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SURGICAL MODIFICATIONS OF EVISCERATION FROM PAST TO PRESENT: A REVIEW OF LITERATURE

***Dr. Praveen Kumar K. V. and Asma Shaik**

Assistant Professor, Dept. of Ophthalmology, Nellore.

***Corresponding Author: Dr. Praveen Kumar K. V.**

Assistant Professor, Dept. of Ophthalmology, Nellore.

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ABSTRACT

Evisceration is a surgical technique involving removal of intraocular contents such as lens, uvea, vitreous, retina and sometimes cornea while leaving behind sclera and extraocular orbital anatomy intact. The controversy over enucleation versus evisceration has persisted in the ophthalmic literature for more than 100 years. Advantages of evisceration over enucleation include ease of surgery, the barrier effect of the intact sclera in preventing orbital spread of infection in cases of endophthalmitis and perceived functional and cosmetic benefits. The conspicuous drawback of conventional evisceration is the inadequate volume replacement with small implants and significant risk of exposure with large ones. Modified techniques of evisceration have therefore been developed, mostly involving additional scleral incisions that allow the placement of larger implants while reducing exposure rates. The review was planned to provide an in depth look at various surgical techniques of evisceration by examining the published literature and will provide an insight into the modifications of the surgical technique over decades so as to adopt a better surgical procedure for the surgeons.

KEYWORDS: Evisceration-Modified techniques-Sclerotomy-Good volume replacement-Minimal risk of exposure of implant.

INTRODUCTION

In the past, a commonly expressed objection to evisceration was the increased risk of sympathetic ophthalmia in traumatized eyes which underwent evisceration rather than enucleation. Evisceration, along with a number of other intraocular procedures has been implicated as a potential cause of sympathetic ophthalmia. Whether or not evisceration can incite sympathetic ophthalmia is one of the most notorious controversies in ophthalmic surgery.[1]

In 1887, Frost reported a series of patients who developed sympathetic ophthalmia following evisceration. The fear of this devastating complication resulted in evisceration being nearly abandoned for many years.[2] A renewed interest in evisceration, utilizing an intrascleral implant, has been apparent since the fear of sympathetic ophthalmitis has been largely dispelled by the reports of the results of evisceration in over 200 cases by Ruedemann and 188 cases previously reported by Berens.[3,4]

Levine and coworkers in 1999 in their study that concluded that evisceration is an effective and safe procedure with a low risk for sympathetic uveitis.[5] Phan et al in their review concluded that evidence for association between evisceration and sympathetic ophthalmia is lacking. They opined that it is probably safe to say that the risk of sympathetic ophthalmia following evisceration is at most extremely low.[6]

The increasing number of eviscerations performed in the recent decades is due to several perceived benefits. Often cited advantages include the perception that evisceration is simpler and faster than enucleation. Since evisceration leaves the extraocular muscles and optic nerve intact, it also has less risk for significant bleeding.[7] Evisceration allows for better preservation of orbital anatomy, improved mobility and therefore enhanced cosmesis.[8-10] It has been proposed that evisceration requires less manipulation and consequently less inflammation and scarring of orbital tissues, fornices and suspensory ligaments remain uncompromised. This helps in better retention of implant. These factors translate to better motility, less risk of superior sulcus deformity and thus an enhanced cosmetic result for patients.[6]

This review provides the transformation in the surgical technique of evisceration over deacades with retention of cornea in the past to various sclerotomy techniques followed today. This comprehensive review made an attempt to elaborate the surgical technique followed by few surgeons as well as cover the recent trends in the modification of sclerotomy techniques. The techniques followed by eminent surgeons for control of haemorrhage and prevention of sympathetic ophthalmia

are also described with special attention on wound closure techniques which is crucial in preventing the extrusion of implants.

HISTORICAL PERSPECTIVE

Evisceration was introduced in 1817 and for most of the 19th century, it was the preferred method for removal of the eye. In 1885, Mules further enhanced the cosmetic result after evisceration by placing a hollow glass sphere within the scleral shell to add volume and support.[11]

A few years later Frost and Lang suggested an implantation in Tenon's capsule.[2] Huizinga performed a modification of this method, whereby, after keratectomy, he removed a larger section of the scleral cup posteriorly and performed an opticociliary neurectomy and implantation. This procedure was called Eviscero-Neurotomy. The purpose of this modification was to reduce the development of Sympathetic Ophthalmitis.[12]

