

MULTIPORTAL VIDEO-ASSISTED THORACOSCOPIC LOBECTOMY WITH NEW MULTI-JOINT WRISTED INSTRUMENTS: A NINE MONTH'S EXPERIENCE

Alexander Kern, Andreas Friedrich, Vera Froebel, and Steffen Drewes

Department of Thoracic Surgery, Fachkrankenhaus Coswig, Academic Teaching Hospital of the University Hospital Dresden, Germany. Center for Thoracic Surgery, Pneumology, Allergology and Respiratory Medicine

Background: Robotic-assisted lobectomy for non-small cell lung cancer (NSCLC) offers outstanding precision via robotic wristed instruments, but robotic surgery is expensive and has safety implications as the surgeon is un-scrubbed away from the patient's side without haptic feedback. By using the robotic-like wristed Artisential® instruments - especially for vessel dissection and lymphadenectomy -the benefits of robotic surgery can be achieved by the patient's side. We report our results in duo/triportal anatomic pulmonary resections with these articulating instruments during the first nine months of experience.

Methods: From April 2021 – January 2022, 16 consecutive VATS-lobectomies due to NSCLC have been performed using the wristed instruments through a duo/triportal approach. We have analyzed early outcomes of Artisential®-assisted lobectomies. Various parameters and experiences of these procedures were compared to a control group of 20 standard duoportal VATS lobectomies with exclusive use of conventional curved VATS instruments.

Results: In the Artisential® group, of 16 VATS lobectomies, 15 were successfully completed with the wristed instruments (one operation was converted to open surgery). The usual set up with the wristed instruments (anterior utility port, 1-2 ports in the 7th intercostal space) took the same time as standard VATS cases. Propensity-matched comparison showed that Artisential®-assisted procedures yielded a higher number of lymph nodes (17 ± 5 vs. 12 ± 6), $p < 0.05$). Ergonomics and comfortability for the surgeon, especially during lymphadenectomy, were better in the Artisential® procedures. Operative time, postoperative pain score, conversion rate, 30-day complication rate, and length of hospital stay were similar between the two groups.

Discussion: Duo/triportal VATS lobectomy with wristed instruments is a safe procedure with good perioperative results. Especially the ability to angle the instruments to 90 degrees in all directions with improved ergonomics enabled accurate dissection of the lymph nodes around the vessels and mediastinal nodal stations, with clear superiority to standard VATS instruments.

Clinicopathological variable	specification	No. standard VATS (n=20)	No. Artisential® VATS (n=16)	HR (95% CI)	p
Age (yrs)	Mean Range	68 47-78	63 45-82		not examined
Sex	Female Male	12 8	7 9		not examined
pTNM stage of NSCLC	IA IB IIA IIB IIIA	4 7 6 2 1	3 8 2 1 2		not examined
Operating time	(min)	165±36	157±24	1.0 (Reference) 1.2 (0.93-1.62)	0.09
Number of resected lymph nodes		12±6	17±5	1.0 (Reference) 1.3 (0.91-1.62)	0.034
Type of anatomic resection (+ LAD)	Right upper lobectomy Right middle lobectomy Right lower lobectomy Left upper lobectomy Left lower lobectomy	6 2 4 5 3	4 2 1 4 5		not examined
Conversion rate		1 (5%)	1 (6%)	1.0 (Reference) 1.1 (0.75-1.24)	0.42
Complications	Postoperative bleeding Leakage Pleural effusion Re-admission Surgical revision	0 3 3 1 0	0 4 2 0 0	1.0 (Reference) 0.9 (0.71-1.19)	0.51
Duration of postoperative stay	(days)	7±2	7±1	1.0 (Reference) 0.9 (0.71-1.19)	0.14
Pain score	VAS-score	2±1	2±1	1.0 (Reference) 1.1 (0.75-1.24)	0.58
Comfort scale (surgeon), 1-10		6	8	1.0 (Reference) 1.2 (0.97-1.55)	0.12

Table 1: Clinical and pathological characteristics of 36 patients, all with complete resection (R0) of their lung cancer, either by standard VATS or VATS with articulating instruments. Statistical analysis showed a significant difference between the two groups only with regard to the resected lymph nodes.



