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Research Article

# Ptosis Incidence in Porous *versus* Nonporous Orbital Implants after Enucleation

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## ABSTRACT

**Background:** Enucleation is a surgical procedure that involves the removal of the eye and anterior optic nerve, usually with the extraocular muscles retained and sewn to the implant. To avoid long-term complications and ensure optimal long-term function and cosmesis of an ophthalmic socket, meticulous surgical technique is required.

**Objective:** To evaluate the ptosis incidence in porous *versus* nonporous orbital implants after enucleation.

**Materials and methods:** In this study, 50 patients had primary enucleation with orbital implant placement. Patients were recruited from the Menoufia University Hospital's ophthalmology outpatient clinic between August 2017 and August 2019. Patients were divided into two groups, after enucleation hydroxyapatite orbital implant was used (Group I) and acrylic orbital implant was used (Group II). Full history taking and examination, and ptosis incidence were studied.

**Results:** Post-traumatic was the most frequent, presented by 17 nonporous patients (68%), and 15 porous patients (60%), followed by tumor by 8 nonporous patients (32%) and 10 porous patients (40%), with non-significant difference (p=0.347). While, all of the studied patients hadn't vision. Ptosis incidence 1$^{st}$ month and post-operative did not show any significant difference among non-porous and porous studied groups. Except 2$^{nd}$ and 4$^{th}$ months was significantly differed among porous and nonporous groups (p<0.05).

**Conclusion:** Ptosis occurred in a significantly greater proportion of patients who received a nonporous implant than in those who received a porous implant. Implant exposure occurred at a low rate.

**Keywords:** Enucleation; Orbital implant placement; Porous implant; Ptosis incidence

## INTRODUCTION

Blepharoptosis (ptosis) is one of the most common upper eyelid disorders seen in both optometric and ophthalmic practise. Ptosis is characterized by unilateral or bilateral drooping of the upper eyelid, which can affect appearance and impair visual function, both of which can have a negative impact on quality of life. While there are several types of congenital ptosis, acquired ptosis (appearing later in life due to a variety of causes) is the most common [1].

Enucleation is required in approximately 35% of patients with Uveal Melanoma (UM), either as primary treatment or as a result of complications from other forms of therapy [2]. Orbital implants placed during enucleation increase orbital volume and improve artificial eye motility. Porous Hydroxyapatite (HA) implants and nonporous silicone or acrylic (AC) implants are commonly used [3].

Porous implants allow for fibrovascular ingrowth and permanent integration with orbital tissues, reducing the risk of extrusion and secondary infection, according to reports. Furthermore, they permit pegging, which improves prosthesis motility. They can be wrapped with different types of tissue, such as donor sclera, to facilitate extraocular muscle attachment, or they can be left unwrapped to avoid the risk of immunologic reaction and infectious disease transmission [4].

Porous spherical implants are currently the most popular. Porous polyethylene is created from a powder of synthetic, high-density polyethylene that is easily moulded into shapes. Perry introduced hydroxyapatite, a porous material derived from the reef-building coral genus *Porites*, as a buried orbital implant in 1985. These nontoxic, non-allergenic, and biocompatible porous spherical implants integrate into the host *via* fibrovascular ingrowth [5].

Fibrovascular ingrowth provides the theoretical benefits of less

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implant extrusion or migration and less secondary infection, as well as the ability to drill a tunnel into the implant and insert a peg [6]. Attaching the peg to the prosthesis improves motility, which is a feature that other implants lack. Nonporous implants, such as AC spheres, are said to have comparable prosthetic motility to non-paged porous implants. They are also less expensive [7]. As a result, the study's goal was to compare the incidence of ptosis in porous *versus* nonporous orbital implants after enucleation.

## MATERIALS AND METHODS

In this study, 50 patients had primary enucleation with orbital implant placement. Patients were recruited from the Menoufia University Hospital's ophthalmology outpatient clinic between August 2017 and August 2019. Patients were enrolled in two groups namely Group I (n=25): hydroxyapatite orbital implant was used after enucleation and Group II (n=25): acrylic orbital implant was used after enucleation.

Inclusion criteria for primary surgery included diagnoses of uveal melanoma, retinoblastoma, ruptured globe, blind painful eye, metastatic cancer.

