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Methylene Blue Staining of the Temporalis Fascia in Myringoplasty

Medical Science

KEYWORDS :

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INTRODUCTION.

Myringoplasty is a basic technique in Otolaryngology practice which involves the repair of the perforated tympanic membrane. It is usually done in non cholesteatomatous chronic suppurative otitis media with central perforation with an intact and normal ossicular chain. A number of local and systemic factors are involved in the final outcome of the surgery like overall condition of the patient, diabetes, discharge from the ear, duration for which the ear has been dry before surgery, condition of the mastoid which is not always possible to determine unless we do a CT scan of the ear, condition of the eustetian tube – whether patent or not, to some extent the size of the perforation as we have seen better results with smaller perforations than with subtotal perforations and location of perforation on the tympanic membrane as myringoplasty is difficult in anterior perforations than in posterior perforations. Other factors are the amount of bleeding during surgery, whether graft was optimally placed or not and a proper postoperative care. Although postoperative perforation may result from infection or some patient factors it also sometimes due to improper placement of the graft during surgery, which may occur due to excessive bleeding during surgery, graft folding, or inability to differentiate between the graft and the tympano-meatal flap while placing it. To overcome this problem we attempt to stain the temporalis fascia graft with methylene blue during surgery so that it can be properly differentiated from the tympano-meatal flap and placement becomes easier and better which can ultimately improve results.

Methylene Blue: Methylene blue also known as methylthioninium chloride is a heterocyclic aromatic chemical compound (a phenothiazine derivative) with the chemical formulaC16H18N3SCl. At room temperature it appears as a solid, odorless, dark green powder, that yields a blue solution when dissolved in water. The hydrated form has 3 molecules of water per unit of methylene blue. Methylene blue has a pH of 3 in water (10g/l) at 25 °C (77 °F). It has many uses in biology and chemistry; for example, it can be used as a stain and as a medication as an antidote to carbon monoxide poisoning and cyanide poisoning (1)

AIMS OF THE STUDY.

The aim of the study was to establish whether the use of Methylene blue staining of the temporalis fascia during the surgery improves the overall result of the procedure.

All the patients were evaluated for the disease, conservative treatment was given to make the ear dry before surgery and an average period of 21 days of dry ear was taken as a criteria for all the patients before surgery. Age and sex was not a consideration but patients below 14 years and above 55 years were not considered for surgery. All the patients underwent a routine evaluation and diabetes was controlled before surgery in some cases who had elevated blood glucose levels. The condition of the middle ear mucosa was also taken as a criteria and patients with edematous mucosa were excluded from the study. All the patients were subjected to audiometric evaluation and all the patients had an air bone gap of more than 30db. Patients with an air bone gap more than 60db were excluded from the study. Ct scan was not done in any case as it is usually not indicated in safe type of chronic suppurative otitis media with central perforation. All the patients were fresh cases and had no previous ear surgery. Patients with chronic sinusitis were included from the study.

Patients were divided in two groups

GROUP 1: Patients treated without staining the temporalis fascia. (n=50)

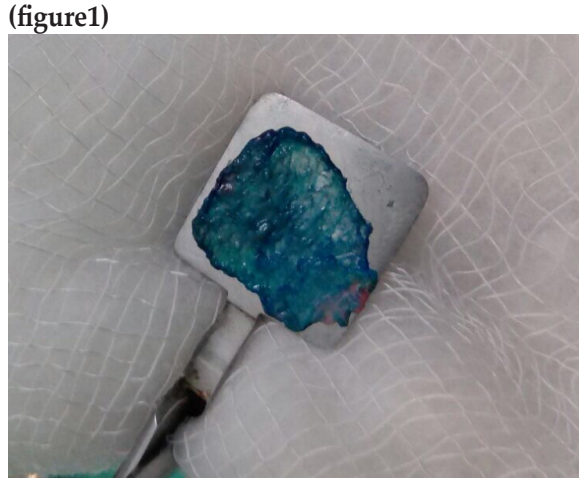
GROUP 2: Patients treated with staining the temporalis fascia with methylene blue (n=50)

METHODS.

