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Fissureless fissure-last video-assisted thoracoscopic lobectomy for all lung lobes: a better alternative to decrease the incidence of prolonged air leak?[†]

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Abstract

OBJECTIVES: Prolonged air leak (PAL) after major lung resections is a common postoperative complication that leads to extended length of hospital stay (LOS) and increased hospital costs. Dissection of the lung tissue through the fissure may increase the incidence of PAL especially in the patients with incomplete fissures. The objective of this study was to evaluate the impact of the fissureless fissure-last technique in VATS lobectomy on immediate outcome, especially relating to air leak and LOS.

METHODS: This is an observational analysis on prospectively collected data of a single thoracic surgery unit. A total of 54 consecutive patients underwent VATS lobectomy and mediastinal lymphadenectomy—in 24 patients conventional VATS lobectomy (Group 1), in 30 patients fissureless VATS lobectomy (Group 2) was performed. The two groups were compared according to preoperative, operative and postoperative parameters.

RESULTS: No differences were found when comparing patient characteristics, operation time (M1 = 185 min; M2 = 176 min; $P = 0.52$) and number of staplers used (M1 = 6.2; M2 = 7.7; $P = 0.088$). The presence of air leak ($P = 0.004$; RR = 3.5), PAL ($P = 0.003$; RR = 10), in days with chest tube (M1 = 7.2; M2 = 4.2; $P = 0.028$) and LOS (M1 = 12.7; M2 = 8.9; $P = 0.020$) was significantly more frequent in patients that underwent conventional VATS lobectomy. Focusing on the air leak, significance was present in male gender ($P = 0.034$; RR = 2.41), higher ASA (M1 = 3.04; M2 = 2.67; $P = 0.012$), postoperative complications other than air leak ($P = 0.001$; RR = 5.78) and age between groups with and without air leak (M1 = 63.9; M2 = 74.1; $P < 0.001$).

CONCLUSIONS: Fissureless fissure-last VATS lobectomy is a feasible and equivalent to conventional VATS lobectomy in terms of operation time, stapler use and complications. Fissureless fissure-last VATS lobectomy, however, appears to be a superior technique to conventional VATS lobectomy in terms of preventing PAL and reducing the LOS.

Keywords: Thoracoscopy/video-assisted thoracoscopy • Lung cancer surgery • Parenchymal fistula • Pleural air leak • Lobectomy

INTRODUCTION

The incidence of prolonged air leak (PAL) following pulmonary surgery is reported 8–15% in different studies and it leads to increased length of hospital stay (LOS), higher overall complication rate and higher hospital costs [1–4]. The surgical approach into the fissural parenchyma may be an important and modifiable factor for the prevention of air leak [5]. The conventional video-assisted thoracoscopic (VATS) lobectomy technique resembles the open lobectomy technique: Following the division of the pulmonary vein, preparation is continued into the fissural parenchyma to expose the pulmonary arteries [6–8]. Dissection through the

fissure may increase the incidence of PAL especially in the patients with incomplete fissures [9, 10]. In the ‘fissureless’ fissure-last VATS lobectomy technique, hilar bronchovascular structures are divided first and the fissural parenchyma is divided at the last step using staplers [11, 12]. As the parenchyma is not dissected, the risk of air leak should be minimized. The objective of this study was to evaluate the impact of the two different surgical techniques on the immediate outcome especially relating to air leak and LOS.

PATIENTS AND METHODS

This study is an observational analysis on prospectively collected data of a single thoracic surgery unit with three consultant thoracic surgeons, all experienced in VATS resections.

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During 2014, 61 VATS lobectomies were performed in our institution. One patient was excluded due to postoperative mechanical ventilation for >48 h, 5 patients were excluded for conversion to open thoracotomy and 1 patient with pulmonary sequestration was excluded as no mediastinal lymph node dissection was performed. As a result, 54 patients with lung tumour who underwent VATS lobectomy with mediastinal lymph node dissection were included in the study, 52 of them having primary lung cancer, 1

having metastasis and 1 benign tumour, in the postoperative pathological evaluation.

A total of 24 patients underwent conventional VATS lobectomy (Group 1), and 30 patients underwent fissureless fissure-last VATS lobectomy (Group 2). Our local institutional ethical committee on human research approved the retrospective evaluation of the data in anonymous fashion.

