26136 - PRESSURES EXERTED BY ENDOBRONCHIAL DEVICES: IN-VITRO MODEL

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INTRODUCTION: Double-lumen endobronchial tubes (DLT) and endobronchial blockers (EBB) may be employed to achieve one-lung ventilation (OLV). Previous studies have measured the tracheal mucosal pressure exerted by the cuff of endotracheal tubes (1,2). High cuff pressures have been shown to cause high mucosal pressures and a reduction in mucosal blood flow in both animal and human studies, with the increased risk of mucosal ischaemia (3,4). We aimed to directly measure the pressure exerted by the bronchial cuff of a DLT and by the cuff of three types of EBB, using a validated in-vitro model.

METHODS: We studied left-sided DLT sizes 35, 37, 39 and 41, and three types of EBB, the Arndt, Cohen and Fuji. Silicon tubing with a 12.8 mm internal diameter modelled as an adult mainstem bronchus, as previously described (5). We measured the pressures exerted by the cuff using four strain-gauge microchip sensors, positioned on the anterior, posterior and lateral surfaces of the cuff, as previously described and validated (1,6). The pressures exerted were recorded with 1 ml increments in cuff volume until maximum inflation was achieved. Simultaneously, we measured the intra-cuff pressure.

RESULTS: Increases in intra-cuff volume (up to 6 ml in DLTs; up to 10 ml in EBBs) produced linear increases in intra-cuff pressure to a maximum of 126 mmHg for the DLTs and 160 mmHg for the EBBs. The pressures exerted by the cuffs of the DLTs ranged from 0 – 12 mmHg (size 35), 0 – 72 mmHg (37), 0 – 61 mmHg (39) and 0 – 109 mmHg (41). Pressures exerted by Arndt and Cohen EBB cuffs were less than 30 mmHg up to 10 ml of inflated volume. The pressure exerted by the Fuji EBB was less than 30 mmHg up to 8 ml of volume, but increased to 133 mmHg at 10 ml. The pressures exerted by the endobronchial devices are displayed in figure 1.

DISCUSSION: Previous work has suggested that the pressure transmitted by an EBB cuff to the bronchial mucosal wall is 40 – 60 mmHg (5), which exceeds the recommended pressure of 30 mmHg to avoid mucosal injury (7). This value was calculated from the intra-cuff pressure and not directly measured. We have shown that at usual clinical intra-cuff volumes (2 – 4 ml for a DLT and 6 – 8 ml for an EBB), the transmitted pressures are less than 30 mmHg.

REFERENCES: 1. Br J Anaesth 1999; 82: 708-11, 2. Anesthesiology 2002; 96: 1074-7, 3. Am J Surg 1977; 133: 562-8, 4. Br Med J (Clin Res Ed) 1984; 288: 965-8, 5. J Cardiothorac Vasc Anesth 1992; 6: 404-8, 6. Anesthesiology 2000; 92: 620-1; 7. Am J Surg 1978; 135:452-7.

Figure 1. Pressures exerted by endobronchial devices on an in-vitro model. DLT: double-lumen tube, EBB: endobronchial blocker.

Figure: Mid-esophageal TEE view during systole at 138° showing the typical hinged appearance of the AMVL due to tethering by secondary chords.