We report a case of traumatic optic neuropathy accompanying a grease gun injury to the orbit. A 48-year-old man with a grease gun injury visited our clinic with decreased visual acuity, proptosis and limited extraocular movement (EOM). Orbital CT revealed a crescent mass of fat in the medial intraconal space. The grease was exuded from a lacerated conjunctival wound. The visual evoked potential (VEP) test demonstrated a decreased response in the left eye. Proptosis and EOM were improved after surgical removal of the grease. Systemic high-dose corticosteroid therapy was administered for suspected traumatic optic neuropathy, after which VEP nearly recovered, while visual acuity was slightly improved. A second surgery for traumatic cataract did not further improve visual acuity.

Key Words: Optic nerve diseases, Orbit, Penetrating eye injuries

Grease is a thixotropic lubricant consisting of a calcium, sodium or lithium-soap jelly emulsified with mineral oil. It liquefies when agitated and solidifies when at rest. Grease guns are commonly used workshop tools used to apply grease under pressure to the part being lubricated. The pressure increases up to 621-1034 kPa and is sufficient to eject grease at a velocity comparable to the muzzle velocity of a rifle bullet.

Grease gun injuries cause mechanical and chemical damage. Chemical damage of tissues caused by injected grease is less than those of other chemical substances due to the high viscosity and low tissue toxicity of grease. However, the high pressure can result in focal penetration followed by blunt dissection along the tissue planes. The most common sites of injury are the fingers and hand; however, any part of the body can be involved. Grease gun injuries of the orbit are very rare, and only six cases have been published to our knowledge [1-5].

We report a case of intraconal grease gun injury accompanied by traumatic optic neuropathy.

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Fig. 1. Appearance just after the accident showing eyelid swelling, chemosis and extreme limitations of extraocular movement (EOM) in all directions.

Fig. 2. Solidified grease (arrow heads) extruded from the conjunctival laceration wound.

One month after the operation, the visual acuity of the left eye was 0.1. Exophthalmlometry readings were 18 mm in both eyes, and EOM was further improved. Intraocular pressure measured 27 mmHg in the left eye by Goldmann tonometry. The cup to disc ratio was about 0.4, and there was no angle recession or retinal nerve fiber layer defect. The patient was instructed to apply dorzolamide hydrochloride/timolol maleate (Cosopt®; Merck & Co., Inc., Whitehouse Station, NJ, USA). MRI showed bubble-like, non-enhancing lesions surrounded by enhancing areas suggestive of an inflammatory reaction. The adjacent rectus muscles appeared slightly compressed and showed fat infiltration (Fig. 5).

After another two months, the EOM was much improved, and the VEP test showed a recovered response despite a maintained decrease in visual acuity (Fig. 6). Intraocular pressure was maintained within high-normal limits with constant use of dorzolamide hydrochloride/timolol maleate. The patient complained of being dazed, likely because of a fixed dilated pupil and anterior capsular lens opacity. He underwent vitrectomy, lensectomy and intraocular lens implantation. One month after the second operation, however, his best corrected visual acuity was still 0.1 in the left eye.

Discussion

In the late 1950s, the widespread use of high pressure paint sprays and hydraulic systems increased the incidence of high pressure injection injuries. However, grease gun injuries to the orbit have rarely been reported. The present case is the seventh report throughout the world, and the first in Korea to our knowledge.

The first such case was reported in 1964 [1]. A mechanic with grease gun injury to the orbit presented with visual disturbance, proptosis, superior visual field loss and bilateral disc edema and venous engorgement. Despite long-term steroid treatment and orbitotomy, there was no postoperative improvement.
In 1988, a 19-year-old man was hit by a jet of oil from a grease gun, resulting in marked proptosis and decreased visual acuity to light perception [2]. Daily irrigation and drainage followed by aspiration of the grease improved the proptosis dramatically and also improved visual acuity to 1.0 within six weeks.

