

Comparison of Onlay and Underlay Techniques of Tympanoplasty

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Abstract

Background: Chronic suppurative otitis media is one of the major cause of morbidity and major cause of deafness. Surgical management of mucosal type of chronic suppurative otitis media is tympanoplasty. Tympanoplasty is a surgical technique used to restore the integrity of tympanic membrane or/and repair the damage of middle ear diseases. There are two main techniques of tympanoplasty. 1) underlay 2) onlay. Objective of the study is to compare the outcome of techniques of tympanoplasty techniques in the form of graft uptake rate and gain in hearing.

Methods: It is a retrospective study which was conducted in between June 2017 to Dec 2019 among 50 patients of suspected chronic otitis media patients admitted in E.N.T. Ward P.D.U. hospital. The patients were qualified for the procedure of tympanoplasty on the basis of history taking, clinical symptoms, ear examination under microscope, otoscopic examination, tuning fork tests, radiological test(x ray mastoid, ct scan), lab investigation and hearing function test(PTA). the patients were divided into two groups(group A and group B).The patients were operated by both techniques according eligibility criteria, accessed pre and post operative status of patients.

Results:

Conclusions: underlay technique is better than overlay technique of tympanoplasty

Keywords: Tympanoplasty, chronic otitis media , onlay , underlay, temporalis fascia

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I. Introduction

Chronic suppurative otitis media is one of the major cause of morbidity and major cause of deafness. Chronic Suppurative Otitis Media is one of the common otological conditions in India for which the patients seek advice from the Otorhinolaryngologist. Poverty, illiteracy, poor hygiene and overcrowding are all important factors which play an important role in the causation of the disease¹.

Chronic ear discharge and decreased hearing are most common clinical presentation in tubotympanic disease. Other symptoms are tinnitus, earache, ear itching. The perforation seen in the chronic suppurative otitis media may be the only sequel remaining when the pathological process in the middle ear has healed¹.

Otoscopic and microscopic examinations are standard techniques for diagnosis. Tuning fork test and pure tone audiometry is a useful diagnostic tool to know the degree and type of hearing loss, preoperatively and as improvement in hearing postoperatively. A radiological investigation such as X-ray mastoid (Schuller's view) is required preoperatively. X-ray mastoid is required to know the anatomy of mastoid and degree of pneumatisation of mastoid. To address these issues, various surgical modalities of treatment have been tried since ages, to eliminate the disease from the middle ear cleft, with varying degree of success rate. One such modality of treatment is Tympanoplasty.

The goal of surgical management includes the eradication of disease, restoration of hearing and maintenance or restoration of normal anatomical configuration. Its drawbacks are, it requires long term postoperative care and life-time water precaution.

Different types of graft material is used to cover the perforation in the ear drum like skin, fascia lata, temporalis fascia, vein, perichondrium. Temporalis fascia is used in this study because it is easily harvestable, locally available and easy to handle. Various types of techniques are used to repair of tympanic membrane examples onlay, underlay, interlay, sandwich, over-underlay etc. Onlay and underlay techniques were taken for this study. Therefore this study was carried out to find out which among the two is a better technique. Success rate of tympanoplasty depends on various factors like ear atelectasis, Eustachian tube

dysfunction, tympanosclerosis, and active suppuration, condition of middle ear mucosa, wide perforation, and revision myringoplasty.

A set of 50 patients were taken and divided into 2 groups of 25 patients each. One group underwent type 1 tympanoplasty by overlay technique of graft placement while other underwent same surgery by underlay technique. The patients were followed regularly and the intactness of the graft, otorrhea and hearing were assessed.

Aim and objective

Aim and objectives of this study are:

1. To compare graft uptake rate following onlay and underlay technique of type 1 tympanoplasty.
2. To compare pre and postoperative hearing status in both the group.
3. To study the degree of hearing loss in tubo-tympanic type of chronic otitis media.
4. To study age and sex distribution of the tubo-tympanic type of chronic otitis media.

II. Methods

It is a retrospective comparative study was carried out in E.N.T. department of P.D.U. medical college and hospital, Rajkot from June 2017 to Nov 2019 of indoor patients with diagnosis of C.S.O.M. (T/T) disease. Data was collected from detailed history taking, clinical examination, relevant blood and laboratory investigations.

Total 50 cases were included the study which is divided into two groups. Group A had 25 patients, were operated with type 1 tympanoplasty by onlay technique and Group B had 25 patients, were operated with type 1 tympanoplasty by underlay technique.

Inclusion criteria

1. Patient above 8 years of age with chronic suppurative otitis media.
2. Tubotympanic type of chronic suppurative otitis media with conductive hearing loss.
3. Dry perforation for at least 6 weeks.
4. Only cases of perforation confined to pars tensa only.

Exclusion criteria

1. Acute suppurative otitis media, Active stage of chronic suppurative otitis media.
2. Previously operated cases.
3. Chronic suppurative otitis media (Atticoantral type), ossicular chain disorder and any combined procedure.
4. Pregnant women and lactating mother.
5. Patient unfit for surgery.

patients were randomly selected fulfilling the above criteria. Preoperatively patients were assessed by detailed history, clinical examination, radiograph (xray both mastoid and chest), routine blood and laboratory investigations. Pure Tone Audiometry (PTA) was done in all the patients.