Surgical technique

Our conventional VATS lobectomy technique is a classic three-port technique with surgeon and assistant standing in front of the patient, as described by Hansen *et al.* [6], and it has been our standard approach since 2011. At the beginning of the year, all the patients were operated with conventional VATS technique: following the division of pulmonary vein, preparation was continued into the fissural parenchyma either bluntly or with cautery to identify the pulmonary artery and bronchus, followed by staple division of the remaining fissure. Later on, during the year, the conventional VATS technique was changed into the fissureless fissure-last VATS lobectomy technique.

The 'fissureless fissure-last' VATS lobectomy technique for all lobes is as follows:

- (i) Right upper lobectomy: After division of the upper lobe vein, truncus anterior is exposed and divided. The next structure to be divided is either right upper lobe bronchus or posterior descending (A2) artery, depending on the local anatomy. The lymph node between upper lobe carina and A2 has to be

Table 1: Preoperative characteristics of patients enrolled in the study

Characteristic	Group 1 (n = 24)		Group 2 (n = 30)		P-value
	Mean	Range	Mean	Range	
Age	70	36–83	66.9	45–85	0.24
Sex (male)	14 (58.3%)		14 (46.7%)		0.4
FEV ₁ %	80	41–134	76	25–132	0.57
DLCO %	78	47–117	73	25–103	0.33
ASA score (median)	3	2–4	3	1–4	0.10
BMI (median)	26.5	18–43	24	15–36	0.11
preoperative CT	4 (16.7%)		2 (6.7%)		0.24
Preoperative RT	0		1 (3.3%)		0.37
Actual smoker	4 (16.7%)		10 (33.3%)		0.16

FEV₁: forced expiratory volume in 1 s; DLCO: carbon monoxide diffusion lung capacity; ASA: American Society of Anesthesiologists; BMI: body mass index; CT: chemotherapy; RT: radiotherapy.

Table 2: Results of comparison between patients in Group 1 (conventional VATS lobectomy) and Group 2 (fissureless VATS lobectomy) in perioperative and postoperative variables

Variables	Group 1 (n = 24)		Group 2 (n = 30)		P-value
	Mean	Range	Mean	Range	
Type of resection					0.037
LUL	6 (25%)		7 (23.3%)		
LLL	7 (29.2%)		6 (20.0%)		
RUL	1 (4.2%)		13 (43.3%)		
ML	2 (8.3%)		2 (6.7%)		
RLL	7 (29.2%)		2 (6.7%)		
LBL	1 (4.2%)		0		
UBL	0		0		
Operation time (min)	185	111–335	176	95–307	0.52
pT, cm (median)	2.7	1–12.5	2.05	0.8–7.5	0.048
Number of staplers (median)	6.5	3–13	7.5	3–13	0.088
Air leak	13 (54.2%)		5 (16.7%)		0.004
PAL (air leak >5 days)	8 (33.3%)		1 (3.3%)		0.003
Days with chest tube (median)	4.5	2–25	4	1–10	0.028
LOS (median)	10	5–41	7	5–33	0.02
Postoperative complications	10 (41.7%)		7 (23.3%)		0.15
Level of adhesions					0.54
0	16 (66.7%)		17 (56.7%)		
1	2 (8.3%)		6 (20.0%)		
2	5 (20.8%)		4 (13.3%)		
3	1 (4.2%)		3 (10.0%)		
Surgeon					0.08
1	11 (45.8%)		21 (70%)		
2	10 (41.7%)		3 (10%)		
3	3 (12.5%)		6 (20%)		
Level of pain at discharge	3	2–5	2.3	0–5	0.052

LUL: left upper lobectomy; LLL: left lower lobectomy; RUL: right upper lobectomy; ML: middle lobectomy; RLL: right lower lobectomy; LBL: lower bilobectomy; UBL: upper bilobectomy; PAL: prolonged air leak; LOS: length of hospital stay.

