Early exploration of diplopia with magnetic resonance imaging after peribulbar anaesthesia

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We report the cases of five patients who have experienced postoperative diplopia after cataract surgery under peribulbar anaesthesia and in whom orbital Magnetic Resonance Imaging was performed immediately after the diagnosis. In four patients, the imaging study showed a T2 hyper-intensity signal and swelling of one extraocular muscle that was interpreted as oedema. Therefore, these cases were most probably a result of an accidental i.m. injection of local anaesthetics. In the other patient, the imaging study revealed no abnormality.

Keywords: anaesthetic techniques, regional, peribulbar; complications, diplopia

Accepted for publication: December 5, 2003

Sporadic cases of diplopia after peribulbar block for cataract surgery have been reported for a long time.¹ The exact mechanism by which peribulbar block may cause diplopia remains uncertain. It may involve direct needle injury to the muscle (eventually causing i.m. haemorrhage) or i.m. injection of local anaesthetic causing direct myotoxicity or elevating tissue pressure thus causing muscle ischaemia.¹² We report five cases with postoperative diplopia after cataract surgery performed under peribulbar anaesthesia in whom orbital Magnetic Resonance Imaging (MRI) was performed immediately after the diagnosis.

Case reports

All patients were undergoing ambulatory cataract surgery by phakoemulsification and had been assessed preoperatively by an anaesthetist. None of them complained of diplopia before surgery. A senior staff anaesthetist performed all peribulbar blocks. After mild sedation with propofol 30–40 mg, patients received one infero-lateral injection of 5–10 ml of a local anaesthetic mixture of equal proportions of lidocaine 2% and bupivacaine 0.5% using a 32 mm, 25 G, short bevelled peribulbar needle (Atkinson, BD Visitec™, Waltham, USA). The injection was followed by a 10 min orbital compression of 30 mm Hg with a Honan balloon to lower intraocular pressure. The patients were all examined on the first postoperative day by their surgeon who diagnosed diplopia upon withdrawal of the eye protection. They immediately underwent an orbital MRI with T1 and T2 weighed axial and coronal images that were interpreted by an experienced staff radiologist (H.F.).

Case 1

A 55-yr-old male (ASA II) underwent an uneventful surgical procedure on the right eye and was discharged 1 h later. The next day, the patient complained of diplopia. Ophthalmologic examination found vertical ophthalmoplegia as a result of paresis of the right inferior rectus muscle. The MRI scan of the orbit was normal. The diplopia persisted and the patient required correction with a prism.

Case 2

A 78-yr-old female (ASA II) with a history of diabetes mellitus underwent an uneventful surgical procedure on the right eye and was discharged 1 h later. The next day the patient complained of diplopia. Ophthalmologic examination found vertical ophthalmoplegia as a result of paresis of the right inferior rectus muscle. The MRI scan of the orbit was normal. The diplopia persisted and the patient required correction with a prism.

Case 3

A 74-yr-old female (ASA II) underwent an uneventful surgical procedure on the left eye and was discharged 1 h later. The next day the patient complained of diplopia. Ophthalmologic examination found horizontal ophthalmoplegia as a result of paresis of the right lateral rectus muscle, which was confirmed with a Lancaster test. The MRI scan of the orbit found a T2 hyper-intensity signal and swelling of the right lateral rectus muscle, which was interpreted as oedema (Figs 1 and 2). The diplopia persisted and the patient required correction with a prism.
later. The next day the patient complained of diplopia. Ophthalmologic examination found horizontal ophthalmoplegia as a result of paresis of the left lateral rectus muscle, which was confirmed with a Lancaster test. The MRI scan of the orbit found a T2 hyper-intensity signal and swelling of the left lateral rectus muscle. Five weeks later the patient underwent another MRI scan, which found that all abnormalities had regressed. The diplopia persisted partially and the patient required correction with a prism.

