

Evaluation of Bleb Fluid After Baerveldt Glaucoma Implantation Using Magnetic Resonance Imaging

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Purpose

The purpose of the present study was to assess the bleb structure after tube-shunt surgery using a 350-mm² endplate Baerveldt glaucoma implant, and to determine the parameters of bleb images that correlated with postoperative IOP in a large sample size.

Methods

Design: Cross-sectional observational case series.

Setting: Fukui University Hospital, Japan.

Study population: Patients who had undergone tube-shunt surgery using the 350-mm² endplate Baerveldt glaucoma implant.

Observation: T2-weighted images of bleb fluid were scanned with 3 Tesla magnetic resonance imaging (FIESTA-C) in 52 patients

Primary Outcome: The primary outcome measure was the classification of bleb layer formation.

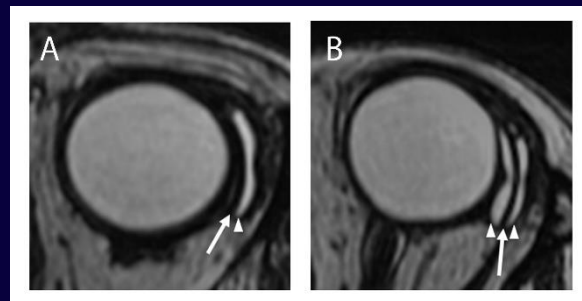
Secondary Outcome: The secondary outcome measures included relationships between the parameters of bleb images (bleb volume or classification based on the structure) and preoperative patient data, endplate position, and postoperative IOP.

Results

In total, 52 blebs were evaluated.

Primary Outcome

In all cases, a curvilinear low-intensity band that corresponded to the signal intensity of the silicone material was observed at the location of the endplate. Areas with the same high intensity as the intraocular fluid, corresponding to the signal intensity of the aqueous humor in the filtering bleb, were located adjacent to the endplate. In 28 out of 52 eyes (53.8%), the signal corresponding to the aqueous humor in the filtering bleb was detected on the outside of the endplate. The remainder of the eyes (46.2%) showed aqueous humor signals on both sides of the endplate. Based on this information, we classified the eyes into two groups: the single bleb layer group and the double bleb layer group (Fig 1).



Secondary Outcome

Relationships between the parameters of bleb images and postoperative IOP

The mean \pm standard deviation bleb volume was 0.23 ± 0.15 cm³ (n = 52). There was no significant correlation between bleb volume and postoperative IOP ($r = -0.080$; $P = 0.57$).

Comparisons of postoperative IOPs between the single bleb layer group and the double bleb layer group revealed significantly lower postoperative IOPs in the double bleb layer group than the single bleb layer group (12.3 ± 3.8 mmHg vs. 14.7 ± 4.1 mmHg, respectively; $P = 0.033$). Comparison of bleb volumes between the two groups showed a significantly larger mean bleb volume in the double bleb layer group than that of the single bleb layer group (0.28 ± 0.2 cm³ vs. 0.19 ± 0.1 cm³, respectively; $P = 0.024$).

Figure 1. MRI scans of eyes with the Baerveldt glaucoma implant

(A) A case with a single bleb layer.

(B) A case with a double bleb layer.

A curvilinear low-intensity area was observed at the location of the endplate (arrows). A high-intensity area corresponding to the aqueous humor, was located adjacent to the endplate (arrowheads).

Comparison of patient characteristics between the single bleb layer and double bleb layer groups

Among the preoperative data, there was a significant difference in the number of intraocular surgeries before Baerveldt glaucoma implantation between the two groups. The single bleb layer group had undergone more intraocular surgeries before Baerveldt glaucoma implantation than the double bleb layer group (2.8 ± 1.4 vs. 1.9 ± 0.8 , respectively; $P = 0.0068$).

Determinants for the single/double bleb layer

Multivariate analyzes using Logistic regression models showed that a higher number of previous intraocular surgeries was significantly associated with the formation of a single bleb layer (relative risk [RR], 2.85; $P = 0.0014$).

Conclusion

In conclusion, Baerveldt glaucoma implantation results in either a layer of bleb fluid on each side of the endplate or one layer outside the endplate. Lower postoperative IOPs are associated with the formation of the double bleb layer, not a larger bleb volume. Repeated intraocular surgery may cause the formation of the double bleb layer to fail, resulting in a higher IOP after Baerveldt glaucoma implantation.