Patients were admitted overnight in the ward. Surgery was carried under general anaesthesia. Half (25) of the patients were operated with type1 tympanoplasty by onlay technique and the other half (25) of the patients were operated with type1 tympanoplasty by underlay technique.

Postoperatively the patients were given antibiotics and antihistaminics routinely for 21 days. Stitches were removed after 1 week.

The follow-up examination was carried out at 1st week, 2nd week, 1st month, and 3th month after the surgery. The status of tympanic membrane, otorrhea, and the air-bone gap on pure-tone audiometry were evaluated post-operatively. Clinical evaluation of subjective and objective hearing improvement following surgery with tuning fork test(256,512 and 1024)with frequency 250, 500,1000,2000, 4000kHz was done.

The outcomes were taken as successful if at the end of the 3th months the graft was in situ and as failure was considered if at the end of 3th months the graft was rejected.

III. Results

The study included 50 patients who were divided randomly into two groups. Group A patient operated by onlay techniques tympanoplasty alone included 25 patients and group B patients operated by underlay technique.

TABLE 1. AGE DISTRIBUTION

AGE	Group A	Group A(%)	Group B	Group B(%)
<20	5	20%	4	16%
21-30	8	32%	13	52%

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31-40	7	28%	4	16%
41-50	4	16%	4	16%
>50	1	4%	1	4%
TOTAL	25	100%	25	100%

TABLE 2.GENDER DISTRIBUTION

Group A patient operated by overlay techniques tympanoplasty alone included 25 patients where 06 (24%) were males and 19 (76%) were females. Group B patients operated by underlay techniques tympanoplasty included 25 patients where 07 (28%) were males and 18 (72%) were females.

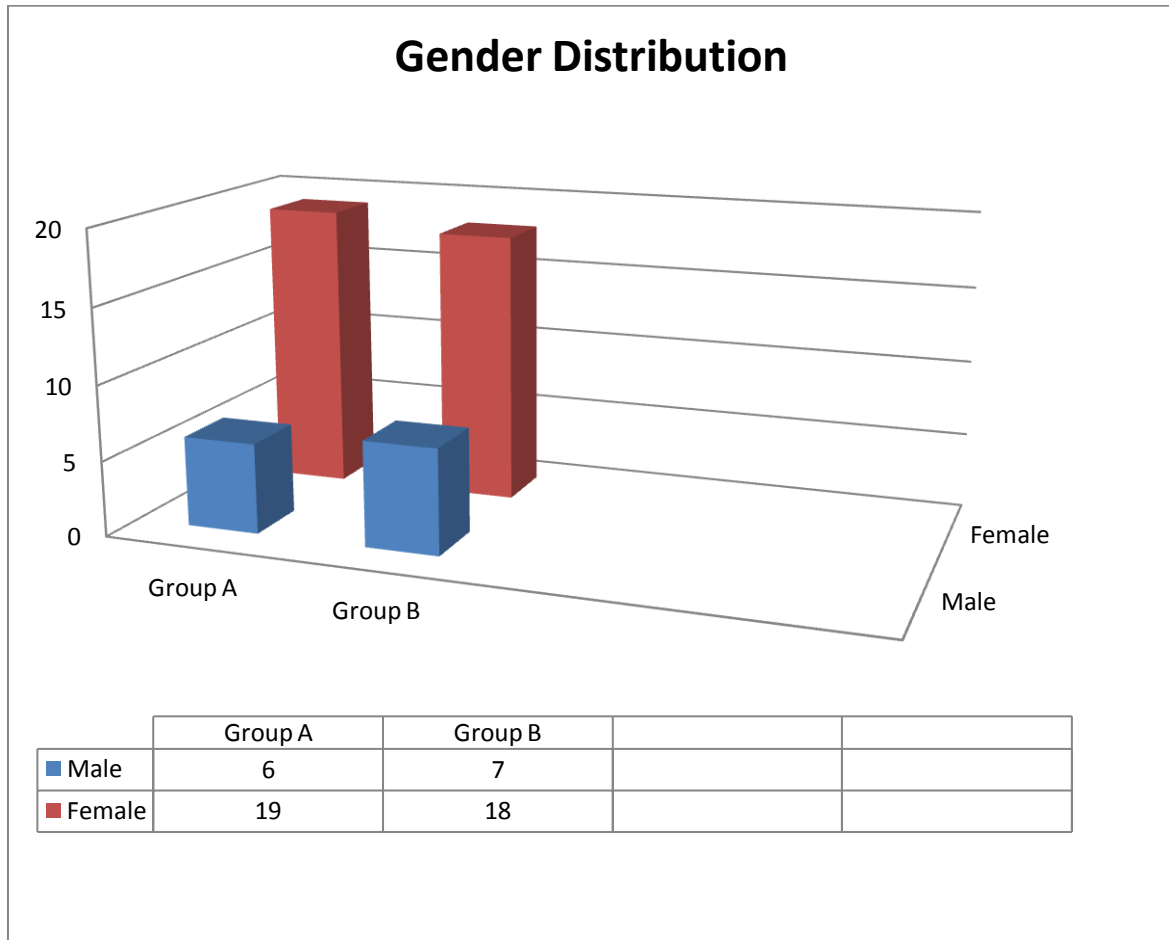


TABLE.3 PREOPERATIVE PRESENTING SYMPTOMS

The following table shows the symptoms of the patients in each group at the time of presentation to the hospital.