Fig. 3: The range of motion of the Artisential® end effector.

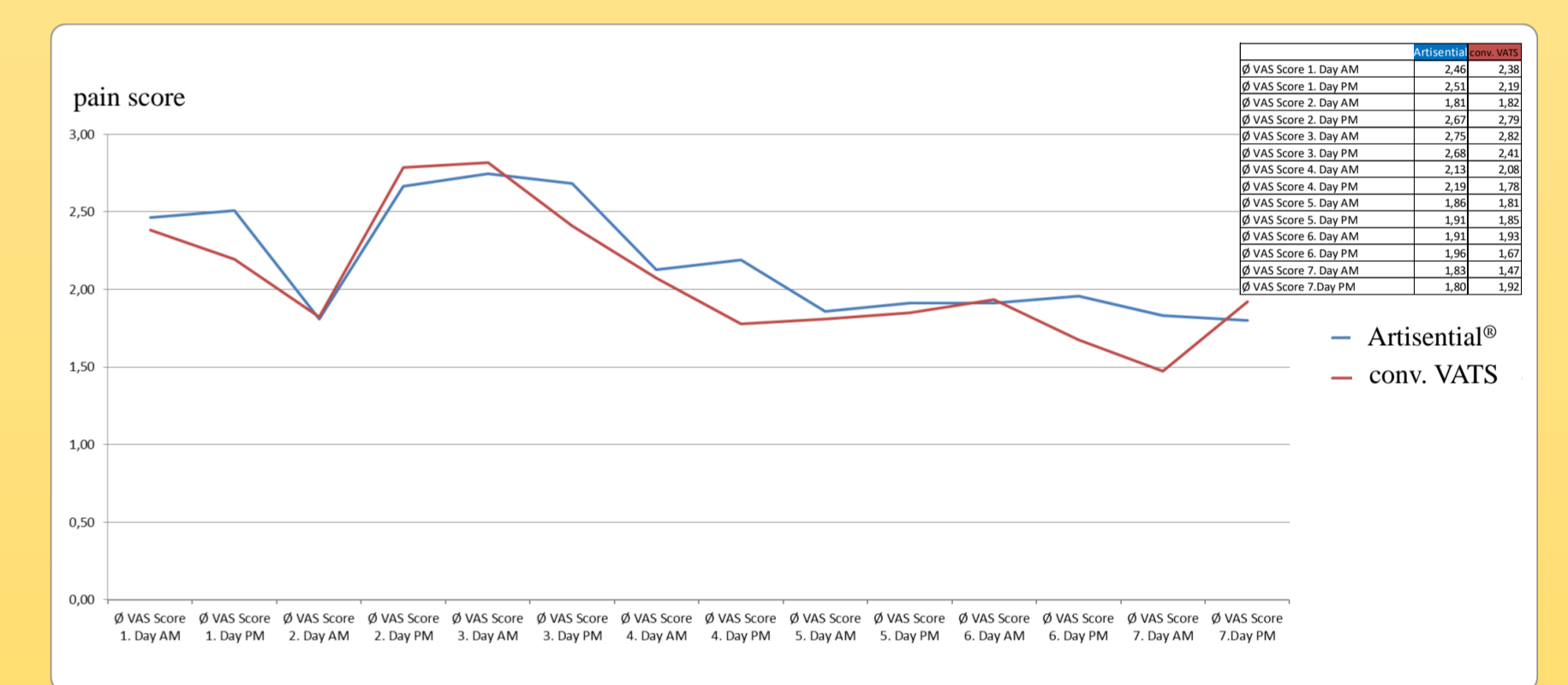


Fig. 4: Postoperative VAS-scores in the two groups showing no significant difference.

