13	13	37	~~37~~	100	100

found to be positive in 83 patients (83%) and 17 patients (17%) had Valsalva -ve 17%, compared to preoperative results it was positive only in 60 % of cases (72 patients out of 120 tested cases).

It was found that out of 9 patients with ETF type I 8 patients (88.88%) had valsalva +ve and one patient (11.12 %) was Valsalva -ve. Out of 21 patients with type II ETF 18 patients (85.71%) were Valsalva +ve while 3 patients were valsalva -ve (14.29 %). Out of 55 patients with type III ETF 48 patients (87.27%) were Valsalva +ve and 7 patients (12.73%) were Valsalva -ve and out of 15 patients with type IV ETF 9 patients (60%) were Valsalva +ve while 6 patients (40 %) were found to be Valsalva -ve. It can be noticed that 88.89% of patients of type I and 60 % of patients of type IV are Valsalva +ve postoperatively.

The difference in Valsalva results between patients with type I ETF and those with type IV ETF was found to be statistically insignificant. (X^2=6.7, P > 0.05).

Comparing these results with preoperative testing shown in table (4), it was found that 80 % of patient with type I ETF and 31.82% of patients of type IV ETF were Valsalva +ve. The difference in preoperative Valsalva results between patients with type I ETF and those with type IV ETF was found to be statistically significant (P < 0.05). The change in the difference between type I and IV from being significant preoperatively and insignificant postoperatively means that

Table (9) : Number and percentage distribution of patients according to their Valsalva test result postoperatively in relation to ETF types.

ETF Type	Valsalva+ve		Valsalva-ve		Total	
	No.	%	No.	%	No.	%
I	8	88.88	1	11.12	9	100
II	18	85.71	3	14.29	21	100
III	48	87.27	7	12.73	55	100
IV	9	60	6	40	15	100
Total	83	83	17	17	100	100

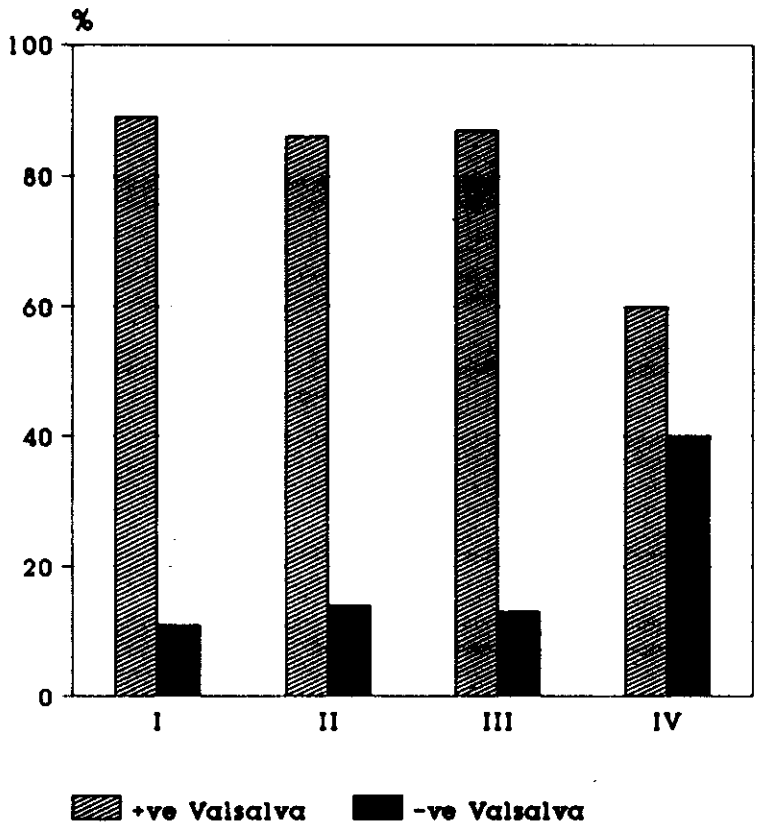

Chart (6): Postoperative results of valsalva test.

eustachian tube function has imporved after successul operation.