Symptom	Group A	Group B
Hearing impairment	16	19
Ear discharge	24	23
Ear ache	8	1
Tinnitus	-	-
Vertigo	1	-
Others	-	-

In group A , out of 25 patients, 24patients had complaints of ear discharge followed by decreased hearing that are 16. 8 patients had ear ache as there only complaint while 1 patient had complaint of tinnitus. In group B, out of 25 patients, 23 patients had complaints of ear discharge. 19 patient reduced hearing as there only complaint while 1 patients had complaints of earache.

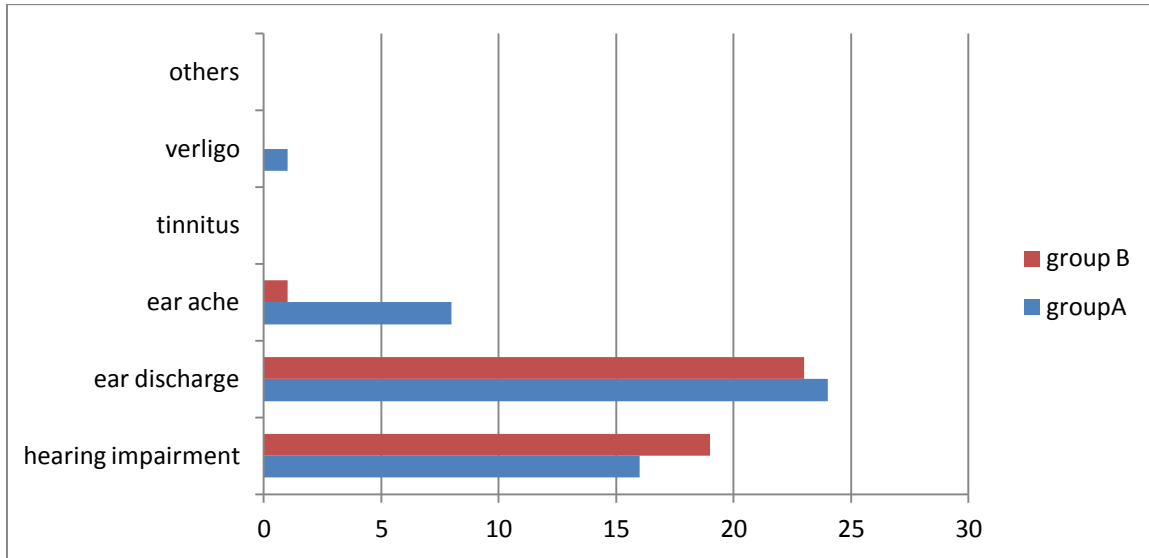


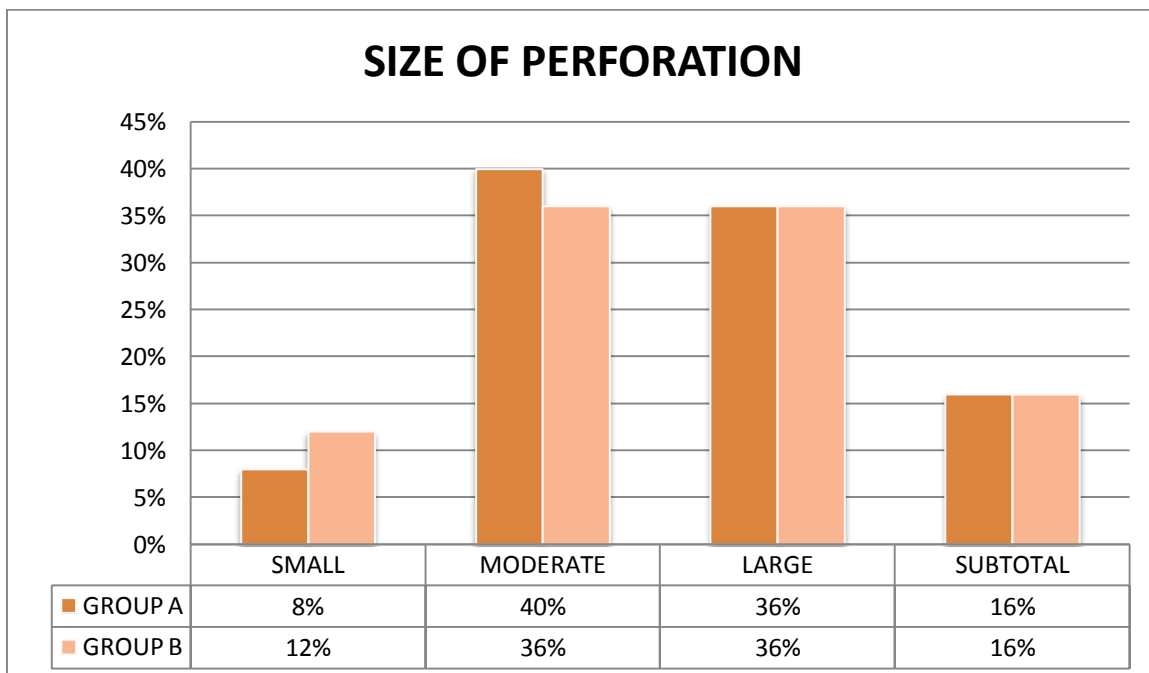
TABLE.4 SIDE OF AFFECTED EAR IN ONLAY&UNDERLAY TECHNIQUES

In present study, the number of patients with unilateral pathology was 29(left dominance) and that with bilateral pathology was 21.