Table 3: Univariate analysis for operative risk factors for air leak

Characteristics Variables	Air leak (n = 18)		No air leak (n = 36)		P-value
	Mean	Range	Mean	Range	
Age	74.1	64–83	63.9	36–85	<0.001
Sex(male)	13		15		0.034
FEV ₁ %	72	40–105	81	25–134	0.18
DLCO%	71	36–111	77	25–117	0.27
BMI	25.9	18–33	26.1	15–43	0.94
ASA score (median)	3	2–4	3	1–4	0.012
Surgical technique					0.004
Conventional VATS lobectomy	13		11		
Fissureless VATS lobectomy	5		25		
Tumour size	2.7	0.8–8	2.2	1–12.5	0.29
Type of resection					0.56
LUL	5		8		
LLL	6		7		
RUL	3		11		
ML	1		3		
RLL	3		6		
LBL	0		1		
Operation time (min)	195.1	120–307	172.8	95–335	0.12
Number of staplers	6.2	3–13	7.7	3–13	0.12
Level of adhesions (0–3; median)	0	0–3	0	0–3	0.83
Level of pain at discharge (median)	2	0–5	2	0–5	0.83
Postoperative complications	11		6		0.001
Surgeon					0.18
1	8		24		
2	7		6		
3	3		6		
Preoperative CT	3		3		0.36
Preoperative RT	0		1		NA
Active smoker	5		9		0.83

FEV₁: forced expiratory volume in 1 s; DLCO: carbon monoxide diffusion lung capacity; ASA: American Society of Anesthesiologists; BMI: body mass index; VATS: video-assisted thoracoscopic surgery LUL: left upper lobectomy; LLL: left lower lobectomy; RUL: right upper lobectomy; ML: middle lobectomy; RLL: right lower lobectomy; LBL: lower bilobectomy; CT: chemotherapy; RT: radiotherapy; N/A: not applicable.

dissected and removed initially. Finally, the fissure is divided detaching the right upper lobe at the same time.

- (ii) Middle lobectomy: Following the division of the middle lobe vein, the middle lobe bronchus is exposed and divided. Right behind the bronchus lays the middle lobe artery, sometimes two, rarely three of them. At the end, the fissure is divided.
- (iii) Right lower lobectomy: Division of the inferior pulmonary vein is followed by the dissection and the division of the lower lobe bronchus. Right behind the bronchus lays the arteries. Common basal and superior segmental arteries are identified and divided. After removing the interlobar lymph nodes, the fissure is divided most recently.
- (iv) Left upper lobectomy: Division of the superior pulmonary vein is followed either by the dissection and division of the upper lobe bronchus or the anterior segmental artery (A3), which is often easier. Sometimes, A3 and apical artery (A1) arise as a common trunk. If not, one can decide to go initially for the A1 and then divide the upper lobe bronchus. Right behind the bronchus lays the lingular artery or arteries, as the next structures are to be divided. The last structure to be divided is the posterior subsegmental artery (A2), followed by the division of the fissure.
- (v) Left lower lobectomy: After division of the inferior pulmonary vein, the next structure to be divided is the lower lobe bronchus. A typical interlobar lymph node has to be dissected and

either completely removed or moved aside to reach the basal arteries. Following the division of both basal and superior segmental (A6) arteries, and lymphadenectomy in this area, the fissure is divided.

All bronchovascular structures and fissures were divided using staplers (Endo GIA®, Covidien Autosuture, Mansfield, MA, USA) in all 54 procedures. Neither sealants nor tenting was considered in these patients.

Pleural adhesions were divided into four groups:

- (i) No adhesions
- (ii) Minimal adhesions on maximum three areas, relatively easily removable adhesions, mostly on the lobe to be removed
- (iii) Adhesions more than in 1 and less than in 3
- (iv) Adhesions covering minimum a complete lobe if this lobe is not the one to be removed. Firm and broad adhesions that are only to be removed with sharp dissection.

At the end of the operation, one chest tube (28 or 24 F, Rocket Medical, Washington, DC, USA) was placed within the hemithorax, according to the size of the chest, and connected to a digital suction device (Thopaz Drainage System, Medela, Switzerland). The presence of air leak was easily assessed over display. Air leak on the operation day (ceased until the next morning) was considered as 'no air leak' and air leak lasting longer than 5 days was considered as PAL. Chest tube removal was surgeon-dependent,

performed usually 1 day after air leak cessation, in regard to pleural drainage (<250 cc per day). After 5 days, if a persistent air leak was detected, suction was removed on the device and the algorithm of Cerfolio et al. followed [13, 14].

Statistical analysis

The statistical analysis was performed with SPSS v.17. The Kolmogorov–Smirnov test was performed to analyse the distribution of variables. For the normally distributed data, unpaired *t*-test was used to compare the values. Levene's test was used to compare homogeneity of the variance.

For comparisons of variances which were tested positive for non-homogeneity, appropriate corrections were applied.

Mann–Whitney *U*-test and Kruskal–Wallis *t*-test were performed for the data that do not follow normal distribution. Categorical variables were compared using χ^2 test with the Monte-Carlo method when appropriate. No correction for multiple comparisons has been performed.