The standard evisceration had two principal variations. With one method, the cornea is preserved and with other, it is excised. When cornea is retained, a 15 mm or 16 mm sphere can usually be safely inserted and this provides a good cosmetic result. With cornea excised, only a 13 mm or 14 mm sphere can be inserted and anophthalmic enophthalmos is more likely to occur.[13]

Retention of the cornea in evisceration, as originally described by Burch and modified by Ruedemann permits the use of a larger implant to replace the entire orbital volume than when the cornea is excised.[3,14] The rate of exposure of implants was approximately 25% with original Mules' operation. Burch and Moretti also experienced the same rate of exposure of implants with Mules technique of Evisceration.[14]

Orbital implant extrusion is a major complication of evisceration surgery, reported in up to 22% of cases. A significant cause of this complication is the placement of an orbital implant that is too large to allow closure of the sclera, Tenon capsule and conjunctiva without tension.[13]

Henceforth many modified techniques in the techniques of evisceration have been proposed to insert large sized sclera implants with less rates of extrusion.

TECHNIQUES OF EVISCERATION

MULES'S OPERATION

After dissection of the conjunctiva from its corneoscleral attachment to the equator of the eyeball, cornea can be removed with a triangular portion of the sclerotic above and below, or with a millimeter of the sclera attached to its edge or by means of a horizontal ovoid abscission, including the iris. Evisceration of the contents of the globe with absolute thoroughness, either with a scoop devised for the purpose or with gauze sponges twisted on the end of a stick, and which are given a rotary movement so as to check hemorrhage. Hemorrhage may be checked by packing the scleral cavity with gauze strips soaked in hot sterile water, or with dry, sterile gauze sponges. Strong antiseptics are unnecessary and sometimes harmful. As an irrigating fluid, Fox uses, a mixture containing bichlorid of mercury and sulphocarbolate of zinc. Sometimes hemorrhage need not be checked before the introduction of the ball, which by pressure upon the stump of the optic nerve may control the bleeding from the central artery. In most instances the scleral wound is united vertically, either with catgut sutures or with black silk sutures, operators of the largest experience preferring silk sutures. The conjunctival wound should be united with a few interrupted sutures. A compress bandage placed either over a wet or a dry antiseptic dressing should cover both eyes and remain in place, unless there are signs of unfavorable reaction, for forty-eight hours.[11]

BURCH TECHNIQUE

A circumcorneal incision is made around two-fifths of the cornea and the conjunctiva reflected, leaving a margin of 5 mm. for closure adjacent to the cornea. A small scleral incision is made just anterior to one of the recti muscles, preferably the superior rectus, when possible. With one blade of a straight, blunt Stevens scissors an incision is made between the uvea and sclera, the intra-ocular contents separated and removed in toto. Using a blunt nasal speculum, hemorrhage is thoroughly controlled with compresses soaked in adrenalin, or by the application of a heated probe, mosquito forceps, or the application of a dull cautery to bleeding points.

The endothelium on Descemet's membrane is wiped off with a gauze applicator and the sclera shell is freely irrigated, dried and swabbed with 1% iodine, neutralized after one minute with 5 per cent. cocain and again irrigated with saline or boric acid solution. With Carter's introducer, a gold or lead-free glass ball (using one 18 mm. in diameter but sometimes one smaller or even slightly larger) is inserted. Further estimation, for size with easy scleral coaptation, is made.

Temporary sutures are placed in the exact ends of the scleral incision for lateral traction by the assistant, in order to secure perfect coaptation of the scleral margins. Fine white silk interrupted sutures, usually about six in number, are mattressed through the sclera. The conjunctiva is closed with black twisted silk, which is removed after a week. A gauze-cotton compress pad is pressed over the eye with elastoplast and left in place for three days. It is again applied after each dressing.

At variable periods an interstitial vascularisation of the cornea occurs until finally the cornea is supplied by blood vessels, a process that becomes complete in from 3-6 weeks. An artificial shell may be fitted after 3 wks.[14]

BEREN'S AND BREKEY'S TECHNIQUE

A scleral section was made from 9 to 3 o'clock with a cataract knife, 1 mm. posterior to the limbus after

undermining the conjunctiva circumcorneally to a depth of 10 mm. After completing the corneo-scleral section with scissors, wedge-shaped pieces of sclera were excised at the ends of the horizontal meridian of the incision. The intra-ocular tissues were evacuated in one piece with a spoon. All remaining shreds of uveal pigment were carefully removed from the sclera, using an illuminated retractor to improve visualization.

