Impact of driving pressure on local inflammatory response in the ventilated lung after one lung ventilation period

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Background and Goal of Study:

Driving pressure (DP) is equivalent to the ratio between the tidal volume and the compliance of the respiratory system. Previous studies have shown an association between DP with lung injury and mortality¹. The goal of the study was to asses how the level of DP during one-lung ventilation (OLV) along lung resection surgery could affect the pulmonary inflammatory response.

Materials and Methods:

We designed a prospective study that included 171 patients undergoing lung resection surgery that expended >1 hour of OLV. All of them were ventilated with volume-controlled mode (VCV): tidal volume (TV) 8 ml/kg, PEEP 5 cmH2O, FiO2 0.5 and respiratory rate modified to maintain EtCO2 30-35 mmHg; during OLV: TV 6 ml/kg, PEEP 5 cmH2O, FiO2 0.6 and permissive hypercapnia. Bronchoalveolar lavage (BAL) was performed in both lungs before and after OLV period to measure inflamatory markers. These markers were analysed using Western Blot. Haemodynamic and respiratory parameters (including DP) were registered at baseline, 30 min after initiating OLV, and at the end of OLV. Patients were divided in two groups: DP ≥20 (n21) or <20 cmH2O (n150) during OLV. Statistical analysis: Non-parametric test comparing markers between groups and bivariate correlation to find any difference between DP and cytokines were used.

Results and Discussion:

There was a significant correlation between proinflammatory cytokines measured in BAL at the end of surgery and DP values during OLV (Table 1). We did not observe any difference in pro-inflammatory cytokines before OLV between two groups but patients with a DP ≥20 had a more intense inflammatory response than patients <20 at the end of surgery (Table 2).

	r	P value
TNF alpha end OLV	,227	0,003
IL7 end OLV	,233	0,002
IL8 end OLV	,190	0,013
IL8/IL10 end OLV	,171	0,026
MMP2 end OLV	,241	0,002
MMP3 end OLV	,207	0,007
MMP7 end OLV	,178	0,02
MMP9 end OLV	,261	0,001

Table 1: Bivariate correlation between inflammatory lung biomarkers and driving pressure measured during OLV (only significant correlations)

	Groups		Baseline	End	Comparison between groups
	Driving Pressure OLV	N	Median (IQR)	Median (IQR)	P value
TNF alpha	>20	21	14.86(13.58-16.63)	24.89(21.47-27.45)	0.007
	<20	150	15.06(14.06-15.85)	20.99(19.93-24.47)	
IL7	>20	21	3.25(2.98-3.53)	5.65(5.10-6.39)	0.004
	<20	150	3.21(2.96-3.44)	5.12(4.98-5.61)	
IL8	>20	21	2.66(2.53-2.95)	51.28(38.51-58.99)	0.045
	<20	150	2.77(2.55-3.01)	33.98(24.87-57.81)	
IL8/IL10	>20	21	0.06(0.06-0.07)	1.30(0.97-1.49)	0.048
	<20	150	0.07(0.06-0.07)	0.75(0.56-1.42)	
MMP9	>20	21	1249(1166-1314)	1433(1402-1550)	0.001
	<20	149	1230(1119-1266)	1392(1306-1431)	

Table 2: Cytokines values obtained in ventilated lung both time before and after OLV

Conclusion:

To our knowledge, this is the first study comparing the relation between the effect of DP during OLV and pulmonary inflammatory response. The presence of a high DP during OLV in lung resection surgery is associated with an increase in the local inflammatory response.

1.Neto AS et al. Association between driving pressure and development of postoperative pulmonary complications in patients undergoing mechanical ventilation for general anaesthesia: a meta-analysis of individual patient data,Lancet respir med, 2016.