

Comparison of Valve-less and Standard Insufflation on Pneumoperitoneum-Related Complications in Robotic Partial Nephrectomy: A Prospective Randomized Trial

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Background

- Subcutaneous emphysema (SCE) is a well-documented complication of laparoscopic surgery and results from leakage of CO₂ into the subcutaneous tissue
- Increased insufflation pressure is a risk factor for SCE
- Valve-less insufflation system (commercially known as AirSeal) maintains better pneumoperitoneum stability but how it translates to improvement in insufflation complications is unclear

Objective

- To compare the rates of SCE and other insufflation-related complications between AirSeal Insufflation System (AIS) and conventional insufflation system (CIS)
- To identify potential risk factors for development of SCE in patients undergoing robotic partial nephrectomy

Methods

- A prospective randomized controlled trial was conducted during a 1.5-year period to compare insufflation-related complications in robotic partial nephrectomies by a single surgeon
- Thirty-one patients were recruited for each group: AIS at 12 mmHg, AIS at 15 mmHg, and CIS at 15 mmHg
- Primary outcome was rate subcutaneous emphysema (SCE)
- SCE assessed by exam every 30 min intraoperatively and by chest Xrays postoperatively
- Secondary outcomes included rates of pneumothorax (PTX), pneumomediastinum (PMS), shoulder pain scores, overall pain scores, pain medication usage, insufflation time, recovery room time, and length of hospital stay
- Predictors for SCE were assessed with univariate and multivariate logistic models

Results

Table 1. Rates of Subcutaneous Emphysema, Pneumothorax, and Pneumomediastinum

	AIS 12 mmHg	AIS 15 mmHg	CIS 15 mmHg	P-value	P-value
	N (%)	N (%)	N (%)	AS 12 vs CIS	AS 15 vs CIS
SCE	6 (19.4)	12 (38.7)	15 (48.4)	0.03	0.61
PTX	0 (0)	1 (3.2)	3 (9.7)	0.24	0.61
PMS	3 (9.7)	4 (12.9)	6 (19.4)	0.47	0.73

Table 2. Effect of Insufflation Type on Overall Pain, Shoulder Pain, Pain Medication Usage, and Length of Stay

	AIS 12 mmHg	AIS 15 mmHg	CIS 15 mmHg	P-value	P-value
	Mean (SD)	Mean (SD)	Mean (SD)	AS12 vs CIS	AS15 vs CIS
Overall Pain					
4 hour	3.9 (2.2)	3.3 (2.3)	3.8 (2.2)	0.86	0.41
8 hour	3.9 (2.3)	3.1(2.1)	4.2 (2.7)	0.55	0.09
12 hour	3.1 (2.3)	3.4 (2.8)	4.4 (2.2)	0.03	0.13
Discharge	2.7 (1.7)	2.2 (2.2)	2.9 (1.8)	0.67	0.19
Shoulder Pain Scale					
4 hour	0.6 (1.1)	0.7 (1.1)	1.0 (1.4)	0.23	0.39
8 hour	0.6 (1.2)	0.6 (1.4)	1.6 (1.9)	0.01	0.02
12 hour	0.4 (0.6)	0.7 (1.5)	1.4 (1.8)	0.003	0.08
Discharge	0.5 (1.5)	0.6 (1.3)	1.0 (1.5)	0.21	0.25
Morphine Equivalents	86.9 (56.1)	79.1 (56.41)	82.4 (38.4)	0.95	0.39
Length of Stay (days)	1.26 (0.68)	1.13 (0.34)	1.19 (0.40)	0.60	0.50

- Baseline characteristics of the study groups were similar, ensuring good randomization
- Rate of SCE was significantly lower in the AIS 12 group vs CIS (19% vs 48%, p=0.03)
- Shoulder pain was less in both AIS groups compared to CIS, especially at 8 hr postoperatively
- No difference between overall pain scores, morphine equivalent use, insufflation time, recovery room time, and length of hospital stay between AIS groups VS CIS
- Univariate analysis showed no smoking history (p=0.05), insufflation with AIS 12 mmHg (p=0.02), and transperitoneal surgical approach (p<0.001) to be significant predictors for lower risk of developing SCE
- When controlling for age, BMI, gender, smoking history, history of respiratory disease, insufflation type, and surgical approach, AIS 12mmHg and transperitoneal approach were significantly predictors for decreased risk of SCE (p<0.001)

Conclusion

- This prospective randomized trial demonstrates a significant decrease in rate of subcutaneous emphysema with AirSeal 12 mmHg compared to standard insufflation
- Shoulder pain was reduced in both AirSeal groups compared to the standard insufflation though overall pain medication use was not different