Side	Group A		Group B	
Right	8	32%	3	12%
Left	8	32%	10	40%
Bilateral	9	36%	12	48%
Total	25	100%	25	100%

TABLE.6 SIZE OF PERFORATION

Size	Group A	Percentage	Group B	Percentage
Small	2	8%	3	12%
Moderate	10	40%	9	36%
Large	9	36%	9	36%
Subtotal	4	16%	4	16%
	25	100%	25	100%



Pre-operatively, in group A 10 (40 %) patients had moderate perforation, 9 (36%) patients had large perforation, 4(12%) patients had subtotal perforation and only 2 (8%)patients had small perforation.

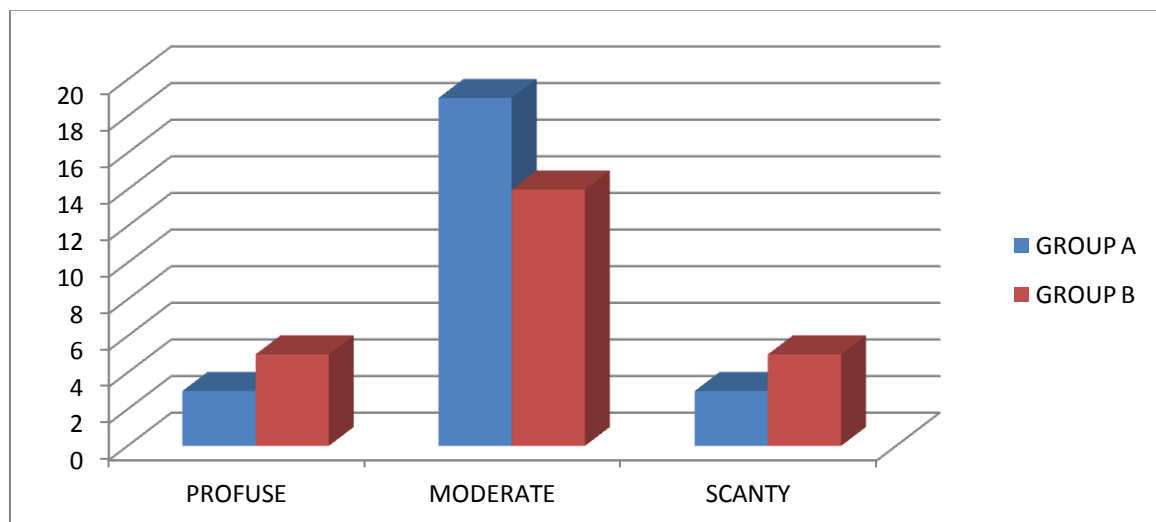
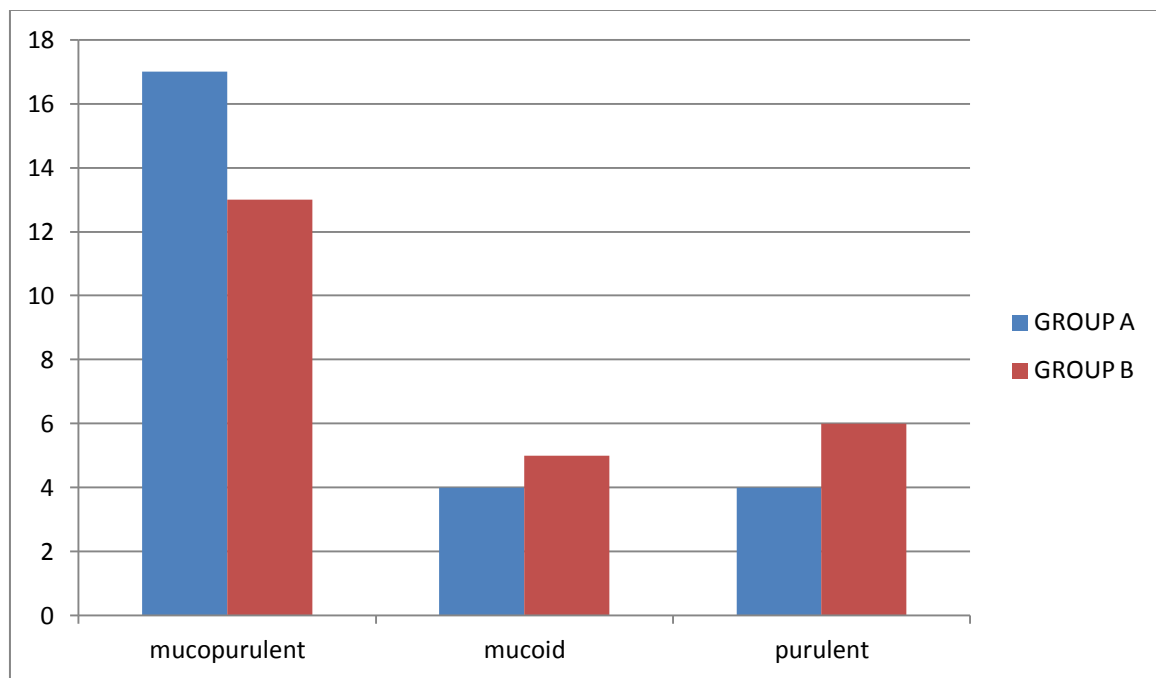
While in other groupB 9(36 %) patients had moderate perforation, 9 (36%) patients had large perforation, 4(16%) patients had subtotal while 3(12%) patients had sm all perforation. Perforation as confirmed by routine otoscopy and microscopy.

