ROLE OF NONVAILABLE PRESERVED CORNEAS IN KERATOPLASTY

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INTRODUCTION

Corneal blindness is the second most frequent cause of total blindness in Nepal.¹ While Medical therapy is helpful for infected eyes, rest can be tackled by corneal grafting. Due to inadequate number of tissue availability, penetrating keratoplasty is not feasible for all in Nepal. Therefore, one has to think about the alternative procedure, where preserved corneas obtained from other countries could be utilised satisfactorily. One such surgery is lamellar keratoplasty.

LAMELLAR KERATOPLASTY

As the name implies lamellar keratoplasty is a procedure where the desirable size and thickness of the recipient's opaque cornea is removed and replaced by the same size and thickness matched donor corneal tissue.

HISTORY

History dates back to 1886 when the first successful corneal lamellar graft was done on a young girl with corneal opacity due to chemical injury using the rabbit cornea as a donor with encouraging cosmetic and functional success. Thereafter, the procedure is being practiced with human donor material.

TYPES

Various types of lamellar keratoplasty have been described with different mechanism of actions. The central inlay lamellar keratoplasty is optical whereas the peripheral is mainly responsible for the stem cell re-population as these cells are situated at limbus & 1 mm in the peripheral cornea or as a tectonic procedure to strengthen the peripheral cornea with central flattening. The onlay lamellar graft provides a tectonic support & also negates the irregular astigmatism by flattening the cornea as seen in cases of keratoconus. Keyhole pattern has a composite action. It prevents recurrence by providing a barrier & also helps optical function as seen in eyes with recurrent pterygium. It also provides stem cell to the diseased cornea.

HOW DOES IT HELP ?

The procedure is helpful

- i) by removal of the partial thickness corneal pathology and replacing by the size and depth matched donor corneal tissue.
- ii) by flattening the cone in a case of extensive keratoconus or to improve the vision.
- iii) by supplementing healthy stem cells in cases of extensive corneal chemical burn and
- iv) as a tectonic procedure in extensive & eccentric

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corneal lesions where penetrating keratoplasty is not primary a procedure of choice.

ADVANTAGES

Advantages of lamellar keratoplasty over conventional penetrating keratoplasty includes being an extra ocular procedure. It is devoid of any intraocular complications, a large graft can be performed & there is minimal chance of rejection. Further, it requires less hospitalisation and less follow up visits. Additionally, as a viable endothelium is not essential for lamellar keratoplasty unlike penetrating keratoplasty, even donor corneas preserved in glycerine can be used effectively. This is more important in developing countries where there is scarcity of donor material due to innumerable reasons. Moreover, if the procedure fails it does not preclude lamellar or penetrating keratoplasty at the later date. Further, this procedure is adequate to combat the corneal pathologies even involving up to Descement's membrane.

WHY LAMELLAR KERATOPLASTY IS NOT FOLLOWED AS A COMMON PRACTICE ?

Lamellar keratoplasty is time consuming & requires more Kill. As a result, most corneal surgeons tend to avoid it despite its varied indications. Other pitfalls in the procedure which make it less popular being it's inability to eradicate a pathology involving full thickness of the cornea. However, this procedure is adequate to combat the corneal pathologies even involving upto Descement's membrane.

SOURCES OF DONOR TISSUE/OR LK²

Sources from which the corneal tissues are obtained for lamellar keratoplasty include

I) Eye ball preserved In moist chamber

II) Media preserved corneoscleral tissue

III) Glycerine preserved corneoscleral tissue

IV) Other sources from which only the limbal tissues are obtained for stem cells transplant include

- a. in situ removal of the lenticula from the adaver eye without removing eye ball
- b. blood related donor and
- c. normal fellow eye

METHODS OF LAMELLAR DISCUSSION

For obtaining better results dissection procedure can be undertaken by microkeratome, open technique or closed technique. As all the corneal surgeons in developing country may not have access to microkeratome, close technique is preferred over open technique. In order to do this, a small cleavage is made with the help of a cyclodialysis spatula or pauflques knife. With help of a nonreflective coating Desmarre's dissector a complete cleavage can be performed. Further, to identify the proper plane, (more so while performing deep lamellar keratoplasty) to lessen the dissection time to obtain a smooth bed, and to avoid intra-operative perforation, stromal injection of either air viscoelastic or saline have been advocated.

INDICATIONS

Congenital ⁶⁻¹²	Limbal dermoid
	Corneal dermoid
	Annular Dermoid
	Extensive dermolipoma
Inflammatory ^{2,13,14}	Post trachoma
	Corneal opacity following ulcer
Degenerative ^{2,15-18}	Pterygium
	Keratoconus and other deg.
	Banshaped keratopathy

Dystrophies ²	Epithelial dystrophies Granular dystrophy	• Inlay sclerokeratoplasty as an adjunctive procedure to P K (sclerokeratoplasty). ²⁶⁻²⁸
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Neoplastic ^{2,19-21}	Invasive sq. cell carcinoma of conjunctiva and cornea.
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Traumatic ^{2,22-24}	Multiple corneal foreign bodies. Chemical burn.
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REVOLUTION IN SURGICAL TECHNIQUES

Over the years, a number of procedures have been mentioned and recommended.