It can also be noted that the incidence of + ve Valsalva rised in cases with type I ETF from 80% of patients preoperatively to 88.88% of patients postoperatively.

In type II ETF it rised from 66.67% of patients preoperatively to 85.71 % postoperatively.

In type III ETF it rised from 64.06% of patients preoperatively to 87.27 % of patients postoperatively.

In type IV ETF it rised from 31.82 % of patients preoperatively to 60 % of patients postoperatively.

The results of postoperative testing are shown in table (9).

3-Toynbee test :

Toynbee's test was repeated postoperatively for patients with successful myringoplasty. As shown in table(10)it was found that out of 9 patients with type I ETF 8 patients (88.88%) were Toynbee +ve and only one patient (11.12%) was Toynbee -ve. In the group with ETF type II 17 patients (80.95%) were Toynbee positive and 4 patients (19.05%) were Toynbee negative. In the group of patients with ETF type III 49 patients (89.09%) were Toynbee positive and 6 patients (10.91%) were Toynbee negative and in the group with ETF type IV 10 patients (66.67%) of the group were Toynbee positive while 5 patients (33.33%) were Toynbee negative. Totally Toynbee positive was found with 84 patients (84%) and Toynbee negative was found with 16 patients (16%).

It can be noticed that postoperatively(88.88%) of patients with type I ETF and (66.67%) of type IV ETF were Toynbee positive and this difference was found to be statistically insignificant ($P>0.05$ and $X^2=5.28$).

Comparing the preoperative with postoperative results of Toynbee testing, it can be seen that Toynbee positive was found in 65% of cases preoperatively while found in 84% postoperatively. The difference between Toynbee positive cases of Type I ETF and of Type IV ETF preoperatively was statistically significant ($P<0.01$) while this difference postoperatively was statistically insignificant. This means definite improvement of ETF after the operation.

Table (10): Postoperative distribution of patients according to the results of Toynbee test in relation to their types of ETF.

ETF	Toynbee +ve		Toynbee -ve		Total	
	No.	%	No.	%	No.	%
I	8	88.88	1	11.12	9	100
II	17	80.95	4	19.05	21	100
III	49	89.09	6	10.91	55	100
IV	10	66.67	5	33.33	15	100
Total	84	84	16	16	100	100

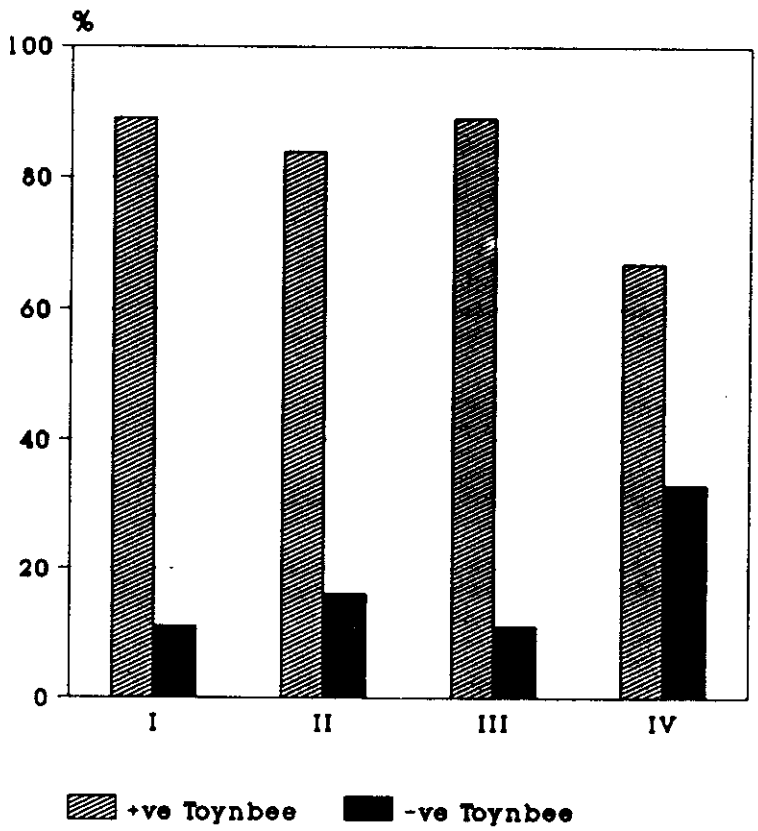

Chart (7): Postoperative results of Toynbee test.

