Unilateral fixed dilated pupil in a child with asthma

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Abstract - A 1-year-old boy was treated in our Paediatric Intensive Care Unit for an acute asthma exacerbation. Because he failed to respond to frequent nebulisation with salbutamol and ipratropium, he was mechanically ventilated. Shortly after intubation, a unilateral fixed dilated pupil was noticed. There were no signs of raised intracranial pressure, or any cerebral swelling or haemorrhage on the CT-scan of the brain. Therefore, local contamination of the eye with a mydriatic agent was assumed to be the most probable cause.

Keywords - Asthma; child; unilateral fixed dilated pupil; ipratropium

Introduction
Any acute onset of a unilateral, fixed dilated pupil in an unconscious patient is usually an alarming symptom. The main causes are trauma to the eye or to the sympathetic trunk and raised intracranial pressure. However, contamination of the eye with mydriatic medication is another possible cause. In presenting this case report, we would like to draw attention to recognising an iatrogenic cause of unilateral mydriasis and underscore the importance of safe drug handling.

Case report
A 1-year-old boy with known bronchial hyper reactivity was admitted to our paediatric intensive care ward for an acute asthma exacerbation. At home he had been nebulised frequently with salbutamol over several hours, in addition to 2 doses of ipratropium. Once admitted to our ward, he failed to respond to hourly nebulisation with salbutamol and consequently an intravenous infusion with salbutamol was started. Ipratropium was added once. Because of progressive respiratory distress, the boy was intubated 3 hours after admission using propofol, midazolam, fentanyl and rocuronium. During this procedure he remained haemodynamically stable and showed no neurological symptoms. Because of severe bronchoconstriction, deep sedation and lung protective ventilation with permissive hypercapnia was started. Salbutamol nebulisation was continued on the ventilator and i.v. steroids were added. After 3 hours we were alarmed by a unilateral non-reactive dilated pupil (see figure 1). A cerebral CT-scan was performed immediately that showed no signs of cerebral oedema or haemorrhage. After several hours, the pupils gradually became symmetrical with normal reflexes. The respiratory condition of the boy rapidly improved and one day after ICU admission he was successfully extubated. He made a full recovery without any neurological sequelae.

Discussion
We report an acute onset of a unilateral fixed dilated pupil in a child treated for an asthma exacerbation. Several possible causes in this patient were considered: raised intracranial pressure, trauma to the eye or sympathetic trunk or instillation of a mydriatic agent in the eye. In ventilated patients with severe asthma, mydriasis based on increased intracranial pressure or cerebral oedema associated with permissive hypercapnia has been reported [1,2]. Cerebral vasodilation due to hypercapnia is considered to be less well tolerated in patients with increased intrathoracic pressures. In our patient there was no history of trauma, no jugular catheter insertion and limited intrathoracic pressure (max PIP 21 cm H2O). In addition, a normal brain anatomy was observed on the CT scan. Furthermore, the unilateral dilated pupil resolved spontaneously within several hours following ICU admission. Based on these data, we hypothesized that local contamination of the eye with a mydriatic agent might be the cause of the transient unilateral pupil dilation. When asked, the parents remembered having given the boy an empty respule to play with sometime during nebulising.

Figure 1
The dilator pupillae muscle is innervated by \( \alpha-1 \)-receptors and ipratropium, being an anticholinergic agent, may be able to induce mydriasis when local contamination of the eye occurs, possibly due to an ill-fitting mask or to manual contamination. This mechanism has also been suggested in several case reports, although questioned by others [3-6]. In our case, it is very likely that this toddler rubbed his eyes with contaminated hands, making inadvertent digital-topical administration the most plausible explanation.

A unilateral dilated pupil is an alarming clinical sign in an unconscious patient and generally requires prompt evaluation. A simple direct approach to distinguish pharmacological from neurological mydriasis is the pilocarpine test [7]; one drop of 1% pilocarpine should result in constriction of the neurologically dilated pupil but will have no miotic effect on the \( \alpha-1 \) adrenerg blocked pupil. However, in our deeply sedated patient with suboptimal neurologic assessment and possible urgent and life threatening causes, we preferred immediate diagnostic evaluation by CT scanning. However, had we noticed the dilated pupil before intubation, which might have been the case, we would not have felt the need for CT-scanning because of the absence of any neurological signs and would have taken the time to perform the pilocarpine test.

A unilateral fixed dilated pupil after ipratropium nebulising has been described before, although only a few times in unconscious patients. In presenting this case, we hope to raise awareness of this iatrogenic cause of reversible pupillary dilation in ipratropium nebulised asthma patients and the discriminatory pilocarpine test. In unconscious patients, however, considerations should be made as to whether there are any risk factors for raised intracranial pressure or any neurological signs. If there are none, the pilocarpine test may avoid the need for unnecessary and possibly harmful investigations.

This case report also underscores the importance of safe drug handling, especially where children are concerned: medication should always be kept out of the reach of children.

References