ORIGINAL ARTICLE

COLLAGEN DRESSING IN CANAL WALL DOWN MASTOIDECTOMY: A COMPARATIVE STUDY

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ABSTRACT: AIM: To evaluate and assess the effect of collagen dressing in canal wall down mastoidectomy on epithelization time and healing. **METHODOLOGY:** A prospective study was conducted in the Dept. of E.N.T at Pt. J.N.M.M.C Raipur wherein patients with chronic otitis media were treated surgically by canal wall down procedure with collagen dressing (28 patients) and without collagen dressing (12 patients). They were followed up over a period of 4 months and the epithelization time was compared. **RESULT:** The epithelization time in the collagen applied group was 4 to 7 weeks (averaging 6+/-0.3 weeks) and 9 to 15 weeks (11.5+/-1.09 weeks) in the control group. The epithelization was significantly different in both these groups. **CONCLUSION:** Collagen dressing of the mastoid cavity in canal wall down mastoidectomy procedure helps to reduce infection and helps in better healing of the cavity with faster epithelization of the same.

KEYWORDS: Mastoidectomy, Collagen dressing, Canal wall down mastoidectomy.

INTRODUCTION: 'The rational treatment must be based on the surgical principle that a diseased bony cavity should be opened up extensively, all diseased tissue removed, and the source of suppuration brought clearly to the light. The pus must nowhere be hindered, in its outflow' -

- Ernst Kuster Clinical observation indicated that many open mastoidectomy cavities achieved a stable epithelial lining without persistent accumulation of debris (The so called 'Self-cleaning' cavity). Other cavities suffered with discharge and accumulation of debris. It is often assumed that mastoid cavities which become clean and dry, do so by the re-establishment of epithelial migration.¹ Otorrhoea following open mastoid cavity surgery is common and is estimated to occur in 10 to 35% of patients. It is usually due to failure of epithelialization of the mastoid cavity for a variety of reasons. For faster epithelization of the mastoid cavity various procedures have been done. Skin grafts, application of amniotic membrane, periosteal flaps, and collagen dressings are used to line the bare bone of the mastoid cavity. In this study collagen is used to line the bare bone of the mastoid cavity following a canal wall down mastoidectomy and are followed up post operatively to assess the epithelization time in the cavity and compare it with the epithelization time of the group without the collagen dressing.

AIMS AND OBJECTIVES: The aims and objectives of this study were to evaluate and assess the effect of collagen dressing in canal wall down mastoidectomy on epithelization time and healing, to compare the epithelization time of the collagen dressed mastoid cavity with the non-collagen dressed mastoid cavity and to achieve a faster epithelization time in the mastoid cavity to reduce mastoid cavity problems.

METHODOLOGY: This was a prospective study conducted in the Department of E.N.T and Head Neck surgery, Dr. B.R.A.M hospital (Pt. J.N.M Medical College), Raipur, which included 40 cases of both

ORIGINAL ARTICLE

sexes in the age group ranging between 10 to 60 years, the youngest being 12 years of age and the oldest being 60 years. These patients presented to the E.N.T OPD with chronic otitis media with/without cholesteatoma. Canal wall down mastoidectomy was done in all these patients and the cavity was dressed with wet collagen. The epithelization and healing of the cavity was assessed over a period of 4 months and this was compared with the results of the same surgical procedure done without collagen dressing. Both the groups were followed up on a weekly basis to assess the mastoid cavity postoperatively by microscopic examination and were compared.

Inclusion Criteria: Patients in the age group of 10 to 60 years of both sexes who required a canal wall down mastoidectomy with conductive hearing loss were included in the study.

Exclusion Criteria: Patients with cholesteatoma around the foot plate of stapes and eustachian tube orifice. Patients with extensive granulation disease. Patients with chronic otitis media with intracranial complications. Patients with sensorineural hearing loss.

History: An in depth history regarding the ear complaints was taken on the symptoms of ear discharge, otalgia, hearing loss, tinnitus, vertigo, and associated E.N.T complaints.

Pre-operative: The complete ear examination was done which included otoscopic examination with the assessment of the vestibular functions and tuning fork tests. Following this the patient was assessed by examination under the microscope.

INVESTIGATION:

Audiological: Pure tone audiometry.

Radiological: Bilateral X ray mastoid schullers view.

Intra-operative: The canal wall down mastoidectomy with/without tympanoplasty was done in all the patients. Following this cavity was lined with wet collagen dressing which was placed in contact with bare bone surface of the mastoid cavity overlying the free edges of the conchomeatal flaps, periosteal flap and the tympanomeatal flap.

Post-operatively: The patients were assessed weekly following the surgery (Both groups) the conchomeatoplasty, the cavity size, facial ridge, post-operative residual disease, the epithelization time and healing were assessed.