TABLE: 7 CHARACTERISTICS OF DICHARGE

The following table shows the characteristics of discharge in both groups.

		GROUP A	GROUP B
TYPE OF DISCHARGE	Mucopurulent	17	13
	Mucoid	4	5
	Purulent	4	6
QUANTITY OF DISCHARGE	Profuse	3	5
	Moderate	19	14
	Scanty	3	5

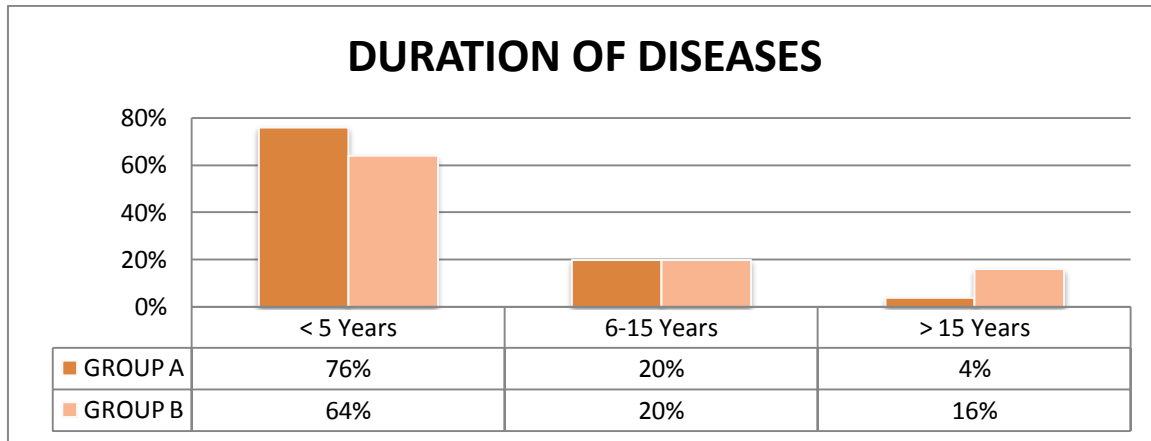
In group A , 17 patients had mucopurulent discharge, 4 patients had mucoid discharge while 4 patients had purulent discharge. In group B, 13 patients had mucopurulent discharge, 5 patients had mucoid discharged while 6 patients had purulent discharge.



In group A, 19 patients had moderate discharge, 3 patients had mild discharge while 3 patients had profuse discharge. In group B, 14 patients had moderate discharge, 5 patients had mild discharge while 5 patients had profuse discharge.

TABLE 8 DURATION OF DISEASES

Duration	Group A	Percentage	Group B	Percentage
<5years	19	76%	16	64%
6-15 years	5	20%	5	20%
>15 years	1	4%	4	16%
Total	25	100%	25	100%



In the present study, 19 patients out of 25 in group A and 16 patients out of 25 in group B is presented in less than 5 years of duration of disease. Rest of patients is presented above 5 years in both groups.

TABLE.9 COMPARISON OF AIR BONE GAP IN ONLAY TECHNIQUE(GROUP A)

AB GAP	NO.OF PATIENTS (PREOP)		NO.OF PATIENTS (POSTOP)	
< 20DB	2	8%	11	44%
21-30DB	8	32%	11	44%
31-35DB	14	56%	3	12%

In the onlay that is group A 14 patients had preoperative 31-35db AB gap which was reduced by 3 postoperatively, less than 20 db air bone gap preoperative were 2 patients and post operative 11 patients and 21-30db air bone gap there were 8 patients in preoperative and 11 patients were postoperative.