Goel et al. [3] reported two cases that occurred in 1988 and 1989. In the former case, the ejected grease ruptured the globe and broke the medial wall and floor. An enucleation was followed by ethmoidectomy, sphenoidectomy, inferior turbinectomy and antrostomy. In the latter case, mild proptosis, diplopia and swelling was improved three weeks after an anterior orbitotomy.

According to the report of Gekeler et al. [4] in 2005, reduced visual acuity resulting from grease gun injury normalized after six weeks of conservative care. Limitation of ocular motility, diplopia or visual field defect was not seen within the following 11 months. Antonio et al. concluded that intraconal grease should not necessarily be removed in the absence of symptoms.

The sixth case was reported recently in China [5]. The patient with a grease gun injury underwent orbital exploration. His visual acuity and EOM were improved after complete removal of the grease. Immediate and thorough removal of the grease was of great importance in this case.

In the present case, an immediate diagnosis was somewhat difficult. The grease gun is an unfamiliar tool and the intraconal mass on CT resembled orbital fat in density. It was helpful to understand the mechanism of a grease gun being operated under high pressure. We presumed that the grease had dissected subconjunctival tissue along the medial plane of the globe, and this presumption was supported by CT findings and fatty material extruding from the conjunctival wound. There was marked proptosis and EOM limitation. Surgical removal was inevitable and actually relieved the symptoms. Traumatic optic neuropathy appeared to accompany grease gun injury in this case. Though high-dose corticosteroid therapy is not of proven benefit to traumatic optic neuropathy itself, it might allow for early visual improvement due to a reduction in edema [6,7]. Some improvement in visual acuity was presumed to be the result of high-dose corticosteroid therapy rather than due to the surgical removal of the grease in this case.

Despite incomplete removal of the grease, additional removal was not attempted because EOM, proptosis and global displacement had improved and VEP recovered after time. Moreover, the remainder of the grease caused no active inflammation, and visual acuity was not expected to improve after further surgery. However, it is well known that oily substances cause sclerosing lipogranulomatous inflammation when injected subcutaneously whether for cosmetic reasons or unintentionally. Therefore, the remaining material should be followed-up persistently even if it is not presently troublesome.
Fig. 5. MRI 1 month after the surgical removal of the grease. Multiple bubble-like cystic lesions (arrows) are surrounded by enhancing areas presumed to be inflammatory reactions (arrow heads) to foreign bodies. Adjacent rectus muscles look slightly compressed. On the T1-weighted image (A), cystic lesions show high signal intensity which resembles that of intraconal fat. On the T2-weighted image (B), the lesions are difficult to distinguish from the surrounding area because of similar low signal intensities. On the fat saturation images (C, D), on the other hand, both the cystic and surrounding lesions are well demarcated and distinguished from the intraconal fat.

Fig. 6. Appearance 3 months after the surgical removal of grease showing markedly improved extraocular movement and proptosis in the left eye. Limitation in the medial gaze is still shown.
It is notable that the prompt removal of grease improved the ocular symptoms and signs except for visual acuity. Visual disturbance continued after VEP recovered. Traumatic cataract might be one factor but, contrary to our expectations, cataract surgery did not improve visual acuity.

The previous and present cases demonstrate a broad spectrum of high pressure grease gun injuries to the orbit. If external wounds or ocular symptoms are not severe, then rare retrobulbar fatty foreign bodies can be overlooked. Careful history taking is important to establish the diagnosis. Imaging studies using CT or MRI are necessary to confirm grease deep within the orbit. MRI is particularly valuable for illustrating the extent of the infiltrate [2]. Intravenous antibiotics and systemic steroids are recommended [3]. Most authors have reported that surgical removal is necessary but Gekeler et al. [4] insisted that close observation was sufficient in the absence of ocular symptoms. The decision to operate should be made according to the general ocular conditions as the tissue toxicity of grease itself is limited.

Conflict of Interest

No potential conflict of interest relevant to this article was reported.

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