RESULTS

There were no differences in patient characteristics as presented in Table 1.

Basically, tumour size was bigger in the 'conventional' group ($P = 0.048$), (Table 2) but showed no impact either on air leak ($P = 0.29$), as seen in Table 3, or PAL ($P = 0.75$), as seen in Table 4.

Air leak ($P = 0.004$) and PAL ($P = 0.003$) occurred less frequent after 'fissureless' lobectomy compared with 'conventional' lobectomy (Table 2). Both chest tube duration ($P = 0.028$) and LOS ($P = 0.020$) were significantly longer in the 'conventional' group (Table 2).

The difference in operation time ($P = 0.52$), number of staplers ($P = 0.062$) and postoperative complications ($P = 0.15$) were statistically not significant (Table 2).

Furthermore, there was a statistically significant difference in the type of resection (lobe to be resected), but this particular variable had no impact on air leak ($P = 0.56$), as seen in Table 3, or PAL ($P = 0.71$), as seen in Table 4.

Focusing on the air leak, chest tube duration and LOS were significantly longer in the 'conventional group' (both with $P \leq 0.001$). Patients with air leak were significantly older; no air leak: mean age 63.9 (SD = 9.5); air leak: mean age of 74.1 (SD = 5.8) ($P < 0.001$). The univariate analysis for the operative risk factors for postoperative air leak is presented in Table 3.

A mean age of 76 (SD = 5.1) has been found for those being in a greater risk of acquiring a PAL (Tables 4 and 5).

PAL was present overall in 9 patients (16.7%), 8 of them being in Group 1. It was shown to be associated with chest tube duration ($P < 0.001$) and prolonged LOS ($P < 0.001$) (Table 4).

Table 4: Univariate analysis for operative risk factors for PAL

Characteristics Variables	Leak >5 (n = 9)		No leak >5 (n = 45)		P-value
	Mean	Range	Mean	Range	
Age	76.2	68–83	65.5	36–85	0.002
Sex (male)	7		21		0.088
FEV ₁ %	69	44–88	80	25–134	0.19
DLCO%	65	36–83	77	25–117	0.072
BMI	25.6	18–33	26.1	15–43	0.77
ASA score (median)	4	3–4	3	2–4	0.002
Stadium of tumour (median)	1	1–4	1	1–4	0.26
Surgical technique					0.003
Conventional VATS lobectomy	8		16		
Fissureless VATS lobectomy	1		29		
Tumour size	2	1.6–8	2.3	0.8–12.5	0.75
Type of resection					0.71
LOL	4		9		
LUL	1		12		
ROL	1		13		
ML	1		3		
RUL	2		7		
Operation time (min)	217	162–307	172.8	95–335	0.014
Number of staplers	6.2	3–13	7.2	3–13	0.53
Level of adhesions (0–3; median)	0	0–3	0	0–3	0.36
Level of pain at discharge (median)	2	2–5	2	0–5	0.44
Postoperative complications	6		11		0.013
Operator					0.19
1	3		29		
2	4		9		
3	2		7		
Preoperative CT	3		3		0.02
Preoperative RT	0		1		NA
Active smoker	1		13		0.27

PAL: prolonged air leak; FEV₁: forced expiratory volume in 1 s; DLCO: carbon monoxide diffusion lung capacity; ASA: American Society of Anesthesiologists; BMI: body mass index; VATS: video-assisted thoracoscopic surgery LUL: left upper lobectomy; LLL: left lower lobectomy; RUL: right upper lobectomy; ML: middle lobectomy; RLL: right lower lobectomy; LBL: lower bilobectomy; CT: chemotherapy; RT: radiotherapy; NA: not applicable.

Table 5: Difference in age according to the presence of air leak and PAL

	Mean age	Standard deviation
Air leak		
No	63.9	9.5
Yes	74.1	5.8
PAL		
No	65.5	9.4
Yes	76.2	5.1

PAL: prolonged air leak.

Table 6: Complications

Complication	Patients
Bronchopneumonia	7 (41.2%)
Bronchopneumonia and acute right heart decompensation	1 (5.9%)
Atrial tachyarrhythmia with atrial fibrillation	3 (17.6%)
Bradycardia with an implantation of pacemaker	1 (5.9%)
Hypertensive crisis	1 (5.9%)
Adrenal insufficiency	1 (5.9%)
Empyema	1 (5.9%)
Haemopneumothorax	1 (5.9%)
Pneumothorax and delirium	1 (5.9%)

Preoperative chemotherapy (CT) ($P = 0.02$) and the operation time ($P = 0.014$) were also found out to be associated with PAL (Table 4). More time-consuming operations were those with more probability of having PAL at the end.