The shell was swabbed carefully with tincture of metaphen. Haemorrhage was controlled with a compressor and adrenalin soaked gauze packed into the scleral shell. If haemorrhage persists, the bleeding points may be cauterized with deliquescent crystals of trichloracetic acid.

From six to eight double-armed 5-0 braided white nylon sutures are passed through the superior scleral lip, 2 mm. from the wound edge and then passed intra-sclerally through the inferior scleral lip, to emerge 2 mm. below the edge of the inferior scleral wound. Four double-armed 5-0 braided white nylon sutures are passed through the steel mesh and the four grooves in the implant of suitable size to permit some scleral shrinkage.

The introduction of these sutures may be facilitated by holding the implant in an introducer for spheres. The hollow plastic implant with the four preplaced sutures is inserted into the scleral shell, with the spherical surface posteriorly. Two of the sutures are brought through the sclera at the ends of the horizontal meridian and the other two at the ends of the vertical meridian; these are then tied securely on the sclera surface. Incisions 5 mm. in length were made with scissors, 10 mm. from the sutured scleral wound, below and temporally and above and nasally, to facilitate drainage of blood and serum. The preplaced mattress sutures are tied and the conjunctival wound is closed with a running centrally locked 5-0 plain catgut suture.[4]

WALTER'S TECHNIQUE

Walter advocated removal of cornea in order to avoid postoperative corneal sensitivity and prevent extrusion of implant.

After 360^0 conjunctival peritomy, conjunctiva and tenon's capsule are reflected back upto the insertions of recti muscles. A limbal incision was made to separate cornea from sclera and a portion of cornea was left attached to the sclera between 5 and 7'0 clock position so that it can be used as traction and stabilization of scleral shell when the intraocular contents are removed. After the bulk of ocular tissue was removed with freer periosteal elevator, the internal surface of sclera was rubbed with cotton tipped swabs and small curettes to remove the remains of uveal pigment. The scleral cavity was irrigated with antibiotic solution and corneal button was severed from attachment between 5 and 7'0 clock. Small triangularly shaped sections were excised from 6 and 12'0 clock position. A loosely fit implant was placed into the sclera cavity. Vertical closure of sclera shell followed by horizontal closure of tenon's and conjunctiva was practised. Several sutures were placed to attach the conjunctiva to the front surface of sclera in order to bring about the increased mobility of conjunctival fornices postoperatively.

A Conformer with few drainage openings in it was placed into the socket at the end of procedure.A temporary suture tarsorrhaphy was done to close the lids. Tarsorhaphy was done to place the conformer in place and to avoid conjunctival prolapse. A firm dressing pad was placed over the operated orbit until 72 hrs.[10]

STEPHENSEN TECHNIQUE

After excising the cornea, intraocular contents were removed in a standard fashion.

Sclerotomy incisions were made in the anterior sclera at 10.30 and 4.30 clock hours to permit insertion of implant. Mid portion of scleral shell was expanded with multiple radial incisions and the antero posterior diameter was lengthened with a spiral incision in the posterior sclera. The purpose of these relaxing incisions was to permit tension free insertion of implant of desired size and to permit tension free wound closure.

A 19 or 20 mm silicone sphere with mesh cap was most commonly used. If a standard sized implant (13-16 mm) were used with this procedure, enophthalmos might develop because of the posterior shift of the implant that is permitted by the relaxing incisions.

The implant was prepared for insertion by placing two 5-0 synthetic absorbable double armed sutute in tandem fashion into the mesh cap. After the implant was inserted within the patient's scleral shell, the arms of preplaced fixation sutures were passed through one of the anterior sclera flaps about 2mm from the margin and then brought through other anterior flap about 4mm from the margin. The flaps were overlapped and preplaced sutures tied.

The incisions in the posterior sclera should be extensive enough so the flaps can be closed with minimal tension on the wound. The flap is additionally secured with a second row of sutures and the conjunctiva closed with interrupted sutures.[13]

MASSRY HOLDS TECHNIQUE

Following 360^0 conjunctival peritomy and keratectomy, intraocular contents were removed using freer periosteal elevator. If needed, the central retinal artery and vortex veins are cauterized.

The internal surface of the sclera was vigorously wiped with gauze soaked in absolute alcohol solution. Saline irrigation was done to remove the alcohol once the sclera has been debrided of all uveal remnants.