RESULTS: The study included 40 patients in which 14 patients (37.5%) were present in the age group of 21 to 30 years, 12 patients (30%) in the age group of 11 to 20 years and 8 patients (20%) in the 4th decade. There were 19(47.5%) males and 21(52.5%) females in this study. 42.5% of patients had right ear disease, 35% had left ear disease and 22.5% had bilateral disease in their ears respectively. Preoperatively 34(85%) of patients presented with cholesteatoma, 12(30%) patients with aural polyp and 6(15%) patients with granulation the middle ear. 26 patients were operated on the right ear and 14 patients on the left ear. Wet collagen dressing was applied in 28(70%) of the patients. In our study the epithelization time in the collagen dressed mastoid cavities was found to range between 4 to 7 weeks, averaging(6 +/- 0.3) and was 9 to 15 weeks, averaging(11.5 +/- 1.09) in the control group.

ORIGINAL ARTICLE

DISCUSSION: Collagen membrane consists of natural collagen fibers which are of high strength, low antigenicity, can promote cell growth and epithelial tissue regeneration, and when placed on the bone surface, the non-cellular components help in rapid formation of fibrous bone surface plexiform layer, reduce the growth of granulation tissue, create favourable conditions for growth of skin grafts, speed up the mastoid cavity epithelization and reduce secondary infection.

During the early postoperative phase the mastoid cavity is in a wet and fragile state, a favorable micro-environment for a variety of bacterial and fungal growth. The procedure involves complete removal of the disease from the affected ear with obliteration of the mastoid cavity and lining of the bare bone in the cavity with collagen membrane.

The discharging cavity may result from one of three causes:

1. **Exposed respiratory epithelium:** Either residual uncleared air cells or a drum perforation.
2. **Failure of healing:** Chronically infected tissue – granulations, osteitis, chondritis, devitalized tissue – myringitis, sequestra, avascular scar tissue.
3. **Failure of the self:** Cleaning epithelial migration.

This will result in debris buildup, secondary otitis externa, resultant chronic tissue inflammation and degeneration, or even trauma from clearing the debris. The basic pathology may arise from preoperative, surgical, or postoperative causes.

Preoperative Factors:

- a) **The Disease:** This may be inaccessible, inoperable, or irreversible. Examples are petrous apex disease, diffuse cellular infection, or infections such as methicillin-resistant staphylococcus aureus (MRSA) or tuberculosis.
- b) **The Tissues:** Local tissue debility such as post radiotherapy changes may cause failure to heal. General patient debility due to age, malnutrition, cachexia, etc., may produce similar difficulties. If present, these preoperative factors may lead to the creation of a wet cavity despite optimal open cavity skills.

Surgical Factors: A number of surgically induced open cavity features that are linked to otorrhoea have been identified in the past.^{2,3}

Implicated factors include the following:

- a) Small meatus. Failure to create an adequate meatoplasty during the open cavity technique leads to humidity, moisture, and infection. In addition the tight meatus may prevent adequate cavity cleaning. Large cavity. The larger the cavity, the more prolonged the healing phase and the greater the risk of postoperative infection. Larger cavities tend to self – clean poorly and may represent previously well pneumatized cases with a greater risk of exposed respiratory epithelium.
- b) Retained high facial ridge. These cases tend to self- clean poorly and a sump posterior to the ridge which leads to debris accumulation. Failure to close off the middle ear will frequently lead to suppuration from this site, particularly if soiled water enters the middle ear.
- c) Failure to clear disease. Inadequate clearance of cholesteatoma or chronic infection will result in persisting granulations and otorrhoea. Disease susceptible respiratory epithelium is more likely to be left exposed in this situation.

ORIGINAL ARTICLE

- d) Failure to revascularize the cavity lining. The classic open technique leaves considerable areas of bare bone to heal by granulation. This inevitably risks residual avascularity. Providing a soft tissue covering for the cavity using periosteal or fascial sheets may help promote vascular in growth as well as scaling off exposed respiratory epithelium.

The surgical factors interact. The more factors present, the worse the prognosis. Avoiding them will improve the chances of a dry cavity. Epithelial migration is a peculiar and important characteristic of the normal external ear canal and tympanic membrane which ensures that this deep skin build is self-cleansing.

Postoperative Factors:

Adverse postoperative phenomena are often difficult to avoid

- a) Infection. Virulent bacterial or fungal infections may cause necrosis and chronic infection in either the immediate or long term postoperative period.
- b) Avascular changes are unpredictable. Atrophic, unhealthy cavity linings commonly occur without apparent cause.
- c) Failure of migration is ill understood. Creation of the cavity itself is contributory, as even previously healthy fenestration sites are prone to the problem. Large cavities, deep local pockets, or protruding sharp edges aggravate the situation. Small, smooth cavities seem less prone to debris build-up.

