The usefulness of stroke volume variation to predict the fluid responsiveness in patients undergoing laparoscopic cholecystectomy.

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INTRODUCTION

Laparoscopic cholecystectomy

- Less painful, early ambulation → short hospital stay
- Enhanced Recovery After Surgery (ERAS) protocol can be applied.
 - : Use of goal-directed fluid therapy in ERAS protocol

Characteristics of Laparoscopic cholecystectomy

- CO₂ insufflation
- Reverse Trendelenburg position and left-side down position

Fluid responsiveness index as a guidance of fluid therapy

- Stroke volume can be affected by intrathoracic pressure change.
- Stroke volume variation (SVV, usually 12-15) can be measured at supine position
- CO₂ insufflation can increase intrathoracic pressure, but reverse Trendelenburg position may decrease intrathoracic pressure.

OBJECTIVES

We investigated changes of stroke volume index (SVI) after 250 ml fluid loading and usefulness of stroke volume variation to predict fluid responsiveness in reverse Trendelenburg positioned patients with pneumoperitoneum.

METHODS

➤ This is observation study with 42 patients

➤ Anesthesia

Induction: propofol 2 mg/kg, fentanyl 1 µg/kg
Neuromuscular blockade: 0.6 mg/kg of rocuronium bromide
Maintenance: Desflurane and medical air, oxygen (FiO₂: 0.5)

➤ Mechanical ventilation

: Tidal volume 8 ml/kg, PEEP 5 cmH₂O, maintaining ET-CO₂ 30-35 mmHg

➤ Hemodynamic monitoring

Invasive blood pressure monitoring
Flotrac® and EV1000 system
Measurement variable

Fluid challenge protocol

- Fluid infusion: plasma solution 2 ml/kg/hr
- Fluid challenge: plasma solution **250 ml for 10 minutes**
- Parameter measurements at four time-points
 - T1: 1 minutes after tracheal intubation
 - T2: Before fluid challenge
 - T3: Immediately after fluid challenge
 - T4: At the time of skin closure
- Measurement parameter: CI, SVV, SVI, BP, HR, BT, ET-CO₂

- Definition of positive fluid response
 - : **15% of SVI increase** after fluid challenge

RESULTS

➤ Demographics

Variable	overall	Non-responder (n=14)	Responder (n=28)	P
Age (year)	54 [46–62]	56 [39–69]	53 [46–60]	0.660
Sex (Male)	24 (57.1%)	8 (57.1%)	16 (57.1%)	1.000
Weight (kg)	62.3 [57.5–77.2]	61.2 [57.5–77.2]	63.1 [56.8–77.2]	0.979
Height (cm)	160.3 [154.1–169.0]	161.5 [157.5–169.0]	159.6 [154.0–169.2]	0.689
Preoperative albumin (g/dL)	4.2 [3.9–4.4]	4.2 [3.4–4.5]	4.3 [4.1–4.4]	0.185
Preoperative creatinine	0.76 [0.67–0.83]	0.70 [0.66–0.81]	0.79 [0.70–0.87]	0.146
Preoperative hemoglobin (g/dL)	13.4 [12.7–15.6]	13.2 [12.6–14.3]	13.8 [12.8–15.7]	0.323

➤ Comparison between two groups

Variable	Non-responder (n=14)	Responder (n=28)	P
Intraoperative parameters			
Anesthesia time	60 [55–65]	55 [50–60]	0.1233
Operation time	31 [29–40]	30 [27–40]	0.3144
Bispectral index, mean	38 [35–40]	37 [30–43]	0.751
Total administered crystalloid (ml)	360 [300–450]	326 [310–350]	0.2268
End tidal anesthetics concentration (vol %)	0.7 [0.6–0.8]	0.7 [0.7–0.8]	0.862
Peak inspiratory pressure (cmH ₂ O)			
supine, no pneumoperitoneum	16 [14–17]	15 [14–17]	0.917
head-up, pneumoperitoneum	21 [19–24]	19 [17–22]	0.131
Tidal volume	480 [415–523]	445 [400–500]	0.416
Postoperative parameters			
Gas out time (hours)	20.5 [17.5–42.4]	22.5 [18.2–40.1]	0.865
Postoperative nausea			
at PACU	0 (0%)	1 (3.5%)	
for 24 hour	5 (35.7%)	8 (28.6%)	0.641
Postoperative vomiting			
at PACU	0 (0%)	0 (0%)	
for 24 hour	1 (7.10%)	2 (7.10%)	1.000

➤ Prediction of fluid responsiveness

- Using SVV
AUC=0.871 (0.732 to 0.954 in 95% CI), P < 0.0001, **cut-off: SVV=11** (sensitivity 85.71%, specificity 85.71%)
- Using SVI
AUC=0.869 (0.752 to 0.986 in 95% CI), P < 0.0001, **cut-off: SVI=40** (sensitivity 100%, specificity 64.29%)

CONCLUSION

- SVV can predict fluid responsiveness in patients of reverse Trendelenburg position with pneumoperitoneum.
- SVV cut-off value of 11 or SVI of 40 ml/m² may be useful in goal directed fluid therapy of laparoscopic cholecystectomy.