Preoperative routine investigations were carried out in all the patients to see for operability of the patients, all medical conditions like diabetes and hypertension were first controlled before surgery; the ear was made dry for at least a period of 21 days before surgery by giving antibiotics and topical medication.

The same surgeon operated an all the cases and all the cases were operated by transcanal or permeatal approach in Local anesthesia. The temporalis fascia graft was harvested by a small postaural incision and was spread on graft spreader, 1 ml of 1% methylene blue was poured on the graft to stain it and was later rinsed with saline to remove excess methylene blue, graft was then left to dry,(figure 1) and post aural incision was closed.

(figure1)



Proper betadine irrigation of the ear was done and then the

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margins of the perforation were freshened, the undersurface of the perforation was made raw with the round knife, vascular strip incisions were given and then a tympano-meatal flap was elevated, the graft was separated from the handle of maleus and was taken anteriorly. Haemostasis was achieved and small pieces of absorbable gelatin sponge were placed in the middle ear. The graft was then placed below the tympano-meatal flap and below the handle of maleus and was tucked under the anterior margin of the perforation, the tympano-meatal flap was then repositioned and dry absorbable gelatin sponge were placed lateral to the graft and the flap. Mastoid dressing was given to all the patients and was opened after a period of 10 days. Same technique was used in both the groups. Postoperatively all the patients were given Oral antibiotics, and anti inflammatory and an anti histaminics for a period of 15 days. All the patients were discharge after 24 hours and were given proper postoperative instruction and care to avoid water entry and to avoid Upper respiratory infection, nose blowing and not to pick heavy weights. The dressing was opened after 10 days, post-aural stitches were removed, canal pack was removed and evidence of infection were noted and if present cleaning was done, the small pieces of absorbable gelatin sponge if present were removed at this stage. The ear was examined under microscope and condition of the graft was noted regarding take up, lateralization, anterior blunting, discharge, residual perforation and rejection were noted.

All patients were followed for at least 3 months after the operation and were evaluated on the same criterias. Postoperative audiometry was done in all the cases to see for hearing improvement.

OBSERVATIONS

A. Evaluation at 10 days:

	GROUP 1	GROUP 2
Intact Graft	86%	94%
Lateralization of graft	--	--
Anterior Blunting	--	--
Discharge	16%	6%
Residual Perforation	4%	2%
Graft Rejection.	10%	4%

Patients were evaluated on the 10th postoperative day when post aural stitches and canal packs were removed. There was a significant difference in the graft take up rate as in Group 1 only 86% (n=43) of cases showed a well epithelialized graft in place as compared to 94% (n=47%) showed a well epithelialized graft. The difference of 8% is significant. No graft lateralization or anterior blunting was seen in any case in either group. Discharge was seen in 16% (n=8) of cases in group1 as compared to only 6% (n=3) in group 2 patients. Residual perforation was seen in 4% (n=2) of cases in group 1 as compared to 2% (n=1) cases in group 2. The incidence of graft rejection was 10% (n=5) in group 1 as compared to 4% (n=2) in group 2 patients. The overall graft uptake rate was better in group 2 patients as compared to group 1 patients along with incidence of residual perforation and graft rejection. The decreased incidence of purulent discharge postoperatively can be attributed to the antibacterial and antioxidant features of methylene blue. The decreased incidence of purulent discharge postoperatively is directly related to postoperative graft uptake, graft rejection and residual perforation.

