In vivo monitoring the intraocular pressure of anterior chamber in normal rabbits

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Abstract—To develop a method to monitor the intraocular pressure (IOP) of the anterior chamber in vivo in normal rabbits, to observe the value of the normal IOP, and to detect the distribution regularity in the 24 hours of normal rabbits. Normal IOP was monitored in 15 New Zealand white rabbit eyes. The measurements of IOP of all the experimental rabbits were by Millar transducer which was embedded in the anterior chamber. The analog signal of IOP was filtered, amplified and transformed into digital signal by Powerlab system, and was real-time displayed by Chart software. We successfully obtained the IOP value of 7 anterior chamber groups. The IOP of anterior chamber was (1.31±0.21–2.74±0.83)KPa. The distribution was as follows: the value of the IOP was lower from 0:00 to 5:00 and from 18:00 to 23:00 and gradually increased from 5:00 to 10:00. The peak value of the anterior chamber was at 11:00 and 17:00. The results suggest that we develop a convenient, feasible method to monitor the IOP of rabbits.

Keywords—anterior chamber intraocular pressure, rabbit, Millar transducer

I. INTRODUCTION

Angle-closure glaucoma (ACG) is the second most serious eye disease which is only inferior to cataract in China. Primary angle-closure glaucoma (PACG) is the main type in all types of glaucoma. PACG patients account for 80% of all the ACG patients. The morbidity of PACG of Chinese people is 10 to 15 times that of the white race [1]. However, the pathogenesis of patients. The morbidity of ACG of Chinese people is 10 to 15 times that of the white race [1]. The peak value of the anterior chamber was at 11:00 and 17:00. The results suggest that we develop a convenient, feasible method to monitor the IOP of rabbits.

Establishment of ACG animal model is the key to study damage and treatment of ACG. Rabbits are commonly used as animal models. The distribution range of the normal IOP of rabbit and the fluctuations in the day and night is important to an experiment. In this work, the normal IOP value of rabbit was observed and the distribution situation of IOP of rabbit was detected, as well as the normal IOP parameter standard was primarily proposed. The work provided references for establishment of ACG model and further treatment and rehabilitation of ACG patient.

II. MATERIAL AND METHOD

A. Material

Experimental Animals: We choose New Zealand albino rabbit weighting 2–2.5kg (NO.:SCXX-beijing-2005-0009), which left eye is big as same as right eye, which conjunctiva is not engorge, which cornea is transparent, which pupil is big equally and is hypersensitive with light, as the sample of this experiment. All experiments were performed according to the guide for care and use of the laboratory animals department of Capital medical university. These rabbit were bred in condition of 20-25℃ and 12h illumination.

Measure Devices: The system consists of Millar pipe (SPR-320), Powerlab system (Adinstrument Pty Ltd), Chart software. The top end of Millar pipe is the sensor, which incept pressure signal and transform pressure signal to simulative electro-signal. These simulative electro-signals were transmitted to the Bridge Amplifier of Powerlab system (ML221). After magnified and filter, and so on, the signals were transmitted to the Host Computer of Powerlab (Powerlab 8/30). In the Host Computer, these signals were transformed digital signals and were imported the computer by USB. At last, they were registered and analyzed using Chart software.

B. Method

System zero-resetting and Scale: We must zero amplifier and transducer before using Millar pipe. Then we scale Millar pressure-pipe according to Fig.1. We need CP300 pressure-sensor (KIMO), Millar pipe, injector, and so on.

The method of measuring IOP: Rabbits were anesthetized with 2% intravenous pentobarbital sodium and the dose is 1.5ml/kg. At the same time, Rabbits were injected with 0.2ml...
atropine. After 5min, all muscles of rabbits were relaxed and rabbits breathed reposefully. After cornea became slow-response, conjunctiva was clipped by using ophthalmological nipper and intravenous indwelling needle (20G) was sideling inserted into the position apart from limbus cornea 1mm. To avoid touching iris and other organizations of eyes, the needle would be drawn back to the position far from casing head 0.5mm when intravenous indwelling needle (20G) was inserted into anterior chamber about 1mm. Then the casing was moved to the position above pupil and the core of needle was withdrawn. Millar pipe was embedded in anterior chamber along the casing and ophthalmological nipper was loosed. At last, the casing was removed from anterior chamber and Millar transducer was adjusted so that the induction part of the transducer was above pupil. Chart software could trace the IOP of anterior chamber automatically. The rabbits were timely anesthetized and the status of rabbits was observed and recorded.

![Figure 1. Calibration Millar transducer](image)

III. RESULT

Aqueous humor of flow rate was 2-3uL/min in rabbits under normal condition. The aqueous humor outflow was about 0.1ml when the needle was embedded into anterior chamber and it would be resumed in 50 minutes. In addition, we found that the value became stable 1 hour later by experiments. So the data that were obtained after the transducer had been embedded for one hour were as effective data to obtain the IOP of anterior chamber in the 24 hours.

A. Mean of the normal IOP of anterior chamber of rabbits

We acquired seven group experimental data using this method and analyzed (\( \overline{X} \pm S \)) of these data. The average intraocular pressure of anterior chamber in normal rabbits distribute according to Fig.2.

B. Comparison between experimental results

The IOP of anterior chamber measured in this experimental method was lower than the value (2.58 ±0.31KPa) measured by Tono-Pen tonometer at central cornea in paper of Zhang Hong[2] and other authors. The IOP of anterior chamber we measured during the day was about 1.68 ± 0.08 to 2.74 ± 0.83KPa. It was about 400Pa lower than the rabbit anterior chamber pressure (2.61 ± 0.52 Kpa) measured during the day which was reported by JIA Li-jun, et al[3]. And it was slightly lower than the average intraocular pressure (2.61 ± 0.26 KPa) of New Zealand rabbit in 24 hours measured with Bar-Ilan Gas Tonometer. However it was about 400Pa higher than the scope of the anterior chamber pressure (0.93-2.26) KPa measured in 24 hours reported by McLaren et al[4].

![Figure 2. The average intraocular pressure of anterior chamber in normal rabbits under pentobarbital anesthesia](image)

IV. DISCUSSION

All anaesthetic may result in intraocular pressure descending observably, but the degressive degree using only one kind anaesthetic is lower than using several kind anaesthetics. The intraocular pressure in night was higher than than in day according to McLaren [4], but we found the intraocular pressure in night was lower than it in day. After analyzing causes, we usually used anaesthetic in the morning so that the physiological parameter of rabbits could debase.

In addition, aqueous humor would flow outside (about 0.1ml) when sensor inserted anterior chamber and posterior chamber. It would affect the value of IOP.

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REFERENCES


