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Comparison of analgesia and akinesia after retrobulbar injections at different speeds

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PURPOSE. *To assess how the speed of injection of local anesthetic solutions affected pain of injection, bulbar akinesia and analgesia with retrobulbar anesthesia (RBA).*
METHODS. *70 patients undergoing RBA for cataract surgery were enrolled in a prospective masked trial. They were allocated randomly to receive 5 ml anesthetic solution injected either within 20 seconds (group A) or within 60 seconds (group B). Additionally, akinesia of the orbicularis muscle was created according to O'Brien's technique. The pain of injection was registered on an ordinal analogue scale immediately before and after RBA. The following data were collected before and 20 minutes after retrobulbar injection: eye motility (Kestenbaum test), and corneal sensitivity (0: no sensitivity; 1: sensitivity remaining). Data were also collected on age, sex, and bulbar length, and any side effects of the intervention.*
RESULTS. *Injection pain did not differ in the two groups. After RBA horizontal and vertical eye motility was slightly lower in group A than group B. Persistent motility was found in 18 patients in group A and 16 in group B. Median horizontal and vertical motility was 0 mm in both groups. Four patients in group A and five in group B had corneal sensitivity persisting after RBA.*
CONCLUSIONS. *This comparison of different injection velocities brought to light no significant differences regarding bulbar analgesia and akinesia after RBA. (Eur J Ophthalmol 2000; 10: 66-70)*

KEY WORDS: *Anesthesia: local/methods, Anesthetics: local/administration and dosage, Cataract extraction, Neuromuscular blockade, Pain/prevention and control, Pain measurement*

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INTRODUCTION

Ophthalmic local anesthetic injections have the drawback of causing significant pain (1, 2), often severe enough to be the patient's main worry about the operation, and it may actually be the most unpleasant part of the whole surgical procedure. Slow injection are considered to be important for analgesia and anesthesia (3) and studies on this topic in fields different from ophthalmlogy have given conflicting results (4-8). To our knowledge no controlled study has measured the effect of injection speed in ophthalmic local anesthetic procedures. Retrobulbar anesthesia (RBA), one of the oldest local anesthetic procedures (9), is still frequently employed in cataract surgery and other types of ocular surgery. The present study was designed to assess whether the speed of retrobulbar local anesthetic injections had an effect on pain of injection and on bulbar akinesia and analgesia.

MATERIALS AND METHODS

A continuous cohort of seventy patients undergoing RBA for cataract surgery were enrolled into a prospective trial. All patients gave their informed consent before inclusion. Exclusion criteria were previous severe ophthalmic injuries, infection, oph-

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thalmic surgery, or previous retrobulbar or peribulbar injections in the eye where the present RBA was to be done. Patients were also excluded for ipsilateral orbital and bulbar malformations and axial bulbar length <20 mm or >26 mm. Patients who were not able to cooperate with the demands of pain assessment on an ordinal analogue scale because of language difficulties or limited physical or mental capacity were also excluded.

Patients were allocated randomly to receive 5 ml of anesthetic solution continuously either within 20±2 seconds (0.250±0.030 ml/sec; group A) or within 60±5 seconds (0.083±0.007 ml/sec; group B). The solution contained a mixture of bupivacainhydrochloride 0.75% (Bucain®; Curasan Pharma GmbH, Kleinostheim, Germany) and articainhydrochloride 2% (Ultracain®; Hoechst AG, Frankfurt am Main, Germany) in a 2:1 ratio. Naphazolinenitrate (1:30000; Sednesa®-eyedrops; Weromedical GmbH & Co. KG, Tanusstein, Germany) and hyaluronidase (5 I.E. per ml; Hylase® "Dessau" 150 I.E.; Pharma Dessau GmbH, Dessau, Germany) were added. In all cases 35 mm, 0.5 mm blunt-tipped needles (Hans Geuder Company, Heidelberg, Germany) were used. Two ml of articainhydrochloride 2% were used according to O'Brien's technique to create akinesia of the orbicularis oculi muscle by blockage of the facial nerve. This procedure was done at least 2 minutes before the RBA to avoid interference with pain assessment. All syringes were kept at room temperature which was 20±1°C.