B. Evaluation at 1 month:

	GROUP 1	GROUP 2
Intact Graft	84%	94%
Lateralization of graft	--	--
Anterior Blunting	--	--
Discharge	16%	6%
Residual Perforation	6%	2%
Graft Rejection.	10%	4%

All these patients were again evaluated for the same criterias after 1 month of surgery. There was a slight decline in graft uptake rate in group 1 patients as now 84% (n=42) of cases showed a well epithelialized graft in place as compared to 94% (n=47%) (same as after 10 days) showed a well epithelialized graft. The difference of 10% has become more significant. No graft lateralization or anterior blunting was seen in any case in either group. Discharge was seen in 16% (n=8) of cases in group1 as compared to only 6% (n=3) in group 2 patients. Residual perforation was seen in 6% (n=3) of cases in group 1 (2% more than after 10 days) as compared to 2% (n=1) (same as after 10 days) cases in group 2. The incidence of graft rejection was 10% (n=5) in group 1 as compared to 4% (n=2) in group 2 patients (same as after 10 days in both groups). The overall graft uptake rate was better in group 2 patients as compared to group 1 patients along with incidence of residual perforation and graft rejection. The fall in graft failure was reflected by increase in residual perforation in group 1, that can be attributed to high incidence of the discharge that was present in group 1 patients.

C. Evaluation at 3 months: All these patients were evaluated on the same parameters after 3 months and the results were the same as after 1 month.

SOME OTHER IMPORTANT OBSERVATIONS:

1. At 10th day of dressing the blue color of methylene blue was not visible in group 2 patients on the newly formed tympanic membrane. This emphasizes the benefits of methylene blue as a stain.

2. Residual absorbable gelatin sponge after 10th postoperative day:

GROUP 1: 34% (n=17) patients had absorbable gelatin sponge in the ear canal.

GROUP 2: 10% (n=5) patients had absorbable gelatin sponge in the ear canal.

Although absorption of absorbable gelatin sponge is dependant on many factors including its make, the antibacterial and antioxidant nature of methylene blue may have a role in it which needs to be confirmed by further studies as the absorption rate was significantly different in the two groups.

3. Post operative improvement in hearing (audiometry) :(Mean Hearing Threshold (dB HL)

	GROUP 1	GROUP 2
Preoperative Air Conduction Threshold	40-55 dB	40-55 dB
Postoperative Air Conduction Threshold	20-25 dB	20-25 dB
Preoperative Air - bone Gap	30-45 dB	30-45 dB
Postoperative Air - bone Gap	10-15 dB	10-15 dB.

GROUP 1:20-30db gain was seen in all the patients after surgery.

GROUP 2:20-30db gain was seen in all the patients after surgery.

The analysis of hearing improvement in the two groups was the same stating that methylene blue is only helpful in placement of the graft and does not have a role in improving the hearing threshold.

4. No patient complained of any allergic reaction or any other unexplained inner ear dysfunction attributed to the use of methylene blue tissue stain.

DISCUSSION.

The first myringoplasty was performed by Marcus Bancer(2) in 1640 even though the term myringoplasty was coined by Berthold in 1878. In 1952 Wullstein published a method of closing perforations with a split thickness skin graft.(3) One year later Zollner described his experiences with a similar graft. Wullstein and House then advised a full thickness graft taken from behind the ear. Later on Zollner and Wullstein devised a classification for tympanoplasty that was based on the type of ossicular chain reconstruction. The ideal reconstructive technique should obtain a thin, oval shaped, vibrating tympanic membrane replacing the original ear drum in order to prevent infection and to improve hearing.

Myringoplasty is a procedure of reconstruction of the tympanic membrane without dealing with the ossicular chain. The procedure has undergone a number of changes over the years but the procedure was constantly encountered with failures either in the form of graft failure, retractions of the newly formed tympanic membrane, lateralization, anterior blunting, epithelial pearl formation, residual perforation and persistent discharge although a number of factors are responsible for it but one of the major factor lies in the procedure itself in the form of folding of the newly placed graft, improper or inadequate coverage of the perforation by the graft due to improper demarcation between graft and normal tissue during surgery and the surgical technique. Schuknecht emphasized that the surgical technique is most important variable for the success of myringoplasty (4). The trans meatal approach remains one of the toughest for the surgeon and Graft failure is considerably higher in anterior perforation, large perforation condition of the middle ear mucosa patency of the eustetian tubes & possibly is also influenced by the placement of the grafts during surgery. The placement of the graft is largely dependant on a dry operating field, good elevation of tympano-meatal flap, good separation of the tympanic membrane from the handle of maleus, proper placement of the graft under the tympano-meatal flap and also under the handle of maleus, complete coverage of the perforation by the graft and if the perforation is placed anteriorly sometimes we need anterior buckling of the graft under the annulus anteriorly. The graft should also be properly separated from the promontory by adequate placement of absorbable gelatin sponge medial to the graft sometimes also covering the eustetian tube. All this meticulous work has to be done in a very narrow field of vision and requires meticulous detailing between various structures of the middle ear. And the graft and the tympano-meatal flap being of the same color sometimes it becomes difficult to differentiate between the two and placement becomes difficult especially covering the anterior margin of the perforation. The use of methylene blue helps overcome this problem by proper demarcation between the graft and the tympano-meatal flap and other structures of the middle ear and helps in better placement of the graft which improves the graft uptake rate. The added advantage of methylene blue as antibacterial and antioxidant nature helps improve the graft uptake rate by reducing the infection although this added feature needs further study.