A Westcott scissors was used to perform a full-thickness sclerotomy from the limbal incision to the optic nerve in the inferonasal and superotemporal quadrants between the rectus muscle insertions to create two scleral flaps. Using a Westcott scissors, the scleral flaps were released from their optic nerve attachments allowing them to be mobilized and easily brought forward.

An orbital implant is placed within the sclera flaps, which were brought over the implant and closed with interrupted 5–0 Vicryl suture. One of the scleral flaps can significantly override the other (2–3 mm of overlap is desirable) and some trimming of the sclera may be necessary. Retraction of the nasal and temporal conjunctiva allows closure of the scleral flaps to the equator. Tenon capsule is closed with interrupted 5–0 chromic gut suture and the conjunctiva with a running 6–0 plain gut suture. Both of these layers are closed under minimal tension.

An antibiotic/corticosteroid ophthalmic ointment is placed in the socket with an overlying socket conformer. A temporary intermarginal tarsorrhaphy was created with a horizontal mattress 4–0 silk suture over foam bolsters. The tarsorrhaphy suture was removed 5 to 10 days after surgery, depending on the degree of swelling.[15]

NANCY TECHNIQUE

After doing 360^0 peritomy using Wescott scissors, blunt dissection is done in all four quadrants using Stevens scissors. A Stab incision into anterior chamber using a #11 blade. Cornea was completely excised at corneoscleral limbus using Wescott scissors. Intraocular contents removed using an evisceration spoon. Inner scleral shell cleaned using Q-tips soaked in absolute alcohol. Scleral cavity rinsed thoroughly using 250 mL normal saline. Cauterization done as necessary to control bleeding inside scleral cavity.

Sclerotomy incisions made by making radial incisions superotemporally and inferonasally using Wescott scissors posteriorly to within 1 cm of the optic nerve. Radial incisions approximately 5 mm to 10 mm from the optic nerve circumferentially 360^0. This completely separates the optic nerve and small amount of sclera posteriorly from the two sclera halves anteriorly.

The implant of appropriate size is placed in the thumb of a #8 glove (cut in a tampon fashion) to allow easy insertion without tissue drag.[16]

KIM TECHNIQUE

A 360-degree conjunctival peritomy was performed just posterior to the corneal limbus with Westcott scissors. Blunt sub-Tenon dissection was performed with Stevens scissors. Bridle sutures were made for the four rectus muscles using 4-0 silk. An incision was made circumferentially in the sclera 1–2 mm from the limbus with No. 11 scalpel blade and a corneal button was removed.

An evisceration spoon or Freer periosteal elevator was used to separate the uveal tissue from the scleral shell and the globe contents were removed. The central retinal artery and vortex veins were cauterized. Suction and bipolar cautery were used to maintain haemostasis. The interior of the scleral shell was scraped with a blade and scrubbed with alcohol to remove all uveal tissue remnants.

Four full-thickness anterior relaxing incisions were made from the limbus, between the rectus muscle insertions, to the equator. The anterior sclera was dissected into four pieces, each containing one rectus muscle. A V-shaped piece of sclera 3–6 mm in length was removed at the 3 and 9 o'clock positions with Stevens scissors; these can be lengthened to accommodate a larger implant. A posterior sclerotomy was made circumferentially surrounding the optic nerve for approximately 330_ with No. 11 scalpel blade. This allowed placement of a larger implant and facilitated vascularization.

A sizing ball was used to assess the residual volume, and an implant size was chosen that would allow tension-free closure of the anterior ocular tissue, 3 mm less than the axial length of the contralateral eye. Then, an appropriate porous polyethylene (Medpor)implant was immersed in an antibiotic solution (500 mg of cefazolin in 500 ml of normal saline) within a 60-ml syringe, and the air was withdrawn. The implant was placed in a sphere introducer and injected into the sclera cavity.

After implant insertion, the edges of the superior and inferior scleral flaps were sutured together horizontally in front of the implant with 5-0 Vicryl. The medial and lateral scleral flaps can significantly override each other without tension (2–3 mm of overlap is desirable) and some trimming of the sclera may be necessary. Then, the edges of the medial and lateral sclera flaps were sutured vertically with 5-0 Vicryl. The Tenon capsule was closed with interrupted 5-0 Vicryl suture and the conjunctiva was closed with a running 6-0 Vicryl suture. Both of these layers were closed without tension.

Antibiotics were injected into the inferior subconjunctival space. A conformer was inserted and antibiotic ointment was placed on the ocular surface. A temporary tarsorrhaphy was created with a horizontal mattress 4-0 silk suture.

