1. Case report

A one-year-old male underwent an initial eye examination for evaluation of conjunctival hyperpigmentation at our institution. He was subsequently diagnosed with ocular melanocytosis which has been infrequently described. At 4 years of age, the patient relocated to another country. At five-years-old, he underwent bilateral glaucoma shunt placement at another institution. The operative reports and glaucoma drainage device (GDD) specifics were not obtainable. No prior or subsequent ocular surgeries were performed. The patient returned to our care at six years of age. His eye pressures were controlled without glaucoma medications. There were GDDs in the superotemporal quadrant of each eye. In the right eye, there was corneal edema in the superotemporal quadrant extending to the pupillary margin and a 3 mm central anterior subcapsular cataract. The shunt tube was extending into the anterior chamber 2 mm in primary gaze. The anterior portion of the tube retracted posteriorly with adduction of the eye (Fig. 1). Upon abduction, the tip of the tube traveled approximately 6 mm in an inferonasal direction. Intermittently, the tip of the tube would dive posterior to the iris to touch the lens (Fig. 2). When the patient lay supine under anesthesia, it was possible to reproduce inferonasal movement of the tip of the tube by moving the eye with forceps (Video).

The appearance was that of an Ahmed glaucoma drainage device. The tube movement (DTM), is an infrequent complication. Law et al. describe three cases of DTM that were identified upon reviewing their series of Ahmed glaucoma valves (AGV) implanted over a ten-year period. At implantation of the AGV, the patients were aged 1.5, 16 and 56 years old. DTM developed 4.5 years after implantation in the younger child in their series and 7 years after implantation in the teenage patient. All shunts had been secured to the sclera with non-dissolvable sutures and in all cases there was between 3 and 4 mm of tube movement between abduction and adduction. In all cases, they observed clinically that the shunt plate and its capsule had become detached from the sclera and did not move in concert with the movements of the globe. The extension of the tubes into the anterior chamber was corneal edema in the superotemporal quadrant extending to the pupillary margin and a 3 mm central anterior subcapsular cataract. The shunt tube was extending into the anterior chamber 2 mm in primary gaze. The anterior portion of the tube retracted posteriorly with adduction of the eye (Fig. 1). Upon abduction, the tip of the tube traveled approximately 6 mm in an inferonasal direction. Intermittently, the tip of the tube would dive posterior to the iris to touch the lens (Fig. 2). When the patient lay supine under anesthesia, it was possible to reproduce inferonasal movement of the tip of the tube by moving the eye with forceps (Video).

Supplementary video related to this article can be found at https://doi.org/10.1016/j.ajoc.2020.100802.

Due to concerns about worsening of the cataract and corneal edema, the patient underwent shunt revision surgery. Intraoperatively, there was no evidence of a pre-existing patch graft or non-dissolvable tube fixation sutures. Additionally, no excessive tube length or kink was noted. The tube entered the anterior chamber 1 mm behind the limbus and was directed anteriorly. The shunt plate and its encapsulating cyst were not explored because no obvious anterior movement of the shunt plate could be elicited by pulling gently on the tube. The tube was repositioned, without altering its length, to enter the sclera in the superotemporal quadrant through a new scleral insertion 2 mm posterior to the limbus. The tube was positioned parallel to the iris plane and was fixated to the underlying sclera with non-dissolvable sutures. The scleral insertion site was covered with a scleral patch graft. One month postoperatively, upon abduction there remained a similar increase in the length of the intraocular portion of the tube. During a subsequent surgery, the anterior portion of the shunt plate was explored. The appearance was that of an Ahmed glaucoma drainage device. The anterior positioning holes were found to have retained sutures from the initial surgery that were no longer affixed to the sclera. The sclera did not seem to be obviously thin or friable. The plate could be moved anteriorly and posteriorly with forceps (Fig. 3). The plate was secured to the sclera with 9.0 nylon sutures. No attempt was made to inspect the posterior portion of the plate or its capsule. The capsule surrounding the plate was left intact. Postoperatively, there was no change in the length of the tube in the eye with eye movements. Two years later, the eye pressure in the operative eye measured 12 mmHg without any glaucoma medications, and the cataract and corneal edema remain unchanged.

