

Simple and fast orotracheal intubation procedure in rats

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Summary. *Introduction:* Endotracheal intubation in the rat is difficult because of the extremely small size of anatomical structures (oral cavity, epiglottis and vocal cords), small inlet for an endotracheal tube and the lack of proper technical instruments. *Material and Methods:* In this study we used seventy rats weighting 400–500 g. The equipment needed for the intubation was an operating table, a longish of cotton, a cotton tip, orotracheal tube, neonatal laryngoscope blades, KTR4 small animal ventilator and isoflurane for inhalation anaesthesia. Premedication was carried out by medetomidine hydrochloride 1 mg/mL; then, thanks to a closed glass chamber, a mixture of oxygen and isoflurane was administered. By means of a neonatal laryngoscope the orotracheal tube was advanced into the oral cavity until the wire guide was visualized through the vocal cords; then it was passed through them. The tube was introduced directly into the larynx over the wire guide; successively, the guide was removed and the tube placed into the trachea. Breathing was confirmed using a glove, cut at the end of a finger, simulating a small balloon. *Results:* We achieved a fast and simple orotracheal intubation in all animals employed. *Conclusions:* We believe that our procedure is easier and faster than those previously reported in scientific literature. (www.actabiomedica.it)

Key words: endotracheal intubation in the rat, simple and fast orotracheal intubation, rat model, inhalation anaesthesia, experimental surgery

Introduction

In an attempt to perform experimental surgery and in vivo trials, small laboratory animals become essential to reach such objective; therefore, procedures of inhalation anaesthesia are often required (1). Endotra-

cheal intubation in the rat is quite difficult because of the extremely small size of anatomical structures (oral cavity, epiglottis and vocal cords), small inlet for an endotracheal tube and the lack of proper technical instruments (2).

These factors greatly increase the risk of damage of the aforementioned structures, causing death of animals and failure of laboratory experiments (3).

In this work, we describe a technique to improve the traditional procedure for rat tracheal intubation.

* Giovanni Tomasello and Francesco Damiani shared the first authorship.

Materials and Methods

The experiments described in this work, comply with the requirements of the German Animal Protection Act of 1986 and with the guidelines set by the Government Committee on Animal Experimentation. All of the animals enrolled in this study were used for Surgical examinations under inhalation anaesthesia; no animals were killed. A total number of 70 rats (35 aged 25 weeks and 35 aged 30 weeks) weighting 400-500 g, were used. For the experiment, an operating table, a longish of cotton, a cotton tip, orotracheal tubes, neonatal laryngoscope blades, a KTR4 small animal ventilator and isoflurane for inhalation anaesthesia, were employed. Before intubation, each rat was pre-medicated with medetomidine hydrochloride 1 mg/mL; then it was positioned in a closed glass chamber where it breathed a mixture of oxygen and isoflurane until its eyelid closure reflex was lost; a 22-Gauge catheter was put into the femoral artery to allow continuous monitoring of heart rate, blood pressure and blood gas analysis. The rat was then positioned on the operating table and a longish of cotton was hooked around its upper incisors. The anaesthesiologist stood beyond rat's mouth; animal's mouth was opened with the blade of the neonatal laryngoscope and the tongue was pushed on one side using the cotton tip (Fig. 1).

Once the vocal cords were identified, the tube was advanced into the oral cavity until the wire guide was visualized through the vocal cords and then it was



Figure 1. The anaesthesiologist stands beyond the rat's mouth; the animal's mouth is opened with the blade of a neonatal laryngoscopy and with the aid of the cotton tip the tongue is pushed to one side

passed through them. The tube was further advanced directly into the larynx over the wire guide; the guide was removed and the tube placed into the trachea. The cut end of a glove finger was used as a balloon and connected to the tube, to confirm, thanks to excursions synchronous to those of the chest (inspiration-expiration), the successful intubation; the tube was connected to the ventilator and fixed to the operating table. The expansion of chest represents the correct positioning of the tube just connected to the respirator. The respiratory rate of the animal was 55/min, inspirational time 30%, 9-15 mmHg of mean pressure, pressure controlled mode, tidal volume was 2 ml/kg to 2.5-3%; isoflurane was administered with 50% air-oxygen. To prevent the loss of the gas in the environment a system of evacuation of gas through the application of a negative pressure was used.

Results

We intubated 70 laboratory mice for abdominal experimental surgery; the average time needed for an expert anaesthesiologist to complete the experiment was 4 minutes; for novices the average time was 13 min. We had five (5.5%) incorrect intubations, in which the tube was inserted into the oesophagus. One rat died for unrecognized oesophageal intubation. No damage to the larynx, trachea and bronchi were reported. Bleedings were not signalled. Pathological examination performed after the experiment showed moderate oedema of the vocal cords.

Discussion

The orotracheal intubation has been described by various Authors. The problems related to the method can be summarized by three aspects: anatomy of the upper airway of the rat, positioning of the animal during the method, the choice of suitable material (4-6). The Literature shows that a 90% success rate could not be obtained by blind intubation technique (7). Most of these methods are unsatisfactory and associated with high failure and high cost complications, including optic fiber, minitracheotomy, head-mounted, mirror-reflected, adjustable focus light, surgical microscope, otoscope and inclined metal plane (8-12).

Kesel et al (5) described a technique of intubation with proper material to visualize epiglottis under direct vision, but this technique exposed animals to a damage of the upper airways. Sometimes, the techniques of blind intubation require a great number of attempts that cause oedema, bleeding and damage to larynx and therefore should be avoided. Moreover, Kastle et al (13) described a simple intubation method, using an inclined metal plane and the Seldinger's technique; unfortunately, this method is not easily reproducible in all laboratories.

Conclusions

The minitracheotomy is an accurate method to ensure control of the upper airway, however it takes time and it is not suitable when the experiment requires a long period of follow up. Intubation with surgical microscope and illuminated with optic fiber, described by various authors, are good atraumatic and safe methods; their limit is related to a not rapid learning curve and high costs. In our opinion the technique described above is economic and easy to learn and allows researchers to keep the steady state necessary for the laboratory experiments. We emphasize the role of the technical instruments (the tube) with respect to the position that the rat should assume which is described in the scientific literature as the essential step of the technique.

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