SURGICAL REVOLUTION

A. Inlay L. K

- I. Conventional - Lesions involving central/total cornea
Subtotal (central LK)
 - Total (Total cornea upto limbus)
 - Circular lamellolamellar sclero-keratoplasty (Large diameter LK)^{2,22,23}
- II. Segmental - Lesions not involving pupillary area
 - Lamellolamellar keratoplasty²
 - Lamellolamellar sclero keratoplasty
- III. Keyhole - Lesions involving both peripheral/pupillary area
 - Lamellolamellar keratoplasty
 - Lamellolamellar sclero keratoplasty
- IV. Annular - Lesions involving only peripheral cornea
 - Annular LK

B. Onlay L. K.

- Epikeratoplasty¹⁶⁻¹⁸
- Stemcell transplant (Lenticule/Annular)²⁴
- Keratoepithelioplasty

C. Others

- Modified stocker's procedure by forming a double chamber.²⁵

SURGICAL STEPS

Conventional inlay L. K

The indication of this procedure is for ail types of corneal resions involving the partial thickness of the cornea and central in location.

PROCEDURE

After the size of the corneal lesion is measured the desired trephine size and the depth are adjusted and the cut is given with pressure over recipient cornea. A small pocket is made with Desmarre's lamellar Dissector by closed technique. The partial thickness cornea is removed & a thorough wash is given to the recipient bed with BSS to wash out tissue debris or blood clot if any. The donor cornea is obtained by similar technique by fixaing the corneoscleral tissue in a Kings' clamp. The donor corneal button thus obtained is sutured to the recipient bed by 16 interrupted 10-0 monofilament nylon sutures with buried knots.

INLAY MODIFIED SEGMENTAL L. K

This is indicated when the corneal lesion invades the partial thickness of the cornea but are eccentric in nature and not involving the visual axis.

PROCEDURE

The surgical steps are similar to inlay lamellar keratoplasty except that the preliminary mark is given either with two trephines of different size or free hand method depending upon the size of Involvement. Similar procedure is also adopted for donor button preparation & fixed to the recipient bed by 10-0 monofilament nylon interrupted sutures with buried knots.

INLAY KEYHOLE LAMELLAR KERATOPLASTY

This technique is indicated when there is involvement of the visual axis along with the peripheral cornea.

PROCEDURE

Surgical steps consist of a mark of the central area without damaging the pterygium by a special trephine having a step at one side Both the ends of the mark are extended to the limbus and the 0.3mm thick corneal tissue along with the pterygium mass is separated and fixed at the medial canthus. Identical size and thickness donor tissue is obtained by similar technique and fixed to the recipient bed with 10-0 monofilament nylon interrupted sutures with buried knots.

ANNULAR L. K

This is indicated for the lesion involving whole of the peripheral cornea, rest being normal procedure. With the help of two trephines of desired size two marks are given one at limbus and other over cornea. The tissue removal is as per other inlay lamellar keratoplasty. To obtain the donor annular tissue the procedure is exactly same as per recipient.

ONLAY LAMELLAR KERATOPLASTY (EPIKERATOPLASTY)

This is indicated in cases of keratoconus having no apical scarring. This aids in flattening the cornea thereby reducing irregular astigmatism.

PROCEDURE

With the help of double trephine having 1mm difference in diameter (7.5 & 8.5mm) an annular mark is applied. The outer cut of the annular mark is 0.3mm deep. The inner cut is 0.1mm deep. A 0.5mm broad annular ring is removed with the help of the Pierce-Hoskin forceps and curved Vannas scissors. Once the ring is removed a pocket is made underneath

the outer cut. This is followed by the removal of the central corneal epithelium. A thorough wash is given to wash out any remnant of epithelial debris.

To prepare the lenticule the donor tissue is fixed either in an eye ball stand or King's clamp depending upon the nature of the tissue whether it is eye ball or corneoscleral tissue. Using a trephine having diameter 0.5mm larger than the outer cut of the recipient cornea a 0.3mm deep cut is applied. The pocket is made & a plano refractive lenticule is prepared by closed technique utilising the Dessemare's lamellar dissector. The prepared lenticule is sutured to the epithelial free recipient bed by sixteen interrupted 10-0 monofilament nylon sutures with buried knots.

Inlay Deep L.K with Descemetoendotheliotomy

(Modified Slacker's procedure/Double chamber technique)

This procedure is indicated in cases of complicated aphakic or pseudophakic painful bullous keratopathy where opening of the chamber is not desirable.

PROCEDURE

The surgical steps are exactly similar to conventional inlay lamellar keratoplasty except that the recipient bed left is only formed by Descemet's membrane and endothelium of the recipient. A full thickness and 0.5mm larger than recipient bed donor corneal button is fixed to the recipient bed with 16, 10-0 monofilament nylon sutures over viscoelastic cushion. Three to four peripheral holes each 1-2mm size are made at the Descemet's membrane & endothelium with the help of a 27 gauge bent needle. Prior to application of last suture.

CONCLUSION

Lamellar keratoplasty will stay forever for its various advantages is a boon for patients with corneal opacities involving upto Descemet's membrane. Further, as it is not dependant on fresh

and viable donor tissue it can be performed by any ophthalmologist with corneal surgery training by obtaining the tissue from the established eye banks.

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