TABLE . COMPARISON OF AIR BONE GAP IN UNDERLAY TECHNIQUE GROUP B

AB GAP	PREOP NO. OF PATIENTS		POST OP NO. OF PATIENTS	
< 20DB	3	12%	10	40%
21-30DB	6	24%	12	48%
31-35DB	16	64%	3	12%

In the underlay that is group B 16 patients had preoperative 31-35db AB gap which was reduced by 3 postoperatively, less than 20 db air bone gap preoperative were 3 patients and post operative 10 patients and 21-30db air bone gap there were 6 patients in preoperative and 12 patients were postoperative

TABLE .11 POST OPERATIVE HEARING GAIN.

Hearing gain (db)	Group A	Percentage	Group B	Percentage
0-10	13	52%	11	44%
11-30	12	48%	14	56%
TOTAL	25	100%	25	100%

Above table shows that in group A 10 patients (44 %) had 0-10 dB gain in AB gap, 10 patients (40 %) had 11-20 gain in AB gap, 2 patients (8%) had 21-30 gain in AB gap, while 3(12 %) patient had no gain in AB gap. In group B , 10(40 %) patients had 0-10 dB gain in AB gap, 14 (56 %) patients had 11-20 dB gap and 1 (4 %) patients had no gain in AB gap.

TABLE .12 GRAFT UPTAKE

In the both (group A and B) technique of Tympanoplasty there was 88% uptake rate.

Uptake	Group A	Group B
INTACT	22	22
NON INTACT	3	3
	25	25

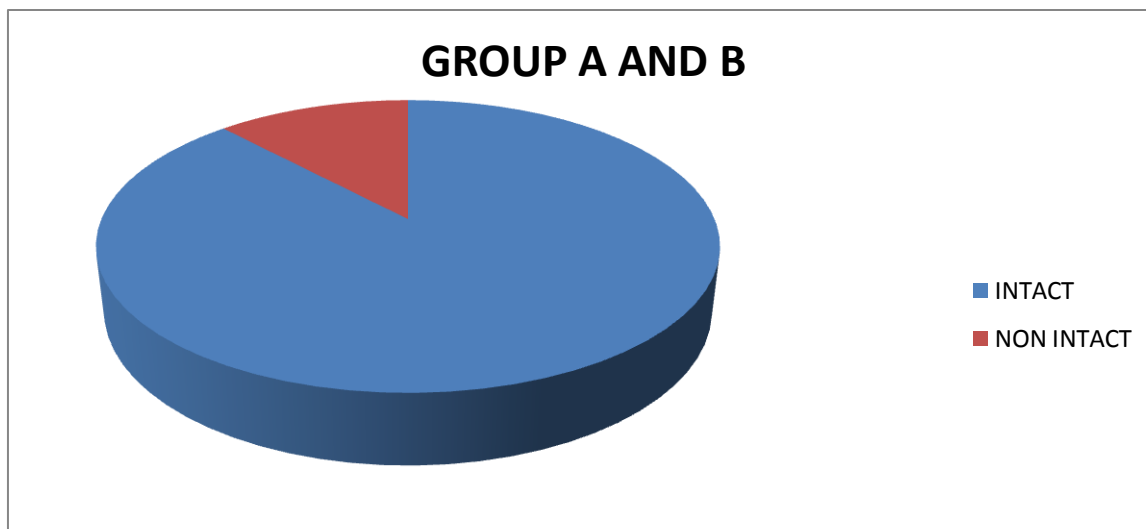
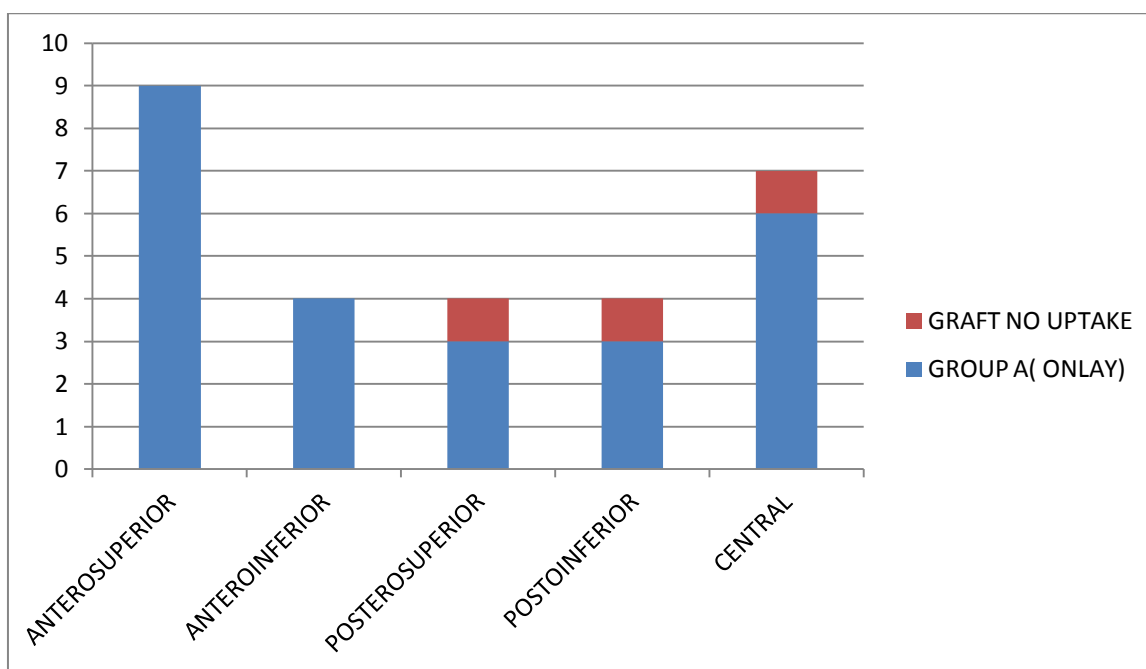