Study conducted by Talas et al. (5) showed a 100% result in the results of the surgery using methylene blue staining of the temporalis fascia (which was not the case in the present study as in the present study 94% result was achieved) He advocated to stain one side of the fascia which makes one side brighter as compared to the other which helps in avoiding twisting and folding of the graft during placement, since in the present study dry graft was placed this problem was not encountered. He also did not encounter any case with allergy or unexplained inner ear dysfunction attributed to the use of tissue stains as in the present study.

The study conducted by Vaiman et al. (6) showed the following results

Tympanic membrane healing (graft take) in 86.66% cases in Group 1 and 100% cases in Group 2 and which was different from the present series.

Significant improvement of hearing in all successful cases (p\0.05) as was in our series. He also has not mentioned any difference in the hearing improvement in the two groups.

He also did not encounter any major side effect of the tissue stain as was in the present series.

They concluded that intra-vital staining with methylene blue in tympanoplasty simplifies the operation and could assist in better visualization and proper placement of the graft. This technique could be most useful in a training process for resident surgeons

The study conducted by Wrong also states that difficulty may be experienced in the placement of the graft during tympanoplasty, especially in anterior tympanic membrane perforation. The author observed that the use of methylene blue stained temporalis fascia graft provides contrast between the edges of the tympanic membrane perforation and the graft. This contrast allows the surgeon to better visualize the graft and thus ensures that the perforation is totally covered with the graft. This was also seen in the present series.

The study conducted by Bhushan etal showed the following

Graft success rate was 85% in group-1 and 95% in group-2, which is not very different from the present series which showed 84% in group 1 and 94% in group 2 patients.

There was statistically significant difference (p = 0.04) between group 2 and group 1 regarding gain in A-B gap postoperatively, which was not the case in present series where no difference was seen in hearing improvement in the two groups, although he evaluated the patients till 6 months postoperatively and we did for 3 months only.

The study conducted by Lee(2005) (9) also used methylene blue as a stain but also made a hole in the graft through which the handle of maleus was passed. This allow the surgeon to better see the hole and better handle the graft, it is useful regardless of the experience of the surgeon without any adverse effect of gentian violet. This provides more stability in graft placement and also reduces the duration of surgery and it can substantially decrease the failure rate of the grafting. This method was not used in the present study.

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CONCLUSION.

1. Methylene blue also known as methylthioninium chloride is a heterocyclic aromatic chemical compound commonly used in medical practice for various purposes.
2. It can be used for staining of the temporalis fascia graft for better tissue demarcation (between tympano-meatal flap and other middle ear structures and the graft.) for better visualization of the graft during surgery, proper placement of the graft and complete coverage of the perforation during surgery which improves the graft take up rate.
3. The method is especially useful for the young training surgeons but can be used by the experienced surgeons also.
4. It's better to stain the graft at the time when it is removed to save drying time of the graft.
5. Although some advocate only one side should be stained not much emphasis was given to this in the present study as even if you stain one side the other side gets stained on its own.
6. Methylene blue as an antioxidant and antimicrobial properties, prevents degradation and lysis of fascia graft, improves the overall success rate of graft uptake with no adverse effect(8)

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