Postoperative complications were significantly more present in a group with PAL ($P = 0.013$) (Table 6).

There were 17 (31.5%) patients overall with complications, 11 (64.7%) from them having a PAL. Interestingly, all the patients having a leak and complications had PAL as well.

DISCUSSION

PAL is a common postoperative complication following pulmonary resections and the presence of air leak predicts a worse outcome after anatomical lung resections with prolonged LOS and more complicated postoperative course [5, 15]. So not only PAL but also any air leak should be considered as a surgical complication and every effort should be taken to avoid it. There are several perioperative or postoperative options to reduce the incidence of PAL or to fasten recovery from it. Pleural tenting [16] and surgical sealants [17] are the most commonly used perioperative techniques, the first being effective particularly in upper lobe resections, and the second being controversial failing to show benefit in LOS with higher costs. Buttressed staple lines for patients with moderate-to-severe pulmonary emphysema [18, 19] and pneumoperitoneum for lower lobectomy and bilobectomy [20] can also be effective to avoid PAL. In the postoperative period, the management of chest tubes either with water seal or suction is reported to provide good results in terms of avoiding PAL [13, 21]. Blood patch is another postoperative technique to induce pleurodesis in the management of PAL [22, 23].

Incomplete fissures are reported to be a risk factor for PAL. In an open thoracotomy approach, the fissureless technique avoiding the dissection of the interlobar lung parenchyma was significantly superior to the conventional technique in terms of preventing PAL and reducing LOS [9].

There are only a few studies in the literature about fissureless technique, with slight differences in terms of approaching the incomplete fissures, two of them being focused only on the right upper lobe [10, 24], and the others referring to all lobes [9, 11]. While most of these studies were focused on fissureless lobectomy via thoracotomy, only two of them were focused on fissureless VATS lobectomy, one showing feasibility and safety [11] and the other reporting that VATS lobectomy with fissureless technique could minimize peri- and postoperative complications [12].

In this study, we could show for the first time, for VATS lobectomy, that air leak and PAL are significantly less frequent after 'fissureless' lobectomy compared with 'conventional' lobectomy, ongoing with significantly shorter chest tube duration and LOS. Increased age and ASA score showed a higher risk of PAL—although this might not be of big surprise, 'older lungs' seem to have tendency to heal slower. Pleurolysis due to adhesions in the lobe or lobes not to be resected may result in air leak, yet we failed to show a significant association between adhesions and air leak, although it seemed likely by observation.

Of course, this study is limited by its non-randomized character. One can argue, since not being randomized, the fissureless group could have by chance patients with 'better' fissure. However, the number of staplers being used for dividing the lung tissue was superior in the fissureless (median 7.5 staplers) compared with the conventional group (median 6.5 staplers) giving in fact an advantage to the conventional VATS lobectomy technique.

Since we began to perform VATS lobectomy with fissureless fissure-last technique, air leak and PAL levels as reported in this study decreased. These results lead to a wider acceptance of this technique at our clinic, even for open lung resections. Of course, these results need to be confirmed by a larger and randomized study.

CONCLUSION

Fissureless fissure-last VATS lobectomy is a feasible technique, equivalent to conventional VATS lobectomy in terms of operation time, stapler use and complications. Nevertheless, it appears to be a superior technique to conventional VATS lobectomy in terms of preventing PAL and reducing the LOS. However, our results need to be confirmed with a large randomized trial.


Conflict of interest: none declared.

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APPENDIX. CONFERENCE DISCUSSION

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Dr L. Spaggiari (Milan, Italy): From an oncological point of view, I would like to ask a question. At the beginning, you say that you perform - video-assisted mediastinoscopic lymphadenectomy before video-assisted thoracoscopic surgery lobectomy?

Dr Stamenovic: Yes, before video-assisted thoracoscopic surgery lobectomy.

Dr Spaggiari: Video-assisted mediastinoscopic lymphadenectomy because you have a suspicious CT, a suspicious PET scan?

Dr Stamenovic: Yes, of course.

Dr Spaggiari: Or do you perform video-assisted mediastinoscopic lymphadenectomy in every patient?

