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FEASIBILITY OF SIMULATED LIVE THORACOSCOPIC AND LAPAROSCOPIC SURGERY IN RABBITS

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Introduction

- Laparoscopic and Thoracoscopic skills are acquired over time. There is a need for simulation for thoracoscopic and Laparoscopic surgery in neonates.
- Rabbits were chosen as they are mammals and their size is similar to human neonates.
- Rabbits present unique challenges for thoracoscopy and laparoscopy due to their small size, delicate anatomy, and physiological sensitivity to stress and anaesthesia.

Purpose

- To demonstrate simulation and establish guidelines for standard operating procedures for safe pediatric laparoscopy and thoracoscopy surgery in Rabbits

Methods

- After Ethical Clearance (319/IAEC-1/2021), rabbits were given general anaesthesia with continuous monitoring for multiple surgical procedures. The important surgical steps and ventilator parameters were recorded. The rabbits were divided into two groups (1.7<2.5 kg and >2.5 -3.5 kg) according to weight to compare the ventilation parameters.

Figure-1- Rabbit is shaved from the abdomen side to perform surgical procedures
Figure-2- Size of pupil of the the rabbit has been enlarged after giving anaesthetic dosage.

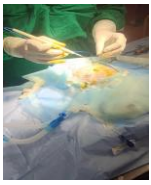

Fig. 3) Thorax was examined by laryngoscope, 4) Incision was made in the stomach 5) suturing is done after the surgery

Results

- 7 rabbits (4 males), aged median 2 months (2-3 months), weighing median of 2.5 (1.7-3.5) kg were operated.
- The ventilation parameters during anesthesia were kept as peak Inspiratory pressure(PIP); peak Inspiratory pressure(PEEP); Fraction of Inspired Oxygen (FiO2), and respiratory rate as 17-30;5;21-40;30-70.
- The Carbon dioxide insufflation pressure was kept at 2-5 mmHg; 4-8 mmHg for Thoracoscopy; Laparoscopy.
- 16 procedures were done on 7 rabbits during 8 operative sessions. These included thoracoscopic lobectomy: esophageal repairs: fundoplication: nephrectomy: bowel anastomosis in 3;4;5:2:2.
- For thoracoscopic procedures, in a semi-prone (side-lying) position, a 5 mm camera port was placed in the mid-thorax along the posterior axillary line, with two 3mm working ports in the anterior axillary line. The targeted lung lobe was identified and dissected using cautery and clips to secure the vessels and bronchus. For esophageal repair, an incision was made in the esophagus and then closed.
- For laparoscopic fundoplication, the liver was retracted, the stomach mobilized, the crus of the diaphragm approximated and a stomach wrap was created around the esophagus.
- All the rabbits tolerated anaesthetic doses well throughout the surgeries.
- The rabbits were sacrificed following the experimental procedures, under institutional and ethical guidelines for the care and use of laboratory animals.
- There was no difference between rabbits 1.7-2.5 kg and >2.5 -3.5 kg for FiO2 and RR (p>0.05). However, there was significant difference for PIP 20+7 vs 25+8, p<0.0412.

Weight of Rabbits	Gender	Dosage	Procedures done	Split Duration	Total Duration
3 Kg	Male	0.3 ml Ketamine, 0.3 mg Etomidate, 0.3 mg Midazolam and 0.3 mg Succinyl Choline	Session-1: Thoracoscopic Lobectomy, Session-2: Esophageal Repair.	90 90	3 hrs
3.5 Kg	Male	0.35 ml Ketamine, 0.35 mg Etomidate, 0.35 mg Midazolam and 0.35mg Succinyl Choline	Laparoscopic Fundoplication, Laparoscopic Nephrectomy	170 70	4 hrs
1.64 kg	Female	1 ml Ketamine, 0.82 Midazolam, 0.16 mg Succinyl Choline	Laparoscopic Fundoplication, Nephrectomy, Bowel anastomosis.	150 40 50	4.5 hrs
2.5 kg	Female	8ml dextrose, 10 unit Adrenaline, 10 unit Atropine, 0.25ml Ketamine	Laparoscopic Fundoplication, Bowel Anastomosis	160 50	3.5 hrs
1.8 kg	Male	0.6 ml Ketamine, 0.1 unit Succinyl Choline, 0.5 ml Midazolam	Thoracoscopic Lobectomy, Esophageal Repair	60 60	2 hrs
2.4 kg	Male	0.24 ml Ketamine, 0.24 mg Midazolam and 0.24 mg Succinyl Choline	Esophageal Repair, Laparoscopic Fundoplication	50 100	2.5 hrs
2.7 kg	Female	10 ml Dextrose, 10 unit Atropine, 0.27 ml Ketamine, 0.27 mg Succinyl Choline	Thoracoscopic Lobectomy, Esophageal Repair, Fundoplication.	30 30 60	2 hrs

Discussion

- Different surgical procedures were carried out on rabbits. The tidal volume and respiratory rate throughout the surgical procedures was 30ml and 70/min respectively which is ideal for neonates and little children. The duration of anaesthesia and surgery decreased with the learning curve.

Conclusion

- The Rabbit model is a good model to demonstrate neonatal laparoscopic and thoracoscopic surgery.
- The duration of the surgery decreased as the learning curve increased.

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