The study was masked as far as possible. Neither the patients nor the investigator asking the questions were aware of the injection speed. The injections were all given by an experienced single second investigator. A standard retrobulbar technique was employed using a constant entry site through the skin of the inferotemporal eyelid. The needle was first aimed tangentially to the equator of the globe and then, after passing the equator, moved toxard the apex of the orbit into the muscle cone. Before beginning the study the injector did a number of "practice" injections to establish a consistent, reproducible speed of injection, using a timer in front of the injector. After injection the eyelid was manually closed by the operator and a balloon (Vörösmarthy-Oculopressor) at a pressure of 40mmHg was held over it for 10 minutes.

The following data were collected before and 20 minutes after retrobulbar injection: eye motility (Kestenbaum test) and comeal sensitivity at four different places (0: no sensitivity; 1: sensitivity remaining). If sensitivity was found in more than one quadrant the patient was classified as having remaining sensitivity. Remaining motility was defined as a movement of the globe of ≥2 mm in at least one direction measured from the primary eye position. Before and immediately after the injection the subjective response to pain of injection was assessed by asking the patient to choose an integer between 0 and 10 on an ordinal analogue scale, where 0 represented no pain and 10 the worst pain imaginable. Linear visual analogue scales, where a mark is made on a continuous line, are a commonly used method of scoring pain (10-15). Like Bell et al (15), however, we felt that many of the elderly patients lying supine would have difficulties accurately placing a mark at the desired location on such a scale. Therefore we asked them in a standardized manner to name the number which assessed their pain. Data aquisition included possible severe side effects such as retrobulbar hematoma, globe perforation, severe neurological disorders (e.g. stroke and loss of consciousness) and symptomatic disorders resulting from arrhythmic diseases or marked changes in blood pressure.

The initial hypothesis (H_0) was that there were no significant differences in the perception of pain between group A and B. The size of the two groups was calculated to detect a difference between the average pain scores of at least 1.5 points which was assessed as being of clinical importance, with a SD of ± 2.2; α and ß of the bilateral hypothesis were 0.05 and 0.2 respectively. The calculated size of the two samples was 35 patients each.

Univariate statistical analysis was performed using analysis of variance and Student's t-test for continuous variables. Since the linear analogue scores were ordinal, a non-parametric Mann Whitney U-test was used. Data were expressed as mean ± standard deviation. The chi-square test was used for discrete variables. Data were expressed as frequencies. A probability value <0.05 was considered statistically significant.

RESULTS

There were18 males and 17 females in group A with a mean age of 70.1 ± 10.0 years (range 47-88 years). In group B there were 13 males and 22 females, mean

age 72.1 ± 10.2 years (range 42-92 years). The mean bulbar length measured with ultrasound was 23.0 ± 1.0 mm in group A (range 21.4-24.3 mm) and 23.3 ± 1.5 mm in group B (range 20.1-24.5 mm). No patient felt eye pain before the injections. No severe side effects were recorded.

Average pain scores and median did not differ in the two groups (Tabs. I, II). After RBA average eye motility and average horizontal and vertical eye motility were slightly lower for group A than group B (Tab. I). Remaining motility was found in 18 patients in group A (maximum horizontal motility 7 mm; maximum vertical motility 3 mm) and 16 in group B (maximum horizontal motility and maximum vertical motility 5mm). The median horizontal and vertical motilities where 0 mm in both groups. Four patients in group A and five in group B had remaining corneal sensitivity after RBA. None of the differences were significant.