Case 4
A 54-yr-old female (ASA II) underwent an uneventful surgical procedure on the left eye and was discharged 1 h later. The next day the patient complained of diplopia. Ophthalmologic examination found vertical ophthalmoplegia as a result of paresis of the left inferior rectus muscle, which was confirmed with a Lancaster test. The MRI scan of the orbit found a mild T2 hyper-intensity signal of the left inferior rectus muscle, which was interpreted as inflammatory oedema. The diplopia persisted and the patient required corrective surgery.

Case 5
An 80-yr-old male (ASA II) underwent an uneventful surgical procedure on the right eye and was discharged 1 h later. The next day the patient complained of diplopia. Ophthalmologic examination found horizontal ophthalmoplegia as a result of paresis of the right lateral rectus muscle, which was confirmed with a Lancaster test. The MRI scan of the orbit found a T2 hyper-intensity signal and swelling of the right lateral rectus muscle, which was interpreted as oedema. The diplopia persisted and the patient required correction with a prism.

Discussion
We report five cases of post-anaesthetic diplopia who were immediately investigated with an MRI scan. In cases 2 to 5, the muscles that had been identified as paretic on examination and by the Lancaster test were all found to be abnormal on the MRI. They displayed similar swelling and T2 hyper-intensity signal of the muscle (Figs 1 and 2). These images were interpreted as inflammatory oedema. There was never any sign of i.m. or intraorbital haemorrhage. In case 1 the MRI scan was normal despite confirmed paresis of the right inferior rectus muscle, thus suggesting a different mechanism.

Gómez-Arnau and colleagues have recently reported an incidence of anaesthesia related diplopia of 0.25%. They suggest several mechanisms to explain the diplopia: direct needle injury to the muscle eventually causing i.m. haemorrhage, or i.m. injection of local anaesthetics causing direct myotoxicity or elevating tissue pressure thus causing muscle ischaemia. Direct injury to the nerve innervating the paralysed muscle has also been suggested. An experimental study conducted on the myotoxic effects of local anaesthetics on extra ocular muscle in primates showed inflammation of the muscles during the first week after injection followed by muscle regeneration in most cases. There was no histological lesion in muscles injected with...
saline thus refuting the hypothesis that elevated muscle pressure could itself cause ischaemic damage.

Cases of post-anaesthetic diplopia are regularly being reported but the precise mechanism of this complication is still unclear. This MRI study confirms that in four out of five cases with post-anaesthesia diplopia there was a large area of inflammation within the paralysed muscle. This is consistent with experimental data. Post-anaesthetic diplopia is most probably as a result of an accidental i.m. injection of myotoxic local anaesthetic causing necrosis of the myocytes, inflammation of the muscle and thereby muscle dysfunction. It is interesting to point out that in these four cases the paretic muscle was either the inferior rectus or the lateral rectus situated close to the infero-lateral injection. Case 2 illustrates that although this inflammation is transient (after 5 weeks, there remained no hyper-intensity signal), muscle dysfunction persisted suggesting in this case that myocyte regeneration was only partial. Furthermore, it suggests that MRI should be performed early after the diagnosis of diplopia when T2 hyper-intensity signal is still apparent. In case 1 the MRI performed at day 1 was normal despite confirmed clinical strabismic diplopia. We believe that the muscle dysfunction was not caused by an i.m. injection but rather by inferior rectus intraneural injection as suggested by Hunter and colleagues. It is also possible that the muscle dysfunction existed preoperatively.

The MRI investigation of cases 2 to 5 illustrates that post-anaesthetic diplopia is, in most cases, probably a result of direct myotoxicity of an accidental i.m. injection of local anaesthetics, clinically confirming experimental data. Performing an MRI early in the case of post-anaesthetic diplopia will determine whether it is secondary to the myotoxic effect of an accidental i.m. injection or whether it could have existed preoperatively.

Acknowledgement
We thank all the patients in this report that gave permission for this publication.

References