Also, in cases with type IV ETF Toynbee was positive in 31.92% of cases and postoperatively it was positive in (66.67%) of cases which is significant improvement of ETF.

Also, in cases with Type III ETF the incidence of postivie Toynbee rised from 68.75% preoperatively to 89.09% postoperatively.

Mobility of the drum :

The drum mobility was tested by the use of pneumo-otoscopy (table 11) and it was found that :

Out of patients with type I ETF 7 patients (77.78%) had mobile drum and in 2 patients (22.22%) the mobility was restricted.

Out of patients with type II ETF 14 patients (66.67%) had mobile drum while 2 patients (9.52%) had immobile drum, and 5 patients (23.81%) the mobility of the drum was restricted.

Out of patients with type III ETF 26 patients (47.27%) had mobile of the drum, 23 patients (41.82%) had restricted mobility of the drum and 6 patients (10.91%) had immobile drum.

Out of patients with type IV ETF 6 patients (40%) had mobile drum, 6 patients (40%) had restricted mobility of the drum and 3 patients (20%) had immobile drum.

It can be noticed that no patient with type I ETF had completely immobile drum, while in 20% of patients with type IV ETF the drum was immobile. From our results we can deduce that the better the preoperative ETF the more the possibility of having normally mobile drum postoperatively.

Table (11) : The mobility of the drum in relation to preoperative ETF.

Mobility of drum / ETF type	Normally		Partially		Immobile		Total	
	No	%	No	%	No	%	No	%
I	7	77.78	2	22.22	0	0	9	100
II	14	66.67	5	23.81	2	9.52	21	100
III	26	47.27	23	41.82	6	10.91	55	100
IV	6	40	6	40	3	20	15	100
Total	53	53	36	36	11	11	100	100

Pure Tone Audiometry:

Preoperative pure tone audiometry :

Out of 120 patients included in the study 3 patients (2.5%) had Air-bone gap (A-B gap)of 0 -10 dB, 37 patients (30.83%) had A-B gap of 10-20 dB and 80 patients (30.83%) had A-B gap of 20-30dB.

The distribution of patients according to their A-B gap in relation to the ETF is shown in Table (12).

Postoperative Pure tone Audiometry :

During the follow up period the patients either showed improvement of hearing, did not change but no deterioration of hearing occurred.

The operation was successful in 100 patients, out of them 24 patients (24%) had their A-B gap between 0 and 10 dB, 49 patients (49%) had A-B gap of 10-20 dB and only 27 patients (27%) had A-B gap of 20-30 dB. This is shown in table (12).

Comparing the preoperative and postoperative hearing results (table 12) it can be noted that preoperatively (2.5%) of patients had A-B gap of 0-10 dB while postoperatively they were 24% of patients.

Patients with A-B gap of 10-20 dB were 30.83% preoperatively while postoperatively they were 49%.

Patients with A-B gap of 20-30 dB were 66.67% while postoperatively they were only 27%.

The bone conduction of our patients did not rise.

Table (10) : Preopertive and postoperative A-B gap.

A - B gap in dB	Preoperative No	%	Postoperative No	%
0 - 10	3	2.5	24	24
10 - 20	37	30.83	49	49
20 - 30	80	66.67	27	27
Total	120	100	100	100

Preoperative mean A-B gap = 21.42 dB.

Postoperative mean A-B gap = 15.30 dB.

Percentage improvement = 28.57%.