### Surgical technique

This technique has previously been reported. Enucleation was accomplished by using Wescott scissors to open the conjunctiva and Tenon capsule for 360° around the corneal limbus. Wet field cautery was used to achieve hemostasis. Stevens's scissors were used to open the four quadrants. Each of the four rectus muscles was isolated on a muscle hook and cleaned of Tenon attachments before being secured on a double-armed 5-0 polyglactin suture with locking bites at each end and disinserted from the globe. The globe's superior and inferior oblique muscles were dissected. With the foster enucleation snare or long Metzenbaum scissors, the optic nerve was cut deep within the orbit.

In all cases, the globe was removed from the socket and sent to the pathology laboratory for evaluation. Windows were created if the implant was covered in donor sclera. The implant was installed in the orbit. The four rectus muscles were firmly sutured into the scleral windows. The Tenon capsule was closed in two layers with interrupted 5-0 polyglactin sutures. Running 7-0 polyglactin suture was used to close the conjunctiva. The wound was treated with antibiotic ophthalmic ointment, and a conformer was inserted. Following that, a pressure patch was applied.

At each postoperative visit, the socket was evaluated. Socket motility was determined subjectively by evaluating the patient's ocular motility in cardinal gaze positions. The cosmetic appearance was determined subjectively by assessing the contour and symmetry of the eyelids with the other eye. Complications were documented throughout the postoperative period.

According to severity, ptosis may be minimal or mild (1-2 mm), moderate (3-4 mm), or severe (>4 mm) [8].

### Statistical analysis

To tabulate and statistically analyse the results, Statistical Package for Social Sciences (SPSS) V.25 and Microsoft Excel 2019 (Microsoft Corporation, One Microsoft Way Redmond, WA 98052-6399 USA) were used (IBM Corporation, 1 Orchard Rd, Armonk, NY 10504, USA), The descriptive statistics included mean (x), median, and Standard Deviation (SD), while the analytical statistics included the chi-square test (2), Standard Student t-test (t), and Kruskal Wallis test. A P-value ≤ 0.05 was considered statistically significant.

## RESULTS

A consort flow chart of the study population is shown in Figure 1. Of the 57 patient's diagnosed exotropia, 4 not meeting inclusion criteria and 3 declined to participate. 50 patients were willing to participate in the study and consented for participation. Thus, 50 patients' ptosis were analyzed to two groups, each group included 25 patients analyzed to males and females (Figure 1).

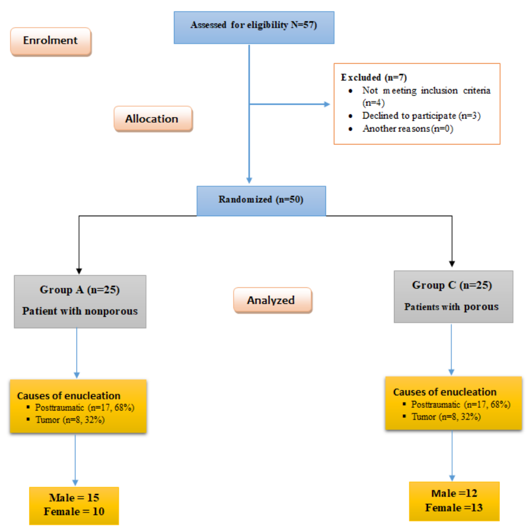


**Figure 1:** Consort flowchart of the studied ptosis.

A total of 50 patients enrolled in this study, there was no significant difference among the studied groups regarding age and sex (P>0.05) (Table 1).

**Table 1:** Sociodemographic data among non-porous and porous studied groups.

| Variables | Nonporous (n=25) | Porous (n=25) | Total (n=80) | t | P value |
|---|---|---|---|---|---|
| Age/year | | | | | |
| Mean ± SD | 29.60 ± 3.42 | 36.20 ± 3.18 | 32.5 ± 5.91 | 1.92 | 0.682 |
| Range | 20-36 | 20-40 | 20-40 | | |
| Median | 28 | 37 | 31 | | |
| Sex, no(%) | | | | | |
| Male | 15(60.00%) | 12(48.00%) | 27(33.75%) | $X^2$=0.725 | 0.395 |
| Female | 10(40.00%) | 13(52.00%) | 23(28.75%) | | |

**Note:** t: Independent test; $X^2$: Chi-square test

Data in Table 2 shows that post-traumatic was the most frequent among the studied groups, it was presented by 17 nonporous patients (68%), and 15 porous patients (60%), followed by tumor was found in 8 nonporous patients (32%) and 10 porous patients (40%), with non-significant difference (p=0.347). While, all of the studied patients hadn't vision (Table 2).