Hospitalization	GROUP					
	Artisential® VATS			Conventional uVATS		
	Median	25 - 75 P	Normal Distr.	Median	25 - 75 P	Normal Distr.
Stay_in_all_days	6,979	5,896 to 8,073	<0.0001	7,104	6,047 to 11,255	<0.0001
Stay_on_ICU_days	1,125	1,042 to 1,984	<0.0001	1,083	1,042 to 2,125	<0.0001
Stay_on_surgery_ward_days	5,146	4,093 to 6,864	<0.0001	5,938	4,370 to 7,745	<0.0001

Table 2: Comparison of Artisential® and standard VATS groups with regard to duration of postoperative stay on ICU and surgery ward.

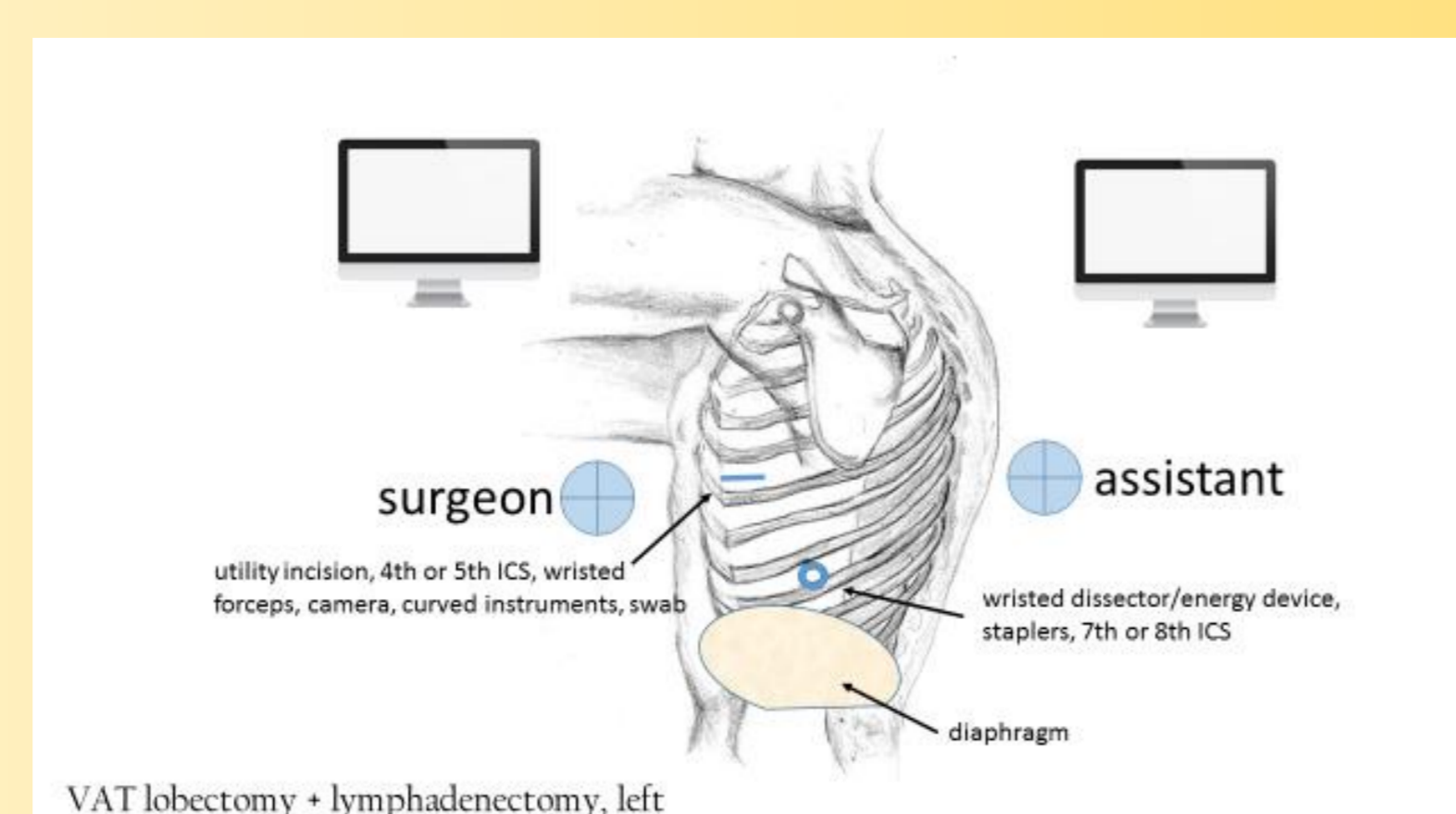
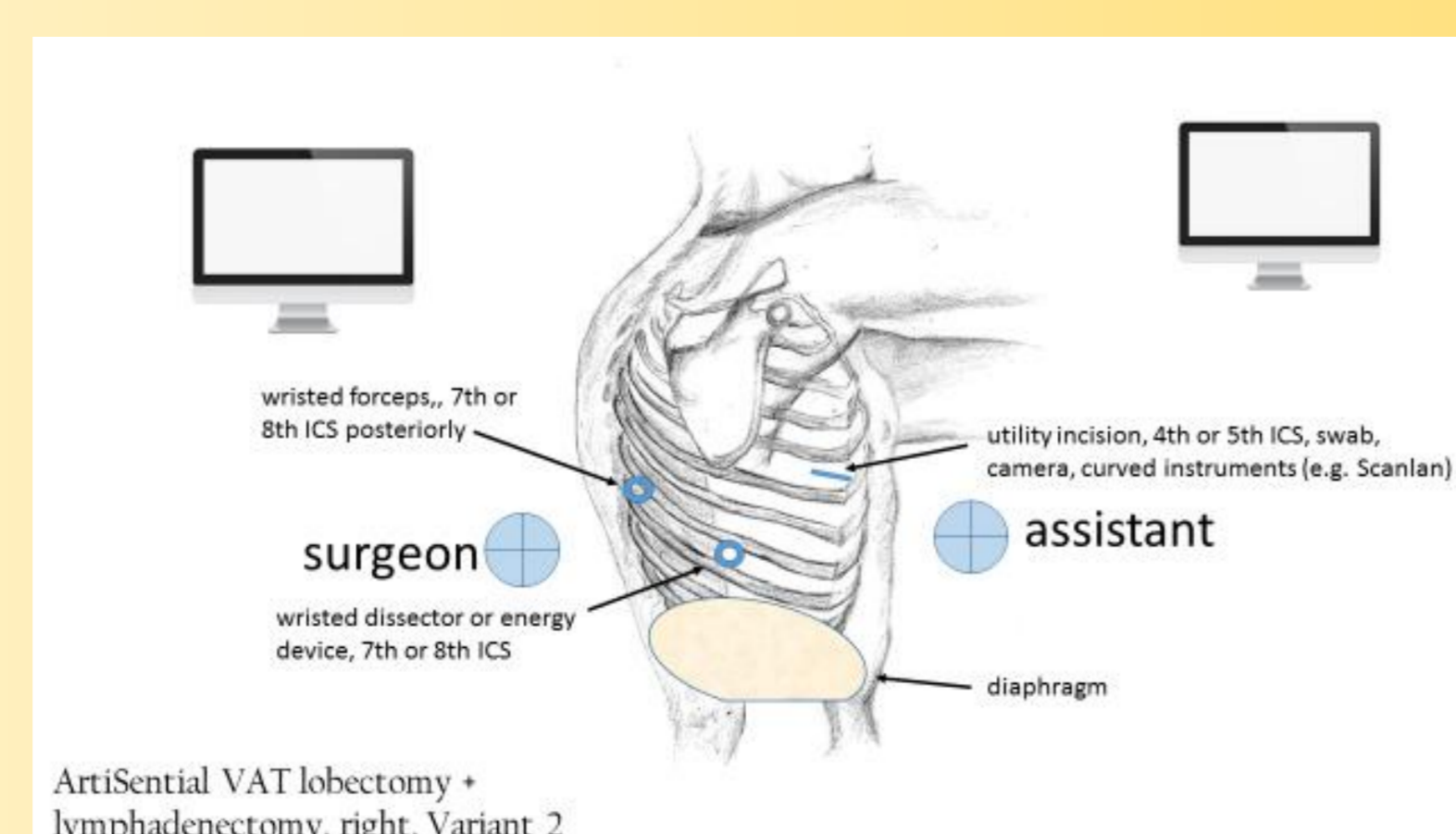