2. Discussion

Slow anterior or posterior migration of a GDD tube in the anterior chamber is not uncommon. However, excessive positional changes in the location of the shunt tube with eye position, referred to as dynamic tube movement (DTM), is an infrequent complication. Law et al. describe three cases of DTM that were identified upon reviewing their series of Ahmed glaucoma valves (AGV) implanted over a ten-year period. At implantation of the AGV, the patients were aged 1.5, 16 and 56 years old. DTM developed 4.5 years after implantation in the younger child in their series and 7 years after implantation in the teenage patient. All shunts had been secured to the sclera with non-dissolvable sutures and in all cases there was between 3 and 4 mm of tube movement between abduction and adduction. In all cases, they observed clinically that the shunt plate and its capsule had become detached from the sclera and did not move in concert with the movements of the globe. The extension of the tubes into the anterior chamber...
resulted from globe rotation either toward or away from the stationary plate and its capsule in the superotemporal quadrant. Potential causes of this separation of the plates from the sclera include a loosening of the fixation sutures and extrusion of the non-absorbable sutures from the sclera. Postulated as a contributing factor is the strong adhesion of the shunt capsules to the fornix relative to their adhesion to the sclera, which may inhibit the ability of the plate to fully rotate with the globe. All three patients had undergone one or more intraocular surgeries before shunt placement. Two of the eyes had undergone one or more intraocular surgeries after the shunt was placed, including one that required surgery to correct an exposed tube. All patients had undergone either an anterior or pars plana vitrectomy at some stage before the DTM was noted. It was also postulated that either the vitrectomy or additional surgeries may have caused the dissociation of the plates from the sclera. No negative effects were identified and no surgical intervention was required in any of these cases. Senthil et al.11 describes a 10-year-old girl who underwent lensectomy and anterior vitrectomy in the right eye. An AGV was placed in the superotemporal quadrant of the eye. Four weeks after shunt implantation, a bleb excision was performed to decompress the encysted bleb during the high-pressure phase. During this surgery, the tube was accidentally cut and the AGV was explanted. Two weeks later, a new AGV

Fig. 1. Intraoperative photograph of the right eye in a neutral position simulating primary gaze (photo on left side) and adduction upon rotating the eye with forceps (photo on right side). The white arrows mark the anterior aspect of the tube. The tube is barely visible in the anterior chamber upon adduction.

Fig. 2. Intraoperative photograph of the right eye simulating abduction by rotating the eye with forceps. Inferonasal travel of tube can be seen (photo on left side). Intermittent inferonasal with posterior travel of the tube with tube-lenticular touch and the disappearance of the tip of the tube under the iris was also noted (photo on right side).

Fig. 3. Intraoperative photograph of the right eye after exploration of the anterior aspect of the shunt plate from the surgeons view. The general location of the cornea (C), superior rectus muscle (SR), lateral rectus muscle (LR) and the shunt tube (T) are marked for reference. The arrows point to each of the anterior positioning holes on the plate. Non-dissolvable sutures from the original surgery can be seen in the positioning holes but they are not in contact with the sclera. The asterisk identifies a reference point just as the tube extends anteriorly under the conjunctiva. Significant posterior (photo on left side) and anterior (photo on right side) movement of the shunt can be demonstrated by manipulation with forceps.
was implanted into the same quadrant after removal of the initial implant. Within two months, the new shunt exhibited DTM with corneal touch anterior to the tube’s insertion and localized corneal edema. An excision of the tube and closure of the scleral fistula was performed. Intraoperatively, no pre-existing patch graft or tube anchoring sutures were identified. The anterior aspect of the implant plate was 14 mm posterior to the limbus and the shunt was not found to be anchored to the sclera. Six weeks postoperatively, a new AGV was placed in the inferotemporal quadrant. It was hypothesized that the hypermobility of the second tube may have been caused by a combination of a lack of fixation of the tube to the sclera along its subconjunctival length, the relative posterior position of the plate and the absence of a patch graft. Also postulated was that the DTM may have resulted from implantation of a new GDD in the region of an explanted drainage device, which could have caused instability in the new implant.

3. Conclusion

This case demonstrates the rare complication of DTM after placement of a GDD in an eye with no previous surgeries. The excessive mobility of the tube within the eye was associated with intermittent tube-to-iris contact and tube-to-lens contact with cataract formation, presumably due to repetitive lens trauma. The corneal edema may have been related to the DTM or to the initial anterior entrance of the tube shunt into the eye. Initial surgical intervention with placement of a patch graft, tube fixation with non-dissolvable sutures and modifying how it entered the eye did not correct the DTM. Ultimately, it was recognized that the excessive tube movement resulted from poor fixation of the plate to the sclera, most likely because of erosion of the suture through the sclera. It is not evident why this complication occurred in this particular patient. However, it is possible that this child and the other two young children described in the literature underwent growth of the eye after implantation of the AGV which may have contributed to the erosion of the suture through the sclera. This case confirms the hypothesis, with surgical intervention, that independent movement of the globe and shunt plate was due to poor fixation of the shunt plate to the sclera. This case demonstrates that DTM can be corrected by refixation of the shunt plate to the sclera.

Patient consent

The patient’s legal guardian consented to publication of the case orally. This report does not include any personal information that could lead to the identification of the patient.

Acknowledgements

The author thanks Alison Rabin for her assistance with this manuscript.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.ajoc.2020.100802.

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