A novel negative pressure-based visualization technique for abdominal Veress needle insertion

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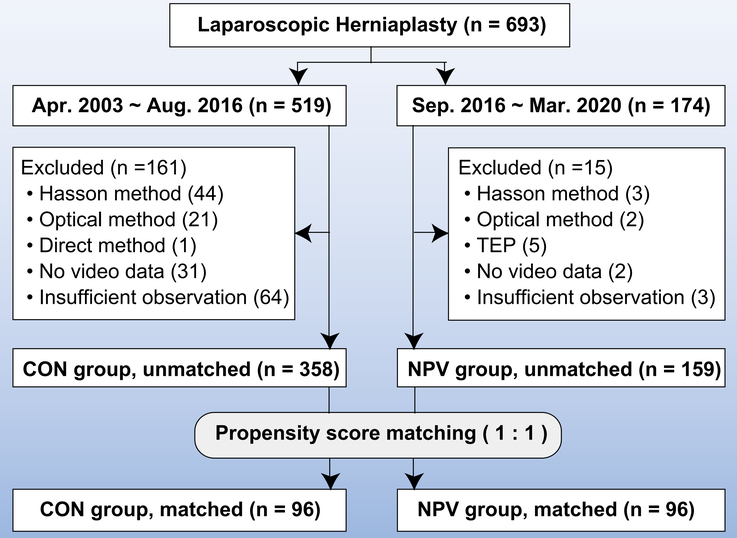
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Background

Abdominal Veress needle insertion is commonly performed to generate a pneumoperitoneum during laparoscopy; safety tests are conducted to confirm accurate needle tip positioning into the abdominal cavity. However, these do not help directly visualize peritoneum puncture. We developed and validated a new negative pressure-based visualization technique (NPV) that helps instantly visualize the entrance of the Veress needle into the abdominal cavity.

Methods

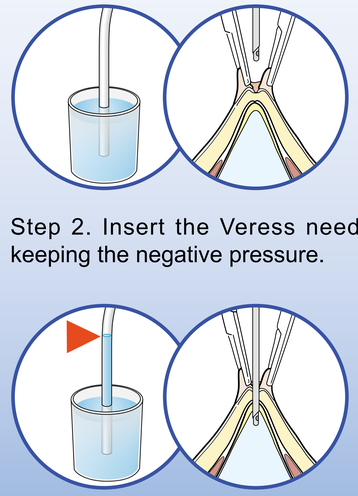
Patients who underwent laparoscopic hernioplasty that entailed pneumoperitoneum creation using Veress needle insertion were divided into the conventional technique (CON) and NPV groups. Propensity score-matched patients were selected and analyzed. The primary outcome was failed entry, and the secondary outcomes were incidence of extraperitoneal, omental, and mesenteric emphysema.



Negative pressure visualization technique



Figure 1. An assembly of the NPV system



Step 1. Making negative pressure in the abdominal cavity.

Step 2. Insert the Veress needle with keeping the negative pressure.

Step 3. Elevating the water level in the tube (red arrowhead) when the Veress needle entering into the abdominal cavity. Then, the tube is replaced with the insufflation tube.

Figure 2. Schema of the NPV

Results

Table 1. Demographic characteristics of the propensity-matched patients

	CON (n = 96)	NPV (n = 96)	*p* value	Std. diff
Age (years)	66.6 ± 13.3	66.8 ± 14.2	0.95	0.01
Sex, male	87 (90.6)	86 (89.6)	1.00	-0.04
BMI (kg/m^2)	22.6 ± 2.8	22.6 ± 2.8	0.96	0.01
Abdominal surgery history	18 (18.8)	18(18.8)	1.00	0.00
Surgeon experience (cases)	38 .5 (17-53.5)	41 (16-54.3)	0.96	0.01

Table 2. Incidence of failed entry, emphysematous complications, and abdominal adhesions in the propensity-matched patients

	CON (n = 96)	NPV (n = 96)	*p* value
Failed entry	9 (9.4)	0 (0.0)	0.003
Extraperitoneal emphysema	6 (6.2)	0 (0.0)	0.029
Omental emphysema	6 (6.2)	10 (10.4)	0.434
Mesenteric emphysema	1 (1.0)	2 (2.1)	1.000
Abdominal adhesion	7 (7.3)	6 (6.2)	1.000

- The significant decrease of "failed entry" in the NPV indicated that the NPV was easy to judge whether the needle was properly positioned in the abdominal cavity.
- The significant decrease of "extraperitoneal emphysema" in the NPV indicated that the moment of elevation of the water level coincided with the peritoneal puncture.

Conclusion

Pneumoperitoneum creation using NPV yielded positive results, without failed entries and a considerably reduced incidence of extraperitoneal emphysema.