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ANESTHETIC CONSIDERATIONS FOR TECAB SURGERY ON BEATING HEART

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Introduction: Improved interactions between robotic-assisted surgical system and surgeon allow different minimally invasive cardiac surgical procedures¹. We report our initial experience in a group of 20 patients, with a significant stenosis of the left anterior descending artery (LAD), scheduled for a totally endoscopic coronary bypass grafting (TECAB) on a beating heart. Surgery was done with the aid of the da-Vinci surgical robot (Intuitive Surgical, Mountain View, CA) and a mechanical stabilizer on the LAD.

Methods: After written informed consent, 19 men and 2 women with a mean age of 54.8 ± 14 years were enrolled in the study protocol. Monitoring included standard electrocardiogram leads II–V5, central venous pressure (CVP), transesophageal echocardiography, radial artery catheter replaced for 6 patients by an arterial pulse contour analysis system (PiCCO, Pulsion Medical Systems, Germany). External defibrillator pads were applied. Induction and maintenance consisted of a target-controlled infusion of remifentanyl and propofol with cis-atracurium. Intubation was performed with a left-sided double-lumen endotracheal tube for left lung exclusion during left internal mammary artery (LIMA) dissection and surgical approach to the LAD. To decrease patient-robot conflict and to avoid brachial plexus injury, patients were placed in the supine position with a 30° elevation of the left hemithorax with the left arm positioned alongside the posterior axillary line. Low flow carbon dioxide (CO₂) insufflation with an intrapleural pressure of 8 ± 0.6 mmHg was used to allow the enlargement of the pleural space. 1.5 mg/kg heparin was administered before LAD clamping and ischemic preconditioning was performed. Normothermia was maintained by all means and 0.1 mg/kg intravenous bolus of morphine was administered 30 minutes before the end of surgery.

Results: The mean duration of one-lung ventilation (OLV) was 236 ± 57 minutes. Mean LAD clamping time was 49 ± 7 minutes. Hemodynamic parameters were studied in a cohort of 6 patients by arterial pulse contour analysis (Table): global end-diastolic volume (GEDV), left ventricular stroke volume variation (SVV), cardiac output (CO), mean arterial pressure (MAP), heart rate (HR), CVP

were analyzed. Parameters were measured after induction (baseline, T1), after OLV (T2) and after OLV and insufflation (T3) with standardized tidal volume. Wilcoxon Rank Sum tests were used to compare parameters between T1 and T2, T1 and T3. A p<0.05 was considered significant.

Two patients presented ventricular fibrillation (VF) due to ischemia. Seven conversions to thoracotomy occurred mainly in the initial learning curve and were caused by bleeding (n=3), problem of LIMA harvesting (n=2), breakdown of the stabilizer (n=1), video system dysfunction (n=1). One conversion to sternotomy with cardiopulmonary bypass (CPB) occurred due to VF and ischemia. Eighteen patients (90%) were extubated in the operating room, without reintubation.

Morphine consumption during the first 24 hours was 45 ± 20 mg via a patient-controlled device.

	T1	T2	T3	T1 vs T2	T2 vs T3
GEDV (ml)	1249 362	1207 385	998 232	NS	P= 0.046
SVV %	13.4 6	12.4 3	17.6 4.6	NS	P= 0.046
CO (L/min)	4.3 0.8	4 0.8	3 0.6	NS	P= 0.028
TAM mmHG	81 11	81 8	77 7	NS	NS
HR b/min	58 6	54 9	58 10	NS	NS
CVP mmHg	8.7 3	9.7 2	13.7 3	NS	P= 0.028

Conclusions: TECAB on a beating heart is an innovative new approach to coronary revascularization but necessitate prolonged OLV, correct patient positioning, close hemodynamic monitoring, monitoring of ischemia and avoidance of hypothermia. CO₂ insufflation produced in a cohort of 6 patients a significant decrease of GEDV, SVV, parameters of preload. CO decreased also significantly and CVP increased significantly, due to the artificial positive intrapleural pressure. Conversions to thoracotomy or sternotomy with CPB are always possible. Postoperative analgesia must be efficaciously provided.

Reference: 1: D'Attelis N. J Cardiothorac Vasc Anesth 16: 397-400, 2002.