Dr Stamenovic: No, no. We accepted this guideline sort of, say, from 2014. So for the tumors larger than 3 cm or centrally located or with N1 or N2 on CT, we perform some kind of mediastinal staging. So in this case, by PET-CT

and enlarged N2 lymph nodes and mediastinum, I decided to perform video-assisted mediastinoscopic lymphadenectomy to remove all the lymph nodes. It makes it easier in resection because I removed already 7, 8 and it's on the left side, in my opinion, more difficult to perform video-assisted thoracoscopic surgery lymphadenectomy because it's deeper and I have more sensitivity, more specificity, more accuracy with video-assisted mediastinoscopic lymphadenectomy than with endobronchial ultrasound. In this case, I performed video-assisted thoracoscopic lymphadenectomy surgery, but it's not always the case.

Dr Spaggiari: So you prefer video-assisted mediastinoscopic. It is actually a VAMLA lymphadenectomy surgery, instead of endobronchial ultrasound.

Dr Stamenovic: No, no, of course not. In some cases.

Dr Spaggiari: And do you perform VAMLA in the same operative time?

Dr Stamenovic: No.

Dr Spaggiari: So you perform VAMLA and then the operation?

Dr Stamenovic: Yes.

Dr Spaggiari: So you do to assist?

Dr Stamenovic: Yes, as an assist.

Dr R. Milton (Leeds, UK): I enjoyed your presentation. I noticed that your median length of stay or your mean length of stay was seven days for the fissureless or fissure-last and ten days for the other.

Dr Milton: That seems quite a long length of stay to me, and I wondered if there were other factors other than air leak that were keeping your patients in hospital or whether you wondered about sending patients home with a chest drain in?

Dr Stamenovic: Yes. In Germany and every German here knows it very well, we have a specific medical system. On one side, the people can't leave up to the fifth day, so to speak, for the hospital to acquire the full settlement amount from the insurance. So on the other side, they're not allowed to be discharged as long as they're not taken care of at home. For instance, if a patient says he is alone at home and there is nobody who can take care of him, we need to involve our Social Service, and it takes a bit longer. So it is the same for all patients, and I didn't, then include or exclude according to the involvement of Social Service, these patients, because it would be difficult. So I planned, actually to make another paper with this prolonged hospital stay in the German medical system, but I think it wouldn't be welcome from the Chief of the Department and from the people there.

Dr Milton: Yes, I agree with you, actually, that we always get obsessed with length of stay. But, actually, there are a lot of other factors that do influence the length of stay which are outside of the surgeon's control.

Dr G. Kocher (Bern, Switzerland): So I have another comment. First it has to be mentioned that the main limitation of your study is that there is the missing of any randomization. So I absolutely share your feeling that with the fissure-last or fissure less technique, we seem to have less air leak. But, I mean, do you select the cases depending on the surgeon and depending on the situation I guess?

Dr Stamenovic: Yes.

Dr Kocher: I guess nobody digs in the fissure where there is really no fissure.

Dr Stamenovic: Yes.

Dr Kocher: So your surgeons must have used stapling of the fissure at some point of the surgery?

Dr Stamenovic: Of course. All the fissures were stapled. Some of them were dissected, some others not. And those that were dissected were classical.

Dr Kocher: So you cannot really draw this conclusion just with this technique, I mean, without randomization?

Dr Stamenovic: No, you cannot really. Because one can always suggest your favored one group over the other. My personal feeling was I didn't plan to make this paper, but as I started to operate it like this and saw the results, I thought, okay, there may be something there. So then I checked the literature and saw, well, there's a little bit there about it. Perhaps we can develop it a little bit. If I succeeded or not, I am not sure.

Dr Kocher: As I said, I absolutely share your opinion. That's not the point. And my other question is concerning the patients with prolonged air leak. What's your management strategy? I mean, some say like after five days we have to do a revision. We just do again thoracoscopy, see where there is air leak and try to suture it. You just wait and see whether it's staying, or if it's decreasing?

Dr Stamenovic: Now in 2015 we are not waiting anymore, but in 2014 we have waited. We applied algorithm. We started all with suction and then took it away after prolonged air leak. But, in fact, in my opinion with my little experience, it's almost the same if you do it or not do it. There are lots of surgeons, lots of different experience, and basically it doesn't have any influence. Perhaps you can do this blood patch or plasma infusion or even re-operate. But in my opinion, before the seventh day, it's too soon. I don't know. That's really just my experience, but everybody has their different one.

Dr Kocher: I think we need some data on that one in the future, I mean, how to manage prolonged air leak.

Dr Stamenovic: I'll give it my best.