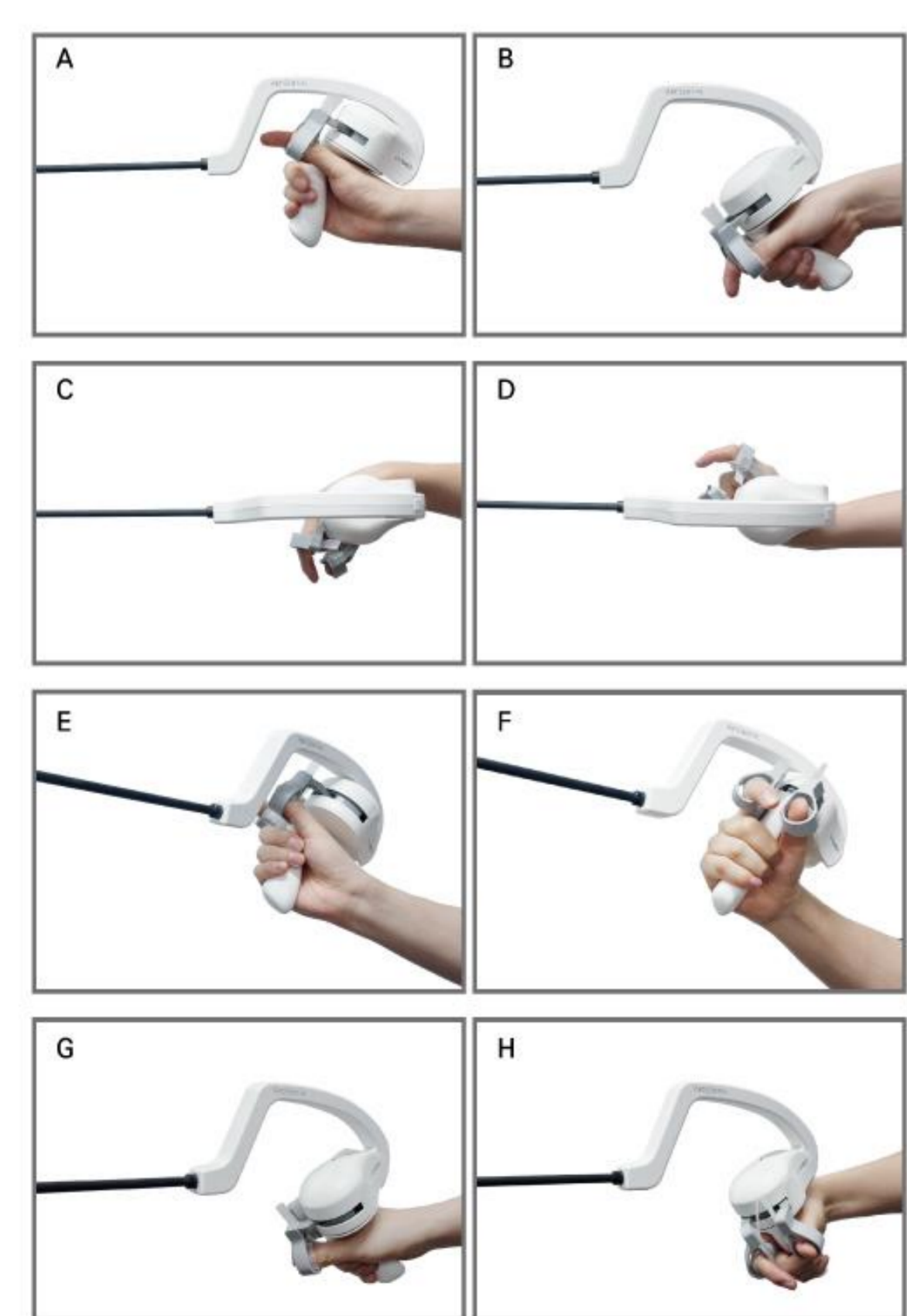
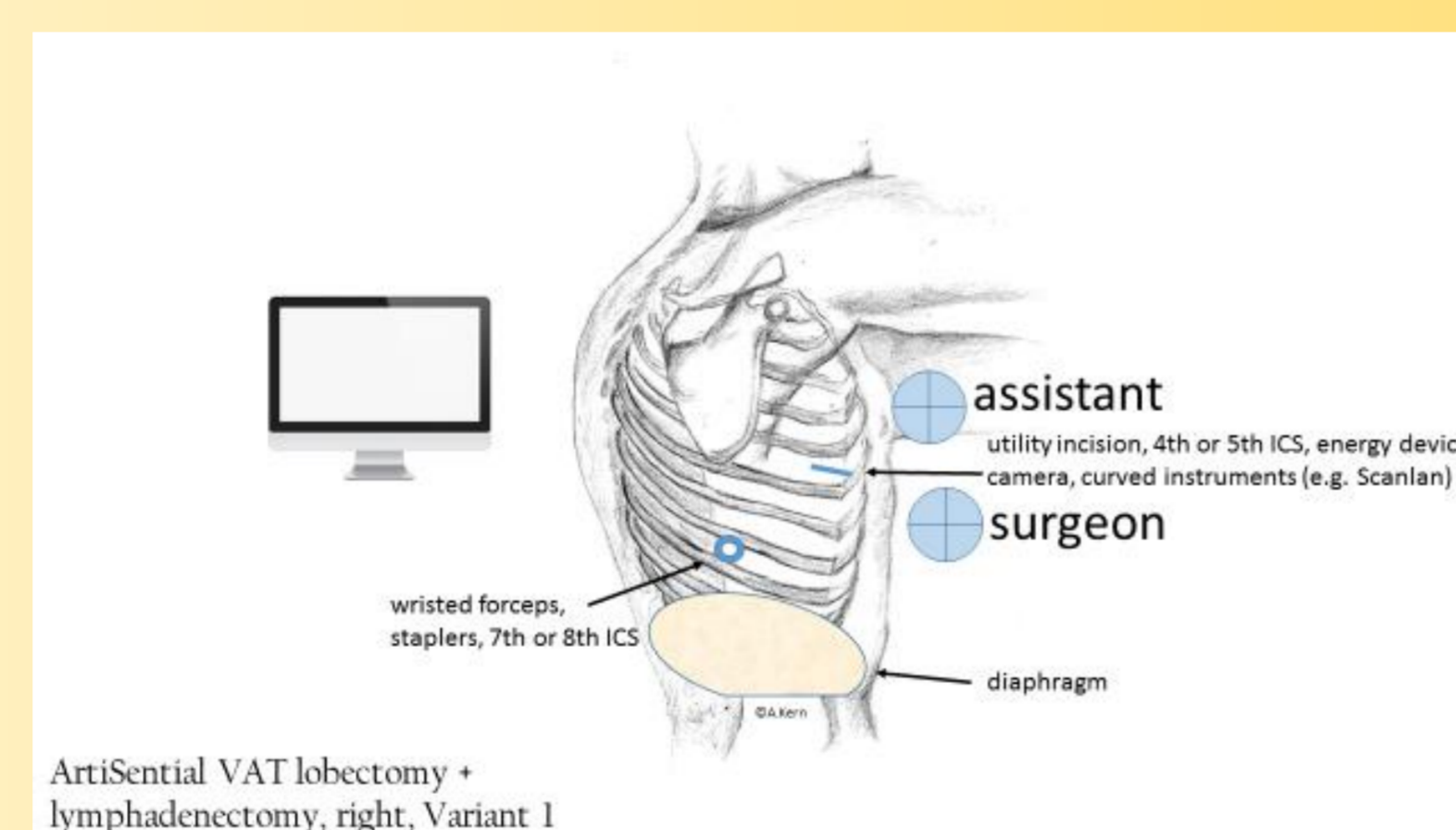
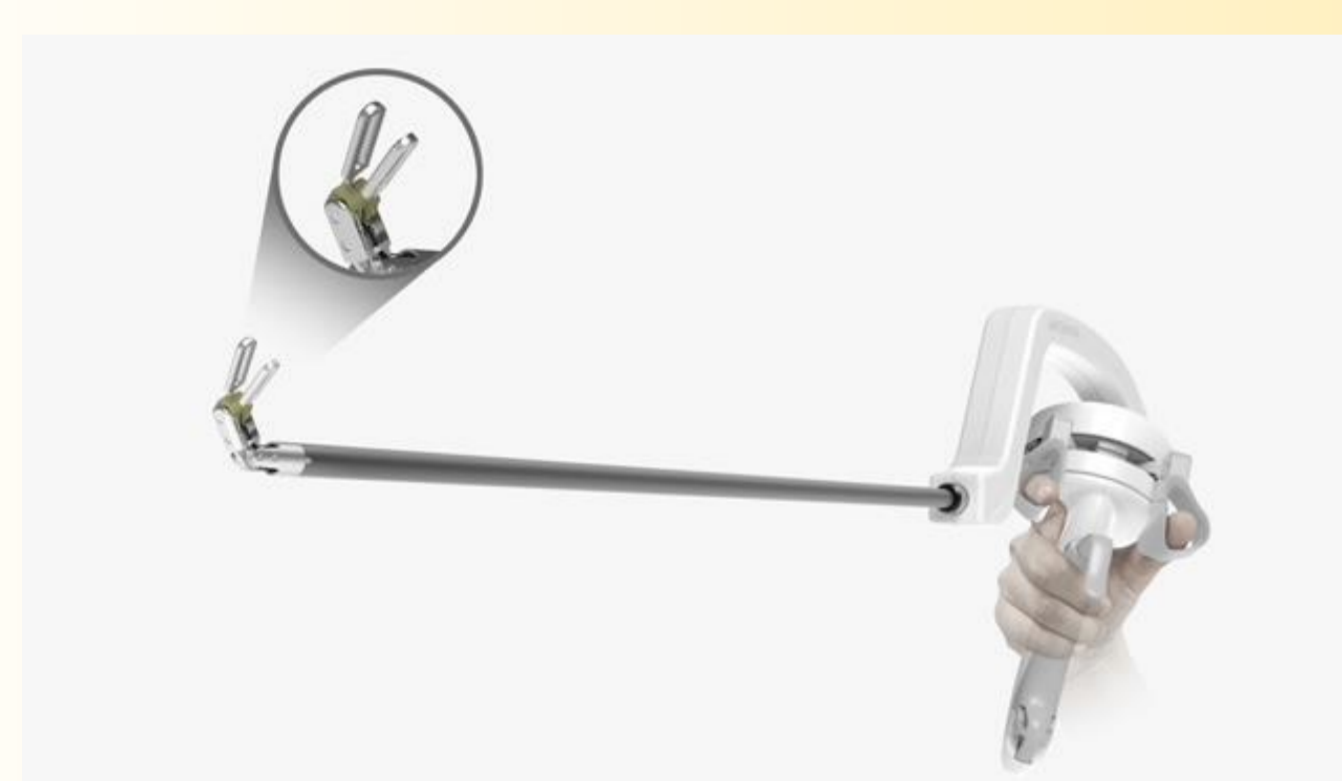