TABLE .13 GRAFT UPTAKE IN RESPECTIVE OF SITE OF PERFORATION

SITE OF PERFORATION	GROUP A		GROUP B	
	No of pts	Graft rejected	No of pats	Graft rejected
ANTERO-SUPERIOR	4	0	4	2
ANTERO-INFERIOR	9	0	2	1
POSTERO-SUPERIOR	3	1	10	0
POSTERO-INFERIOR	3	1	4	0
CENTRAL	6	1	5	0

In the present, 9 patients of antero inferior quadrant perforation were operated by overlay technique of Tympanoplasty and graft uptake was 100%. Similar to 10 patients of posterosuperior quadrant perforation were operated by underlay techniques and no graft rejection seen.



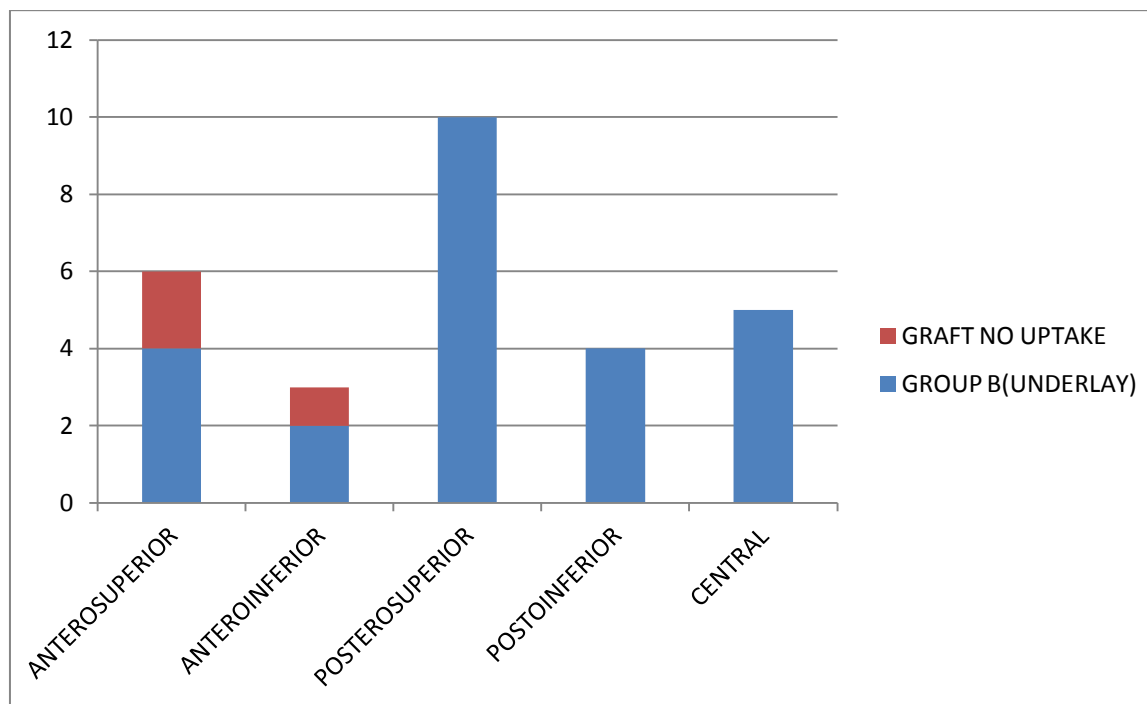


TABLE 14 COMPLICATION OF SURGERY

COMPLICATION	GROUP A	%	GROUP B	%
EAR ACHE	10	40	8	32
OTORRHEA	4	16	3	12
WOUND INFECTION	2	8	4	16
GRANULATION	6	24	5	20
OTHERS	9	36	6	24

In present study, most common complication of surgery was ear ache in the both groups which was treated with analgesics and patients improved. Others complication were granulation over graft and EAC, ear ache otorrhea, wound infection ear itching and ear fullness etc. Granulation was treated with steroid ear drops.

TABLE NeoTM_status * Surgery_ Cross tabulation

		GROUP A	GROUP B	Total	p-value	Yate's p value
Graft status	Intact	22	22	44	1	0.6637
	Non-intact	3	3	6		
Hearing gain	0-10db	13	11	24	0.571	0.777
	11-30db	12	14	26		

IV. Discussion

One of the major illnesses prevalent in our country is that of the chronic suppurative otitis media. A large number of chronic suppurative otitis media cases belong to the safe or tubo-tympanic variety in which there is a central perforation present in the tympanic membrane. It leads to the loss of hearing and recurrent ear discharge which contributes to the morbidity in the population. The patients also suffer socially due to deafness and faces embarrassment due to aural discharge. These patients attend E.N.T. clinics in order to be relieved of these symptoms. Tympanoplasty is one operation employed for these patients. It not only gives a dry ear but also improves the hearing in these patients.