**Table 2:** Visual acuity and causes of enucleation among non-porous and porous studied groups.

| Variables | Nonporous (n=25) no(%) | Porous (n=25) no(%) | Total (n=80) no(%) | $X^2$ | P value |
|---|---|---|---|---|---|
| **Causes of enucleation** | | | | | |
| Posttraumatic | 17(68%) | 15(60%) | 32(64%) | 0.347 | 0.556 |
| Tumor | 8(32%) | 10(40%) | 18(36%) | | |
| **Visual acuity** | | | | | |
| No vision | 25(100%) | 25(100%) | 50(100%) | NA | 1 |

**Note:** $X^2$: Chi-square test

Regarding ptosis incidence 1st month and post-operative did not show any significant difference among non-porous and porous studied groups. Except 2nd and 4th months was significantly differed among porous and nonporous groups (p<0.05) (Table 3).

**Table 3:** Ptosis incidence 1st, 2nd, 4th month and post-operative among non-porous and porous studied groups.

| Ptosis incidence | Nonporous (n=25) no(%) | Porous (n=25) no(%) | Total (n=50) no(%) | $X^2$ | P value |
|---|---|---|---|---|---|
| **1st month** | | | | | |
| Normal | 22(88%) | 25(100%) | 47(58.75%) | 3.191 | 0.074 |
| Mild | 3(12%) | 0(0%) | 3(3.75%) | | |
| **2nd month** | | | | | |
| Normal | 19(76%) | 25(100%) | 44(55%) | 6.818 | 0.033* |
| Mild | 3(12%) | 0(0%) | 3(3.75%) | | |
| Moderate | 3(12%) | 0(0%) | 3(3.75%) | | |
| **4th month** | | | | | |
| Normal | 19(76%) | 24(96%) | 43(53.75%) | 4.915 | 0.042* |
| Mild | 2(8%) | 1(4%) | 3(3.75%) | | |
| Moderate | 3(12%) | 0(0%) | 3(3.75%) | | |
| Severe | 1(4%) | 0(0%) | 1(1.25%) | | |
| **Post-operative** | | | | | |
| Normal | 25(100%) | 25(100%) | 50(100%) | NA | 1 |

**Note:** $X^2$: Chi-square test; *: Significant

In the current study, there was no statistically significant relation between ptosis incidence and age of porous patients (p>0.05) (Table 4).

Additionally, there was no statistically significant relation between ptosis incidence and gender of porous patients (p>0.05) (Table 5).

As fore, causes of enucleation did not show any significant relation with ptosis incidence among porous patients (p>0.05) (Table 6).

**Table 4:** Age in relation to ptosis incidence among porous group.

| Age/year | Ptosis incidence: Normal | Mild | Moderate | Severe | K | P value |
|---|---|---|---|---|---|---|
| **1st month** | | | | | | |
| Mean ± SD | 24.50 ± 3.52 | 25.33 ± 3.06 | - | - | 0.435 | 0.695 |
| **2nd month** | | | | | | |
| Mean ± SD | 24.79 ± 3.61 | 22.67 ± 3.06 | 25.33 ± 2.52 | - | 0.558 | 0.702 |
| Range | 20-30 | 20-26 | 23-28 | | | |
| **4th month** | | | | | | |
| Mean ± SD | 24.79 ± 3.61 | 24.00 ± 2.83 | 22.67 ± 2.52 | 28.00 ± 0.0 | 0.662 | 0.585 |
| Range | 20-30 | 22-26 | 20- 25 | 28-28 | | |