Fig. 1: The range of motion of the Artisential® handle grip: A up, B down, C left, D right, E up-right, F up-left, G down-right, H down-left

Fig. 2: Incisions and trocar positions right and left side for anatomic resections with articulating instruments.

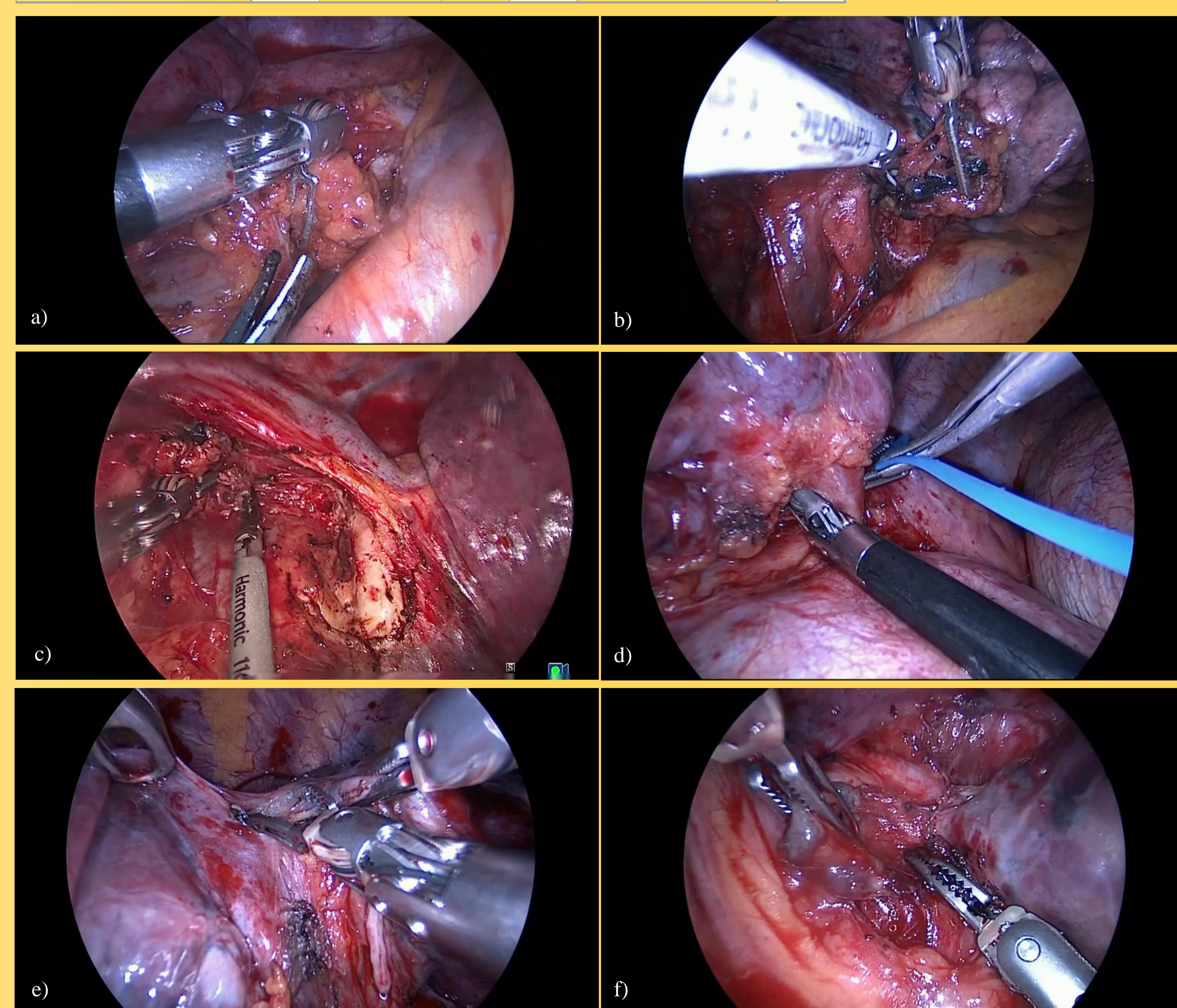


Fig. 5: Paratracheal (a), hilar (b) and infracarinal (c) lymphadenectomy during a right upper lobectomy with articulating instruments; going under the left lower vein (d), interlobar dissection (e) and lymphadenectomy in the aortopulmonary space (f) during a left lower lobectomy.

References:

1. Min S-H et al. J Minim Invasive Surg. 2019;22(4):157-163.
2. Dunning J et al. Ann Cardiothorac Surg. 2019; 8(2): 274-278.
3. Trevis J et al. Front Surg. 2020;7:589565.
4. Lee E et al. J Minim Invasive Surg. 2021;24:35-42.
5. Darwich I et al. Tech Coloproctol. 2022; 26(5):373-386.