Lots of graft materials are use for repairing the perforation in the ear and for treating the pathology. The most commonly used graft material is temporalis fascia which is readily available by a post aural incision.

Most of the studies conducted had come to conclusion that age does not affect the outcome of myringoplasty. This is evidenced by Booth²², Sade, Glasscock²³ and Adkins²⁴.

Raine²⁵ and Singh³⁶ in analysis of 114 tympanoplasty in children in age group of 7 to 16 years demonstrated a significance increase in the rate of failure between 8-12 years of age.

In this study, mean age group is 21-30 years and age does not affect the outcomes.

Patients were randomly selected in the study irrespective of their sex. In this study prevalence is high in female than male. **Caye Thomasen**²⁶ et al (2007) in their study of 26 cases, male to female ratio was 1:1.36. **John Mathai**²⁷ in his study of 200 cases had male to female ratio of 1:1.85.

TABLE : COMPARISON OF SEX DISTRIBUTION IN VARIOUS STUDIES.

In the present study 26% patients were male and 74% patients were female which is similar to studies of **Mahesh and Anubha sengupta**

STUDY	MALE	PRESENT STUDY	FEMALE	PRESENT STUDY
Anubha sengupta ²⁸	45%	26%	55%	74%
Parmod kolsotra ²⁹	51.4%	26%	48.6%	74%
Rahul kawatra ³⁰	53%	26%	47%	74%
Mahesh ³¹	46.6%	26%	53.4%	74%
Khan and khan ³²	66%	26%	33%	74%
Vineet panchal ³³	60%	26%	40%	74%

In our study bilateral tympanic membrane perforation is seen in 42% of the cases and slighty left dominance. **Parmod kolsotra**²⁹, in his study left dominance was present that is 60%. **Robert k jackler and Robert A schindler**³⁴ (1984) in their study of 48 patients, bilateral tympanic membrane perforation was seen in 25%. **John B. Booth**²¹ (1974) in his study of 284 cases, found the incidence of bilateral discharge to be 30%.

In this study, in both group patients with moderate and large size perforation had poorer rate of graft uptake. **Adkins WY**²⁴, **White** in their study of 71 cases found that high failure rate in graft uptake in cases with presence of near total or total perforation. **Jackler Robert K, Schindler Robert A**³⁴ (1984) in their study of 48 myringoplasty cases, found that patients with perforation size small (0- 25 % group) had higher failure rate, in comparison to other sizes. **Sheehy and Glasscock**²⁰ noted that take up rates for total perforation were 97.5% compared to 93.8% for moderate and small sized perforation which is similar to our study. **While Booth**²² in 1974, reported better results for smaller perforations.

TABLE. COMPARISON IN VARIOUS STUDY HEARING GAIN

STUDY	GROUP A(OVERLAY)	GROUP B(UNDERLAY)
Packer ³⁵	36%	54%
Mangal singh ³⁶	57.1%	92.8%
Parmod kalsotra ²⁹	11.72db	11.11db
Rahul kawaba ³⁰	16.50db	14.67db
Khan and khan ³²	69%	86%
Present study	10.64db	10.96db

In majority of studies graft uptake rate is better in underlay technique than onlay example are **Packer**³⁵, **Parmod kolsotra**²⁹, **Fadi**³⁷, **Wang**³⁸, **Glasscock**²³, **Rahul**³⁰, **Khan and khan**³². In **Mangal Singh**³⁶, both techniques have same results which is similar to the present study (83%). **Brown**³⁹ and **Rizer**¹³ studies onlay technique shows higher results.

Table

STUDY	GROUP A	PRESENT STUDY	GROUP B	PRESENT STUDY
Packer ³⁵	91%	83%	93%	83%
Mangal singh ³⁶	93.3%	83%	93.3%	83%
Brown ³⁹	100%	83%	74%	83%
Sheey and Anderson ¹⁴	80%	83%		83%
Parmod kolsotra ²⁹	89%	83%	91%	83%
Fadi ³⁷	66.7%	83%	85.4%	83%
Wang ³⁸	82.1%	83%	85%	83%
Glosscock ²³	91%	83%	96%	83%
Rizer ¹³	95.6%	83S%	88.8%	83%
Rahul kawaba ³⁰	83.3%	83%	86.7%	83%
Khan and khan ³²	70%	83%	86%	83%

V. Conclusion

Chronic suppurative otitis media is a one of the major illness prevalent in India causing recurrent ear discharge and significant hearing loss. The conclusion drawn from this study can be summerized as in the both group the graft uptake rate was 88%. Mean hearing gain in overlay technique (group A) is 10.664 db and in underlay technique (group B) is 10.964db that was insignificant because of p value was less than 0.05.

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DECLARATIONS

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