**Note:** K: Kruskal Wallis test

**Table 5:** Gender in relation to ptosis incidence among porous group.

| Gender | Ptosis incidence | | | | | $X^2$ | P value |
|---|---|---|---|---|---|---|---|
| | Normal | Mild | Moderate | Severe | Total | | |
| | no (%) | no (%) | no (%) | no (%) | no (%) | | |
| | | | 1st month | | | | |
| Male | 13(59.09%) | 2(66.67%) | - | - | 15(60%) | 0.063 | 0.802 |
| Female | 9(40.90%) | 1(33.33%) | | | 10(40%) | | |
| | | | 2nd month | | | | |
| Male | 11(57.89%) | 3(100%) | 1(33.33%) | - | 15(60%) | 2.924 | 0.232 |
| Female | 8(42.11%) | 0(0%) | 2(66.67%) | | 10(40%) | | |
| | | | 4th month | | | | |
| Male | 11(57.89%) | 2(100%) | 2(66.67%) | 0(0%) | 15(60%) | 2.924 | 0.403 |
| Female | 8(42.11%) | 0(0%) | 1(33.33%) | 1(100%) | 10(40%) | | |
| | | | Post-operative | | | | |
| Male | 15(60%) | - | - | - | 15(60%) | NA | 1 |
| Female | 10(40%) | | | | 10(40%) | | |

**Note:** $X^2$: Chi-square test

**Table 6:** Causes of enucleation in relation to ptosis incidence among porous group.

| Causes of enucleation | Ptosis incidence | | | | | $X^2$ | P value |
|---|---|---|---|---|---|---|---|
| | Normal | Mild | Moderate | Severe | Total | | |
| | no(%) | no(%) | no(%) | no(%) | no(%) | | |
| | | | 1st month | | | | |
| Posttraumatic | 14(63.64%) | 3(100%) | - | - | 17(68%) | 1.604 | 0.205 |
| Tumor | 8(36.36%) | 0(0%) | | | 8(32%) | | |
| | | | 2nd month | | | | |
| Posttraumatic | 13(68.42%) | 3(100%) | 1(33.33%) | - | 17(68%) | 1.604 | 0.205 |
| Tumor | 6(31.58%) | 0(0%) | 2(66.67%) | | 8(32%) | | |
| | | | 4th month | | | | |
| Posttraumatic | 13(68.42%) | 2(100%) | 1(33.33%) | 1(100%) | 17(68%) | 3.07 | 0.381 |
| Tumor | 6(31.58%) | 0(0%) | 2(66.67%) | 0(0%) | 8(32%) | | |
| | | | Post-operative | | | | |
| Posttraumatic | 17(68%) | - | - | - | 17(68%) | NA | 1 |
| Tumor | 8(32%) | | | | 8(32%) | | |

**Note:** $X^2$: Chi-square test

## DISCUSSION

Blepharoptosis, or the drooping of one or both eyelids, has an impact on both the function and appearance of the eyes. The levator aponeurosis and the underlying Muller's muscle are detached from the tarsus, attenuated in functional terms, and elongated as a result of ageing or other mechanisms in aponeurotic blepharoptosis [9]. As a result, droopy eyelids may obstruct the superior visual field and, in severe cases, the central visual field [10].

Blepharoptosis also causes a change in facial appearance, with patients reporting that they appeared tired and older. Patient's ranked eye and eyelid appearance as the most important postoperative changes in terms of their improved visual field following ptosis repair surgery [11]. It has been reported that the presence of blepharoptosis is associated with psychological distress. According to Richards et al. patients with blepharoptosis had higher levels of anxiety, depression, and self-consciousness than the general population. Thus, the study's goal is to compare the incidence of ptosis in porous *versus* nonporous orbital implants after enucleation.

In our study, a total of 50 patients enrolled in this study, no significant difference among the studied groups regarding age and sex. In the same line, of 281 patients studied by Ho et al. found no significant differences in age, gender, follow-up time, and response rate to questionnaires between the 2 groups ($p>0.05$), The demographics of patients reviewed by ocularists at 6 weeks and 6 months postoperative visits revealed no significant differences in age or gender between the two groups. At 6 months, there were significantly fewer responses from ocularists in the HA (porous) group ($p<0.001$).