DISCUSSION

A variety of methods including anesthetic drops (16-18), subconjunctival anesthesia (19) or anesthesia in the area of Tenon's capsule (20) help avoid or reduce injection pain and some risks of RBA which, however, maintains intraoperative akinesia and analgesia, and therefore allows complicated surgical procedures in a relatively safe manner. Numerous effects have been investigated for relieving the pain of ophthalmic local anesthesia including premedication (21), injection technique (22-24) and adjunctives (25). In parabulbar anesthesia transconjunctival injections have been found significantly more painful than transcutaneous injections (24). Diluted anesthetic solution injected into parabulbar tissue before the full strength RBA (26, 27) may reduce injection pain. Warming local anesthetic fluids resulted in lower injection pain in parabulbar anesthesia (15, 28) but a similar approach in RBA failed to give any significant differences (29). Investigations on human tissue distant from the eye gave conflicting results (13, 14, 30-33).

The present study was designed in the light of uncontrolled clinical observations (27) and on the hypothesis that the speed of injection of the anesthetic solution may have an effect on retrobulbar nerve compression by the anesthetic and could therefore affect the injection pain. During RBA usually a volume smaller than that used for parabulbar anesthesia is injected inside the cone of orbital muscles and

TABLE I - OVERALL RESULTS

	Group A* (n=35) Mean ± SD	**Group B° (n=35) Mean ± SD**
Average pain score (points)	3.7 ± 2.3	3.7 ± 1.7
Average motility (mm)	1.5 ± 2.4	1.8 ± 2.7
Average horizontal motility (mm)	0.7 ± 1.6	0.9 ± 1.5
Average vertical motility (mm)	0.8 ± 1.2	0.9 ± 1.5

SD = Standard deviation
* Group A: 5 ml anesthetic solution / 20 ± 2 sec (0.25 ± 0.030 ml/sec)
° Group B: 5 ml anesthetic solution / 60 ± 5 sec (0.08 ± 0.007 ml/sec)

TABLE II - FREQUENCY AND MEDIAN OF PAIN SCORES

Pain score	0	1	2	3	4	5	6	7	8	9	10	M
Group A* (n=35)	0	3	5	11	5	5	4	2	0	0	0	3
Group B° (n=35)	3	2	7	6	4	7	1	2	3	0	0	3

M = Median
* Group A: 5 ml anesthetic solution / 20 ± 2 sec (0.25 ± 0.030 ml/sec)
° Group B: 5 ml anesthetic solution / 60 ± 5 sec (0.08 ± 0.007 ml/sec)

connective tissue. Fluid in this limited space causes pressure behind the eye, which on average is higher than with parabulbar anesthesia, and compression of the afferent nerves rather than diffusion of the anesthetic solutions may produce pain. Different aspects of pain during local anesthesia have been investigated (34-38) but the mechanism of pain induction during local anesthesia is still not completely understood. It is not clear whether needle cut and movement of the needle or injection of anesthetic fluids contribute mainly to the pain sensation. Besides, a number of other factors, such as injection speeds different from those we tested, the needle size, volume and type of anesthetic solution, may all affect pain of injection (22). Future trials varying one or more of these factors may demonstrate significant speed-dependent effects.

In spite of differences due to the method of injection and pain assessment our data were within the range of pain scores recorded after RBA (median 5.0 points, range 2.0-10.0 points) (21) and peribulbar anesthesia (5.5 ± 1.0 points (15) and 5.3 ± 2.3 points (28) on average).

Although some authors use topical anesthetic procedures that do not affect perioperative eye motility (e.g. eye drops), most cataract surgeons appreciate bulbar akinesia. Like other investigations (median horizontal akinesia 20 minutes after injection 0 mm; maximum 2 mm (23)) we found a single retrobulbar injection of 5 ml achieved bulbar akinesia in most patients, at both injection speeds.

We found no significant or clinically relevant differences in bulbar analgesia and akinesia between retrobulbar injections at different speeds. Extending the injection time above 20 sec is not necessarily recommended for RBA.

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