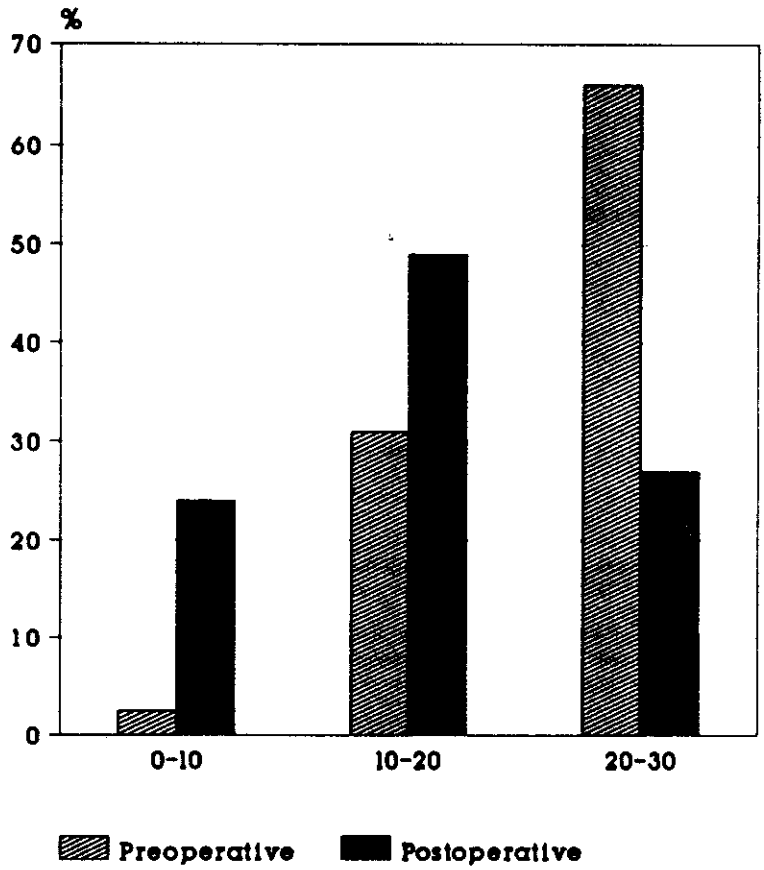

Chart (5): A - B Gap

Preoperative mean A-B gap was 21.42 dB, S.D. = 5.3,While postoperative mean A-B gap was 15.30 dB S.D.=7.17. (t-Test : T = 7.17). The percentage improvement was 28.57%,the difference between preoperative and postoperative hearing results is highly significant.

Correlating the hearing results with the preoperative ETF types (Tables : 13, 14 and 15) it can be seen that :

For patients with ETF type I the preoperative mean A-B gap was 19 dB while postoperatively it was 11.66 dB. The percentage improvement was found to be 38.63%.

For patients with ETF type II the preoperative mean A-B gap was 21.66 dB while postoperatively was found to be 37.35%

For patients with ETF type III the preoperative mean A-B gap was 20.94 dB while postoperatively it was 15.22 dB the percentage improvement was 25.74%.

For patients with ETF type IV the preoperative mean A-B gap was 23.64 dB while postoperative it was 19 dB with percentage improvement of 19.63%.

Table (13): Preoperative hearing results in relation to ETF type .

ETF type	A-B gap 0 - 10 dB		A.B. gap 10-20 dB		A-B gap 20-30 dB		Total	
	No	%	No	%	No	%	No	%
I	1	10	4	40	5	50	10	100
II	1	4.17	6	25	17	70.83	24	100
III	1	1.56	24	37.5	39	60.94	64	100
IV	0	0	3	13.64	19	86.36	22	100
Total	3	2.5	37	30.83	80	66.67	120	100

Table (14) : Postoperative hearing results in relation to ETF type.

ETF type	A-B gap 0 - 10 dB		A.B. gap 10-20 dB		A-B gap 20-30 dB		Total	
	No	%	No	%	No	%	No	%
I	4	44.44	4	44	1	11.11	9	100
II	6	28.57	12	57.14	3	14.29	21	100
III	12	21.82	28	50.91	15	27.27	55	100
IV	2	13.33	5	33.33	8	53.34	15	100
Total	24	24	49	49	27	27	100	100

Table (15): Preoperative and postoperative mean A-B gap and percentage improvement in relation to ETF type.

ETF type	Preoperative mean A-B gap in dB	Postoperative mean A-B gap	% improvement
I	19	11.66	38.63%
II	21.66	12.57	37.35%
III	20.94	15.55	25.74
IV	23.64	19	19.63