Many of the aforementioned factors may be unavoidable in open surgery. The skilled surgeon by minimizing the surgically related causes, will reduce but not prevent the wet cavity rate. The wide meatoplasty smooth cavity, well vascular sized lining and intact drum are very similar objectives to those of elimination surgery.⁴ The key to success in otologic surgery is not whose techniques or what technique one uses, but how well one uses it and one's ability and judgement. If principles are followed, a CWD operation should result in trouble free ear, often one that requires little care.

There are four principles:

1. Create a round cavity.
2. Create an adequate sized meatus.
3. Saucerize the cavity margins, and
4. Amputate the mastoid tip when indicated.

Lowering the posterior canal wall to create a round cavity and creating a large meatus are the most important. To create a round cavity the posterior canal wall should be taken down to the level of floor of external canal, or the facial nerve, whichever is encountered first. Fear of damaging the facial nerve, or being uncertain where it is, probably the most common reason for leaving the posterior canal wall (facial ridge) high. This results in a bean shaped cavity rather than a round cavity, a cavity in which there are areas difficult to see and clean and areas that trap moisture.⁵ most important single factor for failure of the CWD procedure is poor execution of the open technique.⁶

Reasons for failures of mastoid procedures are as follows:

1. Persistent disease is the most common cause of failure of surgical treatment of tympanomastoidectomies.
2. Excessively high facial ridge itself serves as mechanical obstruction to self-cleaning with accumulation of debris.

ORIGINAL ARTICLE

3. The meatus and bony external auditory canal are also important regions related to failures of mastoid procedure.
4. The eustachian tube is often under emphasized for its role in failures.⁷

The causes of surgical failures were categorized as recurrent disease, incomplete exteriorization of diseased cells and the poor architecture of surgical field. The most important factors which promote persistent disease are an inadequately lowered facial ridge, a stenotic meatus, bony overhangs of the cavity edges and a prominent mastoid tip.⁸

The areas of cells most likely to be incompletely exteriorized are the tegmental, sinodural angle, mastoid tip, facial recess and cells within the hypotympanic area.⁹ the age distribution in this study was between 12 years to 60 years averaging 26.9 years. The youngest patient was 12 years of age and the oldest was 60 years. In the current study majority of the patients were in the 3rd decade of life (37.5%) followed by the 2nd decade (30%). According to Lin Chuang Er Bi Yan Hou Ke Za Zhi et al,¹⁰ in their study of collagen application in canal wall down mastoidectomy, 41 patients were evaluated. The patients aged between 21 to 67 years of age and averaged 46.14 years. The sex distribution showed a female preponderance with 52.5% females and 47.5% males 42.5 %of the patients presented with right ear pathology, 35% with left ear pathology and 22.5% with bilateral ear disease. According to Lin Chuang Er Bi Yan Hou Ke Za Zhi et al,¹⁰ in their study of collagen application in canal wall down mastoidectomy, there was a male preponderance of 58.5% to 41.5% being females. Seventeen (42.5%) patients presented with right ear complaints, fourteen (35%) with left ear and nine (22.5%) with bilateral ear complaints.

Twenty six patients (65%) underwent a right sided procedure and fourteen patients (35%) a left sided procedure. According to Lin Chuang Er Bi Yan Hou Ke Za Zhi et al,¹⁰ in their study of collagen application in canal wall down mastoidectomy, twenty patients (48.8%) underwent right sided canal wall down mastoidectomy compared to twenty one patients (51.2%) who underwent a left sided canal wall down mastoidectomy. Canal wall down mastoidectomy with collagen dressing was done in 28(70%) patients and the rest underwent the procedure without the dressing. According to Lin Chuang Er Bi Yan Hou Ke Za Zhi et al,¹⁰ in their study of collagen application in canal wall down mastoidectomy, collagen was applied in 22(53.6%) patients and 19(46.4%) patients were the control group.

According to Kanemaru S et al,¹¹ using post aural pedicle periosteal flap for lining the cavity, the epithelization was near complete by 4 weeks as compare to those with temporalis fascia used to line and obliterate the cavity which took 8 weeks to epithilize. According to Lin Chuang Er Bi Yan Hou Ke Za Zhi et al,¹⁰ the epithelization time of mastoid cavity was 3 to 7 weeks, averaging (4.5 +/- 0.7) weeks in the collagen-applying group and was 5 to 12 weeks, averaging (7.2 +/- 0.8) weeks in control group. In our study the epithelization time in the collagen dressed mastoid cavities was found to range between 4 to 7 weeks, averaging(6 +/- 0.3) and was 9 to 15 weeks, averaging (11.5 +/- 1.09) in the control group. The epithelization time was significantly different (p<0.05).

CONCLUSION: Collagen dressing can be a good and cheap alternative for application in mastoid cavity and can significantly reduce the epithelization time and help in better healing and can be used effectively to achieve a safe, self-cleaning dry ear post-operatively.

Figure 1

Figure 2

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ORIGINAL ARTICLE

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