A pressure bandage was applied and left in place for 2 days. The tarsorrhaphy suture was removed 5–10 days after surgery, depending on the degree of swelling. Topical antibiotics and steroid drops were used for the next 3–4 weeks and oral antibiotics were prescribed for 1 week. A prosthesis made of acryl was fabricated 8–12 weeks after surgery.[17]

OTHER SCLEROTOMY TECHNIQUES

Ainbinder et al. performed posterior sclerotomies to facilitate colonisation of the implant.[17]

Kostick & Linberg described the evisceration technique with anterior and posterior sclerotomies and optic nerve release. Anterior relaxing incisions were used to allow entry of larger implant posterior scleral incisions in a radial fashion, from the equator to the optic nerve, in four quadrants, as well as a continuous circumferential incision around the optic nerve.[19]

Jordan & Anderson expanded on this concept by adding release and mobilization of the sclera from the optic nerve.[20]

Yang et al. described a 'sclera quadrisection' procedure as a modification of standard evisceration. In this technique, the native sclera is quadrisected from the limbus to the optic nerve between the rectus muscle insertions.[21]

Sales-Sanz and Sanz-Lopez performed four sclerotomies from the limbus to the optic nerve to form four separate sclera petals. This created four petals which contained a rectus muscle each. The petals were then brought anteriorly to cover the implant.[22]

Masdottir and Sahlin reported their experience using Split Sclera Technique similar to Massry's and Hold's, where 5% developed exposure or extrusion of implant, but 78% of the patients felt pleased or very pleased with the operation.[23]

Huang et al performed a modified technique, which included quadrisecting the sclera, suturing the implant with each rectus muscle through the scleral petal and then covering the implant with 2 layers of the sclera. Porous polyethylene implant was used in this study.[24]

Smith et al. reported their experience with Massry's and Hold's technique. Sixteen of 201 patients reported complications, while three reported major ones during a mean follow up period of 31.62 months(range, 3-98 months).[25]

Georgescu et al. described a new evisceration technique for patients with phthisis bulbi and microphthalmos. Eighteen patients underwent eviscerstion, where a 5mm wedge of sclera was excised nasally and temporally and a 360^0 equatorial sclera incision was made, dividing the sclera into anterior and posterior halves.[26]

Swinging sclera technique: In this, a 180^0 horizontal cut,bisecting both horizontal rectus muscles insertions and passing just above the attachment of optic nerve. By leaving the optic nerve attached to the inferior half of sclera,a supportive hammock is formed that helps prevent inferior migration of the orbital implant.[6]

In most of the above reports, good results were achieved with complications similar to those seen when a sclerotomy was not performed.

The advantage with a sclerotomy is the ability to place implants upto or even larger than 20mm in a large proportion of patients. These enhanced volume augmentations diminishes the "sunken-in" look often seen in anophthalmic patients. Also, in the few studies that assessed the motility, dismantling the sclera did not adversely affect implant excursion or patients' overall satisfaction

Evisceration also provides superior socket motility. A prospective study in 2007 by A.S. Tari et al compared the motility and complications of 50 patients who underwent evisceration with sclerotomy and alloplastic implantation(group 1) and 50 patients who underwent enucleation and hydroxyapatite implantation(group 2). For the evisceration,s clera quadrisections were performed at 1.5,4.5,7.5 and 10.5 clock hours from the limbus to the optic nerve without disinserting the nerve. Group 1 fared statistically significantly better than group 2 in motility. The mean horizontal excursion was 10.25±1.99(5.9-15)for group 1 and 6.90±1.74(3.2-12) for group 2.The mean vertical excursion was 8.45±1.89(4.3-12) for group 1 and 5.69±1.63(3-10) for group 2.Deep superior sulcus and exposure or extrusion was not significantly different between the two groups.[27]

CONCLUSION

The ophthalmic surgeon should perform destructive surgery like evisceration just as carefully as he or she would perform an intraocular lens implant operation. It should be realized that the patient must live with a defect after the eye is removed and the surgical results must ensure that the prosthesis that the patient will wear fits well, comfortably and with maximum motility and good appearance. With the recent advances in the development of orbital implants which cater the postoperative motility and cosmetic needs of the patient, there has been an increasing need for the refinement of already existing surgical techniques of evisceration. This review facilitates the operating surgeon to follow the appropriate technique in each case for the best possible outcome.

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