Other study by Park et al. [12] reported that, the association between patients over the age of 70 and ptosis was statistically significant ($P>0.05$). This contrasted with the expected rates of ptosis in elderly patients with a weaker or increased likelihood of dehisced levator palpebrae aponeurosis due to involutional changes or a history of prior surgery. This could be because people over the age of 70 have a high number of bilateral involutional changes. Ptosis became more noticeable in younger patients with less involutional change prior to surgery. As a result, new ptosis was more likely in those over 70, whereas those over 70 had minimal or less noticeable preoperative changes due to involutional ptosis.

In the present study, posttraumatic was the most frequent presented by 17 nonporous patients (68%), and 15 porous patients (60%), followed by tumor in 8 nonporous patients (32%) and 10 porous patients (40%), with non-significant difference. Our results were closed to Farokhfar et al. and Obuchowska et al. [13,14] who found trauma, phthisis bulbi, tumours, and infection were identified as the four major factors leading to enucleation surgeries, with the latter being more common in the 20-24 age group. Trauma was reported as the most common cause of enucleation (36%), followed by malignant tumour (20.7%), glaucoma (19.6%), phthisis bulbi (9%), and endophthalmitis (8.1%). Most intraocular tumours (92.1%) were histologically confirmed to be melanomas. In addition, Briceo et al. [15] discovered that moderate to severe blepharoptosis can impair visual function (e.g., loss of superior visual fields).

In the present study, ptosis incidence 1st month and post-operative did not show any significant difference among non-porous and porous studied groups. Except 2nd and 4th months was significantly differed among porous and nonporous groups.

Ptosis rates after eye surgery can range from 10% to 44%, though most cases resolve without treatment after cataract surgery. The large disparity in ptosis rates could be attributed to temporary aponeurotic ptosis, which can occur after surgery, as opposed to permanent aponeurotic ptosis. The most common type of ptosis before and after surgery is permanent aponeurotic ptosis. It is distinguished by levator function of 12-15 mm and a high or absent lid crease that does not improve with age [16].

In a previous study by Paris and Quickert [17], Bernardino and Rubin [18] have shown that patients with permanent aponeurotic ptosis had levator palpebrae aponeurosis disinsertion from the epitasis, whereas patients with ptosis after surgery had a weak levator palpebrae aponeurosis. Several factors have been investigated, but no conclusive evidence of a direct correlation to ptosis has been found. General anaesthesia, lid edema, and the use of a bridle suture are among the risk factors. Ptosis and the type of lid speculum used have been studied and are thought to be more important in patients with smaller palpebral fissures. Moreover, Crosby et al. [19] noted that a more rigid speculum can cause more compression and an increased risk of eyelid malposition in patients with the smallest palpebral apertures. In this regard, Chao et al. [20] found ptosis in 2.9% of 139 patients with HA (porous)/polyethylene (nonporous) implants after a mean follow-up of 46.4 months. At 18 months, 3.5% of 86 patients with a HA implant reported ptosis in their study.

In addition to, Ho et al. found that, the main finding of their study was that there were no significant differences in patient-reported outcomes in eyelid position, ocular motility, complications, and patient satisfaction after enucleation for UM between hydroxyapatite and acrylic orbital implants. At 6 months postoperatively observed by ocularists, there was a higher prevalence of ptosis in patients with AC implants and a greater need for ocularists' visits in patients with HA implants. Extrusion of implant was reported by 1.4% (1/73) of HA (porous) patients and 4.1% (3/74) of AC patients. Despite the fact that AC implants have a higher rate of ptosis than HA implants (46% *vs.* 25%), one of the three patients with AC (nonporous) implant extrusion required implant removal at 19.3 months due to tissue breakdown and a greater need for ocularists' visits with HA than AC because of the need for topical antibiotics for conjunctival discharge or suspected infection. On contrast, Sadiq and colleagues [21] included a smaller number of patients (26 hydroxyapatite and 26 polyethylene implants) with a variety of underlying indications for enucleation. They found no statistically significant difference in complication rates between the two implants.

## CONCLUSION

In conclusion, most common causes of enucleation are trauma and tumor. Ptosis incidence increases after enucleation. But after orbital implant it decreases if the implant was porous. Ptosis occurred in a significantly greater proportion of patients who received a nonporous implant than in those who received a porous implant. Implant exposure occurred at a low rate. When we start implantation early postoperative with porous implant, we will get better result than when we start too late postoperative.

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